
-----Original Message-----

From: Richard Archer <rlfa17@yahoo.com>

Sent: Thursday, May 14, 2020 4:34 PM

To: City Clerk <cityclerk@moval.org>

Subject: per this evening Planning Commission hearing

Warning: External Email – Watch for Email Red Flags!

City Clerk -

Please forward these letters of support for the WLC to the Planning Commission for their review.

Thanks!

Richard Archer

RICHARD LF ARCHER, SR

14140 AGAVE ST, MORENO VALLEY, CA 92553

May 14, 2020

Re: World Logistic Center Re-certification

Dear Planning Commission:

As a Moreno Valley resident, I urge the Planning Commission to give their support and approval to tonight's Re-certification of the World Logistics Center EIR. It is time to get a most worthy project underway that will undoubtedly benefit the Citizens of Moreno Valley.

In light of the pandemic crisis that grips the world, it's impact has been profound locally. The time has come to put petty politics aside and acknowledge the impressive work of Highland Fairview. Their Skechers' project is a shining example of the quality of work to the City can look forward to with confidence.

Sincerely

Richard L F Archer, Sr

Thomas R Jerele, Sr.
24535 Wild Calla Drive
Moreno Valley, CA 92557
310-709-2875 / email: rlfa17@yahoo.com

Moreno Valley Planning Commission
Re: Public Hearing 2 World Logistics Center EIR Re-Certification

May 14, 2020
Via E-Mail

Dear Planning Commissioners:

I strongly support your action to re-certify the EIR for the World Logistics Center (WLC). The WLC went through an extensive, and very thorough public hearing process; to which I was participatory in as a supporter.

It is my understanding with the project developer, Highland Fairview Corporation, has fully addressed and complied with the Court findings/required changes per the original EIR.

Given our current economic status resultant from the CoVid19 Virus situation, the City of Moreno Valley is anticipated to experience huge revenue losses. Had this project been initiated and underway by now, the City of Moreno Valley would be expecting a much better financial future.

It is beyond time, that this project should proceed.

I thank you for your consideration of my written comment. I will attempt to join the meeting through the Zoom process this evening.

Sincerely,

Thomas R. Jerele, Sr.

From: Mike d <mdv28889@gmail.com>
Sent: Thursday, May 14, 2020 5:12 PM
To: Julia Descoteaux
Subject: Too many warehouses already

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I moved to the east end of Moreno Valley to escape the city, both its cluster and constant sirens and helicopters. The peacefulness is slowly dying thanks to the greedy developers that have preyed on our slice of heaven. I am sickened at how one developer has bought and paid for the city council, getting his projects approved without objection by the majority of people who are there to represent me. They do not represent me, nor any one else I know who lives in our community. They started by combining my district with Sunnymead Ranch, a community of mostly pro industry residents. Myself and my neighbors are absolutely against industry building up in our rural community. It's bad enough that the paper plant has a hopper that hums LOUDLY throughout the day and night permanently quelling our once peaceful haven. But also the constant barrage of truck horns and backup safety alarms (on the trucks and forklifts) piercing the cool quiet nights we can only remember, thanks to the greedy businesses taking our sanctuary.

I've requested to make improvements to my property, through the proper channels at city hall, each time being turned down due to my plans not meeting 'the community development standards'. Your plans to fundamentally transform my countryside to a warehouse monstrosity, along with your proposed truck routes and truck stops absolutely do not meet my (and my many neighbors') community development standards. Your desire to stricken us with ungodly amounts of truck traffic and truck exhaust is beyond unconscionable, though it is quite befitting of the selfish nature this council and mayor so blatantly parade.

There are too many warehouses in Moreno Valley as it is, please resist the urge to further condemn us to a life surrounded by industrial pollution.

Thankyou,

mike devalk,
resident at 28889 juniper ave 92555.

Julia Descoteaux

From: Julia Descoteaux
Sent: Wednesday, May 20, 2020 2:20 PM
To: Julia Descoteaux

From: crystal reza <sweettart1987@yahoo.com>
Sent: Thursday, May 14, 2020 5:11 PM
To: City Clerk <cityclerk@moval.org>
Subject: World Logistics Re certification

Warning: External Email – Watch for Email Red Flags!

To the planning commission and city council of Moreno Valley,

Thank you for taking your time in reading my letter about the world logistics center. I would like to say that I feel very optimistic about this project that is coming to our city. My family and I have lived in this growing city since 1994 and have seen both pros and cons through the years. This project is definitely a pro in my family's opinion. I kindly ask that you put all politics aside and do what is good for our community, we need this revenue and we definitely need these jobs. Many may say they travel outside of our city for work and now they might not have to. Please try your best to expedite this approval especially in these uncertain and challenging times that our city has lost tons of money on revenue because of closed businesses. The faster we approve this inproject the faster our city will benefit from over \$5 million in tax revenue a year. Not to mention our schools will also benefit and receive \$5 million dollars a year as well.

Thank you for allowing us to express our feelings on this matter and I hope and pray this is re certified in an expedited form. Stay safe and healthy.

Sincerely, Kris Serrano

Julia Descoteaux
Associate Planner
Community Development
City of Moreno Valley
p: 951.413.3209 | e: juliad@moval.org W: www.moval.org
14177 Frederick St., Moreno Valley, CA 92553

Julia Descoteaux

From: Julia Descoteaux
Sent: Wednesday, May 20, 2020 2:22 PM
To: Julia Descoteaux

From: Santiago Hernandez <santiagodent61@gmail.com>
Sent: Thursday, May 14, 2020 5:01 PM
To: City Clerk <cityclerk@moval.org>
Subject: Recertification for WLC.

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Planning commission and city Council.

Mi nombre es Santiago Hernández ,y e vivido en Moreno Valley por mas de 25 años,e visto su progreso por eso les pido, que lo más pronto posible ,Resertifiquen el nuevo EIR,para el gran proyecto de WLC,y seguir viendo el progreso de esta gran ciudad de Moreno Valley, ASAP.please .atte
Santiago Hernández. 16756 canoe cove Moreno Valley CA.92551.

Julia Descoteaux
Associate Planner
Community Development
City of Moreno Valley
p: 951.413.3209 | e: juliad@moval.org W: www.moval.org
14177 Frederick St., Moreno Valley, CA 92553

Julia Descoteaux

From: Tom Thornsley <tomthornsley@hotmail.com>
Sent: Thursday, May 14, 2020 5:27 PM
To: Julia Descoteaux
Subject: Comments for 5-14-2020 PC Meeting

Warning: External Email – Watch for Email Red Flags!

Julia,

These are very late and don't expect them to get to, or be read by, PC today. Just needed to get some comments in and will speak to them tonight.

Tom Thornsley

Don't see them attached. will down load and try my lap top.

Julia Descoteaux

From: Tom Thornsley <tomthornsley@hotmail.com>
Sent: Thursday, May 14, 2020 5:32 PM
To: Julia Descoteaux
Subject: Re: Comments for 5-14-2020 PC Meeting
Attachments: PC Comment Letter 5-14-2020.docx; PC Comment Letter 5-14-2020.pdf

Warning: External Email – Watch for Email Red Flags!

From: Tom Thornsley
Sent: Thursday, May 14, 2020 5:26 PM
To: Julia Descoteaux
Subject: Comments for 5-14-2020 PC Meeting
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May 14, 2020

Julia Descoteaux
City of Moreno Valley
14177 Frederick Street
Moreno Valley, California 92552

Via e-mail: alberta@moval.org

Re: Comments to the Draft Recirculated Revised Final Environmental Impact Report (SCH #2012021045) World Logistics Center.

Dear Ms. Descoteaux,

We would like to object to the limited time given for review of extraordinarily large set of documents and reports. Although some were previously available the comprehensive review is challenging. That said, and at this time, we have two major concerns of note related to the forgoing of certain Development Impact Fees (DIF) outlined in the Development Agreement and the extraordinary diminished changes to the mitigation measures for Noise impacts.

First: Development Agreement

Neither in Development Agreement nor anywhere else in any project documents did I find a breakdown cost analysis to justify the developer not paying DIF for arterial streets, traffic signals, interchange improvements, and fire facilities. A cost analysis and fair share factor must be provided to evaluate all impacts to the listed exempted items. Impact to the SR-60 and WLC Parkway are almost exclusively attributed to this projects development yet the developer is not required to pay fees for the cost of this improvement. Construction of all project related streets (internally) are the full responsibility of the developer and would not qualify for any form of credit. Project impacts that go beyond the project site would be relatively high nearest the project and can be calculated for a fair share cost that could give the developer credit if 100% of the improvement is made by the developer. Otherwise the DIF would be used to make the outside improvements. The following is the text from the Development Agreement defining the benefit being given the developer without analysis for just compensation verses DIF cost coverage.

Finding: Sections 4.8 and 4.9 of the Development Agreement require the developer of the Project to construct or pay for all necessary traffic improvements and a fire station, all as needed, as a result of the development of the Project. In return, section 1.5, 4.8, and 4.9 of the Development Agreement exempts the Project from the payment of development impact fees ordinarily imposed under Municipal Code sections 3.42.030, 040, and 060. These exemptions shall remain in effect only as long as the Development Agreement is in effect. If the Development Agreement is approved but does not become effective or if it is approved

and does become effective and is terminated for any reason, the requirements that the Project pay development impact fees under Municipal Code sections 3.42.030, .040, .050, and .060 shall become effective.

DA Sections:

1.5 “Development Impact Fee,” “Development Impact Fees” or “DIF” means for purposes of this Agreement only those fees imposed pursuant to Moreno Valley Municipal Code Sections 3.42.070 (police facilities), 3.42.080 (City hall facilities), 3.42.090 (corporate yard facilities) and 3.42.100 (maintenance equipment). The term “Development Impact Fees” (or “DIF”) does not include those fees imposed by Moreno Valley Municipal Code Sections 3.42.030 (arterial streets), 3.42.040 (traffic signals), 3.42.050 (interchange improvements) and 3.42.060 (fire facilities).

4.8 Payment of, and Reimbursement for, the Cost of Improvements Paid for by HF Which Are in Excess of HF’s Fair Share. HF shall satisfy the requirements imposed by Mitigation Measure 4.15.7.4.A, as set forth in the EIR, to ensure that all of the Development’s impacts on the City’s circulation system, including, but not limited to, improvements to arterial streets, traffic signals and interchanges, are mitigated. Because HF will be responsible for paying for or constructing all circulation-related improvements, it shall not pay the fees imposed by Moreno Valley Municipal Code Sections 3.42.030 (arterial streets), 3.42.040 (traffic signals) and 3.42.050 (interchange improvements). City will provide to HF the reimbursement agreement(s) in the form and type as specified in Chapter 9.14 of Title 9 of the Moreno Valley Municipal Code.

4.9 Provision of a “turnkey” Fire Station. HF shall, at its own cost, provide a fully constructed, fully equipped fire station and fire station site, including fire trucks, as specified by the City’s Fire Chief. The fire station’s furniture and fixtures shall be reasonably comparable to those of the most recently completed fire station within the City. The fire station, equipment and trucks shall be provided as and when directed by the Fire Chief. Because HF will be responsible for the provision of the fire station, fire station site, equipment, and trucks, it shall not pay the fee imposed by Moreno Valley Municipal Code Section 3.42.060 (fire facilities). City will provide to HF the reimbursement agreement(s) in the form and type as specified in Chapter 9.14 of Title 9 of the Moreno Valley Municipal Code.

Second: Noise Impact Evaluations

When the original FEIR was approved it use the “**Noise Assessment for the WLCSP**” to establish mitigation measures that would be necessary to limit construction impacts to those residents in the surrounding homes. It noted that work within the project area may be done on a 24 hour 7 days per week schedule which goes beyond the Moreno Valley Municipal Code’s (MVMC Section 8.14.040 Miscellaneous standards and regulations.) listed hours of 7 a.m. to 7 p.m. The Noise Assessment defined construction limits so as to limit noise impacts on the surrounding residences outside the standard construction hours and clearly outlined the high level of noise that could be expected both during daytime and nighttime hours beyond the

allowed decibel levels defined by the MVMC. Thus the study included “**Mitigation Measure N-2. No Nighttime Grading Within 2,800 Feet of Residences South of the Freeway**” was issued. It goes on to allow closer nighttime construction at 1,580 feet after the installation of an appropriate sound barrier. These would appear to be realistic mitigations but it would appear the developer might have found this to be somewhat restrictive and excessive so a different noise analysis firm was selected to prepare a new study.

The new “**Noise and Vibration Technical Report Assessment**” proposed a substantially different evaluation and lesser mitigations to the noise impacts. It states that “No construction activity shall occur within 800 feet of residences between 8 p.m. and 7 a.m. on weekdays and weekends, and a 12-foot tall temporary construction sound barrier blocking the line-of-sight of construction activity to any residential receptor located within 800 feet of active construction areas shall be installed prior to commencement of any construction activity.”

The mitigation requirement for a sound barrier is similar to the original MM however the active setback is now moved forward by 2,000 feet or three and a half times closer. Additionally, the MM includes options that would eliminate the need install the on-site sound barrier if a vote by those affected fails to garner 50% favorable votes or 100% favorable votes for a sound barrier placed on private property. These two provisions were never a consideration in the original noise analysis nor do they seem to be fair to the community due to the percentages needed based on the full text of the MM. It appears that this clause in MM **4.12.6.2A** is of a greater benefit to the developer than to the surrounding residents.

Noise Study and MM

“**Noise Assessment for the WLCSP**” (Mestre Greve Associates) original dated January 2013, revised September 2014. (This document is still referenced in the 12-2019 Draft Recirculated Revised Sections of the Final Environmental Impact Report)

“**Noise and Vibration Technical Report Assessment** (ESA)”, July 2018 which was not in the original 2014 DEIR for WLC) Since both studies are cited in the Draft REIR how is it that the more stringent mitigation measures are not utilized?

In the 2018 edition of the Draft REIR it used the “**Noise and Vibration Technical Report**”, and its mitigation measures now replace those of the “**Noise Assessment for the WLCSP**” that where much more favorable to the community and surrounding homeowners.

Noise Assessment for the WLCSP

Pgs. 27 - 30

2.2.1 On-Site Construction

Work within the project site will consist of mass grading, fine grading, building construction, utilities installation, interchange improvements, paving and curbing, and landscaping. Work within the project area may be done on a 24 hour 7 days per week schedule. Construction activities would occur at varying locations on-site, but may last for an extended period of time. For instance, grading activities for each phase are anticipated to last one year. However, the

grading may be concentrated in one area for a while and then move on to another area, and so on. In other words, grading noise will not impact one area for an entire year. Building construction will occur from time to time over a nine year period lasting from 2013 through 2021.

Residences within the Specific Plan area. Three pockets of homes are located within the Specific Plan area, and construction noise will be an issue for occupants of these residences. While these areas are to be designated for Light Logistics development under the proposed Specific Plan, they may remain in residential use indefinitely. Future Light Logistics uses would not be sensitive to noise, but as long as these sites remain in residential use, they will need to be considered as noise sensitive uses. These homes may be located adjacent to areas where intense construction activities could occur. These homes may experience worst-case unmitigated peak construction noise levels (Lmax) up to 97 dBA. The average noise levels are typically 5 to 15 dB lower than the peak noise levels. Average noise levels (Leq) at 50 feet from the residence could be in the range of 82 to 92 dBA during most phases of construction.

The City of Moreno Valley Municipal Code does not include any exemptions for construction noise. Therefore, construction would be subject to the limitations of 60 dBA during the daytime and 55 dBA at the nighttime measured at occupied residential locations. Exceeding these limits would result in a significant noise impact. Based on information in the previous paragraph these noise levels would regularly be exceeded during the daytime and nighttime hours at residences within the Specific Plan area. Based on an Leq noise level of 90 dBA at 50 feet, an observer would need to be 1580 feet from the construction to experience a noise level of 60 dBA (Leq), or 2,800 feet for a noise level of 55 dBA (Leq). A residence within 1,580 feet during active construction during the daytime would be impacted, or within 2,800 feet during the nighttime would be impacted. Mitigation is discussed in Section 3.1.1.

Residences Adjacent to the Specific Plan area. Residences are located adjacent to the project in the areas along Redlands Boulevard, Merwin Street, Bay Avenue, Cactus Avenue, and Gilman Springs Road. The potential for noise impacts will be similar to those impacts for residents within the Specific Plan area. Specifically, a receptor would need to be more than 1,580 feet from the construction to experience a noise level less than 60 dBA (Leq), or more than 2,800 feet for a noise level less than 55 dBA (Leq). A residence within 1,580 feet during active construction during the daytime would be impacted, or within 2,800 feet during the nighttime would be impacted. Mitigation is discussed in Section 3.1.1.

Mitigation Measures from “Noise Assessment for the WLCSP”
Pgs. 50 – 51

The following mitigation measures are identified for significant construction noise impacts:

N-1. No Construction Vehicles on Redlands Boulevard South of Fir Avenue. No construction vehicles of any type for on-site construction shall be permitted on Redlands Boulevard south of Fern Avenue. The prohibition for construction traffic should occur for all phases of the proposed project.

N-2. No Nighttime Grading Within 2800 Feet of Residences South of the Freeway.

Construction grading shall not be allowed within 2,800 feet of residences south of SR-60 between 8 p.m. and 7 a.m. Prior to the issuance of a grading permit, the developer shall submit a Noise Reduction Compliance Plan (NRCP) to the City as part of the grading permit submittal showing the limits of nighttime construction based on the currently occupied residential dwellings. The limits of nighttime grading shall be shown on the NRCP and grading plan submitted to the City. The limits of construction allowed at night shall be staked or posted on site, and contractors will be provided with a copy of the plan showing the limits of nighttime construction.

With the implementation of this mitigation measure the loudest noise level that would be experienced at any developed residential parcel would be less than 55 dBA (Leq) during the nighttime and these levels would be consistent with the limits established in the City's Noise Ordinance.

If grading is to occur at night within 2,800 feet of residences south of SR-60, then construction of a 12 foot temporary sound barrier will be required. A temporary barrier will reduce noise levels by approximately 10 dB. If an appropriate temporary sound barrier is constructed, then the buffer area can be reduced from 2,800 feet to 1,580 feet. The temporary sound barrier may be used. If sound blankets are used the curtains must have a Sound Transmission Class (STC) rating of 27. Examples of acceptable blankets can be found at the following websites; www.enoisecontrol.com/outdoor-sound-blankets.html and www.acousticalsurfaces.com/curtan_stop/curt_absorb.htm?d=12. Other blankets are acceptable as long as they have the required STC rating. Many unrated blankets are available, but their acoustic performance is generally unacceptable.

Noise measurements of construction activities often reveal that the construction noise levels are less than predicted. At the discretion of the builder, a Registered Professional Engineer can be hired to measure construction noise. Noise measurements over a three hour period on two consecutive nights can be used to modify the required buffer area. A Registered Professional Engineer with an expertise in acoustics shall prepare a report documenting the noise measurements and recommending a specific buffer distance. Once the report is submitted to and approved by the City, the buffer distance may be reduced to the distance recommended in the report.

N-3. Install temporary sound barrier. Construction within 1,580 feet of residential areas south of the freeway has the potential to exceed the daytime Moreno Valley Noise Ordinance criteria of 60 dBA (Leq). Any construction within 1,580 feet of a residence should be shielded from the residence with a 12 foot temporary sound barrier. A sound barrier will reduce the noise levels by about 10 dB. Residences within 500 feet may still be exposed to noise levels greater than 60 dBA (Leq), but the noise levels for residences greater than 500 feet from the construction area will experience noise levels consistent with the City's ordinance.

N-4. Require Residential Grade Mufflers. The grading contractor shall be required to certify that all equipment to be used will have residential grade mufflers or better on their equipment. All stationary construction equipment shall be placed so that emitted noise is directed away from noise sensitive receptors nearest the site. Additionally, stationary construction equipment if

standardly fitted with an acoustic cover by the manufacturer shall have the acoustic cover in place during operation.

N-5. Locate Material Stockpiles 1,200 Feet from Residences South of the Freeway.

Material stockpiles shall be located at least 1,200 feet from the residences. Remotely locating the stockpiles reduces the noise at the residences from equipment traveling to and from the stockpiles, and the noise that is sometimes associated with stacking materials. With these measures in place the impacts from on-site construction will be reduced to an extent. Nighttime impacts from on-site construction will be eliminated. However, daytime impacts to residents within 500 feet of construction will remain significant.

Noise and Vibration Technical Report Assessment (Replacement Mitigation Measures as found in the revised MMRP)

4.12.6.1A Prior to issuance of any discretionary project approvals, a Noise Reduction Compliance Plan (NRCP) shall be submitted to and approved by the City. The NRCP shall be prepared by a qualified acoustical consultant describing how noise reduction measures shall be implemented to reduce the noise exposure on sensitive receptors adjacent to onsite and offsite construction areas. The noise reduction measures shall be implemented so that construction activities do not exceed the City's daytime and nighttime average hourly noise standard of 60 dBA Leq and 55 dBA Leq, respectively. The construction noise reduction measures shall include, but not be limited to, the following measures: • All construction equipment, fixed or mobile, shall be equipped with operating and maintained mufflers consistent with manufacturers' standards.

- Construction vehicles shall be prohibited from using Redlands Boulevard south of Eucalyptus Avenue to access on-site construction for all phases of development of the project. No construction activity shall occur within 800 feet of residences between 8 p.m. and 7 a.m. on weekdays and weekends.
- A 12-foot tall temporary construction sound barrier blocking the line-of-sight of construction activity to any residential receptor located within 800 feet of active construction areas shall be installed prior to commencement of any construction activity. The temporary sound barrier shall be constructed of plywood with a total thickness of 1.5 inches, or a sound blanket wall may be used. If sound blankets are used, they must have a Sound Transmission Class (STC) rating of 27 or greater.
- Distribute to the potentially affected residences and other sensitive receptors within 500 feet of project construction boundary a "hotline" telephone number, which shall be attended during active construction working hours, for use by the public to register complaints. The distribution shall identify a noise disturbance coordinator who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaints and institute feasible actions warranted to correct the problem. All complaints shall be logged noting date, time, complainant's name, nature of complaint, and any corrective action taken. The distribution shall also notify residents adjacent to the project site of the construction schedule. Records of any complaints and corrective action shall be stored at the site and available to the City upon request.

Prior to issuance of any discretionary project approvals, a Noise Reduction Compliance Plan (NRCP) shall be submitted to and approved by the City. The Noise Reduction Compliance Plan shall show the limits of nighttime construction in relation to any then-occupied residential dwellings and shall be in conformance with City standards. Conditions shall be added to any discretionary projects requiring that the limits of nighttime grading be shown on the Noise Reduction Compliance Plan and all grading plans submitted to the City (per Noise Study MM N-2, pg. 51).

4.12.6.2A When processing future individual buildings under the World Logistics Center Specific Plan, as part of the City's approval process, the City shall require the Applicant to take the following three actions for each building prior to approval of discretionary permits for individual plot plans for the requested development:

Action 1: Perform a building-specific noise study to ensure that the assumptions set forth in the Revised Sections of the FEIR remain valid. These procedures used to conduct these noise analyses shall be consistent with the noise analysis conducted in the Revised Sections of the FEIR and shall be used to impose building-specific mitigation on the individually proposed buildings.

Action 2: If the building-specific analyses identify that the proposed development triggers the need for mitigation from the proposed building, including all preceding developments in the World Logistics Center site, the Applicant shall implement the mitigation identified in the Revised Sections of the FEIR to reduce the identified impacts to comply with the Moreno Valley Municipal Code, which sets maximum sound levels (8:00 a.m. – 10:00 p.m.) and 55 dBA during nighttime hours (10:01 p.m. – 7:59 a.m.). Prior to implementing the mitigation, the Applicant shall send letters by registered mail to all property owners and non-owner occupants of properties that would benefit from the proposed mitigation asking them to provide a position either in favor of or in opposition to the proposed mitigation asking them to provide a position either in favor of or in opposition to the proposed noise abatement mitigation within 45 days. Each property shall be entitled to one vote on behalf of owners and one vote per dwelling on behalf of non-owner occupants. If more than 50% of the votes from responding benefited receptors oppose the abatement, the abatement will not be considered reasonable. Additionally, for noise abatement to be located on private property, 100% of owners of property upon which the abatement is to be placed must support the proposed abatement. In the case of proposed noise abatement on private property, no response from a property owner, after three attempts by registered mail, is considered a *no* vote. At the completion of the vote at the end of the 45-day period, the Applicant shall provide the tentative results of the vote to all property owners by registered mail. During the next 15 calendar days following the date of the mailing, property owners may change their vote. Following the 15-day period, the results of the vote will be finalized and made public.

Action 3: Upon consent from benefited receptors and property owners, the Applicant shall post a bond for the cost of the construction of the necessary mitigation as estimated by the City Engineer to ensure completion of the mitigation. The certificate of occupancy permits shall be issued upon posting of the bond or demonstration that 50% of the votes from responding benefited receptors oppose the abatement or, if the abatement is located on private property, any property owners oppose the abatement.

It is hoped that the Planning Commission will actively review and amend these documents prior to forwarding them to the City Council for consideration. Should you or others have any questions regarding our comments please address them to Tom Thornsley at tomthornsley@hotmail.com .

Sincerely,

Tom Thornsley

Tom Thornsley
with Residents for a Livable Moreno Valley

Zoom Info: Works Logistic Center 7 pm Planning Commission Meeting Thursday May 14, 2020

Please keep the Zoom information found below available to use for a call on the World Logistic Center's (WLC) 7 pm Thursday Planning Commission meeting — it is the 2nd item on the agenda. Use your commuter to connect through the website or a fully charged telephone to call one of the two numbers found below. When prompted, enter the Meeting ID and later the Password. Your connection will be kept on mute as while connected to the meeting. Those on a computer can request to speak and those calling in will be asked using the telephone number. Everyone is allowed up to 3 minutes to speak your thoughts. The meeting should be available on cable channel 3. You can also email planner Julia Descoteaux (juliad@moval.org) with your thoughts for the Planning Commissioners. Do not be afraid to comment on those things that bother you most and offer suggestions on how they should be fixed.

The more active participation the better.

Join Zoom Meeting

<https://moval.zoom.us/j/94671746310>

Meeting ID: 946 7174 6310

Password: 294031

One tap mobile

+1 669) 219--2599, Password/ID: 94671746310# (San Jose)

+1 669) 900--6833, Password/ID: 94671746310# (San Jose)

May 14, 2020

Julia Descoteaux
City of Moreno Valley
14177 Frederick Street
Moreno Valley, California 92552

Via e-mail: alberta@moval.org

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Dear Ms. Descoteaux,

We would like to object to the limited time given for review of extraordinarily large set of documents and reports. Although some were previously available the comprehensive review is challenging. That said, and at this time, we have two major concerns of note related to the forgoing of certain Development Impact Fees (DIF) outlined in the Development Agreement and the extraordinary diminished changes to the mitigation measures for Noise impacts.

First: Development Agreement

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Finding: Sections 4.8 and 4.9 of the Development Agreement require the developer of the Project to construct or pay for all necessary traffic improvements and a fire station, all as needed, as a result of the development of the Project. In return, section 1.5, 4.8, and 4.9 of the Development Agreement exempts the Project from the payment of development impact fees ordinarily imposed under Municipal Code sections 3.42.030, 040, and 060. These exemptions shall remain in effect only as long as the Development Agreement is in effect. If the Development Agreement is approved but does not become effective or if it is approved

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1.5 “Development Impact Fee,” “Development Impact Fees” or “DIF” means for purposes of this Agreement only those fees imposed pursuant to Moreno Valley Municipal Code Sections 3.42.070 (police facilities), 3.42.080 (City hall facilities), 3.42.090 (corporate yard facilities) and 3.42.100 (maintenance equipment). The term “Development Impact Fees” (or “DIF”) does not include those fees imposed by Moreno Valley Municipal Code Sections 3.42.030 (arterial streets), 3.42.040 (traffic signals), 3.42.050 (interchange improvements) and 3.42.060 (fire facilities).

4.8 Payment of, and Reimbursement for, the Cost of Improvements Paid for by HF Which Are in Excess of HF’s Fair Share. HF shall satisfy the requirements imposed by Mitigation Measure 4.15.7.4.A, as set forth in the EIR, to ensure that all of the Development’s impacts on the City’s circulation system, including, but not limited to, improvements to arterial streets, traffic signals and interchanges, are mitigated. Because HF will be responsible for paying for or constructing all circulation-related improvements, it shall not pay the fees imposed by Moreno Valley Municipal Code Sections 3.42.030 (arterial streets), 3.42.040 (traffic signals) and 3.42.050 (interchange improvements). City will provide to HF the reimbursement agreement(s) in the form and type as specified in Chapter 9.14 of Title 9 of the Moreno Valley Municipal Code.

4.9 Provision of a “turnkey” Fire Station. HF shall, at its own cost, provide a fully constructed, fully equipped fire station and fire station site, including fire trucks, as specified by the City’s Fire Chief. The fire station’s furniture and fixtures shall be reasonably comparable to those of the most recently completed fire station within the City. The fire station, equipment and trucks shall be provided as and when directed by the Fire Chief. Because HF will be responsible for the provision of the fire station, fire station site, equipment, and trucks, it shall not pay the fee imposed by Moreno Valley Municipal Code Section 3.42. 060 (fire facilities). City will provide to HF the reimbursement agreement(s) in the form and type as specified in Chapter 9.14 of Title 9 of the Moreno Valley Municipal Code.

Second: Noise Impact Evaluations

When the original FEIR was approved it use the “**Noise Assessment for the WLCSP**” to establish mitigation measures that would be necessary to limit construction impacts to those residents in the surrounding homes. It noted that work within the project area may be done on a 24 hour 7 days per week schedule which goes beyond the Moreno Valley Municipal Code’s (MVMC Section 8.14.040 Miscellaneous standards and regulations.) listed hours of 7 a.m. to 7 p.m. The Noise Assessment defined construction limits so as to limit noise impacts on the surrounding residences outside the standard construction hours and clearly outlined the high level of noise that could be expected both during daytime and nighttime hours beyond the

allowed decibel levels defined by the MVMC. Thus the study included “**Mitigation Measure N-2. No Nighttime Grading Within 2,800 Feet of Residences South of the Freeway**” was issued. It goes on to allow closer nighttime construction at 1,580 feet after the installation of an appropriate sound barrier. These would appear to be realistic mitigations but it would appear the developer might have found this to be somewhat restrictive and excessive so a different noise analysis firm was selected to prepare a new study.

The new “**Noise and Vibration Technical Report Assessment**” proposed a substantially different evaluation and lesser mitigations to the noise impacts. It states that “No construction activity shall occur within 800 feet of residences between 8 p.m. and 7 a.m. on weekdays and weekends, and a 12-foot tall temporary construction sound barrier blocking the line-of-sight of construction activity to any residential receptor located within 800 feet of active construction areas shall be installed prior to commencement of any construction activity.”

The mitigation requirement for a sound barrier is similar to the original MM however the active setback is now moved forward by 2,000 feet or three and a half times closer. Additionally, the MM includes options that would eliminate the need install the on-site sound barrier if a vote by those affected fails to garner 50% favorable votes or 100% favorable votes for a sound barrier placed on private property. These two provisions were never a consideration in the original noise analysis nor do they seem to be fair to the community due to the percentages needed based on the full text of the MM. It appears that this clause in MM **4.12.6.2A** is of a greater benefit to the developer than to the surrounding residents.

Noise Study and MM

“**Noise Assessment for the WLCSP**” (Mestre Greve Associates) original dated January 2013, revised September 2014. (This document is still referenced in the 12-2019 Draft Recirculated Revised Sections of the Final Environmental Impact Report)

“**Noise and Vibration Technical Report Assessment** (ESA)”, July 2018 which was not in the original 2014 DEIR for WLC) Since both studies are cited in the Draft REIR how is it that the more stringent mitigation measures are not utilized?

In the 2018 edition of the Draft REIR it used the “**Noise and Vibration Technical Report**”, and its mitigation measures now replace those of the “**Noise Assessment for the WLCSP**” that where much more favorable to the community and surrounding homeowners.

Noise Assessment for the WLCSP

Pgs. 27 - 30

2.2.1 On-Site Construction

Work within the project site will consist of mass grading, fine grading, building construction, utilities installation, interchange improvements, paving and curbing, and landscaping. Work within the project area may be done on a 24 hour 7 days per week schedule. Construction activities would occur at varying locations on-site, but may last for an extended period of time. For instance, grading activities for each phase are anticipated to last one year. However, the

grading may be concentrated in one area for a while and then move on to another area, and so on. In other words, grading noise will not impact one area for an entire year. Building construction will occur from time to time over a nine year period lasting from 2013 through 2021.

Residences within the Specific Plan area. Three pockets of homes are located within the Specific Plan area, and construction noise will be an issue for occupants of these residences. While these areas are to be designated for Light Logistics development under the proposed Specific Plan, they may remain in residential use indefinitely. Future Light Logistics uses would not be sensitive to noise, but as long as these sites remain in residential use, they will need to be considered as noise sensitive uses. These homes may be located adjacent to areas where intense construction activities could occur. These homes may experience worst-case unmitigated peak construction noise levels (Lmax) up to 97 dBA. The average noise levels are typically 5 to 15 dB lower than the peak noise levels. Average noise levels (Leq) at 50 feet from the residence could be in the range of 82 to 92 dBA during most phases of construction.

The City of Moreno Valley Municipal Code does not include any exemptions for construction noise. Therefore, construction would be subject to the limitations of 60 dBA during the daytime and 55 dBA at the nighttime measured at occupied residential locations. Exceeding these limits would result in a significant noise impact. Based on information in the previous paragraph these noise levels would regularly be exceeded during the daytime and nighttime hours at residences within the Specific Plan area. Based on an Leq noise level of 90 dBA at 50 feet, an observer would need to be 1580 feet from the construction to experience a noise level of 60 dBA (Leq), or 2,800 feet for a noise level of 55 dBA (Leq). A residence within 1,580 feet during active construction during the daytime would be impacted, or within 2,800 feet during the nighttime would be impacted. Mitigation is discussed in Section 3.1.1.

Residences Adjacent to the Specific Plan area. Residences are located adjacent to the project in the areas along Redlands Boulevard, Merwin Street, Bay Avenue, Cactus Avenue, and Gilman Springs Road. The potential for noise impacts will be similar to those impacts for residents within the Specific Plan area. Specifically, a receptor would need to be more than 1,580 feet from the construction to experience a noise level less than 60 dBA (Leq), or more than 2,800 feet for a noise level less than 55 dBA (Leq). A residence within 1,580 feet during active construction during the daytime would be impacted, or within 2,800 feet during the nighttime would be impacted. Mitigation is discussed in Section 3.1.1.

Mitigation Measures from “Noise Assessment for the WLCSP”
Pgs. 50 – 51

The following mitigation measures are identified for significant construction noise impacts:

N-1. No Construction Vehicles on Redlands Boulevard South of Fir Avenue. No construction vehicles of any type for on-site construction shall be permitted on Redlands Boulevard south of Fern Avenue. The prohibition for construction traffic should occur for all phases of the proposed project.

N-2. No Nighttime Grading Within 2800 Feet of Residences South of the Freeway.

Construction grading shall not be allowed within 2,800 feet of residences south of SR-60 between 8 p.m. and 7 a.m. Prior to the issuance of a grading permit, the developer shall submit a Noise Reduction Compliance Plan (NRCP) to the City as part of the grading permit submittal showing the limits of nighttime construction based on the currently occupied residential dwellings. The limits of nighttime grading shall be shown on the NRCP and grading plan submitted to the City. The limits of construction allowed at night shall be staked or posted on site, and contractors will be provided with a copy of the plan showing the limits of nighttime construction.

With the implementation of this mitigation measure the loudest noise level that would be experienced at any developed residential parcel would be less than 55 dBA (Leq) during the nighttime and these levels would be consistent with the limits established in the City's Noise Ordinance.

If grading is to occur at night within 2,800 feet of residences south of SR-60, then construction of a 12 foot temporary sound barrier will be required. A temporary barrier will reduce noise levels by approximately 10 dB. If an appropriate temporary sound barrier is constructed, then the buffer area can be reduced from 2,800 feet to 1,580 feet. The temporary sound barrier may be used. If sound blankets are used the curtains must have a Sound Transmission Class (STC) rating of 27. Examples of acceptable blankets can be found at the following websites; www.enoisecontrol.com/outdoor-sound-blankets.html and www.acousticalsurfaces.com/curtan_stop/curt_absorb.htm?d=12. Other blankets are acceptable as long as they have the required STC rating. Many unrated blankets are available, but their acoustic performance is generally unacceptable.

Noise measurements of construction activities often reveal that the construction noise levels are less than predicted. At the discretion of the builder, a Registered Professional Engineer can be hired to measure construction noise. Noise measurements over a three hour period on two consecutive nights can be used to modify the required buffer area. A Registered Professional Engineer with an expertise in acoustics shall prepare a report documenting the noise measurements and recommending a specific buffer distance. Once the report is submitted to and approved by the City, the buffer distance may be reduced to the distance recommended in the report.

N-3. Install temporary sound barrier. Construction within 1,580 feet of residential areas south of the freeway has the potential to exceed the daytime Moreno Valley Noise Ordinance criteria of 60 dBA (Leq). Any construction within 1,580 feet of a residence should be shielded from the residence with a 12 foot temporary sound barrier. A sound barrier will reduce the noise levels by about 10 dB. Residences within 500 feet may still be exposed to noise levels greater than 60 dBA (Leq), but the noise levels for residences greater than 500 feet from the construction area will experience noise levels consistent with the City's ordinance.

N-4. Require Residential Grade Mufflers. The grading contractor shall be required to certify that all equipment to be used will have residential grade mufflers or better on their equipment. All stationary construction equipment shall be placed so that emitted noise is directed away from noise sensitive receptors nearest the site. Additionally, stationary construction equipment if

standardly fitted with an acoustic cover by the manufacturer shall have the acoustic cover in place during operation.

N-5. Locate Material Stockpiles 1,200 Feet from Residences South of the Freeway.

Material stockpiles shall be located at least 1,200 feet from the residences. Remotely locating the stockpiles reduces the noise at the residences from equipment traveling to and from the stockpiles, and the noise that is sometimes associated with stacking materials. With these measures in place the impacts from on-site construction will be reduced to an extent. Nighttime impacts from on-site construction will be eliminated. However, daytime impacts to residents within 500 feet of construction will remain significant.

Noise and Vibration Technical Report Assessment (Replacement Mitigation Measures as found in the revised MMRP)

4.12.6.1A Prior to issuance of any discretionary project approvals, a Noise Reduction Compliance Plan (NRCP) shall be submitted to and approved by the City. The NRCP shall be prepared by a qualified acoustical consultant describing how noise reduction measures shall be implemented to reduce the noise exposure on sensitive receptors adjacent to onsite and offsite construction areas. The noise reduction measures shall be implemented so that construction activities do not exceed the City's daytime and nighttime average hourly noise standard of 60 dBA Leq and 55 dBA Leq, respectively. The construction noise reduction measures shall include, but not be limited to, the following measures: • All construction equipment, fixed or mobile, shall be equipped with operating and maintained mufflers consistent with manufacturers' standards.

- Construction vehicles shall be prohibited from using Redlands Boulevard south of Eucalyptus Avenue to access on-site construction for all phases of development of the project. No construction activity shall occur within 800 feet of residences between 8 p.m. and 7 a.m. on weekdays and weekends.
- A 12-foot tall temporary construction sound barrier blocking the line-of-sight of construction activity to any residential receptor located within 800 feet of active construction areas shall be installed prior to commencement of any construction activity. The temporary sound barrier shall be constructed of plywood with a total thickness of 1.5 inches, or a sound blanket wall may be used. If sound blankets are used, they must have a Sound Transmission Class (STC) rating of 27 or greater.
- Distribute to the potentially affected residences and other sensitive receptors within 500 feet of project construction boundary a "hotline" telephone number, which shall be attended during active construction working hours, for use by the public to register complaints. The distribution shall identify a noise disturbance coordinator who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaints and institute feasible actions warranted to correct the problem. All complaints shall be logged noting date, time, complainant's name, nature of complaint, and any corrective action taken. The distribution shall also notify residents adjacent to the project site of the construction schedule. Records of any complaints and corrective action shall be stored at the site and available to the City upon request.

- Prior to issuance of any discretionary project approvals, a Noise Reduction Compliance Plan (NRCP) shall be submitted to and approved by the City. The Noise Reduction Compliance Plan shall show the limits of nighttime construction in relation to any then-occupied residential dwellings and shall be in conformance with City standards. Conditions shall be added to any discretionary projects requiring that the limits of nighttime grading be shown on the Noise Reduction Compliance Plan and all grading plans submitted to the City (per Noise Study MM N-2, pg. 51).

4.12.6.2A When processing future individual buildings under the World Logistics Center Specific Plan, as part of the City's approval process, the City shall require the Applicant to take the following three actions for each building prior to approval of discretionary permits for individual plot plans for the requested development:

Action 1: Perform a building-specific noise study to ensure that the assumptions set forth in the Revised Sections of the FEIR remain valid. These procedures used to conduct these noise analyses shall be consistent with the noise analysis conducted in the Revised Sections of the FEIR and shall be used to impose building-specific mitigation on the individually proposed buildings.

Action 2: If the building-specific analyses identify that the proposed development triggers the need for mitigation from the proposed building, including all preceding developments in the World Logistics Center site, the Applicant shall implement the mitigation identified in the Revised Sections of the FEIR to reduce the identified impacts to comply with the Moreno Valley Municipal Code, which sets maximum sound levels (8:00 a.m. – 10:00 p.m.) and 55 dBA during nighttime hours (10:01 p.m. – 7:59 a.m.). Prior to implementing the mitigation, the Applicant shall send letters by registered mail to all property owners and non-owner occupants of properties that would benefit from the proposed mitigation asking them to provide a position either in favor of or in opposition to the proposed mitigation asking them to provide a position either in favor of or in opposition to the proposed noise abatement mitigation within 45 days. Each property shall be entitled to one vote on behalf of owners and one vote per dwelling on behalf of non-owner occupants. If more than 50% of the votes from responding benefited receptors oppose the abatement, the abatement will not be considered reasonable. Additionally, for noise abatement to be located on private property, 100% of owners of property upon which the abatement is to be placed must support the proposed abatement. In the case of proposed noise abatement on private property, no response from a property owner, after three attempts by registered mail, is considered a *no* vote. At the completion of the vote at the end of the 45-day period, the Applicant shall provide the tentative results of the vote to all property owners by registered mail. During the next 15 calendar days following the date of the mailing, property owners may change their vote. Following the 15-day period, the results of the vote will be finalized and made public.

Action 3: Upon consent from benefited receptors and property owners, the Applicant shall post a bond for the cost of the construction of the necessary mitigation as estimated by the City Engineer to ensure completion of the mitigation. The certificate of occupancy permits shall be issued upon posting of the bond or demonstration that 50% of the votes from responding benefited receptors oppose the abatement or, if the abatement is located on private property, any property owners oppose the abatement.

It is hoped that the Planning Commission will actively review and amend these documents prior to forwarding them to the City Council for consideration. Should you or others have any questions regarding our comments please address them to Tom Thornsley at tomthornsley@hotmail.com .

Sincerely,

Tom Thornsley

Tom Thornsley
with Residents for a Livable Moreno Valley

Zoom Info: Works Logistic Center 7 pm Planning Commission Meeting Thursday May 14, 2020

Please keep the Zoom information found below available to use for a call on the World Logistic Center's (WLC) 7 pm Thursday Planning Commission meeting — it is the 2nd item on the agenda. Use your commuter to connect through the website or a fully charged telephone to call one of the two numbers found below. When prompted, enter the Meeting ID and later the Password. Your connection will be kept on mute as while connected to the meeting. Those on a computer can request to speak and those calling in will be asked using the telephone number. Everyone is allowed up to 3 minutes to speak your thoughts. The meeting should be available on cable channel 3. You can also email planner Julia Descoteaux (juliad@moval.org) with your thoughts for the Planning Commissioners. Do not be afraid to comment on those things that bother you most and offer suggestions on how they should be fixed.

The more active participation the better.

Join Zoom Meeting

<https://moval.zoom.us/j/94671746310>

Meeting ID: 946 7174 6310

Password: 294031

One tap mobile

+1 669) 219--2599, Password/ID: 94671746310# (San Jose)

+1 669) 900--6833, Password/ID: 94671746310# (San Jose)

From: Darrell Peeden <darrellpeeden@gmail.com>
Sent: Thursday, May 14, 2020 5:36 PM
To: Julia Descoteaux
Subject: Letter of Opposition to World Logistics Center
Attachments: Opposition to World Logistics Center.pdf

Warning: External Email – Watch for Email Red Flags!

To Whom It May Concern:

Below and attached is my letter of opposition to the World Logistics Center to be entered into the public record and shared with our Planning Commission. Thank you.

RE: Opposition to World Logistics Center

Dear Planning Commissioners:

I am writing this letter to express my opposition to the World Logistics Center project.

We are living in uncertain times, now more than ever it is important we center public health in the economic discussion. We have experienced first hand how public health is a deciding factor to economic prosperity. Too often our vulnerable and at-risk communities are left behind in the public debate, and the World Logistics Center debate is no exception. COVID-19 has placed the issue of health disparities in communities of color at the forefront of the economic and health policy debate, and it is our responsibility to ensure that issue is front and center here in Moreno Valley - a city with one of the largest poverty rates in the Inland Empire. In addition, our communities are affected by asthma and other respiratory health issues caused by high levels of air pollution.

Six years ago, I stood against the World Logistics Center project, today, I continue to stand against this project. It has never been more clear than it is now. The continued disregard for the public's health when making economic and planning decisions can no longer continue. These decisions not only hurt our communities, but our collective economic prosperity. The World Logistics Center will produce air pollution that will harm our families and students for generations. Building warehouses the size of 700 football fields is especially short sighted during times of economic uncertainty, which we are now experiencing for the foreseeable future. It is clear, because of Covid19, we will see the logistics industry moving faster towards full automation which is counterproductive to job growth and economic development.

What we need is a project that increases economic diversity in Moreno Valley. Projects that center community and provide for community wealth, not a path towards poverty, environmental destruction and increased public health risks. We need a project that provides economic security to unionized workers in Moreno Valley and protects their health and well-being. The continued consideration of the World Logistics Center project is irresponsible and short-sighted. I urge the planning commission to consider the health and economic well-being of our community when making this decision. I strongly ask you to oppose this project.

Sincerely,

Darrell A. Peeden
Moreno Valley Unified School Board Vice President
Vice President, SBX Youth and Family Services
darrellpeeden@gmail.com

Disclaimer: The views and opinions expressed in this letter are those of the authors and do not necessarily reflect the official policy or position of any agency or organization.

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Darrell A. Peeden
Moreno Valley Unified School Board Vice President
Vice President, SBX Youth and Family Services
darrellpeeden@gmail.com

Disclaimer: The views and opinions expressed in this letter are those of the authors and do not necessarily reflect the official policy or position of any agency or organization.

From: Corinne Orozco <rubyredhummingbird7@yahoo.com>
Sent: Thursday, May 14, 2020 5:39 PM
To: Julia Descoteaux
Subject: WLC

Warning: External Email – Watch for Email Red Flags!

Hello Planners,

I am a resident and property owner in Moreno Valley.

I am against the WLC.

WLC is an encroachment of my community in an unsafe way by polluting, destroying land and its environment, traffic by unsafe infrastructure, and crime.

This is not time to destroy land when in the near future our Nation will be close to financial disasters. Meaning consumerism will be for necessities only.

Decades ago developers had free reign and built shopping centers all over MV. Today, they are unkept and empty. Soon it will look worse.

As far as jobs, we need professional jobs. Planners changed zoning from medical, hospitals, which are in dire need today, schools and housing for warehouses.

My community will become a cement nightmare, low paying jobs which means housing will be multi-family instead of being financially independent.

Also, sex trafficking is a horrible abuse at this time in MV and elsewhere. Containers and drivers go hand in hand. Leave it to your conscious to help hand them what they need.

Concerned MV resident,

Corinne Orozco

Sent from my iPhone

From: Susan Zeitz <whitwdtravel@verizon.net>
Sent: Thursday, May 14, 2020 5:47 PM
To: "juliad\\""@moval.org
Subject: Fwd: May 14, 2020 EIR

Warning: External Email – Watch for Email Red Flags!

For the public record, **I am writing to oppose the approval by the planning commission of the “revised” final wlc EIR** as it still does not adequately address nor fix all the issues described by the courts. I also feel that it should be denied until this proposed street widening plan in its entirety until all affected residents, and neighbors, are properly notified and able to voice their concerns.

I feel this, as well as another non-essential projects such as, the general plan update, and the Theodore interchange project should be postponed during this lock down until the residents can fully participate in person. The Riverside Board of Supervisors and the Riverside City Council have both acknowledged the importance of the democratic process and postponed these types of decisions until the public can fully participate.

Unfair

- It is horrifying to see this new map of road widening in our neighborhoods that is buried in this file.

- All residents in the affected areas should have received individual notices of the road proposals that Benzeevi is hiding in the EIR.

- Four lanes are NOT needed in these neighborhoods and destroying Gilman Springs with 6 lanes is reprehensible.

- Do no allow this negative impact on the homes along Redlands Blvd and the residents that live there. We do not want to pay to widen any streets that will harm our neighborhoods, especially for someones personal gains. Residents should not pay for his project improvements! Benzeevi and his holding Highland Fairview do anything they want as if we aren't smart enough to know what it is they're doing. It is his sneaky way to turn our residential streets into truck routes, further destroying our quality of life and health. **Please do not approve this street widening map and remove it from this EIR.**

- Mr. Benzeevi has not honored his commitment to improve Eucalyptus by skechers and it appears you want us taxpayers to pay for it.

Reject this EIR until all concerns are addressed

- In this revised EIR doesn't provide a location for truck servicing and parking. A project of this magnitude needs to provide those amenities and not force them to go to neighboring residential areas.

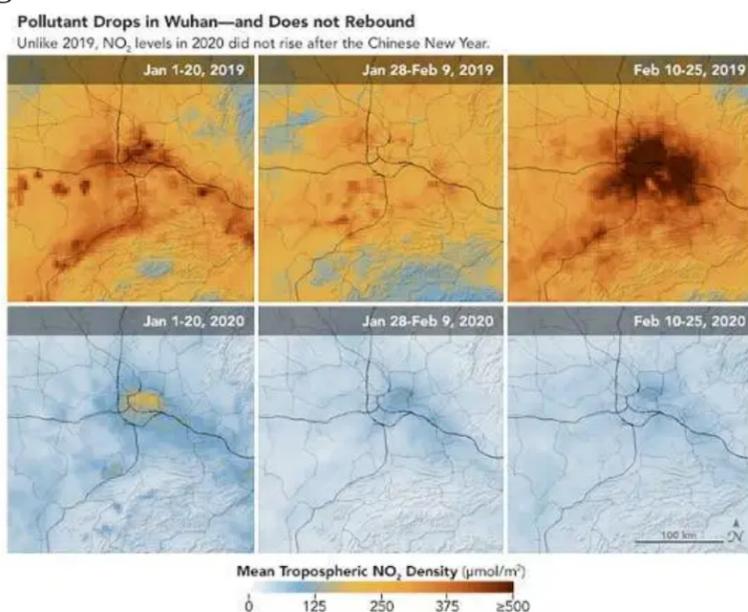
- NE Moreno Valley is NOT where truck stops/fueling stations belong. They belong on the wlc property and this needs to be clear they won't put them here

This will negatively affect the residents in many ways such as but not limited to:

- Suddenly living on a diesel truck route, when they purchased a home on a residential street.
- 24 hours a day increase in traffic
- Widening their residential street bringing traffic closer to their home
- Vibrations felt in their homes caused by the closer proximity and sheer size of diesel truck traffic and vehicles to their residential homes
- Noise pollution at decibels not allowed in residential neighborhoods that will reverberate against, around, and throughout their homes disrupting their lives and way of living.
- Being subjected to road dirt, and diesel dirt.
- Never being able to leave their windows open due to noise and pollution on their doorstep.
- Unable to sleep with windows open due to noise and pollution
- Increase in electric costs because residence can't leave their windows open to catch the afternoon breeze to cool their homes, or leave the windows open at night to take advantage of the cool air
- Night sky loss
- Light pollution from street lights and diesel trucks and additional car trips
- Rural life style of many of these neighborhoods that do not coincide with high traffic, truck traffic, or faster traffic.
- Trying to negotiate getting in and out of their driveways
- Health risk increase due to closer proximity to pollution

Valid Points

- **WLC** should not be allowed to build across the street from occupied homes as is their current plan.
- **Caltrans** has no plans to widen the 60 freeway thru Moreno Valley
- **Neighborhoods** – Plans to widen our residential neighborhood streets will make all residents suffer more traffic, noise, pollution, and danger
- **Road Conditions** – Trucks and additional traffic will further lay ruin to the roads
- **Road work** – Cost of road work, upkeep, and repairs should fall on the developers
- New development agreement exempts Benzeevi from paying for street improvements therefore the entrance needs to be directly from freeway Sec 4.8.... HF (Highland Fairview) shall not pay the fees imposed by Moreno Valley Municipal Code Sections 3.42.030 (arterial streets), 3.42.040 (traffic signals) and 3.42.050 (interchange improvements)
- **HF (Highland Fairview)** should pay the fees as required by MV Municipal codes as noted in section 4.8. The excessive traffic this project will subject our roads to requires HF to pay these fees. Do not accept this provision.
- **Street conditions** – only addresses that Benzeevi is exempt from paying for the impact to our streets even when he and his projects are negatively impacting them
- **Access to the WLC** – the plan does not specify routes trucks must use to access wlc
- **Setbacks** - no changes have been made to the project setbacks, land uses, or design adjacent to all existing residential neighborhoods for traffic, air quality or noise impacts
- **Unknown tenants** mean it's impossible to mitigate all the negative impacts adequately
- **Noise Ordinances** must be made prior to the approval for warehouses or other untenanted buildings before any more are approved/built to protect the residents from 24hr/day noise and must follow the same noise ordinances as residents/construction/yard workers and shut down from 10 pm- 7 am. Solaris Paper Company is a prime example of unreasonable noise all night long.
- **Omission** -The Newkirk home on Dracea was always left out wlc maps during the wlc hearings. Even when they repeatedly informed the city staff and meeting attendees. (another item you wanted brushed under the rug because it did matter) Money trumps Residents
- **San Jacinto Wildlife Area** -There has been no change to the project along the 2-mile border with San Jacinto Wildlife Area and **The judge** specifically called him out on his buffer where he was using land that wasn't his to be the buffer. wlc land needs to be added to the buffer zone.
- **Lights/noise** need to end at night to protect our resident's health and quality of life, protect the wildlife and protect our highly valued night skies.
- **Greenhouse Gas** (GHG) impacts by the wlc are huge and are not mitigated locally or even within California. GHG warming the Earth's atmosphere, resulting climate change
- **Trail system** – Conspicuously, Contemptuously, Disdainfully, Disregarded, Omitted **AGAIN** the Master Planned Trail System connecting the north side of the City to Lake Perris.
- **Master Planned Multiuse Trail** needs to be in all approvals.
- **Master Planned Multiuse** over crossing at Sinclair was moved to Theodore for Mr. Benzeevi's financial benefit in putting in skechers needs to be honored and shown on the maps.
- **Mitigation** for the extra diesel exhaust from trucks is missing



- **Covid-19 Pandemic** proves us that the inherent environmental harm humanity causes and just how quickly we can fix the damage, if we were to change and adopt sustainable practices.

- The wlc project does not mitigate their compounded unhealthful air quality effects and thus this EIR needs to be rejected. Our residents and those in the surrounding areas deserve much better.

San Jacinto Wildlife Area

- Animals and birds that live and depend on this refuge are in imminent danger as they will be detrimentally and negatively impacted by major light pollution, noise pollution, fatalities to birds and animals due to hit by vehicles, and lose of the night sky along the almost 2 miles the WLC will border it.
- **Birds are in trouble. Although they live in nearly every ecosystem on earth, pollinating, dispersing seeds, controlling bugs, cleaning up carrion, and fertilizing plants about 150 bird species have gone extinct at the hand of humanity.**
- **19 species in the last quarter of the 20th century, and at least 3 species in since 2000.** A large number of birds are currently critically endangered or extinct but unconfirmed. Extinctions are continuing with 1,200 species facing extinction in this century.
- The rate of extinctions is increasing as a result of extensive and expanding habitat destruction. If we continue to encroach, degrade, and destroy areas of natural habitats it will lead to larger and more devastating extinctions.
- **Reasons for the extinction of birds is habitat loss, mortality due to structural collisions, and pollution, oil spills, and pesticide use, solar panels, wind turbines**
- **Governments, conservationists, legislation are some of the various ways being used to preserve and restore bird habitat. We should too.**

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- Warehouses
- WLC
- Diesel Truck Traffic

What about foresight?

- Warehouse will become almost completely automated and robotized in less than 10 years and will any plans made now must include that all plans now include these upgrades have to be made as they replace people with electrical powered replacements.

What about being fair instead of sneaky and secretive

- Moreno Valley's Inland Empire's Neighboring communities should be given notice of meetings that will negatively impact their quality of life, the health of their families, added traffic, the pollution, and noise, just as much as us if it's something as massive as WLC.

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The mayor has done a great disservice to the city and the residents by forming a planning commission of some of the least qualified applicants who were already supporters of HF and similarly with the general plan update advisory committee. His actions open the city to even more unnecessary litigation and were unethical to say the least.

With the necessary recusals there is no quorum for the planning commission to consider this EIR or anything related to HF, thus this EIR and the project cannot move forward.

Should these recusals be refused, then the EIR needs to be rejected for the reasons given as well as many more that were not addressed.

Also of great concern is the mayor recently fired the city manager, assistant city manager, city attorney, the head of the Planning Dept. and the head of Human Resources among others. The message to city staff is quite clear- do what the mayor (HF) tells you to do or you will be fired.

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As the general plan update is in progress at the same time, the land use of this property needs to be re-examined and rezoned to more appropriate uses that better benefits the city and protects the residents. The 2006 general plan recognized the value of land use and this area should be rezoned for the high end homes and businesses for which it was intended. This EIR offers no consideration for development alternatives of mixed land uses. To not touch this land during the process and allow Benzeevi to control the city is again opening the city up for more litigation.

Please do not approve this EIR and recommend that this land be rezoned to more appropriate land use that provides more jobs, diverse jobs and state required housing.

Time has shown that these warehouses provide little to no jobs/acre especially as automation takes over which is another reason this land use needs to be re-evaluated. The lies of high paying jobs/exaggerated numbers of jobs need to stop now. We have far too many warehouses in our city already and calling this project “logistics” doesn’t change the reality that they will be warehouses. Our residents deserve better and now that the state is calling for more housing of different types, this property needs to be reverted to 2006 plan which offered housing, and a greater diversity of businesses and jobs. Please take this into consideration and reject this EIR.

Major concerns and many environmental impacts are still not mitigated or reduced in this “new” revised EIR. In fact little has changed, therefore it needs to be denied.

Susan Zeitz

Resident since Feb 1984

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26386 Ironwood Ave.

Moreno Valley 92555

From: Susan Zeitz <whitwdtravel@verizon.net>
Sent: Thursday, May 14, 2020 5:49 PM
To: Julia Descoteaux
Subject: May 14, 2020

Warning: External Email – Watch for Email Red Flags!

For the public record, **I am writing to oppose the approval by the planning commission of the “revised” final wlc EIR** as it still does not adequately address nor fix all the issues described by the courts. I also feel that it should be denied until this proposed street widening plan in its entirety until all affected residents, and neighbors, are properly notified and able to voice their concerns.

I feel this, as well as another non-essential projects such as, the general plan update, and the Theodore interchange project should be postponed during this lock down until the residents can fully participate in person. The Riverside Board of Supervisors and the Riverside City Council have both acknowledged the importance of the democratic process and postponed these types of decisions until the public can fully participate.

Unfair

- It is horrifying to see this new map of road widening in our neighborhoods that is buried in this file.
- All residents in the affected areas should have received individual notices of the road proposals that Benzeevi is hiding in the EIR.
- Four lanes are NOT needed in these neighborhoods and destroying Gilman Springs with 6 lanes is reprehensible.
- Do no allow this negative impact on the homes along Redlands Blvd and the residents that live there. We do not want to pay to widen any streets that will harm our neighborhoods, especially for someones personal gains. Residents should not pay for his project improvements! Benzeevi and his holding Highland Fairview do anything they want as if we aren't smart enough to know what it is they're doing. It is his sneaky way to turn our residential streets into truck routes, further destroying our quality of life and health. **Please do not approve this street widening map and remove it from this EIR.**
- Mr. Benzeevi has not honored his commitment to improve Eucalyptus by skechers and it appears you want us taxpayers to pay for it.

Reject this EIR until all concerns are addressed

- In this revised EIR doesn't provide a location for truck servicing and parking. A project of this magnitude needs to provide those amenities and not force them to go to neighboring residential areas.

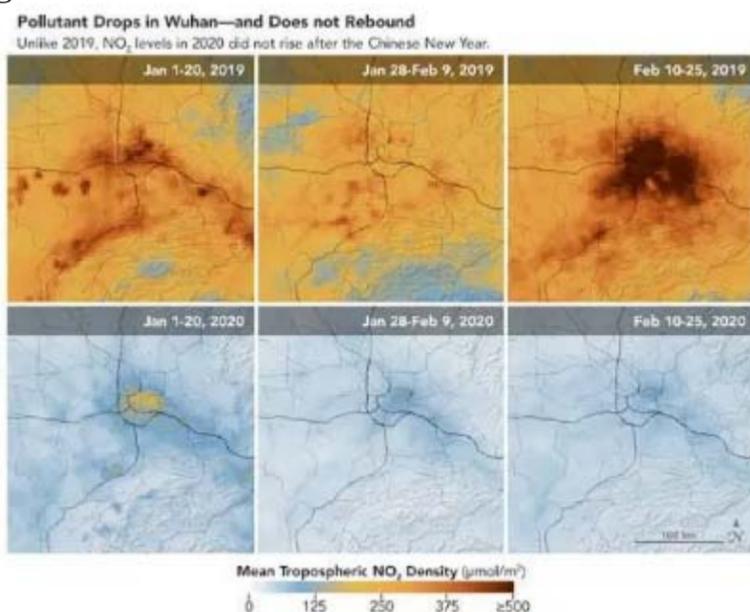
- NE Moreno Valley is NOT where truck stops/fueling stations belong. They belong on the wlc property and this needs to be clear they won't put them here

This will negatively affect the residents in many ways such as but not limited to:

- Suddenly living on a diesel truck route, when they purchased a home on a residential street.
- 24 hours a day increase in traffic
- Widening their residential street bringing traffic closer to their home
- Vibrations felt in their homes caused by the closer proximity and sheer size of diesel truck traffic and vehicles to their residential homes
- Noise pollution at decibels not allowed in residential neighborhoods that will reverberate against, around, and throughout their homes disrupting their lives and way of living.
- Being subjected to road dirt, and diesel dirt.
- Never being able to leave their windows open due to noise and pollution on their doorstep.
- Unable to sleep with windows open due to noise and pollution
- Increase in electric costs because residence can't leave their windows open to catch the afternoon breeze to cool their homes, or leave the windows open at night to take advantage of the cool air
- Night sky loss
- Light pollution from street lights and diesel trucks and additional car trips
- Rural life style of many of these neighborhoods that do not coincide with high traffic, truck traffic, or faster traffic.
- Trying to negotiate getting in and out of their driveways
- Health risk increase due to closer proximity to pollution

Valid Points

- **WLC** should not be allowed to build across the street from occupied homes as is their current plan.
- **Caltrans** has no plans to widen the 60 freeway thru Moreno Valley
- **Neighborhoods** – Plans to widen our residential neighborhood streets will make all residents suffer more traffic, noise, pollution, and danger
- **Road Conditions** – Trucks and additional traffic will further lay ruin to the roads
- **Road work** – Cost of road work, upkeep, and repairs should fall on the developers
- New development agreement exempts Benzeevi from paying for street improvements therefore the entrance needs to be directly from freeway Sec 4.8.... HF (Highland Fairview) shall not pay the fees imposed by Moreno Valley Municipal Code Sections 3.42.030 (arterial streets), 3.42.040 (traffic signals) and 3.42.050 (interchange improvements)
- **HF (Highland Fairview)** should pay the fees as required by MV Municipal codes as noted in section 4.8. The excessive traffic this project will subject our roads to requires HF to pay these fees. Do not accept this provision.
- **Street conditions** – only addresses that Benzeevi is exempt from paying for the impact to our streets even when he and his projects are negatively impacting them
- **Access to the WLC** – the plan does not specify routes trucks must use to access wlc
- **Setbacks** - no changes have been made to the project setbacks, land uses, or design adjacent to all existing residential neighborhoods for traffic, air quality or noise impacts
- **Unknown tenants** mean it's impossible to mitigate all the negative impacts adequately
- **Noise Ordinances** must be made prior to the approval for warehouses or other untenanted buildings before any more are approved/built to protect the residents from 24hr/day noise and must follow the same noise ordinances as residents/construction/yard workers and shut down from 10 pm- 7 am. Solaris Paper Company is a prime example of unreasonable noise all night long.
- **Omission** -The Newkirk home on Dracea was always left out wlc maps during the wlc hearings. Even when they repeatedly informed the city staff and meeting attendees. (another item you wanted brushed under the rug because it did matter) Money trumps Residents
- **San Jacinto Wildlife Area** -There has been no change to the project along the 2-mile border with San Jacinto Wildlife Area and **The judge** specifically called him out on his buffer where he was using land that wasn't his to be the buffer. wlc land needs to be added to the buffer zone.
- **Lights/noise** need to end at night to protect our resident's health and quality of life, protect the wildlife and protect our highly valued night skies.
- **Greenhouse Gas** (GHG) impacts by the wlc are huge and are not mitigated locally or even within California. GHG warming the Earth's atmosphere, resulting climate change
- **Trail system** – Conspicuously, Contemptuously, Disdainfully, Disregarded, Omitted **AGAIN** the Master Planned Trail System connecting the north side of the City to Lake Perris.
- **Master Planned Multiuse Trail** needs to be in all approvals.
- **Master Planned Multiuse** over crossing at Sinclair was moved to Theodore for Mr. Benzeevi's financial benefit in putting in skechers needs to be honored and shown on the maps.
- **Mitigation** for the extra diesel exhaust from trucks is missing



- **Covid-19 Pandemic** proves us that the **inherent environmental harm humanity causes** and just how quickly we can fix the damage, if we were to change and adopt sustainable practices.

- The wlc project does not mitigate their compounded unhealthful air quality effects and thus this EIR needs to be rejected. Our residents and those in the surrounding areas deserve much better.

San Jacinto Wildlife Area

- Animals and birds that live and depend on this refuge are in imminent danger as they will be detrimentally and negatively impacted by major light pollution, noise pollution, fatalities to birds and animals due to hit by vehicles, and lose of the night sky along the almost 2 miles the WLC will border it.
- **Birds are in trouble. Although they live in nearly every ecosystem on earth, pollinating, dispersing seeds, controlling bugs, cleaning up carrion, and fertilizing plants about 150 bird species have gone extinct at the hand of humanity.**
- **19 species in the last quarter of the 20th century, and at least 3 species in since 2000.** A large number of birds are currently critically endangered or extinct but unconfirmed. Extinctions are continuing with 1,200 species facing extinction in this century.
- The rate of extinctions is increasing as a result of extensive and expanding habitat destruction. If we continue to encroach, degrade, and destroy areas of natural habitats it will lead to larger and more devastating extinctions.
- **Reasons for the extinction of birds is habitat loss, mortality due to structural collisions, and pollution, oil spills, and pesticide use, solar panels, wind turbines**
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26386 Ironwood Ave.

Moreno Valley 92555

From: S Z <callthatman@verizon.net>
Sent: Thursday, May 14, 2020 6:37 PM
To: Julia Descoteaux
Subject: May 14 2020 EIR wlc

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The EIR should be rejected until all concerns are addressed and public meetings can be attended by all in person. If Mr. Benzeevi is allowed full participation all residents should have the same rights.

The wlc project EIR does not mitigate their compounded unhealthful air quality and for that alone it should be rejected.

EIR doesn't address where trucks are serviced or park while waiting and it needs to be spelled out where they can and can't park.

I am opposed to changing residential or non designated truck routes to truck routes as this is not fair to the residents who would never have purchase their home on a truck route. They would unfairly be subjected to 24 hours a day of increased traffic, noise, pollution, vibrations, light pollution, inability to keep their windows open for fresh air, cool breezes, and sleeping at night and would increase their electric costs. Widening of roads would bring all this truck and increased traffic closer to their houses along with diesel and road dirt. Night sky loss. It would negativity effect local wildlife. Ruin the rural area we live. Increase dangers in getting in and out of our driveways. Increase the risk to our health due to the closer proximity to pollutants.

Caltrans has no plans to widen the 60 freeway thru Moreno Valley and the residents should not be subject to having their non truck route streets widened and made into mini – freeways for truck routes. They should not be subject to the damage or cost of damage to streets because of traffic due to WLC. We do not want to pay for road damage due to WLC incressed traffic. We do not want to pay for upgrades, building, widening or any other road or signage costs related to a developers projects. These expenses should be paid by developer and subject to the same municipal codes as the citizens of Moreno Valley are. It should clearly state that the traffic goes only from the 60 freeway and that it can't use any other surface streets. The same noise ordinances need to apply to the wlc or any other developments just as it does to the residents with quiet hours at night. Setbacks were not changed adjacent to existing residential neighborhoods and nothing about the noise decibels, air quality or vibrations or blind driveways were addressed. Developments must have mitigated rules for any tenants regarding traffic, noise, routes, quiet nights...example is Solaris Paper Company which can be heard a couple miles north of the 60 freeway and makes it impossible to sleep with windows open and has ruined the rural atmosphere for hundreds of residents.

There has been no change to the project along the 2-mile border with San Jacinto Wildlife Area and **The judge** specifically called him out on his buffer where he was using land that wasn't his to be the buffer. wlc land needs to be added to the buffer zone. Animals and birds that live and depend on this refuge are in imminent danger as they will be detrimentally and negatively impacted by major light pollution, noise pollution, fatalities to birds and animals due to hit by vehicles, and lose of the night sky along the almost 2 miles the WLC will border it.

Our Multi-use trails have been omitted from the Master Planned Trail System connecting the north side of the City to Lake Perris again. All Master Planned Multi-use Trails need to be in all approvals. Benzeevi has yet to honor moving the trail to Theodore had it looks like you want the citizens to pay for that too.

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Because of their connections and undue influence exerted over them by HF I want the following Planning Commissioners to recuse themselves resulting in no quorum.

I contend that:

Robert Harris, Raphael Brugueres, Joann Stephens, Alvin Dejohnette and Ray Baker all need to recuse themselves from hearing, voting or advocating for in their official capacity any item which involves Highland Fairview directly and in some cases, indirectly if Highland Fairview would disproportionately benefit based on the ground of standing conflicts of interest as follows.

I also feel that if Mr. Benzeevi should not be allowed full participation in while residents are denied full the same rights.

The mayor did a great disservice to the city and the residents by forming a planning commission of some of the least qualified applicants who were already supporters of HF and similarly with the general plan update advisory committee. His actions open the city to even more unnecessary litigation and were unethical to say the least.

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The wlc revised EIR is far too large of a document to adequately read, study, comprehend and compare to the former EIR, the judge's writ and AG Becerra's suit to be sure it has been changed and improved adequately. Especially when three of the planning commissioners are also tasked with the general plan update at the same time, making it impossible for them to perform their due diligence on both items.

Additionally this EIR should not move forward as the majority of the planning commissioners need to recuse themselves for conflict of interest due to their relationships with Iddo Benzeevi and Highland Fairview.

As the general plan update is in progress at the same time, the land use of this property needs to be re-examined and rezoned to more appropriate uses that better benefits the city and protects the residents. The 2006 general plan recognized the value of land use and this area should be rezoned for the high end homes and businesses for which it was intended. This EIR offers no consideration for development alternatives of mixed land uses. To not touch this land during the process and allow Benzeevi to control the city is again opening the city up for more litigation. Please do not approve this EIR and recommend that this land be rezoned to more appropriate land use that provides more jobs, diverse jobs and state required housing.

Time has shown that these warehouses provide little to no jobs/acre especially as automation takes over which is another reason this land use needs to be re-evaluated. The lies of high paying jobs/exaggerated numbers of jobs need to stop now. We have far too many warehouses in our city already and calling this project "logistics" doesn't change the reality that they will be warehouses. Our residents deserve better and now that the state is calling for more housing of different types, this property needs to be reverted to 2006 plan which offered housing, and a greater diversity of businesses and jobs. Please take this into consideration and reject this EIR.

Major concerns and many environmental impacts are still not mitigated or reduced in this "new" revised EIR. In fact little has changed, therefore it needs to be denied.

I also feel that if Mr. Benzeevi should not be allowed full participation in while residents are denied full the same rights.

David Zeitz (Feb 1984)
26386 Ironwood Ave.
Moreno Valley 92555

Julia Descoteaux

From: Katie <kctcarriere@aol.com>
Sent: Thursday, May 14, 2020 7:18 PM
To: Julia Descoteaux
Subject: WLC

Warning: External Email – Watch for Email Red Flags!

Sent from my iPhone

Our family vehemently opposes the widening of Locust, Moreno Beach and Redlands blvd. Unless San Timoteo Canyon is being widened, this is building roadways to nowhere and ruining our rural lifestyle, which is the reason we chose the house and neighborhood we did.

Carriere family-off Locust

-----Original Message-----

From: Consuelo Siordia

Sent: Thursday, May 14, 2020 6:37 PM

To: City Clerk

Cc: consuelo siordia

Subject: Recertification for the WLC

Warning: External Email – Watch for Email Red Flags!

Dear Planning Commission and City Council:

My name is Consuelo Siordia a proud resident of Moreno Valley for many years all ready. I have fallow closely The World Logistics Center Project. In my opinion this mega project will change this city 360 degrees, it will bring quality life to its residents do to the fact that those who get a job in Moreno Valley will have more quality time with their families. jobs will flourish and the city economy will bloom the tax revenue will be a blessing to our city. I urge you to please speed up the updates and Re-certify the EIR is time to move on Moreno Valley need jobs this pandemic has left us with more than 26% of unemployment.

Sincerely yours:

Consuelo L. Siordia

E-MAIL: consuelosiordia@yahoo.com
CELL PHONE No 951-588-4394

From: Socorro Gutierrez

Sent: Thursday, May 14, 2020 7:02 PM

To: City Clerk

Subject: Moreno Valey, necesita que aprueben el protexto de Centro Logístico Mundial.para revivir la economía de nuestra ciudad y tener empleos para todos muchas gracias espero su comprencion

Warning: External Email – Watch for Email Red Flags!

Julia Descoteaux

From: Adrian Martinez <amartinez@earthjustice.org>
Sent: Thursday, May 14, 2020 4:33 PM
To: Julia Descoteaux
Cc: amartinez@earthjustice.org
Subject: Earthjustice WLC Revised FEIR Comments Email 1 of 3
Attachments: WLC Revised FEIR Comments 5.14.2020.pdf

Warning: External Email – Watch for Email Red Flags!

Dear Ms. Descoteaux,

Please find the attached comment letter for the Agenda Item No. 2 on the Planning Commission Agenda for tonight. I will be sending two forthcoming emails with the relevant attachments referenced in the letter.

All the best,
Adrian

Adrian Martinez
Staff Attorney
Earthjustice California Office
707 Wilshire Blvd., Suite 4300
Los Angeles, CA 90017
T: 415.217.2000
F: 415.217.2040
earthjustice.org



May 14, 2020

Ms. Julia Descoteaux
Associate Planner
City of Moreno Valley
juliad@moval.org

Re: NOTICE OF COMPLETION - Revised Final Environmental Impact Report (Revised Final EIR) (2012021045); Agenda Item No. 2 on May 14, 2020 Planning Commission Meeting (World Logistics Center Project Development Agreement, Tentative Parcel Map for Finance and Conveyance Purposes only with Certification of the Recirculated Revised Final Environmental Impact Report)

Dear Ms. Descoteaux:

I respectfully submit the following comments to the 2020 Revised Final Environmental Impact Report (“Revised FEIR”) for the World Logistics Center Project (“WLC” or “Project”), in addition to the World Logistics Center Project Development Agreement, Tentative Parcel Map for Finance and Conveyance Purposes Only. Please present these comments and the attachments to the Planning Commission prior to hearing this matter.

As described in the Revised FEIR, this Project entails construction of the largest warehouse development in the nation. For a development of this magnitude, it is vital to properly disclose the environmental consequences of the proposed action and to identify and adopt all feasible mitigation measures and alternatives. Unfortunately, the Revised FEIR continues to fail in its duty to comply with the California Environmental Quality Act (“CEQA”). As such, the City cannot rely on the environmental review contained in the document for the purpose of Project approval, and must require preparation and circulation of a new Recirculated Draft Environmental Impact Report (“Recirculated DEIR”) to allow the public and decision-makers an opportunity for meaningful review of the Project’s impacts, prior to issuing any Project approvals.

I. The Air Quality Analysis Continues To Be Flawed.

The various versions of the EIR constantly have sought to understate air quality impacts from this project. But, high levels of emissions and impacts will result from this Project. The thousands of trucks and other vehicles associated with this project will harm a large area of the region with impacts to local residents in the project vicinity most acutely. The decision on this Project is being based on a flawed air quality analysis.

For example, the Statement of Overriding Considerations concludes “[c]urrently, the 2016 AQMP is being reviewed by the U.S. EPA and CARB. Until the approval of the EPA and

CARB, the current regional air quality plan is the Final 2012 AQMP adopted by the SCAQMD on December 7, 2012. Therefore, consistency analysis with the 2016 AQMP has not been included.” Statement of Overriding Considerations, at 151. This is wrong. The EPA approved the 2016 AQMP on October 1, 2019. 84 Fed. Reg. 52005 (Oct. 1, 2019). Therefore, the EIR must analyze the projects compliance against the 2016 AQMP. Moreover, conclusory statements about compliance with the 2016 AQMP are not sufficient. The Revised FEIR and the Statement of Overriding Considerations must actually analyze compliance with this most recently approved air plan.

The Revised FEIR also continues to ignore the feasibility of implementing zero-emission technologies, including zero-emission trucks – amongst many classes (ie class 2-8) – as a mitigation measure. The Revised FEIR notes “[t]he mitigation measures adopted included some of the suggestions from [California Air Resources Board’s (“CARB”)] previous letters, but do not include the zero-emission technology requirements. Subsequent environmental review may require that specific technology that work with future users be required as condition of approval, but a broad requirement that unknown future users use a specific technology is not currently feasible since current zero-emission technology is very limited in medium-duty and heavy-duty trucks.” Revised FEIR, at 89.

The Revised FEIR’s dismissal of zero-emissions technologies for a project that spans decades based on an analysis from the past is not supported by CEQA. The Revised FEIR notes that “[t]he status of zero-emission technology was addressed in the responses to both of CARB’s previous letters. Essentially, as CARB’s ongoing multi-year planning (not implementation) effort on the Sustainable Freight Plan to lay out pathways to get to a zero-emission freight sector demonstrates, there are no commercially available technology zero-emission on-road heavy-duty trucks available and as CARB’s own progress report on heavy-duty technology and fuels assessment states zero- and non-zero emission technologies are still at the demonstration phase.” Revised FEIR, at 89. This basis is largely based on an analysis completed by CARB in 2015.

In fact in a more recent fact sheet from the Air Resources Board, the commercial availability is answered with the following:

Are any zero-emission trucks commercial available?

There are more than 70 different models of zero-emission vans, trucks, and buses that already are commercially available from several manufacturers. Most trucks and vans operate less than 100 miles per day and several zero-emission configurations are available to serve that need. As technology advances, zero-emission trucks will become suitable for more applications. Most major truck manufacturers have announced plans to introduce market ready zero-emission trucks in the near future.

California Air Resources Board, Advanced Clean Trucks Accelerating Zero-Emission Truck Markets, available at <https://ww2.arb.ca.gov/sites/default/files/2019-07/190521factsheet.pdf>. In fact, CARB feels comfortable enough with this feasibility of zero-emission trucks that next month it will adopt the Advanced Clean Trucks Rule, which will require manufacturers to produce zero-emission trucks starting as soon as 2024. The Revised FEIR never explains with substantial evidence why zero-emission trucks for any of the classes that will visit this Project

are infeasible to be used at the project start for a portion (or all) of the trucks servicing the new warehouses as they are built. And the Revised FEIR also does not provide substantial evidence why these zero-emission technologies cannot be used out into the future when CARB will require manufacturers to make zero-emission trucks across a broad class of trucks. *See* CARB, Proposed Amendments to the Proposed Clean Trucks Regulation, *available at* <https://ww3.arb.ca.gov/regact/2019/act2019/30daynotice.pdf>. The Revised FEIR failure to address new data on feasibility of zero-emission trucks, including addressing the forthcoming sales mandate from CARB, violates CEQA.

II. The Revised FEIR Fails to Adequately Disclose, Analyze the Significance of, and Provide Mitigation for the Project’s Significant Climate Impacts.

The City’s review of this Project’s climate and greenhouse gas (“GHG”) emissions impacts has always been fatally flawed, as outlined in numerous prior comment letters, which are hereby incorporated by reference. The sufficiency of that analysis is now pending before the California Court of Appeal. Now, in a final EIR released only days before the Planning Commission once again considers Project-related approvals, the City and developer have proposed an entirely new strategy for analyzing and mitigating GHG emissions. The new strategy, like the old, fails to satisfy CEQA’s requirements.

a. Legal Standards

The City’s determinations regarding the significance of greenhouse gas (“GHG”) emissions and the effectiveness of mitigation must be based on a correct interpretation of the law. (See, e.g., *City of San Diego v. Board of Trustees of California State University* (2015) 61 Cal.4th 945, 956 [agency’s use of erroneous legal standard constitutes a failure to proceed in a manner required by law].) Moreover, because the FEIR continues to use a quantitative threshold as the basis for its significance determination,¹ there must be specific, quantitative evidence to support a conclusion that mitigation measure (“MM”) 4.7.7.1 will actually reduce Project emissions sufficiently to achieve compliance with that threshold. (See *Center for Biological Diversity v. California Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 227-28.) And even to the extent the FEIR is still relying on the prior threshold of 10,000 metric tons CO₂-equivalent (“MM CO_{2e}”) per year, the same quantitative evidentiary standard controls.

CEQA establishes strict standards for mitigation. “Mitigation measures must be fully enforceable through permit conditions, agreements, or other legally binding instruments.” CEQA Guidelines § 15126.4(a)(2). Development of specific mitigation measures may be deferred only if the agency makes an enforceable commitment to mitigation and adopts specific performance

¹ The EIR contains two independent thresholds of significance. (See Draft Recirculated Revised Sections of the Final Environmental Impact Report at 4.7-18.) Exceedance of either threshold would result in significant climate impacts. Accordingly, the City and developer may not dismiss fatal flaws in the EIR’s analysis of one threshold by attempting after the fact to rely solely on the other.

standards that measures must meet. (CEQA Guidelines § 15126.4(a)(1)(B); *King and Gardiner Farms, LLC v. County of Kern* (2020) 45 Cal.App.5th 814, 857-58.)

Proposals for the use of offsets or carbon credits as CEQA mitigation must be evaluated in light of other state statutes addressing these instruments. When it adopted Assembly Bill 32 (“AB 32”) in 2006, the Legislature established standards for greenhouse gas offsets used in any statewide Cap-and-Trade system: (1) they must be “real, permanent, quantifiable, verifiable,” and “enforceable” by the California Air Resources Board (“CARB”); and (2) they must be “in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur.” (Health & Safety Code, § 38562(d)(1), (2).) CARB adopted regulations applying these standards to carbon credits issued by private “registries”—essentially carbon market brokers—who wish to sell credits for use within the Cap-and-Trade system. (*See* Cal. Code Regs., tit. 17, §§ 95970(a), 95971, 95972.)

Evaluating compliance with these standards requires substantial expertise and rigorous analysis. CARB follows a detailed regulatory process in an effort to establish that offset “protocols”² intended for Cap-and-Trade compliance meet statutory and regulatory requirements. (*See* CARB, *California Air Resources Board’s Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap and Trade Regulation* (May 2013), at <https://ww3.arb.ca.gov/cc/capandtrade/compliance-offset-protocol-process.pdf> (visited May 10, 2020); attached as Exhibit A.) Offset credits must represent greenhouse gas reductions that are “permanent” (i.e., will last at least 100 years), “conservatively quantified to ensure that only real reductions are credited,” independently verifiable, and enforceable through “clear monitoring requirements that can be ... enforced by ARB.” (AR 1383:66171.) Offsets also must be “additional, or beyond any reduction required through regulation or action that would have otherwise occurred in a conservative business-as-usual scenario”; this would exclude any “project type that includes technology or GHG abatement practices that are already widely used.” (*Ibid.*; see also *id.*, pp. 66174-75.)

b. Mitigation Measure 4.7.7.1 Fails to Satisfy CEQA’s Requirements

MM 4.7.7.1 falls far short of CEQA’s standards for adequate mitigation. Any finding that the Project’s climate impacts would be less than significant based on implementation of MM 4.7.7.1 would lack both evidentiary and legal support.

i. Mitigation Measure 4.7.7.1 Cannot Support a Conclusion that the Project’s GHG Emissions Will Be Less Than Significant.

MM 4.7.7.1 proposes that the Project’s massive GHG emissions be mitigated through “proof” of either “offsets” or “carbon credits.” (FEIR 1a at 755-56.) As a threshold matter, the

² “Protocols” are, in effect, the rules offset projects must follow. CARB defines an “offset protocol” as “a documented set of procedures and requirements to quantify ongoing GHG reductions or GHG removal enhancements achieved by an offset project and calculate the project baseline. Offset protocols specify relevant data collection and monitoring procedures, emission factors, and conservatively account for uncertainty and activity-shifting and market-shifting leakage risks associated with an offset project.” (Cal. Code Regs., tit. 17, § 95802.)

difference between “offsets” and “carbon credits” is not explained. “Offsets” appear to be purported GHG reductions from projects *other* than those listed by a registry or conducted pursuant to any established protocol or other recognized mechanism for reducing emissions. Yet MM 4.7.7.1 provides no standards for the City’s Planning Official to use in determining whether such “offsets” are “real, permanent, additional, quantifiable, verifiable, and enforceable by an appropriate agency.” These determinations require rigorous, transparent review and substantial expertise, as reflected in CARB’s Cap-and-Trade regulations and protocol review process. There is no evidence that “the City’s Planning Official” has the expertise or capacity to ensure compliance with or enforcement of these standards. Nor does MM 4.7.7.1 provide any performance standards to guide the Planning Official’s determinations. It also appears that the Planning Official would reach his or her determinations without any public or expert review—in short, without any transparency whatsoever. Finally, to the extent MM 4.7.7.1 would apply similar criteria to “offsets” and “carbon credits,” it cannot ensure compliance with those criteria for the reasons discussed below. As a result, MM 4.7.7.1’s reliance on “offsets” is vague, unenforceable, ineffective, improperly deferred, and inadequate under CEQA.

The “carbon credits” provisions of MM 4.7.7.1 similarly are unsupported by either law or evidence.

First, there is no evidence MM 4.7.7.1 will result in effective mitigation. Although MM 4.7.7.1 lists the basic criteria required under Health and Safety Code section 38562(d)(1) and (2), it requires the City to “conclusively presume[.]” that these criteria are satisfied by any offset credit purchased from “a carbon registry approved by the California Air Resources Board.” (FEIR 1a at 756 [listing without limitation “Climate Action Reserve, American Carbon Registry, Verra [formerly Verified Carbon Standard] or GHG Reduction Exchange (GHG RX)”].) The City cannot simply presume that every carbon credit purchased from one of these registries will meet the referenced criteria. On the contrary, to support such a conclusion, the City would need to identify substantial evidence showing that each and every credit generated under each and every protocol used by each and every registry “approved” by CARB, now or in the future, would meet these criteria. No such evidence exists. Indeed, MM 4.7.7.1’s reliance on a conclusive presumption is a tacit concession that no such evidence exists.

Tellingly, MM 4.7.7.1 and CARB take complete opposite approaches to review of voluntary market carbon credits marketed by private registries. CARB does not simply presume all credits issued by specified registries are adequate, as MM 4.7.7.1 would require the City to do. Nor does CARB take registries at their word that all of their protocols meet state requirements. Rather, CARB independently evaluates each protocol through a full regulatory process in order to determine whether it complies with state standards. (See generally 17 Cal. Code Regs. §§ 95970-95972; see also Exhibit A.) Using these procedures, CARB has approved only six protocols for use in the Cap-and-Trade system over the last 10 years. (CARB, Compliance Offset Program, at <https://ww3.arb.ca.gov/cc/capandtrade/offsets/offsets.htm> (visited May 8, 2020).) And, as discussed below, CARB’s approved protocols remain beset by serious questions as to their adequacy and efficacy despite this process. MM 4.7.7.1, on the other hand, completely abandons any pretense of review or oversight. It would *require* the City to accept credits generated under any protocol listed by any registry, without any review

whatsoever of whether those credits or the protocols they were generated under satisfy the measure's stated criteria, and without any ability even to question whether the credit is adequate.

Second, CARB "approval" of a registry does not establish anything about the quality of carbon credits sold by that registry on the voluntary market. The reference to CARB approval in MM 4.7.7.1 is therefore deeply misleading.³ The fact that a registry is "approved by CARB" does not establish that voluntary market carbon credits sold by that registry satisfy the criteria listed in MM 4.7.7.1. CARB approval of a registry to list Cap-and-Trade-compliant credits does not entail CARB review or approval of other protocols used or credits listed by that registry; CARB's procedures for approving compliance protocols and authorizing registries to list credits generated under those protocols are entirely separate. (Compare 17 Cal. Code Regs. §§ 95970-95972 [CARB compliance protocol approval process] with *id.*, § 95986 [establishing conflict of interest, insurance, expertise, and other business requirements for registries that list Cap-and-Trade compliance credits].) At best, MM 4.7.7.1's reference to "approved" registries reflects a misinterpretation of CARB's regulations and their application (or lack thereof) to the quality of offsets traded on the voluntary market; at worst, it reflects an intentional effort to mislead decision-makers and the public. Either way, the measure's reliance on CARB "approval" is legally erroneous. As a result, a registry's "CARB-approved" status cannot support any conclusion regarding the effectiveness of MM 4.7.7.1, the ability of registry credits to satisfy the measure's purported criteria, or the significance of the Project's impacts after mitigation.

Third, although each private registry may use a wide range of protocols or methodologies in determining which carbon credits to list for sale, the City cannot simply presume that compliance with those protocols ensures compliance with the criteria that purportedly govern MM 4.7.7.1. All GHG offsets are inherently uncertain because reductions embodied in offset credits must be compared against what would have happened without the offset project—a counterfactual scenario that cannot be tested because it will never happen. (See Haya et al. 2016, attached as Exhibit B.) Studies have shown that even the Cap-and-Trade compliance protocols adopted through CARB's regulatory process do not result in one-for-one reductions of GHG emissions. (Haya 2019, attached as Exhibit C; Anderson and Perkins 2017, attached as Exhibit D.) CARB's compliance protocols are largely based on Climate Action Reserve protocols, which suffer from the same deficiencies. Moreover, American Carbon Standard and Verra both list projects using United Nations Clean Development Mechanism ("CDM") methodologies.⁴

³ Notably, despite MM 4.7.7.1's suggestion to the contrary, the "GHG RX" registry has *not* been approved by CARB to handle transactions in Cap-and-Trade offsets. (California Air Resources Board, Offset Project Registries, at <https://ww3.arb.ca.gov/cc/capandtrade/offsets/registries/registries.htm> (visited May 8, 2020), attached as Exhibit M.) The "GHG Rx" program was developed by the California Air Pollution Control Officers Association, but it currently lists no available projects or credits available for purchase, and appears for all practical purposes to be defunct. (See CAPCOA Greenhouse Gas Reduction Exchange (GHG Rx), at www.ghgrx.org (visited May 8, 2020); attached as Exhibit N.)

⁴ See American Carbon Registry, Carbon Accounting, at <https://americancarbonregistry.org/carbon-accounting/old/carbon-accounting> (visited May 8, 2020) (generally accepting CDM methodologies with some additional review); Verra, Verified Carbon Standard Methodologies, at <https://verra.org/methodologies/> (visited May 8, 2020) (accepting "any methodology developed under the [CDM] ... for projects and programs registering with VCS).

Scientists and academic experts have long criticized CDM offset projects for their lack of additionality and other flaws. (See, e.g., Aldy and Stavins 2012, attached as Exhibit E; Cames et al. 2016, attached as Exhibit F; Haya 2009, attached as Exhibit G; He and Morse 2013, attached as Exhibit H; Wara 2008, attached as Exhibit I; Zhang and Wang 2011, attached as Exhibit J.) Carbon markets can also create perverse incentives that undermine the environmental integrity and additionality of offsets. (Schneider & Kollmuss 2015; attached as Exhibit K.)

ii. MM 4.7.7.1 Improperly Defers Formulation of Mitigation.

Because MM 4.7.7.1 defers the identification of specific measures to offset the Project's GHG emissions (whether those measures are denominated "offsets" or "carbon credits"), it must meet CEQA's requirements for deferred mitigation. It fails to do so. MM 4.7.7.1 lacks specific performance standards "the mitigation *will* achieve." (CEQA Guidelines § 15126.4(a)(1)(B).) The measure's list of basic criteria offsets and credits must satisfy does not suffice, because the measure does not establish any performance standards governing how compliance with those criteria will be measured. Performance standards must be specific, not so vague as to grant officials unfettered discretion as to whether effective mitigation will be implemented at all. See *King and Gardiner Farms*, 45 Cal.App.5th at 857-58. As discussed above, there is no evidence the voluntary market registries' processes are designed to ensure carbon credits comply with these criteria, and the City cannot wish this lack of evidence away by "presuming" otherwise. Nor is there any evidence the City's Planning Official can credibly implement these criteria in the absence of any performance standards, guidance, or relevant expertise in evaluating offset projects or carbon credit purchases. MM 4.7.7.1 simply requires the City to presume that whatever a developer submits is adequate. That is not a performance standard. Nor is it even an adequate commitment to ensure mitigation is implemented. MM 4.7.7.1 is improperly deferred.

iii. MM 4.7.7.1 Improperly Defers Implementation of Mitigation.

Implementation of mitigation under MM 4.7.7.1 is also improperly deferred until after emissions occur. Under CEQA, mitigation measures must be in place before an impact occurs; unmitigated impacts are not permitted before mitigation is implemented. *King and Gardiner Farms, LLC v. County of Kern* (2020) 45 Cal.App.5th 814, 860. Rather, "[o]nce the project reaches the point where activity will have a significant adverse effect on the environment, the mitigation measures must be in place." *POET, LLC v. State Air Resources Bd.* (2013) 218 Cal.App.4th 681, 738. Accordingly, there must be substantial evidence that GHG reductions embodied in offsets or carbon credits have actually occurred prior to any GHG-emitting activity. MM 4.7.7.1 violates this requirement by allowing a developer to provide offsets or carbon credits as a condition of issuance of a certificate of occupancy. (FEIR 1a at 756). However, a certificate of occupancy cannot be issued until after grading and construction are complete and the buildings are inspected. (See generally 2019 California Building Code, tit. 24, Part 2, § 111.) By that time, all construction-related emissions will have occurred *before* mitigation is in place—a clear violation of CEQA's prohibition against deferred implementation. Moreover, some carbon credit registries (including Climate Action Reserve) are now marketing carbon credits based on "forecasted" emissions reductions that have not yet occurred. Reliance on such credits—which MM 4.7.7.1 does nothing to restrict—also would violate CEQA's requirement that mitigation be in place before impacts occur.

iv. MM 4.7.7.1 Is Not Adequately Enforceable.

MM 4.7.7.1 improperly eliminates any role for the City in enforcing the effectiveness of mitigation. At best, MM 4.7.7.1 relies entirely on enforcement by carbon credit registries, without identifying any evidence as to how or whether enforcement might occur, and how or whether City enforcement could serve as a backstop in the event registry enforcement fails. As a result, credits under MM 4.7.7.1 are not “enforceable by an appropriate agency” as MM 4.7.7.1 purports to require. The term “agency” as used in CEQA means a *public* agency, not a third-party broker of offset credits. (See, e.g., Pub. Resources Code §§ 21001.1, 21004, 21062, 21063, 21065, 21069, 21070.) Public agencies are ultimately responsible under CEQA for the efficacy and enforcement of mitigation measures. Public agencies must make findings regarding the significance of impacts and the incorporation of feasible mitigation measures (*id.*, § 21081), and must adopt mitigation monitoring and reporting plans that ensure implementation and enforcement of mitigation (*id.*, § 21081.6). The City cannot delegate its basic legal responsibilities under CEQA to developers, offset program operators, registries, or other third parties.

Nor can MM 4.7.7.1 be deemed enforceable by virtue of any third-party agreements that might govern the registries’ issuance of carbon credits. Under MM 4.7.7.1, it does not appear the City would even be aware of, much less be able to monitor or enforce, any agreement between an carbon credit project developer and the registry listing the credits. And even if any such agreement were capable of being enforced by the registry (for example, where an offset project violated the agreement and credits issued by that project were subsequently invalidated), MM 4.7.7.1 contains no mechanism that would require the developer to provide additional credits or take any other action. As the California Attorney General pointed out in a recent amicus brief addressing a substantively similar mitigation measure proposed by the County of San Diego, such measures “lack any adequate criteria to ensure enforceability of the offsets purchased....” (Amicus Brief of the California Attorney General in Support of Petitioners and Respondents, *Sierra Club, et al. v. County of San Diego*, Cal. Ct. App., Fourth Dist., Div. 1, Case No. D075478 (filed Oct. 29, 2019), attached as Exhibit L.) MM 4.7.7.1 improperly abdicates the City’s basic enforcement responsibility.

v. MM 4.7.7.1 Appears to Arbitrarily Limit Mitigation Obligations to 30 Years.

Although MM 4.7.7.1 is not entirely clear on this point, it appears that the developer’s mitigation obligations may be limited to “construction and 30-years operation [*sic*] of all Project facilities.” (FEIR 1a at 756 [citing Tables 4.7-8 and 4.7-16].) Yet nothing in the FEIR appears to limit the Project’s operations to a 30 years following buildout. Accordingly, the FEIR’s conclusion that MM 4.7.7.1 will reduce Project emissions to “net zero” is unsupported. Moreover, as the California Attorney General pointed out in its *Sierra Club v. County of San Diego* amicus brief, developments like the Project that increase VMT result in “structural” GHG emissions that likely will continue well beyond 2050, jeopardizing the state’s ability to meet its

long-term emissions reduction goals.⁵ (See Exhibit L at 22-23.) Mitigation obligations must continue throughout the life of the project.

vi. The FEIR Fails to Address Potentially Significant Impacts of Mitigation.

The FEIR adds an entirely new mitigation strategy, but fails to address any of the environmental impacts of that strategy. CEQA requires analysis of potentially significant impacts that could occur from implementation of mitigation measures. (CEQA Guidelines § 15126.4(a)(1)(D).) Two offset project types generating large shares of offsets on the voluntary offset market globally can have significant environmental and social impacts. Large hydropower projects often impact river water quality and river ecosystems (Haya & Parekh 2011; attached as Exhibit O). Numerous articles have documented the impact that avoided deforestation offset projects have had by displacing forest communities or barring forest communities from their traditional use of the forest. (See, e.g. Kansanga & Luginaah 2019, attached as Exhibit P; Beymer-Farris & Bassett 2012, attached as Exhibit Q.) Researchers also have identified severe adverse environmental and social effects from international forest carbon projects. (See, e.g., Cavanagh & Benjaminsen 2014, attached as Exhibit R.) In the United States and around the world, solar and wind energy projects, livestock digesters, and solid waste to energy projects—all of which are eligible carbon offset projects under various registry protocols—can damage wildlife habitat and increase air pollution. The FEIR’s complete omission of any analysis of these readily foreseeable environmental impacts is legal error and also deprives the FEIR of any evidentiary support.

c. The FEIR Must Be Recirculated for Full Public Review and Comment.

The FEIR contains significant new information and must be recirculated for public review and comment before being considered by the City. (CEQA Guidelines § 15088.5.) The FEIR reflects a fundamental change in how climate impacts are disclosed, analyzed, and mitigated. Prior to release of the FEIR, environmental review for this Project assumed that all GHG emissions with some tenuous connection to the state’s Cap-and-Trade system (what the FEIR still misleadingly calls “capped” emissions) could be dismissed as less than significant. Now, with the California Court of Appeal poised to rule on the correctness of this argument, the City and the developer have switched strategies entirely, substituting a “net zero” analysis for the EIR’s previous “capped emissions” analysis.

Recirculation is required here for at least two reasons. First, the FEIR’s new analysis, however conditional, shows that prior versions of the EIR were fundamentally inadequate. By including a brand new mitigation strategy in the FEIR only a few days before the Planning Commission hearing, the City has thwarted meaningful public comment on significant new information raising complex new issues. Recirculation is required on this basis alone. Second, the FEIR’s new analysis in reveals that impacts previously dismissed as insignificant before mitigation are, in fact, significant. Table 4.7-5 as it appeared in the Draft Recirculated Revised

⁵ This aspect of the Project also deprives the FEIR’s conclusions under the second threshold of significance for climate impacts (interference with policies or plans) of support.

Sections of the Final Environmental Impact Report measured only “Total Uncapped” Project emissions in applying the 10,000 MT CO₂e/year significance threshold. (DRRSFEIR at 4.7-27 to 4.7-28.) The table thus concluded that emissions for 2020 through 2023 would be less than significant without mitigation, even though “Total Capped” emissions exceeded 10,000 MT CO₂e for each year. (*Ibid.*) The FEIR, in contrast, at least conditionally considers all Project emissions—both “capped” and “uncapped”—in applying the 10,000 MT CO₂e/year threshold. By this measure, Project emissions for 2020 through 2023 would exceed the 10,000 MT CO₂e threshold in each year, and thus would be significant before mitigation. The FEIR may not dismiss this impact by concluding that MM 4.7.7.1 will prevent any significant impact after mitigation; the significance of impacts must be disclosed and analyzed prior to development and incorporation of mitigation measures, not after. avoidance (See *Lotus v. Department of Transportation* (2014) 223 Cal.App.4th 645, 655-58.) The FEIR must be recirculated.

III. The Revised FEIR’s Continued Reliance on the Cap and Trade Program to Cover the Vast Majority of GHG Emissions Remains Unlawful.

The Response to Comments in the Revised FEIR does not resolve the significant critiques to the GHG analysis. In fact, it doubles down on the flawed approach of using cap and trade as a mechanism to disguise the vast majority of GHG emissions from this Project. This letter solely addresses a few new items included in the Revised FEIR.

Importantly, the California Air Resources Board, the agency responsible for implementation of AB 32 and the Cap-and-Trade Program, has stated several times that the “[Cap-and-Trade] Program does not, and was never designed to, adequately address emissions from local projects and CEQA does not support a novel exemption for such emissions on this ground.”⁶ In fact, this issue was raised in the Final Statement of Reasons for the 2018 revisions to the California Environmental Quality Act Guidelines where the Building Industry Association made the following request:

Comment 44.37

Guideline 15064.4. Analyzing Impacts from Greenhouse Gas Emissions

Consistent with *Association of Irrigated Residents v. Kern County Board of Supervisors* (2017) 17 Cal.App.5th 708, the following sentence should be added at the end of subsection (b)(3): “Project-related greenhouse gas emissions resulting from sources subject to the cap-and-trade program shall not be considered when determining whether the project-related emissions are significant.”⁷

The Natural Resources Agency emphatically rejected this comment from the Building Industry Association in stating the following:

⁶ Letter from California Air Resources Board to Moreno Valley, September 7, 2018, *available at* https://ww3.arb.ca.gov/toxics/ttdceqalist/logisticsfeir.pdf?_ga=2.143040245.1938875667.1580500719-1770248365.1564513994.

⁷ California Natural Resources Agency, Final Statement of Reasons for Regulatory Action Amendments to the State CEQA Guidelines, OAL Notice File No. Z-2018-0116-12, Exhibit A. at p. 219 (November 2018) *available at* http://resources.ca.gov/ceqa/docs/2018_CEQA_ExA_FSOR.pdf.

Response 44.37

The Agency declines to make any changes in response to this comment. The decision in *Association of Irrigated Residents v. Kern County Board of Supervisors* (2017) 17 Cal.App.5th 708 (“AIR v. Kern”) is from one state appellate court and has not been consistently applied by any other appellate courts. Moreover, the Agency finds that the case does not support the suggested addition. The holding in that case is limited to its facts. That court held only that the CEQA Guidelines may authorize a lead agency to determine that a project's greenhouse gas emissions will have a less than significant effect on the environment based on the project's compliance with the Cap-and-Trade program. The project in that case was directly regulated by the Cap-and-Trade program. The decision did not hold that all emissions from may be subject to the Cap-and-Trade regulation at any point in the supply chain are exempt from CEQA analysis, regardless of how those sources are used by the project.⁸

The Natural Resources Agency further elaborated referencing the Air Resources Board’s letter on the exact project studied in the Draft Recirculated FEIR.

The Agency notes that the California Air Resources Board (CARB) has prepared an extensive legal analysis setting forth why the Cap-and-Trade program does not excuse projects from CEQA’s analysis and mitigation requirements, including emissions from vehicular trips or energy consumption from development projects. (This analysis, prepared by CARB as CEQA comments regarding a major freight logistics facility, is available at <https://www.arb.ca.gov/toxics/ttdceqalist/logisticsfeir.pdf>.) The Agency further notes that CARB’s analysis is consistent with this Agency’s discussion of how greenhouse gas regulations factor into a CEQA analysis of greenhouse gas emissions. (See Final Statement of Reasons (SB 97), December 2009, at p. 100 (“Lead agencies should note ... that compliance with one requirement, affecting only one source of a project’s emissions, may not necessarily support a conclusion that all of the project’s emissions are less than significant”).)

The effect of existing regulations is addressed further in the updates to Sections 15064(b) and 15064.7 of the CEQA Guidelines.⁹

Thus, the agency responsible for implementation of AB 32 and the Cap-and-Trade Program, in addition to the agency responsible for drafting the CEQA Guidelines the Draft Recirculated FEIR relies upon for authority disagrees with the approach taken by the City to rely on Cap-and-Trade for all transportation and energy emissions.

Instead of adhering to the position of the relevant agency, the Revised FEIR continues to rely on two agencies that deserve no deference on this issue. But, even if these agencies positions were entitled to deference on this issue, which they are not, the evidence in the record is flawed. The Revised Final EIR includes new attachments A and B, which are the specific South Coast AQMD Documents relied upon for the conclusion to support the use of cap and trade to erase

⁸ *Id.*

⁹ *Id.*

transportation and energy emissions. Importantly, both of these documents are from 2014. Since that time, the South Coast has produced several other CEQA documents. In fact, in the most recent document from 2020, they do not use this same approach of arguing emissions from transportation will be addressed under the cap and trade program. See South Coast AQMD, Phillips 66 Los Angeles Refinery Ultra Low Sulfur Diesel Project Environmental Impact Report, available at <http://www.aqmd.gov/docs/default-source/ceqa/documents/permit-projects/2020/01-feir-chapters1-7.pdf?sfvrsn=6>. The Developer asked the South Coast to weigh in on its settlement in Attachment Q, so it is unclear why the Developer failed to ask whether the South Coast AQMD continues to use this clearly flawed cap and trade rationale for transportation and energy-related emissions. In reviewing the other CEQA documents where the South Coast AQMD was a lead agency, I could not find other instances of this approach being used after 2014.

In the context of the San Joaquin Valley APCD document, the Revised FEIR fails to explain the relevance of an agency interpretation that has no nexus to this Project. Because of this, the City must recirculate a Draft EIR to properly disclose the significant climate pollution impacts from this Project.

IV. The FEIR Must Be Recirculated Before Project Approval and Certification.

Under CEQA, an EIR must be re-circulated for review and comment whenever significant new information becomes known to the lead agency and is added to the EIR after public notice of the availability of the draft document has been made, and before the EIR is certified. Pub. Res. Code § 21092.1. Under such circumstances the lead agency is specifically required to re-notice the environmental review document to the public and all responsible agencies, and is required to obtain comments from the same, before certifying the document's impacts and alternatives analyses as well as any mitigation measures. See *id.*; see also, Pub. Res. Code § 21153. A lead agency's decision not to recirculate an EIR must be supported by substantial evidence. Cal. Code Regs. tit. 14 ("CEQA Guidelines" or "Guidelines") § 15088.5(e). "Significant new information" includes any information regarding changes in the environmental setting of the project under review. Guidelines § 15088.5(a). It also includes information or data that has been added to the EIR and is considered "significant" because it deviates from that which was presented in the draft document, depriving the public from a meaningful opportunity to comment upon a significant environmental effect of the project, or a feasible way to mitigate or avoid such an effect at the time of circulation of the draft. *Id.* Some examples of significant new information provided in the CEQA Guidelines are: "(1) information relating to a new significant environmental impact that would result from the project or a new mitigation measure; (2) a substantial increase in the severity of an environmental impact [that] would result unless mitigation measures are adopted; and (3) any feasible alternative or mitigation measure considerably different from others previously analyzed ..." Guidelines § 15088.5 (a)(1)-(3). Recirculation is further required where the draft EIR is "so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded." Guidelines § 15088.5 (a).

The required re-noticing and new comment period for a re-circulated EIR is essential to meeting CEQA's procedural and substantive environmental review requirements, as the EIR's

assessment of a project's impacts, mitigation measures and alternatives and the public's opportunity to weigh in on the same is at the heart of CEQA. *Laurel Heights Improvement Assn. v. Regents of University of California* (1993) 6 Cal.4th 1112, 1123. Where new information is added to an EIR in such a way as to highlight informational deficiencies in the draft document's environmental impacts, mitigation and alternatives analyses, the public must be allowed the opportunity and additional time to comment on the changes made in the final document's analyses. Moreover, where significant new information that is added to the EIR's assessment of a particular impact area falls within the purview of another responsible agency's area of expertise that agency must also be allowed a meaningful opportunity to review and respond to such new information and any changes implicated in the EIR's analyses.

While re-circulation is indeed an exception and not the rule in the preparation of final environmental review documents, it is an exception that must be invoked here – where the absence of significant information rendered the draft EIR ineffective in meeting CEQA's substantive mandates, and now, where included, the addition of significant new information substantially changes the FEIR's analyses and conclusions regarding the Project's impacts, feasible alternatives and required mitigation. *Laurel Heights Improvement Assn. v. Regents of Univ. of Cal.* (1993) 6 Cal.4th 1112, 1132. As stated in numerous comments to the various versions of the EIR, that document failed to provide critical information regarding the project area and scope of the project's impacts; it failed to adequately describe fundamental information relating to the phasing and timing of the project's massive structural and infrastructural developments; it lacked adequate detail specifically regarding the construction and operations phases of the project; and it contained analyses and mitigation measures relating to the Project's air quality, traffic, human health and biological resources impacts based on outdated or inapplicable studies and data. In some instances the Revised FEIR erratically and arbitrarily includes selective new data into its analysis of the Project's impacts and mitigation measures, and in others critical information remains absent from the document. Whether referenced in the Revised FEIR as new information, or wholly omitted from the document's analyses, the addition of such information is essential to the public's ability to participate in the environmental review process. The Revised FEIR must therefore be re-drafted and re-circulated document to provide the public at large and the Project's numerous other responsible agencies with more time to review and analyze the Project's impacts and to assess or prescribe necessary mitigation measure to minimize those impacts. The City cannot render a determination on the issuance of the project approvals under consideration until such recirculation occurs, and CEQA compliance is assured.

V. The Draft Statement of Overriding Considerations is Unsupported by Substantial Evidence and Fails To Justify the Project's Significant Impacts and Interference with Health Protective Air Quality Standards Attainment

The Statement of Overriding Considerations is insufficient to justify the Project's significant and unavoidable impacts for the reasons explained below. The statement's terms are insufficiently analyzed in both the draft EIR and in the Revised FEIR. Moreover because the Revised FEIR as a whole suffers from serious deficiencies that taint the whole of the analyses contained in the document, the draft statement cannot adequately weigh the Project's adverse, significant impacts with the espoused benefits from the Project contained in any statement of overriding considerations. *Vedanta Society of So. California v. California Quartet, Ltd.* (2000)

84 Cal.App.4th 517, 530 (a project with significant and unmitigated environmental impacts can only be approved when “the elected decision makers have their noses rubbed” in the Project’s environmental effects, and still vote to move forward). As such the statement and its purported benefits must be rejected.

As the lead agency for the Project, if the City is to approve a project of this magnitude, and with the unmitigated significant environmental and human health impacts that the Project will cause, it “must adopt a statement of overriding considerations.” Pub Res. Code § 21081, subd. (b); Guidelines, § 15093. In contrast with mitigation and feasibility findings, overriding considerations can be “larger, more general reasons for approving the project, such as the need to create new jobs, provide housing, generate taxes, and the like.” *Concerned Citizens of South Central L.A. v. Los Angeles Unified School Dist.* (1994) 24 Cal.App.4th 826, 847. Yet, like mitigation and feasibility studies, a statement of overriding consideration is also subject to a substantial evidence standard of review. *Sierra Club v. Contra Costa County* (1992) 10 Cal.App.4th 1212, 1223; Guidelines § 15093, subd. (b).” Thus, an agency's unsupported claim that the project will confer general benefits is insufficient, and the asserted overriding considerations must be supported by substantial evidence in the FEIR or somewhere in the record. *Sierra Club v. Contra Costa County* (1992) 10 Cal.App.4th 1212, 1223; Guidelines § 15093, subd. (b).”

As part of the EIR review process, statements of overriding consideration are intended to “vindicate the ‘right of the public to be informed in such a way that it can intelligently weigh the environmental consequences’ of a proposed project[;]” and they must make a good-faith effort to inform the public of the risks and potential benefits of the Project whose approval is proposed. *Woodward Park Homeowners Ass'n, Inc. v. City of Fresno* (2007) 150 Cal.App.4th 683, 717-718 (citing *Karlson v. City of Camarillo* (1980) 100 Cal.App.3d 789, 804).

In accordance with this standard, before approving the Project and the FEIR the City must show that it has considered each of the Project’s significant and unavoidable impacts in light of *each* of the alleged overriding considerations that it asserts will justify those impacts. *Cherry Valley Pass Acres & Neighbors v. City of Beaumont* (2010) 190 Cal.App.4th 316, 357 (upholding a statement of overriding consideration on the basis that “the City found the project had eight benefits, each of which ‘separately and individually’ outweighed its unavoidable impacts). Thus, the City must specifically consider and set forth overriding considerations to justify the Project’s significant and unavoidable direct indirect and cumulative impacts in each of the following areas: aesthetics, land use and biological resources, noise, traffic and air quality.

The statement of overriding consideration attached to the FEIR asserts two general areas of benefits that it asserts outweigh the Project’s significant and detrimental, un-mitigated impacts: (1) an increase in jobs that improves the job to housing ratio in the City of Moreno Valley, and (2) an increase the in the City’s overall tax revenue, which could be used to improve schools and confer other public benefits to the residents of the City. Any additional public benefits that the draft statement assumes may result from approval of the Project flow from one of those two underlying considerations.

These two alleged benefits are, however, based on erroneous assumptions that (a) the

Project will bring secure, desirable and certain jobs to the City of Moreno Valley; and (b) that the environmental degradation caused by the Project's significant and unavoidable impacts will not outweigh the benefits conferred by the Project in monetary terms, or based on any other form of valuation methodologies. While the draft statement sites thoroughly to "appendix O" the Fiscal and Economic Impact Study, it fails to account for aspects of the job market that will undoubtedly impact the nature and desirability of the jobs made available at the Project, if it is approved, constructed and permitted to operate. Just some of these unmentioned aspects include trends towards employing largely contract, part-time or temporary or short-term labor to fill the jobs created by the WLC. Indeed the study is based on an assumption that either the WLC or other logistics uses will result in the permanent employment of .5 employees per 1,000 building square feet. Appendix O, at 20. Yet the study fails to calculate what the rate of employment would be if some or all of those jobs were characterized as part-time or temporary contract labor employment.

The draft statement of overriding considerations similarly fails to account for any discrepancy in full-time vs. part time, temporary or contract jobs. Moreover, additional aspects of job desirability including working conditions for laborers employed at the WLC or similar logistics enterprises that would operate in the project area are left wholly omitted from both the Appendix O study and the statement, and to the extent the draft statement relies on the development agreement to ensure that such jobs are actually ensured, such assurances are illusory as the development agreement terms remain unclear.

The draft statement of overriding considerations also fails to adequately quantify, either monetarily or based on some other form of valuation method, the consequences of the Project's impacts, specifically including its impacts to human health, the environment and invaluable threatened and endangered biological resources that surround the proposed project area.

Weighing the Project's true impacts against its purported benefits is a critical environmental review requirement. *See Woodward Park Homeowners Ass'n, Inc. v. City of Fresno*, 150 Cal.App.4th, 720. The City must therefore engage in a good faith effort to thoroughly analyze of the full scope of the impacts for which the statement of overriding consideration is being offered.

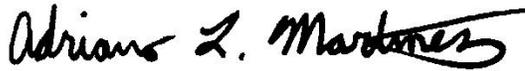
Doing so here would involve some process by which to measure conclusory statements that fully contradict the evidence on the record, such as the statement that the Project will improve health public health. Draft Statement of Overrid., at 209.

Finally, the draft statement of overriding considerations fails to justify the Project's impediment to the South Coast Air Basin achieving federal and state NAAQS, and it's steady, foreseeable future contribution to the region's ability to meet Air Quality Management Plan targets, which are essential to ensuring compliance with state and federal law. The statement of overriding consideration cannot, in essence justify the Project's apparent conflict of potentially causing violations of air quality standards, which carry severe economic sanctions for the 18 million people living the South Coast Air Basin based on parochial economic justifications for one city.

For these reasons stated herein and because the alleged Project benefits included in the draft statement of overriding consideration run counter to the evidence on the record, the City cannot approve the Project, and cannot certify the Revised FEIR as an informational document.

Given the limited time, this comment only raises some of the issues that are of concern related to this project. We appreciate your consideration of these comments. Please do not hesitate to contact us at amartinez@earthjustice.org if you have questions about this comment letter.

Sincerely,



Adriano L. Martinez
Earthjustice

The following Exhibits have been emailed to the Planning Commission for Review.

Exhibit List
(All exhibits submitted in electronic format)

Exhibit	Title
A	California Air Resources Board, <i>California Air Resources Board's Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap and Trade Regulation</i> (May 2013).
B	Haya, B., A. Strong, E. Grubert, and D. Cullenward, <i>Carbon Offsets in California: Science in the Policy Development Process</i> , in J.L. Drake et al. (eds.), <i>Communicating Climate-Change and Natural Hazard Risk and Cultivating Resilience, Advances in Natural and Technological Hazards Research</i> 241-254 (2016) ("Haya et al. 2016").
C	Haya, B. (2019). The California Air Resource Board's U.S. Forest Projects offset protocol underestimates leakage. GSPP Working Paper ("Haya 2019").
D	Anderson, C. & J. Perkins. (2017). Counting California Forest Carbon Offsets: Greenhouse Gas Mitigation Lessons from California's Cap-and-Trade U.S. Forest Compliance Offset Program. Stanford ("Anderson & Perkins 2017").
E	Aldy, J. E. & R. N. Stavins. (2012). The Promise and Problems of Pricing Carbon: Theory and Experience. <i>Journal of Environment & Development</i> , 2, 152-180 ("Aldy & Stavins 2012").
F	Cames, M., R. O. Harthan, J. Füssler, M. Lazarus, C. M. Lee, P. Erickson & R. Spalding-Fecher. (2016). How additional is the Clean Development Mechanism? Berlin ("Cames et al. 2016").
G	Haya, B. (2009). Measuring emissions against an alternative future: fundamental flaws in the structure of the Kyoto Protocol's Clean Development Mechanism (Report No. ERG09-001). Berkeley: Energy and Resources Group ("Haya 2009").

H	He, G. & R. Morse. (2013). Addressing Carbon Offsetters' Paradox: Lessons from Chinese Wind CDM. <i>Energy Policy</i> , 63, 1051-1055 ("He & Morse 2013").
I	Wara, M. (2008). Measuring the Clean Development Mechanism's Performance and Potential. <i>UCLA Law Review</i> , 55, 1759-1803 ("Wara 2008").
J	Zhang, J. & C. Wang. (2011). Co-benefits and additionality of the clean development mechanism: An empirical analysis. <i>Journal of Environmental Economics and Management</i> , 140-154 ("Zhang & Wang 2011").
K	Schneider, L. & A. Kollmuss. (2015). Perverse effects of carbon markets on HFC-23 and SF6 abatement projects in Russia. <i>Nature Climate Change</i> , 5, 1061-1063 ("Schneider & Kollmuss 2015").
L	Amicus Brief of the California Attorney General in Support of Petitioners and Respondents, <i>Sierra Club, et al. v. County of San Diego</i> , Cal. Ct. App., Fourth Dist., Div. 1, Case No. D075478 (filed Oct. 29, 2019).
M	California Air Resources Board, Offset Project Registries, at https://ww3.arb.ca.gov/cc/capandtrade/offsets/registries/registries.htm (visited May 8, 2020).
N	CAPCOA Greenhouse Gas Reduction Exchange (GHG Rx), at www.ghgrx.org (visited May 8, 2020).
O	Haya, B. & P. Parekh. (2014). Hydropower in the CDM: Examining additionality and criteria for sustainability (Working Paper ERG-11-001). Berkeley: Energy and Resources Group ("Haya & Parekh 2011").
P	Kansanga, M. M. & I. Luginaah. (2019). Agrarian livelihoods under siege: Carbon forestry, tenure constraints and the rise of capitalist forest enclosures in Ghana. <i>World Development</i> , 113, 131-142 ("Kansanga & Luginaah 2019").
Q	Beymer-Farris, B. A. & T. J. Bassett. (2012). The REDD menace: Resurgent protectionism in Tanzania's mangrove forests. <i>Global Environmental Change</i> , 22, 332-341 ("Beymer-Farris & Bassett 2012").
R	Cavanagh, C. & T. A. Benjaminsen. (2014). Virtual nature, violent accumulation: The 'spectacular failure' of carbon offsetting at a Ugandan National Park. <i>Geoforum</i> , 56, 55-65 ("Cavanagh & Benjaminsen 2014").



May 14, 2020

Ms. Julia Descoteaux
Associate Planner
City of Moreno Valley
juliad@moval.org

Re: NOTICE OF COMPLETION - Revised Final Environmental Impact Report (Revised Final EIR) (2012021045); Agenda Item No. 2 on May 14, 2020 Planning Commission Meeting (World Logistics Center Project Development Agreement, Tentative Parcel Map for Finance and Conveyance Purposes only with Certification of the Recirculated Revised Final Environmental Impact Report)

Dear Ms. Descoteaux:

I respectfully submit the following comments to the 2020 Revised Final Environmental Impact Report (“Revised FEIR”) for the World Logistics Center Project (“WLC” or “Project”), in addition to the World Logistics Center Project Development Agreement, Tentative Parcel Map for Finance and Conveyance Purposes Only. Please present these comments and the attachments to the Planning Commission prior to hearing this matter.

As described in the Revised FEIR, this Project entails construction of the largest warehouse development in the nation. For a development of this magnitude, it is vital to properly disclose the environmental consequences of the proposed action and to identify and adopt all feasible mitigation measures and alternatives. Unfortunately, the Revised FEIR continues to fail in its duty to comply with the California Environmental Quality Act (“CEQA”). As such, the City cannot rely on the environmental review contained in the document for the purpose of Project approval, and must require preparation and circulation of a new Recirculated Draft Environmental Impact Report (“Recirculated DEIR”) to allow the public and decision-makers an opportunity for meaningful review of the Project’s impacts, prior to issuing any Project approvals.

I. The Air Quality Analysis Continues To Be Flawed.

The various versions of the EIR constantly have sought to understate air quality impacts from this project. But, high levels of emissions and impacts will result from this Project. The thousands of trucks and other vehicles associated with this project will harm a large area of the region with impacts to local residents in the project vicinity most acutely. The decision on this Project is being based on a flawed air quality analysis.

For example, the Statement of Overriding Considerations concludes “[c]urrently, the 2016 AQMP is being reviewed by the U.S. EPA and CARB. Until the approval of the EPA and

CARB, the current regional air quality plan is the Final 2012 AQMP adopted by the SCAQMD on December 7, 2012. Therefore, consistency analysis with the 2016 AQMP has not been included.” Statement of Overriding Considerations, at 151. This is wrong. The EPA approved the 2016 AQMP on October 1, 2019. 84 Fed. Reg. 52005 (Oct. 1, 2019). Therefore, the EIR must analyze the projects compliance against the 2016 AQMP. Moreover, conclusory statements about compliance with the 2016 AQMP are not sufficient. The Revised FEIR and the Statement of Overriding Considerations must actually analyze compliance with this most recently approved air plan.

The Revised FEIR also continues to ignore the feasibility of implementing zero-emission technologies, including zero-emission trucks – amongst many classes (ie class 2-8) – as a mitigation measure. The Revised FEIR notes “[t]he mitigation measures adopted included some of the suggestions from [California Air Resources Board’s (“CARB”)] previous letters, but do not include the zero-emission technology requirements. Subsequent environmental review may require that specific technology that work with future users be required as condition of approval, but a broad requirement that unknown future users use a specific technology is not currently feasible since current zero-emission technology is very limited in medium-duty and heavy-duty trucks.” Revised FEIR, at 89.

The Revised FEIR’s dismissal of zero-emissions technologies for a project that spans decades based on an analysis from the past is not supported by CEQA. The Revised FEIR notes that “[t]he status of zero-emission technology was addressed in the responses to both of CARB’s previous letters. Essentially, as CARB’s ongoing multi-year planning (not implementation) effort on the Sustainable Freight Plan to lay out pathways to get to a zero-emission freight sector demonstrates, there are no commercially available technology zero-emission on-road heavy-duty trucks available and as CARB’s own progress report on heavy-duty technology and fuels assessment states zero- and non-zero emission technologies are still at the demonstration phase.” Revised FEIR, at 89. This basis is largely based on an analysis completed by CARB in 2015.

In fact in a more recent fact sheet from the Air Resources Board, the commercial availability is answered with the following:

Are any zero-emission trucks commercial available?

There are more than 70 different models of zero-emission vans, trucks, and buses that already are commercially available from several manufacturers. Most trucks and vans operate less than 100 miles per day and several zero-emission configurations are available to serve that need. As technology advances, zero-emission trucks will become suitable for more applications. Most major truck manufacturers have announced plans to introduce market ready zero-emission trucks in the near future.

California Air Resources Board, Advanced Clean Trucks Accelerating Zero-Emission Truck Markets, available at <https://ww2.arb.ca.gov/sites/default/files/2019-07/190521factsheet.pdf>. In fact, CARB feels comfortable enough with this feasibility of zero-emission trucks that next month it will adopt the Advanced Clean Trucks Rule, which will require manufacturers to produce zero-emission trucks starting as soon as 2024. The Revised FEIR never explains with substantial evidence why zero-emission trucks for any of the classes that will visit this Project

are infeasible to be used at the project start for a portion (or all) of the trucks servicing the new warehouses as they are built. And the Revised FEIR also does not provide substantial evidence why these zero-emission technologies cannot be used out into the future when CARB will require manufacturers to make zero-emission trucks across a broad class of trucks. *See* CARB, Proposed Amendments to the Proposed Clean Trucks Regulation, *available at* <https://ww3.arb.ca.gov/regact/2019/act2019/30daynotice.pdf>. The Revised FEIR failure to address new data on feasibility of zero-emission trucks, including addressing the forthcoming sales mandate from CARB, violates CEQA.

II. The Revised FEIR Fails to Adequately Disclose, Analyze the Significance of, and Provide Mitigation for the Project’s Significant Climate Impacts.

The City’s review of this Project’s climate and greenhouse gas (“GHG”) emissions impacts has always been fatally flawed, as outlined in numerous prior comment letters, which are hereby incorporated by reference. The sufficiency of that analysis is now pending before the California Court of Appeal. Now, in a final EIR released only days before the Planning Commission once again considers Project-related approvals, the City and developer have proposed an entirely new strategy for analyzing and mitigating GHG emissions. The new strategy, like the old, fails to satisfy CEQA’s requirements.

a. Legal Standards

The City’s determinations regarding the significance of greenhouse gas (“GHG”) emissions and the effectiveness of mitigation must be based on a correct interpretation of the law. (See, e.g., *City of San Diego v. Board of Trustees of California State University* (2015) 61 Cal.4th 945, 956 [agency’s use of erroneous legal standard constitutes a failure to proceed in a manner required by law].) Moreover, because the FEIR continues to use a quantitative threshold as the basis for its significance determination,¹ there must be specific, quantitative evidence to support a conclusion that mitigation measure (“MM”) 4.7.7.1 will actually reduce Project emissions sufficiently to achieve compliance with that threshold. (See *Center for Biological Diversity v. California Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 227-28.) And even to the extent the FEIR is still relying on the prior threshold of 10,000 metric tons CO₂-equivalent (“MM CO_{2e}”) per year, the same quantitative evidentiary standard controls.

CEQA establishes strict standards for mitigation. “Mitigation measures must be fully enforceable through permit conditions, agreements, or other legally binding instruments.” CEQA Guidelines § 15126.4(a)(2). Development of specific mitigation measures may be deferred only if the agency makes an enforceable commitment to mitigation and adopts specific performance

¹ The EIR contains two independent thresholds of significance. (See Draft Recirculated Revised Sections of the Final Environmental Impact Report at 4.7-18.) Exceedance of either threshold would result in significant climate impacts. Accordingly, the City and developer may not dismiss fatal flaws in the EIR’s analysis of one threshold by attempting after the fact to rely solely on the other.

standards that measures must meet. (CEQA Guidelines § 15126.4(a)(1)(B); *King and Gardiner Farms, LLC v. County of Kern* (2020) 45 Cal.App.5th 814, 857-58.)

Proposals for the use of offsets or carbon credits as CEQA mitigation must be evaluated in light of other state statutes addressing these instruments. When it adopted Assembly Bill 32 (“AB 32”) in 2006, the Legislature established standards for greenhouse gas offsets used in any statewide Cap-and-Trade system: (1) they must be “real, permanent, quantifiable, verifiable,” and “enforceable” by the California Air Resources Board (“CARB”); and (2) they must be “in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur.” (Health & Safety Code, § 38562(d)(1), (2).) CARB adopted regulations applying these standards to carbon credits issued by private “registries”—essentially carbon market brokers—who wish to sell credits for use within the Cap-and-Trade system. (*See* Cal. Code Regs., tit. 17, §§ 95970(a), 95971, 95972.)

Evaluating compliance with these standards requires substantial expertise and rigorous analysis. CARB follows a detailed regulatory process in an effort to establish that offset “protocols”² intended for Cap-and-Trade compliance meet statutory and regulatory requirements. (*See* CARB, *California Air Resources Board’s Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap and Trade Regulation* (May 2013), at <https://ww3.arb.ca.gov/cc/capandtrade/compliance-offset-protocol-process.pdf> (visited May 10, 2020); attached as Exhibit A.) Offset credits must represent greenhouse gas reductions that are “permanent” (i.e., will last at least 100 years), “conservatively quantified to ensure that only real reductions are credited,” independently verifiable, and enforceable through “clear monitoring requirements that can be ... enforced by ARB.” (AR 1383:66171.) Offsets also must be “additional, or beyond any reduction required through regulation or action that would have otherwise occurred in a conservative business-as-usual scenario”; this would exclude any “project type that includes technology or GHG abatement practices that are already widely used.” (*Ibid.*; see also *id.*, pp. 66174-75.)

b. Mitigation Measure 4.7.7.1 Fails to Satisfy CEQA’s Requirements

MM 4.7.7.1 falls far short of CEQA’s standards for adequate mitigation. Any finding that the Project’s climate impacts would be less than significant based on implementation of MM 4.7.7.1 would lack both evidentiary and legal support.

i. Mitigation Measure 4.7.7.1 Cannot Support a Conclusion that the Project’s GHG Emissions Will Be Less Than Significant.

MM 4.7.7.1 proposes that the Project’s massive GHG emissions be mitigated through “proof” of either “offsets” or “carbon credits.” (FEIR 1a at 755-56.) As a threshold matter, the

² “Protocols” are, in effect, the rules offset projects must follow. CARB defines an “offset protocol” as “a documented set of procedures and requirements to quantify ongoing GHG reductions or GHG removal enhancements achieved by an offset project and calculate the project baseline. Offset protocols specify relevant data collection and monitoring procedures, emission factors, and conservatively account for uncertainty and activity-shifting and market-shifting leakage risks associated with an offset project.” (Cal. Code Regs., tit. 17, § 95802.)

difference between “offsets” and “carbon credits” is not explained. “Offsets” appear to be purported GHG reductions from projects *other* than those listed by a registry or conducted pursuant to any established protocol or other recognized mechanism for reducing emissions. Yet MM 4.7.7.1 provides no standards for the City’s Planning Official to use in determining whether such “offsets” are “real, permanent, additional, quantifiable, verifiable, and enforceable by an appropriate agency.” These determinations require rigorous, transparent review and substantial expertise, as reflected in CARB’s Cap-and-Trade regulations and protocol review process. There is no evidence that “the City’s Planning Official” has the expertise or capacity to ensure compliance with or enforcement of these standards. Nor does MM 4.7.7.1 provide any performance standards to guide the Planning Official’s determinations. It also appears that the Planning Official would reach his or her determinations without any public or expert review—in short, without any transparency whatsoever. Finally, to the extent MM 4.7.7.1 would apply similar criteria to “offsets” and “carbon credits,” it cannot ensure compliance with those criteria for the reasons discussed below. As a result, MM 4.7.7.1’s reliance on “offsets” is vague, unenforceable, ineffective, improperly deferred, and inadequate under CEQA.

The “carbon credits” provisions of MM 4.7.7.1 similarly are unsupported by either law or evidence.

First, there is no evidence MM 4.7.7.1 will result in effective mitigation. Although MM 4.7.7.1 lists the basic criteria required under Health and Safety Code section 38562(d)(1) and (2), it requires the City to “conclusively presume[.]” that these criteria are satisfied by any offset credit purchased from “a carbon registry approved by the California Air Resources Board.” (FEIR 1a at 756 [listing without limitation “Climate Action Reserve, American Carbon Registry, Verra [formerly Verified Carbon Standard] or GHG Reduction Exchange (GHG RX)”].) The City cannot simply presume that every carbon credit purchased from one of these registries will meet the referenced criteria. On the contrary, to support such a conclusion, the City would need to identify substantial evidence showing that each and every credit generated under each and every protocol used by each and every registry “approved” by CARB, now or in the future, would meet these criteria. No such evidence exists. Indeed, MM 4.7.7.1’s reliance on a conclusive presumption is a tacit concession that no such evidence exists.

Tellingly, MM 4.7.7.1 and CARB take complete opposite approaches to review of voluntary market carbon credits marketed by private registries. CARB does not simply presume all credits issued by specified registries are adequate, as MM 4.7.7.1 would require the City to do. Nor does CARB take registries at their word that all of their protocols meet state requirements. Rather, CARB independently evaluates each protocol through a full regulatory process in order to determine whether it complies with state standards. (See generally 17 Cal. Code Regs. §§ 95970-95972; see also Exhibit A.) Using these procedures, CARB has approved only six protocols for use in the Cap-and-Trade system over the last 10 years. (CARB, Compliance Offset Program, at <https://ww3.arb.ca.gov/cc/capandtrade/offsets/offsets.htm> (visited May 8, 2020).) And, as discussed below, CARB’s approved protocols remain beset by serious questions as to their adequacy and efficacy despite this process. MM 4.7.7.1, on the other hand, completely abandons any pretense of review or oversight. It would *require* the City to accept credits generated under any protocol listed by any registry, without any review

whatsoever of whether those credits or the protocols they were generated under satisfy the measure's stated criteria, and without any ability even to question whether the credit is adequate.

Second, CARB "approval" of a registry does not establish anything about the quality of carbon credits sold by that registry on the voluntary market. The reference to CARB approval in MM 4.7.7.1 is therefore deeply misleading.³ The fact that a registry is "approved by CARB" does not establish that voluntary market carbon credits sold by that registry satisfy the criteria listed in MM 4.7.7.1. CARB approval of a registry to list Cap-and-Trade-compliant credits does not entail CARB review or approval of other protocols used or credits listed by that registry; CARB's procedures for approving compliance protocols and authorizing registries to list credits generated under those protocols are entirely separate. (Compare 17 Cal. Code Regs. §§ 95970-95972 [CARB compliance protocol approval process] with *id.*, § 95986 [establishing conflict of interest, insurance, expertise, and other business requirements for registries that list Cap-and-Trade compliance credits].) At best, MM 4.7.7.1's reference to "approved" registries reflects a misinterpretation of CARB's regulations and their application (or lack thereof) to the quality of offsets traded on the voluntary market; at worst, it reflects an intentional effort to mislead decision-makers and the public. Either way, the measure's reliance on CARB "approval" is legally erroneous. As a result, a registry's "CARB-approved" status cannot support any conclusion regarding the effectiveness of MM 4.7.7.1, the ability of registry credits to satisfy the measure's purported criteria, or the significance of the Project's impacts after mitigation.

Third, although each private registry may use a wide range of protocols or methodologies in determining which carbon credits to list for sale, the City cannot simply presume that compliance with those protocols ensures compliance with the criteria that purportedly govern MM 4.7.7.1. All GHG offsets are inherently uncertain because reductions embodied in offset credits must be compared against what would have happened without the offset project—a counterfactual scenario that cannot be tested because it will never happen. (See Haya et al. 2016, attached as Exhibit B.) Studies have shown that even the Cap-and-Trade compliance protocols adopted through CARB's regulatory process do not result in one-for-one reductions of GHG emissions. (Haya 2019, attached as Exhibit C; Anderson and Perkins 2017, attached as Exhibit D.) CARB's compliance protocols are largely based on Climate Action Reserve protocols, which suffer from the same deficiencies. Moreover, American Carbon Standard and Verra both list projects using United Nations Clean Development Mechanism ("CDM") methodologies.⁴

³ Notably, despite MM 4.7.7.1's suggestion to the contrary, the "GHG RX" registry has *not* been approved by CARB to handle transactions in Cap-and-Trade offsets. (California Air Resources Board, Offset Project Registries, at <https://ww3.arb.ca.gov/cc/capandtrade/offsets/registries/registries.htm> (visited May 8, 2020), attached as Exhibit M.) The "GHG Rx" program was developed by the California Air Pollution Control Officers Association, but it currently lists no available projects or credits available for purchase, and appears for all practical purposes to be defunct. (See CAPCOA Greenhouse Gas Reduction Exchange (GHG Rx), at www.ghgrx.org (visited May 8, 2020); attached as Exhibit N.)

⁴ See American Carbon Registry, Carbon Accounting, at <https://americancarbonregistry.org/carbon-accounting/old/carbon-accounting> (visited May 8, 2020) (generally accepting CDM methodologies with some additional review); Verra, Verified Carbon Standard Methodologies, at <https://verra.org/methodologies/> (visited May 8, 2020) (accepting "any methodology developed under the [CDM] ... for projects and programs registering with VCS).

Scientists and academic experts have long criticized CDM offset projects for their lack of additionality and other flaws. (See, e.g., Aldy and Stavins 2012, attached as Exhibit E; Cames et al. 2016, attached as Exhibit F; Haya 2009, attached as Exhibit G; He and Morse 2013, attached as Exhibit H; Wara 2008, attached as Exhibit I; Zhang and Wang 2011, attached as Exhibit J.) Carbon markets can also create perverse incentives that undermine the environmental integrity and additionality of offsets. (Schneider & Kollmuss 2015; attached as Exhibit K.)

ii. MM 4.7.7.1 Improperly Defers Formulation of Mitigation.

Because MM 4.7.7.1 defers the identification of specific measures to offset the Project's GHG emissions (whether those measures are denominated "offsets" or "carbon credits"), it must meet CEQA's requirements for deferred mitigation. It fails to do so. MM 4.7.7.1 lacks specific performance standards "the mitigation *will* achieve." (CEQA Guidelines § 15126.4(a)(1)(B).) The measure's list of basic criteria offsets and credits must satisfy does not suffice, because the measure does not establish any performance standards governing how compliance with those criteria will be measured. Performance standards must be specific, not so vague as to grant officials unfettered discretion as to whether effective mitigation will be implemented at all. See *King and Gardiner Farms*, 45 Cal.App.5th at 857-58. As discussed above, there is no evidence the voluntary market registries' processes are designed to ensure carbon credits comply with these criteria, and the City cannot wish this lack of evidence away by "presuming" otherwise. Nor is there any evidence the City's Planning Official can credibly implement these criteria in the absence of any performance standards, guidance, or relevant expertise in evaluating offset projects or carbon credit purchases. MM 4.7.7.1 simply requires the City to presume that whatever a developer submits is adequate. That is not a performance standard. Nor is it even an adequate commitment to ensure mitigation is implemented. MM 4.7.7.1 is improperly deferred.

iii. MM 4.7.7.1 Improperly Defers Implementation of Mitigation.

Implementation of mitigation under MM 4.7.7.1 is also improperly deferred until after emissions occur. Under CEQA, mitigation measures must be in place before an impact occurs; unmitigated impacts are not permitted before mitigation is implemented. *King and Gardiner Farms, LLC v. County of Kern* (2020) 45 Cal.App.5th 814, 860. Rather, "[o]nce the project reaches the point where activity will have a significant adverse effect on the environment, the mitigation measures must be in place." *POET, LLC v. State Air Resources Bd.* (2013) 218 Cal.App.4th 681, 738. Accordingly, there must be substantial evidence that GHG reductions embodied in offsets or carbon credits have actually occurred prior to any GHG-emitting activity. MM 4.7.7.1 violates this requirement by allowing a developer to provide offsets or carbon credits as a condition of issuance of a certificate of occupancy. (FEIR 1a at 756). However, a certificate of occupancy cannot be issued until after grading and construction are complete and the buildings are inspected. (See generally 2019 California Building Code, tit. 24, Part 2, § 111.) By that time, all construction-related emissions will have occurred *before* mitigation is in place—a clear violation of CEQA's prohibition against deferred implementation. Moreover, some carbon credit registries (including Climate Action Reserve) are now marketing carbon credits based on "forecasted" emissions reductions that have not yet occurred. Reliance on such credits—which MM 4.7.7.1 does nothing to restrict—also would violate CEQA's requirement that mitigation be in place before impacts occur.

iv. MM 4.7.7.1 Is Not Adequately Enforceable.

MM 4.7.7.1 improperly eliminates any role for the City in enforcing the effectiveness of mitigation. At best, MM 4.7.7.1 relies entirely on enforcement by carbon credit registries, without identifying any evidence as to how or whether enforcement might occur, and how or whether City enforcement could serve as a backstop in the event registry enforcement fails. As a result, credits under MM 4.7.7.1 are not “enforceable by an appropriate agency” as MM 4.7.7.1 purports to require. The term “agency” as used in CEQA means a *public* agency, not a third-party broker of offset credits. (See, e.g., Pub. Resources Code §§ 21001.1, 21004, 21062, 21063, 21065, 21069, 21070.) Public agencies are ultimately responsible under CEQA for the efficacy and enforcement of mitigation measures. Public agencies must make findings regarding the significance of impacts and the incorporation of feasible mitigation measures (*id.*, § 21081), and must adopt mitigation monitoring and reporting plans that ensure implementation and enforcement of mitigation (*id.*, § 21081.6). The City cannot delegate its basic legal responsibilities under CEQA to developers, offset program operators, registries, or other third parties.

Nor can MM 4.7.7.1 be deemed enforceable by virtue of any third-party agreements that might govern the registries’ issuance of carbon credits. Under MM 4.7.7.1, it does not appear the City would even be aware of, much less be able to monitor or enforce, any agreement between an carbon credit project developer and the registry listing the credits. And even if any such agreement were capable of being enforced by the registry (for example, where an offset project violated the agreement and credits issued by that project were subsequently invalidated), MM 4.7.7.1 contains no mechanism that would require the developer to provide additional credits or take any other action. As the California Attorney General pointed out in a recent amicus brief addressing a substantively similar mitigation measure proposed by the County of San Diego, such measures “lack any adequate criteria to ensure enforceability of the offsets purchased....” (Amicus Brief of the California Attorney General in Support of Petitioners and Respondents, *Sierra Club, et al. v. County of San Diego*, Cal. Ct. App., Fourth Dist., Div. 1, Case No. D075478 (filed Oct. 29, 2019), attached as Exhibit L.) MM 4.7.7.1 improperly abdicates the City’s basic enforcement responsibility.

v. MM 4.7.7.1 Appears to Arbitrarily Limit Mitigation Obligations to 30 Years.

Although MM 4.7.7.1 is not entirely clear on this point, it appears that the developer’s mitigation obligations may be limited to “construction and 30-years operation [*sic*] of all Project facilities.” (FEIR 1a at 756 [citing Tables 4.7-8 and 4.7-16].) Yet nothing in the FEIR appears to limit the Project’s operations to a 30 years following buildout. Accordingly, the FEIR’s conclusion that MM 4.7.7.1 will reduce Project emissions to “net zero” is unsupported. Moreover, as the California Attorney General pointed out in its *Sierra Club v. County of San Diego* amicus brief, developments like the Project that increase VMT result in “structural” GHG emissions that likely will continue well beyond 2050, jeopardizing the state’s ability to meet its

long-term emissions reduction goals.⁵ (See Exhibit L at 22-23.) Mitigation obligations must continue throughout the life of the project.

vi. The FEIR Fails to Address Potentially Significant Impacts of Mitigation.

The FEIR adds an entirely new mitigation strategy, but fails to address any of the environmental impacts of that strategy. CEQA requires analysis of potentially significant impacts that could occur from implementation of mitigation measures. (CEQA Guidelines § 15126.4(a)(1)(D).) Two offset project types generating large shares of offsets on the voluntary offset market globally can have significant environmental and social impacts. Large hydropower projects often impact river water quality and river ecosystems (Haya & Parekh 2011; attached as Exhibit O). Numerous articles have documented the impact that avoided deforestation offset projects have had by displacing forest communities or barring forest communities from their traditional use of the forest. (See, e.g. Kansanga & Luginaah 2019, attached as Exhibit P; Beymer-Farris & Bassett 2012, attached as Exhibit Q.) Researchers also have identified severe adverse environmental and social effects from international forest carbon projects. (See, e.g., Cavanagh & Benjaminsen 2014, attached as Exhibit R.) In the United States and around the world, solar and wind energy projects, livestock digesters, and solid waste to energy projects—all of which are eligible carbon offset projects under various registry protocols—can damage wildlife habitat and increase air pollution. The FEIR’s complete omission of any analysis of these readily foreseeable environmental impacts is legal error and also deprives the FEIR of any evidentiary support.

c. The FEIR Must Be Recirculated for Full Public Review and Comment.

The FEIR contains significant new information and must be recirculated for public review and comment before being considered by the City. (CEQA Guidelines § 15088.5.) The FEIR reflects a fundamental change in how climate impacts are disclosed, analyzed, and mitigated. Prior to release of the FEIR, environmental review for this Project assumed that all GHG emissions with some tenuous connection to the state’s Cap-and-Trade system (what the FEIR still misleadingly calls “capped” emissions) could be dismissed as less than significant. Now, with the California Court of Appeal poised to rule on the correctness of this argument, the City and the developer have switched strategies entirely, substituting a “net zero” analysis for the EIR’s previous “capped emissions” analysis.

Recirculation is required here for at least two reasons. First, the FEIR’s new analysis, however conditional, shows that prior versions of the EIR were fundamentally inadequate. By including a brand new mitigation strategy in the FEIR only a few days before the Planning Commission hearing, the City has thwarted meaningful public comment on significant new information raising complex new issues. Recirculation is required on this basis alone. Second, the FEIR’s new analysis in reveals that impacts previously dismissed as insignificant before mitigation are, in fact, significant. Table 4.7-5 as it appeared in the Draft Recirculated Revised

⁵ This aspect of the Project also deprives the FEIR’s conclusions under the second threshold of significance for climate impacts (interference with policies or plans) of support.

Sections of the Final Environmental Impact Report measured only “Total Uncapped” Project emissions in applying the 10,000 MT CO₂e/year significance threshold. (DRRSFEIR at 4.7-27 to 4.7-28.) The table thus concluded that emissions for 2020 through 2023 would be less than significant without mitigation, even though “Total Capped” emissions exceeded 10,000 MT CO₂e for each year. (*Ibid.*) The FEIR, in contrast, at least conditionally considers all Project emissions—both “capped” and “uncapped”—in applying the 10,000 MT CO₂e/year threshold. By this measure, Project emissions for 2020 through 2023 would exceed the 10,000 MT CO₂e threshold in each year, and thus would be significant before mitigation. The FEIR may not dismiss this impact by concluding that MM 4.7.7.1 will prevent any significant impact after mitigation; the significance of impacts must be disclosed and analyzed prior to development and incorporation of mitigation measures, not after. avoidance (See *Lotus v. Department of Transportation* (2014) 223 Cal.App.4th 645, 655-58.) The FEIR must be recirculated.

III. The Revised FEIR’s Continued Reliance on the Cap and Trade Program to Cover the Vast Majority of GHG Emissions Remains Unlawful.

The Response to Comments in the Revised FEIR does not resolve the significant critiques to the GHG analysis. In fact, it doubles down on the flawed approach of using cap and trade as a mechanism to disguise the vast majority of GHG emissions from this Project. This letter solely addresses a few new items included in the Revised FEIR.

Importantly, the California Air Resources Board, the agency responsible for implementation of AB 32 and the Cap-and-Trade Program, has stated several times that the “[Cap-and-Trade] Program does not, and was never designed to, adequately address emissions from local projects and CEQA does not support a novel exemption for such emissions on this ground.”⁶ In fact, this issue was raised in the Final Statement of Reasons for the 2018 revisions to the California Environmental Quality Act Guidelines where the Building Industry Association made the following request:

Comment 44.37

Guideline 15064.4. Analyzing Impacts from Greenhouse Gas Emissions

Consistent with *Association of Irrigated Residents v. Kern County Board of Supervisors* (2017) 17 Cal.App.5th 708, the following sentence should be added at the end of subsection (b)(3): “Project-related greenhouse gas emissions resulting from sources subject to the cap-and-trade program shall not be considered when determining whether the project-related emissions are significant.”⁷

The Natural Resources Agency emphatically rejected this comment from the Building Industry Association in stating the following:

⁶ Letter from California Air Resources Board to Moreno Valley, September 7, 2018, *available at* https://ww3.arb.ca.gov/toxics/ttdceqalist/logisticsfeir.pdf?_ga=2.143040245.1938875667.1580500719-1770248365.1564513994.

⁷ California Natural Resources Agency, Final Statement of Reasons for Regulatory Action Amendments to the State CEQA Guidelines, OAL Notice File No. Z-2018-0116-12, Exhibit A. at p. 219 (November 2018) *available at* http://resources.ca.gov/ceqa/docs/2018_CEQA_ExA_FSOR.pdf.

Response 44.37

The Agency declines to make any changes in response to this comment. The decision in *Association of Irrigated Residents v. Kern County Board of Supervisors* (2017) 17 Cal.App.5th 708 (“AIR v. Kern”) is from one state appellate court and has not been consistently applied by any other appellate courts. Moreover, the Agency finds that the case does not support the suggested addition. The holding in that case is limited to its facts. That court held only that the CEQA Guidelines may authorize a lead agency to determine that a project's greenhouse gas emissions will have a less than significant effect on the environment based on the project's compliance with the Cap-and-Trade program. The project in that case was directly regulated by the Cap-and-Trade program. The decision did not hold that all emissions from may be subject to the Cap-and-Trade regulation at any point in the supply chain are exempt from CEQA analysis, regardless of how those sources are used by the project.⁸

The Natural Resources Agency further elaborated referencing the Air Resources Board’s letter on the exact project studied in the Draft Recirculated FEIR.

The Agency notes that the California Air Resources Board (CARB) has prepared an extensive legal analysis setting forth why the Cap-and-Trade program does not excuse projects from CEQA’s analysis and mitigation requirements, including emissions from vehicular trips or energy consumption from development projects. (This analysis, prepared by CARB as CEQA comments regarding a major freight logistics facility, is available at <https://www.arb.ca.gov/toxics/ttdceqalist/logisticsfeir.pdf>.) The Agency further notes that CARB’s analysis is consistent with this Agency’s discussion of how greenhouse gas regulations factor into a CEQA analysis of greenhouse gas emissions. (See Final Statement of Reasons (SB 97), December 2009, at p. 100 (“Lead agencies should note ... that compliance with one requirement, affecting only one source of a project’s emissions, may not necessarily support a conclusion that all of the project’s emissions are less than significant”).)

The effect of existing regulations is addressed further in the updates to Sections 15064(b) and 15064.7 of the CEQA Guidelines.⁹

Thus, the agency responsible for implementation of AB 32 and the Cap-and-Trade Program, in addition to the agency responsible for drafting the CEQA Guidelines the Draft Recirculated FEIR relies upon for authority disagrees with the approach taken by the City to rely on Cap-and-Trade for all transportation and energy emissions.

Instead of adhering to the position of the relevant agency, the Revised FEIR continues to rely on two agencies that deserve no deference on this issue. But, even if these agencies positions were entitled to deference on this issue, which they are not, the evidence in the record is flawed. The Revised Final EIR includes new attachments A and B, which are the specific South Coast AQMD Documents relied upon for the conclusion to support the use of cap and trade to erase

⁸ *Id.*

⁹ *Id.*

transportation and energy emissions. Importantly, both of these documents are from 2014. Since that time, the South Coast has produced several other CEQA documents. In fact, in the most recent document from 2020, they do not use this same approach of arguing emissions from transportation will be addressed under the cap and trade program. See South Coast AQMD, Phillips 66 Los Angeles Refinery Ultra Low Sulfur Diesel Project Environmental Impact Report, available at <http://www.aqmd.gov/docs/default-source/ceqa/documents/permit-projects/2020/01-feir-chapters1-7.pdf?sfvrsn=6>. The Developer asked the South Coast to weigh in on its settlement in Attachment Q, so it is unclear why the Developer failed to ask whether the South Coast AQMD continues to use this clearly flawed cap and trade rationale for transportation and energy-related emissions. In reviewing the other CEQA documents where the South Coast AQMD was a lead agency, I could not find other instances of this approach being used after 2014.

In the context of the San Joaquin Valley APCD document, the Revised FEIR fails to explain the relevance of an agency interpretation that has no nexus to this Project. Because of this, the City must recirculate a Draft EIR to properly disclose the significant climate pollution impacts from this Project.

IV. The FEIR Must Be Recirculated Before Project Approval and Certification.

Under CEQA, an EIR must be re-circulated for review and comment whenever significant new information becomes known to the lead agency and is added to the EIR after public notice of the availability of the draft document has been made, and before the EIR is certified. Pub. Res. Code § 21092.1. Under such circumstances the lead agency is specifically required to re-notice the environmental review document to the public and all responsible agencies, and is required to obtain comments from the same, before certifying the document's impacts and alternatives analyses as well as any mitigation measures. See *id.*; see also, Pub. Res. Code § 21153. A lead agency's decision not to recirculate an EIR must be supported by substantial evidence. Cal. Code Regs. tit. 14 ("CEQA Guidelines" or "Guidelines") § 15088.5(e). "Significant new information" includes any information regarding changes in the environmental setting of the project under review. Guidelines § 15088.5(a). It also includes information or data that has been added to the EIR and is considered "significant" because it deviates from that which was presented in the draft document, depriving the public from a meaningful opportunity to comment upon a significant environmental effect of the project, or a feasible way to mitigate or avoid such an effect at the time of circulation of the draft. *Id.* Some examples of significant new information provided in the CEQA Guidelines are: "(1) information relating to a new significant environmental impact that would result from the project or a new mitigation measure; (2) a substantial increase in the severity of an environmental impact [that] would result unless mitigation measures are adopted; and (3) any feasible alternative or mitigation measure considerably different from others previously analyzed ..." Guidelines § 15088.5 (a)(1)-(3). Recirculation is further required where the draft EIR is "so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded." Guidelines § 15088.5 (a).

The required re-noticing and new comment period for a re-circulated EIR is essential to meeting CEQA's procedural and substantive environmental review requirements, as the EIR's

assessment of a project's impacts, mitigation measures and alternatives and the public's opportunity to weigh in on the same is at the heart of CEQA. *Laurel Heights Improvement Assn. v. Regents of University of California* (1993) 6 Cal.4th 1112, 1123. Where new information is added to an EIR in such a way as to highlight informational deficiencies in the draft document's environmental impacts, mitigation and alternatives analyses, the public must be allowed the opportunity and additional time to comment on the changes made in the final document's analyses. Moreover, where significant new information that is added to the EIR's assessment of a particular impact area falls within the purview of another responsible agency's area of expertise that agency must also be allowed a meaningful opportunity to review and respond to such new information and any changes implicated in the EIR's analyses.

While re-circulation is indeed an exception and not the rule in the preparation of final environmental review documents, it is an exception that must be invoked here – where the absence of significant information rendered the draft EIR ineffective in meeting CEQA's substantive mandates, and now, where included, the addition of significant new information substantially changes the FEIR's analyses and conclusions regarding the Project's impacts, feasible alternatives and required mitigation. *Laurel Heights Improvement Assn. v. Regents of Univ. of Cal.* (1993) 6 Cal.4th 1112, 1132. As stated in numerous comments to the various versions of the EIR, that document failed to provide critical information regarding the project area and scope of the project's impacts; it failed to adequately describe fundamental information relating to the phasing and timing of the project's massive structural and infrastructural developments; it lacked adequate detail specifically regarding the construction and operations phases of the project; and it contained analyses and mitigation measures relating to the Project's air quality, traffic, human health and biological resources impacts based on outdated or inapplicable studies and data. In some instances the Revised FEIR erratically and arbitrarily includes selective new data into its analysis of the Project's impacts and mitigation measures, and in others critical information remains absent from the document. Whether referenced in the Revised FEIR as new information, or wholly omitted from the document's analyses, the addition of such information is essential to the public's ability to participate in the environmental review process. The Revised FEIR must therefore be re-drafted and re-circulated document to provide the public at large and the Project's numerous other responsible agencies with more time to review and analyze the Project's impacts and to assess or prescribe necessary mitigation measure to minimize those impacts. The City cannot render a determination on the issuance of the project approvals under consideration until such recirculation occurs, and CEQA compliance is assured.

V. The Draft Statement of Overriding Considerations is Unsupported by Substantial Evidence and Fails To Justify the Project's Significant Impacts and Interference with Health Protective Air Quality Standards Attainment

The Statement of Overriding Considerations is insufficient to justify the Project's significant and unavoidable impacts for the reasons explained below. The statement's terms are insufficiently analyzed in both the draft EIR and in the Revised FEIR. Moreover because the Revised FEIR as a whole suffers from serious deficiencies that taint the whole of the analyses contained in the document, the draft statement cannot adequately weigh the Project's adverse, significant impacts with the espoused benefits from the Project contained in any statement of overriding considerations. *Vedanta Society of So. California v. California Quartet, Ltd.* (2000)

84 Cal.App.4th 517, 530 (a project with significant and unmitigated environmental impacts can only be approved when “the elected decision makers have their noses rubbed” in the Project’s environmental effects, and still vote to move forward). As such the statement and its purported benefits must be rejected.

As the lead agency for the Project, if the City is to approve a project of this magnitude, and with the unmitigated significant environmental and human health impacts that the Project will cause, it “must adopt a statement of overriding considerations.” Pub Res. Code § 21081, subd. (b); Guidelines, § 15093. In contrast with mitigation and feasibility findings, overriding considerations can be “larger, more general reasons for approving the project, such as the need to create new jobs, provide housing, generate taxes, and the like.” *Concerned Citizens of South Central L.A. v. Los Angeles Unified School Dist.* (1994) 24 Cal.App.4th 826, 847. Yet, like mitigation and feasibility studies, a statement of overriding consideration is also subject to a substantial evidence standard of review. *Sierra Club v. Contra Costa County* (1992) 10 Cal.App.4th 1212, 1223; Guidelines § 15093, subd. (b).” Thus, an agency's unsupported claim that the project will confer general benefits is insufficient, and the asserted overriding considerations must be supported by substantial evidence in the FEIR or somewhere in the record. *Sierra Club v. Contra Costa County* (1992) 10 Cal.App.4th 1212, 1223; Guidelines § 15093, subd. (b).”

As part of the EIR review process, statements of overriding consideration are intended to “vindicate the ‘right of the public to be informed in such a way that it can intelligently weigh the environmental consequences’ of a proposed project[;]” and they must make a good-faith effort to inform the public of the risks and potential benefits of the Project whose approval is proposed. *Woodward Park Homeowners Ass'n, Inc. v. City of Fresno* (2007) 150 Cal.App.4th 683, 717-718 (citing *Karlson v. City of Camarillo* (1980) 100 Cal.App.3d 789, 804).

In accordance with this standard, before approving the Project and the FEIR the City must show that it has considered each of the Project’s significant and unavoidable impacts in light of *each* of the alleged overriding considerations that it asserts will justify those impacts. *Cherry Valley Pass Acres & Neighbors v. City of Beaumont* (2010) 190 Cal.App.4th 316, 357 (upholding a statement of overriding consideration on the basis that “the City found the project had eight benefits, each of which ‘separately and individually’ outweighed its unavoidable impacts). Thus, the City must specifically consider and set forth overriding considerations to justify the Project’s significant and unavoidable direct indirect and cumulative impacts in each of the following areas: aesthetics, land use and biological resources, noise, traffic and air quality.

The statement of overriding consideration attached to the FEIR asserts two general areas of benefits that it asserts outweigh the Project’s significant and detrimental, un-mitigated impacts: (1) an increase in jobs that improves the job to housing ratio in the City of Moreno Valley, and (2) an increase the in the City’s overall tax revenue, which could be used to improve schools and confer other public benefits to the residents of the City. Any additional public benefits that the draft statement assumes may result from approval of the Project flow from one of those two underlying considerations.

These two alleged benefits are, however, based on erroneous assumptions that (a) the

Project will bring secure, desirable and certain jobs to the City of Moreno Valley; and (b) that the environmental degradation caused by the Project's significant and unavoidable impacts will not outweigh the benefits conferred by the Project in monetary terms, or based on any other form of valuation methodologies. While the draft statement sites thoroughly to "appendix O" the Fiscal and Economic Impact Study, it fails to account for aspects of the job market that will undoubtedly impact the nature and desirability of the jobs made available at the Project, if it is approved, constructed and permitted to operate. Just some of these unmentioned aspects include trends towards employing largely contract, part-time or temporary or short-term labor to fill the jobs created by the WLC. Indeed the study is based on an assumption that either the WLC or other logistics uses will result in the permanent employment of .5 employees per 1,000 building square feet. Appendix O, at 20. Yet the study fails to calculate what the rate of employment would be if some or all of those jobs were characterized as part-time or temporary contract labor employment.

The draft statement of overriding considerations similarly fails to account for any discrepancy in full-time vs. part time, temporary or contract jobs. Moreover, additional aspects of job desirability including working conditions for laborers employed at the WLC or similar logistics enterprises that would operate in the project area are left wholly omitted from both the Appendix O study and the statement, and to the extent the draft statement relies on the development agreement to ensure that such jobs are actually ensured, such assurances are illusory as the development agreement terms remain unclear.

The draft statement of overriding considerations also fails to adequately quantify, either monetarily or based on some other form of valuation method, the consequences of the Project's impacts, specifically including its impacts to human health, the environment and invaluable threatened and endangered biological resources that surround the proposed project area.

Weighing the Project's true impacts against its purported benefits is a critical environmental review requirement. *See Woodward Park Homeowners Ass'n, Inc. v. City of Fresno*, 150 Cal.App.4th, 720. The City must therefore engage in a good faith effort to thoroughly analyze of the full scope of the impacts for which the statement of overriding consideration is being offered.

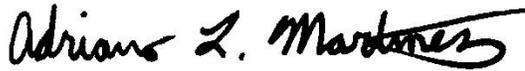
Doing so here would involve some process by which to measure conclusory statements that fully contradict the evidence on the record, such as the statement that the Project will improve health public health. Draft Statement of Overrid., at 209.

Finally, the draft statement of overriding considerations fails to justify the Project's impediment to the South Coast Air Basin achieving federal and state NAAQS, and it's steady, foreseeable future contribution to the region's ability to meet Air Quality Management Plan targets, which are essential to ensuring compliance with state and federal law. The statement of overriding consideration cannot, in essence justify the Project's apparent conflict of potentially causing violations of air quality standards, which carry severe economic sanctions for the 18 million people living the South Coast Air Basin based on parochial economic justifications for one city.

For these reasons stated herein and because the alleged Project benefits included in the draft statement of overriding consideration run counter to the evidence on the record, the City cannot approve the Project, and cannot certify the Revised FEIR as an informational document.

Given the limited time, this comment only raises some of the issues that are of concern related to this project. We appreciate your consideration of these comments. Please do not hesitate to contact us at amartinez@earthjustice.org if you have questions about this comment letter.

Sincerely,



Adriano L. Martinez
Earthjustice

The following Exhibits have been emailed to the Planning Commission for Review.

Exhibit List
(All exhibits submitted in electronic format)

Exhibit	Title
A	California Air Resources Board, <i>California Air Resources Board's Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap and Trade Regulation</i> (May 2013).
B	Haya, B., A. Strong, E. Grubert, and D. Cullenward, <i>Carbon Offsets in California: Science in the Policy Development Process</i> , in J.L. Drake et al. (eds.), <i>Communicating Climate-Change and Natural Hazard Risk and Cultivating Resilience, Advances in Natural and Technological Hazards Research</i> 241-254 (2016) ("Haya et al. 2016").
C	Haya, B. (2019). The California Air Resource Board's U.S. Forest Projects offset protocol underestimates leakage. GSPP Working Paper ("Haya 2019").
D	Anderson, C. & J. Perkins. (2017). Counting California Forest Carbon Offsets: Greenhouse Gas Mitigation Lessons from California's Cap-and-Trade U.S. Forest Compliance Offset Program. Stanford ("Anderson & Perkins 2017").
E	Aldy, J. E. & R. N. Stavins. (2012). The Promise and Problems of Pricing Carbon: Theory and Experience. <i>Journal of Environment & Development</i> , 2, 152-180 ("Aldy & Stavins 2012").
F	Cames, M., R. O. Harthan, J. Füssler, M. Lazarus, C. M. Lee, P. Erickson & R. Spalding-Fecher. (2016). How additional is the Clean Development Mechanism? Berlin ("Cames et al. 2016").
G	Haya, B. (2009). Measuring emissions against an alternative future: fundamental flaws in the structure of the Kyoto Protocol's Clean Development Mechanism (Report No. ERG09-001). Berkeley: Energy and Resources Group ("Haya 2009").

H	He, G. & R. Morse. (2013). Addressing Carbon Offsetters' Paradox: Lessons from Chinese Wind CDM. <i>Energy Policy</i> , 63, 1051-1055 ("He & Morse 2013").
I	Wara, M. (2008). Measuring the Clean Development Mechanism's Performance and Potential. <i>UCLA Law Review</i> , 55, 1759-1803 ("Wara 2008").
J	Zhang, J. & C. Wang. (2011). Co-benefits and additionality of the clean development mechanism: An empirical analysis. <i>Journal of Environmental Economics and Management</i> , 140-154 ("Zhang & Wang 2011").
K	Schneider, L. & A. Kollmuss. (2015). Perverse effects of carbon markets on HFC-23 and SF6 abatement projects in Russia. <i>Nature Climate Change</i> , 5, 1061-1063 ("Schneider & Kollmuss 2015").
L	Amicus Brief of the California Attorney General in Support of Petitioners and Respondents, <i>Sierra Club, et al. v. County of San Diego</i> , Cal. Ct. App., Fourth Dist., Div. 1, Case No. D075478 (filed Oct. 29, 2019).
M	California Air Resources Board, Offset Project Registries, at https://ww3.arb.ca.gov/cc/capandtrade/offsets/registries/registries.htm (visited May 8, 2020).
N	CAPCOA Greenhouse Gas Reduction Exchange (GHG Rx), at www.ghgrx.org (visited May 8, 2020).
O	Haya, B. & P. Parekh. (2014). Hydropower in the CDM: Examining additionality and criteria for sustainability (Working Paper ERG-11-001). Berkeley: Energy and Resources Group ("Haya & Parekh 2011").
P	Kansanga, M. M. & I. Luginaah. (2019). Agrarian livelihoods under siege: Carbon forestry, tenure constraints and the rise of capitalist forest enclosures in Ghana. <i>World Development</i> , 113, 131-142 ("Kansanga & Luginaah 2019").
Q	Beymer-Farris, B. A. & T. J. Bassett. (2012). The REDD menace: Resurgent protectionism in Tanzania's mangrove forests. <i>Global Environmental Change</i> , 22, 332-341 ("Beymer-Farris & Bassett 2012").
R	Cavanagh, C. & T. A. Benjaminsen. (2014). Virtual nature, violent accumulation: The 'spectacular failure' of carbon offsetting at a Ugandan National Park. <i>Geoforum</i> , 56, 55-65 ("Cavanagh & Benjaminsen 2014").

California Air Resources Board's Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap-and-Trade Regulation

1 BACKGROUND

Under the Cap-and-Trade Program, covered entities may use compliance offset credits to satisfy up to eight percent of their compliance obligation.¹ This limit applies to each individual covered or opt-in covered entity for each compliance period. Compliance offsets are tradable credits that represent verified greenhouse gas (GHG) emissions reductions or removal enhancements from sources not subject to a compliance obligation in the Cap-and-Trade Program and resulting from one of the following: (1) a project undertaken using an Air Resources Board (ARB or Board) approved Compliance Offset Protocol pursuant to Subarticle 13 of the Cap-and-Trade Regulation; (2) an offset credit issued by a linked jurisdiction pursuant to Subarticle 12 of the Cap-and-Trade Regulation; or (3) a sector-based offset credit issued by an approved sector-based crediting program pursuant to Subarticle 14 of the Cap-and-Trade Regulation. In almost all cases, these GHG sources are outside of the industrial, energy, and transportation sectors. This document describes ARB's process for the review and approval of new ARB Compliance Offset Protocols. As an important market feature, offset credits can provide covered entities a source of low-cost emissions reductions for compliance flexibility. The inclusion of offset credits will also support the development of innovative projects and technologies from sources outside capped sectors that can play a key role in reducing emissions both inside and outside California.

As required by Division 25.5 of the Health and Safety Code (Assembly Bill 32 or AB 32), any reduction of GHG emissions used for compliance purposes must be real, permanent, quantifiable, verifiable, enforceable, and additional (Health and Safety Code §38562(d)(1) and (2)). Any offsets issued by ARB must be quantified according to Board-approved Compliance Offset Protocols. The Cap-and-Trade Regulation (Regulation) includes provisions for collecting and submitting the appropriate monitoring documentation to support the verification and enforcement of reductions realized through the generation and retirement of Compliance offset credits. The regulatory provisions and the requirements of the Compliance Offset Protocols will ensure that the reductions are quantified accurately, represent real GHG emissions reduction, and are not double-counted within the system. Compliance Offset Protocols are considered regulatory documents and are made publicly available so that anyone interested in

¹ "Compliance obligation" is defined as "the quantity of verified reported emissions or assigned emissions for which an entity must submit compliance instruments to ARB." Title 17, California Code of Regulations, section 95802(a).

developing an offset project can do so if their project meets Board-approved standards. Information on existing and proposed protocols can be found here:

<http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm>

It is important to note that compliance offset credits are only one way to incentivize voluntary GHG reductions outside of the Cap-and-Trade Program. Projects that could reduce GHG reductions could be incentivized through the use of grants, the generation of voluntary offsets, and potentially as regulatory offsets for compliance with the California Environmental Quality Act.

2 COMPLIANCE OFFSET PROTOCOL REQUIREMENTS

2.1 How will ARB determine which protocols to take through the approval process?

Periodically, ARB staff will review offset protocols that are available for use in the voluntary offset programs. These voluntary protocols will be assessed against the protocol criteria listed below. This process will be coordinated with our Western Climate Initiative (WCI) partners. Staff will also consider proposed protocols submitted by stakeholders that include elements to ensure any resulting offsets would meet the AB 32 offset and ARB protocol requirements presented in section 2.2. The specific process and steps prior to Board consideration are provided in section 3 below.

In addition to the ability to generate offsets that meet the AB 32 criteria, there are several other factors that are considered when deciding which project types will be considered for potential development of a Compliance Offset Protocol. These factors include, but are not limited to, the following:

- Potential for projects in California;
- Potential offset supply;
- Cost-effectiveness; and
- Co-benefits.

ARB staff is also working with our WCI partner jurisdictions to identify which offset project types to evaluate next as part of the regional trading program, which may also include a review of existing protocols from voluntary offset programs.² Staff will determine if a proposed protocol for a project type can be applied in California and/or at the regional level, and if it has the potential to meet the criteria listed above. There may be instances where a protocol is not applicable in every jurisdiction of a linked program. In all cases, all linked jurisdictions will have to agree on offset project protocols to

² See: <http://www.westernclimateinitiative.org/component/repository/Offsets-Committee-Documents/> accessed May 3, 2013.

ensure nothing will impact the fungibility of offsets across a regional Cap-and-Trade Program.

ARB staff will continue to meet with stakeholders and consider additional proposed offset project types that meet the AB 32 offset and ARB protocol requirements as we coordinate with WCI partner jurisdictions.

2.2 What criteria will ARB use to evaluate new protocols?

ARB must ensure that all GHG emissions reductions issued as offset credits under a Compliance Offset Protocol meet the AB 32 offset criteria as defined in the Regulation. ARB's decision not to develop a Compliance Offset Protocol does not preclude that project type from being incentivized through grants, development of voluntary offsets, or potentially as mitigation for compliance with the California Environmental Quality Act.

The Regulation also specifies the criteria for Compliance Offset Protocols in section 95972. These requirements will be broadly applied to each offset project type for which ARB is developing a protocol. There may be additional considerations that staff, in collaboration with stakeholders, may look at for specific offset project types.

New protocols can only be considered for project types that meet the following requirements:

- The resulting GHG emission reductions are from sources that are not covered by the cap and that are not subject to a compliance obligation. This is because there is no net reduction (i.e. no "offset") as a result of emissions being shifted from one source under the cap to another source under the cap. As a matter of policy, we do not issue offset credits for reductions from sources that would be covered by the cap but are located outside the State. For example, energy-related projects, such as the installation of solar panels, would not be eligible for offsets as the actual emission reductions are associated with power generation and all electricity generation is already covered under the Cap-and-Trade Program. Similarly, transportation fuels are covered in the program starting in 2015, so ARB will not adopt a Compliance Offset Protocol for cleaner vehicle fleets.
- The GHG emissions reduction must be a direct reduction within a confined project boundary. Recycling activities would not be eligible for offset credit as the recycling activities do not have a direct GHG reduction at the recycling facility, but may have an emissions impact upstream when new materials are extracted or manufactured in lieu of the recycling. Currently, to avoid double counting

issues in the Cap-and-Trade Program, ARB does not plan to adopt protocols that include a lifecycle analysis.

- The GHG emissions reduction must be permanent. For avoided GHG emissions, there must be no opportunity for a reversal of the avoided emissions. An example of this type of permanence is methane flaring in livestock digester projects, which permanently destroys methane. For GHG sequestration, the project must be able to ensure the GHG will not be released into the atmosphere for at least one hundred years. Both the U.S. Forest and Urban Forestry Projects Compliance Offset Protocols require a commitment to keep any credited carbon stocks sequestered for at least 100 years.
- The GHG emissions reduction must be conservatively quantified to ensure that only real reductions are credited. This requires a sound foundation and understanding of the underlying quantification for all sources, sinks, and reservoirs within a project boundary so that the net change from implementing the project represents a real reduction for issuing credit.
- The GHG emissions reduction must be verifiable and enforceable. This requires a Compliance Offset Protocol to have clear monitoring and measurement requirements that can be audited by a verifier and enforced by ARB.
- The GHG emissions reduction must be additional, or beyond any reduction required through regulation or action that would have otherwise occurred in a conservative³ business-as-usual scenario.⁴ In order for ARB to ensure offset credits are additional, ARB would not adopt a protocol for a project type that includes technology or GHG abatement practices that are already widely used. See section 4 for more information.

³ “Conservative,” in the context of offsets, means “utilizing project baseline assumptions, emission factors, and methodologies that are more likely than not to understate net GHG reductions or GHG removal enhancements for an offset project to address uncertainties affecting the calculation or measurement of GHG reductions or GHG removal enhancements.” Title 17, California Code of Regulations, section 95802(a).

⁴ “Business-as-usual scenario” means “the set of conditions reasonably expected to occur within the offset project boundary in the absence of the financial incentives provided by offset credits, taking into account all current laws and regulations, as well as current economic and technological trends.” Title 17, California Code of Regulations, section 95802(a).

3 PROCESS FOR ADOPTION OF COMPLIANCE OFFSET PROTOCOLS

3.1 What are the rulemaking requirements for approving Compliance Offset Protocols?

Compliance Offset Protocols are considered regulatory documents and are subject to the Administrative Procedure Act (APA).⁵ As with any regulation that is considered by the Board, each Compliance Offset Protocol must be developed through a full stakeholder process. As part of this APA process and consistent with ARB's certified regulatory program, staff will also develop an environmental analysis that is included in the staff report prepared for any Compliance Offset Protocol to be considered by the Board. This process satisfies the requirements of the California Environmental Quality Act (CEQA). The primary steps and details of the APA process and how it applies to protocol review and adoption are as follows:

- **Offset Protocol Announcements and Timing:** Staff will announce decisions to develop new offset protocols in a public setting, open to all stakeholders. Information related to new offset protocols will be shared in a transparent and public process so as not to give any one entity a potential market information advantage over another entity.
- **Informal Development Activities:** During this step, staff will hold public workshops or technical meetings to discuss the development of a potential offset protocol, focusing on areas such as, but not limited to, project specific mitigation methods, defining a project boundary, quantification of baseline conditions, and quantification of actual GHG reductions or removal enhancements. Staff will look at offset supply potential that could be generated under each potential Compliance Offset Protocol, prioritizing those with supply in California and then broadly across the United States. When considering offset supply, staff will be interested not only in the potential supply from a single project and the potential supply if only small projects can occur, but also in whether the mitigation methods or technology(ies) are easily transferrable for a larger volume of reductions. This process would, where appropriate, also include the development of draft protocol text following stakeholder input.

Depending on the complexity of the project type, ARB may hold a series of workshops or technical workgroup meetings. Dates of the workshops or

⁵ Government Code, § 11340 et seq. Although Health and Safety Code section 38571 exempts quantification methodologies from the Administrative Procedure Act (APA), Compliance Offset Protocols and the corresponding adoption through the Cap-and-Trade Regulation would include regulatory components that are subject to APA requirements.

meetings will be posted on the ARB website and posted to the relevant email listservs. When possible, such meetings are webcast for broad public participation.

All workshop presentations will be posted on the ARB website and a protocol-specific development webpage will be posted that contains information about the development of that specific protocol. During the first public workshop, a protocol staff lead for ARB will be identified along with his or her contact information.

- **Issuing the Notice:** This step initiates the APA rulemaking action. When, after completing the preliminary activities described above, ARB determines that it would like to proceed with a formal rulemaking on a proposed Compliance Offset Protocol, ARB will issue a notice of proposed rulemaking, which is included in the California Regulatory Notice Register. This notice will include the Board hearing date when staff will present the proposed Compliance Offset Protocol for Board consideration. This notice is posted at least 45-days prior to the Board hearing.
- **Availability of the Proposed Text and the Initial Statement of Reasons:** At least 45-days prior to the Board hearing, ARB will make available the proposed Compliance Offset Protocol text and a staff report that includes an explanation of why certain decisions were made in the development of the proposed Compliance Offset Protocol, any relevant analyses to support the proposed Compliance Offset Protocol, and an analysis of potential environmental impacts. ARB will post the proposed text and the staff report on its rulemaking website with the 45-day notice. ARB practice is to notify the public of the availability of these documents through the relevant email listservs.
- **45-Day Comment Period:** ARB will provide at least 45 days for the public to review the proposed Compliance Offset Protocol text and staff report and provide written comments to ARB.
- **Public Hearing:** Staff will present the proposed Compliance Offset Protocol to the Board for its consideration. This process usually includes a staff presentation at a regularly scheduled Board hearing. The dates and agendas for each hearing are posted on the rulemaking website. Stakeholders can provide written and oral testimony to the Board before the Board takes any action on the proposed Compliance Offset Protocol text. The Board may choose to adopt the proposed Compliance Offset Protocol text as written or to direct staff to make changes and release amended material for a formal comment period of at least 15-days. ARB will consider all formal comments on its proposed Compliance Offset Protocol as required by the APA and Board policy.

- **Summary and Response to Comments:** ARB must summarize and respond to all formal comments submitted during the 45-day comment period, at the Board hearing, and during any subsequent 15-day comment periods on the proposed Compliance Offset Protocol in a document referred to as the Final Statement of Reasons. In this document, ARB will indicate where it made a change in response to a comment, or why a change is not appropriate. When applicable, the written responses to comments addressing the environmental analysis will be considered by the Board prior to making any findings required by the CEQA before a proposed protocol is adopted. This process ensures that ARB has understood and considered all relevant material presented to it before adopting a proposed protocol.
- **Submission of a Rulemaking Action to the Office of Administrative Law (OAL) for Review:** Following final ARB approval, the rulemaking record is submitted to OAL for review. ARB also posts a Notice of Decision with the Secretary of Natural Resources in accordance with its CEQA certified program. OAL has 30 working days to review the rulemaking record to determine whether it demonstrates that ARB satisfied the requirements of the APA. Upon OAL approval, the Board-adopted Compliance Offset Protocol is filed with Secretary of State and becomes effective within a quarterly time schedule provided in the APA.

The Administrative Procedures Act mandates that ARB complete a rulemaking within one calendar year from the date the 45-day notice is published in the California Notice Register. If ARB does not submit the final protocol and regulatory amendments to the Office of Administrative Law by that date, ARB must initiate a new rulemaking. This includes a new 45-day comment period and Board hearing.

4 ADDITIONALITY

AB 32 and the Cap-and-Trade Regulation require any reductions used for compliance to be beyond what would otherwise be required by law, regulation, or legally binding mandate, and that exceed what would otherwise occur in a conservative business-as-usual scenario. For each proposed Compliance Offset Protocol, staff will establish whether GHG reductions or removal enhancements that result from the implementation of offset projects under the protocol are already being required by a local, state, or federal regulation. If a specific GHG mitigation method is already required by regulation, any reductions from that mitigation method would not meet the requirements for additionality. In this case the proposed Compliance Offset Protocol could not include

that specific GHG mitigation method and compliance offsets would not be issued for that reduction activity.

To assess if a specific GHG mitigation method may have “otherwise occurred,” staff will establish if that method is common practice in the geographic area in which the proposed Compliance Offset Protocol is applicable. Where possible, this review would include staff’s best estimate of the percent of the technology or mitigation in use for that sector. This can be done through outreach to the sector that would generate potential offsets, discussions with trade organizations, data research, and reviews of technology trends. Staff will take into consideration cost barriers that may prohibit technology or GHG mitigation methods from occurring in the absence of revenues from the generation of offset credits. For each proposed Compliance Offset Protocol, staff will share their findings during a stakeholder process and solicit feedback to determine whether a specific technology or GHG mitigation method is beyond common practice, and if the resulting reductions would meet the requirements for additionality.

5 HOW DOES ENVIRONMENTAL CREDIT STACKING WORK UNDER THE CALIFORNIA COMPLIANCE OFFSET PROGRAM?

Environmental credit stacking refers to a situation where a single activity provides more than one marketable environmental credit. For example, forest projects can result in carbon sequestration and improved watershed quality benefits. ARB believes that environmental co-benefits are a desired result of its Compliance Offset Protocols. The additional incentives such as other environmental credits would not by themselves disqualify a project type from being considered for the development of a Compliance Offset Protocol. ARB’s assessment of additionality will be based on how prevalent a mitigation practice or technology is within a sector, regardless of whether or not the activity could generate other marketable environmental credits.

6 WILL ARB PERIODICALLY REVIEW COMPLIANCE OFFSET PROTOCOLS?

Yes, ARB will continue to monitor the adoption of new or modified regulations that could affect additionality, as well as new developments in scientific data and quantification related to adopted Compliance Offset Protocols that would warrant a change to an existing Compliance Offset Protocol. Staff will propose amendments to Compliance Offset Protocols as necessary through a stakeholder process prior to Board consideration. Staff will weigh the decision to update a protocol against the market desire for certainty to support an active and robust compliance offset program. Any amendments to an existing Compliance Offset Protocol would involve the same APA process as developing a new Compliance Offset Protocol.

Once ARB updates an existing Compliance Offset Protocol, the previous version would no longer be used by new projects from the date that OAL approves the new version. Any existing projects under the previous version of the protocol would be required to use the new version of the protocol once the existing crediting period has ended.

7 HOW CAN I PARTICIPATE IN THE COMPLIANCE OFFSET PROTOCOL DEVELOPMENT PROCESS?

ARB encourages interested parties, including subject matter experts and general members of the public to attend Compliance Offset Protocol development workshops and provide informal and formal written feedback on proposed content during the Compliance Offset Protocol development process. Stakeholders can also request meetings with ARB staff to discuss protocol-related issues. Stakeholders are encouraged to sign up for the Cap-and-Trade listserv to make sure they are notified of any workshops or public information related to Compliance Offset Protocol development:

http://www.arb.ca.gov/listserv/listserv_ind.php?listname=capandtrade.

8 SUBMITTING IDEAS FOR COMPLIANCE OFFSET PROTOCOLS?

8.1 Can a voluntary offset program recommend a protocol for review?

Yes. Voluntary offset programs such as the American Carbon Registry, Climate Action Reserve, Verified Carbon Standard, and others may submit protocols to ARB for review. However, regardless of how the voluntary protocols are developed, ARB staff must determine whether the voluntary protocol should be developed for use in the Cap-and-Trade Program and if so, to conduct its own rulemaking process under the Administrative Procedure Act. As outlined above, under this process ARB would review, modify, and present a proposed Compliance Offset Protocol for Board consideration. This process ensures that any voluntary protocol modified for consideration by the Board demonstrates the resulting reductions meet the offset criteria in AB 32 as defined in the Cap-and-Trade Regulation and the criteria listed earlier in this document.

Protocols developed by the voluntary programs are not Compliance Offset Protocols as they are not developed through a rulemaking process, may not meet the AB 32 and Cap-and-Trade Regulation criteria, and were not approved by the Board.

8.2 Why has ARB not developed Compliance Offset Protocols for all of the existing voluntary offset protocols?

There are many existing voluntary offset protocols for use in the voluntary offset market. However, ARB must ensure any Compliance Offset Protocol it develops will result in

offset credits that meet the AB 32 offset criteria and the general protocol criteria in section 2.2. ARB will periodically review the available voluntary offset protocols and the potential to develop them into Compliance Offset Protocols.

8.3 Why can't we limit offset protocols just to California projects?

An important role for compliance offsets in the Cap-and-Trade Program is to provide cost containment for covered entities in the program. A covered entity can meet up to eight percent of its compliance obligation by using offsets in each compliance period. It is important to note that if all entities under the cap were to maximize the use of offsets up to the eight percent limit, there would still need to be on-site GHG emissions reductions at covered entities to meet the overall cap limits through 2020. Since the Cap-and-Trade Program already covers most sectors of California's economy under the cap, limiting offsets to just projects in California would significantly reduce the offset supply potential available to covered entities. This would increase their cost for compliance under the Cap-and-Trade Program. As stated in section 2.1, ARB will try to identify potential Compliance Offset Protocols that may be applicable in California, as well as across the United States.

8.4 What if I have a good idea for an offset protocol?

ARB encourages stakeholders to engage with staff regarding the development of new Compliance Offset Protocols and potential new project types that may fit the criteria for compliance offsets. Section 2.2 of this document contains the requirements for Compliance Offset Protocols. These requirements can help stakeholders discern if their ideas could potentially be considered for the Compliance Offset Program.

8.5 Will ARB only approve protocols based on a standardized approach?

Yes, approved Compliance Offset Protocols serve as a cornerstone of the Compliance Offset Program to ensure that reductions are appropriately quantified, monitored, reported, and documented. Those protocols taken to the Board for adoption will consist of standardized methods that quantify reductions based on specific criteria and pre-established calculation methods. This approach streamlines the calculation of project baselines and determination of the additionality of projects by using standard eligibility criteria that ensure projects are additional. By establishing the standardized criteria in the Compliance Offset Protocol, there is less subjectivity by verifiers or offset project developers as to whether a project may be additional and this supports consistent quantification rigor in the offset program.

8.6 Will ARB approve protocols developed under a project-based approach?

No, ARB is not planning to accept project-based protocols because each individual project protocol must be approved by the Board and such a process would be lengthy and administratively burdensome.

Additional Information

More information on the Cap-and-Trade Program, compliance offsets, and current rulemaking activities can be found here:

<http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>

Staff contacts for the Cap-and-Trade Program can be found here:

http://www.arb.ca.gov/cc/capandtrade/contacts/capandtrade_contacts.htm

Chapter 15

Carbon Offsets in California: Science in the Policy Development Process

Barbara Haya, Aaron Strong, Emily Grubert, and Danny Cullenward

Abstract Natural and social scientists are increasingly stepping out of purely academic roles to actively inform science-based climate change policies. This chapter examines a practical example of science and policy interaction. We focus on the implementation of California’s global warming law, based on our participation in the public process surrounding the development of two new carbon offset protocols. Most of our work on the protocols focused on strategies for ensuring that the environmental quality of the program remains robust in the face of significant scientific and behavioral uncertainty about protocol outcomes. In addition to responding to technical issues raised by government staff, our contributions—along with those from other outside scientists—helped expand the protocol development discussion to include important scientific issues that would not have otherwise been part of the process. We close by highlighting the need for more scientists to proactively engage the climate policy development process.

Keywords Carbon offsets • Climate change policy • Carbon markets • Science and policy

15.1 Introduction and Background

Natural and social scientists in the field of global climate change are increasingly stepping out of purely academic roles to inform and support policy that is science-based. This chapter explores the roles that science and scientists play in climate policy development using an example from the California climate policy process. Beginning in the spring of 2013, we participated in the public process for

B. Haya, Ph.D. (✉)
Stanford Law School, Stanford, CA, USA
e-mail: bhaya@berkeley.edu

A. Strong, M.A. • E. Grubert, M.S.
Stanford University, Stanford, CA, USA

D. Cullenward, Ph.D.
University of California, Berkeley, Berkeley, CA, USA

developing two new carbon offset protocols in California. We relay our experiences as scientists in these processes with two main goals. First, we describe the types of input we and other natural and social scientists provided to regulators, in order to shed light on how scientific issues emerge in policy development and the associated role scientists play in practice. Second, we hope this example will encourage interested scientists to engage the climate policy process more directly. Fundamentally, we believe that scientists' active participation in climate policy development can improve policy outcomes and generate useful research agendas.

The primary theme of our work is supporting the robustness of California's offsets policies, a topic on which most of our efforts focused. As used in discussions of global climate change, another term—*resilience*—most commonly refers to the ability of communities or nature to adapt to the uncertain impacts of climate change. In the context of climate change policy, *robustness* offers a similar framing. It refers to the ability of a policy to reliably meet its goals despite substantial uncertainty in predicting or measuring its outcomes (Lempert and Schlesinger 2000).

The concept of policy robustness is particularly relevant in the context of policies concerning carbon offsets because of the deep scientific and behavioral uncertainties involved in calculating accurate emission reductions from offset projects. Because greenhouse gas emitters in a climate policy system that recognizes offsets—such as California's carbon market—use offset credits to justify increased emissions within the policy system's boundaries, it is critical that offsets accurately represent true emission reductions. Meeting this standard is no simple matter, however, as it requires scientifically complex and inherently uncertain methodologies.

The uncertainty stems from the need to calculate emission reductions by comparing an offset project's emissions against an inherently unknowable counterfactual scenario: the emissions that would have occurred without the offset project. Both estimates are subject to uncertain physical, social, and economic drivers. In light of this uncertainty, ensuring that offset credits represent true emission reductions requires conservative decisions about project and baseline emissions to ensure that protocols actually reduce the credited emissions reductions. Accordingly, our participation in California's public policy development processes focused on ways to preserve the robustness of the two offset protocols on which we worked.

The chapter is organized as follows. We begin with an overview of California's climate mitigation policies, describing how offsets fit into the state policy system, as well as the key challenges offsets pose for policy-makers. Next, we describe our activities as stakeholders in the public process for developing new offset protocols. We illustrate our work with a handful of examples that highlight scientific issues that emerged in the policy process, including issues that the regulatory agency identified for public input, as well as those issues we raised in our independent capacity. In the final section, we offer some concluding thoughts about our experience and the various roles we and other scientists played in these policy processes. Finally, we encourage other environmental scientists to explore proactive models of policy engagement.

15.1.1 *California's Climate Policy*

In 2006, California passed the Global Warming Solutions Act (AB 32), launching the state's comprehensive approach to climate mitigation policy. Its key feature is a legally binding requirement to reduce statewide greenhouse gas (GHG) emissions back to 1990 levels by the year 2020. To accomplish this goal, state law delegated broad authority to the California Air Resources Board (CARB), which developed a suite of climate policy instruments over the last several years (CARB 2008, 2014a). The most prominent is California's cap-and-trade program. This program applies to California's electricity, industrial, and fuels sectors, covering about 85 % of state-wide emissions.

Briefly, cap-and-trade carbon markets set an overall limit (or *cap*) on anthropogenic greenhouse gas emissions within the covered sectors. The regulator then issues tradable emissions allowances, with the total number equal to the cap. Each emissions allowance credit confers the right to emit one tonne of GHG pollution (measured in tonnes of CO₂ equivalent, tCO₂e). Covered entities must submit one allowance per tCO₂e of pollution they emit. Since allowances are tradable, if a regulated emitter can reduce emissions more cheaply than the price of a permit, it can do so, freeing up permits to sell to others who face costlier mitigation opportunities. This lowers compliance costs compared to a system in which each emitter must meet an established standard without trading.

Carbon offsets extend the flexibility of this approach by allowing covered entities to seek lower-cost emission reduction opportunities outside of the carbon market—for example, in another state or in an economic sector not covered by the cap—instead of reducing emissions within the capped sectors. The financial benefits to regulated emitters are straightforward: expanding the range of mitigation opportunities outside the capped system through offsets reduces compliance costs. Since climate change is driven by the global stock of GHGs in the atmosphere, reducing one tonne of emissions has the same effect regardless of location.¹ As we discuss below, however, accurately calculating the net emissions reductions raises new challenges.

15.1.2 *Offsets in California*

Companies subject to the cap-and-trade market can use offset credits to cover up to 8 % of their total emissions. This limit on the use of offsets appears significantly more generous when expressed as a percentage of the total mitigation required in the carbon market: if all regulated parties use the maximum amount allowed, offsets

¹ Though other pollution impacts that are coincident with the greenhouse gas emissions may have important local and regional effects, including on public health

would contribute about half of the total emission reductions expected under California's climate policy through 2020 (Haya 2013).

Carbon offsets in California work as follows. CARB issues offset credits for projects that follow approved protocols. The protocols themselves determine what project activities are eligible and define the methodologies by which projects estimate their emission reductions. Thus, offset protocols must be designed to anticipate all of the emissions-related drivers that apply in a given sector—a task that typically involves complex issues of environmental and social science.

Although the decision to develop a new protocol lies entirely at CARB's discretion, offset protocol methodologies must meet certain standards. State law and market regulations both require that emission reductions from offsets be "real, additional, quantifiable, permanent, verifiable, and enforceable."² Each of these terms has a formal legal definition. The most challenging requirement has been *additionality*, defined in AB 32 as crediting only those emission reductions that are made "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."³ CARB's climate regulations provide more context on how additionality is to be tested, requiring the use of a "conservative, business-as-usual scenario."⁴

The regulations also directly address uncertainty and risk management, defining conservative scenarios as those whose "project baseline assumptions, emission factors, and methodologies that are more likely than not to understate net GHG emission reductions or GHG removal enhancements for an offset project to address uncertainties affecting the calculation or measurement of [net GHG reductions]."⁵

Finally, it is important to recognize that political perspectives on offsets vary widely. Many stakeholders, including most major emitters in the market, are strongly supportive of offsets as a mechanism to keep compliance costs low. After all, the supply of offset credits is widely expected to meaningfully reduce carbon market prices relative to a market without offsets (Borenstein et al. 2014; EPRI 2013). In contrast, several nonprofit stakeholders have expressed concerns about whether California's offsets truly represent reductions in GHG emissions. For example, two environmental groups sued CARB, claiming that the agency's decision to evaluate additionality using a performance standard at the protocol level does not satisfy the requirements of AB 32. The trial court rejected the plaintiffs' claims, finding that CARB had the necessary legal authority to adopt its performance standard approach. The court then applied a highly deferential standard to review CARB's treatment of additionality in each of its existing protocols (*Our Children's Earth Foundation v. CARB* 2015). Beyond highlighting the political opposition to offsets, this decision suggests that future legal challenges to CARB's protocol methodologies would face a difficult legal test under which the regulator is likely to prevail.

² Cal. Code Regs. tit. 17, § 95802(a)(14); see also Cal. Health & Safety Code § 38562(d)(1)-(2).

³ Cal. Health & Safety Code § 38562(d)(2).

⁴ Cal. Code Regs. tit. 17, § 95802(a)(4).

⁵ Cal. Code Regs. tit. 17, § 95802(a)(76).

15.1.3 Critical Issues for Carbon Offsets

Offsets raise a number of technical challenges, and CARB's two new protocols are no exception. A carbon market maintains its environmental integrity only if the offset credits it recognizes represent actual net reductions in greenhouse gas emissions. In practice, however, uncertainty about those reductions requires detailed scientific input and is often the subject of significant controversy.

A critical task for policy-makers is establishing a robust standard for offset additionality. An offset project is considered additional only if it occurred because of the financial investment made in return for offset credits. In other words, an offset program should only credit those emission reductions it causes and should not credit reductions that would otherwise have occurred. This standard is necessary to ensure that any climate policy system that accepts offsets achieves its intended emission reductions. But additionality is difficult to achieve in practice. Several studies have shown that a large portion of credits generated by the Clean Development Mechanism (CDM, the Kyoto Protocol's offsets program) were non-additional projects that would have occurred without the financial incentive of offset credits and thus do not represent net emission reductions (Cullenward and Wara 2014; Haya 2009; Haya and Parekh 2011; Wara 2008). As a result, their use by countries to meet Kyoto Protocol targets came at the expense of real reductions in greenhouse gas emissions.

Two issues further complicate the basic question of establishing whether offset credits represent real additional emission reductions. First, uncertainty analysis is particularly important for offset projects in the land-use and agricultural sectors, where emissions vary widely across location, crop, and ecosystem types. Second, there is the risk that offset program incentives cause emissions to increase outside of offset project boundaries. The most egregious example involves offset credits in the CDM awarded for the destruction of hydrofluorocarbons (HFCs), a potent family of greenhouse gases emitted as byproducts in the production of certain refrigerants. Manufacturers realized they could earn greater profits from destroying HFCs than from the sale of the refrigerant itself. There is strong evidence that they increased their production as a result of this incentive, creating surplus HFC byproducts that they subsequently destroyed to earn offset income (Wara 2008). Beyond enticing non-additional credits, the income from HFC-related offsets might have discouraged national governments from directly regulating HFC emissions, in order to maintain offset project eligibility—an effect that has been documented for a range of other project types (Figueres 2006).

Although the problems observed in past offset systems remain relevant, it is important to recognize that CARB's approach to additionality is different than that of its predecessor, the Kyoto Protocol's CDM. The CDM requires individual offset project applicants to evaluate their counterfactual emissions scenarios and demonstrate additionality for each individual project. In contrast, the California system makes these determinations at the protocol level by defining project eligibility criteria. Once CARB has approved a protocol, a project applicant needs only to

demonstrate compliance with the protocol's eligibility criteria in order to earn credit. Given the use of up-front project eligibility criteria, robust protocol design is particularly critical to ensuring that California's offset credits represent real emission reductions.

Finally, we note the importance of CARB's early offset protocols as institutional precedents in American climate policy. As one of the first legally binding climate policies in the United States, California's cap-and-trade system has already become a standard point of reference for climate policy design. In turn, CARB's treatment of complex and uncertain scientific issues in its offset protocol development process will surely set an important example for others.

15.1.4 Proposed Mine Methane Capture and Rice Cultivation Protocols

By the beginning of 2013, CARB had approved four offset protocols covering projects in the following areas: (1) forestry, (2) urban forestry, (3) livestock waste management, and (4) destruction of ozone-depleting substances. We participated in the policy development process for two new protocols: (1) mine methane capture and (2) rice cultivation, which we describe briefly here for background.

CARB approved the Mine Methane Capture (MMC) protocol in April 2014 (CARB 2014b), following a year of development and stakeholder engagement. The protocol awards credits to projects that capture methane that otherwise would have been released into the atmosphere from coal and trona⁶ mining activities. CARB's MMC protocol recognizes two types of projects. Methane can be captured for use as a fuel, such as by injecting captured gas into natural gas pipelines or using it to fire an on-site power plant. Alternatively, MMC projects can destroy methane without putting it to productive use through flaring or oxidation. In any of these cases, methane (CH₄) is converted to carbon dioxide (CO₂), a much less potent greenhouse gas.

At the time that this chapter was written, CARB was in the process of developing a rice cultivation protocol and responding to comments submitted on a discussion draft of the protocol released in March 2014. This protocol would credit reductions in methane emissions from changes in rice cultivation practice in California and the South Central United States. Rice cultivation produces methane emissions because production fields are submerged under water for a large portion of the year. This causes biomass to decompose without oxygen, producing CH₄ rather than CO₂. Methane emissions can be reduced if the fields are submerged for less time or if less biomass is left on the field to decompose anaerobically.

⁶Trona is a mineral mined as the primary source of sodium carbonate in the United States.

15.2 Science in the Policy Development Process

In April 2013, CARB established technical working groups to bring together stakeholders to inform the development of two new offset protocols. The working groups included offset project developers, project verifiers (who verify that project developers have met the protocol's requirements), representatives from industries facing compliance obligations in the carbon market (i.e., offset buyers), environmental nonprofit staff, academic research scientists, representatives from organizations that develop offsets standards for voluntary carbon markets, and state and federal officials from outside agencies. Each working group convened approximately once every three months, though additional discussion continued between meetings.

15.2.1 The Interdisciplinary Nature of Climate Change Policy Development

As a preliminary matter, we note that the scientific and technical expertise needed to ensure the environmental integrity of carbon offset protocols spans a wide range of disciplines. For example, the MMC and rice cultivation protocols drew on experts—including a number of outside scientists, in addition to our group—who provided advice on statistical uncertainty assessment, biogeochemical and ecological modeling, field measurements of gas fluxes, economic analysis, life-cycle analysis, basic mineralogy, engineering of mine construction, wildlife ecology, insect population dynamics, the sociology of agricultural crop production practices, modeling hydrological connectivity above- and belowground, state and federal water law, land-use law, environmental law, and organizational theory. As this list indicates, there are many opportunities for a variety of scientific experts to proactively engage the climate policy process—no agency has all of the necessary experts on staff.

15.2.2 What Did We Do?

Our participation in the offset protocol development process included a wide range of activities. We interfaced with a variety of stakeholders, including CARB staff, CARB board members, offset project developers, and nonprofit groups. Similarly, our communications ranged from informal conversations in person to formal written comment letters. As members of the technical working groups for each protocol, we attended meetings at the agency's headquarters in Sacramento and brought attention to issues we viewed as critical to the environmental integrity of the draft protocols as they developed, based on detailed independent analysis.

We provided our assessments to CARB staff as informal communications and later submitted formal comment letters during public comment periods in the administrative process. At times when we believed that CARB was not adequately addressing critical concerns, we spoke with individual CARB staff and board members outside of the formal working group process, occasionally with the participation of other stakeholders; we also raised our concerns through public testimony at formal board meetings.

The overarching goal of our involvement was to apply our research team's interdisciplinary expertise to helping ensure the environmental quality of the protocols. We did not use a single set of methods in our contributions, but rather, each of us brought methods from our respective disciplines to our shared goal. Below, we offer examples of scientific issues that highlight the kinds of input we offered in an effort to ensure that California's offset protocols reflect the best available science and are robust in the face of significant uncertainty.

Our examples are organized according to different ways that scientific issues arose in the policy development process—at the agency's request or according to our independent review of the protocols—rather than by protocol or chronology. In this way, we hope to illustrate both how science was used in developing the protocols and what roles scientists can expect (or be expected) to play in such processes.

15.2.3 Scientific Issues Raised by the Agency

Our first category of scientific engagement in the policy development process focuses on those issues that CARB proactively identified, either via agency staff asking stakeholders directly for input or by inclusion on agency-drafted meeting agendas. We review one such example in this section.

15.2.3.1 Scale of Uncertainty Assessment in Model-Estimated Emissions from Rice Cultivation

If the proposed rice cultivation protocol is adopted, it will become the first California protocol to use a computer-based model to estimate emission reductions. Using a model is necessary in this case because direct field measurements of emissions are technically challenging, costly, and time-consuming. The proposed protocol relies on a mechanistic biogeochemical model, the DeNitrification-DeComposition (DNDC) model, originally developed at the University of New Hampshire (2012).

The DNDC model is used to estimate offset project emissions and emission reductions. Through the technical working group, we—along with other scientists, including DNDC model developers, biogeochemists, and agricultural experts—addressed questions about model uncertainty and validation, the model's ability to estimate emissions of the potent GHG nitrous oxide (N_2O), and specific biogeochemical parameters used in the model.

Models are by definition simplifications of complex processes and are not perfectly accurate. Accordingly, the draft protocol applies a *deduction* that reduces the model-estimated emission reductions to conservatively account for any model error. Early drafts of the protocol included this deduction, but applied only one value for all eligible projects. Since DNDC must be field-calibrated to particular crop types, however, we were concerned that a blanket assessment of an uncertainty deduction for model error was too general and would not reflect the uncertainty of the model as it would be applied in the rice cultivation protocol—specifically, to fields in different ecosystems, with different cultivars, and in different regions around the country.

We focused our attention on how finely to parse assessments of model uncertainty, raising this issue in both formal and informal comments. Ultimately, the draft protocol included separate uncertainty deduction calculations for each of the rice-growing regions, rather than a single uncertainty deduction for all applications of the model. Furthermore, CARB decided to update the uncertainty deduction coefficients on an annual basis, a feature that will make the protocol more robust in light of new information. On the other hand, there is no formal mechanism for updating the model itself in response to newly published scientific information that directly affects relevant calculations. In the end, the potential for model structures and inputs to change highlights the profound challenge of integrating active scientific research into a fixed policy structure. Inevitably, there will be trade-offs between the adaptability of the protocol to new information and the stability of compliance rules that offset project developers desire.

15.2.4 Scientific Issues We Raised

A second category of scientific engagement describes our independent evaluation of issues that emerged during the protocol development process, as opposed to the assessment of issues on which CARB specifically requested input. In this section, we discuss examples of issues we raised about the conservative estimation of emission reductions from individual projects, additionality assessment, and the risk of unintended consequences caused by interactions between offset protocols and other policies. In some cases, we raised questions that were not being addressed at the time, and in others, we advanced new perspectives on issues that were already under agency consideration.

15.2.4.1 Statistical Bias in the Rice Cultivation Emissions Model

Statistical bias occurs when a prediction repeatedly over- or underestimates real-world outcomes. A model is unbiased if its outcomes are equally likely to over- and underpredict actual emissions as determined by direct field measurements. An unbiased model may still over- or underestimate the reductions achieved by an

individual offset project, but the uncertainty deduction factor (discussed above) ensures that over-crediting is still avoided with a high degree of certainty. However, a model that has not been validated as statistically unbiased for the project types credited under the protocol may result in an overestimation of the emissions reduced by those project types, even after the uncertainty deduction factor is applied.

During the rice protocol development process, CARB staff referred to hundreds of field measurements that had validated the DNDC model, finding no trend in the estimates. Thus, they concluded that the model was not biased. We were concerned, however, that some of the project types eligible under the protocol were not included in the data used to validate the model. Noting this gap, we argued that an assessment of bias at the level of the entire DNDC model was insufficient, and that project-type specific assessment of model bias was warranted. To avoid over-crediting, we suggested that CARB approve the eligibility of a project type under the protocol only if the DNDC model has been validated to have no statistical bias for the type of activities credited by that project type. As of this writing and to the best of our knowledge, CARB staff provided the technical working group with only a list of published references, not the actual data from the model runs used in the bias assessment.

As CARB continues to collect field data to validate the model, we hope to view the complete dataset on which CARB validates the DNDC model. This example illustrates the important role scientists play in reviewing the technical basis of policy—in this case, the methods used to assess statistical bias in an emissions model, in order to avoid over-crediting. It also illustrates the importance of transparency and access to data, both of which are necessary to enable scientific review.

15.2.4.2 Additionality of Methane Capture at Abandoned Mines

Our second example in this category concerns the treatment of additionality in the MMC protocol. CARB determines the additionality of different project types by assessing whether the project activity is *common practice* among a relevant population; a project type is considered additional if it is not common practice. Applying this approach to methane capture at abandoned mines under the MMC protocol, CARB staff studied abandoned underground mines in the United States, finding that “few currently capture and destroy mine methane. Methane capture and destruction is therefore deemed not to be business-as-usual at these mines” (CARB 2013, p. 7). This language suggests that CARB was prepared to deem all abandoned mine methane control projects additional under the MMC protocol.

The case of methane capture at abandoned mines demonstrates the importance of assessing additionality for subcategories of project types and not just for the entire population of possible projects as a whole. It also highlights the value of performing a conservative quantitative assessment to examine compliance with the protocol level additionality standard. While only 38 of the more than 10,000 abandoned mines in the United States have implemented methane capture projects, these 38 mines emit one third of all methane released from abandoned mines in the country (Ruby Canyon Engineering 2013a). Thus, existing methane capture projects at

abandoned mines are correlated with high rates of methane emissions—exactly as one would expect, given that the costs of capturing methane decrease as the rate and concentration of methane emissions at mines increase.

If all abandoned mines were eligible for MMC offset credits, the protocol could generate non-additional credits from projects that would have proceeded regardless of the financial incentives offsets provide. Indeed, if methane capture project development trends at abandoned mines from the last two decades were to continue, the volume of non-additional credits enabled by CARB's initial common practice assessment would likely far exceed methane capture from truly additional projects enabled by the financial incentive created by the offsets program as assessed by Ruby Canyon Engineering (2013b).

A more detailed analysis of abandoned mines suggested a path forward. Currently, most methane capture at abandoned mines occurs at mines that captured methane for pipeline injection when they were active. In fact, all mines that captured methane and were closed within the last ten years continued to capture methane after being abandoned. Methane capture at this subcategory of mines is undoubtedly common practice. Accordingly, CARB narrowed its eligibility criteria in the final protocol it adopted in April 2014, excluding those abandoned mines where methane had been captured and injected into pipelines when the mine was active (CARB 2014b, p. 14).

Our calculations showed that this approach excludes most, but not all, of the non-additional crediting that would conceivably be generated under CARB's initial definition of common practice at abandoned mines. While most non-additional methane capture is excluded from crediting by the narrowing of CARB's eligibility criteria for abandoned mines, past trends suggest that a smaller amount of methane capture may still be cost-effective on its own. We performed a quantitative analysis on the narrowed pool of eligible projects.

We found that if past trends in the development of new methane capture projects at abandoned mines that never previously captured methane were to continue, the expected generation of credits from non-additional projects is likely to be small compared to the expected effect of the protocol on new project development. Our analysis further indicated that under-crediting from conservative methodologies used to estimate emission reductions from abandoned mines under the protocol can reasonably be expected to counterbalance this non-additional crediting.⁷ In other words, even though it is likely that some abandoned mines that would have chosen to implement methane capture technology regardless of the offset credit could generate credits under the protocol, the total quantity of offset credits generated by the protocol is unlikely to exceed the net emission reductions enabled by the protocol.

⁷For a more detailed description of this assessment, please see comments submitted by Barbara Haya on behalf of our research team dated February 14, 2014, "RE: Comments on the informal draft of the Mine Methane Capture (MMC) Projects Compliance Offset Protocol released 31 January 2014" available on California Air Resources Board's Workshop Comments Log: <http://www.arb.ca.gov/lispub/comm2/bccommlog.php?listname=discussion-draft-ws>.

As a result, we concluded that the protocol is expected to meet the additionality requirement defined under AB 32.

In addition to describing how the regulator's approach to a particular technical issue evolved during the MMC protocol development process, this example illustrates a methodological issue that speaks to the broader architecture of California's offsets policy. CARB's common practice approach appears to be designed to avoid the subjectivity of other eligibility metrics by referring to objective measurements of the frequency of emission-reducing activities. Nevertheless, we believe that this approach belies a persistent analytical subjectivity. As the abandoned mine issue shows, how CARB defines the population of project types against which it makes its common practice determination has important implications for the additionality of the offset protocol as whole. This example illustrates the importance of performing additionality assessments on subcategories of projects and conservatively excluding subcategories that could be considered common practice. More broadly, it also shows that the decision to use a common practice standard does not avoid the need for careful risk assessments of possible outcomes; these assessments remain necessary to identify appropriate project eligibility criteria that contain the risk of over-crediting.

15.2.4.3 Potential Conflicts with Clean Air Act Implementation

Our final example concerns a prospective impact that could occur beyond offset project boundaries. Here, our analysis focused on the potential for California's MMC protocol to interfere with other states' implementation of regulations under the federal Clean Air Act. The problem is this: although California's offset regulations exclude as ineligible those offset projects whose emission-reducing activities are separately required by law, they do not consider the incentive California's offset protocols create to keep legal standards in other jurisdictions low.

Under the Clean Air Act, any major new source of greenhouse gases is required to apply for a Prevention of Significant Deterioration (PSD) permit from its state environmental agency. In turn, the state agency is required to determine the best available control technology (BACT) for that particular project. State agencies have broad discretion in setting each project's BACT, with limited room for the federal Environmental Protection Agency (EPA) to review their findings. We expressed concern that California's MMC protocol would create incentives for out-of-state agencies to keep GHG BACT standards for mines artificially low. After all, were an out-of-state regulator to require methane destruction under the BACT determination for a PSD permit that methane destruction project would become ineligible for offset credits (and revenues).

In order to mitigate this risk, we recommended a do-no-harm precaution, temporarily excluding from the MMC protocol those mines that would require a PSD permit under the Clean Air Act. Once a specified number of PSD permits were

issued to comparable mines, however, we suggested the MMC protocol could then expand its eligibility to mines that required PSD permits—so long as the early BACT determinations indicate that this course would be appropriate. Ultimately, these issues were not addressed in the adopted protocol and will be monitored informally.

15.3 Conclusions

The development of two new carbon offset protocols in California provides a rich case study in science-based policy-making. As public members of the technical working groups established by the California Air Resources Board, we both observed and contributed to the scientific discussions that arose during the course of protocol development. In addition to responding to the issues and questions raised by CARB directly, we—along with other outside scientists—played an essential role in expanding the protocol development discussion.

Most importantly, our engagement focused extra attention on the robustness of the protocols, providing strategies to avoid over-crediting despite substantial uncertainty in predicting protocol outcomes. Robustness is critical in the development of carbon offset protocols because of the significant scientific and behavioral uncertainty involved in accurately calculating emission reductions from individual projects. Fundamentally, this uncertainty stems from the challenge of estimating emission reductions (and the number of offset credits awarded) against an inherently unknowable counterfactual scenario of what would have happened without the offset program. Because offset credits are used in place of emission reductions within existing climate policy systems, methodological decisions must be made conservatively and guided by scientific risk assessments in order to avoid weakening these systems. Protocols should also be responsive to new scientific information and changes in the socioeconomic drivers of emissions. By conducting independent analyses of these kinds of issues, we aimed to increase the agency's capacity to evaluate key risks and improve the robustness of the offset protocols.

Finally, we hope the examples in this chapter encourage more members of the scientific community to seek ways to actively engage the development of climate policies. Although the offset protocols on which we worked were certainly informed by traditional scientific publications, our experience shows how the full treatment of scientific issues in the policy process occurs more through direct participation than literature reviews. Many of the critical policy questions involving science and uncertainty analysis would be difficult, if not impossible, to anticipate from a detached distance. In addition, their successful resolution depends on professional relationships built through iterative interactions in the policy process. Collectively, these factors suggest the need for more academics to explore ways to actively engage the climate policy process in the future.

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POLICY BRIEF: The California Air Resources Board's U.S. Forest offset protocol underestimates leakage

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Barbara Haya, PhD, Research Fellow, Center for Environmental Public Policy, University of California, Berkeley, bhaya@berkeley.edu

SUMMARY

Analysis of projects generating 80% of total offset credits issued by the California Air Resources Board's (ARB) U.S. Forest offset protocol finds that 82% of these credits likely do not represent true emissions reductions due to the protocol's use of lenient leakage accounting methods. The U.S. Forest protocol has generated 80% of the offset credits in California's cap-and-trade program. The total quantity of emissions allowed because of this over-crediting equals approximately 80 million tons of CO₂, which is one third of the total expected effect of California's cap-and-trade program during 2021 to 2030 (ARB 2017).

Leakage, in the context of the protocol, occurs when a reduction in timber harvesting at a project site causes an increase in timber harvesting elsewhere to meet timber demand. The way ARB's protocol accounts for leakage when calculating the number of credits awarded has three serious problems.

First, the protocol uses a 20% leakage rate when a rate of 80% or higher is supported by published studies of leakage rates from reduced timber harvesting in the United States (Gan & McCarl 2007, Wear & Murray 2004). Using an unsupported low rate results in over-crediting.

Second and more importantly, there is an inconsistency between the timing of when increases in on-site carbon storage and releases due to leakage are accounted for in the protocol's methods. Most improved forest management projects assume and credit a large reduction in timber harvesting in the first year of the offset project, but deduct the associated leakage over 100 years. This outcome is physically inconsistent, as it assumes the forest would be harvested in the first year for the purpose of giving credit but assumes harvesting would be spread out over 100 years for the purpose of reducing credits to account for leakage. As a result, most forest offset projects begin in greenhouse gas debt; project landowners generate offset credits that allow emitters in California to emit more than the state's emissions cap today, in exchange for promises that their lands will continue to increase their storage of carbon over 100 years.

Third, it is unclear whether the protocol requires forestland owners to increase carbon stocks to cover leakage for 25 years or for 100 years. The ambiguity relates to whether forestland owners are required to continue to maintain on-site growth to cover the impacts of leakage after the end of the project's 25-year crediting period. If forestland owners are only required to account for leakage for 25 years, participating projects could result in no net increase in carbon storage over 100 years compared to the baseline scenario.

The below table presents the actual emissions reductions achieved by projects under the protocol under different assumptions, reported as proportions of the credits already issued. For example, the cell on the upper left (100%) represents the assumptions underlying current policy. If these

assumptions are accurate, then 100% of the credits issued represent true emissions reductions. On the other hand, if these assumptions are inaccurate, the proportion of credits that represent actual emissions reductions can be much lower. The cell on the lower right (18%) shows that if the true leakage rate is 80% and ARB chose to only credit reductions already achieved, rather than reductions expected in the future, then the real reductions achieved to date by the project add up to only 18% of the credits issued.

This analysis was performed on all credits generated by 36 compliance forest offset projects through March 23, 2019. Collectively, these projects generated offset credits equal to 97 million tons of CO₂ reductions, which is 80% of the total credits that ARB has issued under its U.S. Forest protocol.

**Actual emissions reductions by U.S. Forest offset projects
as percent of credits issued to date**

		Expected over 100 years (ARB's current approach)	Achieved to date (Recommended approach)
If the true leakage rate is:	20%	100%	65%
	40%	99%	49%
	60%	97%	33%
	80%	96%	18%

ARB can avoid the over-crediting discussed here with a few modifications to its protocol. ARB should (1) apply a leakage rate that is 80% or higher; and (2) determine the net benefits of reduced harvesting on an annual basis by accounting for both the increased carbon storage on site and the decreased carbon storage elsewhere due to leakage at the same time. This solution is reflected in the bottom right cell of the above table (18%).

These changes are needed for the protocol to be in accordance with current law and regulation. First, given the uncertainty in true leakage rates from reduced timber harvesting within the United States, using an 80% leakage rate or higher, as is supported by the academic literature, better fulfills the conservativeness principle laid out in ARB's cap-and-trade regulations.¹ Using low rates that are not reflected in published literature is unjustified and does not fulfill the conservativeness principle. Second, generating credits today for expected net reductions over many decades into the future runs contrary to the goals of California's Global Warming Solutions Act (AB32), the 2006 law authorizing California's cap-and-trade and offsets programs. This law states that for any trade in credits using a market-based compliance mechanism, the reductions credited should occur "over the same time period" and be "equivalent in amount to any direct emission reduction required" under California's climate change law.²

¹ " 'Conservative' means, in the context of offsets, utilizing project baseline assumptions, emission factors, and methodologies that are more likely than not to understate net GHG reductions or GHG removal enhancements for an offset project to address uncertainties affecting the calculation or measurement of GHG reductions or GHG removal enhancements." California Code of Regulations, title 17, § 95802.

² California Health & Safety Code § 38562(d)(3).

DETAILED DISCUSSION

How the U.S. Forest offset protocol works

The large majority of U.S. Forest offset projects credit forestland owners for holding more carbon on site per acre than they would have in the business-as-usual baseline scenario. Landowners must commit to maintaining those higher carbon levels for 100 years. Projects can be anywhere in the United States, and to date, approximately 20% of credits generated have been from projects in California, and 80% have been from projects elsewhere in the United States.

Most of these improved forest management projects define a business-as-usual baseline scenario that involves aggressive timber harvesting that brings on-site carbon storage close to the average per acre for forests in their region. The assumption is that these offset projects maintain higher on-site carbon stocks by reducing timber harvesting.

In the first year of an improved forest management offset project, the landowner earns offset credits for the amount of carbon on their land above the business-as-usual baseline scenario minus two factors. First, estimates of carbon released due to leakage are deducted. Second, not all loss of on-site carbon is released into the atmosphere. The protocol accounts for the portion of harvested timber that remains long-term in wood products like in houses and furniture and buried in landfills, which would be reduced if total timber harvesting is reduced by the project. Each subsequent year, the landowner is credited for any incremental increase in carbon sequestration on the participating lands as trees grow and sequester more carbon, minus the same two factors.

Leakage rate

ARB's U.S. Forest offset protocol uses a 20% leakage rate. A 20% leakage rate means that 20% of the reduction in timber harvesting caused an offset project is replaced by an increase in harvesting on other forestlands. The other 80% of the reduction is assumed not to be replaced and simply represents a decrease in timber use (i.e., fewer houses built, less paper produced, etc.)

Published literature suggests the leakage rate from reduced timber harvesting in the United States is at least 80%. Using a computable general equilibrium model, Gan & McCarl (2007) estimate that if timber production were reduced in the United States, 77% of that timber harvesting would be displaced to other countries. Wear & Murray (2004) use econometric modeling to trace the effects of reductions in federal timber sales in the western United States in the late 1980s through the 1990s. They estimate that 84% of the reduced timber production was displaced to elsewhere within North America. Both articles underrepresent total leakage from conservation on U.S. forestlands. The former only estimates international leakage, ignoring leakage that might occur among forestland within the United States; the latter only estimates leakage in North America, ignoring leakage that could occur elsewhere. The existing academic literature on leakage rates from reduced forest harvesting does not support a 20% leakage rate. A conservative approach to addressing uncertainty in the true leakage rate would apply a leakage rate that is at least 80%.

The Climate Action Reserve, which developed the original U.S. Forest offset protocol on which ARB based its own protocol, revised its leakage rate from 20% to a sliding scale up to 80%,

depending on the amount of timber harvesting performed by the offset project itself. Under this protocol, an 80% leakage rate is applied to offset projects that do not harvest at all.

The timing issue explained

As is typically done with offset projects, emissions reductions are estimated against a baseline scenario representing what would likely have happened without the offset program. Almost all ARB improved forest management offset projects define baseline scenarios that are well below their actual carbon stocks in their first year. On average across all projects analyzed, these baselines equal 70% of current carbon stocks. This means that in the first year of a project, the land owner is issued a quantity of credits equal to, on average, around 30% of the carbon stocks on their project lands, adjusted downward to account for leakage and any reduction in carbon held long-term in harvested wood products and landfills.

To create a baseline, the landowner models the carbon stocks and fluxes associated with a 100-year timber harvest scenario that reflects the harvesting expected to take place without the financial incentives from the offset program. The modeled scenario should be financially feasible and fulfill all legal and contractual obligations. In order for most projects to earn credits under the protocol, the calculated average carbon stocks in the baseline scenario over 100-years should be no less than that of the average forestlands for the project's region and forest type.

This modeled scenario is then abstracted into two key parameters used to calculate emissions reduced and credits generated by the project. Baseline on-site carbon storage and harvesting rates are assumed to equal the average values generated by the modeled scenario over 100 years. This simplified baseline is treated as equivalent, in terms of carbon accounting, to the range of financially feasible timber harvest scenarios that could have happened without the offset program. Flat average baseline values have the advantage of not requiring the landowner to calculate year-to-year increases in carbon storage against the harvest and growth cycles in one specific baseline management regime for each of 100 years. But this approach has one important disadvantage—flat average baseline values for carbon storage and harvest rates are internally contradictory and physically impossible.

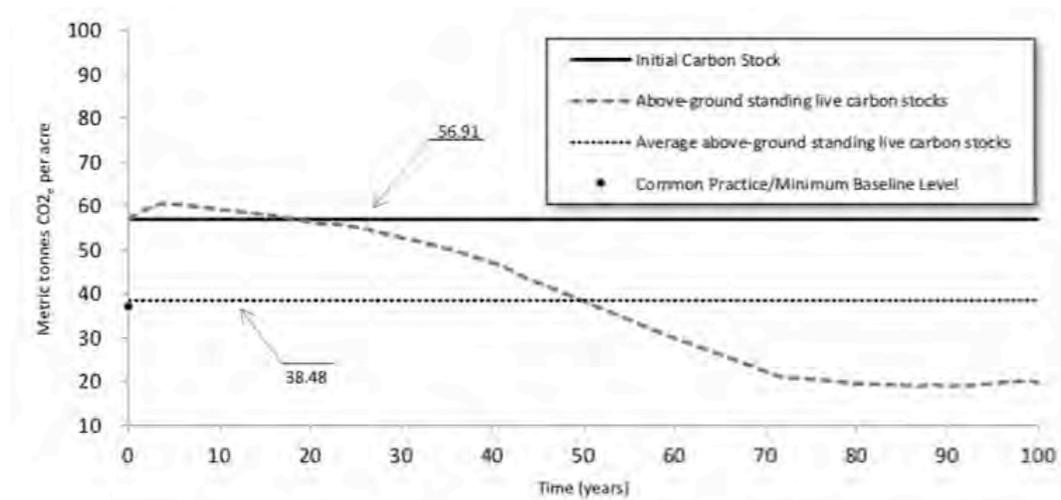
The figure below presents an example of a modeled harvesting scenario used to define the baseline for one large offset project – ACR360, a half million acre project in southern Alaska. The curved dotted line is the modeled business-as-usual scenario for above-ground standing live carbon stocks. The straight dotted line is the baseline used to generate credits, which is the average above-ground standing live carbon stock in the 100-year modeled scenario. The solid line is the actual carbon storage on the project lands at the start of the project.

This simplified baseline scenario suggests that, if the project were not earning offset credits, its lands would be harvested to baseline levels in year 1 and maintained at those carbon stocking levels for 100 years. However, contradicting this assumption, the baseline also assumes that a constant quantity of timber is harvested each year over the project life, equal to the average rate over the 100-year modeled scenario. This second assumption is used to calculate leakage.

These two assumptions are contradictory because it is not possible for both carbon storage and harvesting to simultaneously remain at their respective average values over the project life. Carbon storage and harvesting rates are correlated with one another, and inextricably tied to the actual net growth rate of the project forest. If carbon storage is assumed to drop to the baseline in year 1, that

would happen because of a large amount of timber harvesting. If the harvesting rate is assumed to be constant over 100 years, however, then the carbon storage on the land will also decrease slowly, rather than abruptly in year 1. By mixing these two assumptions into a physically impossible baseline scenario, the protocol maximizes credits generated without reflecting the actual rate at which emissions to the atmosphere are avoided. The protocol calculates gains in carbon against the baseline using the first assumption, and losses in carbon from leakage using the second assumption. As a result, credit generation is frontloaded, and landowners need to continue to increase net carbon storage for decades to make up for the leakage effects associated the reduced harvesting credited at the start of the projects.

Baseline carbon stocks for Finite Carbon – Ahtna Native Improved Forest Management offset project



From: ACR360 “Finite Carbon – Ahtna Native Alaskan IFM” Version 1.3, Attachments G and H: Baseline Carbon Stocks, Submittal Date: 1/19/2018

This over-crediting allows emitters in California to emit more than the state’s emissions cap today in exchange for promises of forest carbon sequestration over 100 years to cover leakage from the start of the project. This is problematic for several reasons. First, emissions today are not equivalent to reductions decades from now given the urgency of climate change mitigation to avoid tipping points. California is designing its cap-and-trade and offset programs as models for other jurisdictions. If California exports a model that trades emissions today with reductions decades from now, California would promote a form of climate policy that fails to reduce emissions in these immediate critical years. Second, these promises can be difficult to keep since productivity slows in ageing forests (Gray et al 2016) and as forests respond to a warming climate. On project lands with less harvesting, fewer older trees will be replaced with younger trees, and the average tree age will increase over the 100 years of the project.

ACR360 generated close to 15 million offset credits in its first year, equal to more than 60% of the expected average annual effect of California’s cap-and-trade program on emissions during 2021-2030.

The 25 year versus 100 year issue explained

If forestland owners are required to increase carbon to cover leakage for 100 years, then there would be no over-crediting over 100 years of the project. Over-crediting in the early years of the project would slowly be compensated as leakage is deducted each year for the project life.

However, it is unclear whether the protocol requires forestland owners to account for the emissions from leakage for 25 or for 100 years. The crediting period of a U.S. Forest offset project is 25 years. After the end of each 25-year crediting period, landowners can choose to renew their offset project for another 25 years but are not required to do so. For each year of a crediting period, landowners must report the net impact of the project on emissions taking into account any change in on-site carbon storage, and any releases due to leakage or reductions in carbon held long-term in harvested wood products and in landfills. If the net impact of the project in any year is negative, a *reversal* is understood to have occurred. The carbon reductions that were previously credited and later released must be replaced with additional procurement of allowance or offset credits.

How a reversal is defined after the last year of crediting is unclear in the protocol. Following the last year of crediting, forestland owners are required to maintain the credited on-site carbon storage for another 100 years. It is unclear if they are also required to ensure their forestland continues to grow to cover off-site releases due to leakage and due to reductions in carbon held long-term in harvested wood projects and landfills.

If forestland owners are only required to account for leakage for 25 years, crediting for reduced harvesting in the first year of the project will be awarded in full, while potentially, as low as only 1% of the leakage associated with that reduced harvest is deducted each year for only 25 years. It would be possible for participating projects to result in a net decrease in carbon storage over 100 years compared to the baseline.³

Methods

Landowners report how they calculate their requested credit issuance in Offset Project Data Reports (OPDRs) based on instructions laid out in the protocol. These reports are made public through the offset registries. We reproduce these calculations for all credits issued to 36 projects as of March 23, 2019. We use data provided by the landowner in their OPDRs and supplemental materials, and adjust the projects' assumptions for leakage and the timing of harvesting in the baseline to investigate the quantity of over-crediting.

Adjusted leakage rate

Using data reported in the OPDRs, we reproduce the calculations of leakage (also called *secondary effects*), carbon in harvested wood products and landfills (HWP&L), and total reductions achieved using leakage rates of 40%, 60%, and 80% instead of 20%.

³ Please see public comments submitted to ARB on May 10, 2018, [Comments on proposed cap-and-trade regulatory amendments](http://bhaya.berkeley.edu), for a more detailed discussion of this need to clarify and revise how the protocol defines a reversal after the last year of credit issuance, found at <http://bhaya.berkeley.edu>.

Adjusted timing of baseline harvesting

We recalculate the credits that would have been generated if the protocol's leakage calculations matched its assumption that timber is harvested in year 1 of the baseline scenario to bring carbon storage down to baseline levels, and continues to be harvested at smaller rates needed to maintain the baseline carbon storage level for one hundred years.

We do this in the following manner:

First, the baseline harvesting level prior to delivery to the mill (PDM) in the first year of the project is calculated as the difference between standing live carbon in the project compared to the baseline.

Second, we calculate the baseline carbon in trees harvested in years 2 to 100 so that the sum of the baseline PDM over 100 years is the same as the sum using ARB's current methods. We calculate the baseline PDM in years 2 through 100 (99 years) as:

$$\text{PDM}_{\text{annual after year 1}} = (\text{PDM}_{\text{total}} - \text{PDM}_{\text{year 1}}) / 99$$

Third, we recalculate the carbon in baseline HWP&L in a similar manner, by:

- a) using the ratio of HWP&L to PDM in year 1 of the baseline in the OPDR to recalculate carbon in HWP&L in year 1 of the baseline for the revised PDM value;
- b) calculating carbon in HWP&L in years 2 through 100 using the same process as for timber harvesting, so that the sum of carbon in HWP&L over 100 years of the baseline is the same in our estimates as it is in ARB's current estimates over the project life;

Fourth, we recalculate emissions reductions from the project using these revised leakage and carbon in HWP&L figures, and otherwise following the methods defined by the protocol.

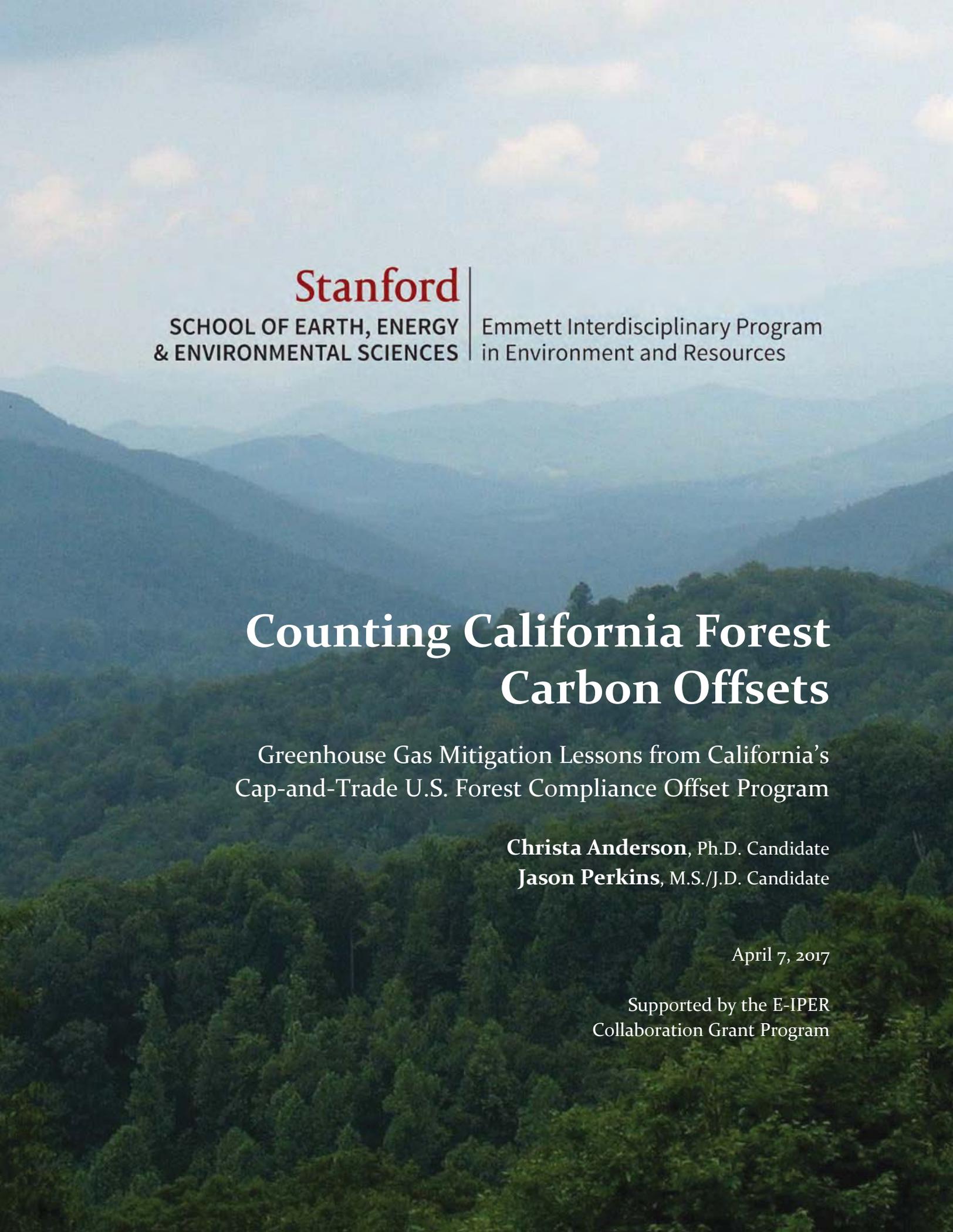
When baseline or project PDM figures are missing from any of the OPDRs, we calculate the missing PDMs mathematically from other reported figures when possible, and apply the following assumptions when needed:

- The ratios of carbon in HWP&L to PDM remain the same across reporting periods.
- When the first reporting period does not equal exactly one year, the PDM in the first year is a prorated amount, reflecting what most projects with at least two reporting periods have done.
- The ratio of carbon in HWP&L to PDM is the same in both the baseline and project scenarios.

Other than the changes and assumptions described above, we repeat the methods used in the OPDRs to re-estimate emissions reduced and credits generated.

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Counting California Forest Carbon Offsets

Greenhouse Gas Mitigation Lessons from California's
Cap-and-Trade U.S. Forest Compliance Offset Program

Christa Anderson, Ph.D. Candidate
Jason Perkins, M.S./J.D. Candidate

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Cover photo from Flickr Creative Commons, available at <https://goo.gl/6lbL3Q>.

Executive Summary

In 2013, California launched a multisector cap-and-trade market designed to reduce greenhouse gas pollution and meet the greenhouse gas mitigation targets set forth in Assembly Bill 32 (2006). Building on many years of effort and policy deliberation, California included in the cap-and-trade market the ability for covered entities with a compliance obligation to pay actors outside the program to reduce *their* emissions, frequently referred to as purchasing ‘offsets’. Since 2013, California has operated a first-of-its-kind forest carbon offset program, in which 39 forest projects across the United States have earned credits through July 2016.

This research analyzes California’s experience in running a first-ever compliance offset program for forests. To our knowledge, no official program evaluations of the forest offset program have been conducted to date. In the absence of identified and measurable official metrics and goals, this paper takes a more general ‘lessons learned’ approach, asking what the State has gotten from this policy innovation and what insights can be applied to other forest carbon sequestration efforts, like California’s ongoing natural and working lands inventory.

From project design document review, survey responses and interviews with project owners and developers, we have four core findings. First, the California program has gone much further towards assuring additionality than other programs, including most voluntary forest offset programs, though some lingering and perhaps unavoidable questions remain. Second, a wide variety of California compliance entities buy forest offset credits, including some that operate facilities located in areas identified by the State as disadvantaged communities. Third, environmental benefits have been created by the program, though their financial importance may be minimal. Finally, California has taken forest offset protocols and policy to new levels, though the future of the market is quite uncertain given the need for supermajority reauthorization of the cap-and-trade program.

This paper first provides an overview of the forest offset program, its history and development, and some data about the current state of the program. It then describes the methods used in this study, and presents the above findings in detail. It concludes by illustrating several ‘lessons learned’ that should be incorporated by the Air Resources Board and cooperating agencies into the broader natural and working lands effort in California.

Overview and Development of the California Forest Carbon Offset Program

Before presenting the results of our research into the offset program, it is necessary to briefly describe the origins, history, policy design choices, and project performance of the California forest offset program in order to inform readers and put our findings in proper context. As of this writing, no comprehensive program evaluations have been conducted of the forest offset program.

Climate Change, Forests, and California Policy

Forest Carbon History and Potential

Forests have played an integral role in climate forcing emissions throughout American history, though only more recently have they served as a net carbon sink. Historically, American forests served as a significant net source of emissions in the 19th and early 20th Centuries, as old growth forests were harvested and trees were a primary building material and energy source. As fossil fuels replaced wood as a fuel source, and as forests regrew in the middle decades of the 20th Century, American forests became a net carbon sink, reaching their lowest net emissions rate (or, alternatively, highest carbon storage rate) in the 1980s. Since then, increased harvesting has lessened American forests' utility as a carbon sink, however significant carbon storage potential remains if deforestation is avoided in the 21st Century.¹ It has been estimated that forest carbon sequestration is equivalent to 12-19% of US fossil fuel emissions,² and the Obama Administration's Climate Action Plan noted the sequestration role being played by US forests,³ though net carbon sinks from land use and forestry changes have been smaller in recent years than in 1990.⁴

California's Experience

Although the concept of forest offsets and other land use-related policies designed to incentivize carbon sequestration stretch back before the adoption of the

¹ Richard Birdsey et al., *Forest Carbon Management in the United States: 1600-2100*, 35 J. ENVIRON. QUAL. 1461, 1465 (July 2006).

² Michael Ryan et al., *A Synthesis of the Science on Forests and Carbon for U.S. Forests*, ISSUES IN ECOL. 13 (Spring 2010), at 1.

³ Executive Office of the President, THE PRESIDENT'S CLIMATE ACTION PLAN (June 2013), at 11, available at <https://goo.gl/KX1ULM>.

⁴ See U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2015* (February 2017) (Table 6-3 at 6-3, 6-4), available at <https://goo.gl/GYpaXH>.

Kyoto Protocol,⁶ California's commitment to forest offsets can be traced to Senate Bill (SB) 1771 (Sher) in 2000.⁷ That bill established the California Climate Action Registry (CCAR), a voluntary emissions inventory established by the state to define, measure and track greenhouse gas emissions. As part of its Climate Change Inventory, CCAR was instructed to acquire and develop data on the "costs, technical feasibility, and demonstrated effectiveness of . . . net reductions through the management of natural forest reservoirs."⁸

Land trust organizations sought to take this forest carbon data-gathering role at CCAR further, and promoted Senate Bill 812 in 2002 (Sher).⁹ SB 812 directed CCAR to develop procedures and protocols for measuring and crediting the emissions impacts of "conservation and conservation-based management [activities in] . . . native forest reservoirs in California" that went beyond "applicable federal, state, and local land use laws and regulations."¹⁰ How, exactly, CCAR would implement this measuring and crediting was a policy design task delegated to a state-convened working group that engaged land trusts, state foresters, forest industry representatives and an electric utility.¹¹

This first 2002-2005 working group fleshed out many of the initial policy design questions, which led to the opening of California's voluntary carbon offset market in 2005. Importantly, from the very beginning, the state focused on a carbon-based payment structure, that is, strict accounting for forest carbon on a per-ton basis that could interface with cap-and-trade programs. The state chose not to take a practice-based or area-based payment approach to offset crediting that would have involved more general and less reliable carbon estimation and impact assumptions.¹² This tradeoff likely resulted in greater carbon sequestration from the projects who participated, perhaps multiple times more, but at the price of increasing project development and monitoring costs and thus a smaller population of potentially eligible projects. Indeed, this initial voluntary protocol (and its update in 2006) drew criticisms from other landowners not involved in conservation or conservation-based

⁶ Cornelis van Kooten et al., *How Costly Are Carbon Offsets? A Meta-Analysis of Carbon Forest Sinks*, 7 ENVION. SCI. & POL. 239, 239 (2004); Marissa Schmitz and Erin Kelly, *Ecosystem Service Commodification: Lessons from California*, 16 GLOB. ENVIRON. POLIT. 90, 90 (Nov. 2016). See also Mark Trexler et al., FORESTRY AS A RESPONSE TO GLOBAL WARMING (1989), available at <http://goo.gl/Pwd8sg>.

⁷ 2000 Cal. Stat. 7482 et seq. (Ch. 1018).

⁸ 2000 Cal. Stat. 7493 (Ch. 1018).

⁹ Schmitz and Kelly, *supra* note 6 at 97.

¹⁰ 2002 Cal. Stat. 2406 (Ch. 423).

¹¹ Schmitz and Kelly, *supra* note 6 at 97.

¹² See Ing-Marie Gren and Abenezer Aklilu, *Policy Design for Forest Carbon Sequestration: A Review of the Literature*, 70 FOREST POL. & ECON. 128, 130 (discussing studies of policies that took these approaches, at left).

management, as its stringent environmental and permanence requirements made initial participation rather unattractive for many for-profit private landowners and the California forest industry at the prices offered by voluntary carbon markets.¹³

A second working group, engaging more forest industry participants, followed after passage of California's landmark Assembly Bill (AB) 32 in 2006. From the beginning of planning the cap-and-trade portion of AB 32 compliance, the California Air Resources Board (ARB) signaled that forest offsets would play a cost-containment role in this new market. Cost-containment was an important concern – ARB's expectations for carbon prices in the cap-and-trade market ranged as high as \$50/ton before the market began operating¹⁴ (though in actual program experience, the allowance price has not risen above \$20/ton since market launch¹⁵). Eventually, the State decided that entities could use offsets to meet up to 8% of their compliance burden, though use of offsets was optional and no particular participation goals were set.¹⁶ With all reductions required to be “real, permanent, quantifiable, verifiable, enforceable, and additional” under AB 32,¹⁷ the second protocol working group focused on “revis[ing] the early protocol to make it compliance-ready,” a shift that had never before been attempted in any other jurisdiction.¹⁸ In addition, to serve the goal of maximum participation and lower project costs (thus greater cost-containment for the cap-and-trade market), the new protocol was to be available for use nationwide, not just for projects in California.¹⁹

¹³ Schmitz and Kelly, *supra* note 6 at 92, 97.

¹⁴ Marc Lifisher, *California's First Auction of Greenhouse-Gas Credits Nears*, L.A. TIMES (November 6, 2012), available at <https://goo.gl/hjzu2F>

¹⁵ Danny Cullenward and Andy Coghlan, *Structural Oversupply and Credibility in California's Carbon Market*, 29 ELECTR. J. 7, 9 (2016).

¹⁶ See California Air Resources Board, Resolution 11-32 (October 2011), at 4, available at <https://goo.gl/s3IbTZ>; see also Press Release, CARB, California Air Resources Board Adopts Key Element of State Climate Plan (Release 11-44; October 20, 2011) available at <https://goo.gl/le0q5M>.

¹⁷ CARB, California Air Resources Board's Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap-and-Trade Regulation [hereinafter Protocol FAQ], at 1, available at <https://goo.gl/DL8ZoV>; 2006 Cal. Stat. 3427 (Ch. 488), now CAL. HEALTH AND SAFETY CODE § 38562(d) (2017). See also Timothy Fahey et al., *Forest Carbon Storage: Ecology, Management, and Policy*, 8 FRONT. ECOL. ENVIRON. 245, 249 (2010) (providing a more general elaboration on what these terms entail in the forestry context).

¹⁸ Schmitz and Kelly, *supra* note 6 at 100, 101.

¹⁹ Protocol FAQ, *supra* note 17 at 10.

Program History: The Design Challenges of Forest Offsets

Two Key Periods of Policy Design

Throughout this formative period from 2002-2009, when California went through two full rounds of forest offset protocol design, stakeholders grappled with five critical design challenges in creating standards for offset projects. First, three commodification hurdles stemming from the United Nations Framework Convention on Climate Change proceedings had to be navigated: additionality, permanence, and leakage.²⁰ In short, to deliver credible climate mitigation, carbon offset projects must only receive credit for emissions reductions that would not have otherwise happened without program intervention (i.e. be ‘additional’ versus a conservative, business-as-usual scenario), must show that the reductions they deliver will persist over time (be ‘permanent’) and must demonstrate that no other emission-causing land use changes will result (no ‘leakage’). In addition, two other design challenges were present – how to maintain the environmental integrity of forests managed for carbon storage, and how to ensure market availability and acceptance of offsets as a salable commodity. Table 1 below summarizes how the 2002-05 and 2007-09 working group protocol-writing periods addressed these key design questions.²¹

²⁰ Steven Ruddell et al., *The Role for Sustainably Managed Forests in Climate Change Mitigation*, 105 J. OF FORESTRY 314, 316-17 (September 2007). The Kyoto Protocol’s Clean Development Mechanism offset program uses similar, though not exactly the same, terms. See UN Framework Convention on Climate Change, GLOSSARY – CDM TERMS (Version 8.0) (defining “additional”, “leakage”, and “long term certified emissions reduction”), available at <https://goo.gl/rZQCQ3>.

²¹ One update did occur between these dates in 2007, though most of the changes came with respect to more technical details of forest data and verification steps. See Climate Action Reserve, VERSION 2.1 at <https://goo.gl/HpcpJJ> (last visited March 15, 2017).

Table 1. Protocol Evolution on Key Design Questions, 2005 and 2009

<u>Design Challenge</u>	<u>Description</u>	<u>Early Protocol Approach</u> (Version 1.0, 2005) ²²	<u>Compliance-Ready Protocol Approach</u> (Version 3.0, 2009) ²³
Additionality	Proving emissions reductions as compared to a no-project counterfactual (a 'baseline')	<ul style="list-style-type: none"> • Crediting sequestration on project lands up to the maximum allowable harvest under CA forest rules 	<ul style="list-style-type: none"> • Quantifying primary effect, consisting of: Crediting sequestration on project lands above a standardized Common Practice baseline, taking into account growth models, legal obligations and project start date
Permanence	Delivering a long-term guarantee of emissions reductions	<ul style="list-style-type: none"> • Requiring a perpetual conservation easement 	<ul style="list-style-type: none"> • Requiring a 100-year commitment • Percentage contribution to buffer pool of credits depending on project-specific reversal risks • Allowed voluntary termination
Leakage	Preventing concomitant emissions from induced land use change and activities elsewhere	<ul style="list-style-type: none"> • Perform an assessment for activity-shifting leakage (required) and market leakage (optional) 	<ul style="list-style-type: none"> • Quantifying secondary effects, including a project-specific leakage adjustment factor, but not including energy effects of alternate materials. • Market leakage adjustment only for IFM projects
Environmental Integrity	Guaranteeing sustainable and environmentally-conscious management (i.e. avoiding mere 'tree farm' projects)	<ul style="list-style-type: none"> • Requiring a perpetual conservation easement • Maintenance of native forests • Natural forest management (preventing even-aged cutting) 	<ul style="list-style-type: none"> • Requiring adherence to sustainable harvesting practices (certification) • Natural forest management for the project area • Increasing standing live carbon stocks
Market Availability and Acceptance	Ensuring offset credit availability and purchaser confidence for a functioning offset market	<ul style="list-style-type: none"> • Five-year third-party certification of forest project results 	<ul style="list-style-type: none"> • Lifting the conservation easement requirement • Permitting even-aged management (with limits) • Six-year third-party verification, with periodic desk reviews

As Table 1 details, the two California working groups engaged in an intricate policy design process in order to meet AB 32's requirement that offsets be real, permanent, quantifiable, verifiable, enforceable, and additional. Several tradeoffs were made in order to expand the possible pool of projects that could participate across the

²² Climate Action Reserve, FOREST PROJECT PROTOCOL VERSION 1.0 (September 2005) at <https://goo.gl/1oyTIs> (last visited March 15, 2017) (see PDF of that name on this webpage).

²³ Climate Action Reserve, FOREST PROJECT PROTOCOL VERSION 3.0 (September 1, 2009) at <https://goo.gl/5clWdB> (last visited March 15, 2017) (same).

program. Changes were made to the additionality, permanence and environmental integrity requirements that facilitated greater program participation.

Analyzing California's Protocol Changes in the Second Working Group

For additionality, California first chose a performance benchmark test in 2005, allowing credit above harvest floors permitted by California regulations.²⁴ Once the program expanded to cover the continental US, however, a new approach was needed rather than one reliant on California regulations.²⁵ The second 2009 working group developed a multi-part approach to additionality that would be applicable across the country. Projects would only receive credit for:

- 1) actions taken after a defined project start date;
- 2) sequestration above all legal, regulatory and financial harvesting and stocking constraints; and,
- 3) credit relative to an area-specific 'Common Practice' baseline developed using US Forest Service Forest Inventory and Analysis Program Data ('FIA data').

This approach combines three types of additionality 'tests'—legal or regulatory, common practice, and timing tests, as identified in Trexler et al (2006). This generally represents a more stringent approach to additionality than in the earlier 2005 protocol. Having multiple additionality screens almost certainly increases the proportion of credited reductions in the program that are truly additional, but at a higher cost of participation and with less supply flexibility.²⁶

Stakeholders also eased the permanence requirement to broaden participation. In order to incentivize lands managed for multiple uses (and not just conservation management), the 2009 protocol no longer required conservation easements. Instead, projects were required to give a 100-year sequestration commitment, and agree to set aside a project-specific proportion of their credits in a 'buffer pool' as insurance against later losses of carbon stock, referred to as 'reversals'.

This permanence policy change no doubt made the program more attractive to for-profit timber companies and family landowners, though it did not eliminate all potential reversal risks program-wide. Buffer pools, later described as the "most commonly used" approach to program impermanence risk, neatly manage the

²⁴ See Mark Trexler et al., *A Statistically-Driven Approach to Offset-Based GHG Additionality Determinations: What Can We Learn?*, 6 SUSTAIN. DEVEL. L. & POL. 30, 31 (Winter 2006) (describing various illustrative types of additionality 'tests').

²⁵ In general, states must be careful about designing state programs that affect out of state entities, since regulations with 'extraterritorial' effect are vulnerable to legal attack under the Commerce Clause of the US Constitution or federal laws. See generally *North Dakota v. Heydinger*, 825 F. 3d 912 (8th Cir. 2016) (finding that a Minnesota clean energy law had impermissible out of state effect).

²⁶ See Trexler et al., *supra* note 24 at 38 (showing tradeoff between flexibility and additionality in Fig. 8).

individual risk of projects by essentially making them insure both themselves and others in the currency of the program – credits. However, this approach to risk does *not* take into account program-level reversal risks, i.e. the fact that individual project risks may under certain circumstances, be correlated.²⁷ The buffer approach essentially assumes that even if one project falls victim to a reversal event (e.g. a wildfire), most others will not. This program-level assumption may not hold if projects share certain common risk-relevant characteristics, like being located in close geographic proximity to one another. Cross-cutting risks, like the increased potential for wildfires as global temperatures rise and climate change progresses, can increase reversal risk across the board, not just for isolated individual projects.

Finally, with respect to environmental integrity, several changes helped make the program more attractive to timber companies and other landowners. Instead of a conservation easement, the 2009 protocol allowed a sustainable forestry certification to suffice as a commitment to environmental integrity. Though natural forest management remained a requirement, this definition was altered to allow some degree of even-aged management over portions of the project area, and in increments less than 40 acres. Projects were also expected to maintain or increase standing live carbon stocks,²⁸ as a way to promote biodiversity and wildlife habitat. In general, the 2009 protocol took several important steps to ensure greater participation while generally not changing the strict verification requirements that help facilitate investor confidence in offset credits.

Administration by ARB and Subsequent Challenges

The 2005 and 2009 protocols had been adopted pursuant to SB 1771 and SB 812, in stakeholder processes run through the CCAR, which was restructured and relaunched as the Climate Action Reserve (Reserve) in 2008. When ARB included forest offsets as part of the broader cap-and-trade program, however, the protocols then became official documents of the ARB, which noted that they had been drawn from version 3.2 of the Reserve’s protocol.²⁹ After several years of accepting projects

²⁷ David Cooley et al., *Managing Dependencies in Forest Offset Projects: Toward a More Complete Evaluation of Reversal Risk*, 17 MITIG. ADAPT. STRATEG. GLOB. CHANGE 17, 17 (2011) (describing three different kinds of correlated catastrophic reversal risks – fat tails, micro-correlations, and tail-dependence – that may be present, yet are unaccounted for by buffer pools). See also Christopher Galik and Robert Jackson, *Risks to Forest Carbon Offset Projects in a Changing Climate*, 257 FOREST ECOL. & MGMT. 2209, 2209 (describing systemic climate risks not accounted for in project-by-project analysis).

²⁸ Compare the 2005 protocol, *supra* note 19 at 15-16, with the 2009 protocol, *supra* note 20 at 12.

²⁹ See CARB Resolution 11-32, *supra* note 13 at 10. See also CARB, COMPLIANCE OFFSET PROTOCOL U.S. FOREST PROJECTS (ADOPTED: OCTOBER 20, 2011) [2011 Forest Offset Protocol], at 7 available at <https://goo.gl/OpLQvv>.

designated as Early Action, the compliance portion of the offset market launched in 2013 with the beginning of the cap-and-trade program.³⁰

ARB implemented compliance protocols based on the 2009 protocol and updated the protocol in 2011, 2014, and 2015. Most of the key issues described above have not changed in these updates, including project-level risk assessments.³¹ Some distinctions and developments have occurred across protocol updates, though there has been more consistency than change.³² Since 2011, ARB has mandated higher levels of professional education and skills in verification teams.³³ Also, two updates to the protocol were released in 2014 and then in 2015, along with growing amounts of interpretive guidance and FAQs posted on the ARB website.³⁴

Importantly, ARB's approach to additionality under this protocol and the other offset protocols was upheld as lawful by the California Court of Appeal in 2015 in *Our Children's Earth Foundation v. California Air Resources Board*.³⁵ That case decided that as a legal matter, ARB had the authority under AB 32 to implement the "standards-based approach" it has taken in adopting offset regulations and protocols since 2011, including for the US forest program.³⁶ CARB did not have to take an idiosyncratic project-specific approach to additionality, as the challengers had wanted. Observing that it is "virtually impossible to *know* what otherwise would have occurred in most cases," ARB could not be held to an additionality standard of omniscience and perfection – the legislature had directed ARB to "establish a workable method of

³⁰ CARB, OVERVIEW OF ARB EMISSIONS TRADING PROGRAM (updated February 9, 2015) at 2

<https://goo.gl/qxOSqZ>.

³¹ See also CARB, COMPLIANCE OFFSET PROTOCOL U.S. FOREST PROJECTS (ADOPTED: JUNE 25, 2015) [2015 Forest Offset Protocol], at <https://goo.gl/hJuX8c>. See also CARB, COMPLIANCE OFFSET PROGRAM (updated March 8, 2017) (website with links to the protocols and other details from past iterations) available at <http://goo.gl/WUBm4Y>.

³² For example, starting with the 2011 protocol, ARB has used the language of 'intentional' versus 'unintentional' reversals in dealing with project owner compensation liability, whereas the previous protocols had distinguished between avoidable and unavoidable reversals, though the substantive standards remain the same. Compare 2011 Forest Offset Protocol, *supra* note 25 at 59 with Climate Action Reserve, FOREST PROJECT PROTOCOL VERSION 3.2 (August 31, 2010) at <http://goo.gl/XX3ubS> (last visited March 15, 2017) at 63. See also CAL. CODE REGS. tit. 17 § 95802(a)(190) (2017) (defining intentional reversal), available at <https://goo.gl/PUMgye>.

³³ See Climate Action Reserve, COMPARISON OF RESERVE FOREST PROJECT PROTOCOL TO ARB COMPLIANCE OFFSET PROTOCOL FOR FOREST PROJECTS (last accessed March 15, 2017), available at <https://goo.gl/jVrLLE> (comparing Version 3.2 to the first CARB protocol).

³⁴ See CARB, COMPLIANCE OFFSET PROTOCOL U.S. FOREST OFFSET PROJECTS: ADOPTED JUNE 25, 2015 (updated December 2, 2015), available at <https://goo.gl/7XiB8G> (website explaining 2015 protocol).

³⁵ 184 Cal Rptr. 3d 365, 378 (2015). See also Alan Ramo, *The California Offset Game: Who Wins and Who Loses?*, 20 J. ENV. L. & POL. 109, 133-43 (Winter 2014), available at <https://goo.gl/eCWrlQ> (providing more background on the case).

³⁶ *Our Children's Earth Foundation*, 184 Cal Rptr.3d at 371, 373, 378.

ensuring additionality with respect to offset credits” in the context of “a market-based compliance mechanism,” which is precisely what ARB did.³⁷

Another important event came in 2014, when ARB recorded its first invalidation of offset credits under any protocol. The Clean Harbors Environmental Services waste incinerator in El Dorado, Arkansas participated in the Ozone Depleting Substances (ODS) protocol up until 2014, when a compliance issue with their hazardous waste environmental permit came to ARB’s attention. For a period in 2012, it was found that Clean Harbors was not in compliance with their hazardous waste permit, though an investigation revealed no environmental integrity concerns with their ODS activities. After investigation, assessment, lobbying from market participants, and a final determination, ARB decided to invalidate 88,955 of the approximately 4.3 million tons of offset credits Clean Harbors had earned, sending ripples of concern through the offset marketplace.³⁸

Though not the precise subject of legal action, or at least not yet, environmental justice concerns have been leveled at the offset program. Offsets are viewed skeptically by environmental justice advocates because they allow facilities located in disadvantaged communities to cover their emissions with offset reductions that happen elsewhere. This has been particularly concerning since several industry sectors have shown increased emissions since the 2013 start of the cap-and-trade market, though to date, the data made available to the public does not permit a very detailed assessment of these equity concerns. A 2016 analysis from scientists at UC Berkeley and several other California universities showed that most compliance entities did not use offsets, though those that did tended to have larger GHG emissions.³⁹ We discuss these environmental justice questions further in the Findings section.

³⁷ *Id.* at 379.

³⁸ See California Air Resources Board, Final Determination: Air Resources Board Compliance Offset Investigation Destruction of Ozone Depleting Substances (November 14, 2014), available at <https://goo.gl/KGeHrr>; Laurel Rosenhall, CalMatters, *A Little Town in Arkansas and its California Connection* 89.3 KPCC (July 26, 2015), available at <https://goo.gl/bnw111>; Gloria Gonzalez, *Despite Market Outcry, California Voids Some Carbon Offsets*, ECOSYSTEM MARKETPLACE (November 14, 2014), available at <https://goo.gl/Obv367>.

³⁹ Lara Cushing et al., USC Dornsife Program for Environmental and Regional Equity, A PRELIMINARY ENVIRONMENTAL QUALITY ASSESSMENT OF CALIFORNIA’S CAP-AND-TRADE PROGRAM: RESEARCH BRIEF – SEPTEMBER 2016 [hereinafter Climate Equity Brief] at 7-10, available at <http://goo.gl/2VrnXm>.

Current Status of Today’s Forest Offset Market

A Small But Notable Part of the Cap-and-Trade Market

According to the latest ARB Compliance Instrument Report at the time of this writing (up through Q4 2016), 95% of program compliance has been achieved through the use of allowances. Of the remaining 5% of offsets, a majority (3% of the total) comes from US Forest projects, with the remainder primarily coming from the Ozone Depleting Substances protocol and smaller amounts from livestock and mine methane capture projects. The amount of offset credits issued is slightly greater, as seen in Table 2. More credits have been issued than have been retired to-date, and Table 2 includes credits that are held back in the forest buffer pool and those that are held by offset project owners, market participants or compliance entities for future compliance. These figures are presented in Figure 2 and Table 2 below.

Table 2. ARB Offset Credits Issued as of March 11, 2017

Project Type	Ozone Depleting Substances	Livestock	U.S. Forest	Urban Forest	Mine Methane Capture	Rice Cultiv.	<u>Totals</u>
Compliance	7,222,320	1,521,590	21,851,822	--	1,259,314	--	31,855,046
Early Action	6,336,710	1,695,029	13,276,494	--	2,879,684	--	24,187,917
Totals	13,559,030	3,216,619	35,128,316	--	4,138,998	--	56,042,963

Source: ARB, Compliance Offset Program website,⁴⁰ at <https://goo.gl/gBSWoj>

⁴⁰ The text appearing alongside this table on the CARB website is: *Table includes all offset credits issued including offset credits placed in ARB's Forest Buffer Account, offset credits returned to an Early Action Offset Program's forest buffer pool, and offset credits subsequently invalidated.*

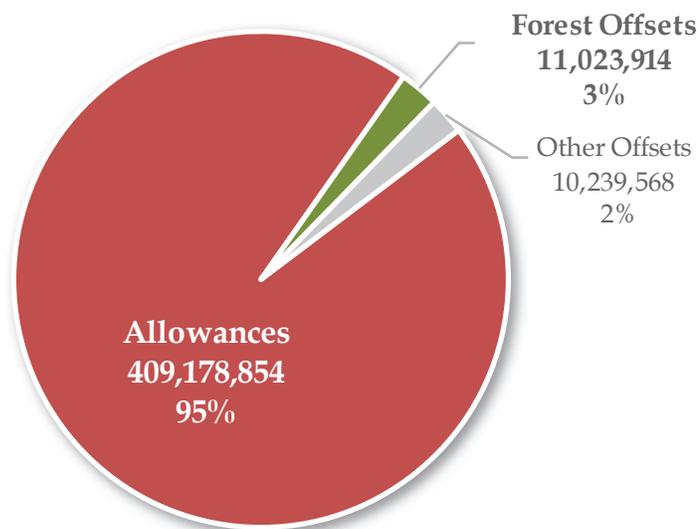


Figure 1. Retired Compliance Instruments Used 2013-16 in the California Cap-and-Trade Program. Source: ARB Compliance Instrument Report, Data through Q4 2016, accessed March 11, 2017, available at <https://goo.gl/Jsj8kf>

Given that offsets account only for 5% of the total compliance instruments used so far in the cap-and-trade program, it would be easy to dismiss their role in the sweep of California’s aggressive climate policies. Indeed, one author likened the cap-and-trade market as a whole to ‘dessert’ after a full meal of other ‘complimentary policies’ for climate action including building energy efficiency standards, tailpipe emission standards, the Low Carbon Fuel Standard and renewable energy mandates. These policies are expected to account for approximately 70% of California’s climate action, with cap-and-trade’s 30% “no ton is left behind” contribution following at the end.⁴¹ In this conception, offsets would be the garnish on that dessert – playing a small role in the last-in-line climate policy. Depending on the future carbon price, of course, offsets could stand to play a much larger role. If carbon prices increase considerably and more entities use closer to their full 8% allotment of offset-based compliance, then it is possible that offsets will exert considerable influence over the overall cap-and-trade program’s economic and environmental outcomes.

Whether a large or small portion of compliance, offsets are somewhat financially beholden to the vagaries of the broader cap-and-trade market. Given that they are substitutes, offset prices according to market participants are generally pegged to the going rate for allowances, though at a small discount likely due to the additional search and transactions costs investing in offsets requires. With market data indicating

⁴¹ Michael Wara, *California’s Energy and Climate Policy: A Full Plate, But Perhaps Not a Model Policy*, 70 BULL. OF THE ATOM. SCI. 26, 27, 28 (2014).

a structural oversupply of compliance instruments in the cap-and-trade market,⁴² the latest allowance price floor⁴³ of \$13.57 may operate as somewhat of a price ceiling on offsets, especially when allowances are abundantly available for purchase from ARB or in the secondary market.

However, as a financial matter offsets should not so easily be dismissed. Both from published data made public by ARB,⁴⁴ and from anonymous survey results collected in this research, offset prices have been in the general vicinity of \$9-13 per ton CO₂e. This price range combined with the information in Table 2 above suggests that the 56 million offsets issued to-date by ARB are in total worth around \$500 million, with about \$300 million of that in forest offsets alone. As a matter of state policy and as an unprecedented experiment in carbon sequestration program design, the forest offset program is certainly worthy of close examination.

Explaining the Distribution of Offset Credits by Project Type

As seen in Table 2 and Figure 2 above, the US Forest offset program accounts for a clear majority of both the credits earned and the offsets surrendered for compliance. This research also draws on project design documents available through the forest offset program, pulled from the climate registry websites as of July 2016. This analysis was conducted for all the projects that had then earned or were earning credits in the program.⁴⁵ Looking at just these projects that had made it all the way through the application process helps show how the project protocols are playing out in practice. From the project document data analyzed for this study, we draw the following project summary statistics in Tables 3 and 4, and the map in Figure 3 below.

Table 3. Credit-Earning Projects in the U.S. Forest Offset Program, July 2016

	Number of Projects	Total Credits	Total Acres
Improved Forest Management	33	24,142,947	854,598
Avoided Conversion	6	1,376,803	8,588
Reforestation	0	0	0
Totals	39	25,519,750	863,186

⁴² Cullenward and Coghlan, *supra* note 15 at 13.

⁴³ CARB, FEBRUARY 2017 JOINT AUCTION #10: SUMMARY RESULTS REPORT (last accessed March 15, 2017), available at <https://goo.gl/MSDdTD>.

⁴⁴ See CARB, 2015 SUMMARY TABLE OF MARKET TRANSFERS (last accessed March 15, 2017), available at <https://goo.gl/qwxFDS>.

⁴⁵ Other analysis has focused on all projects listed in the program, an earlier step in the crediting process. See Erin Kelly and Marissa Schmitz, *Forest Offsets and the California Compliance Market: Bringing an Abstract Ecosystem Good to Market*, 75 GEOFORUM 99, 102 (2016).

Table 4. Credit-Earning Projects in the Offset Program by Protocol Type

	<i>Compliance Program</i>			<i>Early Action Program</i>		
	Number of Projects	Total Credits	Total Acres	Number of Projects	Total Credits	Total Acres
Improved Forest Management	16	16,757,595	691,393	17	7,385,352	163,204
Avoided Conversion	0	0	0	6	1,376,803	8,588
Reforestation	-	-	-	-	-	-
Totals	16	16,757,595	691,393	23	8,762,155	171,792

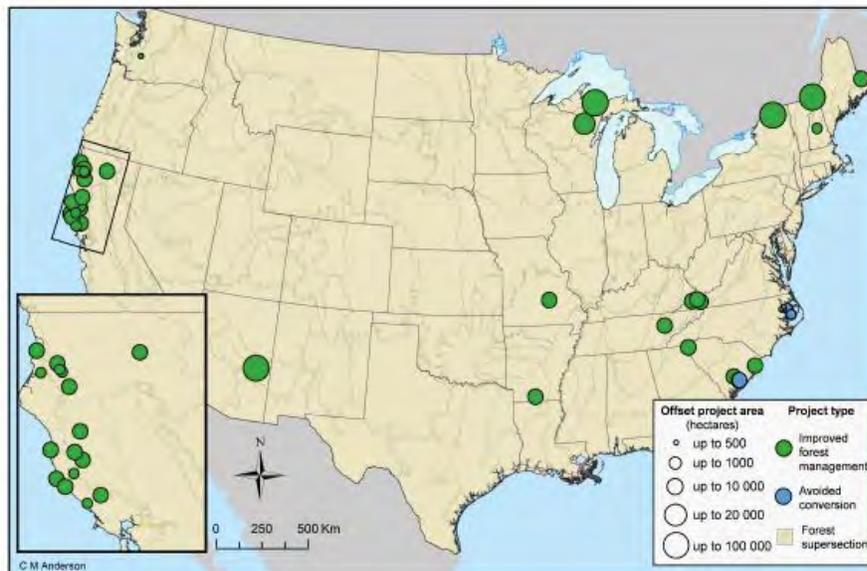


Figure 2. Map of Credit-Earning Projects in the U.S. Forest Offset Program, July 2016

Several trends stand out in the project data presented above. First, improved forest management (IFM) projects dominate the pool of projects that have made it to the crediting phase of the program. The potential reasons for this are several, though interviewees highlighted three important ones. Given that tree growth from plantings does not begin to show financially significant returns in terms of carbon accumulation for 15-20 years, the financial payback period for reforestation projects is simply too

long, explaining why no projects have yet been credited. Second, only a handful of avoided conversion projects have been successfully credited in the program. This may be in part because in ARB's protocol, projects must show that the anticipated alternative land use for the project is more than 80% higher than its current forested value or face credit reductions.⁴⁶ This requirement essentially imposes a property conversion value test whereby converting to another land use must nearly double the value of the land, or face credit erosion by an 'uncertainty discount factor'. The purpose of this discount factor is additionality – only projects with high potential conversion values (i.e. those most likely to actually be converted) can make it into the program and receive full credit. Finally, IFM projects have the benefit of obtaining credit in the first year for the amount of carbon stock above their own modeled harvest baseline and above the Common Practice baseline. Put differently, this means that when an IFM project comes into the program, in the first year they are eligible for an initial crop of carbon offset credits for their current carbon stock that is above both the regional average stock (Common Practice baseline), and above the project-specific modeled baseline that includes financial, legal, and regulatory constraints. In short, above-average forests earn significant credits up front, and multiple interviewees acknowledged that this initial tranche of credits is all but essential for IFM project participation.⁴⁷ Many interviewees note that part of the initial revenue inflow is often used to finance startup costs.

Two additional pieces of evidence reinforce the essential role of up-front revenue. Published research on the potential financial returns from potential small offset projects in the northeastern US found that initial carbon stocking above the Common Practice baseline was the strongest predictive variable of financial returns.⁴⁸ Also, our analysis of project documents for the IFM projects currently earning credits indicates that 4 out of every 5 IFM projects in the program entered with carbon stocking above the Common Practice baseline. The quartile boxplot in Figure 4 below shows that most projects come in above, and many come in significantly above their area's Common Practice baseline. For a project at the median carbon stock (32 tons/acre above) and of a median size (9,753 acres for IFM projects), this means roughly 300,000 credits will be awarded up-front. At approximately \$9 a credit, that amounts to \$2.7 million in year 1 revenue for the project. Figure 5 below shows how IFM projects earn credit over time, demonstrating that about 70% of credits come in the first year and small annual amounts after, reflecting the (slow) net growth of carbon stock after year one.

⁴⁶ 2015 Forest Offset Protocol, *supra* note 31 at 72.

⁴⁷ See also Kelly and Schmitz, *supra* note 45 at 105.

⁴⁸ Charles Kerchner and William Keeton, *California's Regulatory Forest Carbon Market: Viability for Northeast Landowners*, 50 FOREST POL. & ECON. 70, 75 (2015).

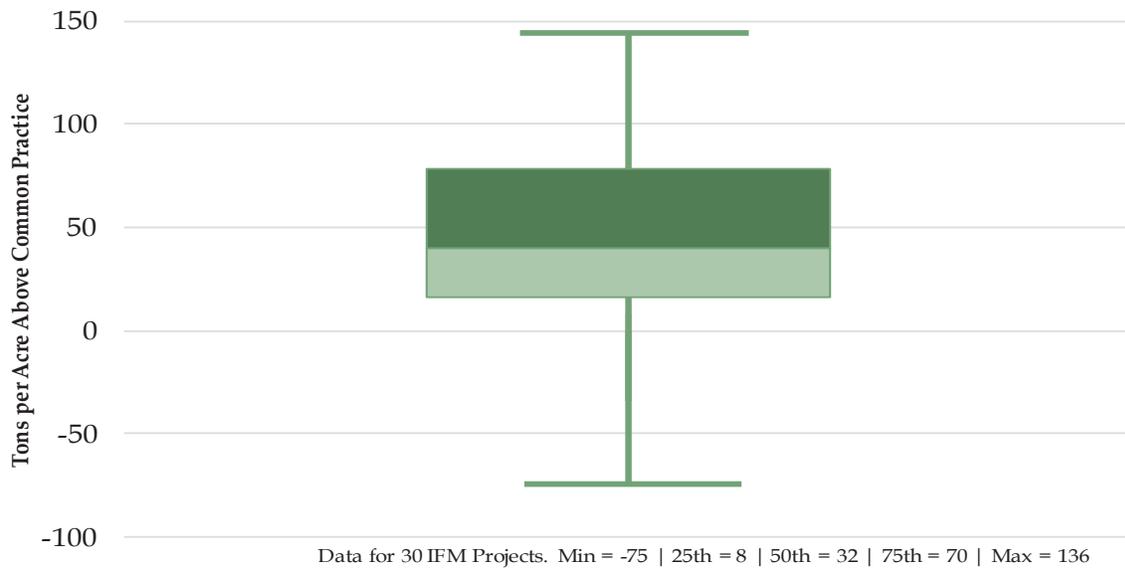


Figure 3. Boxplot of Initial Tons per Acre Above Common Practice from IFM Projects in the US Forest Offset Program as of July 2016.

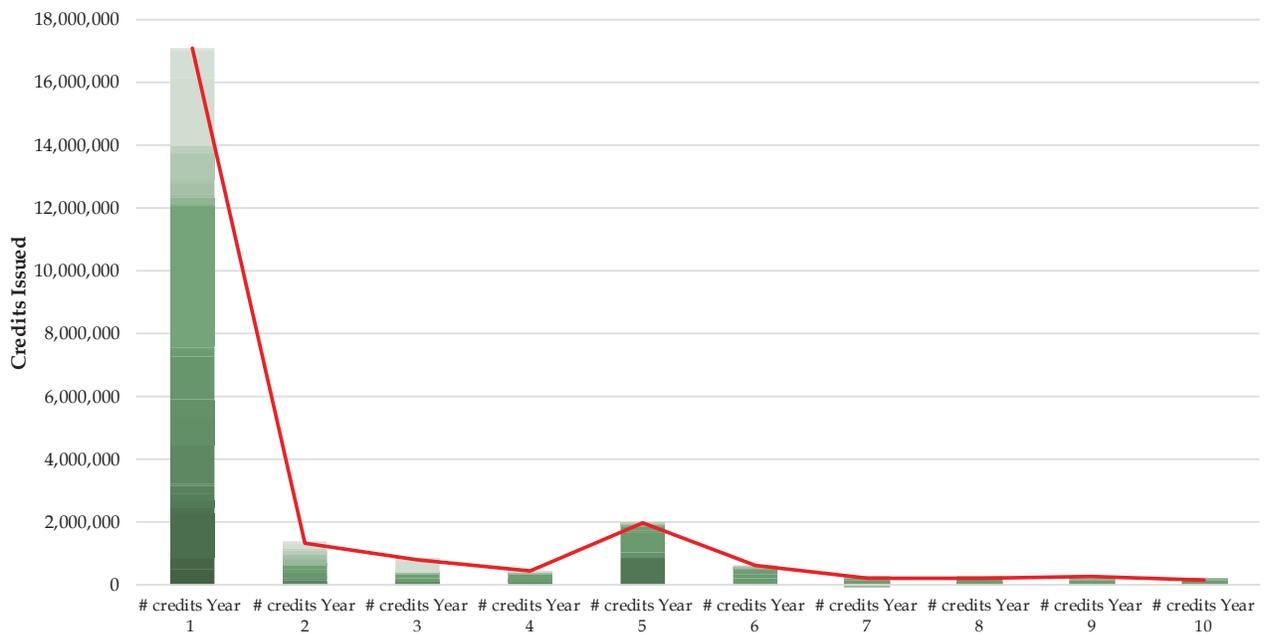


Figure 4. Total Credits per Year Earned by IFM Projects in the US Forest Offset Program as of July 2016.

Summary

In summary, today's California forest offset market is populated by several dozen projects selected for their exceedingly good fit under the rules of the program as specified in the ARB protocol. With a multifaceted approach to additionality, stringent verification and monitoring expectations and robust carbon accounting rules, the projects in the program reflect ARB's emphasis of quality over quantity in the number of projects that earn credits. Project developers have previously reported that only 5-10% of the projects they initially investigate end up being profitable enough to proceed given these high program hurdles.⁴⁹

However, with over 100 projects listed in the program so far (an initial stage in the application process), it is possible that significantly more projects could complete the process and begin earning credits if the price of carbon increases. Reauthorization of the cap-and-trade program past 2020 could cause such a price spike, which would likely lead to the crediting of many more IFM and avoided conversion projects. These projects would presumably be less financially dependent on returns from crediting their initial stocking over the Common Practice baseline, as future growth would be more remunerative. It remains to be seen whether any plausible market scenario will bring reforestation projects into the program, though. What is clear is that future market dynamics will depend largely on future developments in state policy and carbon prices.

⁴⁹ Kelly and Schmitz, *supra* note 45 at 104.

Methods

This review undertook three approaches to assessing forest offset project and program characteristics. First, we conducted an assessment of all 39 credited forest offset projects (listed in Appendix I) using a text review of the public project documents available for each project. Projects must meet stringent reporting requirements, and must be listed on approved carbon registries with public project documents. For this research, available documents included an offset verification statement, annual offset project data reports, offset project listings, and biennial project emissions reporting, yielding a database of 46 variables for each project.

Second, we administered a survey of forest owners/operators and a separate survey of forest offset project developers to gain information beyond what is reported in project documents. The surveys included questions about participant motivations, forest offset credit sales, and other project characteristics, experiences, and opinions. Online surveys were sent to all 32 identified project owners/operators. Postcard reminders were mailed, seven survey reminders were sent by email, and hard copy surveys were sent to those who did not respond within a week. 17 complete survey responses were collected, with a survey response rate of 53%.⁵⁰ These responses covered 21 of the 39 credited projects, also 53% of the total. The same process was used for the project developer survey. Three of four project developers responded. For context, we estimate that 72% of all projects in the program used a project developer to implement their forest offset project.

Third, we conducted in depth interviews with eight project owners (including four on-site forest visits) and with two project developers. These in depth interviews provided nuanced details for specific projects and corroborated information gained from the document review and survey. Between surveys and interviews, this research obtained detailed data from the owners of 28 of the 39 projects credited in the program (72%). This paper draws on each of these three data sources—documents, survey responses, and interviews—in formulating the following findings and lessons.

Last, we compiled additional data for mapping forest offset use in disadvantaged communities (see Finding 2 below). Using a combination of publicly available data from ARB and other sources, we analyzed the share of forest offsets that were used at facilities in disadvantaged communities (estimated to be a pro-rata share of their parent entity's offset use) as compared to offset-linked facilities not located in disadvantaged communities. This analysis used forest offset data from 2013-2015, and annual emissions from facilities in 2014, as described further in footnote 60 below.

⁵⁰ The majority of projects covered in survey responses were Early Action projects.

Findings

Based on document analysis, interviews, and surveys, we elaborate four primary findings on California's forest offset program below.

Finding #1: Additionality is Much Stronger than in Other Forest Offset Programs, But Questions Remain

Project 'additionality' refers to the idea that a forest offset project earns credits for changing practices from what would have happened without the project. For example, forest owners can earn credits by cutting less timber than they would have otherwise, or by keeping forest land standing that they would have otherwise converted to agriculture. The challenge with credit accounting under this approach is that it is never possible to know the counterfactual (what would have happened in the absence of the forest offset project) for certain. By definition, all counterfactuals are hypothetical exercises. Many forest offset programs have been plagued by difficulty in determining the appropriate counterfactual or 'baseline' activity level. California's program continues to face this challenge as well, but it has gone several steps further than prior efforts on forest offsets.

Efforts to Ensure Additionality

This analysis finds that California's forest offset program has incorporated several accounting and protocol elements in an effort to ensure project additionality. First, projects entail rigorous carbon accounting with standardized baselines across the country which are established with long-term forest data from the US Forest Service Forest Inventory and Analysis program.⁵²

Second, forests are required to provide data showing that the project-specific harvest baseline against which their project will be credited would have been financially viable.⁵³ That is, when forests set counterfactual timber harvest levels or forest conversion rates, they are required to provide a net present value analysis or recent sales records from neighboring forests showing that the proposed baseline timber harvest is financially viable for the duration of the offset project.

Third, projects are required to exclude any forest carbon that is already legally protected by another mechanism.⁵⁴ Forest carbon that is already legally protected from harvest would by definition not be harvested, and any crediting for such carbon would

⁵² 2015 Forest Offset Protocol, Appendix F, *supra* note 31 at 139.

⁵³ 2015 Forest Offset Protocol, *supra* note 31 at 28, 62.

⁵⁴ 2015 Forest Offset Protocol, *supra* note 31 at 27.

clearly not be additional. Common legally protected forest carbon in offset projects, for which projects do not receive credits, include legal prohibitions from harvest near streams, on steep slopes, or near endangered species. Another common legal prohibition that prevents some forests from participating in the offset program is the presence of a longstanding conservation easement that prohibits timber harvest on the forest land in question.⁵⁵ The rigor of these requirements is new to the California offset program; preceding voluntary forest offset programs have not generally required this level of scrupulousness.

The Views of Forest Owners and Operators on Additionality

Our survey asked forest owners and project developers to assess their confidence in the additionality of both their forest offset project and other projects. Not surprisingly, the majority of respondents were confident that both their project and other projects in the program are additional (Figure 5).



Figure 5. Survey responses from 17 forest owners re: confidence in additionality.

In more detailed narrative survey responses there were two types of information that stood out on additionality. First, some project owners and operators shared that as long as they maintained property ownership, they were unlikely to have harvested timber at the baseline level calculated in project documents. This would be a concern for project additionality. Second, in both interview and survey responses, project owners and operators emphasized that the *commitment* to carbon sequestration was

⁵⁵ For early action projects which started prior to the compliance market start, projects that already had conservation easements were grandfathered in to the program.

additional. In other words, projects were thought to be additional regardless of the counterfactual because they ensured a 100-year commitment to maintaining forest carbon. The counterfactual would be no *commitment* to maintaining carbon and thus an uncertain future for the forest carbon in question.

Our survey also asked forest owners and operators whether participation in the forest offset program changed their forest management practices. A change in forest management practices would signify a change from the baseline activity and would serve as another indicator for project additionality. Of survey respondents, 4 reported that starting a forest offset project changed their forest managed practices, an additional 6 reported that practices changed somewhat, and 6 reported that practices did not change (Figure 6). Management changes reported by project operators included decreasing harvest levels, adding a forest certification, and purchasing additional forest land.

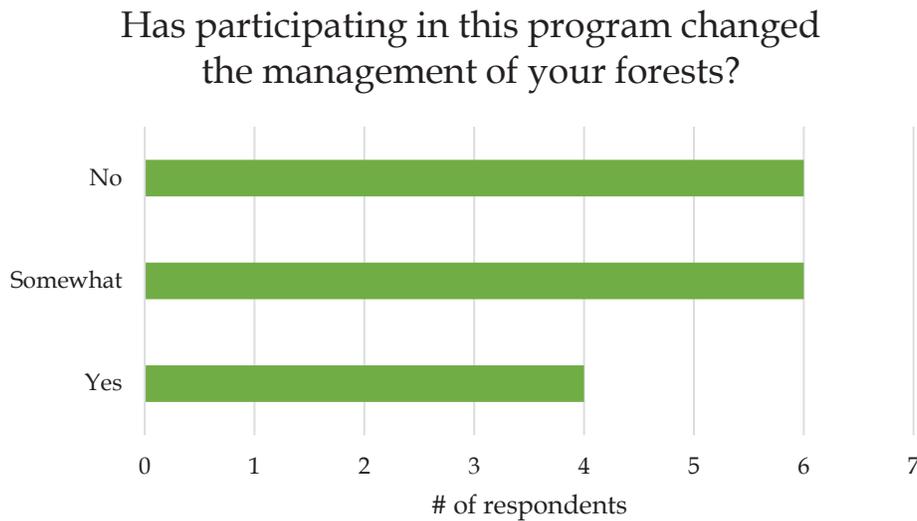


Figure 6. Survey responses from 16 forest owners re: forest management.

Concerns about Project Additionality

One of the most commonly voiced concerns about additionality in the forest offset program concerns conservation easements. California’s forest offset protocol allows projects to simultaneously implement a conservation easement together with a forest offset program, and this is a common occurrence in the program. This type of joint implementation of an easement and offsets would be considered additional under a ‘barriers test’ of additionality, which assumes that a project would not be possible (i.e. would face insurmountable barriers) without implementing both the offset project

and the easement jointly.⁵⁶ However, in the initial Early Action period of the forest offset program, projects were able to join the program even if they had long standing conservation easements already in place. Any easement stipulations prohibiting timber harvest still had to be excluded from crediting, but this early period included multiple projects with long-standing conservation easements already in place. It is an important positive amendment that such projects are no longer permitted to join the offset program.

Finding #2: A Wide Variety of Entities Purchase Offset Credits

Forest Offset Credit Buyers

In the California cap-and-trade market as of 2015, 272 entities and 438 facilities fall under the cap. (Each ‘entity’ may have multiple facility sites.) According to data from CARB⁵⁷ analyzed in this study, 150 facilities purchased offsets and 79 have used forest offsets from 2013 through 2015. The cap-and-trade policy limits each entity to covering a maximum of 8% of its obligations by using offsets. As discussed earlier, the total rate of use falls well below the 8% maximum at present.

Among forest project owners surveyed, 53% of project owners sell their forest offsets directly to entities with a California offset obligation. The remainder of owners sell their credits to brokers and intermediaries who in turn sell credits to entities in the cap-and-trade program. Offsets were initially included in California’s cap-and-trade program to serve as a cost containment mechanism. Capped facilities could avoid or delay the most expensive emissions reductions investments by purchasing offsets. However, since the carbon price in the California market has remained very low through the duration of the market to date,⁵⁸ offsets have not served as a cost containment mechanism, and the cost of offset credits has also remained low. 11 survey respondents anonymously reported on their average carbon sales price. The average price from this data is \$10.20/ton, with a range of \$9-\$13/ton. As shown below in Figures 13 and 14, most respondents anticipated that prices would increase slightly or stay about the same up to 2020. Estimations were similar for prices after 2020, with the addition of a few respondents anticipating prices to increase significantly (more than a 25% increase).

⁵⁶ See Trexler et al., *supra* note 24 at 31.

⁵⁷ See explanation in footnote 60 below.

⁵⁸ Cullenward and Coghlan, *supra* note 42 at 13.

Forest Offset Credits and Environmental Justice

The environmental justice community in California has voiced concern that use of offsets disproportionately impacts disadvantaged communities in the state. Environmental justice advocates have argued that facilities that buy offsets are likely located in disadvantaged communities, and if emissions were reduced onsite instead of through offsets, those communities would gain health benefits from reduced pollution, especially of non-GHG co-pollutants such as particulate matter and air toxics.⁵⁹ We used offsets sales data and facility emissions data from CARB to construct a first-order approximation of the connection between offsets and emissions in disadvantaged communities and to assess whether forest offsets have been used disproportionately in disadvantaged communities.⁶⁰

Forest offsets account for a small share of facility emissions across all facilities. 79 of 438 facilities in the cap-and-trade program (total as of 2015) used forest offsets. Of these facilities, 43% (34) are located in disadvantaged communities (see Figure 7). In 2014, facilities in disadvantaged communities on average offset 2.2% of their emissions with forest offsets, whereas facilities not in disadvantaged communities used offsets slightly more, covering 3.2% of their emissions. As with the rate of use, the total *number* of estimated forest offsets used is also higher outside of disadvantaged communities. Where facilities in disadvantaged communities used close to 70,000 forest offset credits on average, facilities outside of disadvantaged communities used

⁵⁹ See Climate Equity Brief, *supra* note 39 at 7-10.

⁶⁰ This analysis weaves together the forest offsets information reported in the CARB Compliance Reports (available for 2013-14 and 2015) and compares it to facility information made available in CARB's the Integrated Emissions Visualization Tool, with an overlay of the OEHHA's CalEnviroScreen 3.0 shapefile for disadvantaged community location (defined here as a score of 75 or above). We first downloaded all data for the facilities listed as subject to cap-and-trade as of 2013 in the Integrated Emissions Visualization Tool (324 facilities). Then we matched that facility information with the forest offset usage data reported in the Compliance Report's Compliance Offsets Detail tab by entity ID. This matching used the Entity ID data, and ARB GHG ID info reported in the Compliance Summary tab of the Compliance Reports to link entities, and the facilities they own, with offsets usage. Unfortunately, because CARB does not report offset usage down to the facility level, our analysis at that point had to use a pro-rata estimate for each entity; that is, if a particular entity had purchased and retired 100,000 offsets, and owned four facilities subject to cap-and-trade, we have assumed that they retired 25,000 offsets for compliance at each facility. More detailed information would need to be made public about both offset purchase and retirement as well as about facility location and emissions in order for finer and more instructive sets of analyses to be conducted. We recommend that CARB at a minimum commission a program evaluation of the environmental and equity impacts of the offsets program using more finely grained data than what has been made publicly available. For data sources, please visit CARB, INTEGRATED EMISSIONS VISUALIZATION TOOL (last accessed March 15, 2017), available at <http://goo.gl/WJGiVF>; CARB, CAP-AND-TRADE PROGRAM (last accessed March 15, 2017), available at <http://goo.gl/4qeAfj> (specifically, under Publicly Available Market Information, the 2013-14 and 2015 Compliance Reports); Office of Environmental Health Hazard Assessment, CALENVIROSCREEN 3.0 (last accessed March 15, 2017), available at <http://goo.gl/K9Foqg> (specifically the CalEnviroScreen 3.0 Results Shapefile).

more than 130,000 forest offset credits on average. Initial analysis suggests that trends are similar when all offsets, not just forest offsets, are considered. Facilities in disadvantaged communities used 6.4 million offsets cumulatively, while facilities outside of disadvantaged communities used 10.2 million offsets cumulatively. Further analysis and more finely-grained data are needed to more precisely compare the effects of offsets on emissions in and out of disadvantaged communities.

Though any lessening of the incentive to reduce pollution in disadvantaged communities is concerning, and though offset data alone cannot tell us precisely what would have happened in the absence of offset availability, it appears that the use of offsets to date affects but does not appear to disproportionately impact disadvantaged communities. As compared to other areas, fewer facilities in disadvantaged communities purchase offsets, and those that do use a smaller share of offsets. But, this trend could change over time and should continue to be monitored.

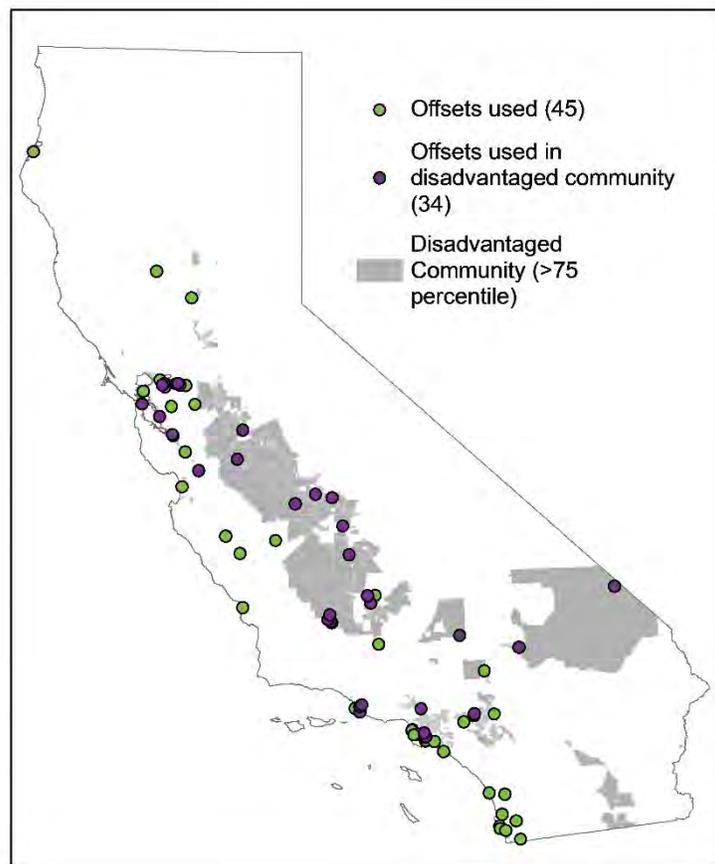


Figure 7. Location of Cap-and-Trade Facilities whose Parent Entities Retired Offsets to Meet Compliance Obligations.

Finding #3: Project Co-Benefits Are Not Monetized

Project document review, interviews, and surveys all corroborate that forest offset projects convey co-benefits for conservation and sustainable forest management. However, delivery of these project co-benefits is a decidedly secondary concern to the financial success of projects, which is conveyed by carbon credits. Project co-benefits may be of greater interest in the long run, and several projects report potential for ‘benefit stacking,’ or deriving financial benefit from co-benefits alongside carbon revenues from participating forest land.

From our analysis of project design documents, 92% of credited offset projects report having at least one environmental co-benefit. In the survey data, however, most respondents report that co-benefits are not important in the sale of their offset credits (11 of 16, 69%). This indicates that while forest owners are aware of the existence of co-benefits, these co-benefits are not financially relevant to the sale of offset credits, though they may be relevant to other ecosystem services markets. Similarly, interviewees often noted their co-benefits with interest, and enjoyed telling stories about them, but generally acknowledged that carbon credit buyers do not ascribe monetary value to co-benefits.

Survey respondents report that their projects provide a number of co-benefits. Most respondents also report that co-benefits are present, but few expend resources to measure these benefits.

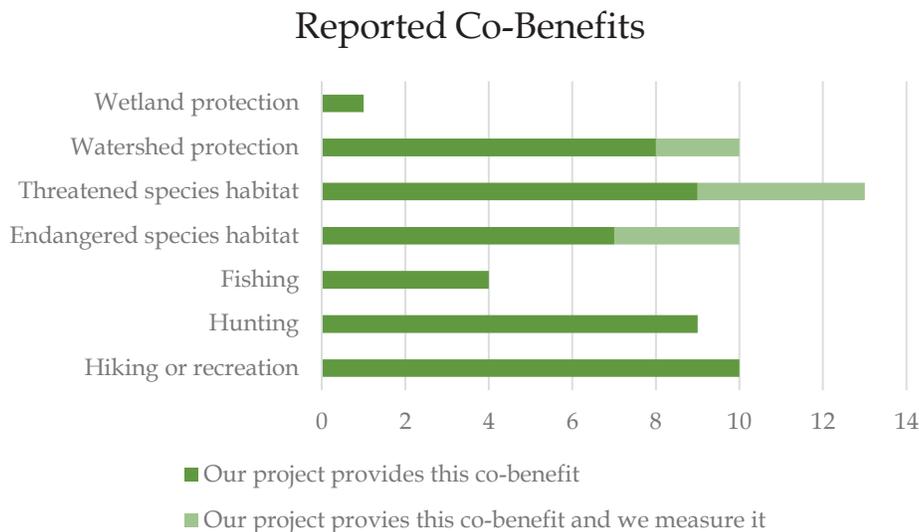


Figure 8. Survey Responses from 17 Forest Owners on project co-benefits.

No project operators or developers that we interviewed or surveyed were interested in additional reporting requirements, on co-benefits or otherwise, although at least one noted that if nationally standardized tracking metrics were developed, the reporting burden to California would be manageable. Respondents were concerned that reporting requirements are already onerous, so any future co-benefit reporting would likely need to have clear benefits for project operators and the state. We note that higher expected carbon prices might alter these assessments.

Finding #4: California Offsets Have Broken New Ground, but Regulatory Risks Hamper Further Development

Transitioning Into a More Mature Policy and Marketplace

The California forest offset program is currently in somewhat of an interstitial period, having traveled far up the learning curve of forest carbon policy experimentation, but still beset with uncertainty about the future. Unlike some other protocols the IFM and avoided conversion portions of the forest offset program have experienced notable project uptake. These areas have delivered emissions reductions and credits used by compliance entities and stand ready to deliver more in the future. Yet judging by the lengthy project listings and the persistently low price of offsets beneath an already low allowance price floor, the offset market seems to be in somewhat of a holding pattern while market participants wait to see how California policymakers chart a climate policy course past 2020.

Survey and interview results tend to confirm these indications. As detailed below, although ARB generally receives good marks in its program implementation thus far, market participants do not have the policy certainty they need to continue growing the program with more participating projects.

Bright Spots: Readiness and Program Experience

Although the price of allowances since 2013 has never risen high enough to necessitate the use of offsets as a cost-containment mechanism,⁶¹ California's unprecedented innovation in developing a compliance-quality program and protocol for forest carbon offsets has resulted in a marketplace with dozens of credited projects. It is possible that many more could participate in the future. Projects that are now marginally economic at a carbon price of around \$10/ton could be brought into the program in the future if the price rises. If the carbon price rises significantly, it is

⁶¹ Cullenward and Coghlan, *supra* note 15 at 7.

possible that whole project types that are not currently financially attractive, such as reforestation projects and urban forest projects, may become economically viable.

In addition, ARB has received generally encouraging reviews in both survey and interview responses collected for this study. Of 17 responses, only three project owners expressed dissatisfaction with ARB’s handling of the program overall, and only two expressed dissatisfaction with individual project application handling. Only two owners expressed that they would not consider expanding or bringing new land into the program in the future, while more than half of respondents expressed interest in the possibility. These results are conveyed in Figures 9, 10 and 11 below. When asked a narrative question about whether their satisfaction levels with ARB had changed over time though, responses were mixed. Some project owners remarked that ARB’s project application reviews had become less predictable and more cautious, and others hypothesized that application interactions had become more frustrating because of an increase in application volume without an increase in ARB processing capacity. (Interestingly, no project owner expressed dissatisfaction with their developer or their registry, although at least one interviewee did indicate having markedly different impressions of two developer entities, one negative and one positive.)

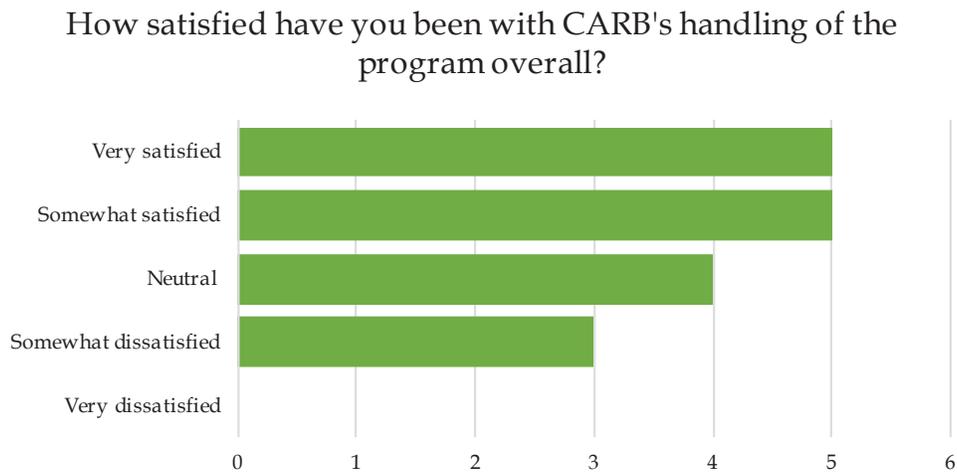


Figure 9. Survey Responses from 17 Forest Owners on CARB’s performance.

How satisfied have you been with your individual project application interactions with CARB?

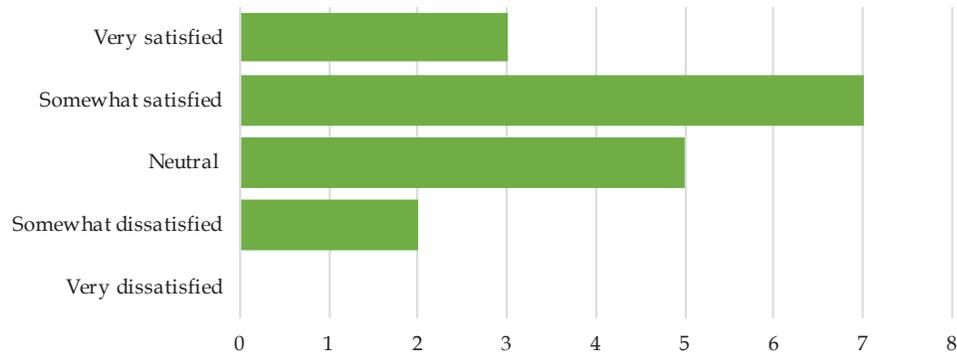


Figure 10. Survey Responses from 17 Forest Owners on CARB's application handling.

Additional Participation: Would you consider expanding an existing project or starting a new project on other forests?

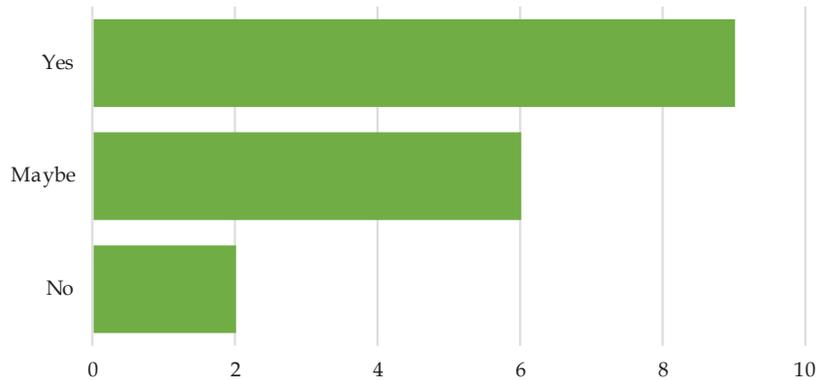


Figure 11. Survey Responses from 17 Forest Owners on additional participation.

Project developers were less sanguine in their appraisal, however. Only one respondent indicated satisfaction with the program (the others had neutral feelings), and divergent satisfied/unsatisfied opinions were reported about individual project interactions. All expressed that their satisfaction had changed over time, with two voicing concern that inefficiencies and the expense of meeting program requirements had not improved.

Both project developers and owners agreed in their general praise for CARB’s approach to project risks. Two of three developers and 16 of 17 project owners reported that CARB has been appropriately accounting for project risks through the individualized project assessment and buffer pool requirements. The lonely dissenters took issue with 20% as the standard buffer pool credit contribution and advocated an individualized fire risk assessment for a particular project, respectively, but generally speaking ARB’s approach to risk was reportedly appropriate in the eyes of market participants. Although the subject came up in some interviews, only one developer and one project owner reported being concerned about invalidation risks in their surveys.

Concerns: Instability, Carbon Price Uncertainty and Rising Verifier Costs

Project owners have much more divergent opinions about what the future may hold for the offset program, reflecting the general uncertainty about state policy and carbon prices that have the offset program in somewhat of a holding pattern. Although the state has committed to continuing climate programs in some form after the year 2020 with the passage and signing of Senate Bill 32 in 2016,⁶² program participants report not being sure yet whether this new policy commitment will impact the return from their current projects. Figure 12 below presents the results from a survey question asked of offset project owners, reflecting their unresolved uncertainty in the wake of SB 32. This uncertainty may help explain the six ‘maybe’ answers reported above with respect to additional participation in the program – so much depends on the next few steps state policymakers take in extending the cap-and-trade program (or not), that possible future projects may simply wait until there is more certainty about the future of the program.

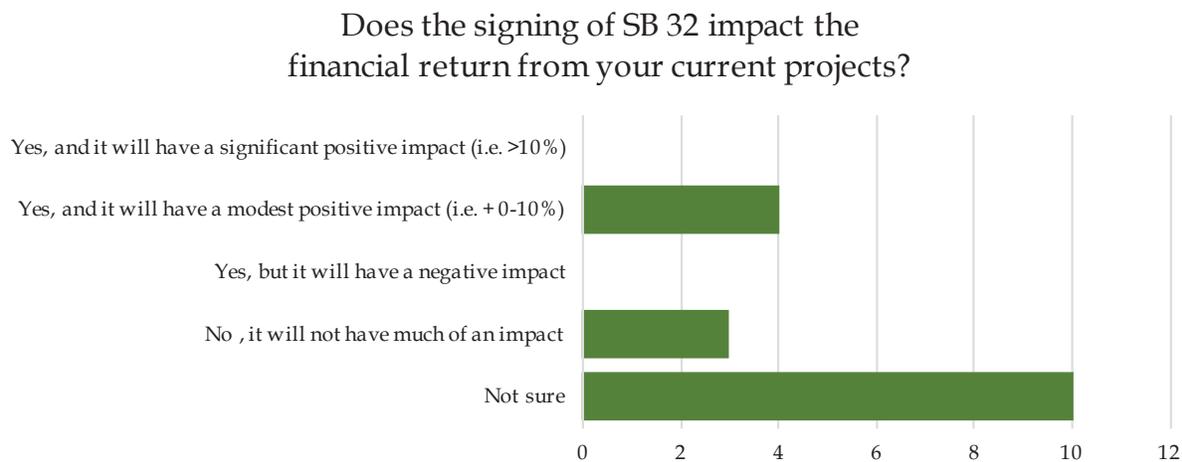


Figure 12. Survey Responses from 17 Forest Owners on the impact of Senate Bill 32.

⁶² See Chris Megerian and Liam Dillon, *Gov. Brown Signs Sweeping Legislation to Combat Climate Change* L.A. TIMES (September 8, 2016), available at <https://goo.gl/ewXwbN> (describing SB 32).

Project owners generally seem optimistic about future price trends, assuming policy stability is provided. An open-ended narrative question on the project owner survey elicited many responses that cited program complexity, changing regulations and future policy uncertainty as major barriers in the program. But, when asked in an anonymous portion of the survey for their opinions about future price trends, project owners in general expressed bullishness and confidence about both near and longer term price trends. As seen in Figures 13 and 14 below, a 60% majority of respondents thought average sale prices for offsets would increase slightly in the time before 2020, and a majority believed they would rise slightly or significantly after 2020 as compared to today. However, when read together with the more cautious additional participation responses and concerns about policy certainty and complexity, this optimism may not translate to deeper program participation without more stability.

Expected Price Trend Between Now and 2020

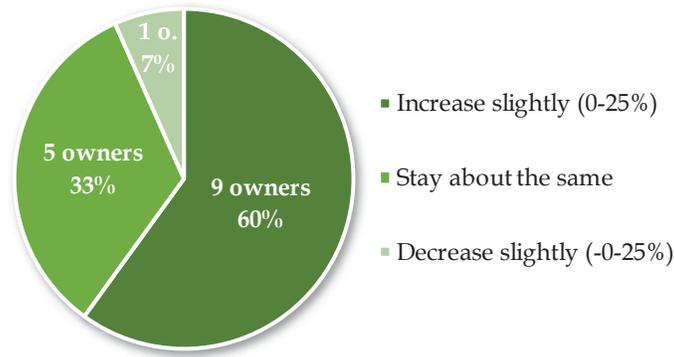


Figure 13. Survey Responses from 15 project owners re: near term price trend expectations

Expected Price Trend After 2020

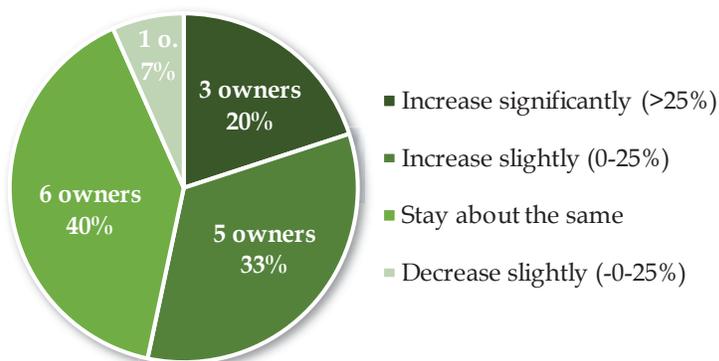


Figure 14. Survey Responses from 15 project owners re: longer term price trend expectations

While owners were conditionally bullish about future price trends, a worry that was repeatedly raised in multiple interviews and in survey data as well was rising verification costs. Other answers to the barriers question cited the steep and rising costs of monitoring and verification. In response to a question asking for their opinion of published verification and monitoring costs appearing in Kerchner and Keeton,⁶³ several respondents with recent verification cost experience stated that the published verification costs were much lower than actual costs. While opinions on that question were somewhat mixed and included five ‘I don’t know’ answers, multiple interviewees expressed the same concern about rising verification costs. Some speculated that invalidation risk concerns had increased the length of verifications and financial exposure of the verifiers. However, most interviewees who mentioned the subject indicated that the likely causes are a short supply of verifiers and verification bodies, and large demands of verification in a compliance program as compared to in the voluntary market. ARB staff have reported that expanded training opportunities for verifiers are on the way to address this shortage. But, these efforts may need to bear fruit in the nearer term in order to keep pending projects from being dissuaded from joining the program at current carbon prices.

⁶³ See Kerchner and Keeton, *supra* note 49 at 75 (reporting ~\$8,000 annual monitoring costs plus \$15,000 costs incurred every six and \$27,000 every 12 years).

Lessons for Natural and Working Lands

The State of California is in the process of updating its climate scoping plan, which sets goals for GHG emissions in each state sector. For the first time, the scoping plan will cover the period to 2030 and will include goals for carbon on natural and working lands, including agricultural lands and forests.⁶⁴ The draft scoping plan sets as an overarching goal that natural and working lands would be an overall emissions sink rather than a source. There are a number of activities and plans associated with this goal. We offer several recommendations for the state's goals in natural and working lands based on its experience thus far managing land-based carbon through the forest offset program:

- **Lesson #1:** Rigor of approach to carbon accounting drives implementation cost

The Forest Offset Program requires a very rigorous approach to carbon accounting, estimating the exact tonnage of forest carbon present on individual project lands. This is currently achieved at the project level through forest inventory, growth and yield modeling, and third party verification.⁶⁵ Detailed accounting through these methods cannot be scaled statewide. This level of detailed accounting is appropriate and feasible when dealing with compact and contiguous project lands, but costly and infeasible to conduct on a statewide basis. The State should and does consider methods of carbon accounting on Natural and Working Lands that are significantly less onerous than the Forest Offset Program, but that are still meaningful in terms of measuring changes in emissions and carbon sinks.⁶⁶ This is a case in which the Forest Offset Program uses a method that works well, but cannot be used at the scale of Natural and Working Lands.

The Proposed Plan offers a scale-appropriate method for carbon accounting on lands in California. It indicates that an updated Natural and Working Lands emissions inventory presently underway “applies airborne and space-based technologies to monitor forest health and quantify emissions associated with land-based carbon.”⁶⁷ Combining remotely-sensed data with ground-based data is a good approach to take at the scale of the state-wide inventory, and should be continued as the inventory is expanded in the coming years.

⁶⁴ California Air Resources Board, THE 2017 CLIMATE CHANGE SCOPING PLAN UPDATE: THE PROPOSED STRATEGY FOR ACHIEVING CALIFORNIA'S 2030 GREENHOUSE GAS TARGET (January 20, 2017), at 107-17, available at <https://goo.gl/ZBkyCN>. Hereafter 'Proposed Plan'.

⁶⁵ See generally 2015 Forest Offset Protocol, *supra* note 31.

⁶⁶ See Proposed Plan at 108.

⁶⁷ Proposed Plan at 108.

➤ **Lesson #2:** Transparency and Accessibility of Program Information

The Forest Offset Program produces voluminous data about carbon accounting, project details, and offset usage, and much of it is available to the public through CARB’s website and project registries. However, these data are not easy to locate or interpret. Data sheets can be difficult to find online, and reporting categories change over time, making consistent comparison over time difficult. In this case, the Forest Offset Program is not using best practices, and based on this experience we recommend a more coordinated approach for Natural and Working Lands data transparency and accessibility.

A clear and pre-designed framework for reporting on Natural and Working Lands should be devised as a part of the Integrated Natural and Working Lands Climate Change Action Plan (“Action Plan”).⁶⁸ This will avoid difficulty in reporting and evaluation later on. The Proposed Plan states that the California will “develop implementation tracking and performance monitoring systems for the Action Plan.”⁶⁹ This is especially important and should be a high priority as reporting in the Natural and Working Lands sector requires complex multi-agency efforts.

➤ **Lesson #3:** Approaches to Uncertainty and Risk

Uncertainty: Emissions accounting on Natural and Working Lands, like that for forests, comes with fundamental risks and uncertainties. The designers of the Forest Offset Program developed a number of notable mechanisms to deal with risk and uncertainty in carbon accounting and carbon crediting. For uncertainty, the Forest Offset Program reduces credits earned proportional to the sampling error of an on-the-ground forest inventory.⁷⁰ A similar approach could be applied to data used for carbon accounting on Natural and Working Lands.

At present neither the Proposed Plan nor Appendix G refer to estimation of uncertainty in developing goals or in developing the Action Plan for Natural and Working Lands.⁷¹ Including uncertainty estimates in ongoing modeling and in the Action Plan will help ensure that the State accomplishes its carbon sink goal for Natural and Working Lands. Including uncertainty estimates is also consistent with

⁶⁸ Proposed Plan at 114.

⁶⁹ Proposed Plan at 117.

⁷⁰ 2015 Forest Offset Protocol at 112.

⁷¹ See Proposed Plan at 117; see also California Air Resources Board, PROPOSED PLAN: APPENDIX G, NATURAL AND WORKING LANDS MODELING (January 2017), available at <https://goo.gl/axN6vS>.

IPCC Good Practice Guidance.⁷² This is a case in which the Forest Offset Program is using a successful practice that can be adapted for use on Natural and Working Lands.

Risk: For risk, the Forest Offset Program also reduces carbon crediting based on the estimated risk of fire, pests, and other ‘reversal’ risks – the risk of releasing forest carbon to the atmosphere over the life of the project.⁷³ Carbon credits deducted based on a project’s risk rating are allocated to a buffer pool of credits, which can be used in case of carbon loss due to fire, disease, or other unintentional losses.

The Natural and Working Lands sector does not need an explicit buffer account because of its more general carbon sink goals (discussed below), but it does need to plan for unavoidable carbon reversals. The Proposed Plan rightly acknowledges that “recent trends indicate that significant pools of carbon [are at] risk [of] reversal,” and that climate change may exacerbate these risks, especially for wildland fire.⁷⁴ Risk should be explicitly incorporated into ongoing Natural and Working Lands modeling to ensure that the State meets its goals for the sector. We recommend adapting the buffer pool approach used in the Forest Offset Program and ‘buffer’ the Action Plan with activities that would exceed the State’s carbon sink goal. This would ensure a ‘contingency fund’ of emissions reductions and enhanced sinks in case of ‘reversal’. Risk estimations could be improved over time as improved data and modeling are available. At present, the Proposed Plan and Appendix G do not discuss accounting for risk in GHG emissions goal-setting for Natural and Working Lands.

➤ **Lesson #4:** Setting a Broad Carbon Sink Goal is Advisable

The experience of the Forest Offset Program shows that modeling future carbon stock, even at the project scale, is a difficult task. Land-based carbon stocks carry risk and uncertainty, as discussed above. The Forest Offset Program dealt with risk by carefully measuring carbon and creating a forest buffer pool—a sort of insurance pool or contingency fund of carbon credits to be used in case of unintentional loss of carbon. The Forest Offset Program further ensures accuracy by requiring multiple levels of verification. While measurement methods for Natural and Working Lands should continue to take advantage of improvements in remote sensing and ground-based data, the method of detailed ton-by-ton carbon accounting used by the Forest Offset Program is not currently feasible at a statewide scale.

⁷² See generally Intergovernmental Panel on Climate Change, 2013 REVISED SUPPLEMENTARY METHODS AND GOOD PRACTICE GUIDANCE ARISING FROM THE KYOTO PROTOCOL at 2.57-2.60 (Section 2.4.3 ‘Uncertainty Assessment’), available at <https://goo.gl/bJWwZW>.

⁷³ 2015 Forest Offset Protocol, *supra* note 31 at 131-36.

⁷⁴ Proposed Plan at 108.

The Proposed Plan states that “California’s climate objective of natural and working lands is to maintain them as a carbon sink (i.e., net zero or even negative GHG emissions).”⁷⁵ The Proposed Plan rightly acknowledges that “the State’s lands, as well as sub-tidal waters, can be both a source and a sink for GHG emissions.”⁷⁶ The State’s goal of maintaining Natural and Working Lands as a carbon sink is an appropriate one. An alternative goal would be to specify a particular percentage or numerical decrease in emissions and/or increase in sinks on Natural and Working Lands. Such an exact goal would be inappropriate because it would necessitate many of the onerous measurements and verification activities pursued under project-based programs like the Forest Offset Program, which are impractical for statewide inventories, as mentioned above. Also, measuring carbon in some sectors of Natural and Working Lands (such as soils) remains quite difficult. The overall ‘carbon sink’ goal is less precise but is also therefore feasible to both measure and attain in a statewide inventory.

While we support the overall ‘carbon sink’ goal for Natural and Working Lands, we recommend that the Proposed Plan clarify whether this is a cumulative or annual goal covering the years between now and 2030. There is likely to be considerable year-to-year variability in emissions from Natural and Working Lands, due to fire and other natural causes. The goal is referred to as cumulative on page 109 of the Proposed Plan, but the measure is not specified in the initial statement of the goal.⁷⁷ The Initial Scoping Plan (2008) set a specific annual goal for forest carbon sequestration,⁷⁸ and this goal has been difficult to measure and attain on an annual basis.

➤ **Lesson #5:** The Offsets Program Does Not Measure Co-Benefits, But Many Are Clearly Delivered

In part because the Forest Offset Program has stringent and detailed carbon accounting requirements, it was not practical, at least in initial years of the program, to require additional accounting of individual project co-benefits. As detailed in the attached report, we advise that the Forest Offset Program now take up ‘no cost’ opportunities for co-benefits reporting. Co-benefits reporting is even more feasible and important for Natural and Working Lands. Because the Natural and Working Lands goals and accounting can take advantage of remotely sensed data, and can tolerate

⁷⁵ Proposed Plan at 107.

⁷⁶ Proposed Plan at 108.

⁷⁷ Proposed Plan at ES5, 107.

⁷⁸ California Air Resources Board, CLIMATE CHANGE SCOPING PLAN: A FRAMEWORK FOR CHANGE (December 2008) at 64-65, available at <https://goo.gl/UFhkyT>.

greater uncertainty in acre-level carbon data, state agencies should be able to collect data and account for carbon *and* co-benefits.

The Proposed Plan rightly notes that policies must advance both carbon sequestration and co-benefits⁷⁹ and states that “strategies that reduce GHG emissions or increase sequestration in the natural and working lands sector often overlap and result in synergies with other sectors.”⁸⁰ Accounting for these co-benefits will allow the state to measure the synergies and efficiency gains it is earning by implementing policies that have win-win benefits for carbon, water, agriculture, biomass utilization, land restoration, and conservation. As the State develops tracking and monitoring systems for Natural and Working Lands, these co-benefits should be included. In the Proposed Plan section for ‘Scoping and Tracking Progress’,⁸¹ the text should be amended to read, “develop implementation tracking and performance monitoring systems for the Action Plan, *[including accounting of carbon and other co-benefits]*.”⁸²

⁷⁹ Proposed Plan at 107.

⁸⁰ Proposed Plan at 110.

⁸¹ Proposed Plan at 116-17.

⁸² Proposed insertion in brackets. See Proposed Plan at 117.

Appendixes

Below are two appendixes that provide more information about the sources, methods, and findings of this analysis. The first appendix presents a list of the 39 projects for whom we compiled and analyzed project design document information. The second appendix presents the list of entities who were reported as retiring forest offsets from 2013-15, and the forest offset projects those offsets came from.

Appendix I – Projects Included in Design Document Analysis

	ARB Project ID #	Project Name	State	Type of Protocol	Registry⁸³	Project Documentation Locator
1	CAFR0030	Blue Source – Francis Beidler Improved Forest Management Project	SC	Early Action	CAR	CAR683
2	CAFR0087	Finite Carbon – Brosnan Forest	SC	Early Action	CAR	CAR658
3	CAFR0063	Green Assets – Middleton <u>Avoided Conversion</u>	SC	Early Action	CAR	CAR749
4	CAFR5034	Finite Carbon – The Forestland Group CT Lakes	NH	Compliance	ACR	ACR199
5	CAFR0088	Finite Carbon – Shannondale Tree Farm	MO	Early Action	CAR	CAR780
6	CAFR5089	Finite Carbon – The Forestland Group Champion Property IFM	NY	Compliance	CAR	CAR1088
7	CAFR5029	Green Assets- Brookgreen Gardens Improved Forest Management Project	SC	Compliance	ACR	ACR192
8	CAFR5016	Miller Forest	CA	Compliance	ACR	ACR189

⁸³ CAR = Climate Action Reserve; ACR = American Carbon Registry

9	CAFR0070	Finite Carbon – Berry Summit	CA	Early Action	CAR	CAR1004
10	CAFR0049	The Van Eck Forest	CA	Early Action	CAR	CAR101
11	CAFR0064	Yurok Tribe Sustainable Forest Project	CA	Early Action	CAR	CAR777
12	CAFR0029	Blue Source – Alligator River <u>Avoided Conversion</u>	NC	Early Action	CAR	CAR497
13	CAFR5043	Blue Source – Goodman Improved Forest Management Project (Michael Hart)	WI	Compliance	ACR	ACR202
14	CAFR5028	Round Valley Indian Tribes Improved Forest Management Project	CA	Compliance	ACR	ACR173
15	CAFR0040	Garcia River Forest	CA	Early Action	CAR	CAR102
16	CAFR5096	Brushy Mountain	CA	Compliance	CAR	CAR1095
17	CAFR0041	Big River / Salmon Creek Forests	CA	Early Action	CAR	CAR408
18	CAFR0042	Gualala River Forest	CA	Early Action	CAR	CAR660
19	CAFR0001	Willits Woods	CA	Early Action	CAR	CAR661
20	CAFR0116	Finite Carbon – NEFF (New England Forestry Foundation)	NH	Early Action	CAR	CAR672
21	CAFR5072	White Mountain Apache Tribe Forest Carbon Project	AZ	Compliance	ACR	ACR211

22	CAFR5095	Ashford III	WA	Compliance	CAR	CAR1094
23	CAFR0058	Virginia Conservation Forestry Program – Clifton Farm	VA	Early Action	CAR	CAR686
24	CAFR0057	Virginia Conservation Forestry Program – Rich Mountain	VA	Early Action	CAR	CAR696
25	CAFR5037	Virginia Highlands I	VA	Compliance	CAR	CAR1032
26	CAFR0103	Finite Carbon – MWF Brimstone IFM Project I	TN	Early Action	CAR	CAR582
27	CAFR0073	McCloud River	CA	Early Action	CAR	CAR429
28	CAFR5055	Buckeye Forest Project	CA	Compliance	CAR	CAR1013
29	CAFR0100	Rips Redwoods	CA	Early Action	CAR	CAR1015
30	CAFR5076	Trinity Timberlands University Hill Improved Forest Management Project	CA	Compliance	CAR	CAR1046
31	CAFR0031	Blue Source – Pocosin Lakes Forest Conservation Project (<u>Avoided Conversion</u>)	NC	Early Action	CAR	CAR676
32	CAFR5084	Finite Carbon – Potlatch Moro Big Pine CE IFM	AR	Compliance	CAR	CAR1086
33	CAFR0002	Finite Carbon Farm Cove Community Forest Project	ME	Early Action	CAR	CAR657
34	CAFR0026	Blue Source – Pungo River Forest Conservation	NC	Early Action	CAR	CAR659

		Project (<u>Avoided Conversion</u>)				
35	CAFR0027	Blue Source – Noles South <u>Avoided Conversion</u> Forest Project	NC	Early Action	CAR	CAR802
36	CAFR0028	Blue Source – Noles North <u>Avoided Conversion</u> Forest Project	NC	Early Action	CAR	CAR688
37	CAFR5003	Blue Source-Bishop Improved Forest Management Project	MI	Compliance	CAR	CAR973
38	CAFR5011	Yuork Tribe/Forest Carbon Partners CKGG Improved Forest Management Project	CA	Compliance	CAR	CAR993
39	CAFR5012	Hanes Ranch Forest Carbon Project	CA	Compliance	ACR	ACR182

Appendix II – Compliance Entities Using Offset Credits

This information is drawn from the Compliance Reports available on the CARB website at <https://goo.gl/m61Kji>, and matched with data from project design documents for the projects listed in Appendix I above.

Compliance Entities Retiring Forest Offsets, 2013-15

California Cap-and-Trade Compliance Offset Program: Retired Forest Offsets by Compliance Obligation Entity			
For Offsets Redeemed 2013-2015			
<u>CARB Entity ID</u>	<u>Compliance Obligation Entity</u>	<u># of Forest Projects Obtained From</u>	<u>Number of Retired Credits</u>
CA1248	AES Alamos, LLC	2	100,105
CA1089	Air Products and Chemicals, Inc.	1	96,601
CA1281	Algonquin Power Sanger, LLC	1	1,620
CA1328	Applied Energy, LLC - NAS North Island	3	16,605
CA1406	California Dairies, Inc.	1	10,140
CA1119	Calpine Energy Services, LP	4	686,178
CA1592	Carson Cogeneration Company	1	1,378
CA2039	Chevron Power Holdings, Inc.	1	49,187
CA1075	Chevron U.S.A., Inc.	10	4,019,283
CA1101	City of Glendale	1	17,649
CA1370	Coalinga Cogeneration Company	1	30,730
CA1311	Double C Limited	1	347
CA1183	Dynegy Moss Landing, LLC	2	165,460
CA1742	Energia Azteca X, S.A. de C.V. and Energia de Baja California S. de R.L. de C.V. (La Rosita Power Marketing)	1	9,814
CA1234	Fresno Cogeneration Partners, LP	1	1,298
CA1070	GenOn Energy Management, LLC	1	7,667
CA1116	GWF Energy, LLC	1	20,867
CA1291	High Desert Power Project, LLC	1	125,000
CA1307	High Sierra Limited	1	353
CA1253	Ingomar Packing Company, LLC	1	5,841
CA1312	Kern Front Limited	1	318
CA1343	Kern River Cogeneration Company	2	102,040
CA1017	La Paloma Generating Company, LLC	4	74,356

CA1552	Macpherson Oil Company	1	17,516
CA1077	Mariposa Energy, LLC	1	3,344
CA1476	Martinez Cogen Limited Partnership	1	9,630
CA1367	Mid-Set Cogeneration Company	1	32,547
CA1107	Midway Sunset Cogeneration Company	1	39,478
CA1138	NRG Power Marketing, LLC	1	245,756
CA1137	OLS Energy - Chino	1	19,960
CA1046	Pacific Gas and Electric Company	1	61,495
CA2106	PBF Energy Western Region, LLC	3	140,179
CA1326	Praxair, Inc.	1	5,000
CA1925	Pro Petroleum, Inc.	1	35,000
CA1204	Rio Tinto Minerals Inc.	1	26,532
CA1136	Russell City Energy Company, LLC	1	39,964
CA1371	Salinas River Cogeneration Company	1	32,244
CA1085	San Diego Gas & Electric Company	1	27,602
CA1372	Sargent Canyon Cogeneration Company	1	32,987
CA1762	SEI Fuel Services, Inc.	3	103,840
CA1251	Shell Energy North America (US), LP	2	209,000
CA1029	Southern California Edison Company	5	501,170
CA1338	Sycamore Cogeneration Company	1	100,608
CA1165	Tesoro Refining & Marketing Company, LLC	10	1,488,172
CA1325	The Procter & Gamble Paper Products Company	1	25,691
CA1195	TransAlta Energy Marketing (U.S.), Inc.	1	6,773
CA1057	Ultramar, Inc.	1	13,857
CA1419	Union Pacific Railroad Company	1	38,184
CA1056	Valero Refining Company-California, Benicia Refinery and Asphalt Plant	3	103,112
CA1590	Valley Electric Association, Inc.	2	813

Grand Total **8,903,291**

Compliance Entities and The Forest Offsets They Buy

Forest Offsets -- Retired Credits by Compliance Obligation Entity and Project Name

Compliance Entities and Forest Offset Projects	# of Listings in Compliance Report	Total Quantity
AES Alamos, LLC	2	100,105
Blue Source – Francis Beidler IFM Project	1	94,705
Hanes Ranch Forest Carbon Project	1	5,400
Air Products and Chemicals, Inc.	1	96,601
Blue Source-Bishop IFM Project	1	96,601
Algonquin Power Sanger, LLC	1	1,620
Blue Source – Pungo River Forest Conservation Project	1	1,620
Applied Energy, LLC - NAS North Island	5	16,605
Finite Carbon – Shannondale Tree Farm	1	2,077
Green Assets – Middleton Avoided Conversion	3	11,687
Round Valley Indian Tribes IFM Project	1	2,841
California Dairies, Inc.	1	10,140
Garcia River Forest	1	10,140
Calpine Energy Services, LP	8	686,178
Finite Carbon – The Forestland Group CT Lakes	1	275,000
Hanes Ranch Forest Carbon Project	1	70,349
Trinity Timberlands University Hill IFM Project	1	222,398
Willits Woods	5	118,431
Carson Cogeneration Company	1	1,378
Green Assets – Middleton Avoided Conversion	1	1,378
Chevron Power Holdings, Inc.	1	49,187
Blue Source-Bishop IFM Project	1	49,187
Chevron U.S.A., Inc.	38	4,019,283
Blue Source – Francis Beidler IFM Project	3	250,000
Blue Source – Goodman IFM Project	1	693,615
Blue Source – Noles North Avoided Conversion Forest Project	6	14,795
Blue Source – Noles South Avoided Conversion Forest Project	6	14,090
Blue Source – Pungo River Forest Conservation Project	6	21,115
Blue Source-Bishop IFM Project	2	379,649

Brushy Mountain	2	1,250,441
Finite Carbon – The Forestland Group Champion Property IFM	1	678,550
Finite Carbon Farm Cove Community Forest Project	1	146,666
Willits Woods	10	570,362
City of Glendale	1	17,649
Big River / Salmon Creek Forests	1	17,649
Coalinga Cogeneration Company	2	30,730
Blue Source-Bishop IFM Project	2	30,730
Double C Limited	1	347
Willits Woods	1	347
Dynergy Moss Landing, LLC	4	165,460
Buckeye Forest Project	1	100,000
Willits Woods	3	65,460
Energia Azteca X, S.A. de C.V. and Energia de Baja California S. de R.L. de C.V. (La Rosita Power Marketing)	1	9,814
Garcia River Forest	1	9,814
Fresno Cogeneration Partners, LP	1	1,298
Willits Woods	1	1,298
GenOn Energy Management, LLC	2	7,667
Willits Woods	2	7,667
GWF Energy, LLC	3	20,867
Willits Woods	3	20,867
High Desert Power Project, LLC	2	125,000
Finite Carbon – The Forestland Group CT Lakes	2	125,000
High Sierra Limited	1	353
Willits Woods	1	353
Ingomar Packing Company, LLC	1	5,841
Green Assets – Middleton Avoided Conversion	1	5,841
Kern Front Limited	1	318
Willits Woods	1	318
Kern River Cogeneration Company	4	102,040
Blue Source-Bishop IFM Project	2	86,918
Willits Woods	2	15,122
La Paloma Generating Company, LLC	4	74,356
Finite Carbon – Brosnan Forest	1	1,314

McCloud River	1	15,038
Trinity Timberlands University Hill IFM Project	1	10,473
Willits Woods	1	47,531
Macpherson Oil Company	1	17,516
Green Assets – Middleton Avoided Conversion	1	17,516
Mariposa Energy, LLC	1	3,344
Willits Woods	1	3,344
Martinez Cogen Limited Partnership	1	9,630
The Van Eck Forest	1	9,630
Mid-Set Cogeneration Company	2	32,547
Blue Source-Bishop IFM Project	2	32,547
Midway Sunset Cogeneration Company	1	39,478
Willits Woods	1	39,478
NRG Power Marketing, LLC	4	245,756
Gualala River Forest	4	245,756
OLS Energy - Chino	2	19,960
Blue Source – Francis Beidler IFM Project	2	19,960
Pacific Gas and Electric Company	1	61,495
Willits Woods	1	61,495
PBF Energy Western Region, LLC	9	140,179
Big River / Salmon Creek Forests	3	52,762
Garcia River Forest	1	48,456
The Van Eck Forest	5	38,961
Praxair, Inc.	1	5,000
Virginia Conservation Forestry Program – Clifton Farm	1	5,000
Pro Petroleum, Inc.	1	35,000
Big River / Salmon Creek Forests	1	35,000
Rio Tinto Minerals Inc.	1	26,532
Big River / Salmon Creek Forests	1	26,532
Russell City Energy Company, LLC	1	39,964
Willits Woods	1	39,964
Salinas River Cogeneration Company	2	32,244
Blue Source-Bishop IFM Project	2	32,244

San Diego Gas & Electric Company	2	27,602
Trinity Timberlands University Hill IFM Project	2	27,602
Sargent Canyon Cogeneration Company	2	32,987
Blue Source-Bishop IFM Project	2	32,987
SEI Fuel Services, Inc	1	28,756
Finite Carbon – MWF Brimstone IFM Project I	1	28,756
SEI Fuel Services, Inc.	2	75,084
Finite Carbon – Shannondale Tree Farm	1	35,084
Green Assets – Middleton Avoided Conversion	1	40,000
Shell Energy North America (US), LP	2	209,000
Blue Source-Bishop IFM Project	1	84,000
Miller Forest	1	125,000
Southern California Edison Company	5	501,170
Blue Source – Francis Beidler IFM Project	1	30,295
Finite Carbon – The Forestland Group CT Lakes	1	125,000
Hanes Ranch Forest Carbon Project	1	6,548
Round Valley Indian Tribes IFM Project	1	241,164
Trinity Timberlands University Hill IFM Project	1	98,163
Sycamore Cogeneration Company	2	100,608
Blue Source-Bishop IFM Project	2	100,608
Tesoro Refining & Marketing Company, LLC	11	1,488,172
Blue Source – Francis Beidler IFM Project	1	908
Finite Carbon – Berry Summit	1	193,277
Finite Carbon – Shannondale Tree Farm	1	50,000
Finite Carbon – The Forestland Group CT Lakes	1	316,601
Green Assets – Middleton Avoided Conversion	2	50,000
Green Assets-Brookgreen Gardens IFM Project	1	160,000
McCloud River	1	65,000
Miller Forest	1	94,084
Trinity Timberlands University Hill IFM Project	1	13,209
White Mountain Apache Tribe Forest Carbon Project	1	545,093
The Procter & Gamble Paper Products Company	1	25,691
Blue Source-Bishop IFM Project	1	25,691

TransAlta Energy Marketing (U.S.), Inc.	1	6,773
McCloud River	1	6,773
Ultramar, Inc.	1	13,857
Blue Source – Francis Beidler IFM Project	1	13,857
Union Pacific Railroad Company	1	38,184
Finite Carbon – Brosnan Forest	1	38,184
Valero Refining Company-California, Benicia Refin. and Asphalt Plant	3	103,112
Blue Source – Francis Beidler IFM Project	1	36,143
Finite Carbon Farm Cove Community Forest Project	1	48,888
Willits Woods	1	18,081
Valley Electric Association, Inc.	2	813
Blue Source-Bishop IFM Project	1	5
The Van Eck Forest	1	808
Grand Total		8,903,291

The Promise and Problems of Pricing Carbon: Theory and Experience

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Joseph E. Aldy¹ and Robert N. Stavins¹

Abstract

Because of the global commons nature of climate change, international cooperation among nations will likely be necessary for meaningful action at the global level. At the same time, it will inevitably be up to the actions of sovereign nations to put in place policies that bring about meaningful reductions in the emissions of greenhouse gases. Due to the ubiquity and diversity of emissions of greenhouse gases in most economies, as well as the variation in abatement costs among individual sources, conventional environmental policy approaches, such as uniform technology and performance standards, are unlikely to be sufficient to the task. Therefore, attention has increasingly turned to market-based instruments in the form of carbon-pricing mechanisms. We examine the opportunities and challenges associated with the major options for carbon pricing—carbon taxes, cap-and-trade, emission reduction credits, clean energy standards, and fossil fuel subsidy reductions—and provide a review of the experiences, drawn primarily from developed countries, in implementing these instruments. Our summary of relevant theory and survey of experience from industrialized nations may be helpful to those who wish to examine the potential applicability of carbon pricing in the context of developing countries.

Keywords

global climate change, market-based instruments, carbon pricing, carbon taxes, cap-and-trade, emission reduction credits, energy subsidies, clean energy standards

¹Harvard University, Cambridge, MA, USA

Corresponding Author:

Joseph E. Aldy, Harvard University, 79 JFK Street, Mailbox 57, Cambridge, MA 02138, USA
Email: joseph_aldy@hks.harvard.edu

Introduction

In a modern economy, nearly all aspects of economic activity affect greenhouse gas—in particular, carbon dioxide (CO₂)—emissions, and hence the global climate. To be effective, climate change policy must affect decisions regarding these activities. This can be done in one of three ways: (a) mandate businesses and individuals to change their behavior regarding technology choice and emissions; (b) subsidize businesses and individuals to invest in and use lower emitting goods and services; or (c) price the greenhouse gas externality, so that decisions take account of this external cost.

By internalizing the externalities associated with CO₂ emissions, carbon pricing can promote cost-effective abatement, deliver powerful innovation incentives, and ameliorate rather than exacerbate government fiscal problems. By pricing CO₂ emissions (or, equivalently, by pricing the carbon content of the three fossil fuels—coal, petroleum, and natural gas), governments defer to private firms and individuals to find and exploit the lowest cost ways to reduce emissions and invest in the development of new technologies, processes, and ideas that could further mitigate emissions. A range of policy instruments can facilitate carbon pricing, including carbon taxes, cap-and-trade, emission reduction credits, clean energy standards, and fossil fuel subsidy reduction.

Some of these instruments have been used with success in other environmental domains as well as for pricing CO₂ emissions. The U.S. sulfur dioxide (SO₂) cap-and-trade program cut U.S. power plant SO₂ emissions more than 50% after 1990 and resulted in compliance costs one half of what they would have been under conventional regulatory mandates (Carlson, Burtaw, Cropper, & Palmer, 2000).¹ The success of the SO₂ allowance trading program motivated the design and implementation of the European Union's Emission Trading Scheme (EU ETS), the world's largest cap-and-trade program, focused on cutting CO₂ emissions from power plants and large manufacturing facilities throughout Europe (Ellerman & Buchner, 2007). The U.S. lead phase-down of gasoline in the 1980s, by reducing the lead content per gallon of fuel, served as an early, effective example of a tradable performance standard (Stavins, 2003). These positive experiences provide motivation for considering market-based instruments as potential approaches to mitigating greenhouse gas emissions. This article focuses on the experience in industrialized countries that have implemented these instruments extensively. We hope that our summary of relevant theory and survey of experience from industrialized nations may be helpful to those who wish to examine the potential applicability of carbon pricing for developing countries.

Climate Change Policy Instruments for the Regional, National, or Subnational Level

We consider five generic policy instruments that could conceivably be employed by regional, national, or even subnational governments for carbon pricing, including carbon taxes, cap-and-trade, emission reduction credits, clean energy standards, and fossil fuel subsidy reduction. First, however, we examine the possibility of relying

on conventional environmental policy approaches, namely, command-and-control instruments, which have dominated environmental policy in virtually all countries over the past four decades.²

Command-and-Control Regulations

Conventional approaches to environmental policy employ uniform standards to protect environmental quality. Such command-and-control regulatory standards are either *technology based* or *performance based*. Technology-based standards typically require the use of specified equipment, processes, or procedures. In the climate policy context, these could require firms to use particular types of energy-efficient motors, combustion processes, or landfill-gas collection technologies.

Performance-based standards are more flexible than technology-based standards, specifying allowable levels of pollutant emissions or allowable emission rates, but leaving the specific methods of achieving those levels up to regulated entities. Examples of uniform performance standards for greenhouse gas abatement would include maximum allowable levels of CO₂ emissions from combustion (e.g., the grams-of-CO₂-per-mile requirement for cars and light-duty vehicles recently promulgated as part of U.S. tailpipe emission standards) and maximum levels of methane emissions from landfills.

Uniform technology and performance standards can—in principle—be effective in achieving some environmental purposes. But, given the ubiquitous nature of greenhouse gas emissions from diverse sources in an economy, it is unlikely that technology or ordinary performance standards could form the centerpiece of a meaningful climate policy.

Furthermore, these command-and-control mechanisms lead to non-cost-effective outcomes in which some firms use unduly expensive means to control pollution. Since performance standards give firms some flexibility in how they comply, performance-based standards will generally be more cost-effective than technology-based standards, but neither tends to achieve the cost-effective solution.

Beyond considerations of static cost-effectiveness, conventional standards would not provide dynamic incentives for the development, adoption, and diffusion of environmentally and economically superior control technologies. Once a firm satisfies a performance standard, it has little incentive to develop or adopt cleaner technology. Regulated firms may fear that if they adopt a superior technology, the government may tighten the performance standard. Technology standards are worse than performance standards in inhibiting innovation since, by their very nature, they constrain the technological choices available.

The substantially higher cost of a standards-based policy may undermine support for such an approach, and securing political support may require a weakening of standards and hence lower environmental benefits.³

The key limitations of command-and-control regulations can be avoided through the use of market-based policy instruments. In the context of climate change, this essentially means carbon pricing.

Carbon Taxes

In principle, the simplest approach to carbon pricing would be through government imposition of a carbon tax (Metcalf, 2007). The government could set a tax in terms of dollars per ton of CO₂ emissions (or CO₂-equivalent on greenhouse gas emissions) by sources covered by the tax, or—more likely—a tax on the carbon content of the three fossil fuels (coal, petroleum, and natural gas) as they enter the economy. To be cost-effective, such a tax would cover all sources, and to be efficient, the carbon price would be set equal to the marginal benefits of emission reduction, represented by estimates of the social cost of carbon (Interagency Working Group on Social Cost of Carbon, 2010). Over time, an efficient carbon tax would increase to reflect the fact that as more greenhouse gas emissions accumulate in the atmosphere, the greater is the incremental damage from one more ton of CO₂. Imposing a carbon tax would provide certainty about the marginal cost of compliance, which reduces uncertainty about returns to investment decisions, but would leave uncertain economy-wide emission levels (Weitzman, 1974).

The government could apply the carbon tax at a variety of points in the product cycle of fossil fuels, from fossil fuel suppliers based on the carbon content of fuel sales (“upstream” taxation/regulation) to final emitters at the point of energy generation (“downstream” taxation/regulation). Under an upstream approach, refineries and importers of petroleum products would pay a tax based on the carbon content of their gasoline, diesel fuel, or heating oil. Coal-mine operators would pay a tax reflecting the carbon content of the tons extracted at the mine mouth. Natural-gas companies would pay a tax reflecting the carbon content of the gas they bring to surface at the wellhead or import via pipelines or liquefied natural gas (LNG) terminals. Focusing on the carbon content of fuels would enable the policy to capture about 98% of U.S. CO₂ emissions, for example, with a relatively small number of covered firms—on the order of a few thousand—as opposed to the hundreds of millions of smokestacks, tailpipes, and so forth, that emit CO₂ after fossil fuel combustion.

A carbon tax would be administratively simple and straightforward to implement in most industrialized countries, since the tax could incorporate existing methods for fuel-supply monitoring and reporting to the regulatory authority. Some developing countries with effective tax systems, including monitoring and enforcement regimes to minimize tax evasion, could also implement carbon taxes in a relatively straightforward manner. Given the molecular properties of fossil fuels, monitoring the physical quantities of these fuels yields a precise estimate of the emissions that would occur during their combustion.

In the event that carbon capture and storage technologies become commercially available, a crediting system for downstream sequestration could complement the emission tax system. A firm that captures and stores CO₂ through geological sequestration, thereby preventing the gas from entering the atmosphere, could generate tradable CO₂ tax credits and sell these to firms that would otherwise have to pay the emission tax.⁴

As fuel suppliers face the emission tax, they will increase the cost of the fuels they sell. This will effectively pass the tax down through the energy system, creating incentives for fuel-switching and investments in more energy-efficient technologies that reduce CO₂ emissions.

The effects of a carbon tax on emission mitigation and the economy will depend in part on the amount and use of the tax revenue. For example, an economy-wide U.S. carbon tax of US\$20 per ton of CO₂ would likely raise more than US\$100 billion per year. The carbon tax revenue could be put toward a variety of uses. It could allow for reductions in existing distortionary taxes on labor and capital, thereby stimulating economic activity and offsetting some of a policy's social costs (Goulder, 1995; Goulder & Parry, 2008). Other socially valuable uses of revenue include reduction of debt, and funding desirable public programs, such as research and development of climate-friendly technology. The tax receipts could also be used to compensate low-income households for the burden of higher energy prices as well as compensating others bearing a disproportionate cost of the policy.

The implementation of a carbon tax (or any other meaningful climate policy instrument) will increase the cost of consuming energy and could adversely affect the competitiveness of energy-intensive industries. This competitiveness effect can result in negative economic and environmental outcomes: firms may relocate facilities to countries without meaningful climate change policies, thereby increasing emissions in these new locations and offsetting some of the environmental benefits of the policy. Such "emission leakage" may actually be relatively modest, because a majority of the emissions in developed countries occur in nontraded sectors, such as electricity, transportation, and residential buildings. However, energy-intensive manufacturing industries that produce goods competing in international markets may face incentives to relocate and advocate for a variety of policies to mitigate these impacts (Aldy & Pizer, 2011).

Additional emission leakage may occur through international energy markets—as countries with climate policies reduce their consumption of fossil fuels and drive down fuel prices, those countries without emission mitigation policies increase their fuel consumption in response to the lower prices. Since leakage undermines the environmental effectiveness of any unilateral effort to mitigate emissions, international cooperation and coordination becomes all the more important. These competitiveness impacts on energy-intensive manufacturing could be mitigated through policy designs we discuss below. Also, it is important to keep in mind that these emission leakage effects exist with any meaningful climate policy, whether carbon pricing or command-and-control.

Real-world experience with energy pricing demonstrates the power of markets to drive changes in the investment and use of emission-intensive technologies. The run-up in gasoline prices in 2008 resulted in a shift in the composition of new cars and trucks sold toward more fuel-efficient vehicles, while reducing vehicle miles traveled by the existing fleet (Ramey & Vine, 2010). Likewise, electric utilities responded to the dramatic decline in natural gas prices (and decline in the relative

gas-coal price) in 2009 and 2010 by dispatching more electricity from gas plants that resulted in lower carbon dioxide (CO₂) emissions and the lowest share of U.S. power generation by coal in some four decades (U.S. Energy Information Administration, 2009). Longer term evaluations of the impacts of energy prices on markets have found that higher prices have induced more innovation—measured by frequency and importance of patents—and increased the commercial availability of more energy-efficient products, especially among energy-intensive goods such as air conditioners and water heaters (Newell, Jaffe, & Stavins, 1999; Popp, 2002).

Cap-and-Trade Systems

A cap-and-trade system constrains the aggregate emissions of regulated sources by creating a limited number of tradable emission allowances—in sum equal to the overall cap—and requiring those sources to surrender allowances to cover their emissions (Stavins, 2007). Faced with the choice of surrendering an allowance or reducing emissions, firms place a value on an allowance that reflects the cost of the emission reductions that can be avoided by surrendering an allowance. Regardless of the initial allowance distribution, trading can lead allowances to be put to their highest valued use: covering those emissions that are the most costly to reduce and providing the incentive to undertake the least costly reductions (Hahn & Stavins, in press; Montgomery, 1972). Cap-and-trade sets an aggregate quantity, and through trading, yields a price on emissions, and is effectively the dual of a carbon tax that prices emissions and yields a quantity of emissions as firms respond to the tax's mitigation incentives. Uncertainty in the costs of abatement leads to uncertainty regarding the allowance price in a cap-and-trade system and uncertainty regarding emissions under a tax. This has potentially important economic and political implications, which we discuss below.

In developing a cap-and-trade system, policy makers must decide on several elements of the system's design. Policy makers must determine how many allowances to issue—the size or level of the emission cap. Policy makers must determine the scope of the cap's coverage: identify the types of greenhouse gas emissions and sources covered by the cap, including whether to regulate upstream (based on carbon content of fuels) or downstream (based on monitored emissions).

After determining the amount of allowances and scope of coverage, policy makers must determine whether to freely distribute or sell (auction) allowances. Free allocation of allowances to firms could reflect some historical record (“grandfathering”), such as recent fossil fuel sales. Such grandfathering involves a transfer of wealth, equal to the value of the allowances, to existing firms, whereas, with an auction, this same wealth is transferred to the government. With an auction, the government would, in theory, collect revenue identical to that from a tax producing the same amount of emission abatement. As with tax receipts, auction revenues could be used to reduce distortionary taxes or finance other programs.

In an emission trading program, cost uncertainty—unexpectedly high or volatile allowance prices—can undermine political support for climate policy and discourage

investment in new technologies and research and development. Therefore, attention has turned to incorporating “cost-containment” measures in cap-and-trade systems, including offsets, allowance banking and borrowing, safety valves, and price collars.

An offset provision allows regulated entities to offset some of their emissions with credits from emission reduction measures lying outside the cap-and-trade system’s scope of coverage. An offset provision can link a cap-and-trade system with an emission-reduction-credit system (see below). Allowance banking and borrowing effectively permit emission trading across time. The flexibility to save an allowance for future use (banking) or to bring a future period allowance forward for current use (borrowing) can promote cost-effective abatement. Systems that allow banking and borrowing redefine the emission cap as a cap on cumulative emissions over a period of years, rather than a cap on annual emissions. This makes sense in the case of climate change, because it is a function of cumulative emissions of gases that remain in the atmosphere for decades to centuries.

A safety valve puts an upper bound on the costs that firms will incur to meet an emission cap by offering the option of purchasing additional allowances at a predetermined fee (the safety valve “trigger price”). This effective price ceiling in the emission allowance market reflects a hybrid approach to climate policy: a cap-and-trade system that transitions to a tax in the presence of unexpectedly high mitigation costs. When firms exercise a safety valve, their aggregate emissions exceed the emission cap. A price collar combines the ceiling of a safety valve with a price floor created by a minimum price in auction markets or a government commitment to purchase allowances at a specific price.

Increasing certainty about mitigation cost—through a carbon tax, safety valve, or price collar—reduces certainty about the quantity of emissions allowed.⁵ Smoothing allowance prices over time through banking and borrowing reduces the certainty over emissions in any given year, but maintains certainty of aggregate emissions over a longer time period. A cost-effective policy with a mechanism insuring against unexpectedly high costs—either through cap-and-trade or a carbon tax—increases the likelihood that firms will comply with their obligations and can facilitate a country’s participation and compliance in a global climate agreement.

In a similar fashion as under a carbon tax, domestic cap-and-trade programs could include some variant of a border tax to mitigate some of the adverse competitiveness impacts of a unilateral domestic climate policy and encourage trade partners to take on mitigation policies with comparable stringency. In the case of a cap-and-trade regime, the border adjustment would take the form of an import allowance requirement, so that imports would face the same regulatory costs as domestically produced goods. However, border measures under a carbon tax or cap-and-trade raise questions about the application of trade sanctions to encourage broader and more extensive emission mitigation actions globally as well as questions about their legality under the World Trade Organization (Brainard & Sorking, 2009; Frankel, 2010).

Emission-Reduction-Credit Systems

An emission-reduction-credit (ERC) system delivers emission mitigation by awarding tradable credits for “certified” reductions. Generally, firms that are not covered by some set of regulations—be they command-and-control or market-based—may voluntarily participate in such systems, which serve as a source of credits that entities facing compliance obligations under the regulations may use. Individual countries can implement an ERC system without having a corresponding cap-and-trade program.

For example, as we discuss below, the Clean Development Mechanism (CDM) under the Kyoto Protocol provides credits used by firms covered by the EU ETS. A firm earns credits for projects that reduce emissions relative to a hypothetical “no project” baseline. In determining the number of credits to grant a firm for a project, calculation of the appropriate baseline is therefore as important as measuring emissions. Dealing with this unobserved and fundamentally unobservable hypothetical baseline is at the heart of the so-called “additionality” problem.

While ERC systems can be self-standing, as in the case of the CDM, governments can also establish them as elements of domestic cap-and-trade or other regulatory systems. These ERC systems—often referred to as offset programs—serve as a source of credits that can be used by regulated entities to meet compliance obligations under the primary system. For example, the Regional Greenhouse Gas Initiative (RGGI) in the northeast United States, which regulates CO₂ emissions from electric power plants (and which we discuss below), recognizes offsets from activities such as landfill methane capture and destruction, reductions in emissions of sulfur hexafluoride from the electric power sector, and afforestation. Electricity generators covered by RGGI can use these offset credits to cover part of their emissions. Other cap-and-trade systems that we discuss below also contain offset provisions.

Clean Energy Standards

The purpose of a clean energy standard is to establish a technology-oriented goal for the electricity sector that can be implemented cost-effectively (Aldy, 2011). Under such standards, power plants generating electricity with technologies that satisfy the standard create tradable credits that they can sell to power plants that fail to meet the standard, thereby minimizing the costs of meeting the standard’s goal in a manner analogous to cap-and-trade.

In the United States, for example, state renewable electricity standards (RESs), a restricted type of a clean energy standard, typically establish the objective of the standard as a specific renewable share of total power generation that increases over time (U.S. Congressional Budget Office, 2011). A few states have implemented alternative energy standards in their power sector that target renewables, new nuclear power generating capacity, and advanced fossil fuel power generating technologies.

The European Union and China have promoted renewable power through renewable electricity mandates that include tradable renewable energy credits.

Clean energy standards that focus on technology targets do not explicitly price the greenhouse gas externality and thus impose a higher cost for a given amount of emission reductions than a carbon tax or cap-and-trade program. A renewable mandate treats coal-fired power, gas-fired power, and nuclear power as equivalent—none of these technologies create credits necessary for compliance—despite the fact that a natural gas combined cycle power plant typically produces a unit of generation with half the CO₂ emissions of a conventional coal power plant, and a nuclear plant produces zero-emission power, as do wind, solar, and geothermal. Thus, mandating power from a limited portfolio of technologies can result in higher costs by providing no incentive to switch from emission-intensive coal to emission-lean gas or emission-free nuclear.

A more cost-effective approach to a clean energy standard would employ a technology-neutral performance standard, such as tons of CO₂ per megawatt hour of generation. All power sources, from fossil fuels to renewables, could be eligible under such a performance standard. This has the advantage over the portfolio approach of providing better innovation incentives and of enabling all possible ways of reducing the emissions intensity of power generation. The Canadian province of Alberta has employed such a tradable carbon performance standard for most large sources of CO₂ emissions and has required a 12% improvement in the emission intensity of these sources since 2007.

Power plants would be awarded credits for generating cleaner (less emission-intensive) electricity than the standard. These clean power plants could sell credits to other power plants or save them for future use. Tradable credits promote cost-effectiveness by encouraging the greatest deployment of clean energy from those plants that can lower their emission intensity at lowest cost. Those power plants could then sell their extra credits to other power plants that face higher costs for deploying clean energy. The creation and sale of clean energy credits would provide a revenue stream that could conceivably enable the financing of low- and zero-emission power plant projects.

Eligible technologies for the standard could extend beyond generation technologies and also permit improvements in energy efficiency, or a broad set of emission offset activities, to create tradable credits. Extending the price on carbon to a broader set of activities could improve cost-effectiveness, but allowing for energy efficiency and other offsets poses risks. As emphasized above, estimating offsets is complex, requires extensive review and monitoring by third parties or regulatory agencies, and risks undermining the objective of a policy because of the additionality problem.

Monitoring and enforcement could be relatively straightforward under either a portfolio or performance standard approach. For example, in the United States, electricity generation, generating technology type, and CO₂ emissions are already tracked at power plants by state and Federal regulators.

A clean energy standard represents a de facto free allocation of the right to emit greenhouse gases to the power sector. Suppose that the U.S. government created a clean energy performance standard of 0.5 tons of CO₂ per megawatt hour (the 2010 U.S. power sector emission intensity was 0.56 tons of CO₂/MWh); this is roughly comparable to a 50% clean energy standard that allows all technologies with lower emission intensity than conventional coal to qualify (with partial crediting for low- but non-zero-emitting facilities). As a result, a clean energy standard could not generate the revenues that a carbon tax or a cap-and-trade program with an allowance auction could.

Eliminating Fossil Fuel Subsidies

Phasing out fossil fuel subsidies can represent significant progress toward “getting prices right” for fossil fuel consumption, especially in some developing countries, where subsidies are particularly large. Imposing a carbon price on top of a fuel subsidy will not lead to the socially optimal price for the fuel, but removing such subsidies can deliver incentives for efficiency and fuel switching comparable to implementing an explicit carbon price. In sharp contrast with our discussion above of other policy instruments, in which we focused on ways to price externalities to correct a market failure, our overview of eliminating fossil fuel subsidies addresses the removal of policy interventions that represent “government failures” and thereby exacerbate a market failure.

At the 2009 G20 Summit in Pittsburgh, Pennsylvania, the leaders of 20 of the largest developed and developing countries agreed to phase out fossil fuel subsidies over the “medium term,” and encouraged all other nations to eliminate such subsidies. The agreement called for phasing out these subsidies while targeting support for the poor, and noted that “inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change” (G20 Leaders, 2009). Soon thereafter, leaders of the APEC nations⁶ reached agreement on fossil fuel subsidy elimination at the 2009 Singapore Summit.

The economic and climate benefits of fossil fuel subsidy reform could be significant. In 2008, fossil fuel consumption subsidies exceeded US\$500 billion globally and could exceed US\$660 billion by 2020 without policy reforms (International Energy Agency [IEA], 2011). In at least 10 countries, fossil fuel subsidies exceeded 5% of GDP, and constituted substantial fractions of government budgets (IEA, 2010). Eliminating fossil fuel subsidies could reduce global oil consumption by about 4.7 million barrels per day by 2020, representing a decline of about 5% of current consumption. The International Energy Agency (2010) estimates that eliminating all fossil fuel subsidies would reduce global CO₂ emissions by about two gigatons per year by 2020. To put this in perspective, the UN Environmental Programme (2010) estimates that the Copenhagen Accord emission pledges will reduce greenhouse gas emissions by three to seven gigatons relative to business as usual in 2020.

The vast majority of fossil fuel subsidies suppress the prices for petrol, diesel, electricity, natural gas, and coal that consumers face, primarily in developing countries.⁷ Some developing country governments have been historically reticent to let fuel and electricity prices rise to market-determined levels because of concerns of public opposition. For example, protests over reducing petrol subsidies contributed to President Suharto's downfall in Indonesia in 1998 (Beaton & Lontoh, 2010). Interestingly, Indonesia successfully reduced their fossil fuel subsidies—doubling consumers' prices for petrol and diesel and tripling consumers' prices for kerosene—in 2005 by coupling the change in the fuel price regime with a targeted, means-tested program to transfer government resources from fuel subsidies to income support. Before its late 2010 subsidy reform that significantly raised petrol and diesel prices in exchange for lump-sum cash transfers, Iran priced diesel fuel at about 10 cents per gallon (Coady et al., 2010).

Critics of subsidy reform claim it will harm low-income households, but most fossil fuel subsidies disproportionately benefit the relatively wealthy in developing countries. Indeed, about 40% of the benefits of petroleum subsidies accrue to the wealthiest quintile, while the lowest income quintile enjoys less than 10% of the subsidy benefits, on average globally (Coady et al., 2010).⁸

To promote implementation and cooperation on the G20 fossil fuel subsidies commitment, the leaders established two processes that enable a *de facto* “pledge and review” process. First, the leaders tasked their energy and finance ministers to compile a list of their own country's fossil fuel subsidies and present their strategies for eliminating them. After a series of staff-and ministerial-level consultations among the G20, the energy and finance ministers presented their plans in 2010 (G20 Leaders, 2010a). Second, the leaders tasked the Organization of Economic Cooperation and Development (OECD), International Energy Agency (IEA), World Bank, and the Organization of Petroleum Exporting Countries (OPEC) to evaluate fossil fuel subsidies (G20 Leaders, 2009). These international organizations subsequently produced joint reports that serve as independent benchmarks of fossil pricing policies by which countries may evaluate others' subsidy elimination plans (IEA, OPEC, OECD, & World Bank, 2010).

In 2010, the G20 leaders explicitly called on these international organizations to “further assess and review the progress made in implementing the Pittsburgh and Toronto commitments” (G20 Leaders, 2010b). While the G20 has no formal compliance mechanism to explicitly enforce the leaders' commitment, it does establish a goal, an implementation process, and what can effectively be a third-party expert review. This combination provides transparency for governments and stakeholders to assess whether nations are delivering on their leaders' commitments. This can promote credibility and trust for future international cooperation and may provide some lessons for the design of bottom-up international climate policy (see more on this below in our discussion of international coordination of carbon pricing policies).

Regional, National, and Subnational Experiences With Carbon Pricing

We briefly examine the few explicit carbon pricing policy regimes that are currently in place: the European Union's Emission Trading Scheme; New Zealand's cap-and-trade system; the Kyoto Protocol's Clean Development Mechanism; northern European carbon tax policies; British Columbia's carbon tax; and Alberta's tradable carbon performance standard (similar to a clean energy standard).⁹

European Union Emission Trading Scheme

By far the world's largest carbon pricing regime is the European Union Emission Trading Scheme (EU ETS), a cap-and-trade system of CO₂ allowances. Adopted in 2003 with a pilot phase that became active in 2005, the EU ETS covers about half of EU CO₂ emissions in 30 countries in a region of the world that accounts for about 20% of global GDP and 17% of world energy-related CO₂ emissions (Ellerman & Buchner, 2007).¹⁰ The 11,500 emitters regulated by the *downstream* program include large sources such as oil refineries, combustion installations over 20 MWth, coke ovens, cement factories, ferrous metal production, glass and ceramics production, and pulp and paper production. Up until now, the program has not covered sources in the transportation, commercial, or residential sectors (Ellerman & Buchner, 2007) although the EU plans to extend the ETS to cover aviation sector emissions starting in 2012.

The EU ETS was designed to be implemented in phases: a pilot or learning phase from 2005 to 2007, a Kyoto phase from 2008 to 2012,¹¹ and a series of subsequent phases. Penalties for violations increase from 40 Euros per ton of CO₂ in the first phase to 100 Euros in the second phase. Although the first phase allowed trading only in carbon dioxide, the second phase broadened the program to include other GHGs, such as nitrous oxide emissions.

The process for setting caps and allowances in member states was initially decentralized (Kruger, Oates, & Pizer, 2007), with each member state responsible for proposing its own national carbon cap, subject to review by the European Commission. This created incentives for individual countries to try to be generous with their allowances to protect their economic competitiveness (Convery & Redmond, 2007). Not surprisingly, the result was an aggregate cap that exceeded business-as-usual emissions.

In the spring of 2006, it became clear that the allocation of allowances in 2005 on net had exceeded emissions by about 4% of the overall cap. This led, as would be anticipated, to a dramatic fall in allowance prices. In January, 2005, the price per ton was approximately €8/tCO₂; by early 2006, it exceeded €30/tCO₂, then fell by about half in one week of April, 2006, before fluctuating and returning to about €8/tCO₂ (Convery & Redmond, 2007). This volatility was attributed to the absence of transparent, precise emissions data at the beginning of the program, a surplus of allowances, energy price volatility, and a program feature that *prevents banking* of allowances

from the first phase to the second phase (Market Advisory Committee, 2007). In truth, the “overallocation” was concentrated in a few countries, particularly in Eastern Europe, and in the nonpower sectors (Ellerman & Buchner, 2007).

The first and second phases of the EU ETS require member states to distribute almost all of the emissions allowances (a minimum of 95% and 90%, respectively) freely to regulated sources, but beginning in 2013, member states will be allowed to auction larger shares of their allowances. The initial free distribution of allowances led to complaints from energy-intensive industrial firms about “windfall profits” among electricity generators, when energy prices increased significantly in 2005. But the higher electricity prices were only partly due to allowance prices, higher fuel prices also having played a role; and it is unclear whether the large profits reported by electricity generators were due mainly to their allowance holdings or to having low-cost nuclear or coal generation in areas where the (marginal) electricity price was set by higher cost natural gas (Ellerman & Buchner, 2007).

The system’s cap was tightened for Phase 2 (2008-2012), and its scope expanded to cover new sources in countries that participated in Phase 1 plus sources in Bulgaria and Romania, which acceded to the European Union in 2007. Liechtenstein, Iceland, and Norway joined the EU ETS in 2008 although sources in Iceland are not yet subject to an emissions cap. Allowance prices in Phase 2 increased to over €20/tCO₂ in the first half of 2008, averaged €22/tCO₂ in the second half of 2008, and then fell to €13/tCO₂ in the first half of 2009, and down to €10/tCO₂ in the fall of 2011, as the economic recession brought decreased demand for allowances due to reduced output in the energy-intensive sectors and lower electricity consumption.

The European Union plans to extend the EU ETS through Phase 3, 2013-2020, with a centralized cap becoming increasingly stringent (20% below 1990 emissions), a larger share of the allowances subject to auctioning, tighter limits on the use of offsets, and unlimited banking of allowances between Phases 2 and 3.

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is a *downstream* cap-and-trade program that was originally intended to limit CO₂ emissions in the United States from power sector sources in 10 northeastern states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey,¹² New York, Rhode Island, and Vermont).¹³ The system is both narrow in its sectoral coverage and unambitious in terms of its emissions reduction objectives.

The program took effect in 2009, after approval by individual state legislatures, and set a goal of limiting emissions from regulated sources to then current levels in the period from 2009 to 2014. Beginning in 2015, the emissions cap is set to decrease by 2.5% each year until it reaches an ultimate level 10% below 2009 emissions in 2019. It was originally anticipated that meeting this goal would require a reduction approximately 35% below business-as-usual emissions (13% below 1990 emissions levels). However, due to the combined effects of the economic recession and drastic

declines in natural gas prices relative to coal prices, the program is no longer binding and is unlikely to become binding through 2020, unless the targets are revised.¹⁴

Because RGGI only limits emissions from the power sector, incremental monitoring costs are low, because U.S. power plants are already required to report their hourly CO₂ emissions to the Federal government (under provisions for continuous emissions monitoring as part of the SO₂ allowance trading program). The system sets standards for certain categories of CO₂ offsets, and limits the number and geographic distribution of offsets. The program requires participating states to auction at least 25% of their allowances and to use the proceeds for energy efficiency and consumer-related improvements.¹⁵ The remaining 75% of allowances may be auctioned or distributed freely. In practice, states have auctioned virtually all allowances.

Several problems with the program's design can be noted. First is the leakage problem, which is potentially severe for any state or regional program, particularly given the interconnected nature of electricity markets (Burtraw, Kahn, & Palmer, 2005). Second, the program is downstream for just one sector of the economy and so very limited in scope. Third, despite considerable cost uncertainty, a true firm safety valve mechanism was not adopted. Instead, there are trigger price that allow greater reliance on offsets and external credits in the expectation that these can increase supply. The program does impose a price floor in the allowance auctions, without which the allowance prices would have approached zero (when the combined forces of the economic recession and lower natural gas prices caused emissions to fall below the declining cap). Fourth, as mentioned above, the program limits the number and geographic origin of offsets.

New Zealand Emissions Trading Scheme

In January, 2008, the New Zealand Emissions Trading Scheme (NZ ETS) was launched. Under this system, the intention is to include all sectors of the economy and all greenhouse gases by 2015, using free allocation of allowances, with special protections (output-based updating allocations) for emission-intensive, trade-sensitive sectors. The forestry sector entered the program first, in 2008; and stationary energy, industrial, and liquid fuel fossil fuel sectors joined in 2010. The waste (landfills) sector is scheduled to enter in 2013, and agriculture—which accounts for nearly half of New Zealand's gross emissions—is scheduled to enter in 2015.¹⁶

Covered sources have the option of paying a fixed fee of NZUS\$25 per ton of emissions, and until 2013, all sectors other than forestry require only one unit of allowances for each two units of emissions. Thus, although the NZ allowances are indirectly linked with the EU ETS through the CDM, the current effective price is very low while the system becomes established. Early evidence suggests that the forestry component has deterred deforestation and may be encouraging new planting, although international policy and consequent price uncertainty are major problems for investment (Karpas & Kerr, 2010).

The Climate Change Response Act of 2002, which provided for the creation of the emissions trading scheme for the purpose of meeting the country's Kyoto obligations,

required a review of the NZ ETS by an independent review panel every 5 years. The first review (Emissions Trading Scheme Review Panel, 2011) was released by the government in September, 2011. While most of the scheme was upheld, it recommended that the agriculture sector face a lower price as it enters the system and that the government should review the wisdom of allowing offsets from HFC-23 destruction projects under the Clean Development Mechanism (see below). The government hopes to link with Australia's emissions trading program, scheduled to be launched in 2015.

Clean Development Mechanism

The most significant GHG emission-reduction-credit system to date is the Kyoto Protocol's Clean Development Mechanism (CDM). Under the CDM, certified emission reduction (CER) credits are awarded for voluntary emission reduction projects in non-Annex I countries (largely, developing countries) that ratified the Protocol, but are not among the Annex I countries subject to the Protocol's emission limitation commitments—also known as the Annex B countries.¹⁷ CDM projects can potentially take the form of building new wind farms, investing in more energy efficient equipment in a manufacturing facility, and capturing methane from landfills. While CERs can be used by the Annex I countries to meet their emission commitments, they could also be used for compliance purposes by entities covered by other cap-and-trade systems, including systems in countries that are not Parties to the Protocol, such as the United States.

From the perspective of the industrialized countries, the CDM provides a means to engage developing countries in the control of GHG emissions, while from the perspective of the developing countries, the CDM provides an avenue for the financing of "sustainable development." Essentially, the purchase of CERs by industrialized country entities to offset their own emissions can reduce the aggregate cost of compliance with the Kyoto Protocol, because it tends to be much less expensive to construct new low-carbon energy infrastructure in developing nations than to modify or replace existing infrastructure in industrialized countries (Wara, 2007).

Of the six GHGs covered by the Kyoto Protocol,¹⁸ approximately 38% of projects in the CDM pipeline as of 2007 were for CO₂, 28% for HFC-23, 23% for methane, and 11% for nitrous oxide (Wara, 2007). In terms of CO₂-equivalent reductions, the CDM has accounted for annual reductions of 278 million tons, about 1% of annual global emissions of CO₂ (U.S. Energy Information Administration, 2011).¹⁹ The largest shares of CERs have been generated in China (52%) and India (16%), with Latin America and the Caribbean making up another 15% of the total, Brazil (at 7%) being the largest producer in that region (World Bank, 2010).

Because the CDM is an ERC system, it is subject to concerns about the additionality of emission-reductions associated with its projects (see generic discussion above regarding ERC systems). Empirical analysis has validated these concerns, with estimates that up to 75% of claimed reductions would have occurred in the absence of the program (Zhang & Wang, 2011).

A particular concern has centered on the fact that nearly 30% of average annual CERs have come from the destruction of HFC-23, a potent GHG that is a by-product of the manufacture of certain refrigerant gases. It is very inexpensive to destroy HFC-23, and companies can earn nearly twice as much from sale of CDM credits as they can from selling respective refrigerant gases. As a result, it has been argued that plants are being built simply for the purpose of generating CERs from destruction of HFC-23. Because of this, beginning in 2013, CERs from HFC-23 destruction will not be valid for purposes of compliance with the EU ETS.

As debate continues regarding a possible second commitment period for the Kyoto Protocol, it appears that the CDM will continue to function, in any event (Bodansky, 2011). A variety of proposals have been put forward to improve its structure and implementation, many targeted at increasing the additionality of approved projects (Hall, Levi, Pizer, & Ueno, 2010). In the meantime, as we discuss below, the CDM may provide a significant function by facilitating indirect linkages among diverse national cap-and-trade systems.

*Northern European Experience With Carbon Taxes*²⁰

In the 1990s, a number of northern European countries imposed carbon taxes to limit their greenhouse gas emissions. In 1991, Norway implemented a carbon tax that varied in its level across sectors of the economy, despite the fact that cost-effective abatement would call for a uniform tax. In the transportation sector, by 2009, the Norwegian carbon tax had increased to about US\$58/tCO₂ on gasoline, but only US\$34/tCO₂ on diesel (Government of Norway, 2009). Natural gas faced a carbon tax of US\$31/tCO₂ to US\$33/tCO₂ in 2009, depending on use. By 1999, facilities using coal paid US\$24/tCO₂ for coal for energy purposes and US\$19/tCO₂ for coal for coking purposes (Bruvoll & Larsen, 2004), but the Government of Norway exempted these activities from the carbon tax starting in 2003 (Government of Norway, 2009). In 2009, the carbon tax applied to about 55% of Norwegian greenhouse gas emissions, while the emission trading scheme that is linked to the EU ETS covered an additional 13% of emissions.²¹ In 2003, Norway also introduced a tax of about US\$33/tCO₂-equivalent on HFCs and PFCs, which slowed the growth rate of these potent greenhouse gases (Government of Norway, 2009).

Likewise in 1991, Sweden implemented a carbon tax of about US\$33/tCO₂ as a part of a fiscal reform that lowered high income tax rates (Speck, 2008). The carbon tax has since increased to more than US\$135/tCO₂ by 2009 (Government of Sweden, 2009). At the same time, Sweden reduced its general energy tax on many of the sources bearing the carbon tax. Refineries, steel, and other primary metal industries received an exemption from the carbon tax (Daugjberg & Pedersen, 2004). In addition, those industries covered by the EU ETS were exempted from the carbon tax (Government of Sweden, 2009). About 33% of Sweden's greenhouse gas emissions are covered by the EU ETS, a smaller fraction than the norm in the EU (Government of Sweden, 2009).

In 1992, Denmark implemented a carbon tax of about US\$18/tCO₂, and reduced this tax modestly to a level of about US\$17/tCO₂ in 2005, where it remained through 2009 (Speck, 2008; Government of Denmark, 2009). Manufacturing industries bear discounted tax rates of more than 90% depending on their energy intensity and participation in a voluntary agreement (Government of Denmark, 2009). The carbon tax on gasoline amounted to about 16 cents per gallon in 2009.

Since 1997, Finland has imposed a general tax on energy coupled with a surtax based on the carbon content of the energy. Like other northern European nations, Finland reduced its carbon tax for some industries covered by the EU ETS, reflecting concerns about adverse competitiveness impacts on trade-exposed manufacturing. Since 2008, the carbon surtax has been about US\$28/tCO₂ although natural gas faces half this rate (Government of Finland, 2009).

Obviously, implementation of carbon taxes in northern Europe have yielded significant variations in the effective tax per unit CO₂ across fuels and industries within each country, contrary to the cost-effective prescription of a common price on carbon among all sources. In addition, fiscal cushioning to carbon taxes—by adjustments to preexisting energy taxes—and to the EU ETS—by adjustments to then preexisting carbon taxes—was common, especially for those industries expressing concerns about their international competitiveness. Nonetheless, these nations have demonstrated that carbon taxes can deliver greenhouse gas emission reductions and raise revenues to finance government spending and lower income tax rates (OECD, 2001; Government of Denmark, 2009; Government of Finland, 2009; Government of Norway, 2009).

British Columbia Carbon Tax

Since 2008, the Canadian province of British Columbia has had in place a carbon tax as one part of its plan to reduce provincial GHG emissions by 33% by 2020 (British Columbia, 2007). The carbon tax is intended to be economy-wide, with a tax of C\$10 per ton of CO₂-equivalent emissions in 2008, increasing by C\$5 per year for 4 years, and reaching C\$30/ton in 2012. The tax is collected “upstream” at the wholesale level (fuel distributors) based on the carbon content of fuels to facilitate administration (Duff, 2008). By law, 100% of the tax revenue must be refunded through tax cuts to businesses and individuals, and low-income individuals are further protected through a Low Income Climate Action Tax Credit.

During 2008 and 2009, the tax generated C\$846 million in revenue. This was accompanied by reductions in a variety of personal and corporate income taxes, plus tax credits for low-income individuals. These cuts totaled approximately C\$1.1 billion, so that the policy yielded significant net tax reductions (Plumer, 2010). A similar pattern occurred in 2010. The government estimates that by 2020, the carbon tax will reduce British Columbia’s CO₂ emissions by approximately 3 million tons annually.

Interestingly, another part of the province’s Climate Action Plan is a provincial cap-and-trade system, which is to be linked with a similar systems planned in

California (under Assembly Bill 32), Ontario, and Quebec through the Western Climate Initiative. The province's plans have not addressed how the carbon tax and cap-and-trade system will be coordinated.²²

Alberta Tradable Carbon Performance Standard

In 2007, the Canadian province of Alberta designed a market-based policy to reduce the carbon intensity of its large sources of greenhouse gas emissions. This program established a rate-based performance standard for emission sources exceeding 100,000 metric tons of CO₂ annually. Building on emission inventories dating to 2003, each large source covered by the program was required to reduce the emission intensity of its production 12% below a base year intensity drawn from the 2003-2006 period.²³ The program covers about 100 sources from the power sector, pulp and paper, cement, and fertilizer industries, and oil sands development. The unit of measure is emissions of CO₂ per unit of physical production from that industry, for example, per barrel of oil from oil sands development (Sass, 2010).

Covered firms have four options for complying with the performance standard. First, they can reduce the emission intensity of production to meet the standard. Second, they may purchase credits from other covered firms with emission intensities below the standard. Third, they may purchase Alberta-based emission offset credits through an emission-reduction credit program. Finally, they may pay the provincial government C\$15 for every metric ton they exceed the standard by, which serves as a safety valve on the cost of compliance with the program (Province of Alberta, 2008).

In 2010, covered sources employed all four options to comply with the performance standard. These sources reduced their emissions relative to baseline by about 2.7 million tons of CO₂ (with a majority of this effort traded from low mitigation cost facilities to high mitigation cost facilities), purchased about 3.9 million tons emission offset credits, and satisfied the remaining 4.7 million ton emission reduction obligation through the C\$15/tCO₂ safety valve. This last option generated about C\$70 million of revenue directed to the Climate Change and Emissions Management Fund, which invests in emission-lean technologies and projects (Province of Alberta, 2011).

International Coordination of Carbon Pricing Policies

Climate change is truly a global commons problem: the location of greenhouse gas emissions has no effect on the global distribution of damages. Hence free-riding problems plague unilateral and multilateral approaches. Furthermore, nations will not benefit proportionately from greenhouse gas mitigation policies. Thus mitigation costs are likely to exceed direct benefits for virtually all countries. Cost-effective international policies—insuring that countries get the most environmental benefit out of their mitigation investments—will help promote participation in an international climate policy regime.

In principle, internationally employed market-based instruments can achieve overall cost effectiveness. Three basic routes stand out. First, countries could agree to apply the same tax on carbon (*harmonized domestic taxes*) or adopt a *uniform international tax*. Second, the international policy community could establish a system of *international tradable permits*—effectively a nation-state level cap-and-trade program. In its simplest form, this represents the Kyoto Protocol's Annex B emission targets and the Article 17 trading mechanism. Third, a more decentralized system of internationally linked domestic cap-and-trade programs could ensure internationally cost-effective emission mitigation.

International Taxes and Harmonized Domestic Taxes

In principle, a carbon tax could be imposed on nation states by an international agency. The supporting agreement would have to specify both tax rates and a formula for allocating the tax revenues. Cost-effectiveness would require a uniform tax rate across all countries. It is unclear, however, what international agency could impose and enforce such a tax, and so an alternative more frequently considered has been a set of harmonized domestic carbon taxes (Cooper, 2010). In this case, an agreement would stipulate that all countries are to levy the same domestic carbon taxes and retain their revenues.

The uniformity of tax rates is necessary for cost-effectiveness. But some developing countries may argue that the resulting distribution of costs does not conform to principles of distributional equity and call for significant resource transfers. Under a harmonized tax system, an agreement could include fixed lump-sum payments from developed to developing countries, and under an international tax system, an agreement could specify shares of the total international tax revenues that go to participating countries.

As an alternative to these explicit transfers, developed countries could commit to constrain the use of their tax revenues in ways that produce global benefits. For example, carbon tax revenues in developed countries could, in part, finance major research and development programs on zero-carbon technologies and adaptation efforts in developing countries, while developing countries could freely use their tax revenues in ways that best facilitate their development.

In some developing countries reluctant to implement a carbon tax, an initial cost-effective contribution to combat climate change could take the form of reducing fossil fuel subsidies. For example, a developing country cutting a petrol subsidy equal to 10% of its price is approximately equivalent to a rich country imposing a carbon tax on petrol that raises its price 10%. Well-planned, broad fossil fuel price reforms in a developing country could deliver substantial emission mitigation just as a carbon tax in a developed country (IEA, 2010). The energy prices are higher in both countries, providing the incentive to invest in energy-efficient technologies and nonfossil energy sources, but the relative prices remain unchanged, so that energy-intensive firms do not face the incentive to relocate to the developing country.

Lowering energy subsidies can free up government revenues that could be directed to other beneficial uses and improve the allocation of resources in the economy to promote faster economic growth. Of course, some energy subsidies in developing countries address pressing, basic energy needs, and efforts to combat climate change may need to account for these social objectives.

International Tradable Permits: Cap-and-Trade and Emission-Reduction-Credits

Under an international tradable permit scheme, all participating countries would be allocated permits for “net emissions,” that is, emissions minus sequestration. A permit would define a right to emit a given volume over some time period, such as a year. In each period, countries would be free to buy and sell permits on an international exchange.

Initial permit allocations could reflect a variety of criteria, such as previous emissions, gross domestic product, population, and fossil fuel production. Whatever the initial allocation, subsequent trading can, in theory, lead to a cost-effective outcome (Montgomery, 1972), if transaction costs are not significant (Stavins, 1995). This potential for pursuing distributional objectives while assuring cost-effectiveness is an important attribute of the tradable permit approach.

Providing large initial permits to developing countries (for reasons of distributional equity) implies that they would sell permits primarily to developed countries. Since permit prices represent an implicit tax on all participating countries, the terms of trade within the coalition for countries with the same carbon intensities in production would remain unaffected. From a distributional point of view, developing countries would receive compensation, whereas developed countries would have to pay for their own emission abatement and for permit purchases from abroad to cover the balance of their emissions (Olmstead & Stavins, 2012).

An important obstacle to the successful operation of such a system is that by its very nature, the trading would be among nations (Hahn & Stavins, 1999). Nation-states are hardly simple cost-minimizers, like private firms, so there is no reason to anticipate that competitive pressures would lead to equating of marginal abatement costs across countries. The system would not have the cost-effectiveness property ordinarily associated with a domestic tradable permit system among firms. Even if nations were cost-minimizers, they do not have sufficient information about the marginal abatement costs of firms within their jurisdiction to define their own aggregate marginal costs. The notion of a simple trading program among countries may be more of a metaphor than a practical policy.

If every country participating in such a system were to devolve the tradable permits to firms within its jurisdiction, that is, if each country instituted a domestic tradable permit system as its means of achieving its national target, then the trading could be among firms, not governments, both within countries and internationally (Hahn & Stavins, 1999). Such a system could indeed be cost-effective. In the near term, this

trading system could be integrated with an emission-reduction-credit system, such as the CDM, for countries that do not take on emission caps.

The current design of the CDM does not secure all low-cost mitigation opportunities in developing countries. The project basis for credits under the CDM increases transaction costs and excludes policy reforms that undermine the cost-effectiveness of the mechanism. Modifying the CDM along several lines could improve its cost-effectiveness, increase the investment in low-carbon technologies in developing countries, and address concerns about whether CDM activities truly reflect additional emission mitigation effort (Hall et al., 2010).

First, the CDM could be expanded to cover mitigation policies. Some of the potentially low-hanging fruit in developing countries—from reducing energy subsidies to designing and enforcing building codes—do not neatly fall within a “project” under the CDM. A policy-oriented CDM could deliver price signals to a greater share of a developing country’s economy that can yield more emission mitigation and reduce the potential for emission leakage. This could also serve as a mechanism for transfers to developing countries that pursue a carbon tax. The obvious challenge lies in setting baseline emissions to assess the emission reduction benefits for any given policy. This effort may be substantial, but when spread over all of the potential emission reductions, the transaction costs may be minor in comparison to the costs of a project-based approach resulting in the same abatement.

Second, the CDM could be expanded to cover sectors as an alternative to projects. A sectoral CDM could establish emission baselines for entire sectors (such as the power sector or the steel sector), and allow countries to implement mitigation policies in those sectors to generate credits. Integrating these policies into the international regime—such as pegging a sectoral carbon tax to the international tradable permit price, or implementing a sectoral cap-and-trade system linked to the international regime—could promote cost-effectiveness. Focusing on the most energy-intensive sectors could also address concerns about competitiveness and emission leakage in developed countries. It would also provide developing countries with the experience to inform their consideration of taking on broader emission or policy commitments in future agreements.²⁴

Decentralized, Bottom-Up Architectures

Cap-and-trade systems seem to have emerged as the preferred national and regional instrument for reducing emissions of greenhouse gases throughout much of the industrialized world, and the CDM has developed a substantial constituency, despite concerns about its performance. Because linkage between tradable permit systems (that is, unilateral or bilateral recognition of allowances from one system for use in another) can reduce compliance costs and improve market liquidity, there is great interest in linking cap-and-trade systems with each other.

There are not only benefits but also concerns associated with various types of linkages (Jaffe, Ranson, & Stavins, 2010). A major concern is that when two

cap-and-trade systems are directly linked (that is, allow bilateral recognition of allowances in the two jurisdictions), key cost-containment mechanisms, such as safety valves, are automatically propagated from one system to the other. Because some jurisdictions (such as the European Union) are opposed to the notion of a safety valve, whereas other jurisdictions (such as the United States) seem very favorably predisposed to the use of a safety valve, challenging harmonization would be required.

This problem can be avoided by the use of indirect linkage, whereby two cap-and-trade systems accept offsets from a common emission-reduction-credit system, such as the Clean Development Mechanism. As a result, the allowance prices of the two cap-and-trade systems converge (as long as the ERC market is sufficiently deep), and all the benefits of direct linkage are achieved (lower aggregate cost, reduced market power, decreased price volatility), but without the propagation from one system to another of cost-containment mechanisms. Such indirect linkage may already be evolving as a key element of the *de facto* post-2012 international climate policy architecture.

Despite the apparent current popularity of cap-and-trade as a national policy approach in many parts of the world, in reality, there are a variety of policy instruments—both market based and conventional command-and-control—that countries can employ to reduce their GHG emissions. Hence it is important to ask whether a diverse set of heterogeneous national, subnational, or regional climate policy instruments can be linked in productive ways. The basic answer is that such a set of instruments can be linked, but the linkage is considerably more difficult than it is with a set of more homogeneous tradable permit systems (Hahn & Stavins, 1999). In fact, the basic approach behind emission reduction credit systems such as the CDM and Joint Implementation (JI) can be extended to foster linkage opportunities among diverse policy instruments, including cap-and-trade, taxes, and certain regulatory systems (Metcalf & Weisbach, 2010).

Another form of coordination can be unilateral instruments of economic protection, that is, border adjustments. In the case of a national carbon tax, this would take the form of a tax on imports that was equivalent to the implicit tax on the same domestically produced goods. In the case of a cap-and-trade system, this would take the form of an import-allowance-requirement. Such border adjustments are found as part of most existing, planned, and proposed national climate policies.

The Future of Carbon Pricing

The political responses to possible market-based approaches to climate policy in most countries have been and will continue to be largely a function of issues and structural factors that transcend the scope of environmental and climate policy. Because a truly meaningful climate policy—whether market based or conventional in design—will have significant impacts on economic activity in a wide variety of sectors (because of the pervasiveness of energy use in a modern economy) and in every region of a country, it is

not surprising that proposals for such policies bring forth significant opposition, particularly during difficult economic times.

In the United States, political polarization—which began some four decades ago, and accelerated during the economic downturn—has decimated what had long been the key political constituency in the Congress for environmental (and energy) action, namely, the middle, including both moderate Republicans and moderate Democrats (Stavins, 2011). Whereas Congressional debates about environmental and energy policy had long featured regional politics, they are now fully and simply partisan. In this political maelstrom, the failure of cap-and-trade climate policy in the U.S. Senate in 2010 was essentially collateral damage in a much larger political war.

It is possible that better economic times will reduce the pace—if not the direction—of political polarization. Furthermore, it is also possible that the ongoing challenge of large budgetary deficits in many countries will increase the political feasibility of new sources of revenue. When and if this happens, consumption taxes (as opposed to traditional taxes on income and investment) could receive heightened attention, and primary among these might be energy taxes, which can be significant climate policy instruments, depending on their design.

It is much too soon to speculate on what the future will hold for the use of market-based policy instruments for climate change. It is conceivable that two decades of relatively high receptivity in the United States, Europe, and other parts of the world to cap-and-trade and offset mechanisms will turn out to be no more than a relatively brief departure from a long-term trend of reliance on conventional means of regulation. On the other hand, it is also possible that the recent tarnishing of cap-and-trade in U.S. political dialogue will itself turn out to be a temporary departure from a long-term trend of increasing reliance on market-based environmental policy instruments. It is too soon to say.

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Notes

1. In the developing country context, refer to Coria and Sterner (2010) and Coria, Löfgren, and Sterner (2010) for an assessment of air pollutant emission trading in Chile.
2. Where market-based policy instruments have been employed, they have typically complimented rather than substituted for command-and-control regulations. Green taxes have been employed in some contexts for the purpose of raising revenue, with little concern for their impacts on environmental outcomes. The OECD (2001) provides an assessment of environmental taxes in a variety of pollution contexts. Beyond the OECD, Máca, Melichar, and

- Š asný (in press) evaluate environmental taxes and subsidies in central and eastern European countries, Cao, Ho, and Jorgenson (2009) assess green taxes in China, and Blackman (2010) and Sterner and Coria (2012) review a variety policy instruments in developing countries.
3. However, in special cases where emission monitoring and enforcement is particularly costly—such as for methane emissions in agriculture—a standards-based approach may be appropriate.
 4. Similar approaches could be undertaken to promote biological sequestration in forestry and agriculture and potentially emission-reduction projects (“offsets”) in other countries. See discussion of Emission Reduction Credit programs below.
 5. From a political perspective, environmentalists have expressed concerns about “emission certainty,” as an alternative to “cost certainty.” From an economic welfare perspective, cost certainty is more important than emission certainty if the slope of estimated marginal abatement costs is relatively steeper than the slope of estimated marginal benefits of abatement (Pizer, 2002; Weitzman, 1974).
 6. The 21 “member economies” of APEC (Asia-Pacific Economic Cooperation) are Australia, Brunei, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Taipei, Thailand, United States, and Viet Nam.
 7. Refer to Badiani, Jessoe, and Plant (in press) for a detailed discussion of electricity subsidies in the agricultural sector in India.
 8. The G20 agreement permits exclusion for subsidies that are explicitly targeted to low-income households. For example, the U.S. government has indicated that it considers the Low Income Home Energy Assistance Program to be exempt from the subsidy elimination commitment for this reason.
 9. In addition to the EU ETS and the New Zealand cap-and-trade system, the Japanese Voluntary Emissions Trading System has operated since 2006, and Norway operated its own emissions trading system for several years before joining the EU ETS in 2008. Legislation to establish cap-and-trade systems is under debate in Australia (combined with a carbon tax for an initial 3-year period) and in the Canadian provinces of Ontario and Quebec. Japan is considering a compulsory emissions trading system.
 10. The EU ETS covers all 27 member states plus Iceland, Liechtenstein, and Norway.
 11. This is the first commitment period of the Kyoto Protocol, 2008-2012.
 12. In May of 2011, New Jersey Governor Chris Christie announced that his state would withdraw from the system.
 13. In addition to RGGI, other regional and state efforts to limit GHGs in the United States have begun. One of the most prominent is California’s enactment of the Global Warming Solutions Act of 2006, which set a statewide GHG emissions limit for 2020 equal to California’s 1990 emissions level. In 2008, the California Air Resources Board proposed the use of a cap-and-trade program as a primary policy for achieving this target. The cap initially would cover electric generators and large industrial facilities, and its scope would later be expanded to include smaller facilities and the transportation sector. The cap-and-trade system is scheduled to commence operations in 2012.

14. Allowance prices have reflected these realities, falling from approximately US\$3 per ton of CO₂ at the first auction in September, 2008, to the floor price of US\$1.89 per ton in 2011.
15. Three states have used some of their auction revenue to help balance their overall state budgets.
16. See <http://www.climatechange.govt.nz/emissions-trading-scheme/>
17. Parties include 37 industrialized countries and emerging market economies of central and eastern Europe. Like the CDM, Joint Implementation (JI) was established as a project-based flexibility mechanism under the Kyoto Protocol. Unlike the CDM, JI applies to emission reduction projects carried out in an Annex I country (the host country) that has a national emissions target under the Protocol. JI projects generate credits, referred to as emission reduction units (ERUs), which can be used to cover increased emissions in other countries.
18. These are CO₂, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.
19. Note that carbon sequestration projects of forestation and reduced deforestation are not included in the CDM under the Kyoto Protocol's first commitment period, 2008-2012.
20. All carbon taxes reported in this subsection are in 2009 U.S. dollars, based on market exchange rates.
21. Greenhouse gas emissions in the offshore oil sector, representing 24% of the nation's emissions, are covered by both a (lower) carbon tax and the emission trading scheme (Government of Norway, 2009).
22. An important issue for national and subnational climate policies is the potential for interactions—some problematic and some positive—among overlapping policy instruments. On this, see McGuinness and Ellerman (2008); Fischer and Preonas (2010); Levinson (2010); Goulder and Stavins (2011); and Organization for Economic Cooperation and Development (2011).
23. New sources covered by the program initially bear less stringent performance standards that converge to the 12% objective over time (Province of Alberta, 2007).
24. Such an approach could be superior to some calls for sectoral policies that effectively set industry-specific performance standards common across participating developed and developing countries. This standard approach establishes walls between sectors that can increase the total mitigation cost for any given emission goal and eliminates opportunities to raise revenues, either through a carbon tax or an allowance auction, to benefit other social objectives.

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Bios

Joseph E. Aldy is assistant professor of public policy, Harvard Kennedy School; nonresident fellow, Resources for the Future; and faculty research fellow, National Bureau of Economic Research.

Robert N. Stavins is Albert Pratt professor of business and government, Harvard Kennedy School; university fellow, Resources for the Future; and research associate, National Bureau of Economic Research.

How additional is the Clean Development Mechanism?

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Authors

Dr. Martin Cames (Öko-Institut)
Dr. Ralph O. Harthan (Öko-Institut)
Dr. Jürg Füssler (INFRAS)
Michael Lazarus (SEI)
Carrie M. Lee (SEI)
Pete Erickson (SEI)
Randall Spalding-Fecher (Carbon Limits)

Head Office Freiburg

P.O. Box 17 71
79017 Freiburg

Street address

Merzhauser Straße 173
79100 Freiburg
Tel. +49 761 45295-0

Office Berlin

Schicklerstraße 5-7
10179 Berlin
Tel. +49 30 405085-0

Office Darmstadt

Rheinstraße 95
64295 Darmstadt
Tel. +49 6151 8191-0

info@oeko.de
www.oeko.de

INFRAS

Binzstrasse 23
8045 Zürich, Switzerland
Tel.: +41 44 205 95 95

Stockholm Environment Institute (SEI)

1402 Third Avenue, Suite 900
Seattle, WA 98101, USA
Tel.: +1 206 547-4000

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Abbreviations

CAR	Climate Action Reserve
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CO₂	Carbon Dioxide
CORSIA	Carbon Offset and Reduction Scheme for International Aviation
CP	Crediting Period
CPA	Component Project Activity of a PoA
DOE	Designated Operational Entity
EB	Executive Board of the CDM
ETS	Emissions Trading Scheme/System
f_{NRB}	Fraction of non-renewable biomass
GHG	Greenhouse Gas
GS	Gold Standard
JCM	Joint Crediting Mechanism
LED	Light Emitting Diode
MP	Methodologies Panel under the CDM EB
MRV	Monitoring, Reporting & Verification
NDC	Nationally Determined Contribution
NRB	Non-renewable Biomass
OECD	Organisation for Economic Co-operation and Development
PDD	Project Design Document
PMR	Partnership for Market Readiness (Initiative of the World Bank)
PoA	Programme of Activities
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VCS	Verified Carbon Standard

Executive summary

With the adoption of the Paris Agreement, which establishes a mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development (Article 6.4), it is clear that the Clean Development Mechanism (CDM) as a mechanism of the Kyoto Protocol will end. However, in terms of its standards, procedures and institutional arrangements, the CDM certainly forms an important basis for the elaboration and design of future international crediting mechanisms.

While this study provides important insights to **improve the CDM up to 2020**, the approach taken in this study could **also be applied more generally both to assess the environmental integrity of other compliance offset mechanisms**, as well as to avoid flaws in the design of new mechanisms being used or established for compliance. Many of the shortcomings identified in this study are inherent to crediting mechanisms in general, not least the considerable uncertainty involved in the assessment of additionality and the information asymmetry between project developers and regulators.

A fundamental feature of both the CDM and the mechanism under Article 6.4 is that they aim to achieve environmental integrity by ensuring that only real, measurable and additional emission reductions are generated. This study analyzes the opportunities and limits of the current CDM framework for ensuring environmental integrity, i.e. that projects are additional and that emission reductions are not overestimated. It looks at the way in which the CDM framework has evolved over time, assesses the likelihood that emission reductions credited under the CDM ensure environmental integrity and provides findings on the overall and project-type-specific environmental integrity of the CDM. In addition, it provides lessons learned and recommendations for improving additionality assessment that can be applied to crediting mechanisms generally, including to mechanisms to be used for compliance under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), and to mechanisms to be implemented under Article 6 of the Paris Agreement.

To ensure robust judgements, we have systematically analyzed the determination of additionality, the determination of baseline emissions and other issues that are key for environmental integrity. Towards this goal, we have evaluated those general CDM rules that are particularly relevant for environmental integrity and assessed in the case of specific project types the likelihood that they deliver real, measurable and additional emission reductions. Based on our analysis **key findings** include the following:

- Most **energy-related project types** (wind, hydro, waste heat recovery, fossil fuel switch and efficient lighting) are **unlikely to be additional**, irrespective of whether they involve the increase of renewable energy, energy efficiency improvements or fossil fuel switch.
- **Industrial gas projects** (HFC-23, adipic acid, nitric acid) are **likely to be additional** as long as the mitigation is not otherwise promoted or mandated through policies.
- **Methane projects** (landfill gas, coal mine methane) have a **high likelihood of being additional**.
- **Biomass power projects** have a **medium likelihood of being additional** overall because the assessment of additionality very much depends on the local conditions of individual projects.
- The additionality of the current pipeline of **efficient lighting projects** using small-scale methodologies is **highly unlikely** because in many host countries the move away from incandescent bulbs is well underway.

- In the case of **cook stove projects**, CDM revenues are often insufficient to cover the project costs and to make the project economically viable. Cook stove projects are also likely to considerably **over-estimate the emission reductions** due to a number of unrealistic assumptions and default values.

Overall, our results suggest that 85% of the projects covered in this analysis and 73% of the potential 2013-2020 Certified Emissions Reduction (CER) supply have a low likelihood that emission reductions are additional and are not over-estimated. Only 2% of the projects and 7% of potential CER supply have a high likelihood of ensuring that emission reductions are additional and are not over-estimated.

Our analysis suggests that the **CDM still has fundamental flaws in terms of overall environmental integrity**. It is likely that the large majority of the projects registered and CERs issued under the CDM are not providing real, measurable and additional emission reductions.

When considering the Paris Framework, the most important change from the Kyoto architecture is that all countries have made mitigation pledges in the form of Nationally Determined Contributions (NDC). An important implication is that host countries with ambitious and economy-wide mitigation pledges have **incentives to limit international transfers of credits** to activities with a **high likelihood of delivering additional emission reductions**, so that transferred credits do not compromise the host country's ability to reach their own mitigation targets. A second important implication is that countries should **only transfer emission reductions where this is consistent with their NDC**, implying that baselines may have to be determined in relation to the host country's mitigation pledges rather than using a 'counterfactual' business as usual scenario as a default.

Taking into account this context and the findings of our analysis, we recommend that the role of crediting in future climate policy should be revisited:

- We recommend potential buyers of CERs to limit any **purchase of CERs** to either **existing projects which risk discontinuing GHG abatement** when the incentive from the CDM ceases, such as landfill gas flaring or to new **projects among** the few project types identified that **have a high likelihood of ensuring environmental integrity**.
- Buyers should **accompany purchase of CERs with support for a transition of host countries to broader and more effective climate policies**. In the short-term, where offsetting is used, it should only be on the basis that purchase of CERs does not undermine the ability of host countries to achieve their mitigation pledges.
- Given the inherent shortcomings of crediting mechanisms, we recommend focusing **climate mitigation efforts** on forms of carbon pricing **that do not rely extensively on credits** and on measures such as results-based climate finance that does not result in the transfer of credits or offsetting the purchasing country's emissions. International crediting mechanisms should play a limited role after 2020, to address specific emission sources in countries that do not have the capacity to implement alternative climate policies.
- To enhance the environmental integrity of international crediting mechanisms such as the CDM and to make them more attractive to both buyers and host countries with ambitious NDCs, we recommend limiting such mechanisms to **project types** that have a **high likelihood of delivering additional emission reductions**. We also recommend reviewing methodologies systematically to address risks of over-crediting, as identified in this report.
- We also recommend provisions that provide strong incentives to the Parties involved to ensure the integrity of international unit transfers. This includes robust accounting provisions to **avoid double counting** of emission reductions, but could also extend to other elements, such as im-

plementation of **ambitious mitigation pledges** as a prerequisite to participating in international mechanisms.

With the adoption of the Paris Agreement, implementing more effective climate policies becomes key to bringing down emissions quickly on a pathway consistent with well below 2°C. Our findings suggest that **crediting approaches** should play a **time-limited and niche role** focusing on those project types for which additionality can be relatively assured. Crediting should serve as a stepping-stone to other, more effective policies to achieve cost-effective mitigation. Continued support to developing countries will be key. We recommend using new innovative sources of climate finance, such as revenues from auctioning of emission trading scheme allowances, rather than crediting for compliance, to support developing countries in implementing their NDCs.

Summary

Aim of the study

With the adoption of the Paris Agreement, which establishes a mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development (Article 6.4), it is clear that the role of the CDM as a mechanism of the Kyoto Protocol will end. However, in terms of its standards, procedures and institutional arrangements, the **CDM** certainly forms an **important basis** for the elaboration and design of future mechanisms for international carbon markets. One key feature of both the CDM and the mechanism under Article 6.4 is that they should generate **real and additional** emission reductions. In other words, emission reductions that are credited and transferred should not have occurred in the absence of the mechanism and should not be overestimated. This study analyzes the opportunities and limits of the current CDM framework and the way in which it has evolved over time and been applied to concrete projects. It provides findings on the **overall and project-type-specific environmental performance of the CDM** in the form of estimates of the **likelihood that the CDM results in real and additional emission reductions**. In addition, it provides lessons and recommendations for improving additionality assessment that can be applied to future crediting mechanisms.

Methodological approach

The main focus of this study is to assess the extent to which the CDM meets its objective to deliver “real, measurable and additional” emission reductions. In order to make well-founded judgements about the overall and project-type-specific likelihood of additionality of CDM projects, we systematically analyze CDM rules and how they have been applied to real projects in practice. We examined the rules for 1) **additionality assessment**, for 2) the **determination of baseline emissions** and 3) a number of **other issues** including the length of crediting period, leakage effects, perverse incentives, double counting, non-permanence, monitoring provisions and third party validation and verification. We approach these aspects from two different perspectives: we evaluate 1) **general CDM rules** that are particularly relevant for the delivery of real, measurable and additional emission reductions and we evaluate 2) **specific project types** with a view to assessing how likely these project types deliver additional emission reductions. To assess the impacts of our analysis, we further estimate the **potential 2013-2020 CER supply** from different project types.

Project-types-specific results

Table 1-1 (p. 13) below provides an overview of the findings on environmental integrity based on the detailed analysis of individual project types. **Most energy-related project types** (wind, hydro, waste heat recovery, fossil fuel switch and efficient lighting) are **unlikely to be additional**, irrespectively of whether they involve the increase of renewable energy, efficiency improvements or

fossil fuel switch. An important reason why these project types are unlikely to be additional is that the revenue from the CDM for these project types is small compared to the investment costs and other cost or revenue streams, even if the CER prices would be much higher than today. Moreover, many projects are economically attractive, partially due to cost savings from project implementation (e.g. fossil fuel switch, waste heat recovery) or domestic support schemes (renewable power generation).

Table 1-1: How additional is the CDM?

	CDM projects			Potential CER supply 2013 to 2020		
	Low	Medium	High	Low	Medium	High
	... likelihood of emission reductions being real, measurable, additional					
	No. of projects			Mt CO ₂ e		
HFC-23 abatement from HCFC-22 production						
Version <6		5			191	
Version >5			14			184
Adipic acid		4			257	
Nitric acid			97			175
Wind power	2.362			1.397		
Hydro power	2.010			1.669		
Biomass power		342			162	
Landfill gas		284			163	
Coal mine methane		83			170	
Waste heat recovery	277			222		
Fossil fuel switch	96			232		
Cook stoves	38			2		
Efficient lighting						
AMS II.C, AMS II.J	43			4		
AM0046, AM0113			0			0
Total	4.826	718	111	3.527	943	359

Sources: Authors' own calculations

Industrial gas projects (HFC-23, adipic acid, nitric acid) can generally be considered **likely to be additional** as long as they are not promoted or mandated through policies. They use end-of-pipe-technology to abate emissions and do not generate significant revenues other than CERs. HFC-23 and adipic acid projects triggered strong criticism because of their relatively low abatement costs, which provided perverse incentives and generated huge profits for plant operators. In the case of HFC-23 and nitric acid projects, perverse incentives have been adequately addressed. With regard to **adipic acid** projects, the risks for **carbon leakage have not yet been addressed**.

Methane projects (landfill gas, coal mine methane) also have a **high likelihood of being additional**. This is mainly because carbon revenues have, due to the GWP of methane, a relatively large impact on the profitability of these project types. However, both project types face **issues with regard to baseline emissions and perverse incentives** and may thus lead to over-crediting.

Biomass power projects have a **medium likelihood of being additional** since their additionality very much depends on the local conditions of individual projects. In some cases, biomass power can already be competitive with fossil generation while in other cases domestic support schemes provide incentives for increased use of biomass in electricity generation. However, where these conditions are not prevalent, projects **can be additional**, particularly if CER revenues for **methane avoidance can be claimed**. Biomass projects also face other issues, in particular with regard to demonstrating that the **biomass used is renewable**.

The additionality of **efficient lighting** projects using small-scale methodologies is **highly problematic** because there were large PoAs in countries in which the move away from incandescent bulbs was well underway. The **new methodologies** address these problems but they are **not mandatory** and the small-scale methodologies are, while the remaining small-scale methodology could still allow for automatic additionality for CFL programmes.

For **cook stove** projects, CDM revenues are often insufficient to cover the project costs and to make the project economically viable. Particularly in urban areas, the additionality of these project types is questionable. Cook stove projects are also likely to considerably over-estimate the emission reductions due to a number of unrealistic assumptions and default values.

Overall environmental assessment

Based on these considerations, we estimate that **85% of the covered projects and 73% of the potential 2013-2020 CER supply have a low likelihood** of ensuring environmental integrity (i.e. ensuring that emission reductions are additional and not over-estimated). Only **2% of the projects and 7% of potential CER supply have a high likelihood** of ensuring environmental integrity. The remainder, 13% of the projects and 20% of the potential CER supply, involve a medium likelihood of ensuring environmental integrity (Table 1-1, p. 13).

Compared to earlier assessments of the environmental integrity of the CDM, our analysis suggests that the CDM's **performance as a whole has anything but improved**, despite improvements of a number of CDM standards. The main reason for this is a **shift in the project portfolio towards projects with more questionable additionality**. In 2007, CERs from projects that do not have revenues other than CERs made up about two third of the project portfolio, whereas the 2013-2020 CER supply potential of these project types is only less than a quarter. A second reason is that the **CDM Executive Board (EB)** has not only improved rules but also **made simplifications** that undermined the integrity. For example, positive lists have been introduced for many technologies, for some of which the additionality is questionable and some of which are promoted or required by policies and regulations in some regions (e.g. efficient lighting). A third reason is that the **CDM EB** did not take effective means to **exclude project types** with a low likelihood of additionality. While positive lists have been introduced, project types with more questionable additionality have not been excluded from the CDM. Standardized baselines provide a further avenue to demonstrating additionality but do not reduce the number of projects wrongly claiming additionality. The improvements to the CDM mainly aimed at **simplifying requirements and reducing the number of false negatives** but did not address the false positives.

The result of our analysis therefore suggests that the **CDM has still fundamental flaws in terms of environmental integrity**. It is likely that the large majority of the projects registered and CER issued under the CDM are not providing real, measureable and additional emission reductions. Therefore, the experiences gathered so far with the CDM should be used to improve both the CDM rules for the remaining years and to avoid flaws in the design of new market mechanisms being established under the UNFCCC.

Recommendations for improving general additionality rules

For an additionality test to function effectively, it must be able to assess, with high confidence, whether the CDM was the deciding factor for the project investment. However, additionality tests can never fully avoid wrong conclusions. **Information asymmetry** between project developers and regulators, combined with the economic incentives for project developers to have their project recognised as additional, are a major challenge. We carefully scrutinised the **four main approaches** used to determine additionality. Our analysis shows that **prior consideration** is a necessary and important but not sufficient step for ensuring additionality of CDM projects and that this step largely

works as intended. The subjective nature of the **investment analysis** limits its ability to assess with high confidence whether a project is additional. Especially for project types in which the financial impact of CERs is relatively small compared to variations in other parameters, such as large power projects, doubts remain as to whether investment analysis can provide a strong 'signal to noise' ratio. The **barrier analysis** has lost importance as a stand-alone approach of demonstrating additionality. Non-monetized barriers remain subjective and are often difficult to verify by the DOEs. In general, the **common practice analysis** can be considered a more objective approach than the barriers or investment analysis due to the fact that information on the sector as a whole is considered rather than specific information of a project only. However, the way in which common practice is currently assessed needs to be substantially reformed to provide a reasonable means of demonstrating additionality; it is important to reflect that market penetration is not for all project types a good proxy for the likelihood of additionality.

Against this background, we recommend that the **common practice analysis** is given a **more prominent role in additionality determination** though only after a significant reform:

- The 'one-size-fits-all' approach of determining common practice should be replaced by **sector- or project-type-specific guidance**, particularly with regard to distinguishing between different and similar technologies and with regard to the threshold for market penetration.
- The **technological potential** of a certain technology should also be taken into account in order to avoid that a project is deemed additional although the technological potential is already largely exploited in the respective country.
- The common practice analysis should at least cover the **entire country**. However, if the absolute number of activities in the host country does not ensure statistical confidence, the scope needs to be extended to other countries.
- As a default, all CDM projects should be included in the common practice analysis, unless a methodology includes different requirements.

We further recommend that the **investment analysis** is excluded as an approach for demonstrating additionality for projects types in which the 'signal to noise' ratio is insufficient to determine additionality with the required confidence. For those project types in which the investment analysis would still be eligible, the project participant must confirm the all information is true and accurate and that the investment analysis is consistent with the one presented to debt or equity funders. The **barrier analysis** should be abolished entirely as a separate approach in the determination of additionality at project level (though it may be used for determining additionality of project types). Barriers that can be monetized should be addressed in the investment analysis while all other barriers should be addressed in the context of the reformed common practice analysis.

In addition, we recommend improvements to key general CDM rules:

- **Renewal and length of crediting periods:** At the renewal of the crediting period the validity of the baseline scenario should be assessed for CDM project types for which the baseline is the 'continuation of the current practice' or if changes such as retrofits could also be implemented in the baseline scenario at a later stage. Crediting periods of project types or sectors that are highly dynamic or complex should be limited to one single crediting period. Moreover, generally abolishing the renewal of crediting periods while allowing a somewhat longer single crediting period for project types that require a continuous stream of CER revenues to continue operation may be considered.
- **Positive Lists:** The review of validity should also be extended to project types covered by the microscale additionality tool. In addition, positive lists must address the impact of na-

tional policies and measures to support low emission technologies (so-called E- policies). To maintain environmental integrity of the CDM overall, positive lists should be accompanied by negative lists.

- **Standardized baselines:** Once established in a country, their use should be made mandatory and all CDM facilities should be included in the peer group used for the establishment of standardized baselines.
- **Consideration of domestic policies (E+/E-):** The risk of undermining environmental integrity by over-crediting emission reductions is likely to be larger than the creation of perverse incentives for not establishing E- policies. Therefore, adopted policies and regulations reducing GHG emissions (E-) should be included when setting or reviewing crediting baselines while policies that increase GHG emissions (E+) should be discouraged by being excluded from the crediting baseline where possible.
- **Suppressed demand:** An expert process should be established to balance the risks of over-crediting with the potential increased development benefits. In addition, the application of suppressed demand could be restricted to countries where development needs are highest and the potential for over-crediting is the smallest.

Recommendations to improve project type specific rules

Industrial gas projects: Adipic acid production is a highly globalised industry and all plants are very similar in structure and technology. Therefore, a global benchmark of 30 kg/t applied to all plants would prevent carbon leakage, considerably reduce rents for plant operators, and allow the methodology to be simplified by eliminating the calculation of the N₂O formation rate. After issues related to perverse incentives have been successfully addressed through ambitious benchmarks, **HFC-23** and **nitric acid** projects would provide for a high degree of environmental integrity. However, industrial gas projects provide for low-cost mitigation options. These emission sources could therefore also be addressed through domestic policies, such as regulations, or by including the emission sources in domestic or regional ETS, and help countries achieve their Nationally Determined Contributions (NDCs) under the Paris Agreement. Parties to the Montreal Protocol are also considering regulating HFC emissions. We therefore recommend that HFC-23 projects are not eligible under the CDM.

Energy-related project types: We recommend that these project types should, in principle, no longer be eligible under the CDM. However, in least developed countries, some project types, particularly wind and small-scale hydropower plants, may still face considerable technological and/or cost barriers. These project types may thus remain **eligible in least developed countries**. In cases in which **biomass power generation** is not competitive with fossil generation technologies, CER revenues can have a significant impact on the profitability of a project, particularly if credits for methane avoidance are claimed as well. We therefore recommend that only biomass power projects avoiding methane emissions remain eligible under the CDM, provided that the corresponding provisions in the applicable methodologies are revised appropriately.

With regard to **demand-side energy efficiency** project types with distributed sources – **cook stoves** and **efficient lighting** – we have identified concerns which question their overall environmental integrity. However, if cook stove methodologies were revised considerably, including more appropriate values for the fraction of non-renewable biomass and if approaches for determining the penetration rate of efficient lighting technologies were made mandatory for all new projects and CPAs while the older methodologies are withdrawn, we recommend that these project types should remain eligible.

Methane projects: Landfill gas and coal mine methane projects are likely to be additional. However, there are concerns in terms of over-crediting, which should be addressed through improvements of the respective methodologies, particularly by introducing region-specific soil oxidations factors and requesting DOEs to verify that landfilling practices are not changed. With regard to landfill gas, we recommend that this project type only be eligible in countries that have policies in place to transition to more sustainable waste management practices.

Implication for the future use of international carbon markets

The **CDM has provided many benefits**. It has brought innovative technologies and financial transfers to developing countries, helped identify untapped mitigation opportunities, contributed to technology transfer, may have facilitated leapfrogging the establishment of extensive fossil energy infrastructures and created knowledge, institutions, and infrastructure that can facilitate further action on climate change. Some projects provided significant sustainable development co-benefits. Despite these benefits, after well over a decade of gathering considerable experience, the **enduring limitations** of GHG crediting mechanisms are apparent.

Firstly and most notably, the **elusiveness of additionality** for all but a limited set of project types is very difficult, if not impossible, to address. Information asymmetry between project participants and regulators remains a considerable challenge. This challenge is **difficult to address through improvements of rules**. Secondly, international crediting mechanisms involve an **inherent and unsolvable dilemma**: either they might create **perverse incentives for policy makers** in host countries not to implement policies or regulations to address GHG emissions – since this would reduce the potential for international crediting – or they **credit activities that are not additional** because they are implemented due to policies or regulations. Thirdly, for many project types, the **uncertainty of emission reductions** is considerable. Our analysis shows that risks for over-crediting or perverse incentives for project owners to inflate emission reductions have only partially been addressed. It is also highly uncertain for how long projects will reduce emissions, as they might anyhow be implemented at a later stage without incentives from a crediting mechanism – an issue that is not addressed at all under current CDM rules. A further overarching shortcoming of crediting mechanisms is that they do **not make all polluters pay but rather they make them subsidize the reduction of emissions**. Most of these shortcomings are inherent to using crediting mechanisms, which **questions the effectiveness of international crediting mechanisms as a key policy tool** for climate mitigation.

The future role of crediting mechanisms should therefore be revisited in the light of the Paris Agreement. Several **elements of the CDM could be used** when implementing the mechanism established under Article 6.4 of the Paris Agreement or when implementing (bilateral) crediting mechanisms under Article 6.2. However, the context for using crediting mechanisms has fundamentally changed. The most important change to the Kyoto architecture is that all countries have to submit NDCs that include mitigation pledges or actions. The Paris Agreement therefore requires countries to **adjust their reported GHG emissions** for international transfers of mitigation outcomes, in order to **avoid double counting** of emission reductions. This implies that the baseline, and therefore additionality, may be determined in relation to the mitigation pledges rather than using a 'counterfactual' scenario as under the CDM, and that countries could only transfer emission reductions that were beyond what they had pledged under their NDC. A second important implication relates to the incentives for host countries to ensure integrity. Host countries with ambitious and economy-wide mitigation pledges would have incentives to ensure that international transfers of credits are limited to activities with a high likelihood of delivering additional emission reductions. However, our analysis showed that only a few project types in the current CDM project portfolio have a high likelihood of providing additional emission reductions, whereas the environmental integrity is questionable and uncertain for most project types. In combination, this suggests that the

future supply of credits may mainly come either from emission sources not covered by mitigation pledges or from countries with weak mitigation pledges. In both cases, host countries would not have incentives to ensure integrity and credits lacking environmental integrity could increase global GHG emissions.

At the same time, demand for international credits is also uncertain. Only a few countries have indicated that they intend to use international credits to achieve their mitigation pledges. An important source of demand could come from the market-based approach pursued under the International Civil Aviation Organization (ICAO), and possibly from an approach pursued under the International Maritime Organization (IMO). For these demand sources, avoiding double counting with emission reductions under NDCs will be a challenge that is similar to that of avoiding double counting between countries. A number of institutions are exploring the use of crediting mechanisms as a vehicle to disburse results-based climate finance without actually transferring any emission reduction units. This way of using crediting mechanisms could be more attractive to developing countries; they would not need to add exported credits to their reported GHG emissions, as long as the credits are not used by donors towards achieving mitigation pledges. The implications of non-additional credits are also different: they would not directly affect global GHG emissions, but could lead to a less effective use of climate finance. However, donors of climate finance aim to ensure that their funds be used for actions that would not go ahead without their support. Given the considerable shortcomings with the approaches for assessing additionality, we recommend that donors should not rely on current CDM rules in assessing the additionality of projects considered for funding.

Taking into account this context and the findings of our analysis, we recommend that the role of crediting in future climate policy should be revisited:

- We recommend potential buyers of CERs to limit any **purchase of CERs** to either existing **projects that are at risk of stopping GHG abatement** or the few project types that have a **high likelihood of ensuring environmental integrity**. Continued purchase of CERs should be accompanied with a plan and support to host countries to **transition to broader and more effective climate policies**. We further recommend to pursue the purchase and cancellation of CERs as a form of **results-based climate finance** rather than using CERs for compliance towards meeting mitigation targets.
- Given the inherent shortcomings of crediting mechanisms, we recommend **focusing climate mitigation efforts on** forms of carbon pricing that do **not rely extensively on credits**, and on measures such as results-based climate finance that do not necessarily serve to offset other emissions. International crediting mechanisms should play a limited role after 2020, to address specific emission sources in countries that do not have the capacity to implement broader climate policies.
- To enhance the integrity of international crediting mechanisms such as the CDM and to make them more attractive to both buyers and host countries with ambitious NDCs, we recommend **limiting** such mechanisms to **project types** that have a **high likelihood of delivering additional emission reductions**. We recommend reviewing methodologies systematically to address risks of over-crediting, as identified in this report. We further recommend revisiting the current approaches for additionality, with a view to abandoning subjective approaches and adopting more standardized approaches. We also recommend curtailing the length of the crediting periods with no renewal.
- Given the high integrity risks of crediting mechanisms, we recommend provisions that provide strong incentives to the Parties involved to ensure integrity of international unit transfers. This includes robust accounting provisions to **avoid double counting** of emission re-

ductions, but could also extend to other elements, such as **ambitious mitigation pledges** as a prerequisite to participating in international mechanisms.

In conclusion, we believe that the CDM has had a very important role to play, in particular in countries that were not yet in a position to implement domestic climate policies. However, our assessment confirms, alongside other evaluations, the strong shortcomings inherent to crediting mechanisms. With the adoption of the Paris Agreement, implementing more effective climate policies becomes key to bringing down emissions quickly on a pathway consistent with well below 2°C. Our findings suggest that **crediting approaches** should play a **time-limited and niche-specific role** in which additionality can be relatively assured, and the mechanism can serve as stepping-stone to other, more effective policies to achieve cost-effective mitigation. In doing so, continued support to developing countries will be key. We recommend using new innovative sources of finance, such as revenues from auctioning of ETS allowances, rather than international crediting mechanisms, to support developing countries in implementing their NDCs.

1. Introduction

With almost 7,700 Clean Development Mechanism (CDM) projects and almost 300 programmes of activities (PoAs) registered and more than 1.6 billion Certified Emissions Reductions (CER) issued, the CDM has developed into an important component of the global carbon market. However, its role in the future remains uncertain. With the adoption of the Paris Agreement, which establishes a mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development (Article 6.4), it is clear that the role of the CDM as a mechanism of the Kyoto Protocol will end, most likely soon after 2020.

However, in terms of its standards, procedures and institutional arrangements, the CDM forms certainly an important base for the elaboration and design of future mechanisms for international carbon markets. The mechanism established under Article 6.4 of the Paris Agreement includes several provisions that are similar to the CDM. Parties also decided that the rules, modalities and procedures of the new mechanism should be adopted on the basis of the “experience gained with and lessons learned from existing mechanisms”. Moreover, experiences gained from the CDM can also be used for the development of domestic baseline and credit policies both in developed and developing countries.

One key feature of both the mechanism under the Paris Agreement (Article 6.4) and domestic baseline and credit policies is that they should generate real and additional emission reductions, in other words: the credited and transferred emission reductions should not have occurred in the absence of the mechanism and or policy. The ability to deliver such a result depends heavily on having a reasonably effective way to assess additionality both for specific project types and on an aggregate basis, and to set a baseline such that the number of credits issued does, in total, not exceed actual reductions.

Demonstrating additionality and setting baselines are the areas in which the most concerns have been raised with the CDM, in particular regarding the investment, barrier and common practice analysis and the assessment of prior consideration. Given its counterfactual nature, asymmetries of information regarding costs, financing, barriers and local project conditions, and signal-to-noise issue, it has been difficult to implement a reliable method for assessing additionality and setting baselines. Other factors that also affect the overall mitigation outcome are the length of the crediting period used, how leakage concerns are dealt with and whether any perverse incentives are addressed, among others.

The difficulties with these traditional approaches have resulted in further refinement and revision of these approaches as well as the introduction of several alternative approaches to setting of baselines and testing additionality. Examples include the use of default values, performance benchmarks or penetration rates and discounting approaches. More fundamental changes include the use of highly standardized baselines and additionality tests at the sectoral level. It remains to be seen whether the methodological difficulties with highly standardized approaches can be solved to make them operational, and whether they will result in a lower likelihood of non-additional credits being issued.

The additionality of CDM projects has been assessed in the past in several general and project-specific studies. Much of the research was conducted before the improvement of rules and the introduction of new approaches, such as standardized baselines. This study aims to assess whether and how these changes have affected the quality of CDM projects, focusing on the project portfolio available in the second commitment period of the Kyoto Protocol and taking due account of the improvements implemented over time.

In order to make well-founded judgements about the overall and project-type-specific likelihood of additionality of CDM projects, a systematic assessment is required of the CDM rules and how they have been applied to real projects in practice. A similar exercise should be carried out for the different reforms suggested to the existing rules. This study therefore analyzes the opportunities and limits of the current CDM framework and the way in which it has evolved over time and been applied to concrete projects. It provides robust and quantified conclusions on the overall and project-type-specific environmental performance of the CDM in the form of estimates of the likelihood that the CDM results in real and additional emission reductions.

2. Methodological approach

2.1. General research approach

The main focus of this study is to assess the extent to which the CDM meets its objective stipulated in Article 12.5(c) of the Kyoto Protocol to deliver “real, measurable and additional” emission reductions. Based on the findings, concrete recommendations are made for further reform of the CDM and implications for the future role of the CDM are discussed.

There are two principal challenges to evaluating of the ability of the CDM to deliver additional emission reductions: the inherent uncertainty of a counter-factual baseline and the uncertainty and bias associated with project and baseline data. Therefore, any assessment of the extent of non-additional or otherwise under- or over-credited CDM activity can therefore only provide rough and directional estimates. Project design documents (PDDs) and monitoring reports provide substantial data and assumptions. However, these data and assumptions are often limited (they may not cover all relevant activity, especially non-CDM activity) and can involve considerable judgment by parties that have an interest in the outcome (e.g. selecting among alternative projections of future fuel prices) made for the purpose of meeting CDM requirements.

We examine the three main aspects as regards whether the CDM delivers additional emission reductions:

1. **Additionality assessment:** The assessment of additionality refers to the question of whether a project was implemented due to the CDM. Additionality is the most important prerequisite to providing an emissions benefit. If a project would have been implemented in the absence of the CDM incentives, the emission reductions would have occurred anyway. If a Party uses non-additional CERs rather than reducing its own emissions to meet its emission reduction commitments, global GHG emissions would be higher than they would have otherwise been. Because errors in additionally determination affect the validity of an entire project’s CERs, additionality assessment forms the main focus of this study.
2. **Determination of baseline emissions:** A second important aspect is how the baseline emissions are determined. Determining baseline emissions is associated with considerable uncertainty. A crediting baseline that is above the emissions that would most likely occur in the absence of the project can lead to significant over-crediting. Vice versa, ambitious baselines that are below the emissions that would most likely occur in the absence of the project, can result in under-crediting.
3. **Other issues:** A number of other issues are important to deliver additional emission reductions, including:
 - the length of crediting period,
 - criteria for the renewal of the crediting period,

- approaches for determining indirect emission effects, such as leakage effects,
- the way in which perverse incentives for both project developers and policy makers are addressed,
- the extent to which double counting of emission reductions within the mechanism and with other mechanisms and pledges is avoided,
- whether potential non-permanence of emission reductions is sufficiently addressed,
- whether monitoring provisions are appropriate, and
- the effectiveness of the regulatory framework for third party validation and verification.

We also touch upon these issues, in particular when they raise concerns with regard to the integrity of the CDM. They do not, however, form the focus of this study.

In our examination, we approach these aspects from two different perspectives:

- **General CDM rules:** In Chapter 3, we evaluate approaches for determining general CDM additionality rules that are particularly relevant for the delivery of real, measurable and additional emission reductions. This includes an assessment of innovative and potentially more objective approaches for setting baselines and determining additionality and an analysis of whether and how these approaches could improve the determination of additionality under the CDM.
- **Specific project types:** In Chapter 4, we evaluate specific project types with a view to assessing how likely these project types deliver additional emission reductions. A separate evaluation by project type is important as the likelihood of additional emission reductions can differ significantly among project types. This evaluation covers the major project types contributing to a large share of the emission reductions in the CDM portfolio.

Drawing on findings from Chapters 3 and 4, we provide an overall assessment of the additionality of the CDM project portfolio in Chapter 5. In Chapter 6, we provide a summary of key recommendations for further reform of the CDM. Finally, we discuss the implications for the future use of the CDM in Chapter 7.

The study employs several analytical methodologies and approaches:

- **Literature analysis** forms the basis for our evaluation of general CDM rules, specific project types, and innovative approaches towards baseline setting and additionality assessment.
- **Qualitative assessment of relevant CDM rules** with a view to their ability for ensuring additional emission reductions. We identify potential shortcomings in the current rules and propose options for addressing them.
- **Empirical, quantitative evaluation of how the CDM rules are applied** through analysis of a representative random sample of projects. The analysis will be based on information in PDDs and validation reports and, where necessary, also monitoring and verification reports. The projects will be identified through stratified random sampling, aiming to ensure representativeness of host countries and project types. This empirical analysis aims to identify possible shortcomings in the application of general CDM rules. The information and data to be evaluated is specific for each of the identified general CDM rules and the questions identified. The methodological approach of the empirical evaluation is further specified in Section 2.2 below.
- **Economic assessment** of the feasibility of different project types is another important building block of the study. The economic assessment is conducted for the evaluation of

specific project types in Chapter 4. The methodological approach of the empirical evaluation is further specified in Section 2.3 below.

- **Sectoral analysis** of the market situation for specific project types to assess whether the technology has often already been implemented without the CDM and whether an observed market uptake occurs due to the CDM. The sectoral analysis is conducted for the evaluation of specific project types in Chapter 4. The methodological approaches are further specified in the corresponding sections.

We use the CDM rules and the CDM project portfolio as of 1 January 2014 as the basis for the assessment.

To assess the impacts of our analysis, we further estimate the potential 2013-2020 CER supply for different project types. The method used to estimate the potential CER volume is described in Section 2.3.

2.2. Empirical evaluation of CDM projects

The assessment of key CDM rules for additionality demonstration in Chapter 3 is based on an in-depth evaluation of PDDs, validation reports, etc. of randomly selected CDM projects. The project samples were randomly drawn from the so-called CDM project pipeline as of 1 January 2014 (UNEP DTU 2014). This pipeline is a compilation of certain information and data provided in the project design document (PDD) of each CDM project. For this assessment, only registered CDM projects were taken into account as the PDDs usually undergo significant changes during the validation period. To ensure representativeness, the samples were stratified by the following characteristics and strata:

- Location (host country/region)
 - China
 - India
 - Asia & Pacific
 - Brazil
 - Latin America
 - Rest of the World
- Technology
 - Industry (HFC-23, N₂O, cement, energy efficiency, energy distribution, etc.)
 - Electricity generation from hydro
 - Electricity generation from wind
 - Electricity generation from renewable energy (solar, tidal, etc.)
 - Other renewable energy (biomass, geothermal, mixed renewable energy, etc.)
 - Waste sector (landfill gas, methane avoidance, etc.)
 - Other (afforestation, reforestation, agriculture, transport, etc.)
- Scale
 - Large-scale projects
 - Small-scale projects
- Time (registration year)
 - Pre 2010
 - In 2010 or 2011
 - Post 2011.

The in-depth assessment of project samples was conducted for the key additionality determination rules: investment analysis (Section 3.2), barrier analysis (Section 3.3) and common practice analy-

sis (Section 3.3). For each of these rules a separate sample of 30 randomly selected CDM projects was drawn.

Since the CDM project pipeline did not include information about which option of additionality determination was applied in the PDD, we had to conduct a two-step sampling: In the first step, we drew a representative sample of 300 projects. For each of the projects of this sample we identified which additionality determination rules were applied so that we could use this sample as population for the second sampling step in which we drew the samples for each of the additionality determination rules.¹

2.3. Estimation of the potential CER supply

We estimate the potential CER supply² for the purpose of assessing the overall integrity of the CDM based on our findings for specific project types or specific additionality tests. The potential CER supply is estimated mainly on the basis of the CDM pipeline as of 1 January 2014 (UNEP DTU 2014). Moreover, we included additional information from a similar pipeline which is provided by IGES (2014). All CDM projects which were registered by 1 January 2014 are taken into account (7,418). In the case of industrial gas projects (HFC-23, adipic acid, nitric acid), some baseline and monitoring methodologies were significantly revised, which has a major impact on the potential CER supply in the second and third crediting periods. For these projects, we use specific bottom-up estimates derived from project-specific information (Schneider & Cames 2014).

We distinguish the CER supply potential considering the duration of the commitment periods under the Kyoto Protocol:

- from credit start to the end of 2012,
- from the beginning of 2013 to the end of 2020 and
- from the beginning of 2021 to the end of the crediting periods (CP).

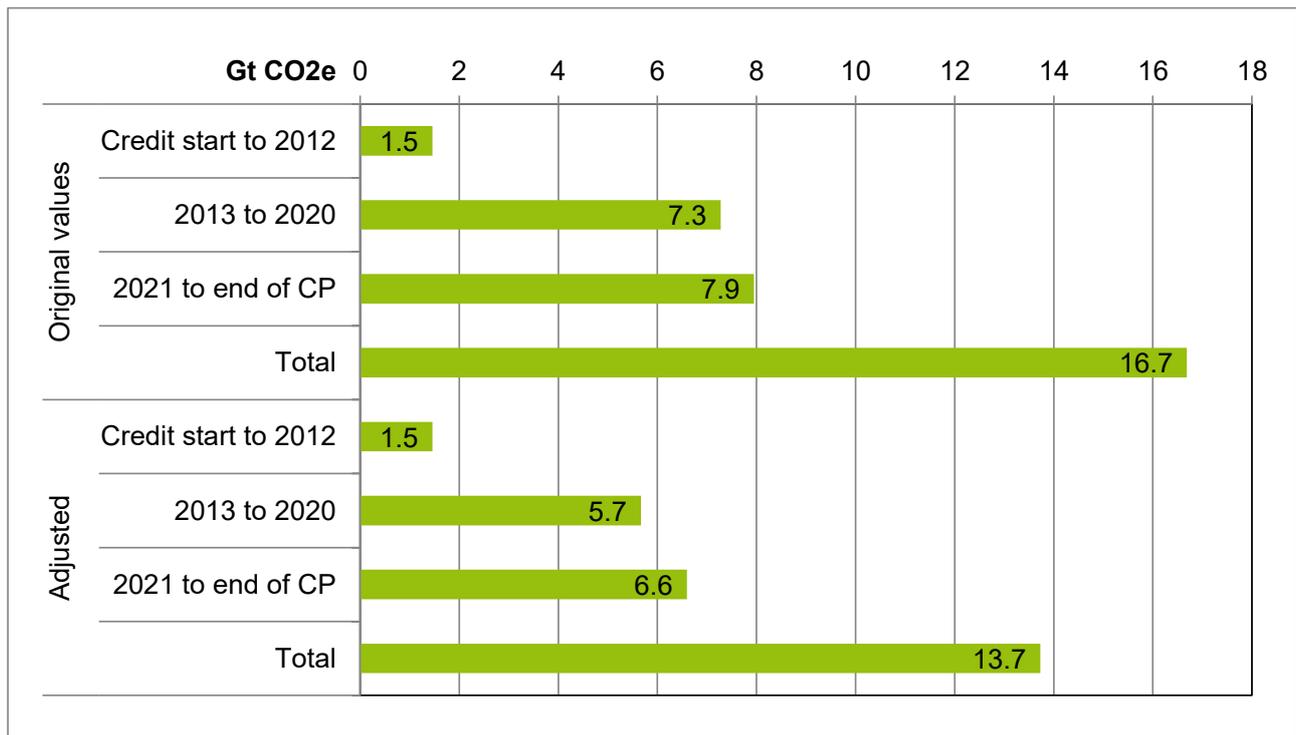
Our study is focused on the period of 2013 to 2020.

Figures for the period from credit start to the end of 2012 reflect the actual CER issuance rather than the potential supply (UNFCCC 2015a). For the latter two periods, we take into account the issuance success rate provided in the CDM pipeline and adjust the expected CER supply accordingly. For some projects, more CERs were issued than projected while for most of the CDM projects less CERs were issued. Several projects had not issued any CERs (4,913). For those projects we assume either the average issuance rate for the respective project type or – if no CERs have been issued for that project type so far – the overall average of the issuance success rate. Figure 2-1 provides an overview of the potential CER supply.

¹ A more detailed description of the sampling approach, the code used for drawing the samples and the reference numbers of the projects drawn into each of the samples can be found in Section 8.1 of the Annex.

² The actual CER supply depends on various conditions of the global carbon market and particularly on price expectations. However, also under normal market conditions, price forecasts are very uncertain. Under post-2012 market conditions, prices are even more uncertain. We therefore only estimate the potential CER supply which is derived from information in PDDs and other project specific or general documents but ignore any interaction with the global carbon market. At price levels of less than \$1/CER, the estimated volumes will not be achieved in practice.

Figure 2-1: Potential CER supply, original and adjusted values

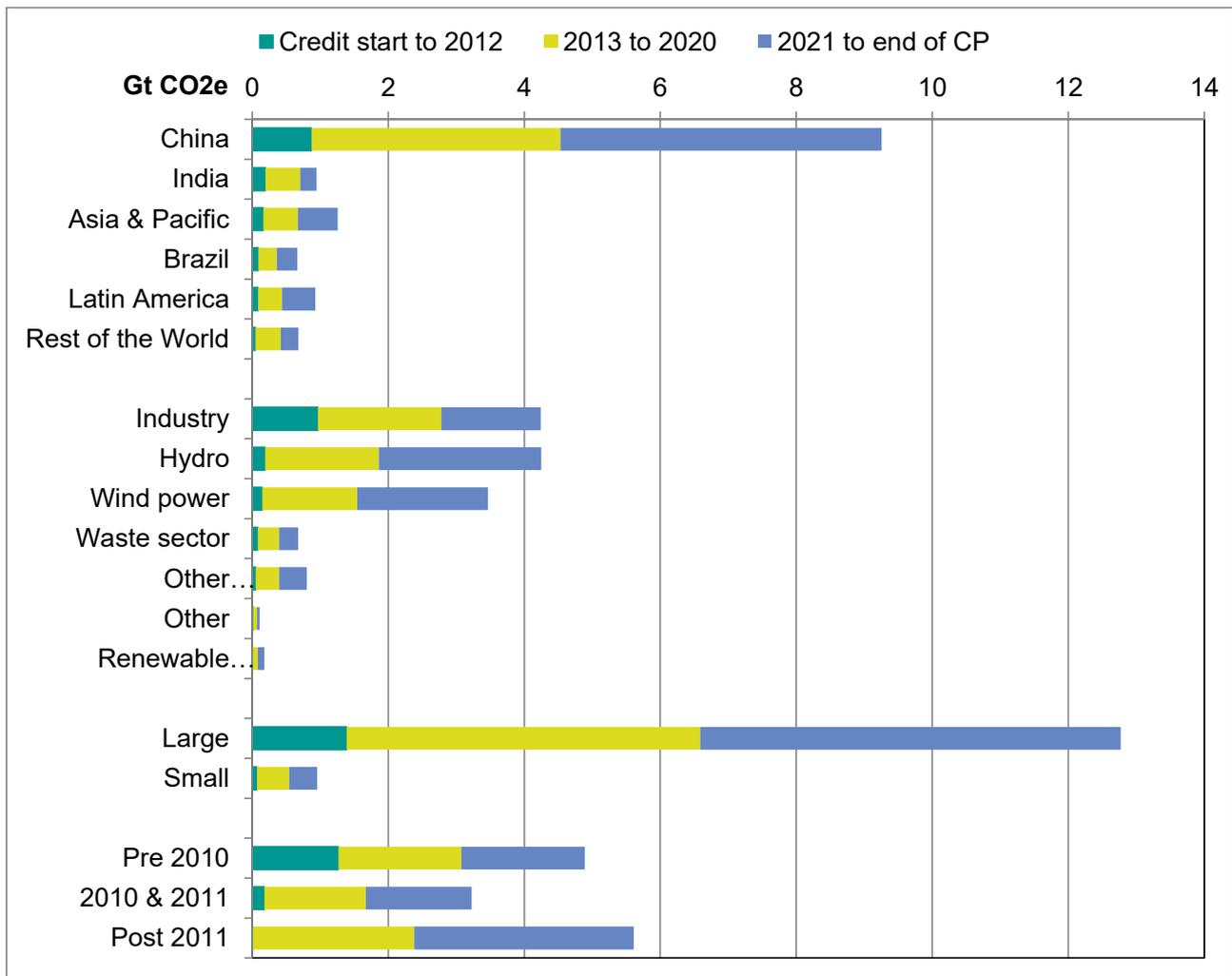


Sources: UNEP DTU 2014, IGES 2014, UNFCCC 2015a, Schneider & Cames 2014, authors' own calculations

The average adjustment factor is -22% though it ranges from -4% for N₂O projects to some -67% for transport projects. The adjusted CER supply for the period of 2013 to 2020 amounts to almost 5.7 billion CERs, almost 4 times the volume issued for the first crediting period.

Figure 2-2 illustrates where the potential CER supply stems from. Obviously China was and will remain the largest potential supplier of CERs. Almost two thirds (64.5%) of the potential CER supply in 2013 to 2020 are expected to be provided by Chinese CDM projects. In terms of project types, the large majority of supply stems from industry (32.0%), hydro (29.4%) and wind (24.6%) projects. Not surprisingly, the large majority (91.3%) of CERs stems from large scale projects while the breakdown in terms of registration period is more even: 31.8% stems from projects registered before 2010, 26.3% from projects registered in 2010 and 2011 while 41.8% of the potential CER supply in the period of 2013 to 2020 can be generated from CDM projects registered after 2011.

Figure 2-2: Potential CER supply by stratification categories



Sources: UNEP DTU 2014, IGES 2014, UNFCCC 2015a, Schneider & Cames 2014, authors' own calculations

In Chapter 4 we analyze the extent to which the likelihood of projects and CERs being additional depends on the project type. We look at 12 different project types, which together cover a broad range of activities and technologies. In terms of CER supply, these 12 project types amount to 85% of the potential supply in the period of 2013 to 2020 (Table 2-1). The largest supply potential is provided by hydro and wind power projects (29.4% and 24.6%, respectively). Industrial gas projects amount to almost 15% of the supply potential while biomass power, landfill gas, waste heat recovery and fossil fuel switch projects could each generate some 3-4% of the supply potential. Compared to these projects types the supply potential of cook stoves (0.04%) and efficient lighting (0.07%) are almost negligible. However, since these project types are often included in government purchase programs or voluntary offset schemes and since their share among projects registered after 2012 is significant, we consider it worthwhile to examine these two project types in greater depth and to assess their likelihood of being additional and of generating additional CERs.

Table 2-1: Potential CER supply by project type

	No. of projects	Credit start to 2012	2013 to 2020	2021 to end of CP Adjusted	Total
			Mt CO ₂ e		
HFC-23 abatement from HCFC-22 production	19	507	375	547	1,429
Adipic acid	4	201	257	269	727
Nitric acid	97	57	175	172	404
Hydro power	2,010	191	1,669	2,388	4,249
Wind power	2,362	148	1,397	1,929	3,475
Biomass power	342	25	162	169	355
Landfill gas	284	57	163	159	380
Coal mine methane	83	34	170	123	327
Waste heat recovery	277	63	222	62	346
Fossil fuel switch	96	51	232	175	458
Cook stoves	38	0.1	2.3	0.4	2.7
Efficient lighting	43	0.4	3.8	0.2	4.5
Not covered	1,763	124	842	603	1,569
Total	7,418	1,459	5,671	6,596	13,726

Sources: UNEP DTU 2014, IGES 2014, UNFCCC 2015a, Schneider & Cames 2014, authors' own calculations

The first Programme of Activities (PoA) was registered in July 2009. From then until the end of 2013, 243 PoAs were registered in total, the large majority of them in 2012 (193). While cook stoves and efficient lighting account for only a small share in the CDM project pipeline, they are quite relevant in the context of PoAs. By the end of 2013, they account together for a quarter of the registered PoAs. Table 2-2 provides a breakdown of the potential CER supply from PoAs by project types.

Table 2-2: Potential CER supply from PoAs

	No. of programs	Credit start to 2012	2013 to 2020	2021 to end of CP	Total
			Mt CO ₂ e		
Hydro power	26		5	13	17
Wind power	24		18	45	63
Landfill gas	4	0	12	27	40
Coal mine methane	2		5	10	15
Fossil fuel switch	2		0	0	0
Cook stoves	31	0	33	82	115
Efficient lighting	30	2	17	63	82
Not covered	124	0	70	144	214
Total	243	2	161	385	547

Sources: UNEP DTU 2014, UNFCCC 2015b, authors' own calculations

The main difference of PoAs compared to projects bundles is that PoAs can – once registered – be extended over time by an unlimited number of so-called component project activities (CPA). An estimate of the CER supply potential is thus less reliable than the estimate for the project pipeline.

However, taking into account all CPAs included in PoAs by the end of 2013, the potential CER supply can roughly be estimated, though it is obvious that the actual supply could be much higher. PoA volumes are much more difficult to estimate, because a PoA might be registered with only one CPA that has 1,000 tCO₂ per year emissions reductions but which may ultimately include CPAs that reduce hundreds of thousands of tCO₂ per year.

Noting these limitations, all PoAs could supply some 0.16 billion CERs in total in the period of 2013 to 2020. The final volume of these PoAs could be many times this amount. Almost a third (31.4%) of this supply would be provided by cook stove or efficient lighting PoAs. CERs from renewable power generation programmes amount to 14% of the supply potential of PoAs. Interestingly, almost half of the PoAs do not fall into the project type categories which together account for 85% of the potential CER supply from CDM projects. This supports the hypothesis that PoAs address project categories or technologies that cannot be adequately addressed by individual CDM projects.

2.4. Economic assessment of CER impact

The demonstration of additionality has been a key issue in the CDM since the beginning of the Kyoto mechanisms (Chapter 3). While most researchers agree that there is no simple and objective approach to determining additionality, several authors argue that the impact of CER revenues on the economic feasibility of projects is an important indicator for the likelihood for projects to be additional (for example Sutter 2003, Schneider 2007, Spalding-Fecher et al. 2012). This builds on the assumption that project proponents are more likely to implement a project due to the CDM if CER revenues have a significant impact on the economic performance of the project. While other benefits from the CDM (e.g. the public relation aspect of registering a project under the UNFCCC) may in some cases help projects to go ahead that would not be implemented in the absence of the CDM, the economic benefit of CER revenues may be considered the main driver to implement CDM projects on a larger scale.

A high economic benefit resulting from CER revenues does not guarantee additionality, because some projects may already be economically viable without CER revenues and may only become more profitable with the CDM. However, low CER revenues are an indicator of a lower likelihood that the project is additional, because with low CER revenues it also becomes more likely that the project would be implemented in the absence of the CER revenues.

In 2005, the CDM Executive Board (EB) decided that, in order to be additional, projects have to demonstrate that they are economically unattractive; however, they are not required to demonstrate that with CER revenues they would become economically viable. Schneider (2007) highlighted that this leads to the situation in which projects with very low CER revenues can prove additionality even though the CER revenues contribute only marginally to closing the profitability gap.

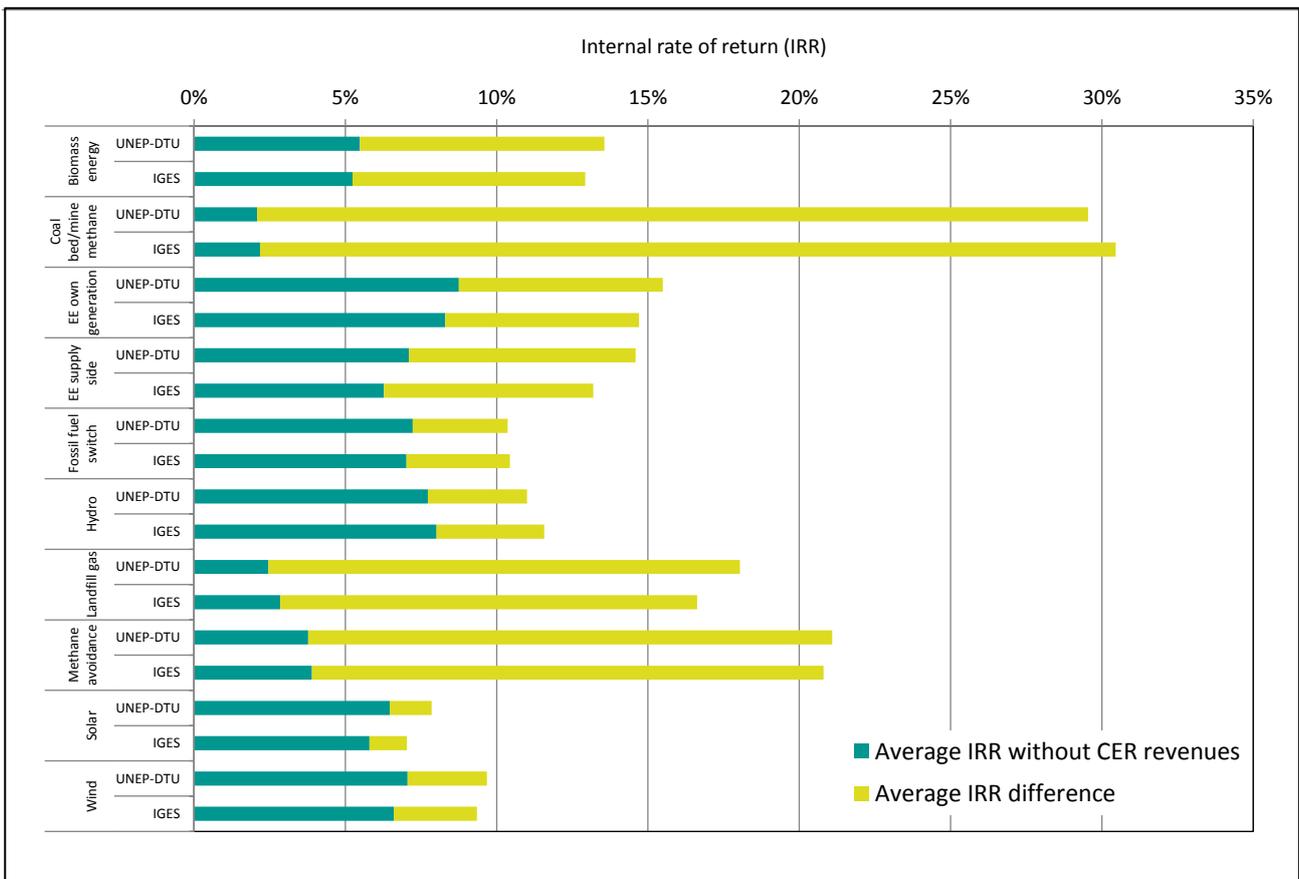
It is difficult to define a minimum required level of contribution from CER revenues that is needed to trigger an investment decision. An important concept in this context is the *signal-to-noise ratio* issue for investment analysis, as mentioned by, for example, Spalding-Fecher et al. (2012): The generally high variability and uncertainty of key parameters that determine the profitability of a mitigation project is often considerably higher than the expected economic benefit of CERs. If the economic impact of the CERs is lower than key uncertainties in the investment analysis, it is rather unlikely that the registration under the CER was the conclusive trigger for the investment and, hence, it is likely that the project is non-additional.

Table 2-3: Impact of CER revenues on the profitability of different project types

Type	Source	Projects with available IRR information	Average IRR without CER revenues	Average IRR with CER revenues	Average IRR difference
Biomass energy	UNEP-DTU	271	5.5%	13.6%	8.1%
	IGES	216	5.2%	12.9%	7.7%
Coal bed/mine methane	UNEP-DTU	70	2.1%	29.5%	27.5%
	IGES	75	2.2%	30.5%	28.3%
EE own generation	UNEP-DTU	205	8.8%	15.5%	6.7%
	IGES	202	8.3%	14.7%	6.4%
EE supply side	UNEP-DTU	36	7.1%	14.6%	7.5%
	IGES	23	6.3%	13.2%	6.9%
Fossil fuel switch	UNEP-DTU	47	7.2%	10.4%	3.1%
	IGES	39	7.0%	10.4%	3.4%
Hydro	UNEP-DTU	1,753	7.7%	11.0%	3.3%
	IGES	1,635	8.0%	11.6%	3.6%
Landfill gas	UNEP-DTU	183	2.5%	18.0%	15.6%
	IGES	165	2.8%	16.6%	13.8%
Methane avoidance	UNEP-DTU	203	3.8%	21.1%	17.3%
	IGES	204	3.9%	20.8%	16.9%
Solar	UNEP-DTU	154	6.5%	7.9%	1.4%
	IGES	122	5.8%	7.0%	1.2%
Wind	UNEP-DTU	2,162	7.1%	9.7%	2.6%
	IGES	1,804	6.6%	9.4%	2.8%

Sources: UNEP DTU 2014, IGES 2014, authors' own calculations

Figure 2-3: Impact of CER revenues on the profitability of different project types



Sources: UNEP DTU 2014, IGES 2014, authors' own calculations

Information on the impact of CER revenues on economic profitability is available from different sources. Table 2-3 and Figure 2-3 show the impact based on data included in project design documents and as documented in the databases by UNEP DTU (2014) and IGES (2014). In addition, Lütken (2012) has analyzed the annual CER revenues in relation to the capital investment and observed for some project types a (very) limited impact stemming from CER revenues. Spalding-Fecher et al. (2012) analyze the impact of CER revenues on the project IRR for different project types in the IGES database. They conclude that the CER impact on the project IRR is the lowest for renewables including hydro and wind (increase of IRR by 2-3%), fuel switch (4%), and supply-side efficiency (5%). They also provide an overview of more studies analysing the impact of CER revenues for different project types. The relatively low impact of CER revenues compared to other cash flows that are relevant for investment decisions is shown for energy efficiency projects below (Box 2-1).

Overall, the available information shows that the impact of CER revenues on the economic performance of projects varies considerably between project types:

- **Non-CO₂ projects**, such as industrial gas abatement, manure management, waste water treatment, landfill gas utilisation and coal mine methane capture, are characterised by a medium to high impact of CER revenues. For several of these project types, CER revenues increase the IRR by more than 10 percentage points, and for coal mine methane projects even by more than 25 percentage points. For these project types, the CER revenues clearly make a difference, which indicates a higher likelihood of additionality.

- **CO₂ projects in renewable energy** such as wind and hydro projects are characterised by a relatively low impact of CER revenues: for wind power, the IRR increases by about 2.5% to 3%, for hydropower by about 3% to 4%, and for solar by about 1% to 1.5%. According to Lütken (2012), the annual CER revenues in relation to investment costs (median) amounted to 1.84% for wind and 3.5% for hydro. Given the typical uncertainties surrounding costs and load factor in renewable projects, this level of CER contributions seems relatively low to justify that the project would not have been implemented in the absence of the CDM. Therefore, in many cases, the additionality of projects within these types may seem rather unlikely (though in some cases it may not be ruled out that additional CER revenues of +3.5% may be the decisive factor rendering a project attractive – though it may not be possible to prove this in an objective way). In addition, many renewable energy projects – in particular hydropower – show a relatively high economic performance without CER revenues (e.g. an IRR of nearly 8% for hydropower without CER revenues), compared to non-CO₂ projects (e.g. landfill gas, coal mine methane and methane avoidance with an IRR of about 2% to 4% without CER revenues).
- **CO₂ projects in fuel switch, energy efficiency, and waste heat utilisation** are typically characterised by relatively low investment costs. Thus, CER revenues are higher compared to investment costs (5% for waste heat and 20% for fuel switch – median value). The impact of CER revenues on the internal rate of return is about 3 to 8 percentage points. However, in this project type, fuel prices are the decisive element determining its profitability. Box 2-1 compares the impact of typical fuel costs and CER revenues for energy efficiency projects. Our analysis indicates that CER revenues tend to have a low impact on project profitability. In addition, these project types show a relatively good economic performance without CER revenues, compared to non-CO₂ projects.

Lütken's analysis was based on a CER price of €12. Our analysis in Table 2-3 and Spalding-Fetcher's build on PDD data with similar CER price assumptions. With today's much lower CER prices, the low impact of CER revenues on CO₂ projects and therefore their high risk of non-additionality is further aggravated.

In conclusion, non-CO₂ projects are characterised by a medium-to-high impact of CER revenues and a relatively low economic performance without CER revenues, while for most CO₂ project types the impact of CER revenues is much smaller and the performance without CER revenues higher. Overall, this indicates that on average non-CO₂ projects have a higher likelihood of additionality.

Box 2-1: An analysis of the impact of CER revenues for energy efficiency projects

Another way of assessing the relevance of CER revenues in investment decisions is to compare them to other important revenues or savings in the investment analysis. For instance, for energy efficiency projects to become profitable, they have to (i) save sufficient costs for fossil fuels and (ii) earn sufficient CERs to pay back the investment costs for new equipment improving the energy efficiency. Figure 2-1, Figure 2-2 and Figure 2-4 illustrate the order of magnitude of fuel cost savings in relation to one tonne of CO₂ reduced or CERs generated in the case of projects saving natural gas, light fuel oil and steam coal. For instance, if an installation implements new equipment that reduces the specific consumption of natural gas and the related GHG emissions by one tonne of CO₂, then the related reduction in fuel costs in 2010 would amount to approx. 150 USD/tCO₂ (at OECD average prices in 2010). For light fuel oil, the fuel cost reduction amounts to over 250 USD/tCO₂ and for steam coal, the savings still amount to 37 USD/tCO₂ (in 2010). With this, it becomes obvious that the impact of fuel cost savings on the project cash flow is much higher than contribution from CER revenues.

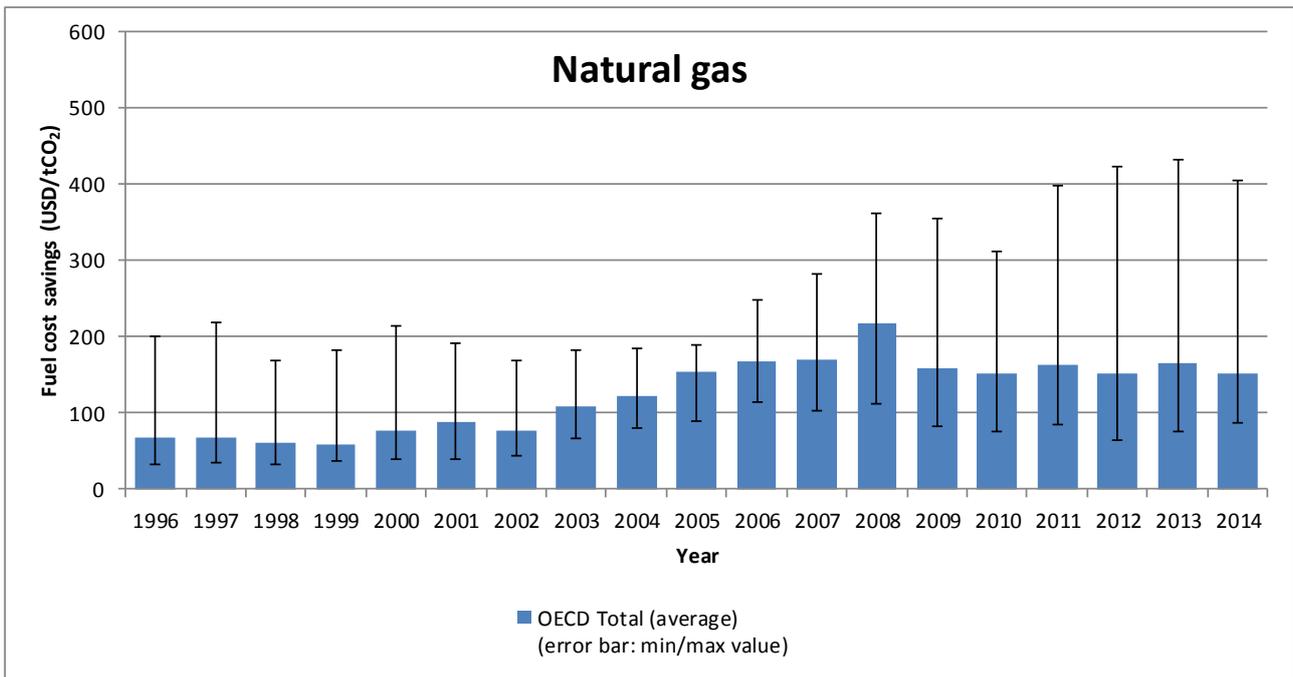
Figure 2-1, Figure 2-2 and Figure 2-4 also show the development of average (and min. and max.) OECD prices over time, which illustrates the high variability of energy prices since 1996. Average specific energy prices have fluctuated in the order of 20 USD/tCO₂ (steam coal) to 200 USD/tCO₂ (light fuel oil). Also compared to the historic fuel price variability, typical CER revenues are low to negligible compared to fuel cost savings.

Please note that because of limitations in data availability, the figures are based on fuel prices in OECD countries, which in many cases also include taxes and may not be representative for all developing countries. In particular, in some developed and developing countries fossil fuel subsidies are very high. In these cases, because of the low prices, the fuel cost savings are low and may be on a similarly low level as the contribution from CER revenues to the positive project cash flow. However, in such a low price situation, the total positive cash flow may in any case be far too small to justify investments in energy efficiency equipment and the scope for CDM may become rather limited.

Overall, it may be argued that for projects to have a high likelihood of additionality the impact of CER revenues should at least be comparable to the main contributor to a positive cash flow, the related fuel savings. This would indicate that in such project types CER prices for energy efficiency projects would need to reach a level of at least 10-20 USD/tCO₂ for steam coal, 30-50 USD/tCO₂ for natural gas and 100-200 USD/tCO₂ for light fuel oil based systems (if prices on the level of OECD countries are assumed). With such CER prices, the economic contribution from CER revenues to positive cash flow reaches a level that may be considered significant (i.e. in the order of ¼ to ½ of fuel cost savings).

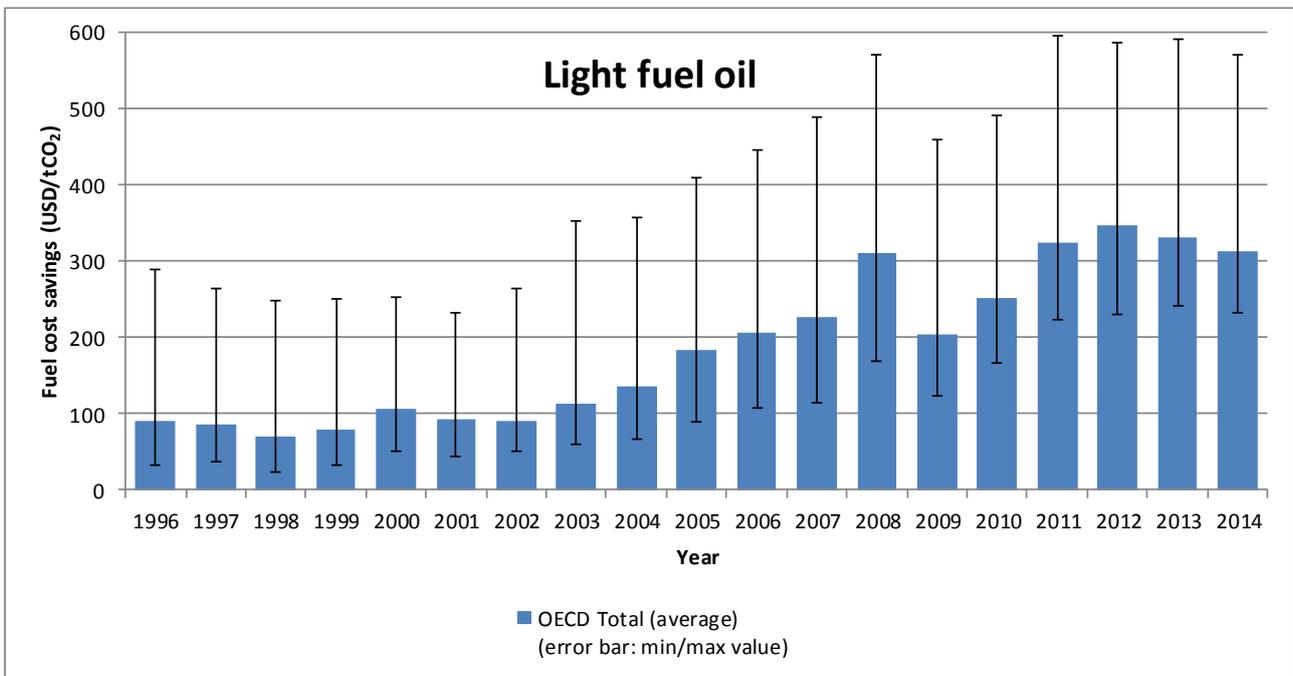
At prices significantly below this level, the economic impact of CERs is insignificant and the risk of non-additionality is very high.

Figure 2-4: Natural gas cost savings per tonne of CO₂ reduced in energy efficiency projects



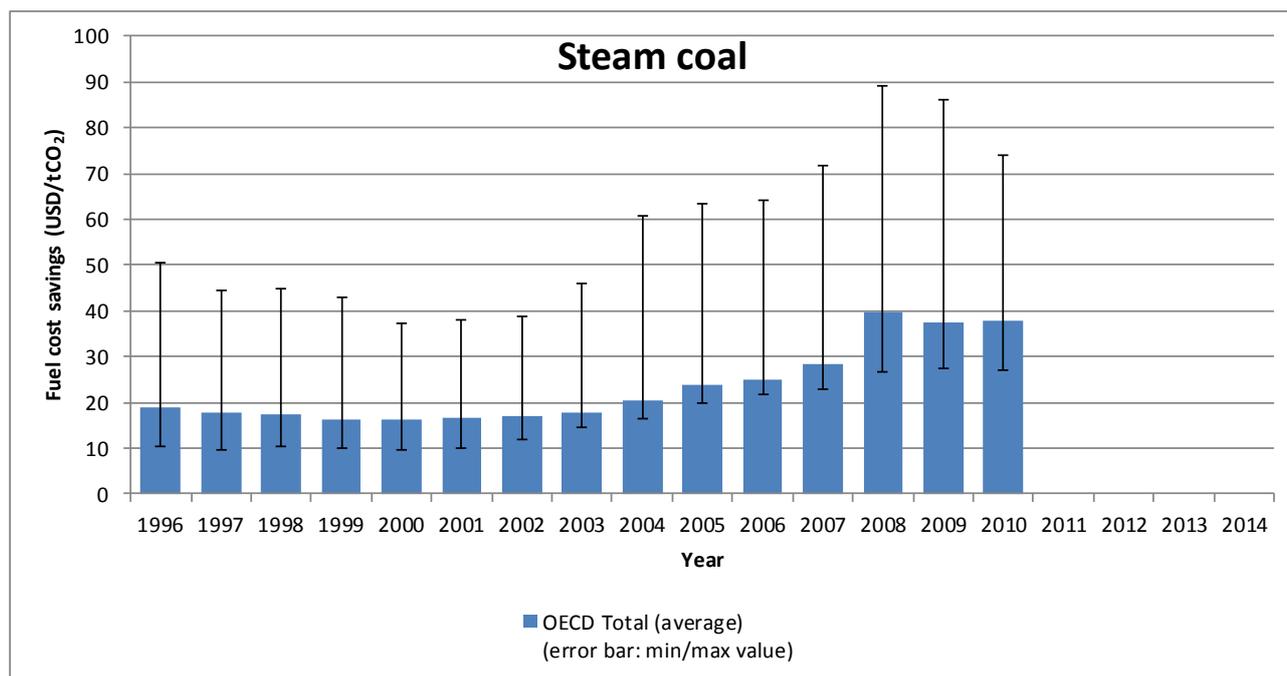
Notes: Average fuel prices of OECD countries (in USD/TJ).
Sources: IEA 2015, IPCC 2006, authors' own calculations

Figure 2-5: Light fuel oil cost savings per tonne of CO₂ reduced in energy efficiency projects



Notes: Average fuel prices of OECD countries (in USD/TJ).
Sources: IEA 2015, IPCC 2006, authors' own calculations

Figure 2-6: Steam coal cost savings per tonne of CO₂ reduced in energy efficiency projects



Notes: Average fuel prices of OECD countries (in USD/TJ).

Sources: IEA 2015, IPCC 2006, authors' own calculations

3. Assessment of approaches for determining additionality and rules relevant towards additionality

3.1. Prior consideration

3.1.1. Overview

Prior consideration is a key requirement in the CDM. It aims to ensure that only projects are registered in which the CDM was seriously considered when the decision to proceed with the investment was made.

In the first version of the additionality tool prepared in 2004³, a provision was introduced for projects with a crediting period starting prior to registration, which stipulated that evidence has to be provided “that the incentive from the CDM was seriously considered in the decision to proceed with the project activity” and that the “evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity.” The provision remained almost unchanged in the second version of the additionality tool in 2005.

In the third version of the additionality tool in 2007, the provision was removed and then included in the Guidelines for completing the PDD, which are applicable to all projects and not only those applying the additionality tool. These guidelines stipulated that “project proponents shall provide an implementation timeline of the proposed CDM project activity” and that “the timeline should include, where applicable, the date when the investment decision was made, the date when construction

³ EB 16, Annex 1: Tool for the demonstration and assessment of additionality.

works started, the date when commissioning started and the date of start-up (e.g. the date when commercial production started)". Also, according to the guidelines, "project participants shall provide a timeline of events and actions, which have been taken to achieve CDM registration, with description of the evidence used to support these actions"⁴.

In 2008, the CDM EB introduced general guidance on the demonstration and assessment of prior consideration⁵. The guidance was subsequently revised twice⁶, including further guidance for DOEs on how to validate real and continuing actions; in 2011 it was incorporated in the project standard (PS)⁷. According to the latest version of the project standard⁸, "if the start date of a proposed CDM project activity ... is prior to the date of publication of the PDD for the global stakeholder consultation, project participants shall demonstrate that the CDM benefits were considered necessary in the decision to undertake the project as a proposed CDM project activity". More specifically, project participants of project activities with a starting date on or after 2 August 2008 "*shall inform the host Party's designated national authority (DNA) and the secretariat of their intention to seek CDM status in accordance with the Project cycle procedure*", while "for a proposed CDM project activity with a start date before 2 August 2008 and prior to the date of publication of the PDD for global stakeholder consultation, project participants shall demonstrate that the CDM was seriously considered in the decision to implement the proposed project activity". For this purpose, "project participants shall provide evidence of their awareness of the CDM prior to the start date of the proposed project activity, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project"⁹, "*provide evidence that continuing and real actions were taken to secure CDM status for the proposed project activity in parallel with its implementation*"¹⁰ and "provide an implementation timeline of the proposed CDM project activity. The timeline should include, where applicable, the date when the investment decision was made, the date when construction works started, the date when commissioning started and the date of start-up (e.g. the date when commercial production started). Project participants shall provide a timeline of events and actions, which have been taken to achieve CDM registration, with description of the evidence used to support these actions".

The CDM project cycle procedure¹¹ includes details about the notification process related to prior consideration (i.e. forms to be used, etc.). According to this procedure, for project activities with a start date on or after 2 August 2008, notification to the DNA of the host country and to the Secretariat must be made "within 180 days of the start date of the project activity". A list of notifications received by the Secretariat is available on the UNFCCC website.¹²

The requirements for demonstrating prior consideration set out in the project standard are generally applicable with the exception of programmes of activities (PoAs).

⁴ EB 41, Annex 12: Guidelines for Completing the Project Design Document (CDM-PDD) and the Proposed New Baseline and Monitoring Methodologies (CDM-NM) (Version 07).

⁵ EB 41, Annex 46: Guidance on the Demonstration and Assessment of Prior Consideration of the CDM.

⁶ EB 48, Annex 61 and EB 49, Annex 22.

⁷ EB 65, Annex 5.

⁸ CDM project standard, Version 07.0, EB 79, Annex 3.

⁹ Relevant evidence could, for instance, relate to "minutes and/or notes related to the consideration of the decision by the EB of Directors, or equivalent, of the project participants, to undertake the project as a CDM project activity".

¹⁰ Relevant evidences "should include one or more of the following: contracts with consultants for CDM / PDD / methodology / standardized baseline services; draft versions of PDDs and underlying documents such as letters of authorization, and if available, letters of intent; emission reduction purchase agreement (ERPA) term sheets, ERPAs, or other documentation related to the sale of the potential CERs (including correspondence with multilateral financial institutions or carbon funds); evidence of agreements or negotiations with a DOE for validation services; submission of a new methodology or standardized baseline, or requests for clarification or revision of existing methodologies or standardized baselines to the EB; publication in a newspaper; interviews with DNA; earlier correspondence on the project with the DNA or the secretariat".

¹¹ Current version 07.0, EB 65, Annex 32.

¹² <https://cdm.unfccc.int/Projects/PriorCDM/notifications/index.html>.

With regard to PoAs, the project cycle procedure includes the non-binding provision that *“the coordinating/managing entity may notify to the DNA(s) of the host Party(ies) of the PoA and the secretariat in writing of the intention to seek the CDM status for the PoA, using the [corresponding form] for the purpose of determining the start date of the PoA”*. According to the CDM project standard, the start date of a PoA is either *“the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the DNA”* or *“the date of publication of the PoA-DD for global stakeholder consultation”*. With regard to CPAs, *“the start date of a CPA is the earliest date at which either the implementation or construction or real action of the CPA begins”* and it shall be confirmed that *“the start date of any proposed CPA is on or after the start date of the PoA”*. The only exception to this rule relates to afforestation and reforestation (A/R) PoAs, which allows *“the inclusion of any A/R project activity that started after 1 January 2000 but has not been registered as a CDM project activity as a CPA in an A/R PoA”*.¹³

3.1.2. Assessment

The issue of projects obtaining registration as CDM projects without serious consideration of the CDM benefits at the time of the investment decision was especially a concern during the first years of the CDM. The requirement to demonstrate prior consideration was only gradually introduced over time and became generally applicable only in 2007. Also, as pointed out by Schneider (2007), the requirement was also not always followed: only 36% of the projects seeking retroactive crediting provided evidence that the CDM was considered in the decision to proceed with the project and it is reported that relevant documentation has been backdated. It can, therefore, be concluded that for early CDM projects, the demonstration of prior consideration was questionable.

The approach applied as of August 2008 (i.e. for the bulk of projects and generated CERs) requires notification of the prior consideration of the CDM as well as, in situations of delay, evidence of continued interest in the CDM using a form designed for this purpose. This requirement addresses the issue of prior consideration in a more objective and appropriate manner, avoiding the risk of back-dating of company-internal information or subjective claims of prior consideration. In this regard, the rules have improved over time and there is no evident flaw in the current rules and therefore no need for the current practice to be changed.

However, it should be noted that the notification of prior consideration ensures that projects cannot claim CDM registration retroactively, but does not demonstrate whether or not a project is additional. In this regard, this rule does not provide any information on the additionality of projects since both truly additional projects and free riders may apply for the CDM status. This rule is therefore important to exclude projects which did not consider the CDM at all and are therefore clearly not additional, but it is not sufficient for assessing whether a project can be considered additional or not.

With regard to the practical implementation, a period of 180 days for notification of prior consideration can be considered quite generous. While a certain grace period is certainly reasonable due to the administrative process of making the PDDs available for global stakeholder consultation, a period of six months could mean that the project is already quite advanced, which would then call into question whether CDM benefits were actually necessary for the project to proceed. A long grace period could therefore be regarded as allowing retroactive crediting.

The requirements regarding the start date of PoAs and CPAs are sufficiently strict to avoid any project activity that has already started being registered as CPAs under a PoA. The only rule that cannot be considered adequate relates to the inclusion of old A/R activities in a newly registered

¹³ Clarification "Start date and crediting period of component project activities under an afforestation and reforestation programme of activities", EB 73, Annex 16.

A/R PoA (see above). For these A/R activities, CDM rules do not require demonstrating prior consideration of the CDM.

3.1.3. Summary of findings

There is no evident flaw in the general design of this rule with the exception of the inclusion of old A/R activities in a newly registered A/R PoA. Also, as outlined above, the time frame for notification of prior consideration appears to be quite generous.

3.1.4. Recommendations for reform of CDM rules

The only rule that needs to be changed relates to the inclusion of old A/R activities in a newly registered A/R PoA (see above). It is therefore recommended that the corresponding rule be withdrawn.

Furthermore, it is recommended that the time frame for notification of prior consideration be shortened in order to reduce the risk that projects apply for the CDM having only learned of the possibility after the project has started. The grace period for notification to the secretariat should therefore be reduced in general, e.g. to a maximum of 30 days after the project start.

3.2. Investment analysis

3.2.1. Overview

The CDM's *additionality tool* requires demonstration that a prospective project is either not financially viable without the CDM (using investment analysis) or that there is at least one barrier preventing the proposed project without the CDM (using barrier analysis). Though both methods are common (and some projects use both), investment analysis is the most widely used, by over three-quarters of all projects and over 90% of the renewable energy (especially hydro and wind) projects that are expected to dominate future CER supplies (Spalding-Fecher & Michaelowa 2013). Investment analysis (or a variation of it) is also used in the *combined tool* and in some CDM baseline and monitoring methodologies that refer neither to the *additionality tool* nor to the *combined tool* for demonstrating additionality.

The additionality tool provides three alternative options for conducting investment analysis:

- For projects with costs but no revenues (other than CERs), a **simple cost analysis** can be used to demonstrate that at least one scenario (other than the project) is less costly. This approach is quite common for a few project types (e.g. projects that capture N₂O from adipic acid plants, or methane from landfills), but it is not common overall.
- The **investment comparison analysis** compares the economic attractiveness of the project without revenues from CERs to other investment alternatives that provide similar outputs or services; this approach is common for just a few project types (e.g. higher-efficiency fossil power), and is not common overall.
- The **benchmark analysis** is used to demonstrate that a proposed project is, without revenues from CERs, economically not attractive (i.e. it does not meet a stated financial benchmark); this approach is, by far, the most common form of investment analysis.

In all cases, investment analysis relies on the premise that, if a project is not a better investment (or less costly) than an alternative or a financial benchmark, then it would not have proceeded but for the existence of the CDM. Exactly how the CDM causes it to proceed, whether through CER revenue or otherwise, does not need to be specified.

The approach to investment analysis has also been refined over time. In particular, in 2008 the CDM EB adopted “Guidelines on the assessment of investment analysis”, which aimed to provide further clarity and reduce ambiguity by, for example, clarifying how to calculate the common financial benchmarks net present value (NPV) and internal rate of return (IRR) and suggested ranges for conducting sensitivity analysis in these parameters. In 2011, this guidance was further revised to introduce default values for the expected return on equity for different project types and host countries, which can (but are not required to) be used by project developers as benchmarks for the benchmark analysis.

3.2.2. Assessment

The expected financial performance of a project is clearly one important factor in determining whether or not it will proceed (see further discussion of this in Section 2.3). For example, unless mandated by an (enforced) government policy, there is little reason for projects with no revenue (other than CER values) to proceed, simplifying the assessment of additionality.

For projects that do collect revenue other than CER values, such as by selling electricity, the CDM rules seek to determine whether the project would not have been financially attractive (and therefore not have proceeded) without the CDM. Researchers have raised several critiques of this approach, which we address in this report under two broad themes.

The first is perhaps the most fundamental, and is whether investment analysis is appropriate for investments that may be driven largely by other (non-economic) factors. This critique asserts that many investments in common CDM activities – e.g. power generation – are undertaken for a host of political, social, and strategic reasons that extend beyond simple project-level economics and may not be designed to maximise economic return. Such critics argue that a market-based test such as investment analysis is not applicable in what is largely a non-market environment, perhaps especially so in centrally planned countries such as China (He & Morse 2010). For example, Bogner & Schneider (2011) and Haya & Parekh (2011) have argued that governments have already subsidized and developed large hydroelectricity projects in developing countries well before the CDM, making them financially viable and therefore raising questions about the extent to which investment analysis can credibly determine that they would not proceed but for the incentive provided by the CDM. For investment analysis to function properly – indeed, for any additionality test to function properly – it must be able to demonstrate, with high confidence, that the CDM was the deciding factor for the project investment. For project types that are routinely constructed outside the CDM, including (but not exclusively) for broader economic, energy security, or political reasons, it remains highly difficult to determine with confidence that, in any particular case, a project’s financial returns are the reason it is not proceeding and that the financial incentive provided by the CDM is the reason for it proceeding (Dechezleprêtre et al. 2014).

Table 4-5 provides an example of how the decision of selecting a certain fuel (coal, fuel oil or natural gas) may depend on many factors that are not only insufficiently covered in an investment analysis, such as level of initial investment or flexibility in operation that may lead, for example, in investment in a natural-gas-fired boiler rather than a coal-based one, even though natural gas may be more costly than coal in terms of direct costs.

The second critique is concerned with transparency, subjectivity, and information asymmetry, such as whether project developers provide sufficient and credible information to allow replication of their calculations and justification of their conclusions, as well as the inherent information asymmetry between project developers and those, especially the CDM EB, tasked with reviewing the information. For example, early research found that project developers regularly provided investment analyzes that were opaque, relied on proprietary company information, or were incomplete (Schneider 2009).

This analysis takes a new look at several aspects of this second critique, including:

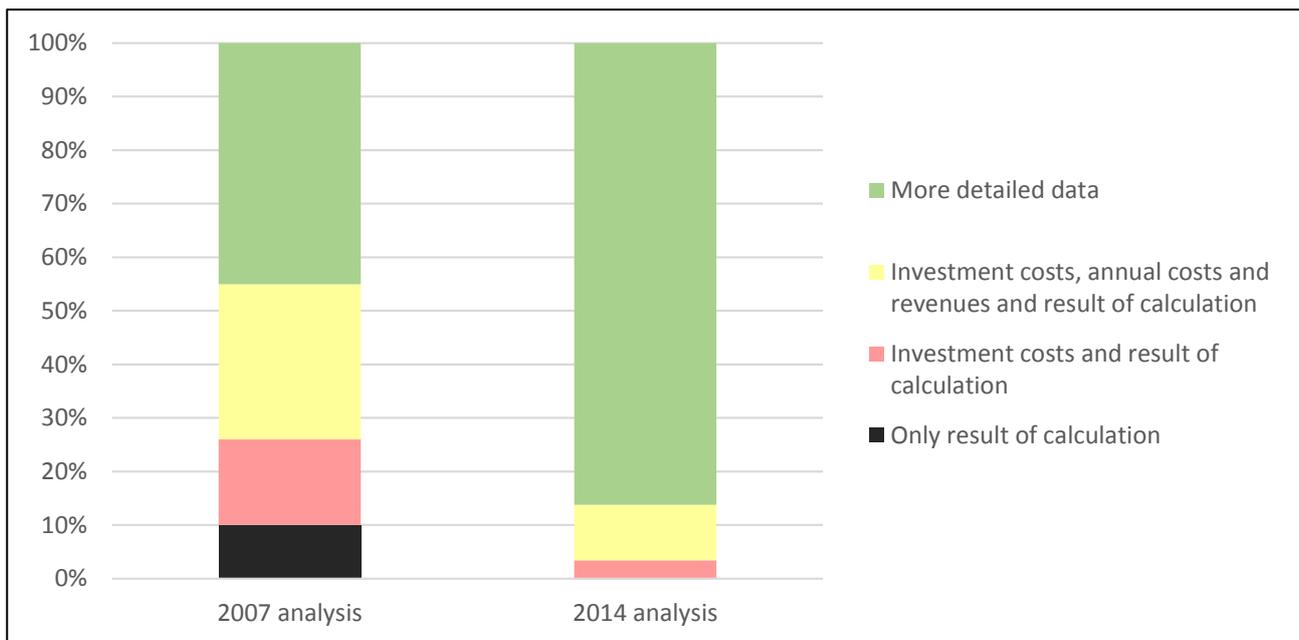
- Transparency, by re-visiting the prior work of Schneider (2009) to gauge how transparently developers conduct the investment analysis.
- Subjectivity and asymmetry, with a new exploration of benchmark rates and CER prices.

These two broad topics are addressed in turn below.

Transparency

To explore transparency in investment analyzes, Figure 3-1 updates the analysis of Schneider (2009) who reviewed a randomly selected group of PDDs for the level of information provided. In our updated analysis, 29 registered projects using the investment analysis were selected at random.¹⁴ Over 90% of the projects selected were registered after 2007, the year of Schneider's prior analysis, so this sample can indicate how practices have changed. In particular, over 80% of the 29 projects in this new analysis provided detailed input data to support their calculations of capital and operating costs and revenues, compared to 2007, when fewer than half did. Furthermore, no projects provided only the result of their calculation in this analysis, with no input data to support their findings. These findings suggest that investment analysis has become more transparent.

Figure 3-1: Level of information provided in PDDs on the investment analysis



Notes: 2007: n=31, 2014: n=29.

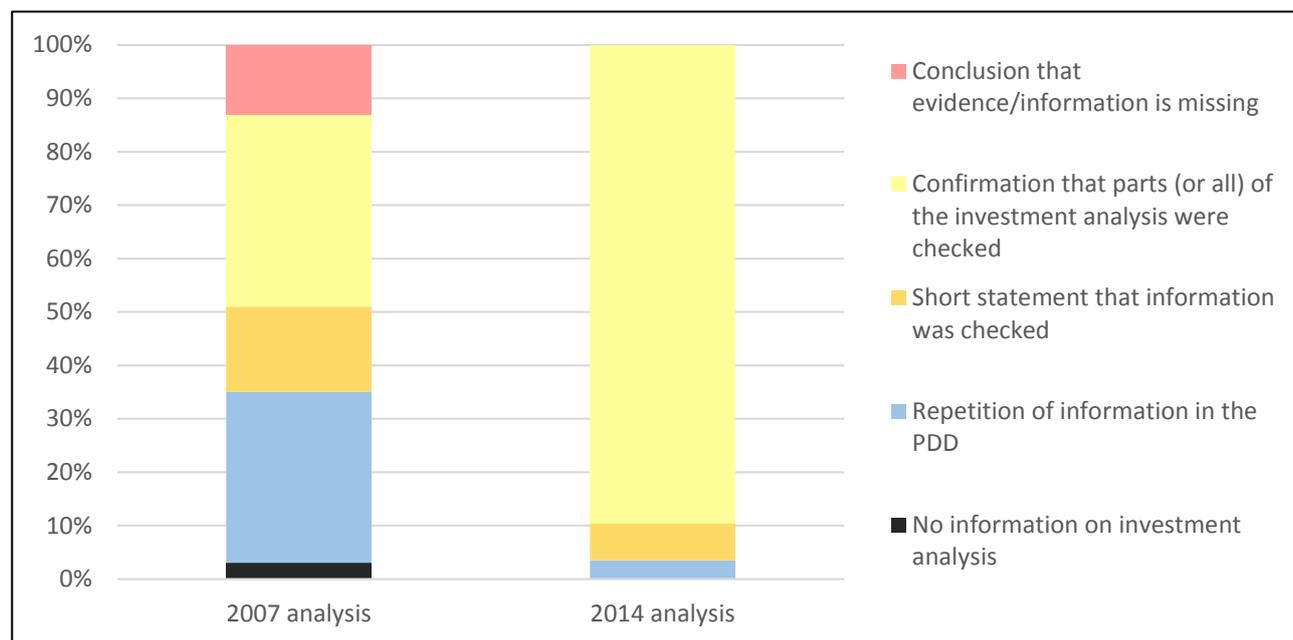
Sources: Schneider (2009), authors' own calculations

Validation reports that review the investment analyzes also appear to have become more thorough. Figure 3-2 also returns to Schneider's prior analysis to update it based on the same randomly selected group of projects as in Figure 3-1. As seen in Figure 3-2, more than 80% of the validation reports confirm that validators checked some or all of the key assumptions of the investment analyzes. The validation reports often review each of several of the most critical investment analy-

¹⁴ According to the sampling design, 30 projects using investment analysis were to be selected. Upon further examination, one of the thirty projects selected, a small-scale, run-of-river hydropower plant, had demonstrated additionality using other methods, as outlined in the "Guidelines for Demonstration Additionality of microscale project activities" and so was not considered in this analysis.

sis inputs and describe that the inputs are reasonable, in many cases citing contract or other documents reviewed to support the choice of inputs.

Figure 3-2: Information in validation reports on the investment analysis



Notes: 2007: n=31, 2014: n=29.

Sources: Schneider (2009), authors' own calculations

Subjectivity and information asymmetry

Despite the findings above, transparency and validator review of the input parameters do not remove subjectivity or choice of alternate input parameters in different contexts. For example, in some cases, project proponents have used different values for key input parameters when submitting applications to financial institutions (Haya 2009), suggesting that the metrics used (and choice of inputs therein) and reliability of such may vary. Indeed, project developers will always have much more information on the project's local conditions – including costs and technical parameters – than will outside parties, whether validators or CDM administrators, and therefore have an incentive to provide biased or inaccurate information to increase the chance of a successful additionality determination and, therefore, the eventual awarding of credits to their project (Gillenwater 2011). This phenomenon is widely referred to as *'information asymmetry'*. As shown above, validators do have more information at their disposal now than in the past, but still lack an objective basis for determining that the investment would not have been undertaken and that inputs provided are the same as they would have been had CDM credits not been sought. Small changes in a number of input parameters – even if individually well within the range of other similar projects (CDM or not), could lead to significant changes in the overall stated financial return of the project. Interestingly, under the CDM, project participants do not need to provide any confirmation that they are submitting truthful information. Some project developers reported that different versions of investment analysis were used for CDM purposes and for the purpose of securing other funding for a project (e.g. loans). Other crediting mechanisms, such as the VCS and CAR, require declaration or attestations from project developers that all information is accurate and presents the truth. To explore further the issue of subjectivity and information asymmetry in input parameters, we take a deeper look at two particular inputs: benchmark rates and CER prices.

Closer examination of benchmark rates

This critique concerns appropriate levels for financial benchmarks (e.g., IRR) (Michaelowa 2009). To explore this question, we reviewed data on IRR benchmarks used by wind, hydro, biomass, and waste gas or heat projects in China, wind and hydro projects in India, and hydropower projects in Vietnam.¹⁵

Nearly all projects in China use standard, government-issued IRR benchmarks. By far the most common benchmark used is 8%, which is applied for most power projects, and derives from a 2002/2003 Chinese government source, *Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects*. Other common benchmarks based on government rules include 10% for small hydro projects, and 12-13% for waste gas/heat projects.

Table 3-1: Summary of most common benchmark rates used in IRR analysis in Chinese CDM projects

Project type	Common IRR benchmark	Fraction of projects using this benchmark	Source of this benchmark
Wind	8.0%	99%	Government's <i>Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects</i> (2002/2003)
Hydro	10.0%	71%	Government's <i>Economic Evaluation Code for Small Hydro-power Projects</i> (1995)
	8.0%	29%	Government's <i>Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects</i> (2002/2003)
Biomass	8.0%	98%	Government's <i>Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects</i> (2002/2003)
	12.0%	30%	Government's <i>Economical Assessment and Parameters for Construction Project, 3rd edition</i> (2006)
Waste gas / heat	13.0%	17%	Government's <i>Economical Assessment and Parameters for Construction Project, 3rd edition</i> (2006)
	18.0%	16%	Conch Cement Company internal WACC

Notes: In this table, and throughout this section, we report IRR benchmarks and values based on analysis of IGES's investment analysis database. We believe that most of the benchmarks, and values reported in the database, are in real terms, based on a review of a small number of PDDs and the assumption in the CDM's Guidelines on the Assessment of Investment Analysis that is conducted in real terms. We make no attempt to identify or convert values in the database that may be in nominal terms.

Sources: IGES 2014, authors' own calculations

Despite the ubiquity of the 8% government-set threshold in China, it is not clear how or why it matches the internal thresholds used by actual project inventors, who may themselves demand returns either higher or lower. (For example, benchmarks for wind power projects in India, where they are determined to a greater extent by investor hurdle rates, are more variable and, on average, higher). For this reason, it is not clear why 8% is the 'correct' benchmark for a test intended to gauge the attractiveness of an investment. Furthermore, it is not clear why common benchmarks used for hydro or waste gas are higher (10% or at least 12%, respectively), and whether these

¹⁵ These project type / country combinations were selected because each of them represents at least 1% of the registered projects in the CDM that use investment analysis (IGES 2012). Though this 1% threshold is arbitrary, it provided us with a basis for focusing the analysis.

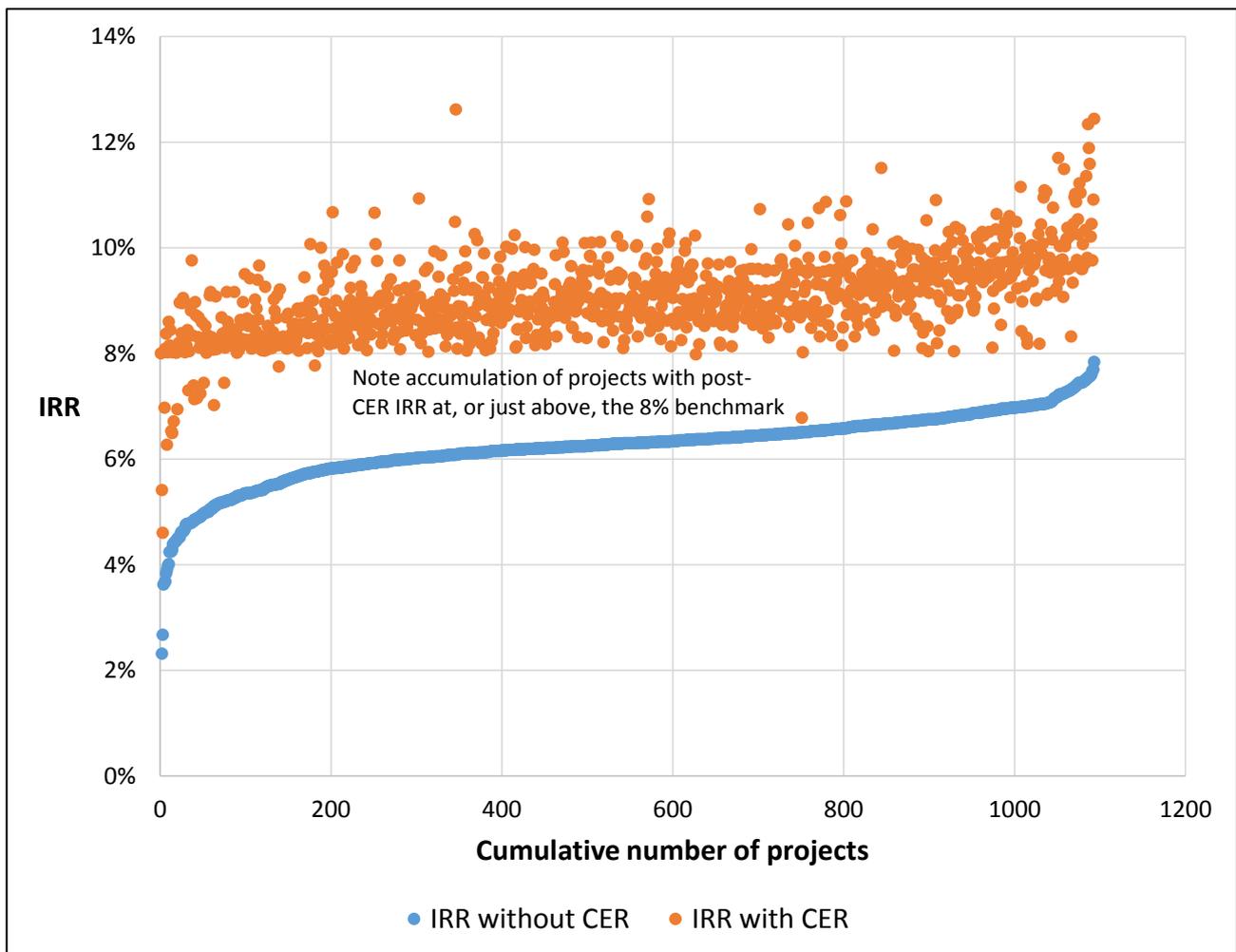
rates accurately capture the risk and expected financial returns in these types of projects. Further analysis of this issue may be warranted, e.g. by comparing it with other sources of equity rates for different investments in China or for similar projects in other countries. A source of such data for projects within China was not immediately known, however.

In principal, the logic of investment analysis is that the project would not have proceeded but for the financial incentive provided by the CDM. That financial incentive is the value of CERs. Many project developers conduct an analysis to show that, at assumed CER prices, the financial return of the project is expected to clear the financial benchmark used. However, this is not actually required by the additionality tool. (In the first versions of additionality, a step 5 'impact of the CDM' was included, which was interpreted by many project developers as an obligation to show that the project is made economically attractive through the CDM. This was later removed).

The above discussion investigated benchmarks used in China, with special attention paid to the widely used 8% benchmark. Because of its ubiquity, this 8% benchmark provides an opportunity to investigate the extent to which CER values indeed bring about expected project returns above this value and therefore, in the logic of the investment analysis, enable the project to proceed. As stated above, though projects are not required to actually show that CER values would push the project above its stated threshold, most do report results of expected return.

The following chart (Figure 3-3) shows the stated IRRs before and after CERs for all wind projects in China that use a benchmark of 8%. As seen in the figure, most of these projects state an IRR without CERs of between 6% and 7%, and an IRR after CER value of 8% to 10%. Note in particular the sharp line at 8%, at which very few projects claim an after-CER IRR of just under 8%, but a large number of projects find a post-CER IRR of just barely more than 8%.

Figure 3-3: Stated IRRs of Chinese wind projects using a benchmark of 8% before and after assumed CER value



Sources: IGES 2014, authors' own calculations

In principle, one explanation for this distribution is that projects in which the 8% threshold is not reached with CER revenues are not implemented, do not apply for CDM registration, and are therefore not represented in this graph. The fact that so many projects just barely meet the 8% threshold (even though they are not required to do so), and so few do not meet it, may instead indicate, however, that project developers are eager to claim that the CER value has allowed the project to clear the benchmark rate.

In contrast to the situation in China where standard government benchmarks are provided, most projects in India use internal, company-specific required rates of return as their IRR benchmarks. However, as in China, the CER value tends to provide a similar increase in expected return (e.g., an increase in IRR of two to three percentage points), just clearing the stated benchmark.

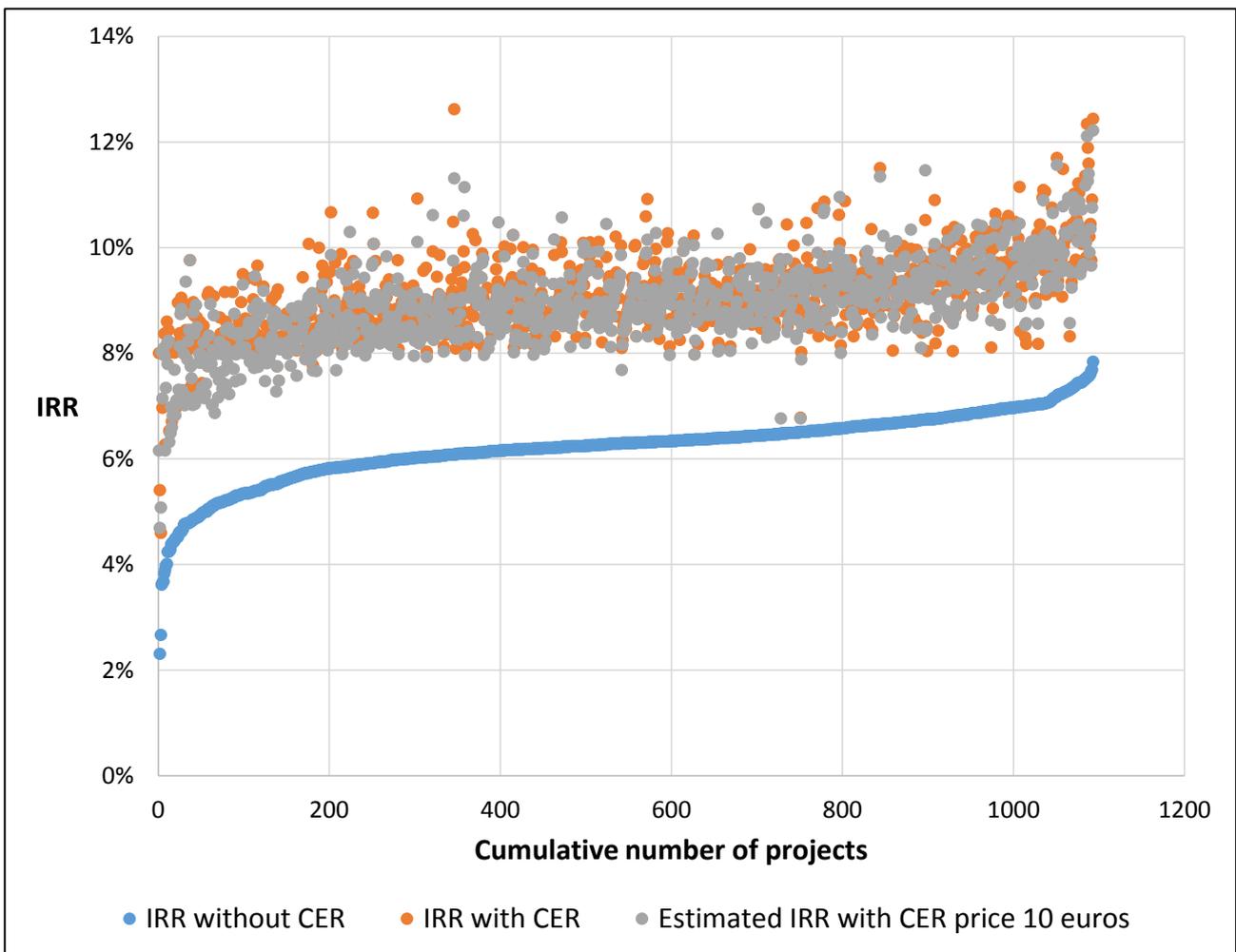
To demonstrate that projects just clear the benchmarks, project developers could select project input parameters so that the benchmark is achieved. These parameters could include CER price, load factor, electricity tariff, or a number of other inputs required in calculating an IRR.

One such parameter that could be adjusted is the expected CER price, which rose consistently through mid-2008, then fell precipitously, and for which forecasts have varied widely since, providing a potentially broad scope for selecting possible future CER prices.

Closer examination of selection of the CER price

To explore the potential effect of the CER price in more detail, Figure 3-4 adjusts the post-CER values stated in the PDDs (as displayed in Figure 3-3) to use a common CER value of €10 for all projects. (€10 is the median value used across all registered projects.) In this example, a large number of projects no longer meet the 8% benchmark. In particular, about 70 projects with pre-CER IRRs of 4% to 6% used CER prices as high as €17 in order to claim they would meet the 8% benchmark. Though this represents just a small share (about 1%) of wind power projects in China, it strongly suggests that input parameters (CER values) have been chosen to achieve the desired result of the 8% government-set IRR benchmark.

Figure 3-4: Estimated IRRs of Chinese wind projects using a benchmark of 8% before and after CER value of €10



Sources: IGES 2014, authors' own calculations

Similar to the situation for Chinese wind power projects discussed above, a number of Indian wind projects that claimed that CER values (median price assumed: €14) would lead them to exceed their benchmark would not have been able to claim that their benchmarks are met if they had used

a lower, and more common, CER price of €10. This suggests that, as found in the case of wind power projects in China, project developers in some instances may select CER values that depart from values used by their peers in order to claim that CDM revenues will make the projects financially attractive.

A similar pattern emerges for hydropower projects in Vietnam, where benchmarks (averaging 13.1%) were derived either as the weighted average cost of capital (WACC) or a stated commercial lending rate.¹⁶ Of the projects analyzed¹⁷, over half of the hydro projects would not have met their benchmarks if they had used a CER price of €10 instead of higher prices (median price assumed: €15.5, and as high as €30, in contrast to the remainder of Vietnamese hydro projects with median price assumed of €10). As above, while this is not definitive evidence of gaming, it suggests that project developers tend to invoke higher CER prices than their peers when needed to claim that their projects become economically viable under the CDM.

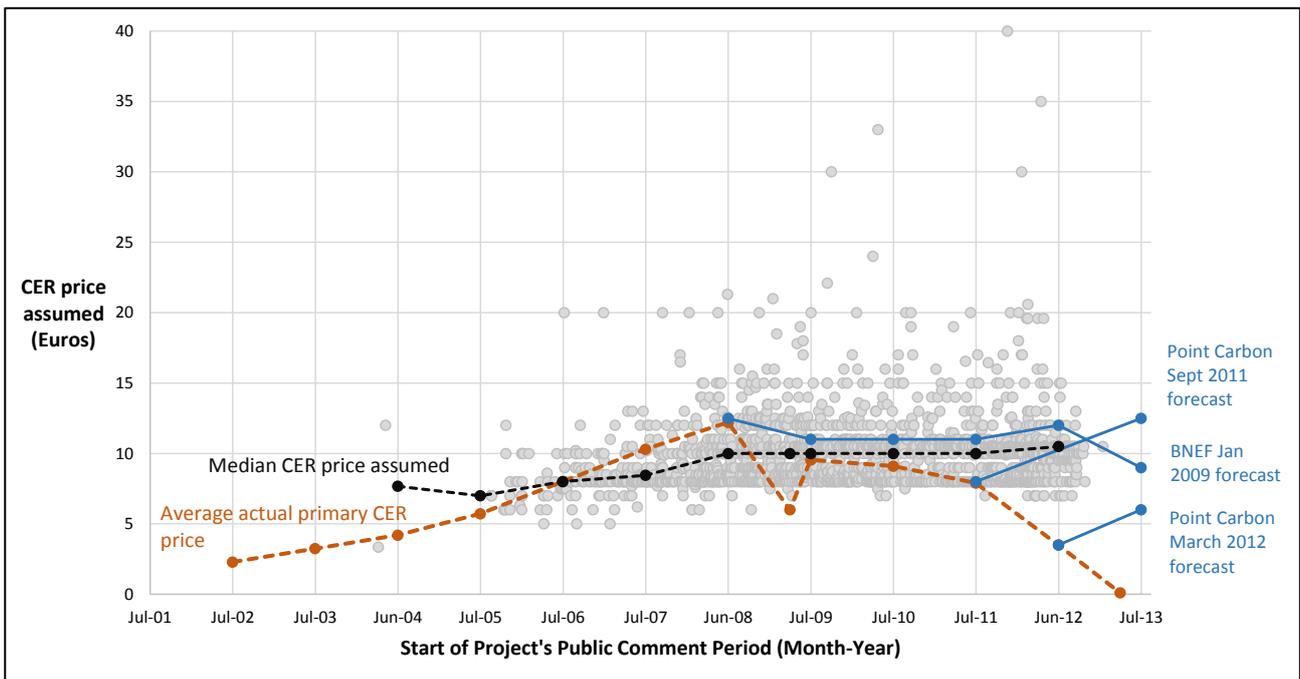
This raises the question of the plausibility of CER prices used by project developers. Looking at all registered projects (Figure 3-5), it appears that the CER prices used by project developers, though highly variable, tended to track then-current primary CER prices, through 2010, when CER prices began a steady decline. Project developers did not then use lower prices, but neither did industry analysts, who forecasted that higher prices would return.

These trends therefore display little evidence that project developers have systematically over- or under-estimated expected CER prices, at least as judged by the median (black line) values. However, the distribution of prices around that median displays a skew wherein a small fraction of projects use very high prices, perhaps because, as shown above, such high prices may be needed to demonstrate that these projects have met benchmarks.

¹⁶ In Vietnam, the median IRR benchmark used by projects in Vietnam was 13.1%, and most benchmarks were derived either as the weighted average cost of capital (WACC) or a stated commercial lending rate. The default expected return on equity for power projects in Vietnam, per the CDM's *Guidelines on the Assessment of Investment Analysis*, is 12.75%; 60% of power projects in Vietnam use an IRR benchmark higher than this rate; 5% have an IRR without a CER value exceeding this.

¹⁷ From the IGES investment analysis database, all hydro projects in Vietnam were selected that reported CER price assumptions in € as well as pre- and post-CER IRR values.

Figure 3-5: CER prices – assumed and estimated



Notes: CER prices assumed by project developers (grey dots) have been relatively consistent with industry forecasts made at the time (blue lines), even though they have been higher than market prices (orange line) since 2008.

Sources: IGES 2014, Point Carbon 2011, Point Carbon 2012

Sensitivity analysis: can it help address subjectivity?

The CDM addresses the subjectivity of input parameters, in part, through the use of sensitivity analysis required in investment analysis. As specified in the *Guidelines on the assessment of investment analysis*, “variables...that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation ... and the results of this variation should be presented.” However, the guidelines do not require that parameters be varied simultaneously, and few project developers do so. For example, in calculating project IRRs (in the PDDs), no project developer of the 30 randomly selected projects assessed the possibility that more than one of the key input variables could vary simultaneously. Furthermore, nearly all claim that even the standard variations of as much as 10% in the individual parameters are implausible, despite evidence (as presented here) that variation in the input values used is quite common. Accordingly, because the possibility that individual parameters could vary widely is discounted, and the possibility that multiple inputs could vary is not considered, the sensitivity analysis as currently applied is not sufficient to address the subjectivity in these parameters.

3.2.3. Summary of findings

Investment analysis is designed to determine whether a project would be uneconomical or less attractive than an alternative in the absence of the CDM. The premise is that if the project is not economical (most often as compared to a particular investment threshold), it would not have proceeded. From a strictly financial perspective, this may well be the case. However, researchers have pointed out that several types of projects in the CDM – especially large power projects that dominate the CDM pipeline – are pursued for reasons that extend beyond simple financial return, particularly in the largely non-market regulatory environments that are found in some of the largest CDM countries. This may be the most fundamental critique of investment analysis, and yet it is also the most analytically challenging to prove or disprove. Projects may proceed for a variety of

factors – economic, strategic, and social – that defy attempts to attribute the viability, or failure, to any one factor. Complicated statistical tests have been proposed – and some statistical research has been attempted – but few compelling approaches have yet emerged.

This research has further explored the issues of information asymmetry, transparency, and subjectivity of input assumptions. Regarding information asymmetry, project developers have considerably more information about their own project than do those – likely including validators – that are charged with reviewing and assessing their additionality. Regarding transparency, this research finds that, since 2007, the transparency of both project design documents and validator assessments has increased markedly, such that the strong majority of projects now include detailed information on input assumptions that their investment analysis could be replicated.

In some cases, there is little reason to question the validity of these input assumptions, as they are based on contract documents (e.g. with equipment providers that would seem to reflect actual prices paid). In other cases, the input assumptions are highly subjective, as in estimates of future fuel prices (e.g. for biomass), electricity tariffs that may be adjusted, or CER prices. In particular, this research has identified dozens of cases in China, India, and Vietnam in which it appears that project developers have used CER prices higher (in some cases, much higher) than their peers in order to claim that the CDM would make their project exceed the chosen financial benchmark. This demonstrates how eager some project developers may be to select input values to give results that would give the appearance of additionality.

3.2.4. Recommendations for reform of CDM rules

As stated above, for an additionality test to function properly, it must be able to demonstrate with high confidence that the CDM was the deciding factor in project implementation. This analysis has demonstrated that the subjective nature of the investment analysis limits its ability to provide that confidence. It is possible that improvements could decrease this subjectivity, such as by applying more complicated tests to assess the true motivations and financial performance of the project. Still, doubts may remain, especially for project types for which the financial impact of CERs is insufficiently large relative to variations in other potential inputs to provide a strong ‘signal-to-noise’ ratio, such as for large power projects. CDM administrators may therefore want to consider whether certain project types, if they cannot be confidently deemed additional by other tests (e.g. barrier analysis, common practice analysis, as in the next sections of this report), might be phased out of the CDM. If the investment analysis continues to be applied, we recommend further improving the guidance to reduce subjectivity. CDM rules could also require formal declarations by the project participants that information is true and accurate. Such declarations may discourage project participants from providing false information, as a violation of such a declaration may have consequences under national legislation. An even stronger form could be a declaration in lieu of an oath.

3.3. First of its kind and common practice analysis

3.3.1. Overview

The CDM uses two approaches to assess additionality based on the market penetration of technologies: the first-of-its-kind approach and the common practice analysis. Under the first-of-its-kind approach, a project is deemed automatically additional if certain conditions apply. The common practice analysis often complements the investment or barrier analysis. It requires an assessment of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. It is a credibility check to demonstrate that a project is not common practice in the region or country in which it is implemented. The common practice analysis can also be used to demonstrate that the baseline technology or practice is frequently implemented and is hence a realistic scenario. The common practice analysis is only relevant for large-scale

projects. Small-scale projects are entitled to use simplified modalities and procedures for small-scale CDM project activities, which do not require common practice analysis.

The first-of-its-kind approach was initially applied as part of the barrier analysis; it was sometimes also referred to as the barrier of lack of ‘prevailing practice’. In 2011, the EB adopted guidelines specifying how first-of-its-kind should be demonstrated. The guidelines were further revised in 2012 and reclassified as a tool in 2015.¹⁸ Showing that a project is the first-of-its-kind is the first step in the additionality tool and combined tool, which stipulate that if a project is the first-of-its-kind, it is considered additional. The steps to be followed for demonstrating first-of-its-kind are further specified in the corresponding guidelines and, since 2015, the methodological tool. According to version 03.0 of the tool, a project activity is “first of its kind in the applicable geographical area” if

- “the project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project” with the same output and that “have started commercial operation in the applicable geographical area before” the PDD “is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier”, if
- “the project implements one or more of the measures” and
- “the project participants selected a crediting period for the project activity that is “a maximum of 10 years with no option of renewal”.

The common practice test was first introduced in the additionality tool in 2004 to complement the investment and barrier analyzes, as a safeguard to ensure the environmental integrity of the CDM. In a first step, other previous or current projects which are similar to the project activity were analyzed. Projects were considered similar “if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.” Other CDM projects were excluded from this analysis. In case similar activities were identified, it was necessary to justify why these exist, while the project activity is considered to be financially unattractive or as facing barriers. ‘Essential distinctions’ had to be identified which may for instance be due to the fact that new barriers have arisen or promotional policies have ended.

For both the first-of-its-kind approach and the common practice analysis, the key issues are defining what is regarded as a comparable technology, what the appropriate geographical scale is and what threshold should be used for a technology to be regarded as first-of-its-kind or common practice. Critics pointed out that no clear definitions of when a project activity should be regarded as common practice were given in the early versions of the additionality tool (Schneider 2009). Another criticism was that the common practice test allows project developers to claim that a frequently implemented project type is not deemed common practice if they can justify ‘essential distinctions’ from other projects. Yet the key terms ‘similar’ and ‘essentially distinct’ were defined so vaguely that any project could be argued to be not common practice, simply by defining ‘similar’ very narrowly or ‘distinct’ very broadly (Schneider 2009; Spalding-Fecher et al. 2012).

The requirements for the common practice analysis in the additionality tool remained largely unchanged until September 2011 when the “Guidelines on Common Practice” were introduced, incorporating elements from the additionality tool and providing additional guidance¹⁹. In parallel to the revision of the “Guidelines on first-of-its-kind”, the “Guidelines on Common Practice” were further revised in 2012 and reclassified as a tool in 2015.

¹⁸ Methodological tool. Additionality of first-of-its-kind project activities (version 03.0).

¹⁹ The new requirements of the Guidelines on Common Practice were then also incorporated in the additionality tool in the same year.

Both guidelines or tools are applicable to four GHG reduction activities, namely, “fuel and feedstock switch, switch of technology with or without change of energy source (including energy efficiency improvement), methane destruction” and “methane formation avoidance”²⁰. Both also use similar approaches for defining similar or different technologies and the appropriate geographical area.

In the 2011 version of the common practice guidelines, the first step was to calculate the applicable output range as +/-50% of the capacity of the project activity. In the next step, all existing plants in the geographical area within this capacity range needed to be identified (with the exception of registered CDM projects). The default applicable geographical area was the entire host country. If the technology was not country-specific, the geographical area should be extended to other countries. If projects differ significantly between locations, the geographical area could also be smaller than the host country. In the next step, among the identified projects, those with different technologies from the project activity were identified. A technology was considered different if it has a different energy source/fuel, feedstock, installation size (micro, small, large), investment climate at the time of the investment decision²¹ or other features.²² Eventually, if the share of plants using similar technology as in the project activity in all plants with the same capacity as the project activity is greater than 20% and if the absolute number of projects using a similar technology is larger than three, then the project activity is considered common practice.

In revising the Guidelines on Common Practice in September 2012, the rules and definitions were further clarified. It is now mandatory to provide a justification for using a geographical area smaller than the entire host country (e.g. province, region). The reference to extending the geographical area was removed from the guidelines. The exclusion of CDM activities was broadened to include registered projects, those requesting registration and those at validation. Furthermore, several definitions and the step-wise approach were better explained (without change in substance). Minor changes to the common practice analysis were made in subsequent versions of the additionality tool.

The definition of different technologies in the first-of-its-kind approach corresponds to the common practice analysis, with the exception that investment climate at the time of the investment decision and other features are not included.

3.3.2. Assessment

The general strength of using market penetration approaches for assessing additionality is that they do not assess the motivation or intent of project developers, but provide a more objective approach to evaluating additionality, based on the extent to which the project activity is already being implemented in the host country or region (Schneider 2009).

The initial criticism of the lack of clear definitions of similar projects and essential distinctions for common practice was addressed by the introduction and further refinement of the common practice guidelines, which clearly outline steps to follow and provide a definition of terms for a common understanding between project developers. Especially, the introduction of a threshold for common practice (20% and at least three similar projects) constitutes a significant improvement since it requires a quantitative assessment against a clear threshold. Clarity about the rules related to common practice analysis has therefore improved considerably over time. Also, from the sampled projects, it can be concluded that the introduction of the common practice guidelines has generally led to more detailed and better structured PDDs.

²⁰ For other types of GHG reduction activities, the more general rules of the additionality tool continue to apply.

²¹ “Inter alia, access to technology, subsidies or other financial flows, promotional policies, legal regulations.”

²² Such as a difference in unit cost of output by at least 20%.

However, several unresolved issues still exist. In the following, different aspects of the common practice analysis and the first-of-its-kind approach are discussed and assessed. The assessment is based on an analysis of the common practice provisions and on the findings of an empirical evaluation of 30 representatively selected projects (i.e. the review of PDDs and validation reports) (Section 2.2).²³

When defining similar projects in the common practice tool, the applicable output range is defined as “+/-50% of the design output or capacity of the proposed project activity”. This definition does not always reflect the scales of a technology, between which meaningful technological differences occur. For instance, in the case of a power plant with a size of 400 MW, power plants between 200 MW and 600 MW would need to be considered in the analysis. However, there may be smaller (e.g. 100 MW) or larger (e.g. 800 MW) power plants which still feature similar technical, economic characteristics (e.g. efficiency), a similar regulatory environment, or which are used in a similar manner (e.g. provision of electricity to the public grid). At the same time, a small power plant (e.g. 5 MW), may be significantly different in terms of technology or use. Also, when several plants are grouped to form a project (e.g. wind farm consisting of several wind generators), an output of +/-50% may be misleading. For instance, for a wind farm with 20 wind generators of 1 MW capacity, the output range would be 10 to 30 MW. However, a smaller wind farm with only 10 wind generators of 1 MW capacity has similar characteristics since the wind generator is identical. For wind power, the test may provide more meaningful results if there was no scale at all since wind parks are usually composed of different wind generators of the same size. However, small internal combustion engines may well differ, from a technological perspective, from a large combined cycle power plant. In conclusion, the definition in the common practice guidelines (+/- 50%) does not allow for a meaningful classification of scale for different technology types. This definition can therefore be considered arbitrary and may lead to the erroneous exclusion of similar plants from the analysis. In contrast to the common practice tool, the first-of-its-kind tool does not use an output range to define similar technologies. This approach seems more appropriate.

When identifying similar projects, the common practice tool excludes CDM projects (registered, submitted for registration or undergoing validation) from the analysis. In the empirical analysis, of the 30 sampled projects, only three identified similar non-CDM projects. All other projects only identified projects under the CDM. A commonly used rationale (i.e. used by 9 of the 30 projects) is that, because all other comparable facilities are either CDM projects or are awaiting registration as CDM projects, the proposed project would also be non-viable without the CDM (i.e. not common practice). However, it could be argued that the general viability of projects is assessed as part of the barriers and/or investment analyzes and should therefore not be used as a pre-emptive argument for excluding CDM projects from the common practice analysis. The exclusion of CDM projects from the common practice analysis is particularly problematic if most or all new facilities in a sector use the CDM. For example, if all new wind power plants in a country register under the CDM, wind power could never become common practice, even if it reached a market share of more than 50% and was highly economically attractive. In contrast to the common practice tool, the first-of-its-kind tool does not have provisions to exclude CDM projects, which suggests that all existing projects, including CDM projects, are considered.

²³ Of the 30 projects sampled for the evaluation of the common practice analysis, the majority stem from China (20 projects), followed by India (3), Egypt (2), Pakistan (2), Brazil (1), Nicaragua (1) and Israel (1). Ten projects were registered before 2010, eight in the 2010-2011 period and twelve after 2011. Technology types in the sample are wind power (17 projects), hydropower (5), industrial projects such as coal mine methane utilisation or waste heat recovery (3), waste projects such as landfill gas capture (4) and other renewable energies such as biomass (1). Most projects (28 of 30) are classified as large-scale. Although the sampled two small-scale projects are not required to conduct a common practice analysis, some information on common practice was given in the corresponding PDDs.

The common practice tool and the first-of-its-kind tool use the same definition of the geographical area, which should be the entire host country, unless justification can be provided for a smaller geographical area. In the common practice analysis sample, 24 of 30 projects limited the applicable geographical area to a specific area smaller than the host country (such as province, region, state, municipality, etc.). All sampled wind projects from China (11)²⁴ and from India (3) selected an area smaller than the host country as the applicable geographical area. The most commonly used justification in the corresponding PDDs for limiting the geographical area is that investment conditions, especially in terms of electricity tariffs, available resources and labour costs, differ from province to province, making provincial/state level comparison necessary.

At first sight, this appears to be plausible since China and India are large countries with regions/states being important players in infrastructure development. Notwithstanding this, the size of the country and the political structure may not be sufficient to justify the choice of the regional/state level. In China, a nationwide feed-in tariff for wind power generation was introduced in 2009, establishing four different tariff categories, ranging from 0.51 CNY/kWh (0.08 USD/kWh) to 0.61 CNY/kWh (0.10 USD/kWh), depending on the region's wind resources (International Renewable Energy Agency 2012). For projects in India, the Electricity Act of 2003 and the resulting new tariff regulations were cited as the cause of different investment climates in various states. In fact, for wind power, the tariff varies based on local wind resources. Four bands of wind power density in W/m^2 determine the level of the feed-in tariff (International Energy Agency 2012). This means that the feed-in tariff may differ even between project locations in the same province if these feature different wind conditions. Therefore, the fact that there are different feed-in tariffs between provinces alone does not explain fundamentally different investment conditions in the different regions, as claimed in many PDDs, but rather only accounts for locally different wind resources, while the general support scheme is national²⁵. Based on these considerations, the rationale used by many projects for limiting the geographical area to a level below the entire country seems questionable. It can also be problematic to consider only the host country as the geographical area. If no or only a very few plants providing the same service exist in the host country, market penetration approaches do not give reasonable results. For example, the first aluminium plant in a country would always automatically be deemed additional, even if it used a technology that is clearly business-as-usual.

While the introduction of the common practice guidelines aimed to address the criticism of a vague definition of what constitutes 'different' technologies, several concerns remain. The possibility of defining a technology "as being different if there is a difference with regard to energy source/fuel, feed stock, installation size (micro, small, large), investment climate at the time of the investment decision (including, "inter alia, access to technology, subsidies or other financial flows, promotional policies, legal regulations") or other features (such as difference in unit cost of output by at least 20%)" still allows for significant possibilities to claim that rather similar projects are very different. This allows for the project to be defined rather narrowly and other plants very broadly, so that the threshold of 20% is not reached. With regard to the installation size, the same issue as for the output range (above) applies. Also, the criterion 'energy source/fuel' may be misleading. For instance, if a country has been using light fuel oil as a basis for its power plants, a switch to natural gas constitutes a different fuel, but does not explain a significant difference since the same generation technology can be used for both fuels. The same holds true for different solid fuels. Finally, 'other features' is a very broad term allowing for arbitrary interpretations. For example, a difference in unit cost of output does not constitute a plausible difference per se²⁶. For instance, higher unit costs

²⁴ Also all other Chinese (non-wind) projects included in the sample use a sub-national geographical area with a similar rationale as that for wind projects.

²⁵ A differentiation of the feed-in tariff depending on local wind resources is common practice in other countries as well.

²⁶ Two sampled hydro projects used this rationale.

may be required for technical or other reasons and may be compensated for by higher yields²⁷. Also, according to this interpretation, a proposed CDM project with *lower* unit costs would be considered different from projects already implemented without CDM, even though it is more profitable than other projects. Although in some cases, 'differences' may be well justified (e.g. by explaining that the investment climate was significantly different due to a change from a state-controlled to a more private investment-oriented power market), overall, the review of arguments presented in the sampled PDDs indicate that the term 'different' allows for significant room for interpretation.

The threshold of 20% market diffusion in the common practice tool cannot be considered robust if applied to all technologies and sectors. The stringency of the 20% is highly dependent on the number of technologies in a sector. In a sector with only two technologies, both available technologies could easily exceed the threshold, whereas none of the technologies may ever reach the 20% threshold in sectors with many different technologies. For instance, in a country with several fuels and technologies available for power generation (e.g. natural gas, coal, wind, hydro, biomass, PV), a low market diffusion may still constitute common practice due to the abundance of options and due to the (potentially) limited potential of some technologies. For instance, hydro electricity generation may constitute only 5% of overall electricity generation. Nevertheless, hydropower could still be considered common practice due to the fact that hydro resources are limited and most of the resources have already been exploited. In contrast, in a sector in which there are only a few technologies (e.g. for a certain industrial process) a market diffusion of 20% may constitute a reasonable value for determining common practice. Also, even though a technology may not be considered common practice considering all existing plants in a sector (i.e. considering the market saturation), it may be common practice considering the recent trend (i.e. considering the market share in a certain year)²⁸. For instance, electricity generation from wind may constitute only a small share of the overall electricity generation in a country (e.g. 1%). However, capacity additions in recent years may constitute a significant share of overall new capacity built. In the former case, wind power would not be considered common practice, whereas in the latter, trend-oriented, perspective wind power would constitute common practice. This issue is especially relevant in the case of long-lived capital stock such as in the power sector (Kartha et al. 2005). Similarly, the provision that at least three plants with a similar technology must have been constructed to consider a project common practice may not be appropriate in all situations. For example, if only four plants exist in a country and three use the same technology, thus constituting a market share of 75%, the construction of a fifth plant with the same technology would still not be regarded as common practice. In conclusion, a one-fits-all value as threshold for market diffusion cannot be considered appropriate.

With regard to the quality of evidence used for the demonstration that a project is not common practice, almost all PDDs provided anecdotal evidence to support their claims. Commonly made statements are that there is no evidence to suggest that a similar project has been, is being or will be implemented in this area and that all other projects use CDM financing as well. To support these claims, publicly available external documents such as energy statistics were used in the majority of projects (20 of 30 projects). Yet, these public documents do not provide information about different investment climates in terms of labour costs, available resources and feed-in tariffs.

As regards the validation of common practice, in 21 of 30 sampled projects, the DOE reviewed documents such as the World Bank website or energy statistics. Other means of validation were conducting interviews with stakeholders such as personnel with knowledge of the project design and implementation, local residents and officials.²⁹ However, the DOEs did not evaluate claims

²⁷ E.g. higher units costs may be required for certain equipment for small hydro in a mountainous area, which may be compensated for by higher yields due to a higher head of water.

²⁸ See Kartha/Lazarus/LeFranc (2005) for a definition of market saturation vs. market share.

²⁹ There is no further information available in the PDDs on the content of the interviews with the stakeholders.

made in the PDDs about different investment climates. In nine cases, the DOE in its validation report just repeated the claims made by the PDD.

3.3.3. Summary of findings

Overall, clarity about the rules related to first-of-its-kind and common practice analysis have improved considerably over time. In addition, from the sampled projects it can be concluded that the introduction of the common practice guidelines has generally led to more detailed and better structured PDDs. However, several flaws remain:

- The definition of the output range in the common practice tool is arbitrary and not linked to actual differences in scale of technologies or use.
- The exclusion of CDM projects from the analysis is questionable in a market situation in which most projects are implemented as CDM projects and significant technological changes and cost reductions occur.
- The rationale for limiting the geographical area to a level below the entire country is questionable. In some instances, limiting the geographical area to the host country can be problematic.
- The definition of a project as 'different' in the current common practice guidelines is still too vague and corresponding rules still leave significant room for interpretation.
- The share of 20% market diffusion and absolute number of three similar projects, across all sectors, cannot be considered robust since the appropriateness of these values depends on the number of available technologies in the sector. Additionally, the result of the common practice analysis is highly sensitive to whether all plants of a sector are considered or whether the recent trend (new plants built) is considered. This is especially relevant for sectors with long-lived capital stock.
- Generally, evidence used for the common practice analysis was not adequate in the sampled projects since relevant information for the determination of common practice (e.g. on different investment climates, available resources or feed-in tariffs) was not provided in the PDDs. Also, the validation by DOEs was not adequate in the sampled projects since claims on investment climates were not evaluated and since in several cases the DOE only repeated the claims made by the project participants.

3.3.4. Recommendations for reform of CDM rules

In general, the first-of-its-kind approach and the common practice analysis can be considered more objective approaches than the barrier or investment analysis due to the fact that information on the sector as a whole is taken into account rather than specific information of a project only. It reduces the information asymmetry inherent in the investment and barrier analysis. In this regard, expanding the use of market penetration approaches could be a reasonable approach to assessing additionality more objectively. However, the presented analysis shows that the way in which first-of-its-kind and common practice are currently assessed needs to be reformed in order to provide a reasonable means of demonstrating additionality. In the following, several recommendations are made for the reform of the current rules.

We identified several issues with the approach of using the same generic approach in the context of rather different sectors or project types. We therefore recommend abandoning this 'one-size-fits-all' approach and introducing specific approaches for specific project types, which adequately reflect the circumstances of the sector, in particular with regard to the definition of what is considered

a different technology and the threshold used to define common practice. A practical means of implementing this is including specific guidance in each methodology.

- Due to the inherently vague concept of ‘different’ technologies, it is recommended that the common practice rules are revised in such a way that methodologies or overarching guidance provide clearer guidance on how to support the claim of a ‘different’ technology including the evidence required (including evidence to demonstrate credible differences in the investment climate). Corresponding provisions in the VVS should also be amended in such a way to provide more specific guidance on how DOEs should assess the claim of ‘essential distinctions’ for different projects types. With regard to the above-mentioned arbitrary definition of the applicable output range, it is recommended that the common practice guidelines are revised in such a way to provide general guidance on how meaningful differences according to scale can be identified for different technologies. More specific guidance on how to define a range of capacity/output should then be defined in the corresponding methodology. In the absence of any definition of capacity/output range in the methodologies, the whole spectrum of plants or activities (from very small to very large) should be covered by the analysis.
- With regard to the exclusion of CDM projects from the common practice analysis, the rules should be amended in such a way that all CDM projects are to be included in the analysis as a general rule, unless specified otherwise by the methodology. Methodologies could specify that CDM projects are excluded to a certain extent and then gradually introduce them in the analysis. This is especially relevant if all projects of a certain technology use the CDM. As Schneider (2009) points out “other CDM projects could be included in the common practice analysis after a certain period or after a specific number of CDM projects have been implemented”. Another criterion for inclusion of CDM could be their market penetration. (International Rivers 2011) suggest that “after 3 years of full operation, a CDM project should be included in the common practice analysis”. Furthermore, a “list of project types that are not eligible for the CDM because they are common practice” (ibid.) (negative list) could also be helpful in this regard.
- Due to our finding that the selection of an area below the host country level as the applicable geographical area is a questionable assumption, it is recommended that the rules be revised to define the appropriate geographical area in the context of the specific circumstances, such as the number of projects or installations in the host country. A level below the host country level should not be used.
- The threshold for common practice should be defined depending on the type of technology and sector. Corresponding guidance should be provided in the methodologies. In sectors with long-lived capital stock (e.g. power sector), the common practice analysis could consider two different perspectives: a) common practice in the sector (e.g. power sector) as a whole (market saturation) and b) common practice in more recent investments (market share) (i.e. similar to the operating and build margin approach for projects displacing electricity). If common practice is established according to at least one of these perspectives, the project should be considered common practice. Since data availability for determining market diffusion may not be sufficient in each country and in order to ensure consistency in determining market diffusion, efforts (e.g. multilateral) for collecting this data and for providing this information to project developers could be helpful. Several global datasets already exist (e.g. UNEP DTU 2014, statistics by the World Bank, sectoral statistics, Platts database on power plants or cement statistics by Cembureau), which could be used to estimate market diffusion in different countries in a consistent manner. An extensive discussion of

the usefulness of market penetration for establishing common practice for certain projects types is included in (Kantha et al. 2005).

Due to the fact that several DOEs repeated the claims made by the project participants without documenting the way in which they actually assessed the appropriateness of the claims, we recommend strengthening efforts to ensure that all DOEs effectively comply with the reporting requirements related to the common practice analysis outlined in the VVS. For this purpose, no change in rules has to be applied, but the accreditation system may need to be strengthened to ensure compliance of all DOEs with applicable CDM requirements.

Another option for improving the analysis of common practice is to consider the overall potential available in a country. For instance, a small share of hydro in overall electricity generation may, on the one hand, be due to barriers, risks or economic unfeasibility of hydro construction (hydro electricity generation would therefore not be common practice). On the other hand, the small share of electricity generation from hydro may be due to the very limited hydro potential in the country. Most of the (small) potential may already have been exploited. Any additional hydro capacity could then be considered common practice since it has been exploited before. However, this approach would bring about the problem of defining ways to establish the potential (e.g. technical vs. economic potential, etc.), and the practicalities and transaction costs of evaluating this for many different technologies.

Furthermore, the common practice analysis could “be the first step in the additionality tool rather than the last” (International Rivers 2011). This way, instead of using often vague arguments for establishing common practice *after* the investment analysis, project developers would need to discuss common practice explicitly at the beginning of the analysis.

3.4. Barrier analysis

3.4.1. Overview

Historically, barrier analysis has been used as an important alternative or complement to the investment analysis analyzed above in Section 3.2. The barrier analysis is used to demonstrate that a project faces barriers that impede the project’s implementation in the absence of the incentives from the CDM. It is applicable to both small- and large-scale CDM projects:

Small-scale projects

According to Attachment A to Appendix B to Annex II of 4/CMP.1 the following barriers may be considered for small-scale projects:

- **Investment barrier:** a financially more viable alternative to the project activity would have led to higher emissions; this includes “the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis”.³⁰ In essence, this barrier allows an investment analysis to be conducted, as described in Section 3.2, but without providing any guidance on how the investment analysis should be conducted. In practice, however, it appears that guidance for investment analysis for large-scale projects (e.g. justification of benchmark IRR or sensitivity analysis) is, in most cases, also applied to small-scale projects.
- **Access-to-finance barrier:** the project activity could not access appropriate capital without consideration of the CDM revenues;

³⁰ See “Non-binding best practice examples to demonstrate additionality for small-scale projects” (EB 35, Annex 34).

- **Technological barrier:** a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
- Barrier due to **prevailing practice:** prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- **Other barriers** such as institutional barriers or limited information, managerial resources, organisational capacity, or capacity to absorb new technologies.

Large-scale projects

In large-scale projects, the barrier analysis is part of the additionality tool and the combined tool. It is applied in two steps:

1. Identify barriers that would prevent the implementation of the proposed CDM project activity. Here, the eligible barriers are similar to the barriers relevant for small-scale projects, with the following differences:
 - The ‘investment barrier’ of the small-scale guidance is, in the large-scale guidance, referred to as ‘investment analysis’ (Section 3.2); a separate option for demonstrating additionality besides ‘barrier analysis’;
 - The ‘access-to-finance barriers’ of the small-scale guidance is called ‘investment barriers’ in the large-scale guidance; and
 - ‘prevailing practice’ of the small-scale guidance is, in the large-scale guidance, usually a mandatory additional step termed ‘common practice analysis’ that is required but is not sufficient in itself to prove additionality.
2. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity).

Another important requirement of the two tools is the following: “If the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional.”

If these steps are satisfied, the project is potentially additional (pending passing of the common practice analysis).

In late 2009 (EB50), the CDM EB adopted the “Guidelines for objective demonstration and assessment of barriers” with a view to improving the objectivity of the barrier analysis. The document provides guidance on the objective demonstration of different types of barriers. For instance, it requires that “barriers that can be mitigated by additional financial means can be quantified and represented as costs and should not be identified as a barrier for implementation of project while conducting the barrier analysis, but rather should be considered in the framework of investment analysis” (Guideline 4 in EB50 A13).

In addition, methodologies may – instead of using one of the tools – provide their own combination of steps from the tools.

3.4.2. Assessment

The concept of barriers preventing investments and mitigation activities is an important element of the research and discussion on technology diffusion and low carbon pathways. From this, it seems reasonable that the additionality test could also take barriers into account and not only be based on

investment analysis. However, the barrier analysis faces multiple challenges in practice that strongly limit its usefulness in the context of the CDM.

Objectivity in barrier analysis

In earlier phases of the CDM, the claim for barriers preventing the implementation of projects was often based on anecdotal evidence, and it was very difficult to provide objective proof of why a barrier is sufficient to “prevent the implementation” (Schneider 2009). In practice, the concept of barriers per se as proof for additionality is problematic, as all investment projects in all countries faces some sort of barriers to its implementation, be they financial, technical or other. In earlier CDM projects, it was sufficient for PDD consultants to state barriers without providing objective and verifiable evidence that they actually *prevent* the implementation of the project. This led to some market participants claiming that with good PDD consultants you could have any project registered based on barriers.

Guidance on objective barriers

In late 2009 (EB50), these problems with barrier analysis led to the adoption of the “Guidelines for objective demonstration and assessment of barriers” by the CDM EB (Section 3.4.1). With their requirement to monetize barriers, the guidelines aim to assess the role of barriers in preventing the implementation of projects in a more transparent way. The monetization of barriers and their inclusion in the investment analysis provide a framework that allows an objective balancing of higher barriers and associated costs with the need for higher revenues. This may be one of the reasons why investment analysis (with or without monetized barriers) has largely replaced the use of the barrier analysis without application of investment analysis in demonstrating additionality (see below).

How much alleviation is necessary to overcome a barrier?

Another weakness of the barrier analysis lies in the application of the requirement to demonstrate that the CDM “alleviates the identified barriers that prevent the proposed project activity from occurring”. The fulfilment of this requirement was not often (explicitly) provided in PDDs nor checked by DOEs. Moreover, the tools do not require that the degree of ‘alleviation’ should be at least comparable to the strengths of the barrier under consideration. To demonstrate the viability of the project with the CDM, one would need to make the case as to why, for example, €x of CER revenues are sufficient to alleviate the risk of damage to a wind farm due to severe sand storms.

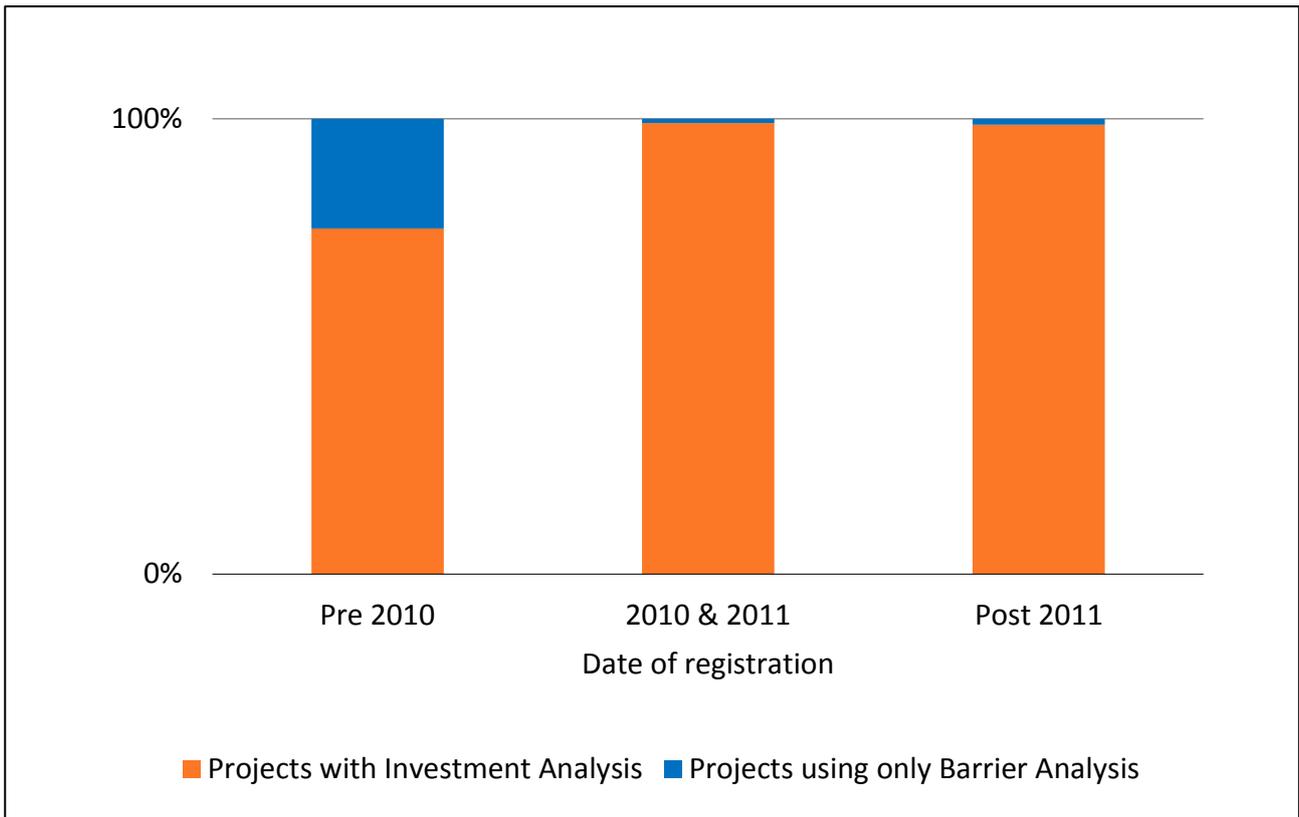
Also with regard to this requirement, the Guidelines provide greater specificity: “Demonstrate in an objective way how the CDM alleviates each of the identified barriers to a level that the project is not prevented anymore from occurring by any of the barriers” (Guideline 2 in EB50 A13).

The vanishing role of barrier analysis in the CDM

The role of barrier analysis in demonstrating additionality in the CDM has been dramatically reduced from 2010 onwards (Figure 3-6). While in the period before 2010 approx. 24% of registered projects used the barrier analysis *without applying an investment analysis in parallel*, this share was reduced to approx. 1-2% of registered projects from 2010 onwards. Since then, the barrier analysis plays a certain role in reinforcing the additionality argument made in the investment analysis, but has largely lost its role as the main approach for demonstrating additionality.

This development might be explained by the introduction of the guidelines for objective demonstration and assessment of barriers.

Figure 3-6: Share of projects using the barrier analysis without applying the investment analysis in total projects



Notes: Own research based on a representative sample of PDDs from 30 stratified and randomly sampled projects that were labelled Investment Analysis option 'none' by the IGES (2014) database revealed that a certain percentage of these PDDs used an approach that in essence follows the Investment Analysis approach of the additionality tool, but was labelled 'Barrier Analysis'. The confusion in terminology was most prominent in small-scale project PDDs, which have the option to demonstrate 'financial barriers' which includes and is often an Investment Analysis. In the representative sample, the fraction of PDDs using actually an Investment Analysis while being labelled Investment Analysis option 'none' by IGES was 36.4% pre 2010 and 90% afterwards. The share of projects using Investment Analysis from the IGES database has, therefore, been increased by these shares from the sample analysis. Without this correction, the share of projects without investment analysis in the IGES database are 38%, 10% and 14%, respectively, for the three considered time periods of registration.

Sources: IGES 2014, authors' own PDD research

With the adoption of the guidelines, the barrier analysis has largely lost its role as the main argument for demonstrating additionality. After 2010, non-financial barriers are quoted in some projects, but merely as additional information to reinforce the main case for additionality, which tends to be based almost uniformly on investment analysis. Potentially, this development may have been supported by an improved performance of DOEs in validating barrier analysis in PDDs, due to an improved accreditation system.

3.4.3. Summary of findings

In early CDM projects, the routine use of anecdotal and often subjective evidence for claiming barriers has led to the registration of projects with questionable claims for additionality, which cannot be objectively assessed by DOEs. With the adoption of the Guidelines and possibly the improved performance of DOEs, the barrier analysis has largely lost its role as the main line of argument for demonstrating additionality. Rather, barriers are monetized and reflected in the investment analysis.

In the CDM, barrier analysis has lost importance as a stand-alone approach to demonstrating additionality because of the subjectivity of the approach. With the guideline, if barriers are claimed, they are monetized and integrated as costs in the investment analysis.

3.4.4. Recommendations for reform of CDM rules

Non-financial barriers can be important factors preventing the implementation of projects even though they may be profitable. Therefore, considering barriers in approaches for additionality determination is a valid approach.

However, the objective demonstration of barriers (as required in the Guidance) has turned out to be very difficult to operationalise without the reflection and monetization in an investment analysis.

Given the de facto non-application of the barrier analysis without investment analysis approaches in the current CDM practice, we recommend removing the barrier analysis from the additionality and combined tools. In return, key aspects of the Guideline related to the monetization of barriers³¹ may be included in the investment analysis step in the additionality and combined tools.

In order to demonstrate additionality of projects with high (non-financial) barriers that may not be monetized, a comprehensive 'common practice' analysis or in small-scale projects 'prevailing practice' analysis shall be carried out (Section 3.3). Here, objective data on market shares of technologies/project types may be collected that may serve as objective proxy information for the extent to which barriers actually prevent the implementation of projects.

On another note, the approval of "Guideline on objective demonstration and assessment of barriers" by the CDM EB may be seen as a positive example of how the CDM regulator, under the right conditions, can react to an obvious flaw in the rules and practice, and rectify the system.

3.5. Crediting period and their renewal

3.5.1. Overview

Project participants can choose between one crediting period of 10 years without renewal or a crediting period of seven years for their project, which is due for renewal every 7 years for a maximum of two renewals (a total of 21 years for normal CDM projects). (For afforestation and reforestation projects, the choice is between one period of 30 years and three periods of 20 years). The Marrakesh Accords state that for each renewal, a designated operational entity shall determine that "the original project baseline is still valid or has been updated taking account of new data where applicable".

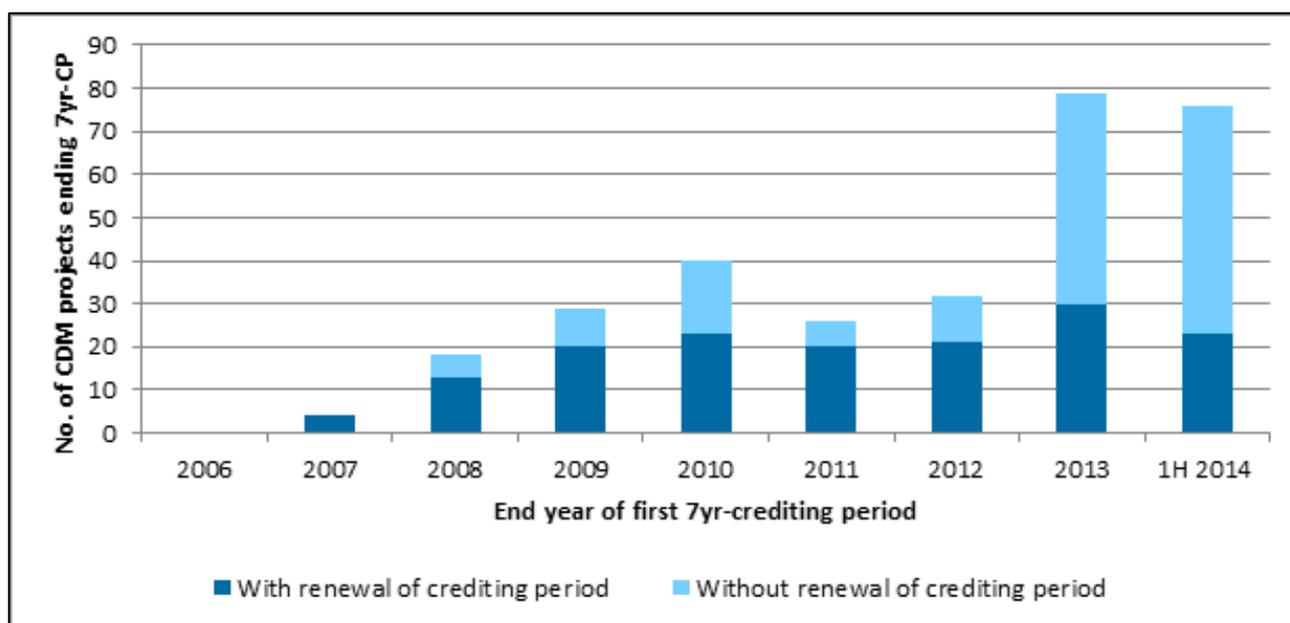
Requirements regarding the renewal of the crediting period were initially adopted in 2006 (EB28, Annex 40), subsequently revised several times (EB33, EB36, EB43, EB46, EB63, EB65, EB66), and partially incorporated in the project standard. At the renewal of crediting period, the latest valid version of a methodology must be used. If a methodology has been withdrawn or is no longer applicable, the project developers may use another methodology or request deviation from an applicable methodology. The CDM EB interpreted the 'validity test' in the Marrakech Accords in such a way that neither additionality nor the baseline scenario needs to be reassessed during the renewal of the crediting period. "The demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have resulted from that scenario" (Project Standard, Version 07.0, paragraph 289). The current rules mainly require an assessment of the regulatory framework, an assessment of

³¹ This relates to Guidelines no. 4 and 5 of EB50 Annex 13 that may be integrated as cost items related to barriers/risks in the investment analysis of the additionality and combined tool. Guideline 2 may also be implemented in the context of the investment analysis in the tools, in that the CER revenues should be sufficient to overcome the financial gap in project finance that is due to the barrier.

circumstances, an assessment of the remaining lifetime of technical equipment to be used in the baseline, and an update of data and parameters, such as emission factors.

Figure 3-7 plots the number of projects that have chosen a 7-year crediting period and that end their first crediting period in a given year and are therefore potentially entering a process of crediting period renewal. The increase in project registrations with the maturing of the CDM market from 2005 is mirrored by a steep increase in candidate projects for renewal seven years later, after 2012. The graph also indicates that the fraction of these candidate projects that actually underwent renewal significantly declines after 2012: While before 2012 roughly two thirds of all candidate projects underwent renewal on average, the rate dropped to roughly one third after 2012. This may be explained by the collapse in pricing and the petering out of the classical CDM market in 2011-2012, whereby CER prices below marginal transaction costs make renewal of crediting economically non-viable for most projects that do not benefit from long-term futures contracts with higher prices.

Figure 3-7: Number of CDM projects ending first seven-year-crediting period – with and without renewals



Sources: UNFCCC 2014, authors' own analysis

3.5.2. Assessment

The requirements to use the latest approved version of a methodology is a very important rule to assure that changes in the methodological ruling are also implemented in CDM projects within a reasonable timeframe and therefore seem appropriate. At the same time, it provides some certainty for investors that rules regarding the calculation of emission reductions are not changed within their crediting period.

The CDM EB's decision to interpret the Marrakesh requirement of assessing that "the original project baseline is still valid" in such a way that that only baseline emissions must be updated but that neither additionality nor the baseline scenario needs to be re-assessed could constitute a major risk for the environmental integrity of some project types. In 2011, the Meth Panel highlighted cer-

tain issues with this approach in an Information note to the EB (MP51 Annex 21³²), but the rules were not changed in response. In the following, we briefly analyze two main issues:

- The case of the baseline scenario changing over the course of the crediting period in a way that is not captured by the baseline methodology;
- The case of limited 'lifetime' of a baseline scenario.

Baseline scenario changing over of the course of crediting periods

In a number of instances, a baseline scenario could change over time during crediting periods and deviate from the assumptions in the underlying methodology. One example is a CDM project consisting of the conversion of an existing open cycle power plant to a closed cycle system. Assuming that after the first crediting period, new and lower cost technologies for the conversion would become available that would make the project economically viable, the implementation of the project activity after the first crediting period might be the most probable baseline scenario in the absence of the CDM. We are not referring here to the concept of dynamic baselines, e.g. the fact that baseline emissions are calculated based on the project output (e.g. in tons of steel or MWh per year). Rather, the scenario is changing, i.e. this refers to projects (or another low carbon activity) which, in the absence of the CDM project, would have been implemented at a later date due to changing circumstances.

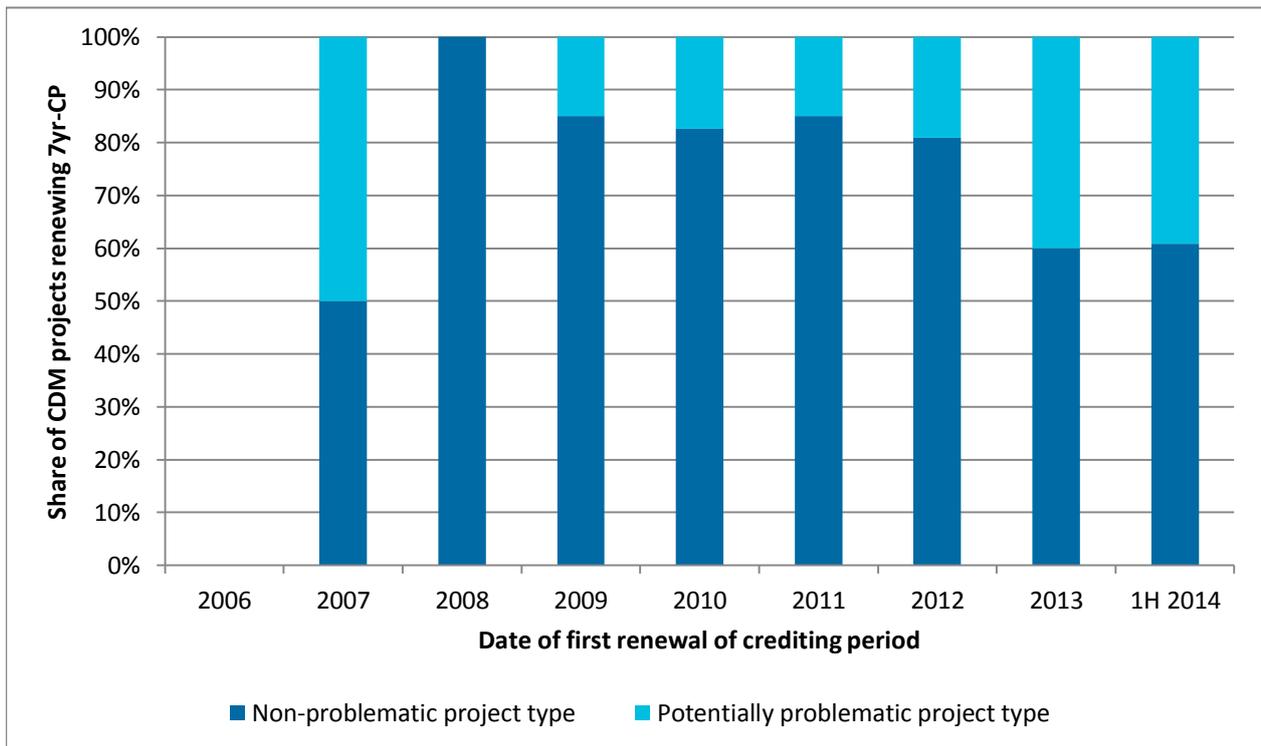
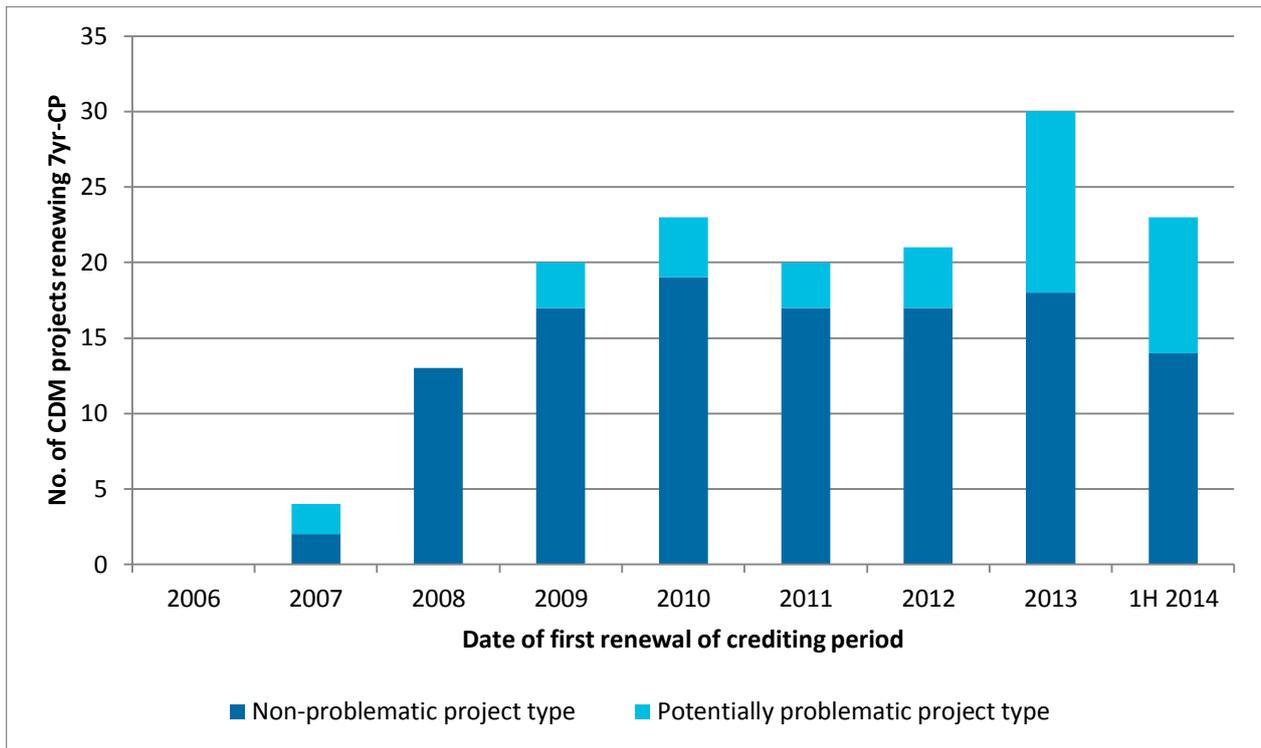
However, it is important to note that not all CDM project types are prone to changing baseline scenarios. Baseline scenarios typically change over time if they are the 'continuation of the current practice'. In such cases, changes such as retrofits could also be implemented at a later stage. In contrast, baseline scenarios do not change over time when they include a significant investment at project start in an alternative that provides similar services. This is the case if, for example, an industry can choose to fulfil their heat demand by either a new biomass boiler (project activity) or a new coal boiler (baseline). If one assumes that the project participant carries out a significant investment at the beginning of the baseline (e.g. to build the new coal boiler), it may be assumed that this investment is used until the end of its operational lifetime; replacing the coal boiler by a biomass boiler after seven years is economically not viable in general.

However, because CDM requirements explicitly rule out the re-assessment of the baseline scenario, cases with a change in baseline scenario cannot be taken into account, which leads to potential over-crediting in the second and third crediting periods in the case that the activity would have been implemented after the first crediting period due to changing circumstances.

Practical examples of such changing circumstances and related potential over-crediting can be found in Purdon (2014) for the co-generation sector. The paper provides an overview of how a change in external influence factors (e.g. sugar price) can influence the additionality and how a baseline scenario that is kept constant over several crediting periods can result in over-crediting.

³² https://cdm.unfccc.int/Panels/meth/meeting/11/051/mp51_an21.pdf.

Figure 3-8: Share of CDM projects renewing their seven year crediting period that is deemed non-problematic



Notes: Potentially non-problematic project types have been selected according to the criteria of having a lower risk of changes in the baseline scenario over several crediting periods.

Sources: UNFCCC 2014, authors' own analysis

Assessment of the scale of the issue

In the following, we make a very rough assessment of the scale of this issue. As mentioned above, not all project types are in danger of undergoing changes in baseline scenarios that are not foreseen in the underlying methodology. In order to arrive at a preliminary estimate of the scale of the potential issue, a list of ‘potentially problematic’ project types was identified that have a higher risk of changes in the baseline scenario over several crediting periods than those categorised as ‘unproblematic’.³³

Please note that ‘potentially problematic’ does not mean that all projects in that project type have issues with the renewal of the crediting period, it simply means that the projects are in a sub-type that may contain potentially problematic projects. Figure 3-8 depicts the number of projects of a non-problematic project type in the total number of projects that actually underwent renewal of the 7-year crediting period in a given year.

The graph indicates that the number of projects renewing their crediting periods increased in 2007-2009. Until 2012, non-problematic projects made up the large majority of renewals. However, from 2013 the share of non-problematic projects dropped to approx. 60% of renewed projects. With such a low share, the issue may become more important in the future with a further increase in renewals (although the increase may be somewhat muted by the unfavourable market conditions).

In this context, it is important to note that CDM projects do not need to renew immediately, but may wait until market conditions are more favourable. Given the high number of projects that may undergo renewal at a later point in time combined with the lowering in the share of non-problematic project types may lead to considerable over-crediting.

Lifetime of baseline scenario

Another, also related, issue is that in more complex and very dynamic systems, such as the transport sector, the determination of a counterfactual baseline scenario is exposed to fundamental limitations in the ability to predict future developments. These limitations can lead to very high uncertainties in the baseline determination. In some instances even after a very few years, the actual baseline emissions could be significantly higher (or lower) than the calculated baseline emissions. For example, while it may be relatively certain that a project proponent choosing in the baseline situation to build a coal-fired boiler will continue to operate this boiler over its lifetime to meet its heat demand, the development of a city’s transport system in the absence of a specific urban rail project could be very difficult and uncertain to predict: over some years one may assume that an increase in transport demand is catered for by increased use of private cars; however, street capacities may be limited and the municipalities may have to find solutions to their transport problems anyway, also in the absence of a specific project activity.

It therefore might be considered that for some project types in complex and dynamic environments, such as transport systems, the baseline scenario cannot be reasonably extended over a period of

³³ For a preliminary screening, the following projects sub-types (according to the classification of UNEP DTU) have been classified as “potentially problematic”, i.e. it cannot be ruled out that the projects would be implemented later in time without the CDM under changing circumstances (please note that the sub-types may also contain projects which clearly do not have an issue): Adipic acid, Aerobic treatment of waste water, Agricultural residues: mustard crop, Air conditioning, Appliances, Biodiesel from waste oil, Biogas from MSW, Bus Rapid Transit, Cable cars, Caprolactam, Carbon black gas, EE industry – Cement, Cement heat, Charcoal production, EE industry - Chemicals, EE own generation - Chemicals heat, Clinker replacement, CMM & Ventilation Air Methane, CO₂ recycling, Coal Mine Methane, Coal to natural gas, Coke oven gas, Combustion of MSW, Composting, Domestic manure, EE public buildings, Existing dam, Food, Glass, Glass heat, HFC134a, HFC23, Industrial waste, Iron & steel, Landfill composting, Landfill aeration, Landfill flaring, Landfill power, Lighting, Machinery, Manure, Mode shift - road to rail, Natural gas pipelines, Nitric acid, EE industry - Non-ferrous metals, EE own generation - Non-ferrous metals heat, Non-hydrocarbon mining, Oil and gas processing flaring, Oil field flaring reduction, Oil to natural gas, EE industry – Paper, EE industry – Petrochemicals, PFCs, Power plant rehabilitation, Rail: regenerative braking, Solar water heating, Stoves, EE industry – Textiles, Ventilation Air Methane, Waste water. All other project types are deemed “non-problematic”.

ten years and a renewal of crediting periods should not be allowed, given the risks of inadequate and very uncertain baseline scenarios for later time periods.

It was for this reason that the crediting period was initially limited to a single crediting period for some project types, including:

- PFC emissions from manufacturing in the semi-conductor industry (e.g. AM0092). This is an industry in which manufacturing technologies and composition of materials etc. change frequently compared to the duration of a 7-year crediting period
- Power saving from efficient management of data centers. Technologies and operating systems also typically have short lifespans compared to a 7-year crediting period.
- Complex transport systems such as the introduction of Bus Rapid Transport (BRT) systems in cities. In this context, the uncertainty in the baseline scenario and the resulting baseline emissions grows very rapidly, because development of transport systems over 5-10 years is difficult to predict with accuracy.

For these project types, the maximum crediting period has been set to 10 years in earlier versions of the methodology, because the uncertainty in the baseline scenario after 10 years did not allow for an objective determination of the emission reduction.

This limit in the crediting period to 10 years also allowed the methodology to be simplified, as the projection of baseline emissions over a limited period allows for simpler approaches and requires less monitoring provisions, thus reducing transaction costs.

Subsequently, however, the CDM EB took the decision (EB67, Para 107) that for each project type and methodology multiple crediting periods can be used (independent of any methodological limitations and uncertainty issues for the baseline setting as discussed above). This decision has been taken based on para 49 of the Modalities and Procedures for the CDM (decision 3/CMP.1, annex) that mentions alternative approaches. The paragraph was interpreted in such a way that both options shall be allowed in *each and every* methodology.

Since then, the relevant methodologies have been revised, allowing crediting for up to 21 years for all methodologies, without providing for further safeguards that would reduce the uncertainty in baseline scenario projection and potential over-crediting.

The issue of renewal of crediting period and more generally the updating of baseline scenarios is further discussed in Schneider et al. (2014).

3.5.3. Summary of findings

When the crediting period of a CDM project is to be renewed, the Marrakesh Accords require that the DOE check the validity of the original project baseline. A subsequent EB ruling (EB 43, Annex 13, paragraph 3) limited this check to an assessment of the regulatory framework, an assessment of the remaining lifetime of technical equipment that would be used in the baseline and an update of data and parameters, such as emission factors. The EB clarified that the validity of the baseline scenario should not be re-assessed.

With CDM project types for which the baseline scenario does not require a significant investment at the beginning of the crediting period (that would determine the baseline technology over the lifetime) this may lead to potential over-crediting. A preliminary analysis of projects that underwent renewal of the crediting period in recent years reveals that from 2013 onwards the share of potentially problematic project types (that might have issues of changing baseline scenarios leading to

over-crediting) increases to approx. 40% of projects with renewal. It is therefore recommended that this issue is resolved.

A subsequent ruling by the EB to remove the limit in the crediting period that some project types had in their methodology in sectors especially prone to baseline uncertainty over one crediting period (e.g. semi-conductor manufacturing, information technology, transport) further exacerbated the issue.

3.5.4. Recommendations for reform of CDM rules

We recommend two reforms to the current rules:

- Reassessing the baseline scenario at the renewal of the crediting period: The issue of potential over-crediting arising from inadequate checking of the validity of the baseline at the renewal of the crediting period could be addressed by expanding the assessment to the validity of the baseline scenario for CDM projects that are potentially problematic in this regard. For this, clear criteria for problematic project types should be formulated and guidance should be provided on how to test the validity of baseline scenarios for specific CDM methodologies.
- Limitation of the overall length of crediting for specific project types: Project types in sectors or systems that are highly dynamic and complex, and in which the determination of baselines is notoriously difficult (e.g. urban transport systems) should be limited to a single 10 year CDM crediting period or should be supported by other (non-crediting) finance sources.
- A further step that may be considered is a general limitation of projects to one 7 years crediting period. This may also build on the observation that when discounting future streams of CER revenue beyond 7 (or 10) years at typical hurdle rates longer crediting periods do not really matter for the NPV calculation. Longer crediting periods would only be allowed for project types that require a continuous stream of CER revenues to continue operation such as landfill gas utilization/flaring etc.

3.6. Additionality of PoAs

The advent of CDM Programmes of Activities (PoA) in 2007, and the subsequent refinement of related additionality approaches, changed the nature of additionality testing for many project types. Additionality assessment for PoAs is simplified compared to the requirements for the registration of individual projects. Project developers can establish eligibility criteria to assess additionality, including eligibility criteria, which identify project types that may be automatically additional. More importantly, because the thresholds for identifying small-scale and microscale activities with simplified additionality procedures are set at the level of the Component Project Activity (CPA) and not the level of the PoA, the overall PoA could be far larger than these thresholds. For example, the registered PoA “Installation of Solar Home Systems in Bangladesh” (Ref. 2765) has so far installed 123 MW of solar power and has estimated emissions reductions of 569,000 tCO₂ per year, or almost ten times the small-scale CDM threshold.

In the period of 2013 to 2020, PoAs potentially could supply 0.16 billion CERs. However, as discussed in Section 2.3, the eventual volume for these PoAs could be many times this amount.

3.6.1. Assessment

There are three principle issues with the demonstration of additionality in PoAs: specific additionality concerns about the technology areas covered by PoAs, the robustness of eligibility criteria to check additionality, and the use of small and microscale thresholds for PoAs that are much larger

in total than these thresholds. The first point is largely addressed in Chapter 4, because it is related to the mitigation technologies used in PoAs. As shown in Table 2-2, the majority of PoAs are in technology areas that are analyzed in this report (e.g. efficient cook stoves, efficient lighting, wind, hydropower, biomass), so these chapters should be consulted for an assessment of those technologies.

The second point concerns eligibility criteria, namely that the PoA rules require that the project participants develop a set of eligibility criteria that should guide the inclusion of CPAs. The criteria should be constructed so that, for each new CPA, simply confirming that the CPA meets the criteria is enough to ensure that the CPA is additional. These criteria should be based on approaches used in the relevant methodology or other additionality approach that is relevant for the PoA. In other words, there is not a detailed additionality assessment for each CPA in the way that project activities submitted for registration are evaluated. Instead, the eligibility criteria in the registered PoA design document (PoA-DD) should ensure that the CPA meets the relevant additionality test. For example, if part of demonstrating additionality in the relevant methodology is proving that the project is a particular scale or uses a particular technology, then the scale and technology specification would be listed as eligibility criteria against which each new CPA was checked. A possible concern could be that, if the project participants proposed eligibility criteria in the PoA-DD that did not fully capture the additionality requirements of the underlying methodology, there would be a risk that future CPAs could be included even if they were not additional. Although there was some confusion during the early days of PoAs on how to formulate eligibility criteria, this has not been the case since late 2011 when the EB published a standard for eligibility criteria. This was later replaced by the standard for “Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities” (CDM-EB65-A03-STAN, version 3.0). This standard provides not only the full list of issues that must be covered in the eligibility criteria, but also clear rules on how additionality may be assessed for PoAs.

The third point is perhaps the most important – whether allowing PoAs that are, in total, much larger than the size thresholds for small and microscale projects could increase the risks of non-additionality among PoAs. The small-scale CDM thresholds are 15 MW for renewable energy, 60 GWh savings for energy efficiency, and 60,000 tCO₂ per year emissions reductions for other project types with approved small-scale methodologies. The scale limits for the microscale additionality rules are 5 MW for renewable energy, 20 GWh savings for energy efficiency projects, and 20,000 tCO₂ for other project types, and are then combined with other criteria (described in detail in Chapter 4, e.g. country type, size of individual units, or even designation by a national authority), to qualify as automatically additional. However, the EB decided at their 86th meeting that microscale technologies using unit size as the basis of automatic additionality (i.e. independent units of < 1500 kW for renewables, < 600 MWh for energy efficiency and < 600 tCO₂ for other projects, all serving households and communities) would have no limit of the total scale of the project or CPA. In other words, an efficient cook stove project activity or CPA could have total emission reductions of greater than 20, or even 60, ktCO₂ per year.

Projects (in this case, CPAs) that qualify as small-scale CDM (SSC) then have access to the technology-based ‘positive list’ in the tool for “Demonstration of additionality of small-scale project activities” (Tool21, version 10.0). CPAs below the micro-scale thresholds would all be automatically additional as long as they meet both the scale and other requirements (e.g. technology, location, etc.). For small-scale CDM, the list of technologies considered automatically additional includes the following:

- Certain technologies whether grid-connected or off-grid: solar (PV and thermal), off-shore wind, marine (wave and tidal), and building-integrated wind turbines or household rooftop wind turbines up to 100 kW;

- Additional off-grid technologies below the SSC thresholds: micro/pico-hydro (with power plant size up to 100 kW), micro/pico-wind turbine (up to 100 kW), PV-wind hybrid (up to 100 kW), geothermal (up to 200 kW), biomass gasification/biogas (up to 100 kW);
- Technologies with isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-scale CDM thresholds;
- Rural electrification projects using renewable energy in countries with rural electrification rates less than 20%.

Both microscale additionality and the small-scale CDM positive list approaches have been used extensively by PoAs. As shown in Table 3-2, 33% of the CPAs in registered PoAs, representing 27% of expected CERs, have applied the microscale or small-scale positive list approaches ('first of its kind' is discussed in Chapter 4). An analysis by the UNFCCC Secretariat³⁴ also shows that 142 of the 282 registered PoAs use microscale or small-scale rules for automatic additionality, with 65% of PoAs targeting households utilising one of these tools (Table 3-3). Many of these PoAs have already exceeded the microscale and small-scale thresholds at an aggregate level, as allowed in the CDM PoA rules. In contrast, the 120 CDM project activities that have used small-scale positive lists or microscale guidelines comprise only 0.8% of projects and 0.1% of expected emissions reductions (UNEP DTU 2015a).

Table 3-2: Use of automatic additionality approaches in CPAs within registered PoAs

Approach for automatic additionality	Annual CERs (ktCO ₂ /yr)	CPAs	CERs	CPAs
Microscale tool: country, unit size or DNA selection	3,520	188	11%	23%
Microscale tool: SUZ	60	9	0%	0%
SSC positive list	5,078	91	16%	10%
None	21,279	551	70%	65%
Total	29,936	839	100%	100%

Notes: A more recent version of the PoA pipeline was used here because of a revision of how the use of automatic additionality is classified.

Sources: UNEP DTU 2015b

³⁴ "Concept note: Thresholds for microscale activities under programmes of activities" (CDM-EB85-AA-A09)

Table 3-3: Technology and end-user types in registered PoAs that applied microscale and/or small-scale positive list criteria

Technology type	PoAs	Share of this type of PoA
End use type: Households	92	65%
Household biogas digesters	13	
Energy efficiency - household	2	
Energy-efficient lighting (LED and CFL)	28	
Improved cookstoves	36	
Solar water heaters	7	
Water purifiers	5	
Renewable-based rural electrification	1	
End use type: Others	50	35%
Energy efficiency – industrial	2	
Fuel switch	3	
Grid/off-grid connected renewable energy technologies (e.g. wind, solar PV, geothermal)	35	
Waste treatment (e.g. Wastewater, animal waste)	10	
Total	142	100%

Sources: Concept note: Thresholds for microscale activities under programmes of activities (CDM-EB85-AA-A09)

Whether granting automatic additionality to PoAs that are over the small and microscale thresholds poses a risk for additionality testing depends on the *reason* for the positive list designations. One of the main issues raised by the positive list is the *unit size* of the technology, with the argument being that the unit size on its own may be sufficient to identify a project type with a high likelihood of additionality (in combination with the other microscale criteria, where relevant). On this basis, the EB recently agreed that the size criterion for the microscale additionality tool should be *only* unit size, and not total project size.³⁵ This means that even a PoA using a large-scale methodology and have a total size beyond the SSC thresholds can still apply microscale additionality guidelines, as long as the unit size and other criteria are met.

The SCC positive list sets unit size limits for most categories of eligibility, although not for rural electrification or the grid-connected technologies (other than the 15 MW limit). The microscale guidelines also include the option of using a unit size less than 1% of the SSC threshold as a justification for applying these guidelines even if the projects are not located in Least Developed Countries (LDCs) or Special Underdeveloped Zone (SUZs).

The most important categories of PoAs (in terms of their contribution to expected CERs) utilising these tools are improved cook stoves, energy efficient lighting, biogas and small unit size solar power³⁶. For the first three technologies, the unit size is inherently small, so the size of the total project or PoA should not, by itself, determine the viability of the technology (bearing in mind, however, that overhead programme costs are obviously lower per unit for larger programmes). The additionality issues with improved cook stoves and energy efficient lighting are reviewed in Sections 4.12 and 4.13, respectively. These sections raise important questions about the additionality

³⁵ The changes to the Tools for “Demonstration of additionality of small-scale activities” (version 22) and “Demonstration of additionality of microscale project activities” (version 07) were approved at EB86 (October 2015), as were changes in the Project Standard, Project Cycle Procedure, and standard on standard on “Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities.”

³⁶ Although the table from the UNFCCC Secretariat refers to “Grid/off-grid connected renewable energy technologies (e.g. wind, solar PV, geothermal)”, our analysis has not identified any wind or geothermal PoAs using the small-scale positive list or the microscale guidelines.

of these project types, despite their small unit size, particularly because of the role of other support programmes in promoting these technologies and possible over-crediting for cook stoves, for example. On the other hand, the extensive literature on household energy access technologies and carbon markets also points to numerous well documented barriers, and the high unit transaction costs associated with small unit size technologies (e.g. Gatti & Bryan 2013; IFC 2012; Warnecke et al. 2015, 2013). In addition, the analysis from the UNFCCC Secretariat mentioned earlier also shows that the average unit size of PoAs using the small-scale and microscale positive lists is, in fact, far below even the microscale unit size of 1% of the SSC threshold (Table 3-4).

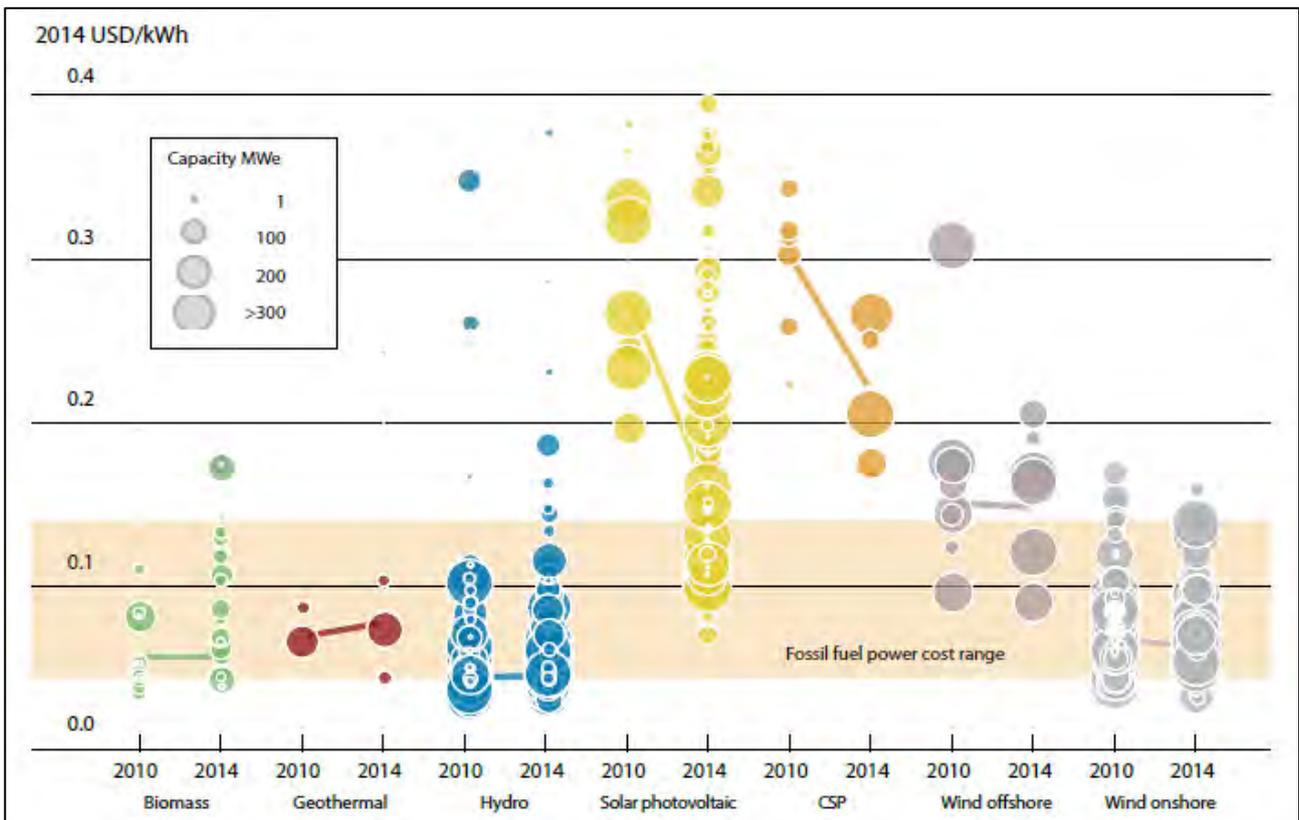
Table 3-4: Size of individual units in microscale and small-scale PoAs using positive lists

Unit size as % of SSC threshold	Type I (kW)	Type II (MWh)	Type III (tCO ₂)
1%	150	600	600
PoAs applying microscale criteria			
Average – 0.022%	3.3	13.3	13.2
Std deviation – 0.054%	8.1	32.4	32.4
PoAs applying small-scale criteria			
Average – 0.23%	34	136	137
Std deviation – 0.34%	51	204	204

Sources: Concept note: Thresholds for microscale activities under programmes of activities (CDM-EB85-AA-A09)

For renewable power technologies, even if the total capacity of a PoA was over 15 MW, the unit size could not be larger than 5 MW for most technologies (15 MW for solar PV or solar thermal) to qualify for automatic additionality. Given the economies of scale in renewable energy power generation (Pryma 2012), small unit sizes would be expected to have higher capital costs, and would therefore be more likely to face investment barriers than larger scale plants. Project-level analysis by the International Renewable Energy Agency (IRENA) also suggests that smaller renewable energy plants not only have higher costs (i.e. because the smaller dots, representing smaller scale projects, are generally higher up in the figure), but that for solar PV and solar thermal these costs are still considerably higher than for fossil fuels (Figure 3-9). Analysis by EPRI has also shown that solar power at the several MW scale is considerably more expensive than conventional alternatives (EPRI 2012). This suggests that a solar PV (grid connected or off-grid) programme of any total size would not be economically viable if the units were below the small-scale thresholds. However, the challenge with solar technologies is that they are so expensive that carbon revenue is unlikely to close the financial viability gap, so they may be more driven by national policies than carbon markets (Section 3.7).

Figure 3-9: Levelized cost of electricity from renewable technologies, 2010 and 2014



Notes: Size of the diameter of the circle represents the size of the project. The centre of each circle is the value for the cost of each project on the Y axis. The LCOE of a given technology is the ratio of lifetime costs to lifetime electricity generation, both of which are discounted back to a common year using a discount rate that reflects the average cost of capital.

Sources: IRENA (2015)

On the basis of the unit size analysis shown in Table 3-4, the Secretariat prepared a concept note with recommendations to the EB using on unit size, and not total project or CPA size, as the basis for determining microscale additionality (CDM-EB85-AA-A09). The EB agreed to begin to implement an approach of using only a unit size threshold to determine if the size of the project qualifies for microscale (EB85 report, paragraph 42). The other requirements for microscale (e.g. location in an LDC or SUZ, if the unit size is greater than 1% of the SSC threshold) would remain unchanged. This means that the CPAs comprised of technologies that were below the unit size threshold would not be limited in their total size. For example, a CFL PoA in an LDC could have a CPA with 100,000 MWh savings and still apply the microscale additionality guidelines.

3.6.2. Summary of findings

While the PoA rules do allow programmes with a total size greater than the small-scale and microscale thresholds to utilise the automatic additionality provisions for these scales of projects, there is no evidence that this increases the risk of non-additional projects on its own (i.e. the share of projects that could be non-additional). In other words, the PoA rules do not fundamentally change the additionality risks for a given category of project technologies. The PoA process could, of course, increase the overall *scale* of the risk because they were designed to facilitate the large scale dissemination of small, distributed technologies. For example, there are 40 registered ‘improved stove’ project activities with expected CERs of 1 million tCO₂ per year, but there are 46 registered ‘improved stove’ PoAs that already have expected CERs of 8.1 million tCO₂ per year.

3.6.3. Recommendations for reform of CDM rules

Reform of the CDM rules related to additionality for particular project types and positive lists will address any concerns about additionality of PoAs.

3.7. Positive lists

The concept of ‘positive lists’ means that specific project types are considered automatically additional. Positive lists are one option to reduce transaction costs and increase the certainty of the CDM system from the perspective of project developers. Similar to standardized baselines, creating a positive list requires an upfront evaluation of technologies and their economic and regulatory environment, independent of the assessment of a particular CDM project proposal, to establish certain objective criteria that, if met, will result in a high likelihood of additionality. Once a positive list is established, a specific CDM project only needs to show that the pre-defined criteria are met, and does not have to apply other tools to justify additionality.

3.7.1. Positive lists in the CDM and impact on CER supply

Positive lists were introduced in the CDM through various routes. As briefly mentioned in Section 3.6, the CDM EB adopted the “Guidelines for demonstrating additionality of micro-scale project activities” in 2010, which were subsequently converted to a methodological tool, which first established automatic additionality for certain project types regardless of the type of methodology used (i.e. small-scale or large scale). Table 3-5 shows the technologies covered under version 7 of that tool, and the criteria they must meet in order to be deemed automatically additional. In addition to total project size (or, in the case of PoAs, the size of an individual CPA), the technologies must meet a further criterion such as location, unit size and/or consumer group.

Table 3-5: Projects considered automatically additional under the tool “Demonstration of additionality of microscale project activities”

<p>1 Based on country (LDCs, SIDSs)</p> <ul style="list-style-type: none"> • Renewable energy up to 5 MW • Energy efficiency up to 20 GWh savings per year • Other small-scale CDM projects (Type III) up to 20 ktCO₂ emissions reductions per year
<p>2 Based on unit size and consumer (households, communities, SMEs) (i.e. any country)</p> <ul style="list-style-type: none"> • Renewable energy of any size as long as unit size is less than 1500 kW • Energy efficiency of any size as long as unit savings are less than 600 MWh per year • Other small-scale CDM projects (Type III) of any size as long as unit savings are less than 600 tCO₂ per year
<p>3 Based on host country designation of special underdeveloped zone (SUZ)</p> <ul style="list-style-type: none"> • Renewable energy up to 5 MW • Energy efficiency up to 20 GWh savings per year • Other small-scale CDM projects (Type III) up to 20 ktCO₂ emissions reductions per year
<p>4 Based on designation of a technology by the host country</p> <ul style="list-style-type: none"> • Grid connected renewable energy specified by DNA, up to 5 MW, which comprises less than 3% of total grid connected capacity
<p>5 Based on other technical criteria</p> <ul style="list-style-type: none"> • Off-grid renewable energy up to 5 MW supplying households/communities (less than 12 hours grid availability per 24 hours is also considered ‘off-grid’)

Notes: LDCs = Least Developed Countries, SIDSs = Small Island Developing States, SME = Small and micro enterprises, DNA = Designated National Authority.

Sources: Tool for “Demonstration of additionality for microscale activities”

In 2011, the “Guidelines on the demonstration of additionality of small scale project activities”, which later were similarly converted to a methodological tool, also included for the first time a list of technologies that would be considered automatically additional for any project meeting the small-scale CDM thresholds. This initially only included a list of grid and off-grid renewable energy technologies (i.e. the first two blocks in Table 3-6), but was expanded in 2012 to include small isolated units serving communities and renewable energy-based rural electrification.

Table 3-6: Technologies considered automatically additional under the tool “Demonstration of additionality of small-scale project activities”

<p>6 Renewable energy (up to 15 MW, grid or off-grid, all end users)</p> <ul style="list-style-type: none"> • Solar PV and solar-thermal electricity generation • Offshore wind • Marine technologies (e.g. wave and tidal) • Building integrated wind turbines or household roof top wind turbines (unit size =< 100 kW)
<p>7 Renewable energy (up to 15 MW, off-grid only)</p> <ul style="list-style-type: none"> • Micro/pico-hydro (unit size =< 100 kW) • Micro/pico-wind turbine (unit size =< 100 kW) • PV-wind hybrid (unit size =< 100 kW) • Geothermal (unit size =< 200 kW) • Biomass gasification/biogas (unit size =<100 kW)
<p>8 Distributed technologies for households/communities/SMEs (off-grid only)</p> <ul style="list-style-type: none"> • Aggregate size up to SSC threshold (15 MW, 60 GWh or 60 ktCO₂ emission reductions) with unit size =< 5 per cent of SSC thresholds (i.e. =< 750 kW, =< 3 GWh/y or 3 ktCO₂e/y)
<p>9 Rural electrification using renewable energy</p> <ul style="list-style-type: none"> • In countries with rural electrification rates less than 20%

Notes: Numbers in left hand column continue from previous table.

Sources: Tool for “Demonstration of additionality of small-scale activities” (version 10.0)

In addition to these tools, which apply across many methodologies, some individual methodologies have provided for automatic additionality for certain project types, often related to regulations. The most widely used is ACM0002 “Grid-connected electricity generation from renewable sources” (version 16.0), which was revised in November 2014 to include a two-part positive list for grid connected technologies. The first part is a list of technologies that are considered automatically additional: solar PV, solar thermal, offshore wind, marine wave and marine tidal (i.e. the technologies included in the first part of the small-scale CDM additionality tool, except at larger scale). The second part says that any technology with less than 2% of the total grid-connected capacity or less than 50 MW total capacity in the country is considered automatically additional. Since the revision of ACM0002, ten new project activities have requested and completed registration (no new PoAs have been registered). Of these, only one project has applied the new positive list provisions – a 141 MW solar PV facility in Chile. This is the largest solar facility to be granted automatic additionality.

Another important methodology with automatic additionality provisions includes ACM0001 “Consolidated baseline and monitoring methodology for landfill gas project activities” (version 15.0), which was revised in late 2013 to consider the following technologies automatically additional if, prior to the project activity, landfill gas was only vented and/or flared:

- electricity generation in one or several power plants with a total nameplate capacity that equals or is below 10 MW;
- heat generation for internal or external consumption;
- flaring (assuming no flaring prior to the project).

AM0113 “Distribution of compact fluorescent lamps (CFL) and light-emitting diode (LED) lamps to households” (version 01.0) provides for automatic additionality for any project distributing self-ballasted LED lamps to households. Projects distributing CFLs are only considered automatically additional if they are in a country with “no or only limited lighting efficiency regulations” reported by the UNEP en.lighten initiative’s Efficient Lighting Policy Status Map. AM0086 “Distribution of zero energy water purification systems for safe drinking water” (version 04.0) considers projects automatically additional if less than 60 percent of the population has access to improved drinking water sources or if the project proponents can demonstrate that more than half of the improved drinking water delivered does not actually meet the appropriate health standards. AMS-III.D “Methane recovery in animal manure management systems” (version 19.0) considers projects automatically additional when there is no regulation that requires the collection and destruction of methane from livestock manure. In addition to these, AM0001 “Decomposition of fluoroform (HFC-23) waste streams” (version 6.0), the first approved large-scale methodology, essentially uses a positive list approach based on regulation, because any project that does not face a regulatory requirement to abate HFC-23 emissions is considered additional. The same is true for ACM0019 “N₂O abatement from nitric acid production” (version 02.0).

While the positive lists presented above have not been used widely by CDM project activities (e.g. only 121 registered projects), PoAs have utilised the lists in the small-scale and microscale additionality tools (Table 3-2), with a third of CPAs in registered PoAs using these additionality approaches. Whether this growing group of PoAs presents concerns for the additionality depends on the strength of the justification for the original positive lists and for how long this justification is likely to be valid (i.e. how often the lists should be updated).

The criteria used to select the positive lists as well as the validity of these lists are presented in an information note prepared by the Small-scale Working Group in November 2014 called “Criteria for graduation and expansion of positive list of technologies under the small-scale CDM” (CDM-SSCWG46-A23). Table 3-7 summarises all of the positive list approaches, and shows the range of criteria used. The individual methodologies often refer to regulations to determine automatic additionality, or current penetration rates. The small-scale and microscale additionality tools use a mix of end-users, location, cost of service and penetration rates, depending on the specific technology group. This also highlights the similarity between positive lists discussed here and standardized baselines (Section 3.8), which also define a list of automatically additional technologies based on penetration rates and comparative costs.

Table 3-7: Criteria used for determining positive lists

	End-user	Regulation	Location	LCOS	Penetration	Capital cost
1	Microscale based on country (LDCs, SIDSs)					
	Renewable energy < 5 MW; Energy efficiency < 20 GWh; Other up to 20 ktCO ₂					
			x			
2	Microscale based on unit size and consumer (households, communities, SMEs) (i.e. any country)					
	Renewable energy < 5 MW and unit size <1500 kW; Energy efficiency < 20 GWh and unit savings < 600 MWh; Other < 20 ktCO ₂ with unit savings < 600 tCO ₂					
	x					x
3	Microscale based on host country designation of special underdeveloped zone (SUZ)					
	Renewable energy < 5 MW; Energy efficiency < 20 GWh; Other < 20 ktCO ₂					
			x			
4	Microscale based on designation of a technology by the host country					
	Grid connected renewable energy specified by DNA, up to 5 MW, < 3% of capacity					
					x	
5	Microscale based on other technical criteria					
	Off-grid renewables < 5 MW supplying households					
	x					
6	Small-scale renewable energy (up to 15 MW, grid or off-grid, all end users)					
	Solar PV and solar-thermal electricity generation; off-shore wind; marine (e.g. wave and tidal); building integrated wind turbines or household p wind =< 100 kW					
				x		
7	Small-scale renewable energy (up to 15 MW, off grid only)					
	Micro/pico-hydro (unit <= 100 kW); micro/pico-wind (unit <= 100 kW); PV-wind hybrid (unit <= 100 kW); geothermal (unit <= 200 kW); biomass gasification/biogas (unit <= 100 kW)					
						x
8	Small-scale off-grid distributed technologies for communities					
	Unit size =< 5 per cent of SSC thresholds					
	x					
9	Rural electrification using renewable energy					
	In countries with rural electrification rates less than 20%					
10	AM0086 water purification					
	<60% access to improved drinking water and <50% use of point-of-use zero energy water purification					
					x	
11	AM0113 energy efficient lighting					
	CFLs in countries with no or limited regulatory support All self-ballasted LED lamps					
		x			x	
12	ACM1 landfill gas utilisation					
	LFG for electricity or heat where vented or flared, or flaring where previously vented					
					x	x
13	AMS III.D methane and manure management					
	Biogas for power < 5 MW where no regulation requires collections and destruction of methane					
		x				
14	AMS III.C electric and hybrid vehicles					
	Market share of electric/hybrid vehicles < 5%					
					x	

Notes: LCOS = Levelized cost of service, LDCs = Least Developed Countries, SIDSs = Small Island Developing States, SMEs = Small and micro enterprises, DNA = Designated National Authority.

Sources: UNFCCC documents as cited in text

In terms of the duration of validity of the positive lists, the small-scale and microscale additionality tools did not originally include a time limit, although many of the methodologies specify a three-year duration of validity. The EB (EB81, paragraph 72) accepted a Small-Scale Working Group recommendation in late 2014 to set a three-year limit on validity for the small-scale CDM positive lists. In addition, the EB agreed on thresholds for ‘levelized cost of service’, ‘penetration rate’, and ‘capital cost’, as shown in Table 3-8. Note that these new rules only apply to the positive lists under the tool for “Demonstration of additionality of small-scale project activities”, and not to microscale activities or any other positive lists.

Table 3-8: Graduation criteria for technologies under the tool for “Demonstration of additionality of small-scale project activities”

	End-user	LCOS	Penetration	Capital cost
Grid connected renewable electricity generation				
All renewable energy technologies in the current positive list		>= 50% higher than all fossil fuels	Global average penetration <3%	
Off-grid renewable electricity generation				
All off-grid renewable technologies in the current positive list				>= 3 times the cost of all fossil fuels
Distributed technologies for households/communities/SMEs				
All distributed technologies eligible under Type I/II/III and providing services of households/communities/SMEs	Assess appropriateness of user groups		Global average penetration rate < 3%	>= 3 times cost of all plausible baseline technologies

Sources: Information note “Criteria for graduation and expansion of positive list of technologies under the small-scale CDM” (CDM-SSCWG46-A23)

3.7.2. Assessment of current positive lists

The positive lists developed under the CDM to date are based on specific criteria such as penetration rate, costs, regulatory environment, and location. While these lists have not been used widely for automatic additionality among CDM project activities, their use among PoAs is widespread and growing. Some of the positive lists are now reviewed regularly, and have a clear basis for determining whether a technology should still be included in the lists. **This review of validity should also be extended to other project types, in particular those covered by the microscale additionality tool or approaches used in relevant methodologies (e.g. ACM0002).**

An important challenge with the current positive lists, however, is that the basis upon which they are established varies widely, without a clear rationale for the choice or level of the indicator (e.g. why penetration might be used for some technologies but levelized cost of service for others). **A consistent approach to determining technology eligibility is needed** to ensure that existing and new positive lists do not pose risks of non-additionality. The criteria and indicators used should have clear justification for how they influence project implementation. For example, while low market penetration or high capital costs could be strong indicators of prohibitive barriers for some technologies, it is not clear how the concept of ‘special underdeveloped zones’ (SUZ), which may

be defined differently by each DNA according to UNFCCC guidelines, is a reliable indicator of barriers.

As part of the justification of project types and technology choices, **positive lists must address the impact of national policies and measures to support low emissions technologies** (so-called, E- policies). As discussed in Section 3.9 and many of the sections within Chapter 4, national policies may be the primary driving factor for the implementation of certain technologies, rather than their underlying economics, market position or location. In fact, one of the criticisms of allowing renewable technologies to be considered automatically additional is that their costs are so high that carbon revenue alone cannot possibly make them financially viable, and so other incentives and policies are the real determining factor (Lazarus et al. 2012; Spalding-Fecher et al. 2012). This is even truer with smaller scale technologies. For example, in a study in Southern Africa, the levelized cost of roof-top solar PV was 20% more expensive than utility scale solar PV, while small hydropower was 70% more expensive than large scale (Miketa & Merven 2013). For positive lists to avoid the possibility of ‘false positives’ driven by national policies, some objective measure of renewable energy support may be needed as part of the evaluation process. An example of this would be the REN21 renewable energy global overview and interactive map,³⁷ which provides a comprehensive technology-specific database of the policies in place to support renewables. A positive list that included renewables could therefore be qualified by restricting its applicability to countries that did not have any support policies in place for that technology. Having support policies in place does *not*, on its own, mean that those technologies would not be additional, but only that there is a greater risk of this and so applying a positive list approach in that country would not be appropriate. Projects in those countries could still use the other tools available for demonstrating additionality for small- and large-scale projects – they would only not have access to automatic additionality based on the positive list. As an example, the positive list in the tool for “Demonstration of additionality of small-scale project activities” includes all solar PV and solar thermal technologies in all CDM-eligible countries. According to the REN21 policy database, however, the following countries have support policies³⁸ in place for solar PV: Algeria, Argentina, Brazil, Cape Verde, China, Côte d'Ivoire, Ecuador, Egypt, Gambia, Ghana, India, Jordan, Lebanon, Malaysia, Mauritius, Nepal, Nigeria, Republic of Korea, Senegal, Thailand, Uruguay, Uzbekistan, and Venezuela. For these countries, therefore, it might be more appropriate to require an analysis of barriers to solar PV rather than considering them automatically additional. This approach could be refined based on additional research into publicly available and up-to-date databases of renewable energy policies.

Finally, to maintain environmental integrity of the CDM overall, **positive lists should be accompanied by negative lists**. This is because the introduction of a positive list without any negative list could, by definition, only lower environmental integrity compared to the traditional approaches. Projects that do not fall within the positive list can still apply the traditional approaches. So, the positive list will lead to more ‘false negatives’ passing the test, but will not rule out any projects that are not additional. Overall, environmental integrity is thus lowered (albeit with the positive element of reducing transaction costs). An exception to this could be the few methodologies that deem projects as ineligible if they reach a market penetration threshold above a certain level, because they, in essence, include both a positive and negative list.

³⁷ The interactive map is shown at: <http://www.ren21.net/status-of-renewables/ren21-interactive-map/>. The full database of policies is available at <http://www.ren21.net/wp-content/uploads/2015/09/Downloadable-Consolidatedv1.2.1.xlsx>.

³⁸ Support policies may include, for example, feed-in tariffs, electric utility quota obligation, capital subsidies, tax credits, and net metering, but exclude renewable energy targets not accompanied by other incentives.

3.8. Standardized baselines

Project developers have repeatedly complained about the expensive and time-consuming process for formally registering a project under the CDM. The setting of the baseline for the greenhouse gas emission reductions associated with a project has required project developers to apply project specific methodologies in order to calculate baseline emission levels. The project developers take on significant costs before the approval of their project when collecting the data necessary to set the baseline and demonstrate additionality. In some cases the risks associated with these upfront costs may be too high for developers of smaller projects in poorer countries (Spalding-Fecher & Michaelowa 2013) – impacting the regional distribution of projects under the CDM. Apart from high transaction costs, the project-specific determination of baselines and assessment of additionality has been criticised in the past for being subjective (Schneider 2009). Due to the information asymmetry between project developers and DOEs subjective assumptions may be difficult to verify, which could result in non-additional projects or over-crediting, which both undermine the environmental integrity of the CDM.

The Cancun Agreements in 2010 provided for the use of *standardized baselines* in the CDM to address these limitations with the aim “to reduce transaction costs, enhance transparency, objectivity and predictability, facilitate access to the clean development mechanism, particularly with regard to under-represented project types and regions, and scale up the abatement of greenhouse gas emissions, while ensuring environmental integrity” (UNFCCC 2011c). In contrast to the project-by-project approach to setting baselines and demonstrating additionality, standardized baselines are established for a project type or sector in one or several CDM host countries. Standardized baselines can address any or all of three areas for standardization: demonstrating additionality, determining the baseline scenario or determining baseline emissions. In the latter case, standardization can include emission factors or individual parameters needed to calculate emission reductions.

Standardized baselines require host country approval and are submitted through the DNA of the host Party. They can cover one or several Parties. Once approved, project developers can use a standardized baseline when submitting a project for registration. In 2014, the EB further decided that it is up to the host Parties to decide whether projects must use an approved standardized baseline or whether they may alternatively use a project-specific approach, but noted that the EB could reject standardized baselines if this poses a risk to environmental integrity (CDM-EB78, para 24). In practice, all approved standardized baselines have so far been voluntary, except for a multi-country grid emission factor in the Southern African region.

The CDM allows standardized baselines to be derived either from suitable methodologies, from tools such as the ‘*Tool to calculate the emission factor for an electricity system*’³⁹ or from a generic framework that is applicable to all project types and sectors such as the ‘*Guidelines for the establishment of sector specific standardized baselines*’⁴⁰ adopted by the EB in 2011. Further regulatory documents include a procedure for submission of standardized baselines, a standard on the coverage and vintage of data, and guidelines for quality assurance and quality control.

The ‘*Guidelines for the establishment of sector specific standardized baselines*’ combine elements of market penetration, performance benchmarks, investment and barrier analysis. Under this framework, the standardized baseline results in a positive list of fuels, feedstocks and/or technologies for a given sector. The least emission-intensive fuel/feedstock/technology needed to produce

³⁹ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.pdf>.

⁴⁰ https://cdm.unfccc.int/filestorage/4/II/Y/4IY1RB7DMKLPWGF59XC3UE6JNH8Q2A/eb62_repan08.pdf?t=N2d8bnRoeHN3fDDSYyp3xU9Kx6IMk5Ho1yFw.

a certain percentage of the sector's output (i.e. defined by the CDM EB)⁴¹ is selected as the baseline fuel/feedstock/technology. All fuels/feedstocks/technologies that are associated with lower emission intensities than the baseline technology are candidates for inclusion in a positive list of fuels/feedstocks/technologies that are automatically deemed additional. The DNA of the host country also needs to demonstrate for each of the candidates for the positive list that they are either less economically attractive than the non-candidates or face barriers to entry (Schneider et al. 2012). The baseline technology is also used to determine the baseline against which emission reductions are calculated (Hermwille et al. 2013).

Table 3-9: Approaches for deriving grid emission factors

DNAs could use either the standardized baseline guidelines or the grid emission factor tool to determine the grid emission factor and submit the value as a standardized baseline. The weaknesses of this opportunity to choose between two alternative approaches are explained below:

- 1) **Pick and choose issue:** The two approaches will provide two different values for the grid emission factor. Thus, the DNA could pick and choose between two completely different methodological approaches for determining the grid emission factor. Countries for which the guidelines result in higher values will use that approach, whereas countries for which the tool results in higher values will use that approach. Overall, having two parallel approaches could undermine the environmental integrity compared to the current situation in which only one approach is available.
- 2) **Vintage of data issue:** The standardized baseline guidelines consider all plants, whether they were recently constructed or decades ago. This could result in a situation in which coal power is determined as the baseline fuel, even if no coal power plant has been constructed or been under construction for a decade. In contrast, the grid emission factor tool aims to consider recent developments by observing which plant types were recently added to the system or are under construction or which plants actually operate at the margin.
- 3) **'One size fits all' issue:** The grid emission factor tool uses a methodologically approach that considers the particularities of the electricity system, considering different possible effects of displacing grid electricity (marginal plants not being dispatched/the construction of other power plants avoided or delayed). In contrast, the guidelines do not consider the characteristics of the sector and make generalised assumptions, which have little meaning in the power sector. The guidelines therefore result in less accurate grid emission factors than the grid emission factor tool.

Sources: Own compilation

The environmental impact of standardized baselines will be affected by how stringently the standardized baseline is set for a given project type. The stringency of standardized baselines needs to safeguard the environmental integrity of the CDM whilst also striking the right balance between accuracy and transactions costs in order to ensure that there is an incentive for developing new CDM projects.

The implications of standardized baselines on environmental integrity will also vary depending upon the sector that they are applied to, as the approach relies considerably upon the assumption that the penetration of a fuel/feedstock/technology is negatively correlated with its cost and/or with barriers that impede their deployment (Hermwille et al. 2013). For certain sectors there will undoubtedly be a strong correlation, i.e. energy efficient lighting and efficient electrical appliances.

⁴¹ In its guidance, the EB has defined a preliminary additionality/crediting threshold of 80 % in priority sectors and 90% in other sectors.

However for other sectors, i.e. with multiple products or with strongly varying circumstances among installations, the correlation will be weaker or absent and alternative approaches for setting baselines and demonstrating additionality may be more suitable (Hermwille et al. 2013). Applying the current framework to sectors for which such a correlation is lacking could broaden the positive lists for technologies that are unlikely to be additional. In the power sector, for example, the guidelines do not reflect the particular features of an electricity system. The Methodologies Panel recommended that the EB limits the applicability of the SB standard to sectors other than the power sector (MP65, paragraph 38 and 39). In response, the EB requested the Methodologies Panel to assess the applicability of the proposed framework to different project types (EB81, paragraph 41). However, as of January 2016, the current guidelines are still applicable to all sectors. In 2015, a standardized baseline was finalized for consideration by the EB, which includes grid emission factors for different islands of Cape Verde and applies for some islands the “*Guidelines for the establishment of sector specific standardized baseline*” and for others the grid emission factor tool. The issues arising from the application of the guidelines to the power sector are highlighted in Table 3-9.

The following issues may pose further environmental risks through the implementation of standardized baselines in the future:

- **Mandatory versus voluntary use of standardized baselines:** The current CDM EB framework does not make the use of standardized baselines mandatory (CDM-EB74, para 24). It is the discretion of the DNA to decide whether project participants can select between project-specific or standardized baselines. In this regard, the DNA can make their use voluntary or mandatory. This may have two consequences:
 - Standardized baselines open an alternative route towards positive lists (Section 3.7), while keeping the approach of demonstrating additionality through the current means. By definition, this can only increase the number of false positives. Hence, the likelihood for additionality is lower, compared to a situation in which there would be no standardized baselines.
 - The voluntary use of standardized baselines could lead to project developers picking and choosing between baseline emission factors which could result in over-crediting (Table 3-9, bullet point 1). Indeed, Spalding-Fecher & Michaelowa (2013) argue that the CMP should make standardized baselines mandatory.

The degree of these risks depends on how conservative the standardized baselines are set. The more conservatively that they are set, the lower the risk is. An example of how picking and choosing between project-specific and standardized baselines can undermine environmental integrity is the approved standardized baseline ASB0018 for cook stove projects in Burundi. The approved standardized baseline provides default values for the amount of non-renewable biomass consumed in the baseline (1.5 tonnes per person and year for households in urban areas and 1.1 tonnes per person and year for households in rural areas). However, at the same time, a PoA (9634) is registered in Burundi with project-specific baseline values based on data from a more recent survey. The project-specific baseline is more ambitious (1.21 tonnes per person and year for households in urban areas and 0.83 tonnes per person and year for households in rural areas). Had the standardized baseline been approved prior to the registration of the project, the project could have opted for the less ambitious standardized baseline. At the same time, projects with higher project-specific baseline values could opt for their project-specific baseline and not use the standardized baseline.

- **Quality assurance and quality control (QA/QC) of standardized baselines:** Version 04.0 of the procedure ‘*Development, revision, clarification and update of standardized baselines*’

(CDM-EB84-A10) sets out how a project developer can submit a proposal for a standardized baseline to the CDM EB following first the approval of the relevant DNA. It is necessary for the project developer to provide a list of documents when submitting a standardized baseline proposal, which includes the Form F-CDM-PSB, supporting documents and an Assessment Report of QA/QC. The CDM EB clarified only in 2015 that DOEs not only need to verify whether the required documents were submitted and that the data were collected according to guidelines for quality assurance and quality control but that they also need to check that the standardized baseline has been calculated in accordance with the relevant standards (CDM-EB85-A10). However, this decision still needs to be adequately reflected in the latest version of the ‘*CDM validation and verification standard*’ (CDM-EB82-A14). Moreover, stakeholders expressed concerns that if the requirements for QA/QC are too stringent, it may prevent the approval of standardized baselines from LDCs (Hermwille et al. 2013). Therefore, the QA/QC Assessment Report is currently not compulsory for countries with 10 or fewer registered CDM projects as of 31 December 2010 for the first 3 submissions (CDM-EB84-A10, Para. 18), even though countries can request financial support from the UNFCCC for the development of Assessment Reports. These exemptions from applying the QA/QC guidelines could undermine the environmental integrity of the CDM.

- **Development of country-specific thresholds:** CMP9 requested the EB “*to prioritise the development of top-down thresholds for baseline and additionality for the underrepresented countries in CDM*” (CDM-EB82-AA-A10, Para. 3). Many stakeholders regard the currently approved default thresholds for additionality and baseline as ‘*unattractive*’ and ‘*not suitable*’ for specific national/regional/sectoral circumstances (CDM-EB82-AA-A10). However, the adoption of country-specific thresholds could be a difficult process as such thresholds are a policy choice rather than a methodological choice. It is uncertain whether or not the development of country-specific thresholds would undermine the environmental integrity of the CDM. However, it would likely result in the incomparability of emission reductions from different standardized baselines within the same project type or technology.
- **Exclusion or inclusion of CDM facilities in the peer group to determine standardized baselines:** The development of certain standardized baselines relies upon the performance and actual output from the facilities of a sector of the host country. Some of these facilities may already have registered CDM projects (i.e. referred to as CDM facilities) that would have improved performance due to the incentives provided by the CDM. Given that it is difficult to determine the performance and outputs of these facilities in the absence of the CDM, it is necessary to take a decision on whether to include CDM facilities in the calculation of a standardized baseline or not. Exclusion of CDM facilities could undermine the environmental integrity of the CDM (CDM-EB78-AA-A05). As a default all CDM projects need to be included in the respective cohort unless the DNA can demonstrate that the cost of fuels/feedstocks/technologies exceed those of certain comparable projects (CDM-EB79, para 41).
- **Vintage of standardized baselines and static versus dynamic standardized baselines:** Standardized baselines are often constructed based on plants for which the investment decision was taken many years in the past. If a standardized baseline is static and not frequently updated, it can mean that additionality is established and baselines are determined based on a market situation that is ten or twenty years old (i.e. failing to take into account technological breakthroughs). This could result in significant crediting of BAU (Table 3-9, bullet point 2). The high-level CDM Policy Dialogue has therefore recommended that in order to drive technological change, the standardized baseline framework must ensure “*that the focus of incentives constantly shifts to the next generation of technologies*” (CDM Policy Dialogue 2012, p. 6). As a consequence, the current standardized baseline framework specified interim data vintages and

update frequencies of 3 years respectively (CDM-EB77-A05). For example, sectors associated with slow dynamic developments in the past may allow for a relaxation in the frequency of updates without compromising the environmental integrity of the CDM.

- **Level of disaggregation:** The level of disaggregation is an important factor to consider in the development of a standardized baseline, which can enable a DNA with limited resources to prioritise which mitigation measures to incentivise within a sector. For example, Hermwille et al. (2013) refer to a case study of the rice mill sector in Cambodia where only a small number of large scale rice mills account for approximately 60% of the total output. Given that the remaining output is provided by thousands of small-scale rice mills with very varied use of technologies that are associated with different emission intensities, it was necessary to disaggregate the standardized baseline on the basis of plant size (i.e. focus standardisation on the large-scale mills). The importance of disaggregation of standardized baselines is further demonstrated in the power sector. If a standardized baseline is based upon the entire power sector of a country, it is likely that the use of renewables and possibly of the most efficient fossil fuel technologies would be encouraged. However, if the standardized baseline was disaggregated further to consider fossil fuel consumption only – different mitigation options such as fossil fuel switching would be encouraged instead (Hermwille et al. 2013). The appropriate level of disaggregation depends very much on the project type and the actual circumstances. With the current approach, DNAs can determine the level of disaggregation, though there is no EB guidance on how the appropriate level can be determined. In addition, such guidance would hardly be compatible with the ‘one size fits all’ approach pursued in the standardized baseline guidance.

In light of all of these challenges, the implementation of standardized baselines may not be suitable for all sectors, project types or countries. The development of a standardized baseline can achieve the objective of simplification in certain sectors associated with more homogenous products. However, standardized baselines will be more difficult to apply to sectors associated with a range of products and strongly varied circumstances amongst installations. Therefore, it should be carefully checked for which purposes, sectors, project types and baseline emission sources standardized baselines are appropriate. Applying one single approach to establish standardized baselines for different sectors, project types and locations, as currently pursued under the CDM, is likely to undermine the environmental integrity of the CDM. Standardized baselines should be developed from actual projects and reflect the particular circumstances of the sector, project type and location. Once approved within a country or region, standardized baselines need to be mandatory for all new CDM projects to prevent that more CERs are issued as if the standardized baseline was not established (Schneider et al. 2012).

To ensure that the concept of standardized baselines provides what it was established for, particularly *“to reduce transaction costs, ... while ensuring environmental integrity”* (UNFCCC 2011c), the EB should review the standardized baseline framework. This review should ensure that

- stringent QA/QC procedures are applied to all standardized baselines,
- all CDM facilities without any exemptions are included in the peer group for the standardized baseline,
- DNAs can build their decision on the appropriate disaggregation level on a clear guidance document which aims to determine the level of disaggregation in a way that covers the mitigation activity of the standardized baseline as accurately as possible and includes as few external factors (‘noise’) as possible;
- the practice of using the same methodological approach to establish standardized baselines for all the different sectors, project types and locations is replaced by the development

of project-specific standards derived from actual projects and reflect the particular circumstances of the sector, project type and location, and last but not least,

- standardized baselines are mandatory for new projects once they are approved for a country.

If these improvements were introduced, standardized baselines could be a valuable tool to improve the environmental integrity of the CDM while lowering transaction costs.

3.9. Consideration of policies and regulations

The consideration of policies and regulations in demonstrating additionality and establishing emissions baseline has been a controversial issue for project-based mechanisms as the CDM. Policies and regulations adopted by the host country can have a significant impact upon future emission pathways. For example, the introduction of air quality regulations for power plants impacts their CO₂ emissions while fossil fuel subsidies reduce the viability of less emission-intensive technologies (Schneider et al. 2014). When setting the baseline and demonstrating additionality there have been concerns raised about both perverse incentives for policy makers (i.e. host countries not implementing policies and measures that reduce emissions so that they can secure greater carbon revenues) and about environmental integrity, by either over-crediting of emission reductions (i.e. inflating the baseline by excluding policies and measures that reduce emissions) or non-additional projects (i.e. registering projects that are economically viable and do not face barriers by allowing the exclusion of subsidies in the investment analysis).

The modalities and procedures for the CDM require that *"a baseline shall be established taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector"* (decision 3/CMP.1, para 45(e)). However, in order to avoid the creation of perverse incentives for policy makers, the CDM EB adopted, at its 22nd meeting, the following rules with regard to the consideration of policies in setting baselines:

- **E+ policies:** to not consider policies adopted after 1997 which *"give comparative advantages to more emissions intensive technologies or fuels over less emissions intensive technologies or fuels"* in setting the baseline;
- **E- policies:** to not consider policies adopted after 2001 which *"give comparative advantages to less emissions intensive technologies over more emissions intensive technologies"* in setting the baseline.⁴²

These rules failed, however, to fully address perverse incentives for policy makers, as host countries would continue to have incentives to maintain existing E+ policies such as fossil fuel subsidies. Furthermore, although host countries will not be discouraged from implementing national policies and measures that reduce emissions (E- policies), the rules are likely to result in over-crediting of emission reductions.

Overall, in the case of E- policies it seems difficult to reconcile the two policy objectives: avoiding perverse incentives for policy makers and ensuring environmental integrity. If E- policies were excluded when demonstrating additionality or setting baselines, perverse incentives would be addressed but environmental integrity would be undermined, since projects that are financially viable could claim they are not, and emissions baselines would be inflated. If E- policies were included, environmental integrity would be ensured but perverse incentives not addressed.

⁴² EB 22 report, Annex 3: Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline Scenarios (Version 02), https://cdm.unfccc.int/EB/022/eb22_repan3.pdf.

In 2013, the EB reviewed its E- policy guidelines with a view to balancing these two conflicting policy objectives and *“agreed to pursue an approach by which, for the first seven years from the effective implementation date of the relevant E- policy, the benefit of that E- policy does not need to be considered by project participants in the additionality demonstration through investment analysis”* (CDM-EB73, para. 70). The approach would thus ignore new E- policies but for a limited time period. Initially allowing the exclusion of E- policies could be seen as addressing perverse incentives for policy makers, while ensuring environmental integrity in the longer term. It would also expand the approach of ignoring E- policies from baseline setting to demonstrating additionality. However, the EB has not yet been able to agree on a revision of its E+/- policy guidelines.

Based upon an econometric analysis, Lui (2014) raises questions about the decline of feed-in tariffs in China⁴³ that may imply a gaming to ensure wind projects are not economically attractive for the purpose of demonstrating additionality under the CDM. Schneider et al. (2014) argue that with regards to E- policies it is simply not feasible to achieve both a robust crediting baseline and avoid the creation of perverse incentives at the same time. Striking a balance between the two objectives is therefore required when setting the crediting baseline, which is likely to vary depending upon the sector, project type and type of policy.

Given the contrasting objectives, the decision on whether to include E- policies in the baseline or not and the determination of additionality of a project-based mitigation activity should depend upon the potential risk of either creating perverse incentives or over-crediting. Schneider et al. (2014) recommend that the following approach should be pursued when setting baselines and determining additionality:

- If the **risk of creating perverse incentives** is judged to be considerably larger than the risk of over-crediting, then E- policies should not be considered (for a certain period) in setting the baseline;
- If the **risk of over-crediting** is deemed to be considerably greater than the risk of creating perverse incentives, then E- policies should be considered in setting the baseline.

The extent to which the setting of baseline and determination of additionality for a project-based mitigation activity is more liable to either the risks of perverse incentives or over-crediting depends upon the wider co-benefits associated with a policy other than simply climate change mitigation. For example, the deployment of renewables is associated with multiple co-benefits such as employment opportunities, energy security and air quality improvements. Given the additional benefits associated with such E- policies, it is less likely that these policies would not be adopted as a consequence of changes to an international crediting mechanism. Schneider et al. (2014) and Spalding-Fecher (2013) therefore both argue that the risk of creating perverse incentives (i.e. delaying policies and regulations to secure more CER revenues) may be lower than the risks of setting a less robust baseline (i.e. by not including E- policies in the baseline) that leads to the over-crediting of emission reductions. Spalding-Fecher (2013) also points out that such co-benefits are likely to occur with electricity generation, energy efficiency and agriculture projects.

However, the risk of creating perverse incentives is likely to be greater from mitigation activities such as the capture of HFC-23, which reduce GHG emissions but do not lead to significant co-benefits. In such a case, preventing the creation of perverse incentives (i.e. host country delaying regulation on the capture of HFC-23) could be given priority over additionality and environmental integrity by not considering such E- policies when setting the baseline. Nevertheless, CERs resulting from such projects would be used to offset GHG emissions in other capped systems and, since

⁴³ Spalding-Fecher (2013) discusses the uncertainty within the CDM EB on how such a policy change should be classified under the E+/- policy guidance.

they are not truly additional, result in globally higher emissions. Therefore, it would be more appropriate to support such technologies by other means such as ODA or climate finance or by addressing these mitigation potentials as own contribution under the ADP negotiations.

From a more practical perspective, Spalding-Fecher (2013) emphasises the difficulty of accurately accounting for the effects of E- policies when setting either the baseline or demonstrating additionality. The level of difficulty depends upon the policy type. For example, the impact of direct financial incentives such as mandatory feed-in tariffs can be removed more easily from an emissions baseline than indirect sectoral incentives such as renewable energy portfolio standards or economy-wide policies such as domestic emissions trading schemes. Furthermore, defining the date of policy implementation and the effectiveness of enforcement may sometimes represent additional challenges (Spalding-Fecher 2013). If the guidance provided by the CDM EB – given the difficulty in isolating the impact of multiple (and sometimes conflicting) policies when setting emission baselines or demonstrating additionality – would only relate to direct financial incentives this could lead to the unequal treatment of host countries under the CDM based upon the types of policies implemented (Spalding-Fecher 2013). For example, it would be easier to determine the additionality of a renewable energy project in a host country with direct financial incentives such as feed-in tariffs compared to a host country that adopted a domestic emissions trading scheme. This practical problem could not only undermine the environmental integrity of the CDM but also mean that excluding E+ or E- policies may simply not be practical.

Taking into account the various challenges to strike the right balance between avoiding perverse incentives for policy makers and ensuring environmental integrity, Spalding-Fecher (2013) concludes that the risk of perverse incentives is not as high as previously assumed in many countries and sectors, while the risk of over-crediting is substantial. He therefore suggests that as a general rule all E- policies should be considered in both baseline-setting and additionality determination. Schneider et al. (2014) outline the following options in relation to E- policies:⁴⁴

- No consideration of E- policies: No perverse incentives would be created if both existing and planned E- policies were not considered when setting the crediting baseline. In fact, host countries would be encouraged to introduce further E- policies to further reduce emissions below the baseline. However, the disadvantage of this option would be that the emission baseline would most likely be inflated above BAU.
- Consideration of existing E- policies, exclusion of future E- policies: A more balanced approach could involve the introduction of a cut-off date for excluding future E- policies from being considered in the setting of the crediting baseline. However the setting of a cut-off date is problematic. For example, if the cut-off point is set too early it may inflate the crediting baseline by considering E- policies that have already been adopted. Nevertheless, the option provides a positive incentive for host countries to adopt new E- policies (after the cut-off point) to reduce emissions.
- Consideration of existing and future E- policies: A robust crediting baseline would be established if both existing and future E- policies were considered (either ex-ante or ex-post), however this would most likely create disincentives to introduce E- policies as their introduction could lower the potential for credits. In addition, this option would provide greater uncertainty for investors as to when a crediting baseline would be updated.

In order to prevent the over-crediting of emission reductions, it would be a sensible approach to include current E- policies in the crediting baseline. However, accounting for future E- policies is

⁴⁴ These options are outlined in the context of a sector based crediting mechanism though they also apply to the CDM.

more problematic and warrants further research to ensure that a reasonable balance is achieved between limiting the over-crediting of emission reductions and preventing the creation of perverse incentives. Schneider et al. (2014) and Spalding-Fecher (2013) conclude that the balance should be more in favour of limiting over-crediting in the CDM or future mechanisms as they judge this risk to be greater to undermining environment integrity than from the creation of perverse incentives. Therefore, as a general rule Schneider et al. (2014) recommend that adopted policies and regulations reducing GHG emissions should be included when setting crediting baselines and policies that increase GHG emissions should be discouraged by their exclusion from the crediting baseline where possible.

3.10. Suppressed demand

One of the challenges of applying GHG accounting approaches in poor communities is that the current consumption of many household services (e.g. heating and cooking energy, lighting and potable water) may not reflect the real demand for those services. This could be a result of lack of infrastructure, lack of natural resources or poverty, particularly the high costs of these services relative to household incomes. The situation of 'suppressed demand' creates a problem for setting baselines, because the CDM rules say that the baseline scenario selected for a project should provide the same level of service and quality as the project scenario (Gavaldão et al. 2012; Michaelowa et al. 2014; Spalding-Fecher 2015; Winkler & Thorne 2002). This is clearly not the case if the project scenario provides a much higher service level, owing to low historical consumption. At the same time, the CDM rules state that "the baseline may include a scenario in which future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host Party" (UNFCCC 2006a para. 46). This section analyzes how the concept of suppressed demand has been implemented in CDM methodologies and what the potential impacts on CER issuance as a result of the revised and new methodologies. For a more detailed conceptual explanation of suppressed demand, as well as background on previous EB decisions and guidance, see Chapter 9 of Spalding-Fecher et al. (2012).

3.10.1. Treatment of suppressed demand in approved methodologies

Table 3-10 below shows the methodologies in which suppressed demand has been explicitly considered, in three different categories. The first group is from a work plan agreed by the EB at their 67th meeting, when the EB requested that the Secretariat and relevant support panels explore how to incorporate suppressed demand. The second group is methodology revisions for which the proponent of the revision motivated the change based on the Suppressed Demand guidance. The final group is new methodologies that were developed after the approvals of the Suppressed Demand guidance and incorporated those ideas, as documented in the UNFCCC Methodology Guidebook. Of the original 10 methodologies in the EB work plan, 5 were revised or replaced, while an additional 8 methodologies fall into the second and third categories.

Note that a group of methodologies not listed here, but that implicitly recognise suppressed demand, are those addressing new large-scale power generation or industrial development. New renewable energy, natural gas or high-efficiency coal power plants are not required to show that they actually replace an existing power plant. Given that most developing countries have shortages in power supply, building a new natural-gas-fired power plant, for example, could potentially increase emissions compared to current levels. However, the accepted principle on baseline development across the CDM is that the baseline is not necessarily the same as historical emissions, but should reflect the most likely development scenario for the sector. Even in countries with chronic power shortages, it would be difficult to argue that there would be *no* capacity increases under the baseline scenario. This means that, even in these cases, CDM projects – if properly justified –

would potentially displace another alternative new plant. The determination of the alternative plant is then the subject of the methodology's baseline scenario analysis.

Table 3-10: Methodologies explicitly addressing suppressed demand or part of EB work plan on suppressed demand

Meth No.	Meth Name	Re-vised?	When	Pipeline ¹⁾	
				Pro-jects	PoAs
From EB67 work plan List of Methodologies					
AM0025	Alternative waste treatment processes	ACM22	EB69	127	5
AM0046	Distribution of efficient light bulbs to households	No		2	0
AM0086	Installation of zero energy water purifier for safe drinking water application	No	EB70	1	0
AM0094	Distribution of biomass based stove and/or heater for household or institution	No	EB70	0	0
ACM0014	Treatment of wastewater	Yes	EB77	47	1
ACM0016	Mass Rapid Transit Projects	No		16	1
AMS I.A	Electricity generation by the user	Yes	EB69	50	17
AMS I.E	Switch from non-renewable biomass for thermal applications by the user	Not necessary	EB70	24	58
AMS II.E	Energy efficiency and fuel switching measures for buildings	No		44	5
AMS III.AR	Substituting fossil fuel based lighting with LED/CFL lighting systems	Yes	EB68	4	14
Additional revisions referring to Suppressed Demand					
AM0091	Energy efficiency technologies and fuel switching in new and existing buildings	Yes	EB77	0	0
AMS II.G	Energy efficiency measures in thermal applications of non-renewable biomass	Yes	EB70	45	62
AMS III.F	Avoidance of methane emissions through composting	Yes	EB67	103	20
New methodologies where EB noted Suppressed Demand					
ACM0022	Alternative waste treatment processes	New	EB69	10	0
AMS II.R	Energy efficiency space heating measures for residential buildings	New	EB73	0	0
AMS I.L	Electrification of rural communities using renewable energy	New	EB66	0	1
AMS III.BB	Electrification of communities through grid extension or new mini-grids	New	EB67	0	0
AMS III.AV	Low greenhouse gas emitting safe drinking water production systems	New	EB60/62	0	10
Total with revisions or new related to suppressed demand				473	194
Total pipeline				11,990	446²⁾

Notes: ¹⁾ Pipeline is as of 1 January 2014. ²⁾ PoA DD's submitted, which may include multiple methodologies and include 23 PoAs replaced by new versions. Total number of methodology citations in all PoAs submitted is 874.

Sources: Authors' own compilation

While the proportion of project activities influenced by these methodologies is very small, a significant share of PoAs are utilising the revised or new methodologies. In terms of the quantitative impact of the revisions to methodologies to incorporate suppressed demand; however, this may only relate to projects or PoAs entering the pipeline after the revision. While project participants are allowed to update the version of the methodology that they use prior to the renewal of the crediting period, this should not make the emission reduction calculations less conservative. Given that the suppressed demand revisions could increase the baseline significantly, it is not entirely clear whether the EB would approve this revision for existing projects prior to the renewable of the crediting period (when the latest version of the methodology must be used). Because AM00025 was replaced by ACM0022 in order to address suppressed demand, none of the projects or PoAs under AM0025 (which was not used after October 2012) would be able to utilise the new suppressed

demand approach embodied in ACM0022. Table 3-11 below shows the number of PoAs and Projects in the pipeline both before and after the revisions.

Table 3-11: CDM pipeline affected by suppressed demand methodologies

Meth No.	Meth Name	Total pipeline		New pipeline since revision	
		Projects	PoAs	Projects	PoAs
Revised methodologies					
ACM0014	Treatment of wastewater	47	1	0	0
AMS I.A	Electricity generation by the user	50	17	0	13
AMS III.AR	Substituting fossil fuel based lighting with LED/CFL lighting systems	4	14	3	1
AM0091	Energy efficiency technologies and fuel switching in new and existing buildings	0	0	0	0
AMS II.G	Energy efficiency measures in thermal applications of non-renewable biomass	45	62	2	18
AMS III.F	Avoidance of methane emissions through composting	103	20	7	8
New methodologies that incorporate suppressed demand					
AMS I.E	Switch from non-renewable biomass for thermal applications by the user	24	58	24	58
ACM0022	Alternative waste treatment processes	10	0	10	0
AMS II.R	Energy efficiency space heating measures for residential buildings	0	0	0	0
AMS I.L	Electrification of rural communities using renewable energy	0	1	0	1
AMS III.BB	Electrification of communities through grid extension or construction of new mini-grids	0	0	0	0
AMS III.AV	Low greenhouse gas emitting safe drinking water production systems	0	10	0	10
Total		283	183	46	109

Sources: Authors' own compilation

How the suppressed demand concepts and guidance are implemented varies significantly by methodology. With the exception of AMS III.AR, all of the methodologies use the project activity level as the baseline activity level. Only AMS III.AR defines a quantitative Minimum Service Level that is used to calculate baseline emissions. AMS I.L and AMS III.BB define an MSL, but it is only used to adjust the emissions factor for the baseline, rather than to directly calculate baseline activity levels or emissions. For AMS III.F and ACM0022, the minimum service level is qualitatively defined as having a solid waste disposal site (i.e. rather than considering the quantity of waste processed per household). What the methodologies all do, however, is to define a baseline technology that may have higher emissions than the actual current technology. For example, households may currently only use candles and kerosene hurricane lamps, and therefore have very low lighting services, but the methodologies use a kerosene pressure lamps for the baseline technology, because this can deliver the MSL for lighting services.

For the revised methodologies, the resulting baselines emissions could be substantially higher per household (Annex 8.2, Table 8-1). For example, under ACM0014, baseline methane emissions may still be considered even if the wastewater is currently not treated or stored in a way that would necessarily produce emissions (e.g. lagoons with depth less than 1 m). ACM0022 and AMS III.F have emissions factors that could be double the current practices, while for AMS I.L and AMS

III.BB, the emission factor for very small users (e.g. 50 kWh/yr) is almost 7 times the emissions factor originally used in AMS I.A for these projects.

3.10.2. Impact on CER supply

If current energy service demand is suppressed by lack of income, relatively high energy prices and/or lack of physical access, how quickly might this change without the CDM project? In other words, how long might it take for the current emissions to reach the suppressed baseline emissions? This depends on many factors, including income growth in the host communities and changes in access. Data from the World Bank's World Development Indicators (World Bank 2014), for example, shows that, at a highly aggregated level, per capita incomes in most developing regions have, indeed, increased substantially, but this is slower in low income countries. Electricity consumption per capita, however, has not shown such consistent growth in Africa, largely due to population growth outstripping energy supply growth and electrification programmes (World Bank 2014). This data cannot necessarily be applied to specific sub-regions or project areas, but does show that significant increases in energy consumption are possible in a relatively short time frame. In terms of electrification rates, these have increased relatively rapidly for key countries, rising from 25% or 30% to 60% to 80% in as little as 10 or as many as 30 years (Bazilian et al. 2011). Clearly, the level at which the minimum service level is set will also influence the risk of over-crediting, with lower service levels being more likely to reflect potential consumption in the shorter term without the CDM.

Even if the households were not to reach the minimum service levels in the near term and the emissions factors used in these methodologies is substantially higher than in traditional methodologies, the overall impact on CER generation is likely to be very small. The total CERs projected to 2020 for the methodologies in Table 3-11 after the revisions to those methodologies is approximately 17 million. Even if all of the CERs for those methodologies are considered (i.e. before and after revision), at approximately 112 million, this is still less than 1% of the entire CDM pipeline, and so does not represent a significant impact on emissions.

3.10.3. Additionality concerns

In summary, while the introduction of the concept of suppressed demand in CDM methodologies is expanding, and will have important development impacts, it is unlikely to have a major impact on the overall additionality of CDM projects. In many project areas, it is likely that the communities could reach the Minimum Service Levels during the course of the CDM project life, although this is uncertain and will depend on local circumstances. Creating an open and transparent process of setting minimum service levels, with expert input as well as input from other stakeholders, could also help to balance the risks of over-crediting with the potential increased development benefits. In addition, the application of suppressed demand principles in methodologies could be restricted to certain country groups (e.g. LDCs, under-represented countries), in which development needs are highest and the potential for over-crediting it the smallest. Even if the suppressed demand does lead to some over-crediting, the overall impact is very small, particularly if restricted geographically. More importantly, the increased contribution to sustainable development provides a strong justification for this approach to project types that address poverty and development issues.

4. Assessment of specific CDM project types

The relevant literature highlights that the likelihood of CERs representing real, measurable and additional emission reductions varies considerably among project types. Some project types do not generate revenues other than CERs. These projects have a high likelihood of being additional. Other project types are heavily promoted and/or subsidized by governments, generate significant

other revenues, or their economic feasibility is hardly impacted by CER revenues. For these projects, additionality is more questionable.

Other aspects affecting the quality of CERs also vary among project types. Perverse incentives are particularly relevant for projects that generate large CER revenues compared to the cost structure of their main business (e.g. HFC-23 projects). Baselines are particularly challenging to determine in dynamic sectors with high rates of learning and innovation and penetration of new technologies over relatively short periods of time. The length of crediting is critical for project types which are implemented earlier due to the CDM incentives.

For these reasons, this chapter evaluates the ability to deliver real, measurable and additional emissions reductions for specific CDM project types. In the following, we select important project types in Section 4.1 and assess these project types in the subsequent sections.

4.1. Project types selected for evaluation

We select the project types for evaluation mostly based on their potential CER volume in the period of 2013 to 2020 according to the current CDM project portfolio. Focusing on the period of 2013 to 2020 and on the largest CDM project types in terms of potential CER volume allows the best estimation of the quality of the overall CDM project portfolio for future new demand for CERs. Moreover, the project types with the largest market share are most critical for the overall quality of the CDM.

The specific project types selected for evaluation are provided in Table 4-1. The table also shows that these project types cover a potential CER volume of 4.8 billion CERs, which corresponds to 85% of the overall CER supply potential for the period of 2013 to 2020 (Section 2.3). This ensures a large representativeness.

Table 4-1: Project types selected for evaluation

Project type	Potential CER supply 2013 to 2020 [million]	Focus areas analyzed
Wind power	1,397	Additionality, baselines
Hydropower	1,669	Additionality, baselines
Biomass power	162	Additionality, baselines, leakage
HFC-23	375	Perverse incentive, baselines
Adipic acid	257	Perverse incentives (leakage)
Nitric acid	175	Perverse incentives, baselines
Landfill gas	163	Additionality, baselines, perverse incentives
Coal mine methane	170	Additionality, baselines
Waste heat recovery	222	Additionality, baselines
Fossil fuel switch	232	Additionality, baselines
Efficient cook stoves	2.3	Additionality, baselines
Efficient lighting	3.8	Additionality
Total of all selected project types	4,829	
Total of all projects in the CDM portfolio	5,671	

Source: Authors' own compilation and calculations

4.2. HFC-23 abatement from HCFC-22 production

4.2.1. Overview

Hydrofluorocarbon-23 (HFC-23) is a waste gas from the production of hydrochlorofluorocarbon-22 (HCFC-22), which is a GHG and an ozone-depleting substance (ODS) regulated under the Montreal Protocol on Substances that Deplete the Ozone Layer. HCFCs were introduced as an alternative to the highly ozone-depleting chloro-fluorocarbons (CFCs) because of their lower ozone-depleting potential. HCFC-22 is mainly used for two purposes: as a refrigerant in refrigeration and air-conditioning appliances and as a feedstock in the production of polytetrafluoroethylene (PTFE). The production for the refrigeration and air-conditioning industry is regulated under the Montreal Protocol, whereas the production for feedstock purposes is not.

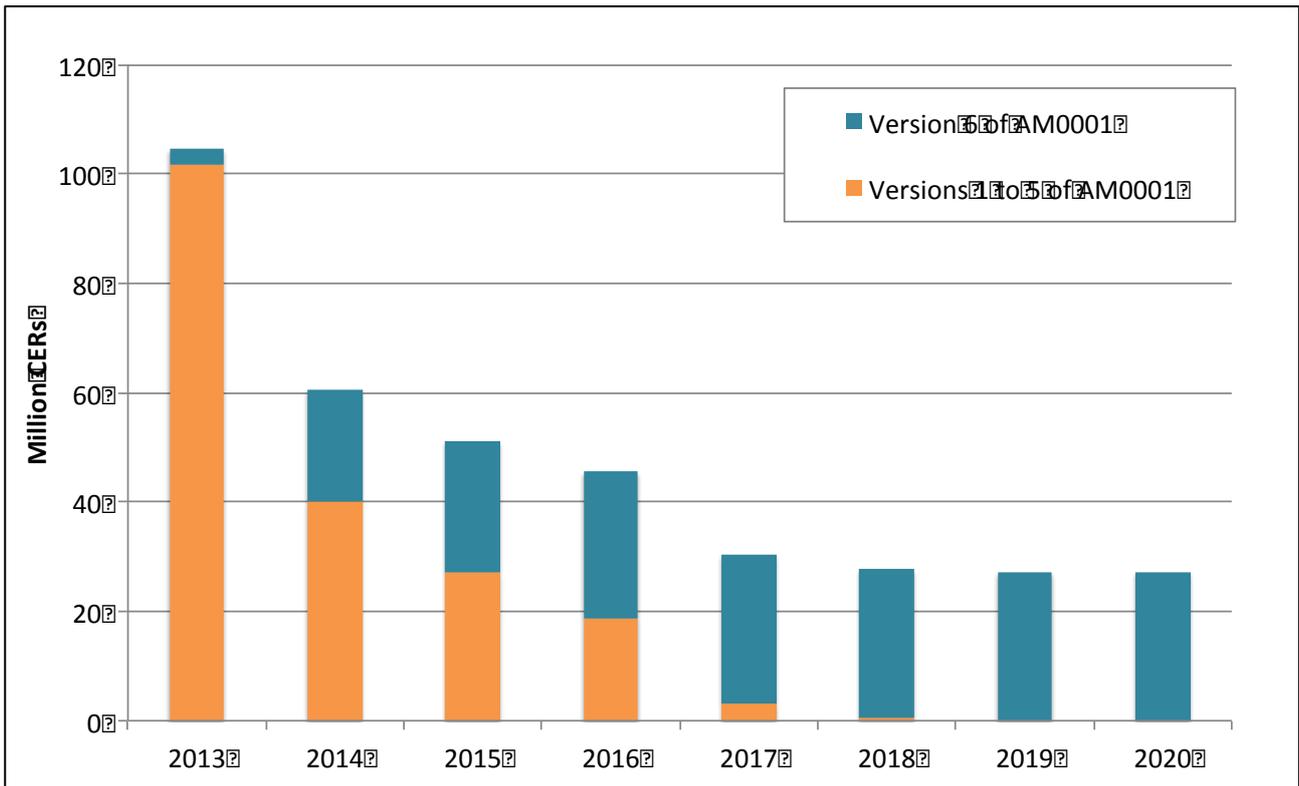
HFC-23 is a potent greenhouse gas; its global warming potential (GWP) is estimated at 14,800 for the second commitment period of the Kyoto Protocol. Emissions of HFC-23 from HCFC-22 production can be abated in two ways: a) by reducing the rate of waste gas generation (by-product rate) through process optimization and b) by capturing and destroying HFC-23 through installation and operation of high temperature incinerators. In the absence of regulations, incentives, or voluntary commitments by the industry, HFC-23 is usually vented to the atmosphere (Schneider & Cames 2014).

4.2.2. Potential CER volume

Under the CDM, 19 HFC-23 projects have been registered. Eleven projects are located in China, five in India; South Korea, Argentina and Mexico each host one project. All projects apply the baseline and monitoring methodology AM0001. In the first commitment period of the Kyoto Protocol, the abatement of HFC-23 has been the project type with the largest CER issuance: 516 million HFC-

23 CERs or 36% were issued of a total of 1.4 billion CERs by the end of 2013. The potential CER supply for the period of 2013 to 2020 is estimated using a bottom-up model based on a detailed evaluation of the information in PDDs and monitoring reports from all 19 projects (Schneider & Cames 2014). In estimating the potential CER supply we differentiate between CERs from the application of versions 1 to 5 and version 6 of the applicable baseline and monitoring methodology AM0001 due to the significant differences between these methodology versions. The potential CER supply for the period of 2013 to 2020 is illustrated in Figure 4-1; it amounts to approx. 375 million CERs for the entire period, with 191 million from the application of version 1 to 5 and 184 million from the application of version 6 of the methodology AM0001.

Figure 4-1: CER supply potential of HFC-23 projects



Sources: Authors' own compilation

4.2.3. Additionality

All versions of the applicable baseline and monitoring methodology AM0001 consider HFC-23 projects to be automatically additional, as long as no regulations to abate HFC-23 are in place in the host country. This rule seems appropriate. Prior to the CDM, none of the plants in developing countries had equipment to destruct destroy HFC-23; HFC-23 generated in the production process was vented to the atmosphere. The same holds for plants that are not eligible for crediting under the CDM because they started commercial operation after 31 December 2001. Plant operators do not have economic incentives to install HFC-23 destruction equipment, as the installation and operation does not reduce costs or generate any significant revenues other than from CERs.⁴⁵ Based on these considerations, we assess that this project type is very likely to be additional.

⁴⁵ Schneider & Cames (2014) report that plant operators could sell HF which is a by-product from flue gas treatment. However, these revenues are likely lower than the costs for HFC-23 destruction.

4.2.4. Baseline emissions

HFC-23 generation from HCFC-22 production depends on two factors: the amount of HCFC-22 production and the ratio between HFC-23 generation and HCFC-22 production, which is often referred to as 'waste generation rate'. The applicable methodology AM0001 determines baseline emissions of HFC-23 based on these two factors, by multiplying the baseline HCFC-22 production with the baseline waste generation rate.⁴⁶ How these two parameters are calculated, has evolved over time.

The approaches changed over time with a view to addressing perverse incentives which are a particular concern for the crediting of HFC-23, due to the low technical abatement costs⁴⁷ and significant profits which can accrue from CER revenues and could exceed the costs of HCFC-22 production (Schneider 2011, UNFCCC 2011b, TEAP 2005). Significant perverse incentives were observed in two JI projects in which plant operators increased the waste generation rate to unprecedented levels once methodological safeguards were abandoned (Schneider & Kollmuss 2015). Perverse incentives can arise from the CDM in the following ways:

- HCFC-22 plants could operate at a higher waste generation rate than they would in the absence of the CER revenues, leading to over-crediting;
- The amount of HCFC-22 produced at CDM plants could be higher than in the absence of the CER revenues. This could lead to over-crediting if
 - HCFC-22 production is displaced at non-CDM plants that have a lower waste generation rate than the baseline rate used at the CDM plants;
 - HCFC-22 production is displaced at plants located in Annex I countries that already are required to abate HFC-23 emissions;
 - HCFC-22 is not produced for use in applications but is vented to the atmosphere;
 - The use of HCFC-22 becomes economically more attractive due to the CDM and is increasingly used compared to other less GHG-intensive alternatives;
 - The base year emissions (2009-2010) under the accelerated phase-out under the 2007 amendment to the Montreal Protocol are higher due to the CDM;
 - The implementation of the accelerated phase-out of HCFC-22 is delayed due to the CDM.
- The HCFC-22 plants could operate longer than they would in the absence of CDM revenues. This could lead to over-crediting under the same circumstances as a higher HCFC-22 production at the plants.

Robustness and conservativeness of the methodology has significantly increased over time. Perverse incentives constitute a major challenge in versions 1 to 5, whereas the conservative approach in version 6 largely avoids and compensates for perverse incentives.

For CERs issued to projects under versions 1 to 5, the amount of over-crediting is uncertain, since it hinges strongly on assumptions on HCFC-22 production levels, HFC-23 waste generation rates and the indirect effects noted above. Munnings et al. (2016) suggest that under-crediting due to conservative baselines may have more than compensated for the potential over-crediting from perverse incentives that these baselines were intended to curb. However, Munnings et al. (2016) make several assumptions that seem rather implausible. For example, they assume that in the absence of the CDM, some plants would have produced more HCFC-22 than they did under the CDM. As a result, we do not find their arguments persuasive.

⁴⁶ Versions 1 to 5 of methodology AM0001 do not explicitly calculate baseline emissions but directly calculate the emission reductions.

⁴⁷ Schneider & Cames (2014), Appendix, provide an overview of technical abatement costs for HFC-23 destruction.

Under version 6, on the other hand, net under-crediting (or net emissions benefit) is very likely since the methodology uses an ambitious default value of 1.0% for the baseline waste generation rate and caps the amount of HCFC-22 production that is eligible for crediting in a more conservative manner (Erickson et al. 2014). However, as of 1 January 2016, no credits have been issued under version 6.

4.2.5. Other issues

Continued low CER prices could jeopardize continued abatement activities at CDM HFC-23 project sites, an unfortunate outcome given the very inexpensive abatement opportunities they provide. At the same time, the failure of the CDM market to ensure continued abatement creates the opportunity for other policies that could yield even greater net emission benefits, especially if no credits are generated that could be also used to increase emissions elsewhere. For example, China recently launched a results-based finance programme that supports HFC-23 abatement in CDM and non-CDM plants (NDRC 2015). This programme helps support HFC-23 abatement across the sector in China. However, continued abatement in other CDM-eligible countries is less certain.

There are also other means to ensure these important abatement opportunities are not lost. Emissions of HFC-23 from HCFC-22 production can be regulated through the Montreal Protocol and for new facilities that have not yet installed GHG abatement, the Protocol's Multilateral Fund (MLF) for GHG abatement can provide financial support (Schneider & Cames 2014).

Note also that continued crediting under the CDM could also create perverse incentives for policy makers not to pursue alternative policies such as these, which address emissions without yielding CERs.

4.2.6. Summary of findings

Past changes to methodologies have now improved the integrity of these projects. If they are operated they are likely to yield more emissions reductions than CERs – i.e. a net mitigation benefit. However, continued low CER prices jeopardize their continued operation in some countries.

Additionality	<ul style="list-style-type: none"> • Likely to be additional
Over-crediting	<ul style="list-style-type: none"> • Risk of perverse incentives largely addressed in most recent methodology (version 6). • Version 6 could lead to under-crediting (net mitigation benefit)
Other issues	<ul style="list-style-type: none"> • Low CER prices jeopardizes continued operation • Emissions could be addressed through Montreal Protocol • Perverse incentives to avoid domestic regulation

4.2.7. Recommendations for reform of CDM rules

The necessary changes in AM0001 have been implemented in recent years. No changes in CDM rules are needed.

4.3. Adipic acid

4.3.1. Overview

Adipic acid is an organic chemical that is used as a building block in a range of different products, most importantly polyamide, often referred to as 'nylon'. Other applications include the production of polyurethanes and plasticizers. Adipic acid is a globally traded commodity, with more than one-third of the production traded internationally. Nitrous oxide (N₂O) is an unwanted by-product of adipic acid production. The formation of N₂O cannot be avoided; it is the result of using nitric acid

to oxidize cyclohexanone and/or cyclohexanol. Generally, the amount of N₂O generated varies very little over time and among plants.

N₂O in the waste gas stream can be abated in different ways: by catalytic destruction, by thermal decomposition, by using the N₂O for nitric acid production, or by recycling the N₂O as feedstock for adipic acid production (Schneider, L. et al. 2010). These methods typically reach an abatement level of about 90% (IPCC 2006, p. 3.30, Ecofys et al. 2009, p. 44). However, plants implemented under CDM and JI achieved significantly higher abatement levels of approx. 99% in the case of CDM and 92% to 99% in the case of JI, apparently through the strong economic incentives from the CDM and JI (Schneider, L. et al. 2010).

4.3.2. Potential CER volume

Under the CDM, four projects were registered. Two projects are located in China, one is in Brazil and one in South Korea. All four CDM plants had no abatement installed before project implementation and applied either thermal or catalytic abatement. The four implemented CDM plants cover only a part of the adipic acid production in developing countries because the applicable CDM methodology AM0021 is limited to plants that started commercial operation before 2005. Since then, five new plants are known to have started commercial operation in China; none of them abates N₂O emissions (Schneider & Cames 2014). Based on a bottom-up model used by Schneider & Cames (2014), the four CDM projects could generate about 257 million CERs in the period of 2013 to 2020.

4.3.3. Additionality

The applicable methodology AM0021 combines the approaches included in the different approaches to demonstrate additionality. Version 1 establishes three criteria for additionality demonstration: no regulations should require N₂O abatement, the project should not be common practice and it should not be economically viable. Versions 2 and 3 refer to the additionality tool and hence the investment analysis is not mandatory for additionality demonstration, as compared to version 1. Nevertheless, all four registered projects conduct an investment analysis and determine the net present value (NPV). Versions 2 and 3 also require reassessment of additionality during the crediting period if new NO_x regulations were introduced.

N₂O abatement from adipic acid production can be regarded as highly likely to be additional, for several reasons. Firstly, none of the non-Annex I countries in which adipic acid is produced have regulations in place to abate N₂O. Secondly, for thermal or catalytic destruction of N₂O, plant operators have no economic incentives to abate N₂O emissions. The abatement generates steam as a by-product; however, the cost savings or revenues are lower than the investment and operation and maintenance costs. Based on a review of PDDs and literature information, the technical abatement costs are estimated at €0.3/t CO₂e, with a range from €0.1/t CO₂e to €1.2/t CO₂e (Schneider & Cames 2014).

Thirdly, the abatement of N₂O from adipic acid production is not common practice in non-Annex I countries. In Western industrialized countries, N₂O has been abated voluntarily since the 1990s. In non-Annex I countries, only one plant in Singapore had abatement technology installed prior to the CDM (Schneider, L. et al. 2010). None of the plants commissioned after 2004, which are not eligible for crediting under the CDM, installed N₂O abatement technology.

4.3.4. Baseline emissions

Baseline emissions of N₂O are determined by multiplying the amount of adipic acid production eligible for crediting with a baseline emission factor. The methodology further estimates baseline

emissions from steam generated during the catalytic or thermal destruction of N_2O . Baseline emissions from steam generation are very small compared to baseline emissions of N_2O .

The baseline emission factor is determined as the lower value between the actual rate of N_2O formation and a default value of 270 kg N_2O / t adipic acid, which corresponds to the lower end of the uncertainty range of the IPCC default value of 300 kg / t adipic acid (IPCC 2006). This approach is used in all three methodology versions and intends to exclude the possibility of manipulating the production process to increase the rate of N_2O formation. Versions 2 and 3 require the actual N_2O formation rate to be determined in two ways: 1) based on the consumption of nitric acid and the ratio of N_2O to N_2 in the off-gas, and 2) based on direct measurements of N_2O in the off-gas adjusted by a 5% discount factor to account for measurement uncertainty. As a conservative approach, the lower resulting value of the two ways is used to determine the baseline emission factor. Overall, the methodology ensures that the baseline emission factor is determined in a conservative manner. The rate of N_2O formation typically observed is higher than the default value of 270 kg / t adipic acid, which could potentially lead to under-crediting of few percentage points.

The amount of adipic acid production that is eligible for crediting is capped in all three methodology versions with a view to avoiding incentives to expand the production as a result of the CDM. Version 2 and 3 establish the cap as the highest annual production in the three years prior to the implementation of the project activity. Version 1 does not provide a procedure to determine a cap but specifies that the methodology is "only applicable for installed capacity (measured in tons of adipic acid per year) that exists by the end of the year 2004". There has been controversy about how this requirement is to be interpreted. Following a request for clarification (AM_CLA_0148), the Methodologies Panel recommended using production data from three historical years, similar to Versions 2 and 3. However, the CDM EB concluded that the panels' clarification "provides too extensive interpretation to an older version of methodology" and clarified instead that the cap should be determined as the "validated maximum daily production of adipic acid multiplied by 365 days multiplied by the operational rate".⁴⁸ This was further interpreted in a way that allowed plants to seek credits beyond their annual design capacity specified in PDDs. All four CDM projects were registered with Version 1 of the methodology. Two projects (0099 and 0116) recently renewed their crediting period, applying Version 3 of the methodology, which lead to caps that are 14.8% and 13.9% lower than the caps applicable in their first crediting period.

While the methodology intended to avoid production shifts through caps on the amount of production that is eligible for crediting, data on adipic acid production, plant utilisation and international trade patterns suggest that carbon leakage, i.e. a shift of production from non-CDM plants to CDM plants, occurred during the economic downturn in 2008 and 2009 (Schneider, L. et al. 2010). Such production shifts do not only lead to distortions in the adipic acid market but can also lead to over-crediting if N_2O is abated in the non-CDM plants. Schneider, L. et al. (2010) estimate that carbon leakage leads to over-crediting of approx. 6.3 MtCO₂e or about 17% of the CERs from adipic acid projects issued in 2008 and approx. 7.2 MtCO₂e or about 21% of the CERs from adipic acid projects in 2009. These effects could thus outweigh the conservative determination of the baseline emission factor.

The lenient interpretation of historical production capacity in version 1 of the methodology considerably contributed to the carbon leakage. However, the more conservative approach for the establishment of the cap on adipic acid production in versions 2 and 3 of the methodology addresses this issue only partially. In a global economic recession, adipic acid production could fall well below historical rates of plant utilisation. Depending on the CER prices, CDM plants operators would then have significant competitive advantage over non-CDM plants, which could lead to similar produc-

⁴⁸ Report of the 48th meeting of the EB, paragraph 24.

tion shifts as observed in 2008 and 2009. As for HCFC-22 production, the underlying issue is that carbon market revenues can have a strong impact on adipic acid production costs. Carbon leakage is unlikely to occur at current market prices for CERs, but could become an issue again if CER prices increased.

4.3.5. Other issues

No other issues were identified.

4.3.6. Summary of findings

Adipic acid projects have a very high likelihood of additionality. The baseline emission factor is determined in a conservative manner that could lead to a few percentage points of under-crediting. The methodology does not include sufficient provisions to address carbon leakage. This could lead to significant over-crediting in times of higher CERs prices and when the adipic acid production capacity significantly exceeds demand.

Additionality	<ul style="list-style-type: none"> Likely to be additional
Over-crediting	<ul style="list-style-type: none"> Most recent methodology could lead to slight under-crediting Leakage could lead to significant over-crediting in times of higher CER prices
Other issues	<ul style="list-style-type: none"> None

4.3.7. Recommendations for reform of CDM rules

Based on the considerations above, we recommend revising the applicable CDM methodology as follows:

- The provisions for additionality demonstration could be simplified, as this project type can be considered to be very likely additional. We recommend considering this project type as automatically additional, as long as no regulations require N₂O abatement.
- The potential for carbon leakage should be addressed. We recommend introducing a standardized ambitious emission benchmark to determine baseline emissions. Carbon leakage would be avoided most effectively if a consistent emissions benchmark is used for all plants around the world, including plants under ETSs, and if it is set at or below the abatement level typically achieved in the industry. A standardized global emission benchmark for all adipic acid plants, regardless of policy approach or specific emission trading mechanism, could provide a level playing field for the adipic acid industry and eliminate potential economic distortions. Adipic acid production is particularly amenable to a standardized global benchmark because it is a highly globalized industry, and all plants are very similar in structure and technology (Schneider, L. et al. 2010). We recommend a level at or below 30 kg/t adipic acid, which reflects the abatement level achieved by the large majority of producers world-wide.
- If a standardized ambitious emissions benchmark is introduced, the methodology could be further simplified as measurements and calculations of the rate of N₂O formation would not be necessary.

4.4. Nitric acid

4.4.1. Overview

Nitric acid is mainly used for the production of synthetic fertilizers and explosives. In the industrial production of nitric acid, ammonia (NH_3) is oxidized over precious metal gauzes (primary catalyst) to produce nitrogen monoxide (NO), which then reacts with oxygen and water to form nitric acid. N_2O is an unwanted by-product generated at the primary catalyst. The better a primary catalyst functions, the lower the N_2O emissions. Nitric acid is produced during production campaigns of typically 3-12 months (Kollmuss & Lazarus 2010).

N_2O emissions from nitric acid production can be abated in three ways (Schneider & Cames 2014):

- **Primary abatement** prevents the formation of N_2O at the primary catalyst. According to gauze suppliers, improved gauzes could potentially lead to a 30-40% reduction of N_2O formation (Ecofys et al. 2009).
- **Secondary abatement** removes N_2O through the installation of a secondary N_2O destruction catalyst in the oxidation reactor. The abatement efficiency of the secondary catalyst is often estimated as ranging from 80% to 90%. However, in practice it varies in CDM plants from about 50% to more than 90%. Registered CDM projects achieved an average abatement efficiency of 70% (Kollmuss & Lazarus 2010, Debor et al. 2010).
- **Tertiary abatement** removes N_2O from the tail gas through either thermal or catalytic decomposition. Tertiary abatement can reduce N_2O emissions by more than 90% but involves larger investment and operating costs and more demanding technical requirements than secondary abatement. Registered CDM projects achieved an average abatement efficiency of 86% (Kollmuss & Lazarus 2010, Debor et al. 2010).

Four methodologies have been approved for N_2O abatement from nitric acid production:

- **AM0028** is applicable to tertiary abatement in plants that started commercial operation before 2006. 19 projects used the methodology. In 2013, the methodology was limited to caprolactam production in 2013, and replaced by amending the methodology ACM0019.
- **AM0034** is applicable to secondary abatement in plants that started commercial operation before 2006. 56 projects used the methodology. In 2013, the methodology was withdrawn and replaced by amending the methodology ACM0019.
- **AM0051** is also applicable to secondary abatement in plants that started commercial operation before 2006. The methodology was never used and was withdrawn in 2013. It is therefore not considered in detail in this study.
- **ACM0019** is applicable to both secondary and tertiary abatement and both existing and new plants. 26 projects used the methodology. Since 2013, this is the only valid methodology for nitric acid projects.

Table 4-2 provides an overview of the main features of and differences between the methodologies.

Table 4-2: Overview of methodologies for nitric acid projects

	AM0028	AM0034	AM0051	ACM0019
Projects	19	56	None	26
Technology	Tertiary	Secondary		Secondary and tertiary
Validity	Limited to caprolactam in 2013	Withdrawn in 2013		Valid
Applicability	Plants that started operation before 2006			Existing and new plants
Additionality demonstration	Additionality tool			Automatically additional
Baseline emission factor	Ex-post measurements	Ex-ante measurement campaign	Ex-post measurements	Emission benchmark
Cap on baseline production	Design capacity			No cap
Re-assessment of baseline scenario or additionality	In case of new NO _x regulations			Not applicable

Sources: Authors' own compilation

4.4.2. Potential CER volume

Under the CDM, 97 projects were registered and another four projects were submitted for validation as of January 2014. China is the most important host country with 44 projects. Other important countries are India (5 projects), Uzbekistan (6 projects), South Africa (5 projects), and Brazil, Egypt, Israel and South Korea which host each four projects. Among the 97 registered CDM projects, only 51 have issued CERs as of January 2014. In the current market situation, it is likely that most of the remaining 47 projects have not been implemented. Based on a bottom-up model developed by Schneider & Cames (2014), the 101 published CDM projects could generate approx. 175 million CERs in the period of 2013 to 2020. Potential new projects that have not yet been developed or published are estimated to have a potential of approx. 31 million CERs over the same period.

4.4.3. Additionality

Up to 2011, all three approved methodologies (AM0028, AM0034, AM0051) used the additionality tool to demonstrate additionality. In 2011, ACM0019 was adopted, which deems projects to be automatically additional and employs a dynamic emission benchmark to determine baseline emissions.

N₂O abatement from nitric acid production can be regarded as highly likely to be additional, for similar reasons as for HFC-23 abatement from HCFC-22 production and N₂O abatement from adipic acid production. Non-Annex I countries usually do not have regulations which address N₂O emissions from nitric acid production. Prior to the CDM, secondary or tertiary abatement is not known to have been used in non-Annex I countries and N₂O is usually released to the atmosphere. While plant operators have economic incentives to take primary abatement measures to reduce the rate of N₂O formation, they do not save any costs or generate any revenues – other than car-

bon market revenues – from the installation of secondary or tertiary abatement. Based on a review from PDDs and literature information, the average technical abatement costs are estimated at €0.9/t CO₂e for secondary abatement and at €3.2/t CO₂e for tertiary abatement (Schneider & Cames 2014). For these reasons, in our assessment, the approach in ACM0019 of assuming this project type automatically additional seems reasonable.

4.4.4. Baseline emissions

Baseline emissions are determined by multiplying the amount of nitric acid production with a baseline emission factor. The methodologies AM0028, AM0034 and AM0051 limit the amount of nitric acid production eligible for claiming emission reductions to the design capacity of the plant in 2005; ACM0019 has no such cap. The baseline emissions factor is determined in three different ways in CDM methodologies: through measurement campaigns conducted prior to the installation of the abatement technology (AM0034), through measurements during the crediting period (AM0028 and AM0051), and by using an emissions benchmark (ACM0019).

All three methodologies using measurements (AM0028, AM0034 and AM0051) aim to provide safeguards to avoid perverse incentives to artificially increase the rate of N₂O formation in order to increase CDM revenues (UNFCCC 2012b; UNFCCC 2013; Schneider & Cames 2014). In AM0028, the baseline emission factor is capped to the level of previous monitoring periods if project participants do not use a primary catalyst that is common practice in the region or has been used in the nitric acid plant during the last three years and if they cannot justify the use of a different catalyst. In addition, key operating conditions of the plants cannot be changed during project implementation. In AM0034, the methodology requires a new baseline measurement campaign to be conducted if the chemical composition of the primary catalyst is changed after project implementation. While these provisions aimed to avoid perverse incentives to increase the N₂O formation due to the CDM, they provide economic disincentives to plant operators to use primary catalysts that reduce the formation of N₂O, as this would lower their CER revenues and could involve additional costs for conducting a new baseline campaign (UNFCCC 2012b; UNFCCC 2013; Schneider & Cames 2014). However, advanced primary catalysts that increase the NO yield and lower the generation of the by-product N₂O are emerging in the industry. They have become widespread in Europe, are gaining market shares in other parts of the world, and have been used in a number of CDM projects prior to their start (UNFCCC 2012b). It is thus possible that some CDM projects applying the AM0034 or AM0028 methodology would, in the absence of the CDM incentives, employ more advanced primary catalysts, in particular over the time frame of three crediting periods, leading to over-crediting (UNFCCC 2012b).

The Methodologies Panel further identified that some plants using the AM0034 methodology had established baseline emission factors which are significantly above the uncertainty range of the IPCC default values and which would result in considerable economic losses for the plant operators (UNFCCC 2012b). The highest reported value from a baseline measurement campaign is 37.0 kg N₂O / t nitric acid, while the highest IPCC default value is 9.0 kg N₂O/t nitric acid, with an uncertainty range of ±40% (IPCC 2006). Such high emission factors indicate that these plants are operated at a high specific ammonia consumption. Plant operators could intentionally reduce the production efficiency during the baseline campaign in order to achieve a higher CDM baseline emission factor (UNFCCC 2012b). Moreover, while inefficient plant operation can be observed in Non-Annex I countries, it seems questionable whether the observed levels of nitrogen loss would continue over the course of three crediting periods. On the other hand, it is important to take into account that the IPCC default emission factors were estimated at times when much less information was available on N₂O formation from nitric acid plants. In particular, continuous measurements over the length of a production campaign, with increasing N₂O emissions towards the end of the

campaign, were not available. The values and their assigned uncertainty should therefore not be outweighed.

To address these two issues, the CDM EB withdrew the AM0034 and AM0051 methodologies and limited the applicability of the AM0028 methodology to caprolactam plants in 2013. At the same time, the EB revised the methodology ACM0019, distinguishing the approach between plants that used AM0028 or AM0034 in their first crediting period and other (mostly newer) plants. For AM0028 and AM0034 plants up to their design capacity, the methodology uses the lower value between the historical baseline emissions during the first crediting period under AM0028 and AM0034 and a default value set at the upper end of the uncertainty range of the IPCC default value and declining by 0.2 kg N₂O/t nitric acid per year to reflect technological innovation in primary catalysts that may reduce emissions over time. This approach caps the baseline emissions particularly for those plants that have established baseline emission factors above the IPCC uncertainty range. It also reduces the maximum amount of baseline emissions that can be claimed over time to account for technological innovations in primary catalysts. For production above the design capacity and other (mostly newer) plants, the methodology uses a more ambitious emissions benchmark set at 3.7 kg N₂O/t nitric acid in 2013 and declining by 0.2 kg N₂O/t nitric acid per year, up to a level of 2.5 kg N₂O/t nitric acid in 2020 which is maintained in subsequent years.

The new approach has several advantages but also some shortcomings:

- Importantly, using default emission benchmarks – whatever the real baseline emissions from a specific plant are – fully avoids perverse incentives for plant operators not to use advanced primary catalysts that reduce the formation of N₂O. Plant operators have incentives to innovate, as this lowers their project emissions and increases the number of CERs issued;
- Using default emission benchmarks further fully avoids the risk that plant operators could intentionally increase the rate of N₂O formation during a baseline campaign in order to maximize CER revenues;
- Using default emission benchmarks can lead to over-crediting in plants that actually have lower N₂O formation rates and to under-crediting in plants that actually have higher N₂O formation rates. Both under- and over-crediting is likely to occur since the N₂O formation rate observed in CDM projects varies by a factor of 10 from 3.5 to 37.0 kg N₂O/t nitric acid, with an average value of 8.6 kg N₂O/t nitric acid (UNFCCC 2012b). Significant over- and under-crediting can have several unintended consequences (Schneider et al. 2014). Plants with a high N₂O formation rate may not be able to reduce their project emissions significantly below the emissions benchmark and may thus not be implemented – although their implementation would be possible with a project-specific baseline. Such ‘lost opportunities’ could increase the global cost of GHG abatement.

The overall impact on environmental integrity depends on the methodology and plant type (Table 4-3). For newer plants, the emission benchmark declining from 3.7 to 2.5 kg N₂O / t nitric acid is rather conservative and will likely lead to under-crediting for most – if not all – plants. For plants that used AM0028 or AM0034 in the first crediting period, the declining project-specific benchmark in ACM0019 is a reasonable baseline on average over all projects in our assessment; projects with higher baseline emission rates than the IPCC range will receive less CERs, while some over-crediting could occur for projects that adopt more advanced catalysts at a faster rate than the decrease of 0.2 kg N₂O / t nitric acid per year foreseen in the methodology. The use of AM0028 and AM0034 could lead to over-crediting in some instances, due to the issues identified above. Considering all plant types and methodology versions together, it seems likely that the approaches for

baseline emissions overall reasonably provide for environmental integrity; the low or moderate levels of over-crediting that could occur under AM0028 and AM0034 could be compensated by significant under-crediting for newer plants applying ACM0019. Over time, the quality of CERs will increase due to the increased phase-in of ACM0019.

Table 4-3: Assessment of environmental integrity of nitric acid projects

Plant type	Methodology	Identified environmental integrity issues	2013-2020 CER potential	Potential for under- or over-crediting
Plants that started operation before 2006: 1 st CP	AM0028 AM0034	<ul style="list-style-type: none"> Perverse incentives not to adopt technologies that reduce the rate of N₂O formation Risk of manipulation of the production process during the baseline campaign 	73 million	Low or moderate over-crediting
Plants that started operation before 2006: 2 nd and 3 rd CP	ACM 0019	<ul style="list-style-type: none"> Under-crediting for plants with higher N₂O formation rates than the IPCC range Over-crediting for plants that adopt advanced primary catalyst technologies at faster rates 	70 million	Neutral / Low over- or under-crediting
Newer plants or plants that did not use AM0028/ AM0034	ACM 0019	<ul style="list-style-type: none"> None 	32 million	Moderate to significant under-crediting

Sources: Authors' own compilation

4.4.5. Other issues

No other issues were identified.

4.4.6. Summary of findings

Nitric acid projects have a very high likelihood of additionality. Baseline emissions can be over- or under-credited; overall, they are likely to reasonably ensure environmental integrity for 2013-2020 CERs, with the average quality of CERs improving over time.

An important lesson learned from this project type is that the potential for technological innovation and perverse incentives was not sufficiently considered when approving the initial methodologies. For sectors that could undergo significant technological innovation, using historic data or measurement campaigns to establish a baseline for up to 21 years is debatable. The more recent ACM0019 methodology accounts for technological innovation by using an emission benchmark that declines over time.

Additionality	<ul style="list-style-type: none"> • Likely to be additional
Over-crediting	<ul style="list-style-type: none"> • Most recent methodologies lead to under-crediting • Overall, little risks of overall over-crediting
Other issues	<ul style="list-style-type: none"> • None

4.4.7. Recommendations for reform of CDM rules

No recommendations.

4.5. Wind power

4.5.1. Overview

CDM wind power projects mainly use four methodologies.⁴⁹ The vast majority of projects (more than 99% of all CDM wind projects) feed electricity into the grid.⁵⁰

According to the UNEP DTU (2014), by the end of 2013, an overall wind power capacity of 111 GW had been installed by projects using the CDM. The main contributors to this overall capacity are China (83 GW), India (10 GW), Mexico and Brazil (both 4 GW). The other 36 countries with CDM wind power projects account for 10 GW of installed capacity in total.

Figure 4-2, Figure 4-3 and Figure 4-4 illustrate the development of wind power capacity and the use of the CDM in China, India and Brazil.⁵¹ In China, installation of wind power capacity accelerated from 2005 onwards. A comparison of the total wind power capacity installed and the capacity installed by projects using the CDM⁵² over the 2005 to 2012 period (Figure 4-2) shows that CDM projects accounted for about 90% of the total cumulated installed capacity as of 2012 (about 75 GW). In the case of India (Figure 4-3), installed capacity increased significantly between 2005 and 2012 from 1.4 GW in 2005 to more than 15 GW in 2012. CDM projects accounted for about half (51%) of the total cumulated capacity installed as of 2012. In the case of Brazil (Figure 4-4), the total cumulated installed capacity as of 2012 was much smaller (2.5 GW). The share of CDM projects in cumulative capacity was 43% as of 2012.

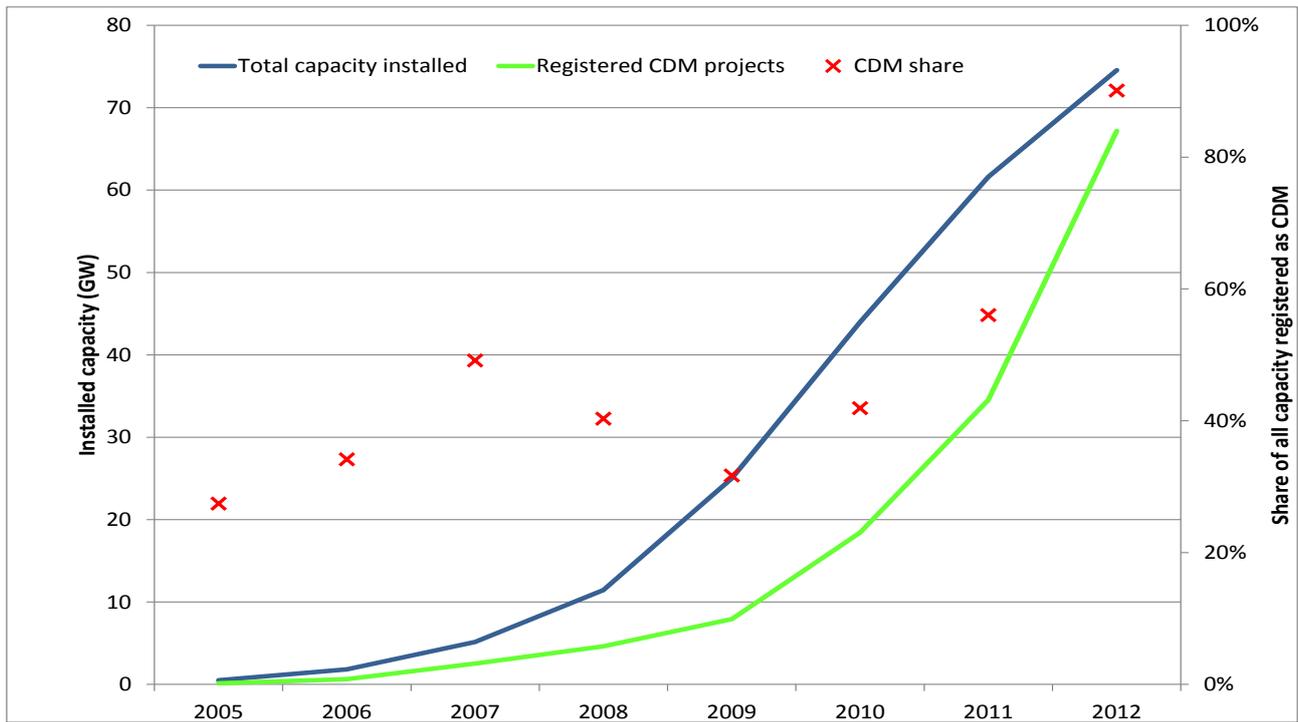
⁴⁹ ACM0002, AMS-I.A, AMS-I.D, AMS-I.F.

⁵⁰ ACM0002 (large scale), AMS-I.D (small scale).

⁵¹ China, India and Brazil are selected for the graphs in order to ensure comparability across chapters on renewable power generation since they are important CDM countries for hydropower and biomass power, too.

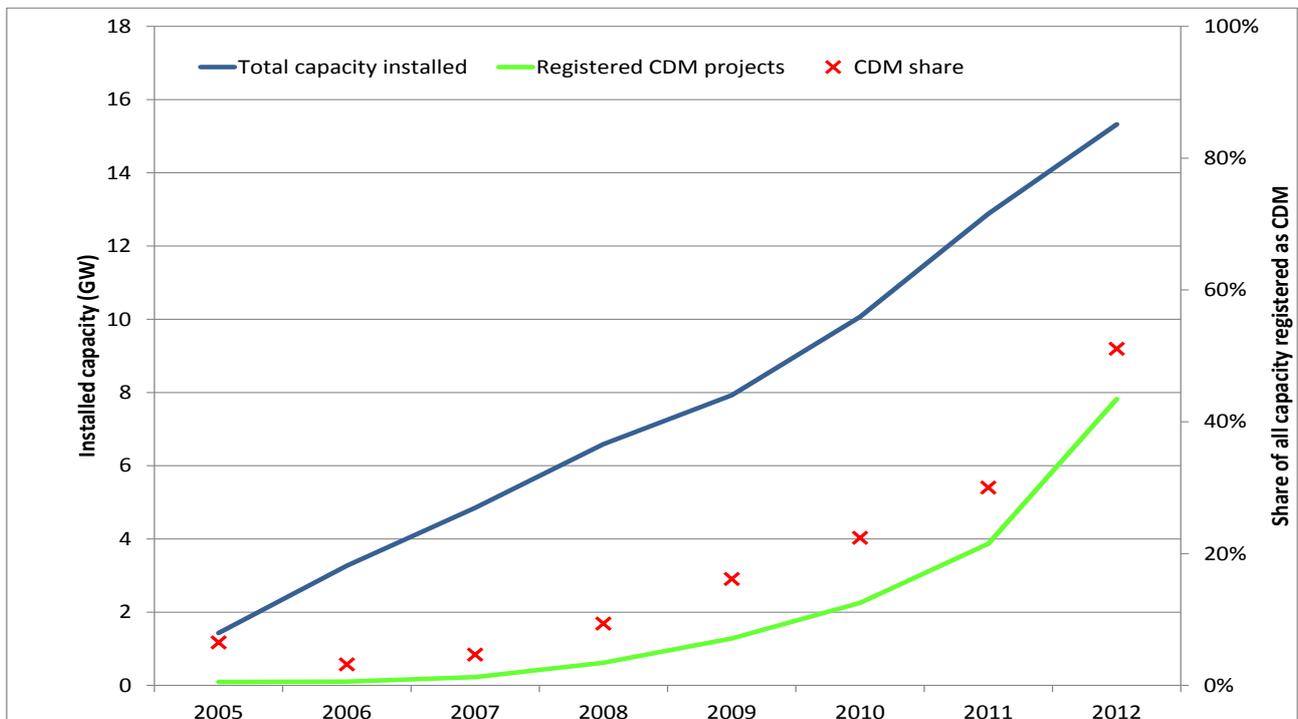
⁵² The total installed capacity between 2005 and 2012 is taken from the World Wind Energy Association statistics (WWEA 2015) and accumulated across the years. The installed capacity of projects using the CDM is taken from UNEP DTU (2014) and accumulated, too. The installation year is taken as the starting date of the crediting period. Cumulative values were used to illustrate the contribution of the CDM since annual values are misleading due to potential differences between the year of construction and the year in which the crediting period starts. Therefore, cumulative values provide a better picture of the general trend of the CDM share in total capacity installed.

Figure 4-2: Total cumulated wind power capacity installed in China between 2005 and 2012



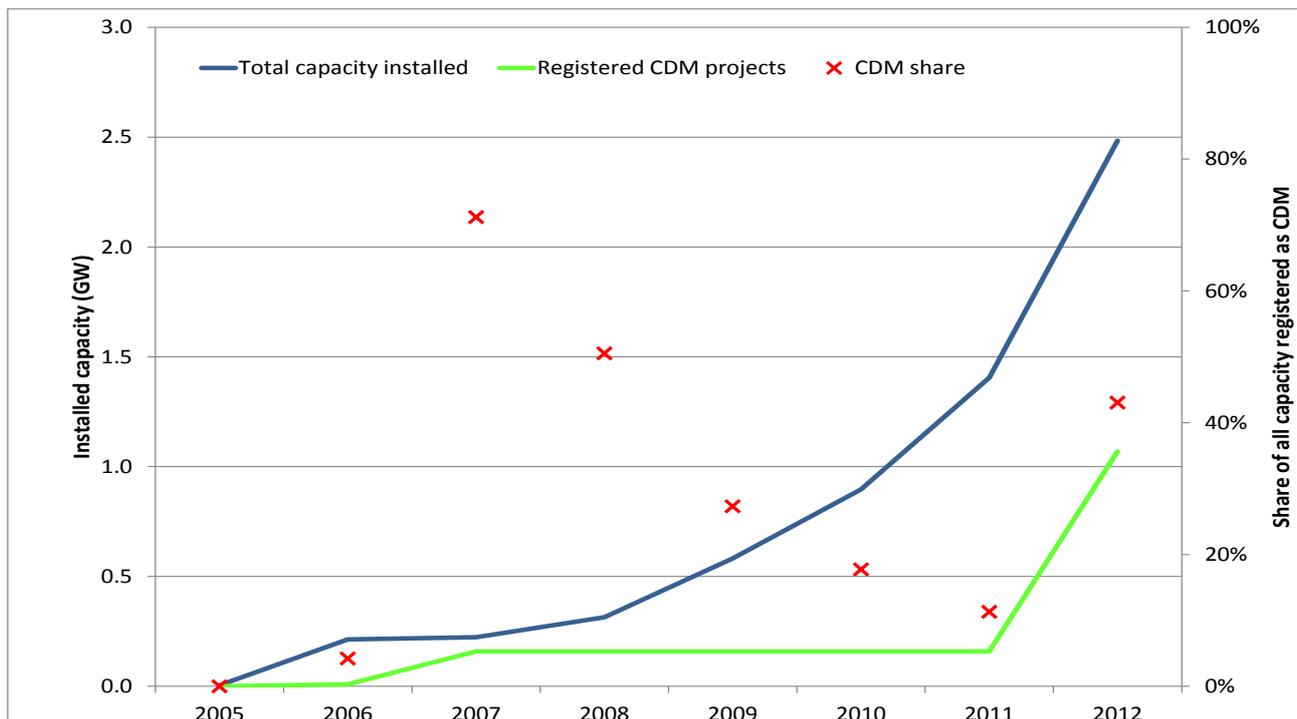
Sources: UNEP DTU 2014, WWEA 2015, authors' own calculations

Figure 4-3: Total cumulated wind power capacity installed in India between 2005 and 2012



Sources: UNEP DTU 2014, WWEA 2015, authors' own calculations

Figure 4-4: Total cumulated wind power capacity installed in Brazil between 2005 and 2012



Sources: UNEP DTU 2014, WWEA 2015, authors' own calculations

4.5.2. Potential CER volume

According to our own estimates, registered CDM wind power projects have the potential to issue 3.5 billion CERs by the end of their respective crediting periods, of which 1.4 billion CERs fall in the period from 2013 to 2020 (Table 2-1). CERs from wind power account for about one quarter of the total CER issuance potential.

4.5.3. Additionality

Large-scale wind power projects apply the methodology ACM0002 which requires using the “Tool for the demonstration and assessment of additionality” to demonstrate additionality.⁵³ In this tool, the investment analysis is one of the approaches for demonstrating additionality. Most CDM wind power projects use investment analysis. The tool for small-scale projects (“Methodological tool. Demonstration of additionality of small-scale project activities”⁵⁴) requires “an explanation to show that the project activity would not have occurred anyway due [...] to barriers”, among which one of the most important barriers is the so-called ‘investment barrier’, which generally features a similar rationale as for the investment analysis of large-scale projects.

Section 3.2 describes the general criticism associated with the investment analysis and Section 2.4 assesses for different project types the impact of CER revenues on their economic performance. According to these analyzes, for wind power projects, CER revenues lead to an increase in the internal rate of return (IRR) of two to three percentage points. An analysis by the World Bank finds that “the incremental IRR from future carbon revenues in renewable energy projects, taking the World Bank’s projects as an example, is quite low” (Carbon Finance at the World Bank 2010). In

⁵³ Current version 07.0.0 (EB 70, Annex 8).

⁵⁴ Current version 10.0 (EB 83, Annex 14).

this analysis, the incremental IRR for renewable energy projects amounts to 1.7% for a purchase period of 10 years and an assumed CER price of \$10/t. Another analysis finds that “wind, hydro and biomass projects experience only a small increase in profitability through CDM” and that “the change in profitability caused by regional variables is greater than the CDM’s impact for wind, hydro and biomass”⁵⁵ (Schneider, M. et al. 2010). From these analyzes, it can be concluded that the CDM impact in the profitability of wind power plants is generally relatively low and that the ‘signal’ provided by the CDM is usually much smaller than the ‘noise’ of national and regional variations in other parameters.

In addition, many countries have set up domestic support schemes in order to promote the increased use of renewables. Spalding-Fecher et al. (2012) provide an overview of several important support incentives for renewable energy generation in major CDM countries (such as China and India) and find “that national policies on electricity tariffs for renewable power could be a more important driver of the viability of wind, hydropower and biomass projects than the CDM is.” In the case of wind power plants in China, Bogner & Schneider (2011) point out that “the wind power boom in China is mainly driven by favourable policies and not by the CDM” and that “the majority of projects would most likely have been implemented without the CDM”. Liu (2014) elaborates on the links between the CDM and national policy in the case of wind power development in China. He finds that a decreasing national feed-in tariff can increase “CDM-supported installed capacity because more projects may comply with CDM requirements as their financial returns remain below the predefined additionality threshold”, which indicates that there is a clear interference between national policy development and the additionality requirements of the CDM. He also finds that “the reduction of technology costs combined with an increasing local manufacturing capacity has paved the way for a scaled-up deployment of wind capacity” (ibid.), which indicates that other factors than the CDM were important in the significant growth of wind power in China. However, he concludes that the CDM “effect on wind technology diffusion [...] is more than twice as high as that of technology cost and industrial policy” (ibid.). He also finds that “while domestic policies must be the engine for large-scale clean energy investments in developing countries, the international carbon offset policy can help that engine run faster, but only if the engine is running” (ibid.). For India, in comparing wind power projects registered under the CDM with those without such support, Dechezleprêtre et al. (2014) find that, “all other things being equal, CDM wind farms tend to be larger, to benefit from higher feed-in-tariffs, and to be located in windier areas, three factors which increase profitability.” According to this analysis, there is “serious evidence of non-additionality of the CDM” (ibid.). He & Morse (2013) find that “Chinese power prices are either tightly controlled by state regulators or are distorted by the presence of large state owned enterprises (SOEs)” and this leads to the conclusion that “IRR-based additionality tests are fundamentally incompatible with state-controlled power pricing regime”.

Furthermore, investment costs for wind power generators have decreased significantly in recent years, which results in wind power featuring (in many cases) competitive levelized costs of electricity in comparison to new fossil-fired power plants (IRENA 2015; ISE 2013). In addition, IRENA (2015) also shows that specific investments costs for onshore wind power plants are significantly lower in China and India than in OECD and ‘rest of the world’ countries. Similarly, Schmidt (2014) finds that the risk associated with low-carbon investment is higher in some parts of the world than in others. In an analysis for industrialised and low-income countries (using typical values for costs of capital in these countries), he finds that due to the higher cost of capital in low-income countries, levelized costs of electricity for onshore wind power plants could be as much as 46% higher than in low-risk countries. Altogether, the available information indicates that the profitability of wind power

⁵⁵ In this analysis, regional factors are the electricity tariff, the load factor and the discount rate.

plants has generally improved. However, there is also a significant dependence of the profitability on regional circumstances.

Overall, due to the limited impact of CER revenues on the profitability of wind power plants, the widespread introduction of domestic support schemes and the significant decrease of wind power costs, we consider the additionality of wind power projects as generally questionable in the context of the CDM, at least for countries with support schemes, low investment costs for wind power and low investment risks.

4.5.4. Baseline emissions

Baseline emissions of CDM wind power projects feeding electricity into the grid include CO₂ emissions from fossil-fired power plants that are displaced due to the project activity. In most cases, the corresponding baseline CO₂ emission factor is estimated using the “Tool to calculate the emission factor of an electricity system”⁵⁶ (Box 4-1).

Box 4-1: The grid emission factor tool

The grid emission factor is calculated as the “combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM)”⁵⁷. According to the tool, “the operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.”

In the tool, several approaches for estimating the combined margin are presented, depending on the specific conditions of the project and data available. In general, the approach of using a combination of OM and BM, depending on the type of project, is appropriate. It suitably reflects that CDM projects could have short-term impacts on the dispatch of power plants and long-term impacts on the power plants built, and different weights for the OM and the BM can be applied (depending on the crediting period and on whether it relates to a project using intermittent or non-intermittent sources), which also can be considered appropriate. A number of specific issues arise from the tool:

In many cases, so-called low-cost and must-run power plants are not considered in the calculation of the CO₂ grid emission factor, which may lead to higher baseline emissions per amount of electricity produced. Neglecting low-cost/must-run power plants, such as renewables or nuclear power, may generally be considered adequate for the estimation of the operating margin (since low-cost/must-run power plants can be expected to be running irrespective of any other power plant in the system). However, an increasing share of renewables (e.g. wind or solar) in the system may lead to a situation in which renewable power generation is at the margin in some hours, i.e. an additional kilowatt hour of renewable electricity does not displace fossil fuels in that hour. In some countries, for example, wind power plants are switched off when electricity supply exceeds demand in order to ensure a stable electricity system. Furthermore, ‘low-cost’ power plants are not clearly defined and some of them may be dispatchable (such as biomass). Overall, the provision of excluding low-cost/must-run power plants may lead to an overestimation of baseline emissions.⁵⁸

⁵⁶ Current version 04.0 (EB 75, Annex 15).

⁵⁷ AMS-I.D, version 17 (EB 61, Annex 17).

⁵⁸ It has to be noted, however, that in the case the country has a large share of low-cost/must-run power plants (more than 50%), e.g. hydro, the simple adjusted operating margin has to be used. In that case, whenever hydro electricity provides sufficient electricity to cover the load demand in a certain hour, this hour is counted as not emitting. This leads to lower baseline emission factors overall than the simple operating margin. The implicit assumption is that water would be spilled in that hour if additional (i.e. CDM) power

Also, both the operating and the build margin approaches are based on historical production and installation data if the option of determining the grid emission factor at the validation stage (ex-ante) is chosen. The resulting baseline grid emission factor is then kept constant throughout the crediting period and only updated at the renewal of the crediting period. This approach does not reflect the general trend towards an increasing share of less-emitting power sources in the electricity mix of many countries. It is oriented to past power systems (backward-looking perspective) rather than to the actual power systems during the crediting period with a higher penetration of renewables (forward-looking perspective). This is especially problematic in countries with a rapidly changing or expanding electricity system. In countries with a growing share of renewable energy capacities, this approach may lead to an overestimation of baseline emissions. However, due to the long-lived capital stock in the electricity sector, changes of the grid emission factor are only gradual (i.e. take several years) in case the power system as a whole is not expanding fast. An advantage of using historical data is that it relies on observed and objective information, whereas scenarios for the future development of the power system may be prone to uncertainty and use of unrealistic assumptions.⁵⁹ Therefore, the determination of the grid emission factor based on historical data is not considered problematic per se but should be adjusted to account for trends in the sector.⁶⁰ Another option for determining the grid emission factor is the ex-post determination during monitoring. This approach is certainly adequate since it reflects the current state of the power sector.

With regard to the build margin, CDM projects are generally excluded from the estimation of the CO₂ emission factor. CDM projects only need to be gradually included if they comprise a significant share of power plants built in the last ten years. This approach can generally be considered adequate, especially in countries with an already significant share of renewable electricity generation or promotional policies for renewables in place, in which case a neglect of CDM projects in the build margin would not be a plausible representation of what would have happened in the absence of the project. This approach therefore addresses the risk of over-estimating baseline emissions in countries with a large share of CDM projects.

The quality of input data in calculating the grid emission factor is also important. In analysing grid emission factors provided by different DNAs, Michaelowa (2011) finds “that most of the documents provided by the DNAs do not allow an external observer to judge whether the data has been collected correctly” and that “there are clear indications that the grid emission factors, as well as the coal power plant benchmarks, have been overestimated both in China and India.” In some countries, the governments established grid emission factors, and DOEs apparently used the values without validating whether they comply with the methodological requirements under the CDM. In order to address this issue, Michaelowa (2011) recommends, inter alia, an “independent validation of grid EF”. Recently, few grid emission factors are submitted as standardized baselines which ensures independent validation by a DOE or the UNFCCC secretariat.

Furthermore, the tool provides several default values for parameters such as the electric efficiency of power plants. The values provided can be considered quite conservative, i.e. they assume rather high electric efficiencies. For those countries using the default values, this may lead to an under-estimation of baseline emissions.

generation is available. However, some countries do not only have run-of-river hydro power plants (for which case, the assumption of spilling water may be reasonable), but water may also be stored in large reservoirs and thus used at a later stage. In this regard, the estimation of baseline grid emissions for countries with a large share of low-cost/must-run power plants can be considered conservative, i.e. tending to under-estimate baseline emissions. However, it has to be noted that less than 5% of CDM projects used this approach for estimating the grid emission factor.

⁵⁹ E.g. assuming that there would be a significant increase of coal-fired power generation without straightforward evidence.

⁶⁰ For example, trends in a changing composition of the electricity grid or the grid emission factor observed in recent years could be considered and extrapolated for future years. Similar approaches are used in a number of other CDM methodologies.

The overall emissions impact of wind power plants also depends on other factors. Firstly, the upstream emissions from wind power, such as for construction, are relatively low (about 10 g CO₂e/kWh (IPCC 2014)); for most countries they are likely to be lower than upstream emissions from fossil fuel use displaced in grid power plants. Ignoring upstream emissions is therefore a conservative assumption. Secondly, an increasing uptake of wind power plants due to the CDM may lead to decreasing costs for wind power generation, which in turn could contribute to a higher uptake of wind power. This positive spillover effect is, however, difficult to estimate, in particular with regard to any emissions outcome. Thirdly, the length of the crediting period may lead to under-crediting if wind power plants are operated longer than the crediting periods.⁶¹ However, many wind power plants are expected to operate for about 20 years and about three quarter of wind power projects have selected a renewable crediting period of up to 21 years. Further aspects of potential over- and underestimation of baseline emissions are described in (Erickson et al. 2014).

Overall, we conclude that the current approach for estimating emission reductions from CDM wind projects is largely suitable. Methodological assumptions lead to both over- and under-estimation of emission reductions but can be considered appropriate for estimating baseline emissions of CDM wind projects.

4.5.5. Other issues

No other issues were identified.

4.5.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • CER revenue has only a limited impact on profitability of wind power plants • Support schemes often exist and are a main driver for wind power development • Investment costs have decreased significantly in recent years, making wind power in some cases competitive with fossil generation (LCOE) • Wind power is already widely used in large CDM countries (e.g. China, India)
Over-crediting	<ul style="list-style-type: none"> • Methodological assumptions may lead to both over- and under-crediting; no clear-cut conclusion on whether over- or under-crediting occurs overall
Other issues	<ul style="list-style-type: none"> • None

4.5.7. Recommendations for reform of CDM rules

Due to our finding of an overall questionable additionality of wind power projects, we recommend that this project type is generally no longer eligible for new projects under the CDM. As an exception to this rule, countries with significant technological and cost barriers⁶² may be allowed to further use the CDM for implementing wind power plants.

With regard to the estimation of baseline emissions, we recommend the following:

- The CDM EB should ensure that grid emission factors are always verified by designated operational entities (DOEs);

⁶¹ For a discussion of the effects of the crediting period, refer to Section 3.5.

⁶² Such as transaction costs, e.g. due to the non-availability of technical knowledge in the country, or risk premiums in low-income countries. Least-developed countries could, for instance, be included in the list of eligible countries. Furthermore, the market share of wind power could be used to establish eligibility since it could be considered an indicator for barriers in the country.

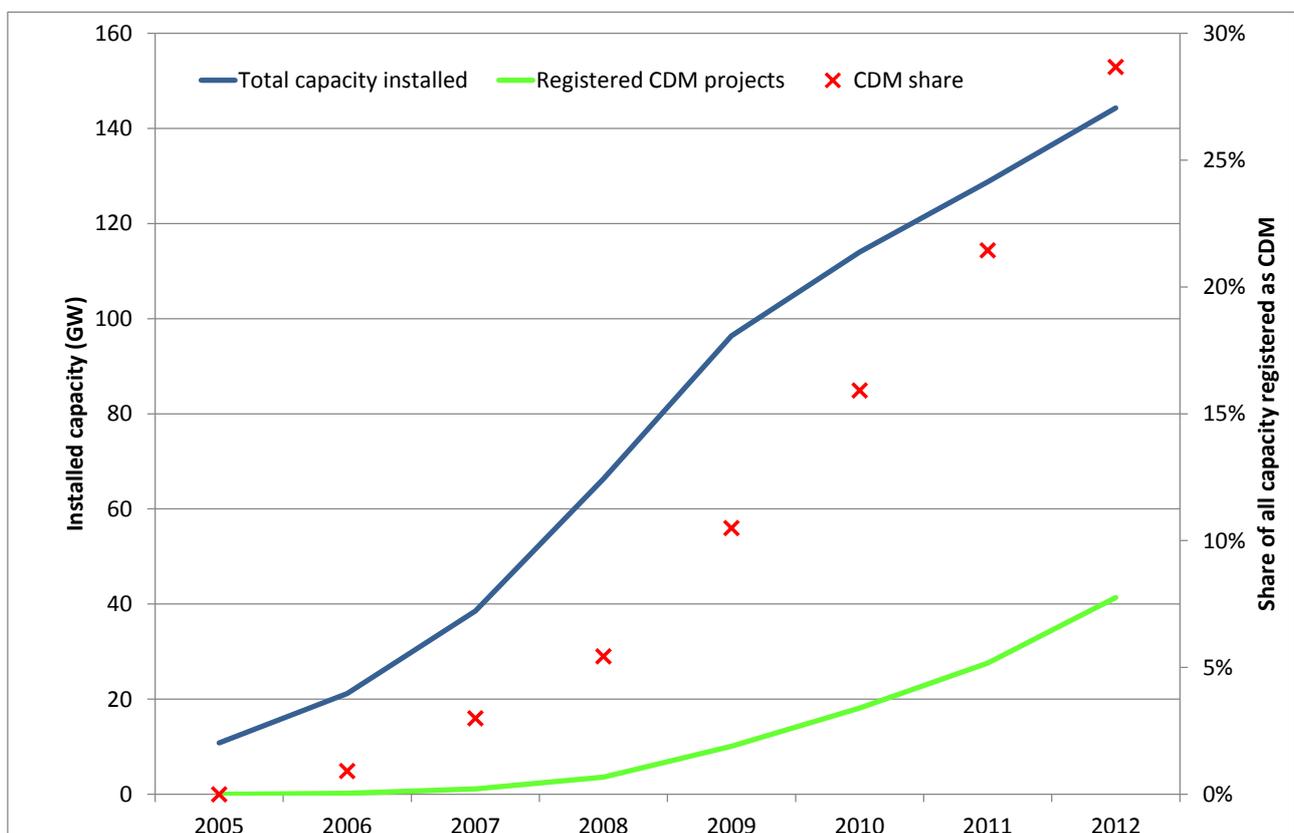
- The provisions for low-cost/must-run plants should be reviewed, including a clear definition of such plants and provisions which ensure that such plants are included in the operating margin if they are at the margin of the dispatch at any time;
- The grid emission factor tool should be revised to reflect trends in the composition of the power sector over time.

4.6. Hydropower

4.6.1. Overview

CDM hydropower projects mainly use two methodologies.⁶³ According to the UNEP DTU (2014), by the end of 2013, an overall hydropower capacity of 92 GW had been installed by projects using the CDM. The main contributors to this overall capacity are China (58 GW), Brazil (12 GW), followed by Vietnam and India (6 GW each). The other 44 countries with CDM hydropower projects account for 11 GW of installed capacity in total.

Figure 4-5: Total cumulated hydropower capacity installed in China between 2005 and 2012



Sources: UNEP DTU 2014, Platts 2014, authors' own calculations

As for wind power, Figure 4-5, Figure 4-6 and Figure 4-7⁶⁴ illustrate the development of hydropower capacity and the use of the CDM in China, India and Brazil. In all three countries, hydropower has played an important role for many decades. Significant capacity has been installed without the CDM. Hydropower may therefore be considered common practice in all three countries.

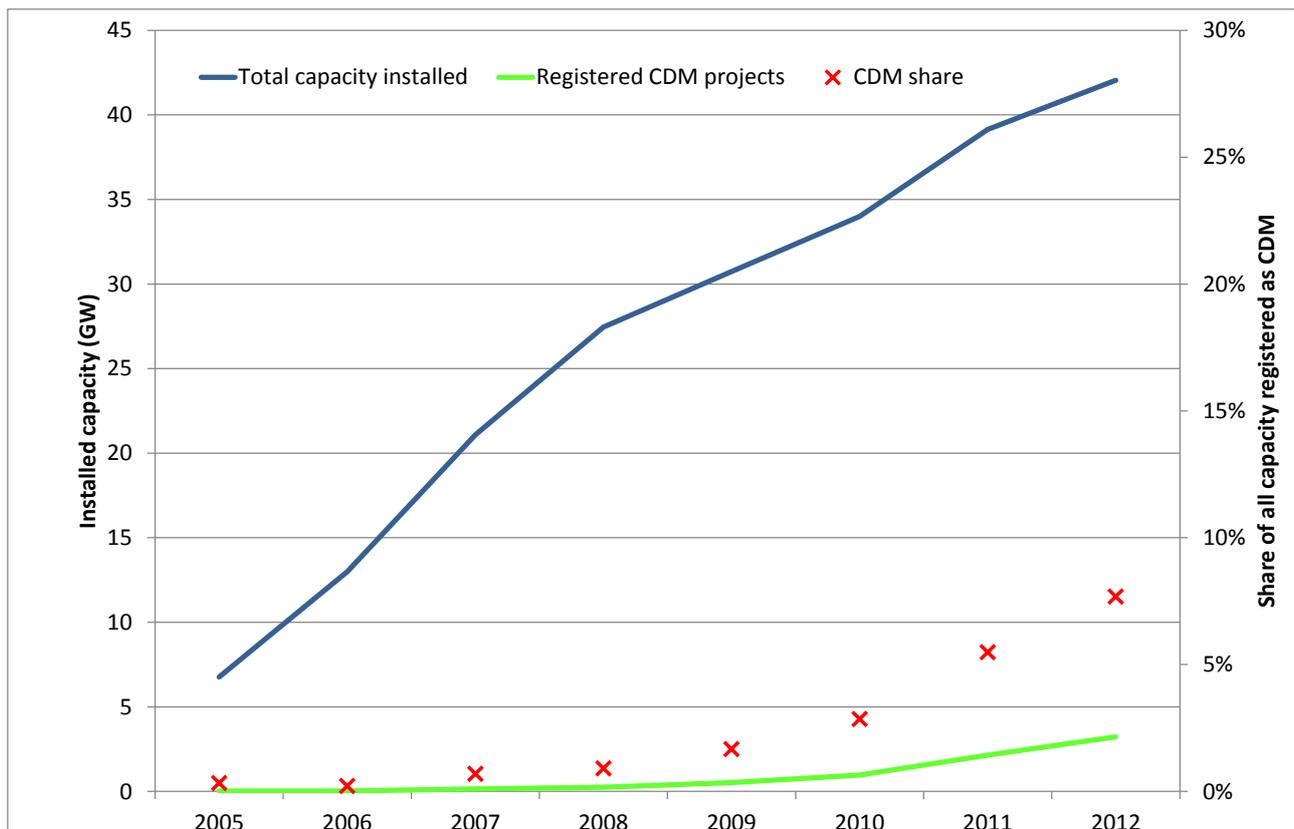
⁶³ ACM0002, AMS-I.D.

⁶⁴ Cf. footnote 51.

In China, the cumulated installed capacity in 1990 amounted to approx. 25 GW. A comparison of total hydro capacity installed and the capacity installed by projects using the CDM⁶⁵ over the 2005-2012 period (Figure 4-5) shows that there were no CDM projects until 2005, even though capacity additions in that year amounted to 11 GW. As of 2012, the share of CDM projects was 29% of total installed capacity.

In the case of India (Figure 4-6), the cumulated installed capacity in 1990 amounted to approx. 19 GW. Almost 7 GW of capacity was added in 2005 alone, with the CDM covering only a negligible share. After the introduction of the CDM, only a small share of hydropower projects used the CDM, with the CDM accounting for about 8% of total cumulated installed capacity⁶⁶ as of 2012.

Figure 4-6: Total cumulated hydropower capacity installed in India between 2005 and 2012



Sources: UNEP DTU 2014, Platts 2014, authors' own calculations

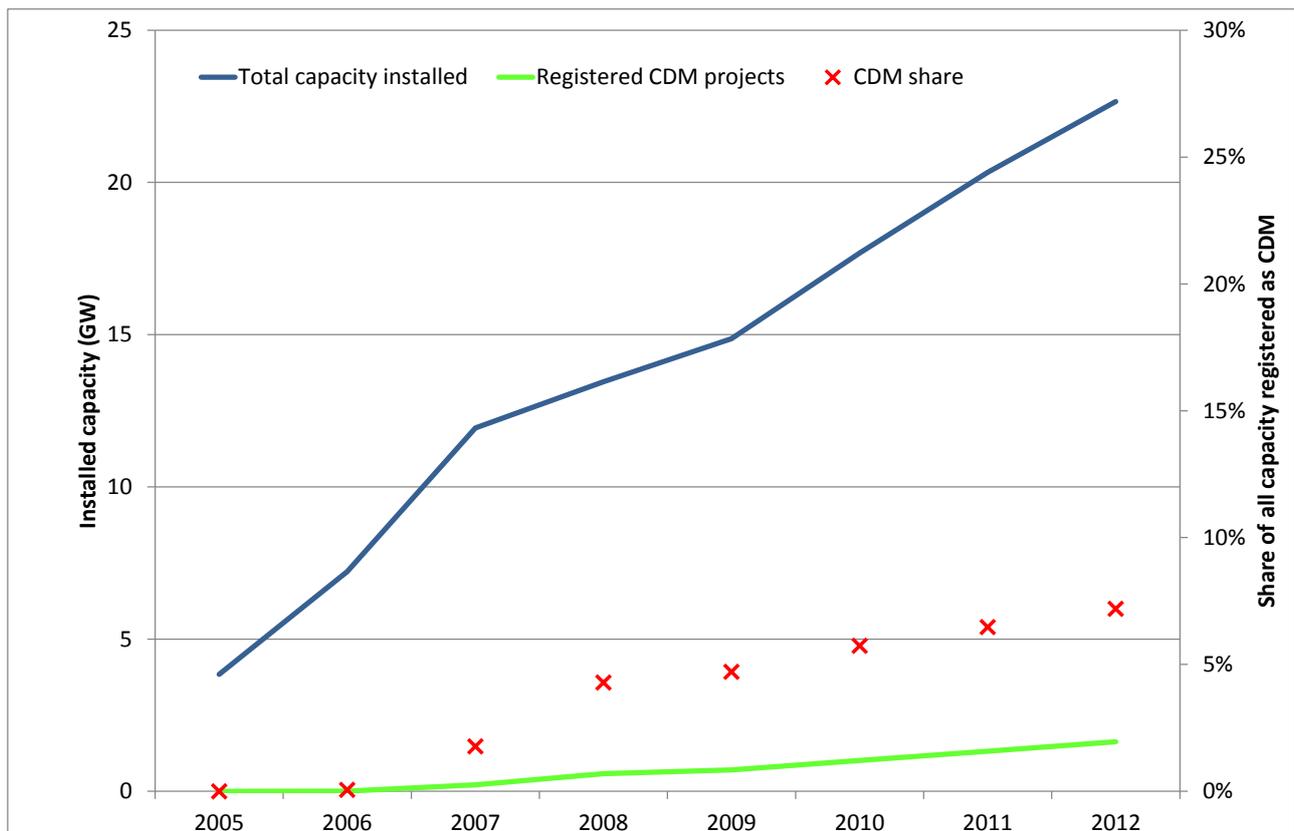
In the case of Brazil (Figure 4-7), the cumulated installed capacity in 1990 amounted to approx. 53 GW. Almost 4 GW of capacity was added in 2005, with no CDM projects being registered in that year. Even after the introduction of the CDM, only a small share of hydropower projects used the CDM (approx. 7% of total cumulated installed capacity⁶⁷ as of 2012).

⁶⁵ The total installed capacity between 2005 and 2012 is taken from the Platts database and accumulated across the years. The installed capacity of projects using the CDM is taken from the UNEP DTU (2014) and accumulated, too. The installation year is taken as the starting date of the crediting period. See Section 4.5 for the rationale of using cumulative data.

⁶⁶ Between 2005 and 2012.

⁶⁷ Between 2005 and 2012.

Figure 4-7: Total cumulated hydropower capacity installed in Brazil between 2005 and 2012



Sources: UNEP DTU 2014, Platts 2014, authors' own calculations

4.6.2. Potential CER volume

According to our own estimates, registered CDM hydropower projects have the potential to issue 4.2 billion CERs by the end of their respective crediting periods, of which 1.7 billion CERs fall in the 2013-2020 period (Table 2-1). CERs from hydropower account for approx. 30% of the total CER issuance potential.

4.6.3. Additionality

Generally, the same methodologies and additionality rules apply as for wind power (Section 4.5.2). Hydropower CDM projects primarily use investment analysis to demonstrate additionality.

The analysis in Section 4.6.1 demonstrates that hydropower plants have been constructed for a long time in many countries, which suggests that the technology may be regarded as common practice in many countries. In many cases, especially large hydropower plants were established without subsidies, which is demonstrated by the uptake of hydropower many years ago (Section 4.6.1). In the case of small hydropower (SHP) plants in China, Bogner & Schneider (2011) find that “apparently, smaller SHP plants face stronger barriers despite the government’s commitment to SHP development” and that “an especially remote location, an inappropriate feed-in tariff or banks that deny loans can be possible barriers”. Therefore, they conclude that “the CDM may have played a certain role for some SHP project developments” (ibid.). However, they argue that “investment in SHP stations between 20 and 50 MW appear more feasible without the CDM” (ibid.). Moreover, according to their analysis “medium and large hydropower has witnessed considerable growth a long time before the CDM even existed, which makes it difficult to justify that new projects

can only be implemented with the help of the CDM. In conclusion, our analysis suggests that the CDM is for most projects not an important factor for investment decisions in the medium and large hydropower plants. It appears likely that most projects would have been implemented in any case, i.e. without the CDM”.

The impact of CER revenues on profitability is, at three to four percentage points, somewhat larger than for wind power (Section 2.4), mostly due to a higher plant utilization than for wind power. However, the increase in profitability due to CDM revenues is still relatively small compared to other project types⁶⁸. Also, in many cases, hydropower generally features competitive levelized costs of electricity in comparison to new fossil-fired power plants (IRENA 2015; ISE 2013).

Overall, due to the fact that hydropower is common practice in many countries, the limited impact of CER revenues on the profitability of hydropower plants and the competitiveness of hydropower with fossil electricity generation in many cases, we consider additionality of hydropower projects as questionable in the context of the CDM, especially for large hydropower.

4.6.4. Baseline emissions

Hydropower projects largely use the same methodological approaches for baseline emissions as wind power plants, and hence the same conclusions apply with regard to different aspects of over- or under-crediting. Few differences should be noted with regard to the emission impacts: Hydropower projects have, on average, somewhat higher upstream emissions for their construction (approx. 20 g CO₂e/kWh related to the “infrastructure & supply chain emissions” according to (IPCC 2014)), which, however, are still lower than typical upstream emissions from fossil use in the baseline. Thus, ignoring upstream emissions is still conservative. More importantly, the lifetime of hydropower can be significantly longer than the maximum crediting period under the CDM (21 years), which adds to the conservatism of the estimation of emission reductions for hydropower plants. In this regard, over the plants' lifetime, overall emission reductions may be rather under-estimated than over-estimated.

4.6.5. Other issues

In addition to baseline emissions, project CH₄ emissions ensuing from hydro reservoirs are considered under the CDM. The ACM0002 methodology uses the power density, which is defined as the installed hydro capacity divided by the reservoir surface, as an indicator of whether CH₄ emissions from reservoirs need to be considered. CDM projects with a power density below 4 W / m² are not eligible and projects with a power density between 4 and 10 W / m² have to estimate methane emissions, using a default emission factor of 90 g CO₂e/kWh. According to (IPCC 2014), methane emissions from “currently commercially available technologies” amount to 88 g CO₂e/kWh, however, the bandwidth is quite large. However, according to (Fearnside 2015), the default emission factor of 90 g CO₂e/kWh refers “only to bubbling and diffusion from the reservoir surface and” is an underestimate “of hydropower impact because these values ignore the main sources of methane release: the turbines and spillways”. Overall, he finds that “tropical hydroelectric dams themselves emit more greenhouse gases than are recognized in CDM procedures”. It can therefore be concluded that the current methodological rules under the CDM may lead to a potential underestimation of methane emissions from hydropower.

⁶⁸ It has to be noted, however, that the range of operating hours and investment costs of hydro power plants depends quite strongly on plant-specific conditions, for which reason the contribution of the CDM to overall profitability may be higher in some cases and lower in others.

4.6.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • Common practice in many countries • CERs have only a moderate impact on profitability • In many cases competitive with fossil generation (LCOE)
Over-crediting	<ul style="list-style-type: none"> • Methodological assumptions may lead to both over- and under-crediting; over the lifetime of the project, emission reductions are likely to be underestimated
Other issues	<ul style="list-style-type: none"> • Potentially significant methane emissions from reservoirs which may not be fully reflected by CDM methodologies

4.6.7. Recommendations for reform of CDM rules

We recommend excluding large scale hydropower projects from being eligible under the CDM, due to the overall questionable additionality. A similar recommendation is made by (Erickson et al. 2014), who, in an analysis of the net mitigation impact of the CDM conclude “that excluding large scale power supply projects from the CDM could help increase the net mitigation impact of the CDM, as well as steer investment towards projects that are truly dependent on CER revenues”. We recommend that small-scale hydropower projects with significant technological or cost barriers⁶⁹ may be allowed under the CDM.

With regard to the estimation of baseline emissions, our recommendations for wind power plants (Section 4.5.7) also apply here. In addition, the provisions with regard to the estimation of methane emission from hydropower should be revised to address the potentially significant magnitude of these emissions.

4.7. Biomass power

4.7.1. Overview

CDM biomass power projects mainly use four methodologies.⁷⁰ According to the UNEP DTU (2014), by the end of 2013, an overall biomass energy⁷¹ capacity of 8.5 GW was installed by projects using the CDM. The main contributors to this overall capacity are China (3.7 GW) and India (2.1 GW), followed by Brazil (0.9 GW). The other 36 countries with CDM biomass projects account for 1.8 GW of installed capacity in total.

Generally, data availability is not sufficient to judge the magnitude of biomass capacity installed prior to the introduction of the CDM. Moreover, due to inconsistencies in the data, no meaningful comparisons can be made between projects installed with and without the use of the CDM.

4.7.2. Potential CER volume

According to our own estimates, all registered CDM biomass power projects have the potential to issue 0.36 billion CERs by the end of their respective crediting periods, of which 0.16 billion CERs fall in the period from 2013 to 2020 (Table 2-1). CERs from biomass power account for about 3% of the total CER issuance potential.

⁶⁹ The criteria need to be further specified. See also footnote 62.

⁷⁰ ACM0006, AM0015, AMS-I.C, AMS-I.D. It has to be noted, however, that the AM0015 methodology was only used for CDM projects registered in the early phase of the CDM.

⁷¹ Including different energy forms from biogenic sources.

4.7.3. Additionality

For large-scale projects (according to ACM0006), the identification of the baseline scenario and the demonstration of additionality are conducted in parallel.⁷²

With regard to the investment analysis, due to the diversity of project types, no overall conclusions can be drawn. Also, analysis available in the literature is quite limited, in contrast to wind and hydropower. On average, the impact of CER revenues on the profitability of projects is with about eight percentage points considerably larger than for wind or hydropower plants, making additionality claims more plausible (Section 2.4). The profitability of projects without CER revenues is, with an average IRR of approx. 5%, also lower than for wind (approx. 7%) and hydro (approx. 8%). The higher impact of the CDM is mostly due to the claiming of avoided methane emissions in many projects, which significantly improves the profitability of CDM biomass projects.

The investment analysis, which is applied by many projects, involves considerable uncertainty due to the variability of the biomass price, which strongly affects the profitability of biomass plants. In addition, many countries have set up domestic support schemes in order to promote the increased use of renewables, including ones for biomass power generation. In addition, biomass power is not a completely new technology, but is rather based on the technology of thermal power plants in general and has been used extensively in some industries and countries before (e.g. in the sugar cane industry in Brazil), which indicates that the technology has been profitable in the past in some instances. This is underpinned by the fact that biomass power features competitive levelized costs of electricity in comparison to new fossil-fired power plants (IRENA 2015; ISE 2013).

Only a few scholars explicitly deal with the additionality of CDM biomass power projects. Stua (2013) finds that, in the case of China, the national feed-in tariff made “most of the biomass-fuelled power plants [cost-competitive] against [...] coal-fired plants”.

Overall, based on the information presented above, we cannot clearly conclude on the likelihood of the additionality of biomass power plants.

4.7.4. Baseline emissions

As outlined in Section 4.7.2, the identification of the baseline scenario and the demonstration of additionality are conducted in parallel, considering a wealth of different options.

One key requirement in methodologies for using biomass residues is that the biomass residues would not be used in the absence of the project and would be left to decay (sometimes aerobically, sometimes anaerobically also claiming CH₄ baseline emissions). This requirement is appropriate and important due to potential competing uses for the biomass. If the biomass residues were used in the absence of the project for other purposes, there may be no emission reductions, since the diversion of biomass from one use to another due to the CDM may lead to increased emissions elsewhere. If CDM projects only divert the use of biomass residues but do not result in more biomass residues being collected which would otherwise decay, this may also lead to indirect land-use change, i.e. due to the increased use of biomass (residues), previous demand may be covered by drawing on biomass from other areas, thus leading to decreasing carbon stocks there.

Methodologies vary with regard to how they assess that the biomass residues are indeed ‘available in abundance’ and that decay is a likely scenario. In older versions, the abundance of biomass residues had to be monitored annually, while in newer versions this is only checked once at the project start and at the renewal of the crediting period.

⁷² For small-scale biomass projects, the same additionality rules as for wind power apply (Section 4.5.2).

In general terms, there is an increasing demand of biomass for different uses (food, raw materials, energy) worldwide. This means that biomass residues (in many cases) either already have or will likely have a price in the future. As a consequence, the demonstration that biomass residues would otherwise be (completely) left to decay needs to take current market developments into account. For this reason, a regular checking of the abundance of biomass residues through monitoring may be more appropriate than a simple check once at the project start.

Furthermore, in many cases, anaerobic decay of biomass is claimed by project developers. However, this assumption may be contested depending on the circumstances. For instance, if biomass waste is spread on fields, biomass decay is rather aerobic than anaerobic, thus producing little or no methane emissions. In many instances, the amount of methane emissions claimed appears very large; it may be questionable whether truly anaerobic conditions prevail in the typical circumstances in which biomass residues are left to decay. We therefore conclude that the current approach of demonstrating the abundance of biomass residues may lead to a risk of over-crediting as no adequate monitoring of availability of biomass residues is in place. In addition, exaggerated claims of anaerobic decay of biomass may lead to further over-crediting.

With regard to the baseline emissions from displacing power plants in the grid, the same conclusions apply as discussed in Section 4.5.4.

4.7.5. Other issues

No other issues were identified.

4.7.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • Significant impact of CER revenues on plant profitability due to claims of methane emission reductions • In many cases competitive with fossil generation (LCOE) • Support schemes exist
Over-crediting	<ul style="list-style-type: none"> • Demonstration that biomass is left to decay or available in abundance is only conducted once at the start of the project activity • Risk of exaggerated claims of anaerobic decay
Other issues	<ul style="list-style-type: none"> • None

4.7.7. Recommendations for reform of CDM rules

Due to our finding that the demonstration of abundance of biomass as well as of the claim that biomass is left to decay (under potentially anaerobic conditions) is key for avoiding any over-crediting of emissions, it is recommended that corresponding provisions in the applicable methodologies are reviewed, with a view to ensuring that this demonstration considers current trends of biomass use and disposal and that any claims for anaerobic conditions of biomass decay are realistic. In particular, the monitoring of biomass abundance should be carried out more frequently (e.g. annually).

4.8. Landfill gas

4.8.1. Overview

Decomposition of solid waste in landfills generates carbon dioxide (CO₂) and methane (CH₄). This landfill gas can be captured and flared or captured and utilised for electricity production or as a fuel. GHG emission reductions are achieved through the destruction of methane, and in the case of

energy production, displacement of a more GHG-intensive energy source. Global estimates suggest that 50 Mt of methane are generated annually from landfills (IPCC 2014).

The composition of landfill gas is usually approx. 50% CO₂ and 50% CH₄ (Hoorweg & Bhada-Tata 2012; US EPA 2013). It varies by climate and waste composition. In general, methane generation increases in wetter versus arid climates and warmer versus cooler climates. Warmer climates increase the growth of methane-producing bacteria (US EPA 2013). Waste composition with a higher percentage of organic material generates more methane and degrades more quickly (US EPA 2013). Waste in lower income countries often includes a higher percentage of organic material than higher income countries (Hoorweg & Bhada-Tata 2012).

4.8.2. Potential CER volume

The potential to capture landfill gas varies by landfill management type. Gas collection rates can be as high as 75% for basic landfills in which waste is compacted and covered and up to 85 - 95% for engineered sanitary landfills whereby landfills are lined or capped to prevent leakage or contamination from the waste (US EPA 2013). Landfill management practices vary by region. While the majority of landfills in developed countries are engineered landfills, in developing countries mitigation opportunities are more limited because the majority of landfills are basic landfills or open dumps (US EPA 2013). In open dumpsites, decomposition is predominantly aerobic; as a result methane generation rates are relatively low and gas recovery rates are limited (~10%) (US EPA 2013). Because there is often a high concentration of food waste and wet condition in developing country sites, waste decays quickly and the methane gas is released quickly. As a result, mitigation activities to capture methane must be implemented on active open dumpsites, since after a lag of even 1-2 years most of the methane will have already been generated⁷³ (US EPA et al. 2012).

There are two primary landfill gas methodologies under the CDM. ACM0001 is the consolidated large-scale methodology and AMS-III.G is the small-scale methodology. As of 1 July 2015, there were 364 registered landfill gas projects. Predominantly these are large-scale projects located in Latin America and Asia/Pacific regions, though there are also projects in Africa, Europe/Central Asia and the Middle East. Of the 364, 149 projects have issued a total of 69 million CERs. As of 1 August 2015, the average issuance success rate amounted to 58% (UNEP DTU 2015a).

4.8.3. Additionality

Prior to 2013, large-scale landfill gas projects assessed additionality according to the CDM "Combined tool to identify the baseline scenario and demonstrate additionality". This tool, similar to the CDM 'additionality tool' requires that projects demonstrate that they are additional based on either an investment or a barrier analysis, complemented by a common practice analysis. Similarly, prior to 2014, small-scale projects applied the general guidelines or tool for small-scale activities. Most projects used investment analysis to demonstrate additionality, predominantly benchmark analysis or simple cost analysis (IGES 2014, similar to earlier results from Spalding-Fecher et al. 2012).

A standardized approach to additionality assessment was incorporated into Version 15 of ACM0001, eligible as of 8 November 2013, and version 9 of AMS-III.G, eligible as of 28 November 2014. This revision established a positive list for additionality of landfill gas projects. All landfill gas projects are automatically considered additional if prior to the implementation of the project they only vented or flared methane, and if under the project activity they either flare the methane, or use methane to generate heat, or use the methane to generate power with a capacity of less than 10 MW. As of 1 May 2014, only one landfill gas project had been registered using this methodology

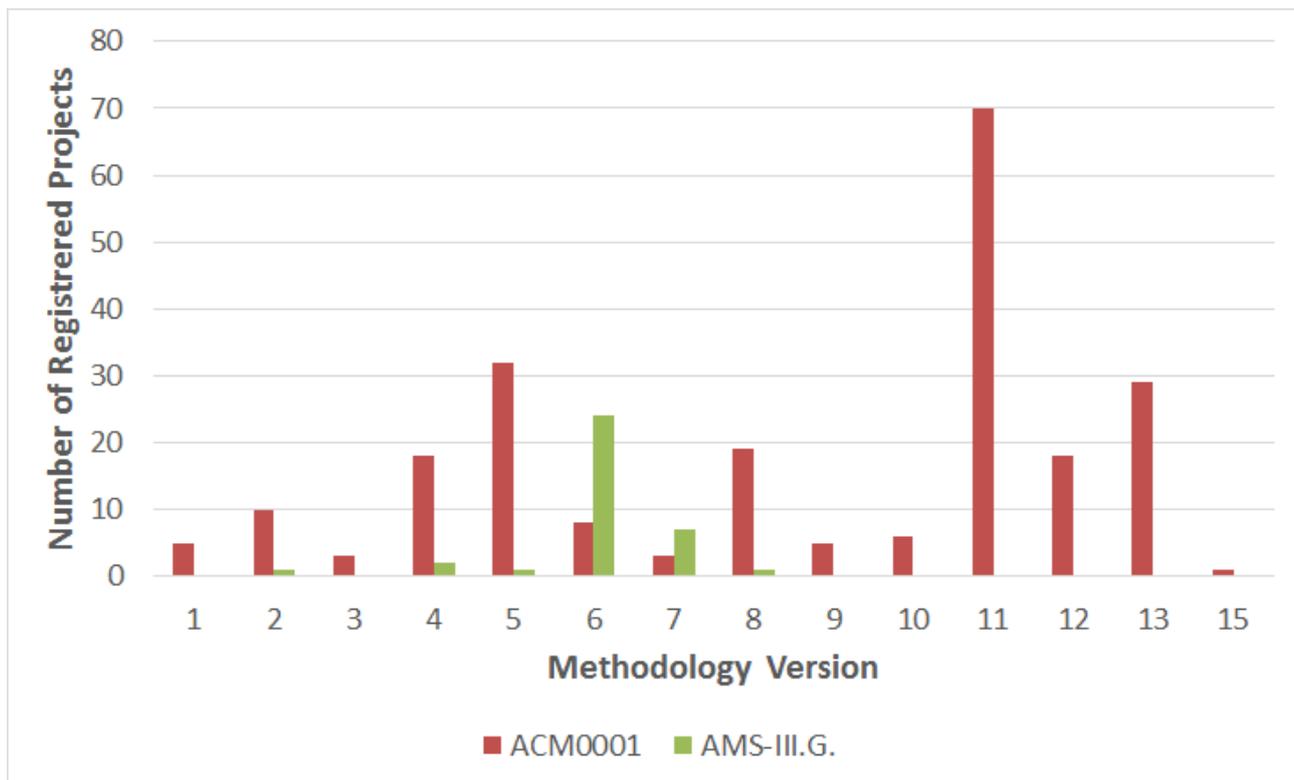
⁷³ While not applicable for the landfill gas methodology (ACM0001), the rapid decay rates may have implications on the applicability of the first order decay model used in the CDM "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" and included in the avoided landfilling via composting methodologies.

Version 15, as shown in Figure 4-8. The CDM EB will review the validity of these standardized procedures after a three-year time period.

CDM projects can only claim emission reductions for methane capture that exceeds any applicable regulations. In regions in which a regulation is in place but it can be demonstrated that it is not enforced, projects can still claim emission reductions for implementing the regulation. This has raised concerns that enforcement may be discouraged by constituencies receiving CER revenues. One such example is in the Philippines, where regulation has been established requiring gas capture and destruction, but it has not been enforced. Concerns have been raised that CER revenue has led to a pressure to discourage enforcement (Docena 2010).

Projects that capture and flare methane have no independent revenue source (US EPA et al. 2012). Flaring projects are therefore very likely to be additional. For projects using landfill gas for energy generation, additionality seems likely. As shown in Section 2.4, the available data from CDM projects indicates that the IRR is rather low without CER revenues (approx. 2.5-2.8% on average) but increase substantially with CER revenues (to approx. 16.6-18% on average). Indeed, collection and flaring of landfill gas is not common practice in developing countries without carbon finance, though it may be possible to implement projects economically where there are renewable portfolio standards (RPS) or feed-in tariffs, to allow energy production revenue to cover costs and provide capital investment for methane collection systems. For projects that supply heat, electricity, or methane to natural gas pipelines, the price and revenue from energy generation are a primary driver of the economics of the project. With economies of scale, the larger the landfill gas project, the more energy can be generated and the more likely the project is profitable.

Overall there are no substantial concerns with the approach to assess additionality for large- and small-scale landfill gas projects. The primary lingering concern is the potential for CDM projects to discourage the implementation of regulations that require capture and destruction of landfill gas.

Figure 4-8: Number of registered landfill gas projects by methodology


Source: IGES 2014

4.8.4. Baseline emissions

The baseline scenario for ACM0001 and AMS-III.G is assumed to be the atmospheric release of methane, unless capture and flaring is required by regulation or unless capture occurred to some extent prior to the implementation of the project. Baseline emissions are determined based on the amount of methane flared or used under the project activity (less any methane gas that was flared under the baseline). The overall volume of emission reductions generated is based on the baseline emissions minus any combustion efficiency losses and minus any methane that would have been destroyed under the baseline via soil oxidation. ACM0001 considers four different cases for how to account for regulation and existing landfill gas capture systems. These include no regulation/no existing capture system, no regulation with existing capture, regulation without existing capture, and regulation with existing capture. The small-scale methodology uses, in principle, the same approach but is less specific; the baseline emissions must take into account the volume of landfill gas required to be collected by regulation and the presence of pre-existing landfill gas collection and combustion systems. The overall approach of estimating the baseline emissions based on the amount of captured gas seems reasonable. However, there are concerns related to the default assumptions for pre-existing systems and regulations, and the accounting for soil oxidation.

If a regulation requires the collection of landfill gas or if a landfill gas collection system was pre-existing, but the regulation does not specify the amount to be collected or the historical amount collected is not known precisely, then both methodologies assume that 20% of the amount captured under the project scenario would be captured in the baseline. The methodology explains that this default value is based on assumptions that the capture efficiency of the project system is 50% and under the baseline 20%, and that in the baseline the methane was flared using an open flare with an efficiency of 50%. Despite the explanation, it remains unclear how the overall default value

of 20% of project emissions is derived. While a 50% destruction efficiency for an open flare is conservative when considering project emissions, used in the context of baseline emissions it has the potential to actually overestimate the emission reductions. The methodologies implicitly assume that the CDM project captures five times the amount of methane than would be captured under a regulation. This assumption seems rather optimistic and likely leads to a significant over-estimation of emission reductions.

There are two types of soil oxidation that can occur at a landfill. Top-layer soil oxidation refers to soil oxidation under baseline conditions when methane oxidizes as it passes through the top layers of the landfill. The second type of oxidation can occur when additional air is introduced into the landfill due to suction from the LFG capture system under the project scenario.

Early versions of ACM0001 and AMS-III.G did not account for these two effects. This likely led to an overestimation of baseline emissions for projects that were registered up to version 11 of ACM0001 (valid until 25 July 2012) and up to version 7 of AMS-III.G (valid for registrations until 28 May 2013). This shortcoming was recognised and, in principle, addressed from version 12 of ACM0001 and version 8 of AMS-III.G onwards, by introducing a default factor for the amount of methane that would oxidize in the baseline, using 10% for “managed solid waste disposal sites that are covered with oxidizing material such as soil or compost” and 0 “for other types of solid waste disposal sites”.

Concerns have been raised about the default values applied for the soil oxidation factor. Methane oxidation in covered landfills occurs mainly through bacterial degradation, primarily by methanotroph bacteria, resulting in production of carbon dioxide, water, and biomass. The rate of oxidation is influenced by a variety of physical factors, including different soil cover types (Chanton et al. 2009). Methane oxidation generally increases with temperature up to around 40°C and is also influenced by moisture, where either too dry or too wet conditions can inhibit methane oxidation (Chanton et al. 2009; Spokas & Bogner 2011). Soil oxidation further depends on the type of soil cover and the thickness of soil cover. Higher soil oxidation rates occur in landfills that are well managed with a thick soil cover. In a study of landfills with similar operational characteristics in different climate zones of the United States, methane oxidation was lowest in humid subtropical regions and highest in arid regions (Chanton et al. 2011). This research suggests that for poorly managed landfills in humid sub-tropical and tropical regions the soil oxidation rates may be very low.

The IPCC sets default values for landfill cover methane oxidation are typically between 0% and 10% of generated CH₄ (IPCC 2006), possibly derived from one early study of a New Hampshire landfill. The 2006 IPCC Guidelines for National Greenhouse Gas Inventories indicate that:

“The use of the oxidation value of 10% is justified for covered, well-managed solid waste disposal sites to estimate both diffusion through the cap and escape by cracks/fissures. The use of an oxidation value higher than 10%, should be clearly documented, referenced and supported by data relevant to national circumstances.”

This highlights that the 2006 IPCC Guidelines consider a soil oxidation value of 10% as justified only for covered and well-managed sites. However, more recent literature surveys and experimental studies indicate that oxidation rates for covered landfills are higher, amounting on average to approx. 30% (Chanton et al. 2009; Chanton et al. 2011), although the 2009 paper indicates that the data may over-represent warmer conditions when oxidation rates would be higher.

Some stakeholders have raised concerns that the soil oxidation factor was not adjusted upwards in the CDM methodologies when more recent research indicated that an average value of 30% may be more representative (Chanton et al. 2009). However, the higher soil oxidation rates reported by

(Chanton et al. 2009) may not be fully appropriate for the context of developing countries, given that both an intermediate and final cap would have to be in place to a certain engineering standard. In most developing countries, landfills are rarely well managed with a thick soil cover required for this level of soil oxidation. This suggests that the higher soil oxidation rates may not be applicable to the conditions for some CDM projects. Nevertheless, having a default factor for both managed and unmanaged landfills avoids creating a disincentive for covering and managing landfills. The use of the soil oxidation rates as a standard default for all projects runs the risk of underestimating the volume of credits generated in some sub-tropical and tropical regions with unmanaged landfills for which soil oxidation rates under the baseline would have been very low or zero.

4.8.5. Other issues

Stakeholders have commented in public submissions to the UNFCCC with regard to revisions of ACM0001 that different types of perverse incentives can arise from landfill gas projects. Two main perverse incentives can be of concern, which both lead to an over-estimation of emission reductions.

Firstly, project developers can have an incentive to store the waste in a manner that generates more methane. For example, a 'flat' landfill with low methane generation potential could be changed to store waste at a greater height. Moreover, project proponents can have an incentive to maximise methane generation through other means, such as pulling water in the landfill to create anaerobic conditions. On a site visit to a landfill gas project in China in 2005, engineers proudly explained how they had found a way to generate more methane by stacking waste higher in one section of the landfill rather than spreading it evenly across the landfill site. While this is just one anecdotal example, there is reason to believe that some landfill projects may be altering management practices to do so. Based on these observations, in 2012 more recent versions of both the large- (version 13.0) and small-scale methodologies (version 8.0) included an applicability criterion that excludes projects in which the management is changed in order to increase methane generation. However, verifying this requirement may be difficult in practice and it has not been included as an explicit provision for DOEs to assess after the project implementation.

Secondly, there could be perverse incentives for policy makers and private actors not to engage in recycling or other ways of preventing waste generation, as this could lower the potential for CDM landfill gas projects. Similarly, there could also be perverse incentives to continue landfilling instead of introducing other waste treatment methods (incineration, composting).

Public comments received on behalf of waste picker organizations have raised concerns that development of a project limits access of waste pickers who, through the informal economy, contribute significantly to the recycling of materials (Global Alliance for Incenterator Alternatives, GAIA). Project developers who were interviewed acknowledged that sites need to be secured for project installation, to avoid having equipment tampered with or material stolen. For certain projects, including examples in Latin America and Thailand, agreements have been made for waste pickers to pick through waste before it is transferred into the secure site. However, in other cases there has not been any cooperation between the project developers and waste pickers, which has resulted in conflict and loss of livelihoods. There is evidence that the development of landfill gas projects is limiting the access of waste pickers and thereby reducing the reuse and recycling of waste through the informal economy. Given the success of collaborative agreements with waste pickers, this may be a model which new projects should be required to incorporate.

Pursuing landfilling instead of other waste treatment methods, such as recycling, incineration or composting, is likely to result in overall higher GHG emissions, even if the landfill gas is captured, because landfill gas collection systems are not able to capture all of the methane. The CDM may thus provide perverse incentives for policy makers or project owners to continue pursuing a waste

treatment method that is more GHG-intensive. If in the absence of the CDM, other waste treatment methods would be pursued, it would lead to an over-estimation of emission reductions.

Early versions of CDM methodologies did not include any provisions to address this issue. Regarding the potential perverse incentive to reduce recycling, starting with version 12 of ACM0001, an applicability criterion requires that “the implementation of the project activity does not reduce the amount of organic waste that would be recycled in the absence of the project activity”. However, there is no reference to how this should be assessed. Moreover, this applicability condition does not address the broader concern that the CDM provides incentives to continue pursuing landfilling and not composting or waste incineration. In public comments submitted by non-governmental organisations, such as the GAIA, there have been calls for eligibility requirements that would allow projects only on closed landfills in order to prevent the potential for this perverse incentive of reducing recycling and composting. Project developers argued that in developing country contexts, with warmer climates and higher percentage of organics in the waste stream, the capture of methane must take place while the landfill is actively being used, otherwise the methane will have already been released once it is closed. This is in contrast to landfills in more temperate climates, where methane production happens more slowly and where it is more common to develop a project at a closed landfill.

Overall, there is reason to believe that landfill gas projects are contributing to perverse incentives to manage landfills in ways that generate more methane and to reduce reuse and recycling or avoid a shift towards composting or waste incineration. In addition, it appears there are cases in which project participants increase methane production – an issue which may deserve particular attention in the validation and verification auditing processes.

4.8.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • Likely to be additional
Over-crediting	<ul style="list-style-type: none"> • Default assumptions for the rate of methane captured under pre-existing collection systems or regulations are unjustified and have the potential to overestimate emission reductions • Default soil oxidation rates may underestimate emission reductions for uncovered landfills in humid sub-tropical and tropical regions with very low soil oxidation rates; nevertheless, requiring the use of a default soil oxidation rate for baseline emissions avoids creating a perverse incentive to avoid covering landfills • Potential for perverse incentives for policy makers not to regulate landfills or enforcing regulations in place • Perverse incentives for project developers to manage landfills in ways that increase methane generation
Other issues	<ul style="list-style-type: none"> • Perverse incentives for policy makers not to pursue less GHG-intensive waste treatment methods, such as composting or incineration • Some landfill gas projects exclude waste pickers and informal sector recycling, reducing overall rates of reuse and recycling

4.8.7. Recommendations for reform of CDM rules

We recommend several revisions to the CDM landfill gas methodologies to address the potential over-crediting, in particular the perverse incentives for both project owners and policy makers:

- Instead of applying one value for the soil oxidation factor to all projects, different values could be applied to different regions based on the climatic conditions and practices in that region.

- The approach of the default factors used for estimating methane capture from pre-existing collection system or landfills with regulations should be revisited. Assumptions in the default factor could be revised to be more conservative by assuming that more (rather than less) methane was captured and destroyed.
- Include specific requirements for DOEs to verify that the landfilling practice was not changed with a view to generating more methane.
- To avoid the reduction in recycling by excluding waste pickers access to the site, the methodology could be revised to be more specific about how projects should provide waste pickers with access to solid waste before it is deposited in the secure dumpsite.
- Given the long-term need to transition away from landfilling and increase composting and recycling, there could be a sunset clause considered for CDM landfill projects.

4.9. Coal mine methane

4.9.1. Overview

Methane is stored within coal as part of the coal formation process. During coal mining activities some of the methane is released. The build-up of methane in coal mines creates a potential explosive hazard and efforts before, during, and after mining are taken to reduce the safety risk by releasing methane into the atmosphere. Methane released from coal mines makes up approx. 8% of global anthropogenic methane emissions (Global Methane Initiative 2011). Methane originating in coal seams that is drained prior to mining is known as coal bed methane (CBM). Through a process of pre-mining drainage, this methane can be extracted to reduce the safety risk. During coal mining, methane can be vented from coal mines, which is known as ventilation air methane (VAM). After mining has ceased, methane can be extracted, which is known as post mining or post drainage coal mine methane (CMM). Coal mine methane projects involve installation of control technologies to collect and destroy and/or utilise methane from existing and abandoned mines, instead of releasing it to the atmosphere. Under the ACM0008 methodology of the CDM, capturing methane is eligible from pre-mining via underground boreholes and surface drainage of CBM, during mining from VAM that would normally be vented, as well as post mining from abandoned/decommissioned mines.

4.9.2. Potential CER volume

Of the 84 CMM projects that have been registered under the CDM, all are located in China, except for one project in Mexico. Projects from other countries, including India, Indonesia, Philippines and South Africa have been submitted to the UNFCCC but not registered.⁷⁴ As of 1 May 2014, 34 million CERs have been issued from 37 projects located in China. The total volume of credits expected from the credit start dates up to 2020 is 170 million CERs (Section 2.3).

The best conditions for CMM projects are deep coal mines with high methane concentrations. Under these conditions, methane is concentrated and easy to collect. For geographic and regulatory reasons, coal mines in China have been well suited for CMM projects to date. In India, for example, most coal mines are surface mines, where methane concentrations are lower and it is harder to collect the methane. Another barrier in India is national regulation that divides permits for using coal and gas. This means that coal mines do not have a permit to utilise the methane gas generated and would be unable to authorise a CMM project. A CMM project would require an additional permit process, an added administrative barrier.

⁷⁴ There are two projects under validation from India and one from the Philippines. Projects in Indonesia and South Africa have had their validation terminated or validation replaced.

4.9.3. Additionality

All of the registered CMM projects use the large-scale ACM0008 methodology. The most recent ACM0008 Version 8 requires use of the “Combined tool to identify the baseline scenario and demonstrate additionality” and provides further guidance on the application of the tool in the context of CMM projects. As of May 2014, no projects had been registered under version 8, which was approved in February 2014. The majority of projects are registered under versions 6 and 7. In these prior versions, the CDM additionality tool was applied, and a separate procedure was used to select the baseline scenario. Starting with version 6, the methodology was changed to allow for benchmark analysis as part of investment analysis for projects where no investment would occur in the baseline scenario.

Most CDM CMM projects apply a benchmark analysis to demonstrate additionality, as shown in Table 4-4. Benchmark analysis compares the financial performance of the project, often expressed as IRR, to a relevant benchmark or investment ‘hurdle rate’. In contrast to some other project types, CER revenue for CMM projects does make up a large portion of the return on investment on capital expenditures for projects. According to information from PDDs, the IRR without CER revenue is approx. 2% on average and increases to approx. 28% with CER revenues, the largest increase among all project types (Section 2.4). When we derive a simple indicator that puts the capital investment in relation to the number of CERs generated over ten years, as referenced in Section 2.4 in this report, we find an average ratio of about USD 4 / CER for all CMM projects. These calculations show that CMM projects have a high likelihood of additionality. They support reports from technical experts and project developers that abatement costs for CMM co-generation plants are approximately USD 3 - 5 per tCO₂ during 10 years of operation. Other reports indicate that CMM projects are usually not economically viable; according to United Nations (2010) power generation from CMM only becomes economically viable for coal mines with very large methane sources exceeding 20 m³/t (United Nations 2010).

Table 4-4: Additionality approaches used by CDM CMM project activities

Additionality approach	Number of project	Average Annual CERs (1,000)
Benchmark Analysis	76	33,465
Investment Comparison Analysis	4	1,557
Investment Comparison Analysis and Benchmark Analysis	1	266
Simple Cost Analysis	4	1,883

Sources: IGES 2014

A high likelihood of additionality is also supported by observation of common practice in the sector. Coal mines are very averse to having any combustion on-site. Combustion of any kind increases the potential risk of a methane gas explosion. Venting methane is the safest approach to avoid combustion, and miners and management are very familiar with this approach. Coal mine operators are generally averse to having a methane combustion system onsite as a result in order to avoid the risk of mine closures due to concerns around worker safety. Global Methane Initiative staff reported that in China, prior to the presence of the carbon market, efforts by the Global Methane Initiative were wholly unsuccessful in implementing CMM projects. No pilot projects or sponsored projects were able to get off the ground. Technical barriers were significant and persistent. The equipment used was unable to cope with the difficulties of the coal mine system, including the concentrations of volatile methane and the gas volumes. Only with the revenue from CERs were there sufficient incentives to develop technologies that worked well for these conditions. Now, in

China, it has become common practice for large coal mines to capture methane with revenue from a CDM project. As of 2014, there were still 2 projects in China at the validation stage; however since the technology for developing CMM projects in China is now proven, it can no longer be claimed to be first of its kind or a technology barrier. Although the CMM projects have become common practice, this has only been the case with CDM revenue. Overall, the risk for non-additionality is low for VAM projects.

4.9.4. Baseline emissions

Baseline emissions are calculated as the sum of CO₂ emissions from destruction of methane that would occur in the baseline scenario, emissions from the production of power, heat, or use of gas replaced by the project activity, and release of methane into the atmosphere that is avoided by the project activity. The baseline scenario is selected based on an examination of all the options that are technically feasible and comply with applicable regulations and elimination of all baseline scenario alternatives that face prohibitive investment, technological and/or prevailing practice barriers.

There is some concern that mines may take part in marginally more pre-mining drainage than they would have done without incentives from the CDM; however, the drained methane would likely have been emitted upon mining (and likely would have been emitted through ventilation later on). So these concerns seem limited, given that there are provisions in the methodology that emission reductions may only be credited once mining starts, ensuring that CERs are not issued in cases in which mining may not have occurred under the baseline. Our review has not identified any other concerns related to the determination of baseline emissions.

4.9.5. Other issues

The methodology includes a requirement that methane collection must exceed that which is required by applicable regulations, with the exception of cases in which it can be shown that the regulation is not enforced. A regulation was put in place in China requiring that methane captured from coal mines that exceeds 30% methane concentration must be captured and used. It has been suggested by project proponents that the Chinese government actually put this regulation in place as a result of the success of the CDM, to support the use of CDM financing to capture methane as best practice and to stimulate more CDM project development. However, interpretations vary and it has led to questions around the additionality of projects and whether or not they would have been required by regulation. As a consequence, project developers focused on projects where the methane concentration was below 30%. These projects would be avoided for safety reasons in North America or Europe, because this gets close to the explosive range of methane concentrations of 15-25%. It is better practice and safer to improve the capture rate and increase the concentration of methane, however this could run the risk of exceeding the 30% concentration regulatory requirement in China, and hence not meeting the CDM additionality requirements. This raises the risk of perverse incentives for project developers to diluting methane gas to reduce the concentration below 30% in order to be eligible for the CDM. However, no evidence is available whether this happened.

4.9.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • Likely to be additional • CDM revenue makes up a large portion of return on capital investment • Technology for CMM in China is now well demonstrated, no longer technical barriers
Over-crediting	<ul style="list-style-type: none"> • Potential concerns regarding increased mining and/or pre drainage of coal mine methane but no evidence whether or not this occurs
Other issues	<ul style="list-style-type: none"> • Potential perverse incentives to dilute methane in order to avoid that abatement is required by regulations

4.9.7. Recommendations for reform of CDM rules

There are no recommendations regarding reforming the CDM rules for CMM projects. Further investigation of China’s regulations for methane capture are warranted to ensure that perverse incentives are avoided.

4.10. Waste heat recovery

4.10.1. Overview

Waste heat utilization includes generally energy efficiency measures, where the thermal content of hot waste gases that would be vented in the absence of the CDM project activity is used for heating purposes, replacing fossil fuel use. For example, hot exhaust gases from cement kilns can be used to pre-heat the raw material before entering into the kiln.

A related category of projects is waste gas utilization where the calorific value of waste gases that contain a certain fraction of hydrocarbons or hydrogen that would be flared in the absence of the CDM project activity is used to replace regular fossil fuels. For example, waste gases with a high content of carbon monoxide and hydrogen can be used as fuel for steam production in industry. This second project category has similar features than the ‘thermal’ recovery of waste gases, but the present chapter focusses on the first category.

4.10.2. Potential CER volume

According to our own estimates, registered CDM projects have the potential to issue 0.35 billion CERs by the end of their respective crediting periods, of which 0.22 billion CERs fall in the period from 2013 to 2020 (Table 2-1). CERs from these projects account for about 2.5% of the total CER issuance potential.

4.10.3. Additionality

The methodologies for waste heat utilization (AM58, AM66, AM95, AM98, ACM12, AMS-II.I., AMS-III.P.AMS-III.Q., AMS-III.BI.) generally use standard CDM additionality tests based on barrier and/or investment analysis.

The general issue with this project type is that the use of waste heat is a standard practice in many integrated industrial facilities, in particular where energy costs represent a larger fraction of production costs such as in cement production, refineries, iron and steel and chemicals. However, the extent of the use of waste heat and energy efficiency may vary significantly even within a country, as energy costs, financial resources and engineering and management skills may differ between sectors and plants. While one steel plant may define its competitive edge in systematically using all waste heat and reducing heat loss along the steelmaking process because of competitive steel markets and relatively high fuel costs, a refinery plant may vent significant amounts of waste heat and experience severe heat losses all over the refinery because its cost of fuel is very low.

In the use of investment analysis for demonstrating additionality for waste heat recovery projects involves several uncertainties: the highest uncertainties are in the assumptions on future fuel prices which show high variability over time (Figure 2-4 to Figure 2-6). In addition, the considerable uncertainties in investment cost for equipment and construction and the often uncertain impact of the considered measure on efficiency makes it difficult to objectively determine the profitability of the measure and the relevant hurdle rate (Section 3.2).

For projects implemented in existing plants, the methodologies require demonstrating that the waste heat or gas has been flared/vented at least three years before the project implementation. This is an important safeguard to assure at least some degree of additionality.

Some methodologies, such as ACM0012, also allow waste heat recovery projects in greenfield plants. This is very problematic, as it is very difficult to demonstrate that the waste heat utilization would not have been implemented in the absence of the CDM (Section 3.2). The methodology ACM0012 (V.5) provides for two options for demonstration additionality in the case of greenfield plants. Option 1 requires to identify similar plants; the project is deemed as additional “if *more than 80 per cent of the analyzed facilities in the list do not use waste energy, it can be decided that the proposed Greenfield facility also would have wasted the energy in the absence of waste energy recovery CDM project*”. While the methodology tries to be descriptive on how to identify baseline waste energy use, there remain large uncertainties and most importantly, data on the degree of waste energy usage in plants from competitors may be very difficult to obtain. Under option 2, project participants can submit a (hypothetical) *alternative design* without or with a lower level of waste heat recovery and demonstrate using investment analysis that the alternative design would be the baseline scenario for the waste energy generated in the greenfield facility. Given the high uncertainties in price data and hypothetical level of waste heat utilization in the absence of the CDM, this leads to significant risks of non-additionality.

The economic impact of CERs on the profitability of the waste heat recovery project is usually rather small compared to related fuel cost saving. I.e. a change in fuel costs of a few percent may have the same impact as the CER revenues (Sections 2.4 and 3.2).

Overall, the risk for non-additionality of greenfield plants seems higher than for existing plants, where the requirement for a minimum of three years of generation of waste heat prior to the start of operation of the CDM project has to be demonstrated.

4.10.4. Baseline emissions

Baseline emissions are usually derived from the amount of waste heat used in the project case. It is assumed, that this heat would be generated by fossil fuels in the baseline scenario.

However, even though the methodologies for existing facilities require demonstrating that the waste heat or gas has been flared/vented at least three years before the project implementation, in practice it may be very difficult to rule out that waste heat has not been used in some form in existing facilities before project implementation, which may inflate baseline emissions.

Also, waste heat recovery may lead to a different operation of the plant than in the baseline scenario. For example, if waste heat is used for pre-heating of a product, the plant may be run in such a way that more waste heat is generated to assure a certain temperature level of the pre-heated product, which leads to a higher fuel consumption in the boiler generating the waste heat. Therefore the amount of heat wasted in the baseline may be overestimated. Moreover, baseline usually do not capture any other autonomous energy efficiency improvements that might be implemented in the absence of the project.

In greenfield projects, the emission reduction is based on the difference in emissions in modelling a baseline and project scenario. The models build on many assumptions that are difficult to validate objectively. The results are therefore prone to high uncertainty and may lead to over-crediting.

Lastly, the methodologies do not consider emission reductions from the reduction in upstream emissions (such as from the production of natural gas or coal) which leads to a slight under-crediting, if upstream emissions occur in a non-annex I country.

4.10.5. Other issues

None.

4.10.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • CER revenues are very small compared to cost reduction from fuel savings • Ex-ante estimation of key parameters including investment costs and fuel savings has large uncertainties • Waste heat recovery is common practice in many countries and sectors (though not in all)
Over-crediting	<ul style="list-style-type: none"> • In existing facilities: It is very difficult to rule out that waste heat has not been used in some form before project implementation, which may inflate baseline emissions • In greenfield projects: Modelling of amount of waste heat lost in baseline is subject to very high uncertainties. • Waste heat recovery may lead to a different operation of the plant than in the baseline case, e.g. to assure a certain temperature level of the heat medium or to NCV level of waste gas, therefore the amount of gas wasted in the baseline may be overestimated
Other issues	<ul style="list-style-type: none"> • None

4.10.7. Recommendations for reform of CDM rules

Waste heat recovery is standard practice in many energy intensive industrial sectors, though there exist barriers to the implementation of waste to energy measures. The high uncertainty in additionality demonstration make it less suitable for the CDM, the project type may be taken out of the CDM or restricted to cases with clear additionality demonstration, e.g. of a very low uptake of waste heat recovery can be demonstrated in a specific industrial sector. We recommend that option 1 in Appendix 1 of ACM0012 be maintained as it provides a more objective way of assessing the practice in the sector and country and that option 2 not be used.

4.11. Fossil fuel switch

4.11.1. Overview

Fossil fuel switch includes the switching from a fuel with higher carbon intensity (such as coal or petroleum) to a fossil fuel with lower carbon intensity (such as natural gas) in the generation of heat for industrial processes or in power plants. In this section we do not consider switching from fossil fuels to biomass. Methodologies are for existing installations only (e.g. ACM0009, ACM0011, AMS-III.AH., AMS-III.AN) or for both existing and greenfield installations (AMS-III.B and AMS-III.AG – power only).

4.11.2. Potential CER volume

According to our own estimates, registered CDM wind power projects have the potential to issue 0.46 billion CERs by the end of their respective crediting periods, of which 0.23 billion CERs fall in

the period from 2013 to 2020 (Table 2-1). CERs from wind power account for about 3.3% of the total CER issuance potential.

4.11.3. Additionality

Both fossil fuels with higher carbon intensity such as hard coal, lignite or fuel oil and fuels with lower carbon intensity such as natural gas are widely used in stationary installations in energy and manufacturing industries as well as in the buildings sector. In existing facilities, the choice of fuel is often determined by the existing fuel, because fuel changes may be costly, though there are also multi-fuel systems. In greenfield plants, the fuel choice usually depends on the economic viability of each fuel option.

Table 4-5: Examples of differences in characteristics between the use of coal and fuel oil compared to natural gas

Characteristics	Hard coal, lignite (fuel with high carbon intensity)	Natural gas (fuel with lower carbon intensity)	Considered in investment analysis
Initial investment for burner/boilers etc.	Higher	Lower ¹⁾	Yes
Fuel cost per energy unit	Lower	Higher	Yes
Non-fuel operation costs	Higher	Lower	Yes
Flexibility in operation ²⁾	Lower	Higher	No
Means of distribution to end-user	Vehicle-based: by trucks, train i.e. requires access roads or rails	Network based: by distribution lines ³⁾	No
Price building mechanisms	In many countries based on world market price	In many countries price is based on local long term contracts, often taking into account a price index, e.g. based on oil price	No
Dependence on specific supplier	Lower	Higher	No
Compliance with local air quality standards (if any)	More difficult: Coal based furnaces may require expensive exhaust cleaning systems	Less difficult: Natural gas based furnaces have generally lower air pollutant emission levels ⁴⁾	No
Need of space for local fuel storage	Yes	No ⁵⁾	No

Notes: ¹⁾ This is the case if the (higher) investment for distribution lines necessary to connect to the natural gas grid is borne by a different entity, e.g. the natural gas supplier. In case of LNG initial investment costs may be somewhat higher for LNG terminals, local storage facilities etc. ²⁾ E.g. shorter time lag to start-up operation of power plant if dispatching system in a grid requires more power. ³⁾ Or Vehicle based in case of LNG. ⁴⁾ Please note that this may hold true even though local air quality standards may be stricter for natural gas than for coal-based systems. ⁵⁾ Except for LNG.

Sources: Author's own research

The large-scale methodologies ACM0009 and ACM0011 require an investment analysis for demonstrating additionality, a barrier analysis (Section 3.2) is not deemed sufficient.⁷⁵ This makes sense as the economic viability may be seen as one of the key aspects when deciding on a specific fuel. Requiring investment analysis may reduce the risk of non-additionality, because using this

⁷⁵ Though e.g. ACM0009 allows for the additionality to be proven by claiming „prohibitive barriers“ for the project (natural gas) scenario applying step 3 of the additionality tool.

test may be more difficult in the case of very lucrative fuel switches (e.g. if cheap natural gas becomes newly available in a project site).

In general, fuel prices per energy unit are generally lower for coal than for natural gas. This is offset to a certain degree by higher initial investment and non-fuel operation costs for coal furnaces (Table 4-5). However, while the investment analysis takes these cost factors into account, there could be other factors that may lead to the choice of natural gas as a fuel, even though it may be economically somewhat less attractive than lignite or hard coal.

An issue that contributes to the high uncertainty in investment analysis are the assumptions made about future developments of fuel prices. In the investment analysis, the fossil fuel switch methodologies allow to choose between (i) keeping fuel prices at present levels for future years, or (ii) to use future prices that *“have to be substantiated by a public and official publication from a governmental body or an intergovernmental institution”* (ACM0009 V.5, Section 5.2.4).

For small-scale projects, however, the barrier analysis is deemed sufficient, which may considerably increase the risk of non-additionality (Section 3.3). This risk is only somewhat mitigated by some small-scale methodologies requiring that the CDM project involves at least some capital investments⁷⁶, ruling out projects where fuel switch can be carried out without any investment in additional fuel switching equipment, e.g. in natural gas burners. Still, small-scale fuel switching methodologies have the full set of issues that have been identified for barrier analysis (Section 3.3).

In addition, similar to other energy related project types, with fuel switch projects CER revenues are very small compared to typical fluctuations of price differences between fuels (dark-spread), which increases the risk of non-additionality.

4.11.4. Baseline emissions

The exploitation, transport, processing and distribution of fossil fuels results in upstream emissions, many of which may originate in non-Annex I countries. In most CDM project types, the amount of fossil fuel used is *reduced* with the project; therefore, it may be assumed that also upstream emissions are reduced. As a conservative simplification, the relevant methodologies usually do not consider upstream emissions. In the case of fossil fuel switch, however, upstream emissions from fossil fuels could either increase or decrease. In general, upstream emissions from natural gas tend to be higher than upstream emissions from lignite, hard coal or fuel oil (depending on source of fuel).

With fuel switch activities the amount of fuel used in terms of energy content remains more or less constant (or may slightly be reduced because of higher efficiency of natural gas burners). Because of the potentially higher upstream emissions of natural gas, switching from coal/oil to natural gas may result in an increase in upstream emissions, the so-called ‘upstream leakage’ emissions. For this reason, CDM methodologies for fossil fuel switch projects consider upstream emissions.

The procedures for estimating upstream emissions are included in the methodological Tool “Upstream leakage emissions associated with fossil fuel use” (V.1, EB69 Annex12). The tool allows project developers to use default values for upstream emissions or to come forward with their own values derived from relevant data. The default values have been substantially revised with the tool (e.g. from the values included in Table 3 of methodology ACM0009 V.4 (EB68 Annex 12)).

For instance, according to the latest version of the tool, default upstream emissions values from natural gas are 2.9 tCO₂/TJ, based on data from the US. This is comparable to the 2.6 tCO₂/TJ

⁷⁶ For example, as in the applicability requirements of small-scale methodology AMS-III.B (V.18): “The methodology is limited to fuel switching measures which require capital investments. Examples of capital investment include creating infrastructure required to use project fuel or retrofitting existing installations.”

(105 tCH₄/PJ; total) default upstream emissions in Western Europe in ACM0009 V.4 (based on IPCC), but is much lower than in e.g. the former values for Eastern Europe and former Soviet Union (23 tCO₂/TJ) or Rest of the World (7.4 tCO₂/TJ).

Also, the revised aggregated default values for natural gas (Table 1 in the tool) of 2.9 appears much lower than the sum of the default values for the different elements in the upstream chain of natural gas (Table 3 in the tool), including exploration and production (3.4 tCO₂/TJ), processing (4 tCO₂/TJ), storage (1.6) and distribution (2.2). The latter are all based on the US Department of Energy's GREET model, which may not necessarily be representative for upstream emissions of natural gas in developing countries.

With this, the revised values become comparable to those from (underground) coal. It is unclear whether this is a reasonable assumption or an artefact because of the origin of the natural gas upstream emissions data. If the values in the upstream tool are not conservative, i.e. provide too low default values for natural gas upstream emissions, this would lead to an increased risk of over-crediting of fuel switch projects.

An additional issue is the assumptions for the default values on the share of upstream emissions that are covered by caps of Annex-I countries – and how effective these caps are in limiting upstream emissions.

Table 4-6: Default emission factors for upstream emissions for different types of fuels reproduced from upstream tool (Version 01.0.0)

Fossil fuel type x	Default emission factor (tCO ₂ e/TJ)	
Natural Gas (NG)	2.9	
Natural Gas Liquids (NGL)	2.2	
Liquefied Natural Gas (LNG)	16.2	
Compressed Natural Gas (CNG)	10	
Light Fuel Oil (Diesel)	16.7	
Heavy Fuel Oil (Bunker or Marine Type)	9.4	
Gasoline	13.5	
Kerosene (household and aviation)	8.5	
LPG (including butane and propane)	8.7	
Coal/lignite (unknown mine location(s) or coal/lignite not 100% sourced from within host country)	Lignite	2.9
	Surface mine, or any other situation	2.8
	Underground (100% source)	10.4
	Lignite	6
	Surface mine, or any other situation	5.8
	Underground (100% source)	21.4

Notes: The detailed table 3 in tool does not seem to provide data for conventional NG upstream emissions.

Sources: EB69, Annex 12, <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-15-v1.pdf>

Table 4-7: Former default emission factors for upstream emissions for different types of fuels

Activity	Unit	Default emission factor	Reference for the underlying emission factor range in Volume 3 of the 1996 Revised IPCC Guidelines
Coal			
Underground mining	t CH4 / kt coal	13.4	Equations 1 and 4, p. 1.105 and 1.110
Surface mining	t CH4 / kt coal	0.8	Equations 2 and 4, p.1.108 and 1.110
Oil			
Production	t CH4 / PJ	2.5	Tables 1-60 to 1-64, p. 1.129 - 1.131
Transport, refining and storage	t CH4 / PJ	1.6	Tables 1-60 to 1-64, p. 1.129 - 1.131
Total	t CH4 / PJ	4.1	
Natural gas			
<i>USA and Canada</i>			
Production	t CH4 / PJ	72	Table 1-60, p. 1.129
Processing, transport and distribution	t CH4 / PJ	88	Table 1-60, p. 1.129
Total	t CH4 / PJ	160	
<i>Eastern Europe and former USSR</i>			
Production	t CH4 / PJ	393	Table 1-61, p. 1.129
Processing, transport and distribution	t CH4 / PJ	528	Table 1-61, p. 1.129
Total	t CH4 / PJ	921	
<i>Western Europe</i>			
Production	t CH4 / PJ	21	Table 1-62, p. 1.130
Processing, transport and distribution	t CH4 / PJ	85	Table 1-62, p. 1.130
Total	t CH4 / PJ	105	
<i>Other oil exporting countries / Rest of world</i>			
Production	t CH4 / PJ	68	Table 1-63 and 1-64, p. 1.130 and 1.131
Processing, transport and distribution	t CH4 / PJ	228	Table 1-63 and 1-64, p. 1.130 and 1.131
Total	t CH4 / PJ	296	
Note: The emission factors in this table have been derived from IPCC default Tier 1 emission factors provided in Volume 3 of the 1996 Revised IPCC Guidelines, by calculating the average of the provided default emission factor range.			

Sources: EB68 Annex 12, ACM0009, V.4, Table 3, http://cdm.unfccc.int/filestorage/r/t/4M2I7TA9GRCU5QDB0JLNHK6PY1ZOWE.pdf/eb68_repan12.pdf?t=Z0p8bzJ3YnExfDBVPWpbmgO_k-sMZsZlso1q

4.11.5. Other issues

None.

4.11.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • Small-scale methodologies for fuel switching do not require investment analysis but may build only on barrier analysis, which provides a high risk for non-additionality • Even in large scale methodologies, modelling of fuel choice depends not only on prices, but also on availability/reliability, need for diversification, and operational needs (e.g. NG power plants for covering peak demand); this may imply that the investment analysis may not be sufficient to determining additionality • CER revenues are very small compared to typical fluctuations of the price difference between fuels (dark-spark spread)
Over-crediting	<ul style="list-style-type: none"> • Upstream emissions need to be taken into account, but with the revised default values of the tool they may not be addressed in an adequate way anymore
Other issues	<ul style="list-style-type: none"> • None

4.11.7. Recommendations for reform of CDM rules

In sum, the revision of upstream default values as documented in the tool practically eliminates the consideration of upstream emission in a fuel switch e.g. from (underground) coal to natural gas. The assumptions behind the revisions (mostly data from the US may not be representative for the situation with natural gas used in developing countries and require urgent independent analysis and revision.

4.12. Efficient cook stoves

4.12.1. Overview

Under the CDM, there are two methodologies applicable to efficient cook stoves. AMS-II.G⁷⁷ applies to cases where inefficient existing cook stoves are replaced by improved-efficiency cook stoves to reduce the demand for non-renewable biomass. AMS-I.E⁷⁸ applies to cases where a renewable technology, such as biogas or solar cookers, is introduced to displace existing cook stoves using non-renewable biomass. The number of projects has increased quickly since the introduction of these methodologies in 2008/2009. Most notably the introduction of PoAs, enabling multiple project activities to be registered through a single approval process, has lowered the transaction costs and increased scalability for projects like efficient cook stoves.

4.12.2. Potential CER Volume

As of 1 July 2015, a total of 102 cook stove projects have been registered under the CDM, 37 as individual CDM project activities and 65 as PoAs (along with a total of 180 individual CDM Program Activities (CPAs)).

Table 4-8: Number of efficient cook stove single CDM project activities by country

Country	Number of CDM project activities	Annual CERs (1,000)	Avg. CERs per CDM project activity (1,000)
China	1	12	12
India	29	469	16
Lesotho	1	34	34
Malawi	2	71	35
Mozambique	1	192	192
Nepal	1	20	20
Nigeria	1	31	31
Zambia	1	130	130
Total	37	960	

Sources: UNEP DTU 2015a

Project activity under the CDM peaked in 2012 and dropped sharply in 2013. As of 1 July 2015, single CDM cook stove projects are mostly located in the Asia and Pacific regions (Table 4-8), while component project activities developed under PoAs are predominantly located in Africa, as shown in Table 4-9. The annual volume of CERs estimated by project developers from PoA projects is 9.2 million, nearly 10 times the annual volume of CERs projected from single CDM project

⁷⁷ AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass, <https://cdm.unfccc.int/methodologies/DB/UFM2QB70KFMWLV07LJN8XD1O2RKHEK>.

⁷⁸ AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user, <https://cdm.unfccc.int/methodologies/DB/O799FU5XYGECUSN22G84U5SBXJVM6S>.

activities of 0.96 million. Many of the registered PoAs have only 1 or a few CPAs associated with them (Table 4-9), so there is potential to scale up CPAs in these cases. In Bangladesh and Madagascar, many individual CPAs have already been developed under the one PoA registered in each of these countries (Table 4-9).

Table 4-9: Number of efficient cook stove PoAs and CERs by country and methodology

Country	Number of PoAs	Annual CERs (1,000)	CPAs per PoA	Annual CERs/CPA (1,000)
Bangladesh	1	543	11	49
Burkina Faso	2	68	1	68
Burundi	2	452	4	113
China	1	10	1	10
Congo DR	3	124	1	124
Côte d'Ivoire	2	160	2	80
El Salvador	2	90	1	90
Ethiopia	3	201	2	121
Ghana	2	377	4	108
Guatemala	1	43	1	43
Haiti	2	68	1	68
Honduras	1	34	1	34
India	5	543	2	302
Kenya	4	319	2	159
Madagascar	1	4,198	59	71
Malawi	6	299	1	257
Mali	1	33	1	33
Mexico	1	40	1	40
Mozambique	1	28	1	28
Myanmar	1	43	1	43
Nepal	4	204	2	136
Nigeria	2	226	4	56
Rwanda	3	229	2	114
Senegal	3	209	1	209
South Africa	1	32	1	32
Tanzania	1	63	1	63
Togo	3	48		144
Uganda	3	265	2	132
Zambia	3	345	3	129
AMS-I.E	7	4,657	9	509
AMS-II.G	57	4,535	2	2,371
AMS-I.E + AMS II.G	1	100	1	100
Total	65	9,292		

Sources: UNEP DTU 2015a

4.12.3. Additionality

Improved cook stove methodologies under the CDM fall under one of two types: improved energy efficiency (AMS-II.G) or fuel switching to renewable energy (AMS-I.E). Under both methodologies projects must apply the CDM “Guidelines on the demonstrating of additionality of SSC project activities” (Methodological Tool: Demonstration of additionality of small-scale project activities. Version 10.0). Following these CDM guidelines, projects using either of these methodologies are on

the positive list of project types and automatically considered additional so long as each unit is no larger than 5% of the small-scale CDM threshold (750 kW installed capacity or 3000MWh energy savings per year or 3,000 metric tons emission reductions per year), and end users are households/communities.

Lambe et al. (2015) reviewed PDDs for cook stove projects in Kenya and India. Although projects are considered automatically additional and were thus not required to document barriers, the study found that several did include a discussion of barriers in the PDDs. The most-cited barrier was household poverty, which makes improved stoves unaffordable. The study found that several PDDs for projects in Kenya include simple cost analysis to assess the ability of households to purchase an efficient cook stove based on their income and their costs for food and fuel; the calculations suggest that households would need to save 22–30% of their remaining income for a year to purchase a stove. This claim was supported in the pricing models the authors found used by projects in rural areas, which nearly exclusively distributed stoves for a free or subsidized price. In an urban setting, the study found that many projects were selling stoves at the retail price with micro-finance options. The study noted that these PDDs suggest that since urban households are already purchasing charcoal, they have an incentive to buy an improved cook stove to reduce their fuel costs. The study authors also found that many projects also cited the lack of access to credit for working capital, low profit margins, high upfront capital costs, lack of sufficient consumer outreach and support for program operations, reduced consumer demand resulting from failure of past efforts, need for ongoing improvement and modifications of stoves to suit user needs as barriers to project implementation.

Lambe et al. (2015) also investigated what contribution offset revenues make to the overall project revenue. The study reviewed claims made in PDDs regarding the use of offset revenue and found that a majority of projects planned to use offset sale revenues to subsidize the price of improved cook stoves, as well as to cover operational costs, including maintenance and replacement of stoves, training of cook stove users, outreach and marketing to households, microcredit systems and distribution. Interviews of market actors affiliated with these projects by the authors found that while some projects were entirely dependent on offset revenue, others admitted that given the uncertainty in revenue from offsets it was advantageous not to depend on carbon revenues.

These conclusions raise substantial concerns about the additionality of improve cook stove projects under the CDM. Carbon revenues are more likely to be a primary financial enabler of projects in rural areas, where revenues are needed to subsidize the price of stoves. In urban areas, where households have a financial incentive to reduce their fuel purchasing costs, business models without carbon financing may be more viable. While these factors may reduce confidence in the additionality of cook stove projects in urban areas, low income urban households are unlikely to be able to afford more efficient and more costly cook stoves with a payback period of more than a few months.

4.12.4. Baseline emissions

In both types of cook stove projects – improved efficiency and fuel substitution – emission reductions are calculated as the product of the amount of woody biomass saved, the fraction that is considered non-renewable biomass, the net calorific value (NCV) of the biomass, and an emission factor for the fuel used. The net calorific value of the non-renewable biomass ($NCV_{biomass}$) is relatively straightforward – it is empirically measurable and a default value from the Intergovernmental Panel on Climate Change (IPCC) exists. However, Lee et al. (2013) concluded that there is uncertainty in the approaches to estimating the other parameters: biomass fuel consumption (B_y), fraction of non-renewable biomass (f_{NRB}), and emission factors for fuel combustion ($EF_{projected_fossilfuel}$). A study by Johnson et al. (2010) assessed the relative contributions of these three variables to the overall uncertainty in

carbon offset estimation for an improved cook stove project in Mexico and found that fuel consumption (B_y) contributed to 28% of the uncertainty, fraction of non-renewable biomass (f_{NRB}) contributed 47%, and emission factors ($EF_{projected_fossilfuel}$) accounted for 25%.

The CDM methodology AMS-II.G presents project developers with three options for quantifying biomass fuel savings from improved stoves: the Kitchen Performance Test (KPT), the Water Boiling Test (WBT), and the Controlled Cooking Test (CCT). The WBT and CCT are laboratory-based methods, whereas the **Kitchen Performance Test** is done in the field, and can thus better represent stove users' actual cooking behaviour. The primary advantage of the **Water Boiling Test** is its simplicity and reduced costs; the laboratory-based method is standardized and replicable. However, the laboratory results on stove performance do not necessarily translate to cooking actual meals in households, and thus the accuracy of this method is frequently called into question (Abeliotis & Pakula 2013; Johnson et al. 2007). Meanwhile, the **Controlled Cooking Test** protocol provides a compromise, better representing local cooking while being conducted in a controlled environment. Berrueta et al. (2008), which evaluated the performance of a stove designed primarily for tortilla-making by using all three tests and found that the WBT "gave little indication of the overall performance of the stove in rural communities", while the CCT was somewhat more predictive of the fuel savings found by the KPT (44-65% for CCT vs. 67% for KPT). There may be options for reducing costs associated with the KPT, such as having local NGOs perform the tests rather than hiring expensive international consultants, as well as opportunities to improve the WBT. In recent years, more comprehensive and appropriate testing methods and performance standards are under development through both ANSI and ISO standardisation organisations. The CDM methodology provides default efficiency values for two traditional stove types – a three-stone fire, or a conventional system with no improved combustion – as well as a default efficiency value for devices with improved combustion air supply or flue gas ventilation. Experts interviewed by Lee et al. (2013) noted that these limited defaults do not cover the range of cook stoves in most countries. The CDM Small-Scale Working Group (CDM SSC WG) considered this in the past, but made the determination not to proceed with developing regional default efficiency values for traditional cook stoves because of the huge variability in values among the available data (UNFCCC 2012a). Lee et al. (2013) conclude that although the KPT is more logistically complicated, and time- and resource-intensive, testing stoves outside of a controlled laboratory setting and using a variety of typical cooking activities appears to be an important factor in ensuring accurate and credible results in the baseline or default analysis. Overall, evidence suggests the Water Boiling Test is not an appropriate tool for assessing baseline fuel consumption and should be removed from the CDM methodology. The methodology should require the use of either the Kitchen or Controlled Cooking Tests. AMS-I.E follows a similar approach for calculating baseline emissions from fuel substitution of cook stoves.

The factor f_{NRB} represents the fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass and is a key variable in all current cook stove offset methodologies

Based on its definition of renewable biomass (UNFCCC 2006b), the EB has identified several indicators of scarcity to help identify non-renewable biomass. Woody biomass is considered non-renewable if at least two of the following indicators are shown to exist:

- A trend showing an increase in time spent or distance travelled for gathering fuelwood, by users (or fuelwood suppliers) or alternatively, a trend showing an increase in the distance the fuelwood is transported to the project area;
- Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area;

- Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;
- Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass (UNFCCC 2011a).

In 2012, the EB issued national default factors for f_{NRB} based on a highly aggregated approach, balancing the mean annual increment in biomass growth (MAI), the annual change in living forest biomass stocks (ΔF) and biomass growth in protected forest areas (UNFCCC 2012a). Under this approach, f_{NRB} values were calculated for nearly 100 countries, based on the total annual national biomass removals minus the portion of demonstrably renewable biomass from growth in protected reserve areas. The large majority (over four-fifths) of default values exceed 80%, with the remainder ranging from 40% to 77%. While Lee et al. (2013) noted that market actors interviewed characterize development of default f_{NRB} values as a ‘huge triumph’, there was also recognition by market actors and researchers interviewed that national-level forest growth and total forest harvest removal data alone do not necessarily capture the impact of fuelwood harvesting on carbon stocks. First, the approach does not distinguish removals for timber harvesting from those for fuelwood. Furthermore, there is no justification or validation of whether the change in national carbon stocks has any correlation to fuelwood harvesting. Second, according to this method, high values of f_{NRB} are calculated for countries with significant deforestation. However, deforestation could occur in different geographical areas and be driven by entirely other factors than fuel wood collection. In practice, renewable biomass may be extracted both from plantations and natural forests that are not under protection. The MAI approach is better suited to assess the fraction of harvested wood products that are renewable, rather than fuelwood. Using the change in carbon stocks due to harvested wood products has the potential to significantly overestimate the fraction of non-renewable biomass. Estimates published by de Miranda Carneiro et al. (2013), based on the use of a spatially-explicit land use model to examine the availability of fuelwood, suggest default values for f_{NRB} of wood-fuel on the order of 20-30%, much lower than the prior estimates. Bailis et al. (2015) estimate that 27–34% of woodfuel harvested was unsustainable, with large geographic variations, and conclude that cookstove methodologies probably overstate the climate benefits.

Under the CDM methodology AMS-II.G and AMS-I.E, the quantification of project emission reductions relies on the factor $EF_{projected_fossilfuel}$, representing the fossil fuel emission factor of “substitution fuels likely to be used by similar users”. Since emission reductions from the LULUCF sector can only be claimed from afforestation and reforestation under the CDM, the use of fossil fuel emission factors for baseline fuels represents something of a workaround. While the short-term emission reductions actually occur from avoiding the depletion of carbon stocks, such as avoiding deforestation, emission reductions are calculated using fossil fuel emission factors. One possible argument for this approach is that kerosene or LPG cook stoves might be used by the households if they had a higher income. In this regard, the consideration of emissions from fossil fuel based cooking devices might be regarded as a suppressed demand baseline. However, the approach combines the efficiency of fuel-wood cook stoves with the CO₂ emission factor of fossil fuels. This approach has been roundly criticized. Johnson et al. (2010) say it has “no scientific basis, given that wood emits approximately double the CO₂ per unit fuel energy compared to LPG or kerosene thus halving possible offsets from non-renewable harvesting of fuel”. One could also argue that it leads to overestimating baseline emissions if one would assume the long-term suppressed demand baseline of using kerosene or LPG cook stoves. By combining the efficiency from inefficient fuel-wood cook stoves with the CO₂ emission factors from fossil fuels, the claimed baseline emissions are higher than if the households would use kerosene or LPG cook stoves. The CDM methodology AMS-II.G. suggests the use of a weighted average value of 81.6 tCO₂/TJ², representing a mix of 50% coal, 25% kerosene, and 25% LPG. However, no justification for this fuel mix provided. Coal is not commonly used as a cooking fuel for households transitioning from traditional to modern biomass.

LPG is the dominant fossil fuel used in households transitioning to modern energy for household cooking. Assuming that households would use coal vs. LPG overestimates the emissions factor. For example, if we compare the emissions factor if the fuel mix was LPG vs. the current emission factor we find that the emissions are overestimated by 23%. For charcoal production, the simplification is stretched even further beyond reality. The methodologies permit calculating wood use by charcoal stoves by multiplying the charcoal volume by six, following the 1996 IPCC accounting guidelines to estimate total biomass consumed (IPCC/OECD/IEA 1996, p. 1.42). Then baseline emissions are estimated by applying the projected fossil fuel use emissions factor, which in effect assumes that the project displaces fossil fuel use for charcoal production, which likely significantly overestimates the baseline emissions (Lee et al. 2013).

4.12.5. Other issues

Improved cook stove projects are dependent on end users to achieve emission reductions: households must actually use the improved cook stoves instead of their traditional stoves. Carbon finance monitoring requirements include checking the efficiency of the stove and confirming at least every two years that the stove is still in use. Additional stove monitoring of the efficiency and usage rate is required annually or biannually. Monitoring requirements furthermore include sampling and surveying as specified in the applicable offset protocol. This has been a significant challenge. Carbon finance project monitoring requirements further specify that projects must either ensure that the improved stoves completely replace traditional stoves, or else the traditional stoves must be monitored and accounted for under the project calculations for emission reductions. Lambe et al. (2014) found in their review of projects in Kenya and India that this presented several challenges. In Kenya, where the predominant mode of traditional cooking is with a three-stone fire, the study found that many PDDs acknowledged that this form of traditional stove cannot really be removed or destroyed. In India, traditional stoves in several regions are known as chulhas. These stoves often have a religious significance and households often build the stoves themselves from locally available materials such as mud, brick, or cement (Lambe & Atteridge 2012). This form and construction makes it difficult to guarantee that a new chulha will not be made following the destruction of the old one. Lambe et al. (2014) found that many projects required households to destroy these existing cook stoves. In some cases, photographic evidence is used to demonstrate that the existing stoves have been destroyed. However, because of the challenges with removing traditional stoves and the barriers to ensuring adoption and sustained use of improved cook stoves, more often a stacking of stoves and fuels occurs where traditional and improved cook stoves are both used for different types of cooking (Ruiz-Mercado et al. 2011). While the methodologies contain monitoring guidance for adjusting the baseline fuel consumption if the traditional stove continues to be used, this adds further uncertainty to quantification of changes in fuel consumption. Use of temperature sensors to monitor usage of traditional and improved cook stoves have shown promising signs of helping to address this issue, but are not yet in widespread use in carbon market projects (Ruiz-Mercado et al. 2011).

There is a broader concern about crediting emission reductions from displacement of non-renewable biomass since the increased carbon storage from changes in carbon stocks may only lead to temporary reductions. The risk of non-permanence of emission reductions is addressed through appropriate accounting approaches for afforestation, reforestation, and carbon capture and storage project activities, but it is not addressed for improved cook stove project types. Under the CDM, there are projects promoting the use of biomass energy to displace fossil fuel, as well as improved cook stove projects aimed at decreasing biomass energy use. In theory, this does not present a conflict, assuming that biomass power projects are based in regions with increasing or stable carbon stocks and improved cook stove projects are located in regions with declining carbon stocks. However, looking at registered CDM projects there are several examples of provinces in which there are both biomass power and cook stove projects. This means that in the same prov-

ince, there are simultaneously CDM projects getting credit for increasing the use of biomass, as well as reducing the use of biomass. For example, in the Henai province in China there are 9 biomass energy projects fuelled by agricultural residues (rice husk and other kinds) as well as 4 improved cook stove projects.

4.12.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • CER revenues are insufficient to fully cover project costs, confidence in additionality may be low in urban settings where households are paying for improved stoves at the retail price
Over-crediting	<ul style="list-style-type: none"> • Uncertainty in some widely used approaches for estimating biomass savings • Significant uncertainty around the fraction of non-renewable biomass values, recent research suggests this parameter may be significantly overestimated. • Emissions intensity factors of fossil fuel likely underestimate emissions relative to wood-fuel used in the baseline. • Emissions factor for suppressed demand use of fossil fuel overestimate emissions; LPG is the appropriate substitute used by similar consumers, including coal and kerosene overestimate emission reductions.
Other issues	<ul style="list-style-type: none"> • Challenges in ensuring adoption and sustained use of improved cook stoves result can lead to over-crediting if traditional stoves continue to be used. • The use of biomass as a renewable energy sources is inconsistently accounted for under the CDM; the same region can have biomass power projects receiving credit for increasing biomass use and improved cook stove projects receiving credit for decreasing biomass use.

4.12.7. Recommendations for reform of CDM rules

We recommend revising the current methodologies as follows:

- Eliminate the use of the Water Boiling Test as a means of determining baseline emissions.
- Reconsider the use of default f_{NRB} factors based on the MAI approach.
- Revise the emission factor for the substitution of non-renewable biomass by similar consumers to one based solely on LPG.
- Explore options for incorporating temperature sensors in monitoring plans to improve reliable assessment of the adoption and sustained use of improved vs. traditional cook stoves in households.
- Review the use of biomass as an energy source under the CDM to ensure consistent accounting across project types and regions. The f_{NRB} should be considered in improved cook stove projects, as well as modern biomass energy projects to confirm that projects are not contributing to loss of carbon stocks. The CDM EB needs to provide justification for how both biomass energy and improved cook stove projects can be approved within a sub-region.

4.13. Efficient lighting

4.13.1. Overview

For energy efficient lighting, we focus our analysis on the replacement of incandescent electrical bulbs with more efficient electric lighting, such as Compact Fluorescent Lamps (CFLs) or Light Emitting Diode (LED) lamps. This includes all projects registered under AM0046⁷⁹ and AMS II.J⁸⁰

⁷⁹ [Distribution of efficient light bulbs to households --- Version 2.0.](#)

⁸⁰ [Demand-side activities for efficient lighting technologies --- Version 6.0.](#)

methodologies as well as projects registered under AMS II.C⁸¹ that are labelled as 'lighting' and 'lighting in service' in UNEP DTU (2014).⁸² This technology category was a late starter in the CDM – in mid-2010 there were only half a dozen registered projects and 3 registered PoAs. Recent growth in PoAs, particularly with larger PoAs, indicates a higher potential in the future – even beyond the current project activity and PoA pipeline. Energy efficient lighting projects are typically implemented by an entity (often public sector or linked to a utility) that distributes energy efficient lamps for free or for a nominal fee, and collects and disposes of the incandescent bulbs that have been displaced.

4.13.2. Potential CER volume

For CDM project activities, the 40 projects registered by the end of 2013 state that they will produce 1.4 million CERs per year. This would be 10.3 million CERs in the period of 2013 to 2020. However, the issuance success for the largest project activity, which is the only project using the large-scale methodology, amounted to only 12% in the first monitoring period. This could be related to the time required for the CFL distribution programme to reach full scale, however, and does not necessarily mean that other projects will have similar issuance rates (or that this rate will not increase over time). Other projects have been much more successful, but are considerably smaller. Project activities are dominated by a stream of small-scale projects in India and a single large-scale project in Ecuador – the only registered large-scale energy efficient lighting project – which account for almost 80% of the expected CERs. More than 80% of the small-scale projects use AMS II.J, which was designed specifically as a simplified approach to energy efficient lighting.

The largest volume of CERs for energy efficient lighting, however, could come from PoAs. Twenty-six PoAs had been registered for energy efficiency lighting by the end of 2013. Just from the CPAs already included in these registered PoAs as of the end of 2013, the volume of CERs is estimated by the project developers at 3.4 million per year, or two and a half times greater than for project activities. This could continue to grow, given that only four PoAs have more than one CPA. For PoAs, the main players are China, India, Mexico and Pakistan, with South Africa also hosting multiple PoAs (Table 4-10). The four PoAs with more than one CPA have large numbers of CPAs (e.g. 9 to 53). For some PoAs, the CPAs are delineated to have very similar emission reductions in each CPA (e.g. in Mexico, India, Bangladesh).

⁸¹ [Demand-side energy efficiency activities for specific technologies --- Version 14.0.](#)

⁸² This excludes one registered PoA under AMS II.C that focuses on street lighting and is labelled as sub-type "Street lighting".

Table 4-10: Number of energy efficient lighting PoAs and CERs by country and methodology

Country	Number of PoAs	Annual CERs (1,000)	CPAs per PoA	Annual CERs/CPA (1,000)	PoAs with >1 CPA
Bangladesh	1	124	9	14	1
China	14	443	1	32	
India	3	1,555	17	30	1
Kenya	1	31	1	31	
Mexico	1	607	25	24	1
Nigeria	1	29	1	29	
Pakistan	1	557	53	11	1
Senegal	1	4	1	4	
South Africa	3	80	1	27	
AMS-II.C.	6	668	5	22	
AMS-II.J.	20	2,762	6	21	
Total	26	3,431			4

Sources: UNEP DTU 2015b

All of the PoAs for lighting efficiency upgrades have moved to the newer methodology AMS II.J rather than AMS II.C (Table 4-10). No new energy efficient lighting PoAs have entered the pipeline since October 2012, and the new project activity pipeline largely stopped in January 2012, with only one new project activity starting validation in 2013 (in The Gambia).

4.13.3. Additionality

Because only one project activity uses the large-scale methodology, this entire technology area essentially uses SSC methodologies and additionality rules. For SSC projects and PoAs, additionality can be determined through several different routes: All SSC projects (or SSC CPAs within PoAs) must refer to the tool for “Demonstration of additionality of small-scale project activities” (Tool21, ver10.0). This includes the choice of using several different barriers to justify additionality (i.e. investment barrier, technology barrier, prevailing practice barrier, or other barriers). In addition, from July 2012, projects comprised entirely of units below 5% of the small-scale CDM threshold (i.e. 3000 MWh savings for energy efficiency) were considered automatically additional without any further justification. This new ‘positive list’ additionality argument has not been used by CDM project activities but has been used extensively by PoAs, as discussed further below. Most CDM project activities applying the SSC additionality tool cite investment barriers and use simple cost analysis to prove additionality (Table 4-11). This is because the organisations distributing the efficient lamps do not receive the energy savings, so they incur only costs without any revenue (other than a nominal fee from consumers in some cases).⁸³

As mentioned above, since July 2012, the tool for additionality of SSC activities has allowed automatic additionality based on a ‘unit threshold’ described as “project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-

⁸³ The organisations that charge a nominal fee would be receiving less than the wholesale cost of the CFL, so would lose money on each bulb even though there is nominal revenue. In theory, any programme implemented by an electric utility should not be able to use simple cost analysis because the utility has avoided power generation costs (and deferred capital costs) that are a benefit stream to the project. Even where the project is implemented by a utility (e.g. South Africa’s Eskom), this is not addressed because the unit threshold positive list is used to justify additionality.

scale CDM thresholds.” For energy efficiency, this threshold of 3000 MWh is roughly 46,000 CFLs. All projects and PoAs applying SSC methodologies may use this rule to qualify for automatic additionality.

Table 4-11: Additionality approaches used by efficient lighting CDM project activities

Additionality approach	Number of PAs	Total Annual CERs (1,000)
Investment barrier: Benchmark Analysis	2	71
Investment barrier: Investment Comparison Analysis	2	60
Investment barrier: Simple Cost Analysis	33	1.079
Investment barrier: Other	1	18
Positive list	2	44
Total	40	1.272

Sources: Authors' own compilation

Lighting PoAs have also made extensive use of this unit threshold for automatic additionality. A report by the UNFCCC Secretariat in mid-2014 (CDM-EB85-AA-A09) found that 28 of the registered lighting-related PoAs at that time had used either micro-scale or unit thresholds to qualify for automatically additionality. As an example, all 12 of the Chinese PoAs registered in December 2012 used the unit threshold for automatic additionality.

As one of the first ‘top-down’ large-scale methodologies, the EB published an energy efficiency lighting methodology in November 2013, which included a new approach for additionality demonstration:

- In countries with limited or no regulations supporting energy efficient lighting, as evidenced by a UNEP Global Lighting Map⁸⁴ survey of regulations and support for energy efficient lighting, CFLs are automatically additional.⁸⁵
- For other countries (i.e. those with more regulatory support), the “Tool for the demonstration and assessment of additionality” must be used, with an investment analysis and common practice analysis. While the investment analysis may still use simple cost analysis (which would mean that almost all projects would be additional), any country with a higher than 20% penetration of CFLs is not additional under the common practice test.

This new approach essentially restricted CFL CDM projects to countries with limited regulatory support or low market penetration. Given that there are no new projects or PoAs entering the pipeline, however, this more recent methodology has not yet had an impact.

In November 2014, AMS II.J was also revised to only allow for automatic additionality for CFLs when there were limited or no regulations to support energy efficient lighting. However, for countries in which there is significant support for energy efficient lighting, the methodology says that additionality should be demonstrated using the latest version of the “Guidelines on the demonstration of additionality of small-scale project activities”. This difference is critical, however, because any project participant may simply use the unit threshold in the “Guidelines on the demonstration of

⁸⁴ <http://map.enlighten-initiative.org/>.

⁸⁵ Countries coloured red on the map have limited or no support for energy efficient lighting.

additionality of small-scale project activities” to guarantee automatic additionality, whatever the market penetration in the host country.

The main concern with the additionality of energy efficient lighting in the CDM is whether some activities – at least projects involving CFLs and fluorescent tubes – were already common practice at the time of registration and therefore not additional. The use of micro-scale or unit threshold positive lists means that project activities and PoAs do not have to address this common practice issue at all when using the SSC methodologies. In other words, using the SSC methodologies would be a way of circumventing the higher stringency of the new large-scale methodology. Projects could simply define the size of each CPA in a way that they qualify as automatically additional, whatever the regulations and market penetration in the host country. To evaluate the additionality of the existing pipeline, it is useful to consider the two criteria from AM0113 and the revised AMS II.J: regulatory support and market penetration.

According to the ‘en.lighten’ initiative’s Global Lighting Map referenced in the methodologies, regulatory support for efficient lighting is widespread, but varies greatly by country (Figure 4-9). For the countries with the most CDM PoA activity, the level of support is generally strong:

- China has already banned incandescent lighting⁸⁶ and implemented large state subsidy programmes since 2006.⁸⁷
- India does not have a ban on incandescent bulbs, but does have awareness-raising programmes, energy service company initiatives, and consumer financing options.
- Pakistan’s minimum energy performance standards also still allow incandescent bulbs, but the country has awareness-raising programmes, bulk procurement and tax incentives.
- South Africa has announced that incandescent bulbs will be phased out by 2016⁸⁸, and has testing and certification facilities. More importantly, the national utility, Eskom, distributed 30 million free CFLs between 2002 and 2010.⁸⁹
- A regional report for Latin America on the en.lighten initiative’s website notes that a Mexican regulation was passed in December 2010 prohibiting the sale of 100 watt and higher incandescent lamps for the residential sector after December 2011, and similar bans for 75 watt as of December 2012 and 40-60 watt as of December 2013.⁹⁰ The Mexican PoA was registered in July 2009, which preceded the passing of these regulations.
- In terms of their rating on minimum energy performance standards by the Global Lighting map, all of the countries with PoAs except Kenya and Malawi are orange (some/in progress) or green (advanced). This means that, in terms of the new large-scale methodology (AM0113), projects in all of the countries except Kenya and Malawi would not be automatically additional, but require the use of the additionality tool with investment analysis and the common practice threshold of 20%.

⁸⁶ Imports and sales of 100-watt-and-higher incandescent lamps are banned from 1 October 2012, 60-watt-and-above from 1 October 2014, and 15 watts or higher from 1 October 2016 http://www.chinadaily.com.cn/china/2011-11/04/content_14039321.htm.

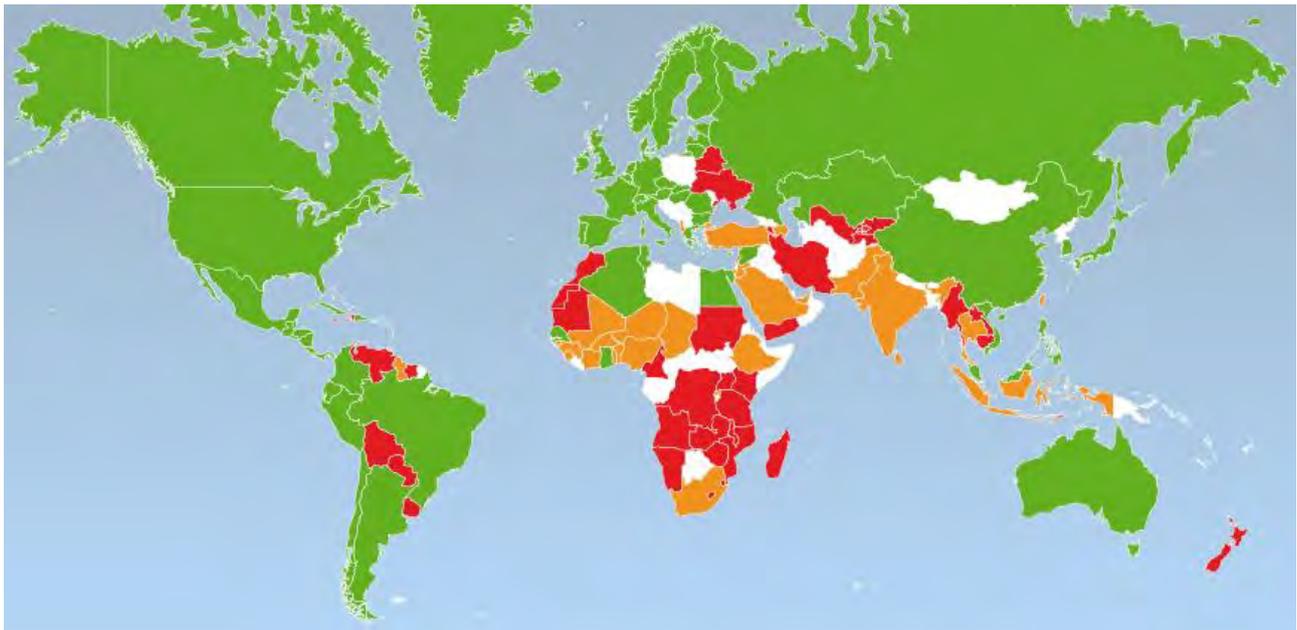
⁸⁷ http://www.sdpc.gov.cn/zjgx/t20080508_210093.htm.

⁸⁸ <http://www.thegef.org/gef/content/phasing-out-inefficient-lighting-combat-climate-change-south-africa-announces-national-phase>.

⁸⁹ http://www.eskom.co.za/OurCompany/SustainableDevelopment/ClimateChangeCOP17/Documents/The_Eskom_National_Efficient_Lighting_Programme_Compact_Fluorescent_Lamps_Clean_Development_Mechanism_Project.pdf.

⁹⁰ <http://www.enlighten-initiative.org/portals/0/documents/country-support/regional-workshops/Regional%20Report%20LA%20&%20C%20Final%20Eng..pdf>. The reference is to regulation “NOM- 028 – ENER – 2010 Energy Efficiency of Lamps for General Use”.

Figure 4-9: Minimum energy performance standards for lighting technologies



Notes: Green = Advanced/in place, Orange=In progress, Red=few/limited, white=no information available

Sources: <http://map.enlighten-initiative.org/>

In terms of assessing common practice, the available evidence suggested that CFLs are likely already common practice in most key CDM countries, and LEDs may be so in the next few years, though not in the poorest countries. The main CDM countries have the following market information:

- According to the “Regional Report on the Transition to Efficient Lighting in South Asia”⁹¹ prepared by the Tata Energy Research Institute in 2014, the market share of CFLs in India amounted to 29% in 2012-2013. Three of the four Indian PoAs were registered in late 2012, while one was registered in early 2010. In addition, for the largest PoA – which was registered in 2010 and has 50 CPAs – the PoA DD states that, “[t]he penetration share of incandescent lamps for lighting in commercial and residential sector put together is thus nearly 80% in India.”⁹² The market share for CFLs, therefore, was almost certainly above 20% when the PoAs were registered.
- In China, a 2012 McKinsey & Company report estimates the penetration of LEDs (the more expensive alternative to CFLs) as 12% in 2011, rising to 46% by 2016. The report also notes that, “CFL is still the dominant technology in the residential segment.”⁹³ This means that, at the time of registration of the PoAs, the market share of CFLs was almost certainly above 20%. China does not have any LED PoAs yet. If they were proposed, AMS II.J and AM0113 both consider LED lamps automatically additional in all countries until at least the end of 2016. Given the McKinsey projections presented above, automatic additionality for LEDs in China would not be appropriate.

⁹¹ <http://www.enlighten-initiative.org/Portals/0/documents/country-support/Regional%20Report%20on%20the%20Transition%20to%20Efficient%20Lighting%20in%20South%20Asia.pdf>.

⁹² <http://cdm.unfccc.int/ProgrammeOfActivities/gotoPoA?id=CZ59J1XMR8K4ELUS6WY3BA01VTGQ2F>.

⁹³ http://www.mckinsey.com/~media/mckinsey/dotcom/client_service/automotive%20and%20assembly/lighting_the_way_perspectives_on_global_lighting_market_2012.ashx.

- The large PoA in Mexico states in the PoA DD that CFL penetration in 2007 was already at 20%, while the PoA was registered in June 2009.⁹⁴
- In South Africa, even before the start of the Eskom free CFL distribution programme, the market share of CFLs was estimated at 7% in 2002 (Nkomo 2005). With 30 million CFLs distributed after this time,⁹⁵ in a country with less than 10 million households, the penetration of efficient lighting was almost certainly well above 20% when Eskom registered their CDM project activity and PoAs in 2012.
- For Pakistan, the “Regional Report on the Transition to Efficient Lighting in South Asia” cited above estimates the CFL market share at 8%, but also notes that linear fluorescent lamps make up 32% of the market.
- For Bangladesh, the same report puts the CFL market share at 25%, with linear tube fluorescent lamps at 18%. This market share could be for 2013 and the PoA was registered in May 2011, so there is a reasonable likelihood that the market share of CFLs was 20% at the time of registration.

This information suggests that the largest CDM PoA countries for energy efficient lighting would not pass the common practice test if the large-scale AM0013 methodology were applied, and so these PoAs would not qualify as additional. Bangladesh, China, India, South Africa and Mexico account for almost 80% of the expected CERs from PoAs, and yet these countries were likely above the 20% market share for CFLs when the PoAs were registered.

For off-grid lighting (AMS III.AR), the situation is quite different. Access to electricity in rural households in Sub-Saharan Africa, for example, is less than 10% (IEA et al. 2010; Legros et al. 2009). Between 2010 and 2015, the estimated number of unelectrified households in Africa was estimated to grow from 110 million to 120 million (Dalberg Global Development Adv. 2010). The off-grid solar lamp market is expanding to address the 1.5 billion people who do not (and, in many cases, will not) have access to electricity (IFC 2012). While solar lantern and solar kit prices are decreasing, they still face major barriers in terms of distribution challenge, upfront costs (and lack of consumer financing), and successful business models for scaling up (ESMAP 2013; IFC 2012).

Assessing the economics of energy efficient lighting faces the classic problem of ‘split incentives’ (Spalding-Fecher et al. 2004). From an economic point of view, upgrades to energy efficient electric lighting are unquestionably economically beneficial (i.e. have large positive IRRs) (McKinsey & Company 2009) but the benefits do not accrue to those who pay for the additional costs if the project is funded by outside agencies. The economics of efficient lighting are more likely to be driven by electricity prices than carbon prices. For example, a 15 W CFL replacing a 60W incandescent lamp operated 3.5 hours per day could save 57 kWh per year. With a relatively carbon-intensive grid (e.g. 0.8 tCO₂/MWh), this would be 0.05 tCO₂e savings per year. Electricity prices to the consumer in developing countries vary widely, from \$50/MWh in heavily subsidized economies to more than \$170/MWh in more competitive emerging economies (EIA 2010; Winkler et al. 2011). This means an energy savings of \$2.87 to \$9.77/year. CFL costs have also declined rapidly, with current costs of \$1.50-\$2.50 in many countries (UNEP 2012). This would mean a typical payback period of much less than one year, before any carbon revenue was received. At current CER prices, carbon revenue would be less than two cents per year only, while at \$3-5/CER, revenue would be \$0.15-0.25, or less than 5% of energy savings.

⁹⁴ http://cdm.unfccc.int/ProgrammeOfActivities/poa_db/17BH6AJX524TYQUZF8KGCWV3OIPSE9/view Annex 3.

⁹⁵ http://www.eskom.co.za/OurCompany/SustainableDevelopment/ClimateChangeCOP17/Documents/The_Eskom_National_Efficient_Lighting_Programme_Compact_Fluorescent_Lamps_Clean_Development_Mechanism_Project.pdf.

In summary, CDM rules on additionality of efficient lighting projects vary considerably. Using market penetration and regulatory support as indicators for the likelihood seems a reasonable approach. The large-scale AM0113 methodology uses market penetration and regulatory support as indicators for demonstrating additionality; this approach seems reasonable and reflects the varying circumstances of host countries. AM0046 may provide for a suitable alternative by monitoring the market penetration of CFLs and LEDs in a control group outside the project boundary; however, the complexity and cost of monitoring under this methodology means that only one project has even chosen to utilise it – so the additionality approaches may not be relevant for the overall impact of this project category. In contrast, under small-scale methodologies, including the revised AMS II.J, this project type is, in practice, considered automatically additional, even if the use of CFLs is required by regulations and is widespread. However, for countries with regulations that have phased out incandescent bulbs or large subsidy programmes for CFLs, these existing registered projects are unlikely to be additional. If we take the 20% market share used in AM0113 as the point at which CFL programmes are no longer likely to be additional, then this would apply to most of the current CDM pipeline for energy efficient lighting.

4.13.4. Baseline emissions

In AMS II.J, AM0113 and AMS II.C (when used for lighting) the baseline is simply the use of the existing incandescent lamps – those which are collected and replaced within the project boundary.⁹⁶ Both AMS II.J and AM0113 take similar approaches, where emissions reductions are related to the difference in power between a CFL and baseline bulb, operating hours, lamp failure rates, a ‘net-to-gross’ adjustment, and the grid emissions factor (taking technical losses into account).⁹⁷ As a default, 3.5 operating hours per day are assumed. If project participants want to use operating hours greater than 3.5 per day, they must conduct a once-off survey at the start of the project to justify this. The lamp failure rates are also based on periodic surveys of the first group of bulbs installed, up to the end of their rated life. The methodologies require project participants to explain how they will collect and destroy baseline lamps. For off-grid lighting, an innovative ‘deemed consumption’ approach assigns a standard emissions reduction to each off-grid lighting unit, based on the fossil fuel alternative. The parameters and assumptions are conservative. Overall, the approaches to baseline emissions for efficient lighting are straightforward and conservative, and the improvements over the last two years have also simplified or clarified many of the sampling procedures.

4.13.5. Other issues

At 3-5 hours of use per day, a typical CFL would last anywhere from 3 to 10 years. This means that a crediting period of 10 years is almost certainly too long, unless the CDM project guarantees free replacements throughout the programme or restricts crediting to the measured life. The latter approach has been adopted under the CDM. Emission reductions do not accrue once the lamp failure rate reaches 100%, so if all lamps fail before the end of the crediting period and are not replaced, then no CERs would be issued. These provisions seem appropriate.

⁹⁶ AM46 also includes the possibility of some efficient lighting in the baseline, as a form of “autonomous efficiency improvement”, but this methodology has only been used once and is unlikely to be used in the future.

⁹⁷ AMS II.C is not so specific, because the guidance was for all energy efficiency technologies, but the approach elaborated by the project participant would essentially be the same.

4.13.6. Summary of findings

Additionality	<ul style="list-style-type: none"> • Granting automatic additionality under small-scale methodologies to all energy efficient lighting programmes in the past was highly problematic because there were large PoAs in countries in which the move away from incandescent bulbs was well underway; the new large-scale AM0113 methodology appropriately addresses these problems but is not mandatory, while the remaining small-scale methodology could still allow for automatic additionality for CFL programmes, so it is unlikely that the large-scale methodology will be used. • In many countries with lower income or less regulatory support, however, efficient lighting still faces major barriers, even if it is potentially economic beneficial, and so projects may need the support of the CDM to be implemented; these projects currently form a very small part of the project pipeline but could grow in the future.
Over-crediting	<ul style="list-style-type: none"> • Over-crediting is unlikely, given the robust monitoring procedures.
Other issues	<ul style="list-style-type: none"> • None

4.13.7. Recommendations for reform of CDM rules

AMS II.J should be revised so that CFL programmes in countries with significant regulatory support may use the tool for “Demonstration of additionality of small-scale project activities” but may not use the paragraph referring to automatic additionality based on small unit size.

5. How additional is the CDM?

Based on the detailed analysis of individual project types in the previous chapter, this chapter provides an overall assessment of the environmental integrity of the CDM project portfolio available for the second commitment period of the Kyoto Protocol. Table 5-1 provides an overview of the summary of findings for each of the analyzed project types.

Table 5-1: Evaluation of project types

Project type	Additionality ¹⁾	Over-crediting ²⁾	Other issues	Overall environmental integrity ³⁾
HFC-23 (up to version 5)	<ul style="list-style-type: none"> Likely to be additional 	<ul style="list-style-type: none"> Risk of perverse incentives 	<ul style="list-style-type: none"> None 	Medium
HFC-23 (version 6)	<ul style="list-style-type: none"> Likely to be additional 	<ul style="list-style-type: none"> Risk of perverse incentives largely addressed Ambitious baseline could lead to under-crediting (net mitigation benefit) 	<ul style="list-style-type: none"> Low CER prices could jeopardize continued operation Emissions could be addressed through Montreal Protocol 	High
Adipic acid	<ul style="list-style-type: none"> Likely to be additional 	<ul style="list-style-type: none"> Most recent methodology could lead to slight under-crediting Leakage could lead to significant over-crediting in times of higher CER prices 	<ul style="list-style-type: none"> None 	Medium
Nitric acid	<ul style="list-style-type: none"> Likely to be additional 	<ul style="list-style-type: none"> Most recent methodologies lead to under-crediting Overall, little risks of overall over-crediting 	<ul style="list-style-type: none"> None 	High
Wind power	<ul style="list-style-type: none"> CER revenue has only limited impact on profitability Investment costs decreased significantly in last years In some cases competitive with fossil generation Support schemes Widespread in many countries 	<ul style="list-style-type: none"> Methodological assumptions may lead to both over- and under-crediting 	<ul style="list-style-type: none"> None 	Low
Hydro power	<ul style="list-style-type: none"> Common practice in many countries CERs have only moderate impact on profitability Competitive with fossil generation in many cases 	<ul style="list-style-type: none"> Methodological assumptions may lead to both over- and under-crediting; over the lifetime of the project likely under-crediting 	<ul style="list-style-type: none"> Methane emissions from reservoirs may be important and may not be fully reflected by CDM methodologies 	Low
Biomass power	<ul style="list-style-type: none"> Significant impact of CER revenues on profitability for projects claiming methane avoidance Competitive with fossil generation in many cases Support schemes 	<ul style="list-style-type: none"> Demonstration of biomass decay/abundance of biomass is key Risk of exaggerated claims of anaerobic decay 	<ul style="list-style-type: none"> None 	Medium

Project type	Additionality ¹⁾	Over-crediting ²⁾	Other issues	Overall environmental integrity ³⁾
Landfill gas	<ul style="list-style-type: none"> Likely to be additional 	<ul style="list-style-type: none"> Default assumptions for the rate of methane captured historically have the potential to overestimate emission reductions Default soil oxidation rates may underestimate emission reductions for uncovered landfills in humid subtropical and tropical regions Perverse incentives for project developers to increase methane generation 	<ul style="list-style-type: none"> Perverse incentives for policy makers not to pursue less GHG intensive waste treatment methods 	Medium
Coal mine methane	<ul style="list-style-type: none"> Likely to be additional 	<ul style="list-style-type: none"> Potential concerns regarding increased mining 	<ul style="list-style-type: none"> Potential perverse incentives to dilute methane in order to avoid that abatement is required by regulations 	Medium
Waste heat recovery	<ul style="list-style-type: none"> CER revenues small compared to fossil fuel cost savings Future fuel cost savings uncertain Widespread in many countries 	<ul style="list-style-type: none"> Brownfield: risks for inflated baselines Greenfield: modelling uncertain Plant operation under the project different to baseline 	<ul style="list-style-type: none"> None 	Low
Fossil fuel switch	<ul style="list-style-type: none"> Use of barrier analysis allowed for small-scale projects not appropriate Investment analysis insufficient as choice of fuel depends not only on prices CER revenues have a small impact 	<ul style="list-style-type: none"> Default values for upstream emissions not appropriate 	<ul style="list-style-type: none"> None 	Low

Efficient cook stoves	<ul style="list-style-type: none"> • CER revenues are insufficient to fully cover project costs • Additionality questionable in urban areas 	<ul style="list-style-type: none"> • Fraction of NRB likely to be overestimated • Water boiling test not appropriate • Emission intensity factors of fossil fuel likely underestimate emissions relative to wood-fuel used in the baseline • Emissions factors used for suppressed demand are unrealistic • Unrealistic assumptions for charcoal use • Over-crediting if traditional stoves continue to be used 	<ul style="list-style-type: none"> • Inconsistent accounting: CDM credits in the same region both reduction and increase of biomass use 	Low
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Project type	Additionality ¹⁾	Over-crediting ²⁾	Other issues	Overall environmental integrity ³⁾
Efficient lighting (AMS II.C AMS II.J)	<ul style="list-style-type: none"> • Shift to EE lighting well underway and/or mandates in most common PoA countries, and PoAs allowed to use SSC additionality 'loophole' 	<ul style="list-style-type: none"> • Unlikely 	<ul style="list-style-type: none"> • None 	Low
Efficient lighting (AM0113, AM0046)	<ul style="list-style-type: none"> • Likely to be additional 	<ul style="list-style-type: none"> • Unlikely 	<ul style="list-style-type: none"> • None 	High

Notes:
 1) High/medium/low likelihood of projects being additional under current rules;
 2) High/medium/low likelihood of avoiding over-crediting under current rules;
 3) High/medium/low likelihood of emission reductions being additional and not over-credited under current rules.

Sources: Authors' own compilation

Overall, the table shows considerable differences between project types. Most energy-related project types (wind, hydro, waste heat recovery, fossil fuel switch and efficient lighting) are unlikely to be additional, irrespectively of whether they involve the increase of renewable energy, efficiency improvements or fossil fuel switch. An important reason that these projects types are unlikely to be additional is that for them the revenue from the CDM is small compared to the investment costs and other cost or revenue streams, even if the CER prices would be much higher than today. In addition, technological progress was much faster than expected, so that investment and generation costs have fallen considerably. Moreover, some project types are, in many instances, economically attractive (e.g. waste heat recovery, fossil fuel switch, hydropower), or supported through policies (e.g. wind power, efficient lighting), or mandatory due to regulations (e.g. efficient lighting). Some of these project types also have a medium likelihood of overestimating emission reductions, mainly due to risks of inflated baselines.

Industrial gas projects (HFC-23, adipic acid, nitric acid) can generally be considered likely to be additional as long as they are not promoted or mandated through policies. They use end-of-pipe-technology to abate emissions and thus do not generate revenues other than CERs. HFC-23 and adipic acid projects triggered strong criticism because of their relatively low abatement costs, which provided perverse incentives and generated huge profits for plant operators. In the case of HFC-

23, perverse incentives were addressed with the adoption of version 6 of AM0001, which uses an ambitious baseline that could lead to a net mitigation benefit. Similarly, concerns with perverse incentives for nitric acid plant operators not to use less GHG-intensive technologies were addressed. With regard to adipic acid projects, the risks of carbon leakage were not addressed.

Methane projects (landfill gas, coal mine methane) also have a high likelihood of being additional. This is mainly because carbon revenues have, due to the GWP of methane, a relatively large impact on the profitability of these project types. However, both project types face issues with regard to baseline emissions and perverse incentives and may thus lead to over-crediting.

Biomass power projects have a medium likelihood of being additional since their additionality very much depends on the local conditions of individual projects. In some cases, biomass power can already be competitive with fossil generation while in other cases domestic support schemes provide incentives for increased use of biomass in electricity generation. However, where these conditions are not prevalent, projects can be additional, particularly if CER revenues for methane avoidance can be claimed. Biomass projects also face other issues, in particular with regard to demonstrating that the biomass used is renewable.

The additionality efficient lighting project using small-scale methodologies is highly problematic because there were large PoAs in countries in which the move away from incandescent bulbs was well underway. The new methodologies address these problems but they are not mandatory and the small-scale methodologies are while the remaining small-scale methodology could still allow for automatic additionality for CFL programmes.

For cook stove projects, CDM revenues are often insufficient to cover the project costs and to make the project economically viable. In urban areas, however, the additionality of these project types is questionable. Cook stove projects are also likely considerably over-estimate the emission reductions due to a number of unrealistic assumptions and default values.

Based on these considerations we can estimate to which extent the CDM is likely to deliver additional emission reductions during the period of 2013 to 2020 (Table 5-2).

Table 5-2: How additional is the CDM?

	CDM projects			Potential CER supply 2013 to 2020		
	Low	Medium	High	Low	Medium	High
	... likelihood of emission reductions being real, measurable, additional					
	No. of projects			Mt CO ₂ e		
HFC-23 abatement from HCFC-22 production						
Version <6		5			191	
Version >5			14			184
Adipic acid		4			257	
Nitric acid			97			175
Wind power	2.362			1.397		
Hydro power	2.010			1.669		
Biomass power		342			162	
Landfill gas		284			163	
Coal mine methane		83			170	
Waste heat recovery	277			222		
Fossil fuel switch	96			232		
Cook stoves	38			2		
Efficient lighting						
AMS II.C, AMS II.J	43			4		
AM0046, AM0113			0			0
Total	4.826	718	111	3.527	943	359

Sources: Authors' own calculations

Our analysis covers three quarters (76%) of the CDM projects and 85% of the potential CER supply during that period. 85% of the covered projects and 73% of the potential CER supply have a low likelihood of ensuring environmental integrity (i.e. ensuring that emission reductions are additional and not over-estimated). Only 2% of the projects and 7% of potential CER supply have a high likelihood of ensuring environmental integrity. The remainder, 13% of the projects and 20% of the potential CER supply, involve a medium likelihood of ensuring environmental integrity.

Has the performance of the CDM in terms of additionality improved over time? Several EB decisions have certainly improved the performance, particularly those which introduced ambitious baselines and/or addressed perverse incentives. However, Schneider (2007) estimated, “that additionality is unlikely or questionable for roughly 40% of the registered projects. These projects are expected to generate about 20% of the CERs”. Schneider’s methodological approach is not identical with the approach applied in this study but is, nevertheless, similar enough for a comparison of the overall results. Compared to earlier assessments of the environmental integrity of the CDM, our analysis suggests that the CDM’s performance as a whole has anything but improved, despite improvements of a number of CDM standards. There are several reasons for this:

- The main reason is a shift in the project portfolio towards projects with more questionable additionality. In 2007, CERs from projects that do not have revenues other than CERs made up about two third of the project portfolio, whereas the 2013-2020 CER supply potential from these project types is only less than a quarter. This is mainly due the registration of many energy projects between 2011 and 2013, including both fossil and renewable projects, which represent the largest share of CDM projects and of potential CER supply today, many of which are unlikely to be additional. It can therefore be questioned whether the CDM is the appropriate incentive scheme for those project types, or more generally, whether these project types are appropriate for crediting schemes at all.

- A second reason is that the CDM EB not only improved rules but also made simplifications that undermined the integrity. For example, positive lists were introduced for many technologies, for some of which the additionality is questionable and some of which are promoted or required by policies and regulations in some regions (e.g. efficient lighting). Another example is biomass residue projects, for which requirements to demonstrate that the biomass is available in abundance were strongly simplified, making an over-estimation of emission reductions more likely.
- A third reason is that the CDM EB did not take effective steps to exclude project types with a low likelihood of additionality. While positive lists were introduced, project types with more questionable additionality were not excluded from the CDM. The common practice test is not effective as it stands. Standardized baselines can be optionally used as an alternative to project-specific baselines, which provides a further avenue for demonstrating additionality but does not reduce the number of projects wrongly claiming additionality. In conclusion, the improvements to the CDM mainly aimed at simplifying requirements and reducing the number of false negatives (projects that are additional but do not qualify under the CDM) but did not address the false positives (projects that are not additional but qualify under the CDM).

Our analysis of the environmental integrity of the CDM has focused on the quality of CERs in terms of ensuring emission reductions that are additional and not over-credited. The overall environmental outcome of the CDM is, however, also influenced by several overarching and indirect effects:

- **Awareness raising and capacity building:** The CDM has drawn attention to climate change and to options of how it can be mitigated and thus contributed to the issue of climate change being better understood and taken more seriously in many parts of the world. In this way it has helped to pave the way towards the global agreement achieved at COP 21 in Paris in December 2015.
- **Technological innovation:** The CDM has helped to spread and reduce costs of many GHG mitigation technologies such as renewable energy technologies or technologies to avoid methane emissions in many developing countries. This may have helped developing countries to avoid locking in carbon-intensive technologies. The increased application of these technologies has contributed to reducing their total cost, and the CDM has contributed to building the capacity on how these technologies can domestically be applied in many developing countries.
- **Length of crediting periods:** Certain projects may continue their operation beyond their crediting period and will not receive credits for the respective GHG reductions. This effect has been estimated to have a significant potential for under-crediting (Spalding-Fecher et al. 2012). However, over time the respective technologies often become economically viable without support and thus the common practice in many circumstances. The CDM may thus have contributed to advancing an investment, which would anyhow be conducted some years later, so that even the additionality of CERs generated in the late years of a crediting period could be questioned.
- **Rebound effects:** For CDM project developers and host countries, CER revenues are similar to subsidies, which often lower the cost of the product or service provided (e.g. electricity, cement, transportation), thereby inducing greater demand for the product or service. In contrast, carbon taxes or auctioning of allowances under the ETS generally provide incentives to reduce the demand for products or services. Calvin et al. (2015) show that ignoring such system-wide rebound effects in the power sector can lead to significant over-

crediting compared to the actual reductions at system level. The overall mitigation outcome of crediting could be systematically over-estimated, even if projects are fully additional and the direct GHG emission impact of a project is quantified appropriately. This is mainly because credits subsidize the deployment of technologies with lower emissions instead of penalising the use of more emitting technologies and because CDM methodologies draw the boundary around a project and do not consider the wider rebound effects.

- **Perverse policy incentives:** In some instances, the CDM may provide an incentive to governments not to implement domestic policies to address emissions. For example, policy makers may have disincentives to introduce regulations requiring the capture of landfill gas or to further pursue landfilling instead of less GHG-intensive waste treatment methods, since they would otherwise lose revenues from CERs.

All these effects somehow influence the environmental outcome of the CDM, partly for the better and partly for the worse. The overall effect can hardly be determined. However, it is unlikely that these overarching and indirect effects fully compensate for the overall low environmental integrity of many projects and CERs. On the contrary, in a forward-looking perspective, comparing the situation in which the CDM continues to be used with a situation in which this would not be the case, it is rather likely that these overarching effects further undermine the environmental outcome of the CDM overall.

The result of our analysis suggests that the CDM still has fundamental flaws in terms of environmental integrity. It is likely that the large majority of the projects registered and CERs issued under the CDM are not providing real, measurable and additional emission reductions. Therefore, the experiences gathered so far with the CDM should be used to improve both the CDM rules for the remaining years and to avoid flaws in the design of new market mechanisms being established under the UNFCCC. In the following chapters we summarise how the existing CDM should be improved (Chapter 6) and what can be learned from the CDM experience for the future of market mechanisms in general (Chapter 7).

6. Summary of recommendations for further reform of the CDM

The recommendations for the further reform of the CDM can be distinguished according to improvements of the general rules and approaches how to determine additionality and to project type-related recommendations.

6.1. General rules and approaches for determining additionality

As mentioned above, for an additionality test to function effectively, it must be able to assess, with high confidence, whether the CDM was the deciding factor for the project investment. However, additionality tests can never fully avoid wrong conclusions. They cannot fully reflect the complexity of investment decisions. Additionality tests always look at part of the full picture and use simplified indicators, such as economic performance or market penetration, to make a judgment on whether or not a project is truly additional. Information asymmetry between project developers and regulators, combined with the economic incentives for project developers to qualify their project as additional, are a major challenge. The key policy question is how confident regulators should be that a project is additional. In other words, how should the number of false positives (projects that qualify as additional but are not) and false negatives (projects that are additional but do not pass the test) be balanced? We assessed the current additionality tests from the perspective that a high degree of confidence is required. The main reason is that the implications of false positives are much more severe than the implications of false negatives. A false positive leads to both an increase in global

GHG emissions and higher global costs of mitigating climate change, whereas a false negative does not affect global GHG emissions but only leads to higher costs of mitigating climate change (Schneider et al. 2014).

In Chapter 3 we thoroughly scrutinised the four main approaches used to determine additionality. Our analysis shows:

- **Prior consideration** is a necessary and important but insufficient step for ensuring additionality of CDM projects. This step works largely as intended (Section 3.1.4).
- The subjective nature of the **investment analysis** limits its ability to assess with high confidence whether a project is additional. It is possible that improvements could further decrease this subjectivity, e.g. by applying more complicated tests to assess the financial performance of the project. However, especially for project types in which the financial impact of CERs is relatively small compared to variations in other parameters such as large power projects, doubts remain as to whether investment analysis can provide a strong 'signal to noise' ratio (Section 3.2.4).
- To reduce the subjectivity of the **barrier analysis**, the '*Guidelines for objective demonstration and assessment of barriers*' require that barriers are monetized to the extent possible and integrated in the investment analysis. As a result of this, the barrier analysis has lost importance as a stand-alone approach of demonstrating additionality. However, barriers which are not monetized remain subjective and often difficult to verify by the DOEs (Section 3.4.4).
- In general, the **common practice analysis** can be considered a more objective approach than the barriers or investment analysis due to the fact that information on the sector as a whole is considered rather than specific information of a project only. It reduces the information asymmetry inherent in the investment and barrier analysis (Section 3.3.4). In this regard, expanding the use of common practice analysis could be a reasonable approach to assessing additionality more objectively. However, the presented analysis shows that the way common practice is currently assessed needs to be substantially reformed to provide a reasonable means of demonstrating additionality. Moreover, when expanding its use, it is important to reflect that market penetration is not a good proxy for all project types for the likelihood of additionality. The fact that few others have implemented the same project type is only an indication of the actual attractiveness. It should thus be only applied to those project types for which market penetration is a reasonable indicator.

Against this background we recommend that

- the **prior consideration** grace period for notification after the start of a CDM project should be shortened from 180 to 30 days to reduce the risk that projects apply for the CDM having only learned about this option after the start of the project,
- the **common practice analysis** is significantly reformed and receives a more prominent role in additionality determination,
- the **investment analysis** is excluded as an approach for demonstrating additionality for projects types for which the 'signal to noise' ratio is insufficient to determine additionality with the required confidence; while for those project types for which investment analysis would still be eligible, project participants must confirm that all information is true and accurate and that the investment analysis is consistent with the one presented to debt or equity funders, and

- the **barrier analysis** is entirely abolished as a separate approach in the determination of additionality at project level (though it may be used for determining additionality of project types); barriers which can be monetized should be addressed in the investment analysis while all other barriers should be addressed in the context of the reformed common practice analysis.

A prerequisite for expanding the use of the common practice analysis is significant improvements of its current shortcomings, most notably with regard to the following issues (Section 3.3.4):

- The project types and sectors covered by the CDM are very different in their technological and market structure. Determining what is deemed to be common practice must take into account these differences. Therefore, the 'one-size-fits-all' approach of determining common practice should be abandoned and be replaced by **sector or project-type specific guidance**, particularly with regard to distinguishing between different and similar technologies (appropriate level of dis-/aggregation) and with regard to the threshold for market penetration, which can have very different implications for the number of projects passing the test, depending on the features of the sectors or project types.
- The **technological potential** of a certain technology should also be taken into account in order to avoid that a project is deemed additional although the technological potential is already largely exploited in the respective country. However, results of studies on the technological potential depend strongly on their assumptions and may thus vary significantly. The exploitation rate should therefore only be considered one criterion among others in determining whether a technology is common practice; it should not form the only decisive criterion.
- The common practice analysis should at least cover the **entire country**. However, to ensure statistical confidence, the control group needs a minimum absolute number of activities or installations. If the observations in the host country do not exceed that minimum threshold, the scope needs to be extended to other countries (e.g. the neighbouring countries or the entire continent).
- Last but not least, all CDM projects should be included into the common practice analysis as a default, unless a methodology includes different requirements.

In addition to the above-mentioned improvements of general approaches for determining additionality, we recommend further improvements to key general CDM rules:

- **Renewal and length of crediting periods:** At the renewal of the crediting period, not merely the validity of the baseline but the validity of the baseline scenario should be assessed for CDM projects that are potentially problematic in this regard. This is the case if the baseline is the 'continuation of the current practice' or if changes such as retrofits could also be implemented in the baseline scenario at a later stage. Crediting periods of project types or sectors that are highly dynamic or complex such as urban transport systems or data centres should be limited to one single period of 10 years maximum. Moreover, generally abolishing the renewal of crediting periods but allowing a somewhat longer single crediting period for project types which require a continuous stream of CER revenues to continue operation (e.g. landfill gas flaring) may also be considered (Section 3.5.4).
- **Positive Lists:** Some of the positive lists are now reviewed regularly, and have a clear basis for determining whether a technology should still be included in the lists. This review of validity should also be extended to project types covered by the microscale additionality tool. In addition, positive lists must address the impact of national policies and measures to

support low emissions technologies (so-called E- policies). For positive lists to avoid the possibility of ‘false positives’ driven by national policies, some objective measure of renewable energy support may be needed as part of the evaluation process. A positive list that included renewables, for example, could be qualified by restricting its applicability to countries that did not have any support policies in place for that specific technology. Finally, to maintain environmental integrity of the CDM overall, positive lists should be accompanied by negative lists (Section 3.7).

- **Programmes of activities:** PoA rules allow that the total project size exceeds the small-scale or micro-scale thresholds while using the automatic additionality provision established for small-scale and micro-scale projects. This may increase the risk of registering non-additional projects. Reform of the CDM rules related to additionality for particular project types (Chapter 4) and positive lists (Section 3.7) will address any concerns about additionality of PoAs (Section 3.6.3). However, as long as these rules are not reformed accordingly, PoA have the potential to boost the number of non-additional project activities and CERs.
- **Standardized baselines:** These were introduced to reduce transaction costs while ensuring environmental integrity. In contrast to the general expectation, they do not increase the environmental integrity of the CDM. On the contrary, as long as they are not mandatory, once established, they lower the environmental integrity because they allow for increasing the number false positive projects. Therefore, their use should be made mandatory. Moreover, all CDM facilities should be included in the peer group used for the establishment of standardized baselines and clearer guidance needs to be provided for DNAs on how to determine the appropriate level for disaggregation. Finally, the practice of using the same methodological approach for the establishment of standardized baselines for all sectors, project types and locations should be abolished (Section 3.8).
- **Consideration of domestic policies (E+/E-):** The risk of undermining environmental integrity through over-crediting of emission reductions is likely to be larger than the creation of perverse incentives for not establishing E- policies. Therefore, adopted policies and regulations reducing GHG emissions (E-) should be included when setting or reviewing crediting baselines while policies that increase GHG emissions (E+) should be discouraged by their exclusion from the crediting baseline where possible (Section 3.9).
- **Suppressed demand:** In many cases, the Minimum Service Levels may be reached during the lifetime of CDM project. However, even if the suppressed demand does lead to some over-crediting, the overall impact is very small. An expert process should be established to balance the risks of over-crediting with the potential increased development benefits. In addition, the application of suppressed demand principles in methodologies could be restricted to countries in which development needs are highest and the potential for over-crediting is the smallest, such as LDCs (Section 3.10).

6.2. Project types

We note that even with ‘perfect’ rules for determining additionality as recommended in Section 6.1, many project types have fundamental problems with this determination. Drawing upon our findings for specific project types (Section 4), this section provides recommendations of which project types should remain eligible in the CDM. In doing so, we not only consider the environmental integrity under current rules, but also whether improvements of general or project type-specific rules could be implemented to ensure overall environmental integrity. We also include other considerations, such as whether the emission sources can be addressed more effectively by other policies.

Industrial gas projects: In contrast to conventional wisdom and their perception in the general public, our analysis shows that industrial gas projects provide for a high or medium environmental integrity. After issues related to perverse incentives have been successfully addressed through ambitious benchmarks, **HFC-23** and **nitric acid** projects now provide for a high degree of environmental integrity. They are very likely to be additional because they involve so-called 'end-of-the-pipe' technologies and do not have significant income other than CERs and because revenues from CERs have a large impact on the economic feasibility. Moreover, they partially use emission benchmarks as baselines which underestimate the actual emission reductions. The methodologies for HFC-23 and nitric acid projects have already been improved in the past and do not require further improvements (Sections 4.2.7 and 4.4.7). For **adipic acid**, the situation is different; this project type is also likely to be additional but concerns about carbon leakage due to high CER revenues have never been addressed. Adipic acid production is a highly globalised industry and all plants are very similar in structure and technology. A global benchmark of 30 kg/t applied to all plants would prevent carbon leakage, considerably reduce rents for plant operators, and allow the methodology to be simplified by eliminating the calculation of the N₂O formation rate (Section 4.3.7). Industrial gas projects provide for low cost mitigation options. Under current rules, HFC-23 and adipic acid projects may generate large rents for plant operators. These emission sources could therefore also be addressed through domestic policies, such as regulations or by including the emission sources in domestic or regional ETS, and help countries achieve their NDCs under the Paris Agreement. For example, China is introducing a domestic results-based finance policy aiming at incentivising HFC-23 emissions reductions. Parties to the Montreal Protocol also consider regulating HFC emissions. We therefore recommend that HFC-23 projects are not eligible under the CDM. A transition to address these emissions domestically may also be supported by bilateral or multilateral initiatives of (results-based) carbon finance.

Energy-related project types: Our analysis suggests that many energy-related project types provide for a low likelihood of overall environmental integrity, particularly **wind and hydropower** (Sections 4.5.7 and 4.6.7), **fossil fuel switch** (Section 4.11.7) and **supply-side energy efficiency project** types such as **waste heat recovery** (Section 4.10.7). The main reason for this assessment is that CER benefits are often relatively small compared to fuel cost savings, so that the impact of CER revenues on the economic feasibility is marginal (Section 2.4). Many projects are also supported through other policies, such as feed-in tariffs for renewable electricity or emerging ETSs. The costs for renewable power technologies are decreasing rapidly. In our assessment, the potential for addressing additionality concerns through improved tests are rather limited for these project types. Many projects are economically viable and even an improved investment analysis or common practice test may not be suitable to clearly distinguish additional from non-additional projects. We therefore recommend **that these project types should be no longer eligible in principle** under the CDM. However, in least developed countries, some project types, particularly wind and small-scale hydropower plants, may still face considerable technological and/or cost barriers (Section 4.5.3). These project types may thus remain eligible in least developed countries.

We recommend that some other energy-related project remain eligible if methodologies are improved. **Biomass power projects** can be competitive with fossil generation technologies under certain but not all circumstances. In cases in which power generation from biomass is not competitive with fossil generation technologies, CER revenues can have a significant impact on the profitability of a project, particularly if credits for methane avoidance are claimed as well. In these cases, the demonstration of abundance of biomass as well as of the claim that biomass is left to decay is key for avoiding any over-crediting of emissions. We therefore recommend that only biomass power projects avoiding methane emissions remain eligible under the CDM provided that the corresponding provisions in the applicable methodologies are revised appropriately (Section 4.7.7).

With regard **demand-side energy efficiency** project types with distributed sources – **cook stoves** and **efficient lighting** – we have identified concerns which question their overall environmental integrity. However, environmental integrity concerns could be addressed if cook stove methodologies were revised considerably, including more appropriate values for the fraction of non-renewable biomass (Section 4.12.7), and if approaches for determining the penetration rate of efficient lighting technologies as already established in AM0113 were made mandatory for all new projects and CPAs under these project types and the older methodologies were withdrawn (Section 4.13.7). As CER revenues can have a considerable impact and as barriers persist these projects, we recommend that they should remain eligible, subject to the improvements recommended.

Methane projects: Landfill gas and **coal mine methane** projects are likely to be additional. However, there are concerns in terms of over-crediting, which should be addressed through improvements of the respective methodologies, particularly by introducing region-specific soil oxidations factors and by requesting DOEs to verify that landfilling practices are not changed (Sections 4.8.7 and 4.9.7). For both project types, the CER revenues have a considerable impact on their economic performance. With regard to landfill gas, an important concern is that continued incentives for landfilling could delay the implementation of more sustainable waste management practices, such as recycling or composting. We therefore recommend that this project type only be eligible in countries that have policies in place to transition to more sustainable waste management practices.

Table 6-1 summarises our recommendations for the specific project types assessed above.

Table 6-1: CDM eligibility of project types

Project type	Environmental integrity under current rules	Environmental integrity if rules were improved	Recommendations
HFC-23	Medium / High	High	Not eligible
Adipic acid	Medium	High	Eligible (with benchmark of 30 kg / t AA)
Nitric acid	High	High	Eligible
Wind power	Low	Low	Not eligible
Hydropower	Low	Low	Not eligible
Biomass power	Medium	Medium / High	Eligible (projects avoiding methane emissions)
Landfill gas	Medium	Medium / High	Eligible (subject to transition arrangements)
Coal mine methane	Medium	Medium / High	Eligible
Waste heat recovery	Low	Low	Not eligible
Fossil fuel switch	Low	Low	Not eligible
Efficient cook stoves	Low	Medium / High	Eligible
Efficient lighting	Low / High	Medium / High	Eligible

Sources: Authors' own compilation

7. Implications for the future role of the CDM and crediting mechanisms

In this section, we consider the implications of our analysis for the future role of the CDM and crediting mechanisms generally. We situate these implications not only in the context of the CDM but also the Paris Agreement and draw general conclusions for the design of international crediting mechanisms under the Paris Agreement as well as crediting policies established at national level.

The CDM has provided many benefits. It has brought innovative technologies and financial transfers to developing countries, helped identify untapped mitigation opportunities, contributed to technology transfer and may have facilitated leapfrogging the establishment of extensive fossil energy infrastructures. The CDM has also helped to build capacity and to raise awareness on climate change. It also created knowledge, institutions, and infrastructure that can facilitate further action on climate change. Some projects have provided significant sustainable development co-benefits. Despite these benefits, after well over a decade of considerable experience, the enduring limitations of GHG crediting mechanisms are apparent.

- Firstly, and most notably, the elusiveness of additionality for all but a limited set of project types is very difficult, if not impossible, to address. Our analysis shows that many CDM project types are unlikely to be additional. Information asymmetry between project participants and regulators remains a considerable challenge. This challenge is difficult to address through improvements of rules. Further standardisation can be helpful for reducing transaction costs but has a limited scope, particularly within the CDM, for resolving additionality concerns. The scope for added standardisation is limited by the number of amenable project types and the wide variation of conditions across CDM host countries. Standardisation approaches have been most successful in regional crediting programs such as California or

Australia, where they have focused on a limited number of suitable and largely non-energy project types, such as landfills or coal mines.⁹⁸ The overall integrity of the CDM could only be improved significantly if the mechanism were limited to those project types that have a high likelihood of providing additional emission reductions. In our assessment, this would require excluding most of the current CDM project types and focusing mainly on projects that abate other GHGs than CO₂.

- Secondly, international crediting mechanisms involve an inherent and unsolvable dilemma: either they might create perverse incentives for policy makers in host countries not to implement policies or regulations to address GHG emissions – since this would reduce the potential for international crediting – or they credit activities that are not additional because they are implemented due to policies or regulations. This well-known dilemma has been discussed by the CDM EB without a resolution.
- Thirdly, for many project types, the uncertainty of emission reductions is considerable. Our analysis shows that risks for over-crediting or perverse incentives for project owners to inflate emission reductions have only partially been addressed. It is also highly uncertain how long projects will reduce emissions, as they might anyhow be implemented at a later stage without incentives from a crediting mechanism – an issue that is not addressed at all under current CDM rules.
- A further overarching shortcoming of crediting mechanisms is that they do not make polluters pay but rather subsidize the reduction of emissions. This lowers the cost of the product or service, inducing rebound effects that are not considered under CDM rules and that lead to over-crediting. Most of these shortcomings are inherent to using crediting mechanisms, which questions the effectiveness of international crediting mechanisms as a key policy tool for climate mitigation.

It should be noted that the results of the analysis provided here for the CDM are to a large extent also relevant and valid for other international carbon offset or crediting programs, such as the Japanese Joint Crediting Mechanism (JCM), the Climate Action Reserve (CAR), the Verified Carbon Standard (VCS) or the Gold Standard (GS). The results are also relevant for the mechanisms to be implemented under Article 6 of the Paris Agreement, any mechanism to be used for compliance under the Carbon Offset and Reduction Scheme for International Aviation (CORSIA) and to a certain extent for the Joint implementation (for an overview see Kollmuss et al. 2015a). Even though the programs differ in many aspects, generally speaking, the CDM has been the origin and the role model for these offset programs. In particular, the CDM's approaches to additionality testing and baseline setting have served as the main blueprint for most other programs. With the aim of reducing transaction costs, rules and methodologies for additionality that have been borrowed from the CDM have been simplified, which did not generally strengthen their environmental integrity. Therefore, the issues raised here in the context of the CDM will remain relevant for other international offset programs.

The future role of crediting mechanisms should be revisited in the light of the Paris Agreement. The CDM in its current form will end with the conclusion of the second commitment period of the Kyoto Protocol. Several elements of the CDM could, nevertheless, be used when implementing the mechanism established under Article 6.4 of the Paris Agreement or when implementing (bilateral) crediting mechanisms under Article 6.2. However, the context for using crediting mechanisms has fundamentally changed. The most important change to the Kyoto architecture is that all countries have to submit NDCs that include mitigation pledges or actions. As of 15 December 2015, 187

⁹⁸ <http://wupperinst.org/en/projects/details/wi/p/s/pd/377/>.

countries, covering around 95% of global emissions in 2010 and 98% of global population, have submitted NDCs (CAT 2015). Many mitigation pledges in NDCs cover economy-wide emissions or large parts of the economy. This implies that much of the current CDM project portfolio will fall within the scope of NDCs.

The Paris Agreement requires countries to adjust their reported GHG emissions for international transfers of mitigation outcomes in order to avoid double counting of emission reductions. This implies that the baseline, and therefore additionality, may be determined in relation to the mitigation pledges rather than using a 'counterfactual' scenario as under the CDM, and that countries could only transfer emission reductions that were beyond that which they had pledged under their NDCs. Double counting can occur, *inter alia*, if the same emission reductions are accounted by both the host country – as reflected in its GHG inventory – and the country using these credits towards achieving its mitigation pledge. Avoiding such double counting could imply that host countries will have to add internationally transferred credits to their reported GHG emissions if the emission reductions fall within the scope of their mitigation pledges. This has several important implications.

Firstly, issuing and transferring credits that do not represent additional emission reductions or are under- or over-credited has other implications for global GHG emissions. Under the Kyoto Protocol, non-additional CDM projects or over-crediting increase global GHG emissions, whereas under-crediting from additional projects provides a net mitigation benefit. The implications are different and more complex when the emission reductions fall within the scope of the NDC of the host country: they depend on whether the credited activities are additional, whether they are over- or under-credited, the ambition of the mitigation pledge of the host country, *i.e.* whether or not it is below BAU emissions, and whether the emission reductions are reflected in the host country's GHG inventory⁹⁹ (Kollmuss et al. 2015b). Compared to the situation in which international transfers of credits would not be allowed, global GHG emissions could not be affected, decrease or increase due to the transfer of credits, depending on the circumstances. For example, if the host country has an ambitious NDC, non-additionality and over-crediting may not necessarily increase global GHG emissions because the country would have to reduce other GHG emissions to compensate for the adjustments to its reported GHG emissions. For the same reasons, under-crediting would not necessarily lead to a global net mitigation benefit. Additionality and over-crediting mainly matter when host countries have weak mitigation pledges above BAU emissions.

A second important implication relates to the incentives for host countries to ensure integrity and participate in international crediting mechanisms. If mitigation pledges are ambitious, host countries might be cautious to 'give away' non-additional credits. To achieve its mitigation pledge, the host country would need to compensate for exports of non-additional credits, by further reducing its emissions. Host countries with ambitious and economy-wide mitigation pledges would thus have incentives to ensure that international transfers of credits are limited to activities with a high likelihood of delivering additional emission reductions. However, our analysis showed that only a few project types in the current CDM project portfolio have a high likelihood of providing additional emission reductions, whereas the environmental integrity is questionable and uncertain for most project types. For those project types with a high likelihood of additionality, the potential for further emission reductions is limited and it is unclear whether host countries would be willing to engage in crediting for this 'low-hanging fruit' mitigation potential. The experience with Joint Implementation showed that most credits originated from countries with 'hot air', *i.e.* where the emission pledge is less ambitious than BAU emissions, while the potential for crediting was quite limited in countries

⁹⁹ Some emissions reductions may not be reflected in the country-wide GHG inventory, for example, because the country uses simple Tier 1 methods to estimate an emissions source which do not account for the emission reductions achieved through CDM projects or because the reductions occur in a sector that is not covered by the host country's GHG inventory.

with ambitious mitigation targets, also due to overlap with other climate policies (Kollmuss et al. 2015b). In conclusion, this suggests that the future supply of credits may mainly come either from emission sources not covered by mitigation pledges or from countries with weak mitigation pledges. In both cases, host countries would not have incentives to ensure integrity and credits lacking environmental integrity could increase global GHG emissions.

At the same time, demand for international credits is also uncertain. Only a few countries, including Japan, Norway and Switzerland, have indicated that they intend to use international credits to achieve their mitigation pledges. An important source of demand could come from the market-based approach pursued under the International Civil Aviation Organization (ICAO), and possibly from an approach pursued under the International Maritime Organization (IMO). For these demand sources, avoiding double counting with emission reductions under NDCs will be a challenge that is similar to that of avoiding double counting between countries.

A number of institutions are exploring the use of crediting mechanisms as a vehicle to disburse results-based climate finance without actually transferring any emission reduction units. This way of using crediting mechanisms could be more attractive to developing countries; they would not need to add exported credits to their reported GHG emissions, as long as the credits are not used by donors towards achieving mitigation pledges. The implications of non-additional credits are also different: they would not directly affect global GHG emissions, but could lead to a less effective use of climate finance, which could indirectly increase global GHG emissions compared to using the available resources more effectively. However, donors of climate finance aim to ensure that their funds be used for actions that would not go ahead without their support. They need to show that their investments *'make a difference'*. Given the considerable shortcomings with the approaches for assessing additionality, we recommend that donors should not rely on current CDM rules to assess the additionality of projects considered for funding.

Some countries pursue domestic crediting policies. South Korea allows companies to convert CERs from Korean projects into units eligible under its domestic emissions trading system. The Chinese and California-Quebec ETS allow the use of credits from domestic offsetting projects. Mexico, South Africa and Switzerland are pursuing policies that allow using domestic credits to meet tax or other obligations (see also the paragraph above on other offsetting programs). In these cases, using non-additional credits has no direct implication on global GHG emissions but will increase the country's costs towards achieving its NDC. In the long run, this provides incentives for these countries to limit crediting to project types with a high likelihood of additionality. However, meeting the ambitious long-term climate change mitigation goals of the UNFCCC and the Paris Agreement requires much stronger action and a rapid bridging of the emissions gap (UNEP 2015). It is hard to imagine that such ambitious goals could be achieved on a global level in a timely manner without a sharing of effort or burdens that could encompass some form of transfer of mitigation outcomes and/or results-based climate finance.

Taking into account this context and the findings of our analysis as well as other evaluations, we recommend that policy makers revisit the role of crediting in future climate policy:

- **Moving towards more effective climate policies:** We recommend focusing climate mitigation efforts on forms of carbon pricing that do not rely extensively on credits, and on measures such as results-based climate finance that do not necessarily serve to offset other emissions. If well designed, emission trading systems and carbon taxes have several advantages over crediting mechanisms: they do not require additionality to be assessed or hypothetical baselines to be set but rather rely on information on actual emissions for which information asymmetry is more manageable; in principle, they make the polluter pay rather than providing subsidies; and they expose all regulated entities to a carbon price, enabling

up-scaled, sector-wide emission reductions. We recommend that international crediting mechanisms play a limited role after 2020 to address specific emission sources in countries that do not have the capacity to implement broader climate policies. Crediting should not be further pursued as a main tool for GHG mitigation.

- **Fundamental and far-ranging changes to the CDM:** To enhance the integrity of international crediting mechanisms such as the CDM and to make them more attractive to both buyers and host countries with ambitious NDCs, we recommend limiting the mechanism to project types that have a high likelihood of delivering additional emission reductions. We recommend reviewing methodologies systematically to address risks of over-crediting, as identified in this report. We further recommend revisiting the current approaches for additionality, with a view to abandoning subjective approaches and adopting more standardized approaches where possible. We also recommend curtailing the length of the crediting periods with no renewal. A larger question is whether the UNFCCC and CDM processes can create the consensus needed to make the fundamental changes needed to improve the integrity of the CDM in significant ways.
- **Purchase of CERs:** We recommend potential buyers of CERs to limit any purchase of CERs to either existing projects that are at risk of stopping GHG abatement ('vulnerable projects') or the few project types that have a high likelihood of ensuring environmental integrity. Continued purchase of CERs should be accompanied with a plan and support to host countries to transition to broader and more effective climate policies that ensure GHG abatement in the long-run. Purchase of CERs could also be used to deliver results-based finance in this context. Further, we recommend pursuing the purchase and cancellation of CERs, as a form of results-based climate finance, rather than using CERs for compliance towards meeting mitigation targets.
- **Mechanisms under Article 6 of the Paris Agreement:** Given the high integrity risks of crediting mechanisms, we recommend that Parties consider provisions that provide strong incentives to the Parties involved to ensure integrity of international transfers of mitigation outcomes. This includes robust accounting provisions, inter alia, to avoid double counting of emission reductions, but should also extend to other elements, such as comprehensive, transparent and ambitious mitigation pledges as a prerequisite to participating in international mechanisms.

In conclusion, we believe that the CDM had a very important role to play, in particular in countries that were not yet in a position to implement domestic climate policies. However, our assessment and other evaluations confirm the strong shortcomings inherent to crediting mechanisms. With the adoption of the Paris Agreement, implementing more effective climate policies including international cooperative actions becomes key to bringing down emissions quickly to a pathway consistent with well below 2°C. Our findings suggest that crediting approaches should play a time-limited and niche-specific role, where additionality can be relatively assured, and the mechanism can serve as stepping-stone to other, more effective policies to achieve cost-effective mitigation. In doing so, continued support to developing countries will be key. We recommend using new innovative sources of finance, such as revenues from auctioning of ETS allowances, rather than international crediting mechanisms, to support developing countries in implementing their NDCs.

8. Annex

8.1. Representative samples of CDM projects

8.1.1. Task

The population consists of 7,418 CDM projects which have 4 characteristics (location, technology, size, time), from which representative samples for three additionality approaches (investment analysis, barrier analysis and common practice analysis) should be drawn. One challenge consists of the fact that the additionality approaches are not directly known before the analysis. After some preliminary analyzes, we decided on a two-step approach.

1. Draw a representative sample with regard to all strata of the 4 characteristics of size 300. The additionality approaches are determined for the projects in this sample.
2. Draw sub-samples from the projects belonging to each of the three additionality approaches, which are representative for the strata of the 4 characteristics, as they occur for the projects of each additionality approach. The sub-samples shall consist of 50 projects each, which are to be further divided into one 30-project sample and two 10-project samples. The 30- and 10-project sample should each be representative of the strata and combine to the 50-project sample.

8.1.2. Approach

The challenge consists of the fact that the small sample sizes lead to less than one draw for many strata. In a first step, therefore, a randomised procedure is necessary to identify the strata from which to draw, such that the frequencies of the strata are best preserved from the population to the samples.

Drawing the 300-project sample

1. Randomly select strata from which to draw
 - a) Calculate the target number of draws for each stratum as (stratum frequency) (population size) (sample size). These are decimal numbers and often below.

In order to obtain an integer number of draws for a stratum, discretise its corresponding target number to the enclosing integers, e.g. 2.1 is randomly assigned either 2 or 3, where the probability of the assignment of the higher enclosing integer is weighted with $(\text{target number})^{(\text{lower enclosing integer})}$. In the example, the probability that 2.1 becomes 3 is therefore weighted with $2.1^2 \approx 0.1$. The number of target numbers assigned to the higher enclosing integer is determined such that the sum of all assigned lower enclosing integer and all assigned higher enclosing integer is as close as possible to the rounded sum of all respective target numbers.

For example, assume 3 target numbers between 2 and 3, namely (2.1, 2.3, 2.9). Their rounded sum is 7. Drawing twice from two strata and three times from one strata yields the targeted 7 total draws. The third strata with the target number 2.9 has the highest chance of being chosen for the three draws.

- b) Strata with 0 frequency in the population have of course 0 frequency in the samples as well.
2. Randomly draw from the strata with the discretised target numbers of the previous steps.

Drawing sub-samples of the 300-project sample with the added additionality approach information

From the 300-project sample, we extract the projects that belong to each additionality approach, yielding three sub-samples. From each of these sub-samples, we draw samples of 50 projects, which are representative with regard to the strata of the 4 characteristics in the respective sub-sample. We employ the same approach as for drawing the 300-project sample (Section 2.1).

These three samples of 50 projects are ordered with respect to the strata of the 4 characteristics. Then we extract two sub-sets of 10 projects, one consisting of the 1st, 6th, 11th, 15th... project, the second consisting of the 3rd, 8th, 13th, 18th... project of the ordered sample. The 30-project sample consists of the remaining projects. This ensures that the strata within the 50-project sample are preserved in the smaller samples as well as possible.

8.1.3. Samples

Investment analysis: 69, 544, 1436, 1906, 2007, 2075, 2229, 2525, 3068, 3490, 3703, 4042, 4317, 4657, 5047, 5659, 5661, 5707, 5757, 6052, 6899, 7073, 7185, 7843, 7974, 8057, 8523, 8615, 8801, 9002

1875, 2315, 3033, 3186, 3799, 4600, 4687, 5843, 7024, 7551, 8903

1795, 2931, 4817, 5555, 6173, 6440, 7540, 8291, 8818, 8821

Barrier analysis: 244, 348, 582, 644, 1053, 1408, 1578, 1738, 2180, 2561, 3174, 3191, 3639, 3739, 3856, 4468, 4478, 4508, 4748, 5099, 5749, 5961, 6012, 6302, 6636, 7242, 7392, 7651, 8680, 9419

534, 831, 937, 1151, 1827, 2098, 4147, 5234, 7595, 8319

544, 2077, 2975, 3393, 4089, 5888, 6246, 7578, 8927, 9100

Common practice analysis: 69, 1227, 1602, 1737, 2007, 2075, 2098, 2109, 2302, 2315, 3068, 3186, 3642, 3670, 3799, 4687, 5006, 5359, 5659, 5843, 6173, 6553, 6899, 7648, 7936, 8125, 8140, 8506, 8636, 9699

588, 2486, 3994, 4317, 6440, 7400, 8093, 8505, 8523, 8879

366, 544, 1661, 1875, 3703, 4042, 4310, 5487, 7494, 8818

8.2. Information on suppressed demand in CDM methodologies

Table 8-1: Information on suppressed demand in CDM methodologies

Meth No.	Definition of baseline technology	Definition of MSL	Definition of baseline activity level
ACM0014	Methane Correction Factor of 0.4 for domestic wastewater	None	Project activity level (i.e. quantity of wastewater treated)
AMS I.A	Allows AMS I.L approach	Allows AMS I.L approach	Project activity level (i.e. quantity of electricity consumed)
AMS III.AR	Fossil fuel powered lamp	3.5 hrs per day x 2 CFL lamps (240 lux)	Deemed savings with fossil fuel lamp to match MSL, with annual growth in kerosene consumption
AMS II.G	Mix of fossil fuel cooking technologies	None	Project activity level (i.e. quantity of biomass saved)
AMS III.F	Unmanaged waste disposal with > 5m depth (methane Correction Factor of 0.8)	MSL is having a waste disposal site	Project activity level (i.e. quantity of waste converted to compost)
AMS I.E	Mix of fossil fuel cooking technologies	None	Project activity level (i.e. quantity of renewable energy used)
ACM0022	Unmanaged waste disposal with < 5m depth (methane correction factor of 0.4)	MSL is having a waste disposal site	Project activity level, although project proponent may propose another baseline
AMS I.L	Kerosene pressure lamp for lighting; car battery for appliances; diesel generator for larger loads	240 lux for lighting (50 kWh/yr using CFL), 195 kWh/yr for other appliances	Project activity level (i.e. quantity of electricity consumed) but with emissions factor of baseline technology
AMS III.BB	Kerosene pressure lamp for lighting; car battery for appliances; diesel generator for larger loads	240 lux for lighting (50 kWh/yr using CFL), 195 kWh/yr for other appliances	Project activity level (i.e. quantity of electricity consumed) but with emissions factor of baseline technology
AMS III.AV	Fossil fuel or non-renewable biomass to boil water (only requires justification if share of total population without access to improved drinking water is > 60%)	No minimum, but sets maximum level of 5.5 litres per person-day for crediting	Project activity level (i.e. quantity of water purified by project), but capped at 5.5 litres per person per day

Sources: Authors' own compilation

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**Measuring Emissions Against an Alternative Future:
Fundamental Flaws in the Structure of the Kyoto Protocol's
Clean Development Mechanism**

Barbara Haya
Energy and Resources Group
University of California, Berkeley
bhaya@berkeley.edu

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Executive Summary

The Kyoto Protocol's Clean Development Mechanism (CDM) enables industrialized countries to partially meet their emissions reduction targets by reducing emissions in developing countries. An appeal of the CDM is its perceived efficiency as a market mechanism. The CDM theoretically creates value for carbon reductions and allows the market to find the cheapest reductions anywhere in the world. A key challenge to the environmental integrity of the CDM is filtering out business-as-usual, or "non-additional," projects. The CDM should only generate carbon credits from activities beyond business-as-usual. Each business-as-usual project that is allowed to generate carbon credits under the CDM will permit an industrialized country to emit more than their Kyoto targets by paying developers in developing countries to do what they were doing anyway rather than actually reducing emissions. The poor quality of the arguments and evidence used to prove project additionality in CDM application documents, and the resulting large-scale registration of non-additional projects, have been well documented. Proposals for reforming the CDM range in scope, from making the CDM's rules stricter and/or more objective, to a more fundamental shift away from project-based offsetting.

This paper examines the possibility of improving the CDM's environmental integrity and effectiveness as a project-based offsetting mechanism by studying how the CDM is working in practice in the Indian power sector. It is based on interviews conducted in India during 2004 and 2009 with over 80 CDM and renewable energy professionals involved in CDM project development, including project developers, consultants, validators (hired to audit each project applying for CDM registration), carbon traders, bank employees, government officials, members of the CDM governance panels, and others involved in renewable energy and hydropower development in India. It also draws on analysis of the UNEP Risoe CDM project database, and analysis of documents from 70 CDM projects comprising all of the large (over 15 megawatt) wind, hydro, and biomass projects registered in India since 2007 and the 20 most recently registered hydro projects in China. This paper presents the following findings:

- The majority of CDM projects are "non-additional" and therefore do not represent real emissions reductions.
- A reasonably accurate project-by-project filter for non-additional projects is infeasible.
- The need to test project additionality, which is inherently difficult and inaccurate, adds uncertainty and time to the CDM application process, compromising its effectiveness in supporting truly additional projects.
- Beyond the problems with additionality testing, the structure of project-based offsetting leads to the over-generation of credits and limits its ability to reduce emissions.
- The large-scale use of offsetting hinders global efforts to mitigate climate change in the coming decades.

The following is a section-by-section summary of the analysis in this paper on which these findings are based.

Widespread opinion in India that the CDM is not working

It is the widely held belief among CDM and renewable energy professionals in India that many if not most CDM projects are non-additional and that the CDM is having little effect on renewable

energy development in the country. At least twelve developers and consultants told me that the CDM projects that they proposed would have been built regardless of the CDM. Many more developers and consultants responded to my probings with general statements that very few CDM projects are additional. Validators, tasked with auditing CDM additionality claims, believe that additionality testing procedures are subjective and can be manipulated, with many “knobs you can turn.” Several validators suggested ways to lessen the manipulation, but did not believe that it is possible to prevent it. It is commonly understood in India that banks are not taking carbon credits into account in their lending decisions due to the uncertainties associated with CDM registration and carbon credit revenues. Interviewees commonly made statements such as: CDM revenues are just “cream on the top”; developers decide to build projects “on their own terms” rather than based on the small and uncertain financial benefit from carbon credit sales; and “any project can be registered under the CDM.”

If business-as-usual projects are registering under the CDM, we would expect to see evidence of manipulation and fraud as developers seek to prove that their projects require CDM revenues to go forward when in fact they do not. Indeed, evidence of fraud was surprisingly easy to find. A murmur of agreement went through the audience at a carbon markets conference in Mumbai when a panelist mentioned that board minutes documenting early consideration of the CDM in decisions to build projects are being forged and post-dated. One CDM consultant told me that he presented two sets of investment analyses to a bank for a single project – one for the CDM application showing that the project would not be financially viable without carbon credits, and a second for the loan application showing that the project is financially viable on its own. Only one of the seventeen large wind CDM projects in India that make their financial assessments publicly available uses and correctly calculates the tax benefits offered to wind power developers by the Indian government.

An accurate project-by-project additionality test is infeasible

The “investment analysis” is the means for demonstrating project additionality that is viewed as having the most potential to accurately test project additionality if it is made more rigorous. The investment analysis presumes that it is possible to accurately predict whether a project would be built based on the sign (positive or negative) of a single number – the difference between the expected financial returns from the proposed CDM project and a benchmark defining the boundary between viability and lack of viability for that project type. If the returns are below the benchmark, the project would not likely be built; above it, it would. One indication that the investment analysis has been inaccurate is that just under half of the 29 Indian projects examined in this analysis that make their financial assessments publicly available calculate financial returns below the benchmark even with carbon credit income. This predicts that the projects would not have been built even with income from carbon credit sales. Yet all of these projects were still built.

The main challenge to implementing an accurate investment analysis is that developers have incentives to choose the benchmark and project cost and revenue inputs that show that their proposed CDM project is additional, so that when a range of values is possible, the values are suspect. Analysis of financial assessments for wind and biomass projects in India reveals assumptions that can be varied within reasonable ranges to change the expected financial returns

of the projects more than the amount that the returns are above or below the benchmark. Even the best cases for an investment analysis – wind projects in India in which all of the main inputs into the financial assessment are typically documented in formal agreements before project construction starts – still have room to vary assumptions (for example the tariff after the end of the power purchasing agreement) within ranges equivalent to the effect of the carbon credit sales. For the investment analysis to be accurate even at this level, supply and loan agreements would need to be signed before the start of the CDM application process. For most other project types there is even more room for manipulation of cost inputs. For example, assumptions about future biomass prices affect the expected financial returns much more than carbon credits do for biomass projects purchasing biomass from neighboring farms.

Large hydropower in India is inappropriate for additionality testing for several reasons. First, large hydropower development is decided by a government planning process and involves a wide range of considerations that are not easily predicted. Second, the per-kilowatt hour tariff provided to large hydropower producers is calculated periodically on a cost-plus basis to ensure that the producer receives a pre-agreed return on their equity investment. The investment analysis is meaningless in this context. Third, financial assessments have not been a good predictor of hydropower development in the past, nor have they been a good predictor of actual project costs. Affecting most project types is the lack of a single accurate benchmark since project development decisions can be based on multiple factors and project risk assessment is inherently subjective. This analysis suggests that an accurate project-by-project additionality test is infeasible for most projects and another means for determining which projects are worthy of receiving international support through international climate change agreements is required.

The CDM has little influence on project development

While additionality testing is not very effective in preventing non-additional projects from registering under the CDM, the need to conduct a test that is inherently imprecise and subjective limits the ability of the CDM to support truly additional projects. The CDM's ability to influence the decisions of developers, lenders and investors is compromised by a combination of the length of time it takes to validate and register a proposed CDM project (seventeen and a half months on average for projects registered over the last two years) and the uncertainties associated with CDM validation and registration and carbon credit issuance.

Developers are not waiting to make sure that their projects are successfully validated or registered under the CDM before deciding whether to build their projects. Three-quarters of all registered CDM projects were operational by the time they were registered as CDM projects. Construction on 17 of the 70 projects reviewed in this analysis began before the Kyoto Protocol entered into force in February 2005 and before the first project was registered under the CDM in November 2004. Two of these projects were registered within the last year. Developers do not seem to view a positive validation or CDM registration as helpful in acquiring project financing. Developers of 66 of the 70 projects started the CDM validation process around the time of or after the beginning of project construction.

It is likely that most of these developers did not make their decisions to go forward with their projects based on the expectation of CDM income because of the substantial uncertainties

associated with CDM revenues. Uncertainties include the possibility that the project would not pass validation or be accepted for CDM registration, fluctuating carbon credit prices, and uncertainties about the value carbon credits will have post-2012. A large proportion of the risk, time and complexity of the CDM application process is because of additionality testing.

Beyond additionality, the fundamental structure of the CDM leads to the over-generation of credits and limits its ability to reduce emissions

Looking beyond additionality testing, the structure of project-based offsetting in a number of other ways contributes to the generation of more credits than actual reductions and limits its influence on emissions. The CDM should result in reductions in emissions in developing countries at least as large as the credits it generates. Therefore, since each CDM project is allowed to produce carbon credits for its full lifetime, defined either as a single 10-year period or 21 years (3 consecutive 7-year periods) without retesting additionality, the CDM should only support projects that would not have been built for 10 or 21 years without the CDM.

Hydropower, wind and other low-carbon electricity generation technologies are generally developed in order of their cost effectiveness. A preferred support mechanism would accelerate the development of all of these plants rather than change the order in which they are built. The CDM as it is currently structured could work in one of two ways. It could support a portfolio of projects that would not otherwise have been built for more than a decade, a portfolio of unattractive projects, enabling less attractive projects to be built before more attractive ones. Alternatively, the CDM could accelerate the building of all plants, generating more credits than the emissions actually avoided. Neither is a good option.

The CDM can only fund activities for which it is believed that emissions reductions can be reasonably estimated. Therefore, the CDM is unable to support many measures that are needed or are more cost effective for the deployment of technologies and the decarbonization of sectors but for which it is especially difficult to measure emissions reductions, such as policy, research and development, demonstration projects, and information dissemination. A long-standing criticism of the CDM is that it may create perverse incentives for governments not to implement climate-friendly policy in order to maintain a high baseline against which domestic facilities can prove additionality and generate carbon credits.

The large-scale use of offsetting credits hinders global efforts to mitigate climate change

Scenarios put forward by the Intergovernmental Panel on Climate Change (IPCC) suggest that a reduction in carbon emissions in industrialized countries by 25% to 40% below 1990 levels by 2020, on a path towards 80% to 95% reductions by 2050, will still result in a 2.0-2.4 degree Celsius temperature increase. The large quantities of offsets being proposed for use by industrialized countries post-2012 would put them far away from these reduction pathways, hindering global mitigation efforts in the coming decades.

Any offsetting mechanism in developing countries, whether it is project- or sector-based, involves measuring emissions against an alternative business-as-usual growth scenario and therefore the quantity of emissions reduced is inherently uncertain. Further, the use of large quantities of offsets in one commitment period makes it harder for industrialized countries to

accept meaningful reductions in the next, since industrialized countries will be more dependent on the uncertain availability of credits through the carbon market to meet deepening targets. If industrialized countries are to use the quantities of offset credits they propose post-2012, the majority of global reductions over the next ten years will occur in developing countries. Industrialized countries are therefore committing either to steeper annual reductions in the future, or to long-term inequalities in emissions between the North and the South. Both options make future cooperation more difficult. Major shifts in high emitting sectors in industrialized countries require time to allow for changes in behavior and in support industries, for experimentation and learning, adapting technologies to diverse local contexts, research, development and deployment. The use of offsets postpones these processes in industrialized countries. We live in a globalized world with a widely shared linear view of development and progress. Deep in urban and rural India, visions of “development” and symbols of high status are heavily influenced by images of lifestyles in the global North. In a world dominated by a single vision of progress, the vision of progress that we are striving towards must be sustainable. Ultimately, promoting low-carbon development in the South requires demonstrating it in the North.

The way forward

Our inability to accurately measure the emissions reduced by individual projects, compounded by the large-scale use of offsetting credits by industrialized countries to meet their reduction commitments, risk substantially undermining the effectiveness of the post-2012 climate change regime and our ability to control global greenhouse gas emissions. Any offsetting mechanism included post-2012 will need to:

- include an alternative means for targeting projects and activities without testing additionality on a project-by-project basis, a process which is essentially subjective and inaccurate;
- be predictable, providing certain benefits to those depending on it; and
- be small in the context of deeper Annex 1 targets.

The first point is practically difficult, the third, politically difficult. We have seen little indication that countries will agree to an offsetting mechanism that is small enough and targeted enough, with conservative enough baselines, to preserve its environmental integrity, and the environmental integrity of the whole agreement. Attention must be refocused on reductions in countries with emissions caps, with non-credited support for mitigation efforts in developing countries.

Measuring emissions against an alternative future: fundamental flaws in the structure of the Kyoto Protocol's Clean Development Mechanism

Abstract

Proposals for reforming the Clean Development Mechanism (CDM) range in scope, from making the CDM's rules stricter and/or more objective, to a more fundamental shift away from project-based offsetting. Interviews conducted in India during 2004-2009 on how the CDM is working in practice in India's electricity sector, an analysis of the project documents from 70 registered CDM projects in India and China, and analysis of the UNEP Risoe CDM project database together indicate fundamental limitations to improving the outcomes of the CDM within its basic structure as a project-based offsetting mechanism. I find: (1) The majority of CDM projects are "non-additional" (would have gone ahead regardless of support from the CDM) and therefore do not represent real emissions reductions; (2) Due to the subjectivity inherent in project development decisions, a reasonably accurate filter for non-additional projects is infeasible; (3) The need to test project additionality, which is inherently difficult and inaccurate, adds uncertainty and time to the CDM application process, compromising its effectiveness in supporting truly additional projects; (4) Beyond the problems with additionality testing, the fundamental structure of the CDM leads to the over-generation of credits and limits its ability to reduce emissions; (5) Taking a step back, the large-scale use of carbon credits generated in developing countries by industrialized countries to meet their emissions targets hinders global efforts to mitigate climate change over the next decades. Both the large-scale use of offsetting to meet industrialized country targets and the continuation of project-based offsetting risk undermining the ability of global climate change agreements to control greenhouse gas emissions.

1. Introduction

Industrialized countries have two sets of obligations under current international climate change agreements: to reduce their own emissions, and to support climate change mitigation and adaptation in developing countries. The Kyoto Protocol's Clean Development Mechanism (CDM) is critical for meeting both sets of obligations. The CDM in principle allows industrialized countries to invest in projects in developing countries that reduce emissions, and use the resulting emissions reduction credits towards their Kyoto Protocol targets. Any project registered under the CDM is able to produce carbon credits, called certified emissions reductions, or CERs, totaling the estimated tons of CO₂-equivalent emissions avoided by the CDM project. The CDM is the most used of the Kyoto Protocol's "flexibility mechanisms," which are meant to lower compliance costs by allowing industrialized countries to partially meet their emissions targets through reductions outside of their own borders. It is also the main instrument under current climate agreements supporting climate change mitigation in developing

countries, currently passing around three billion Euros per year to developers of low-emitting projects in developing countries.¹

A key regulatory challenge of the CDM is calculating the emissions reduced by a single project. This requires comparing the emissions from the project with emissions from a counterfactual scenario of what would likely have happened without the CDM project. The biggest challenge in determining the counterfactual baseline scenario is assessing whether the project itself is in that counterfactual scenario, or in other words, if the proposed CDM project would have gone ahead anyway, without the expected revenues from the CDM. The CDM should only generate credits from activities beyond business-as-usual (BAU), since any carbon credits generated by BAU CDM projects allows an industrialized country to emit more than their Kyoto targets by paying developers in developing countries to do what they were doing anyway, rather than actually reducing emissions. Each project applying for CDM registration must demonstrate their “additionality,” that the project would not likely have gone forward had it not been for the expected CDM income.

Another key regulatory challenge of the CDM relates to the nature of the market it creates. A common appeal of the CDM is that it is a market mechanism meant to create a global market for emissions reductions, lowering the cost of compliance by allowing industrialized countries to reduce emissions wherever in the world it is least expensive to do so. In practice, the CDM does not create a market for emissions reductions. It creates a market for emissions permits, since it is the permit to emit that is the primary interest of most CER buyers, as they seek low cost options of complying with domestic climate regulations. For the most part, neither the buyer nor the seller of CDM credits is primarily concerned with emissions reductions, such that neither have a strong interest in ensuring the environmental benefit represented by the permits sold. In addition, these permits to emit are wholly human created, numbers in databases, such that no extra cost is incurred from producing more permits. CDM project proponents not only have little incentive to protect the environmental integrity of the permits, they have a financial interest to exaggerate the number of carbon credits generated by CDM projects. Therefore, the integrity of this market in terms of emissions reductions relies almost entirely on effective regulation. These features – the buyer is unconcerned with the quality of the underlying physical thing represented by the wholly human-made tradable asset – are also features of many of the financial instruments whose deregulation in the US caused the current global financial crisis, reminding us of the importance of regulation for markets to function. As mentioned above, the market in CDM credits is especially difficult to regulate because it involves calculating emissions reductions against a hypothetical scenario, and most importantly, determining if the project itself is a part of that scenario.

The poor quality of the arguments and evidence used to prove project additionality under the CDM have been well documented (Michaelowa & Purohit 2007, Schneider 2007). Schneider (2007) concludes that “for about 40% of the registered CDM projects additionality is unlikely or questionable.” Wara and Victor (2008) estimate that bona fide emissions reductions compose “only a fraction of the real offsets market,” based on a range of evidence including the high proportions of hydropower, wind and natural gas power plants being built in China that are in the CDM pipeline, despite China’s active promotion of these technologies. Various proposals have been put forward for controlling the number of carbon credits generated by business-as-usual

¹ The CDM projects currently registered under the CDM would produce 319 million tons of CERs a year if they meet the expectations in their PDDs (Fenhann J. 2009. October 1, CDM Pipeline Overview. UNEP Risø Centre. <http://www.cdmpipeline.org/>). Primary CER prices are currently around 10 Euro per CER.

projects. Many of these involve continuing the CDM in its current form, and improving the rigor of its additionality test (some of the ideas put forward by Schneider 2009, and by Wara & Victor 2008).

This paper explores how the CDM is working in practice in the Indian power sector. It examines the proportion of CDM projects that are non-additional, and how effective the CDM is at supporting truly additional projects. It also considers whether it is possible to substantially improve the outcomes of the CDM within its current structure as a project-based offsetting mechanism. This paper also explores how the substantial use of offsets purchased from reductions made in developing countries currently being proposed by most industrialized countries post-2012 might help or hinder global efforts to control greenhouse gases to levels needed over the next forty years.

This paper presents the following findings:

- The majority of CDM projects are “non-additional” and therefore do not represent real emissions reductions.
- A reasonably accurate project-by-project filter for non-additional projects is infeasible.
- The need to test project additionality, which is inherently difficult and inaccurate, adds uncertainty and time to the CDM application process, compromising its effectiveness in supporting truly additional projects.
- Beyond the problems with additionality testing, the structure of project-based offsetting leads to the over-generation of credits and limits its ability to reduce emissions.
- Taking a step back, the large-scale use of offsetting hinders global efforts to mitigate climate change in the coming decades.

In what follows, section 2 provides background information on the current state of the CDM and how it works, as well as why our ability to effectively filter out non-additional CDM projects has implications for the success of the global climate change regime. Section 3 describes the methods used in this analysis. Section 4 delves into the analysis with stories from my research interviews indicating widespread skepticism among CDM and renewable energy professionals in India regarding the impacts the CDM is having and describing instances of fraud used to demonstrate project additionality. This is followed by analyses of the feasibility of substantially improving the CDM’s additionality testing procedures (section 5) and how effective the CDM is in supporting truly additional projects (section 6). Stepping away from additionality testing, section 7 presents a number of other ways that the CDM structure leads to the over-generation of credits and compromises the CDM’s ability to reduce emissions. Taking one more step back, section 8 asks if it is helpful or harmful to long-term international cooperation for industrialized countries to use large amounts of offset credits towards their near-term targets. Finally, I discuss alternatives to the current CDM in a post-2012 climate change regime.

2. Background

2.1 How the CDM works

Developers of low-carbon projects in developing countries can submit their projects to the CDM Executive Board (EB) for CDM registration. An application for CDM registration includes a Project Design Document (PDD), a validation report from an independent validator, and a letter of approval from the host country government. The PDD gives a detailed description

of the project, including an estimation of the emissions that it will reduce following an accepted “methodology” for doing the estimation, and evidence that the project is additional. The developer must hire a certified third party auditor, called a validator,² to validate that the project meets all of the requirements of the CDM. After a project is approved by the CDM Executive Board, the developer chooses how often to submit requests for the issuance of CERs. Typical end buyers of CERs are governments of and regulated facilities in countries that have Kyoto Protocol targets. Often the first buyers of CERs from the developer are intermediary companies that trade in carbon credits. The developer can choose to enter into a CER purchasing agreement with a buyer before or after credits are generated. Figure A-1 in the Appendix presents the key steps in the process of registering a project under the CDM and applying for CER issuance.

2.2 The current state of the CDM

As of October 1, 2009 there were a little over 1,800 registered CDM projects, and another 2,800 proposed CDM projects in the validation process. The total number of registered CDM projects is presented by country in Figure 1, and by type in Figure 2. China and India host 60% of all registered CDM projects, with few projects registered in Africa and in many other smaller developing countries. 31% of all registered CDM projects are renewable energy projects and 27% are hydropower projects. Non-CO₂ gas projects make up 4% of all registered CDM projects but are expected to produce 61% of the credits generated through 2012 because of their relatively high potency as greenhouse gases, if all projects were to produce the amount of credits predicted in their PDDs (see Figure 3).

2.3 The *Additionality Tool*

The “Tool for the demonstration and assessment of additionality,”³ is the most common method used for proving the additionality of proposed CDM projects. The *Additionality Tool* requires developers to demonstrate the additionality of their proposed CDM project by an investment analysis, a barrier analysis, or a combination of both.

- The investment analysis is based on the idea that that carbon credit revenues improve the financial returns of projects, making losing or marginally profitable projects viable. It assesses the financial returns of the proposed project, most commonly in terms of project or equity internal rate of return (IRR).⁴ A benchmark is defined that represents the threshold financial returns, or hurdle rate, defining whether the project would go forward. If the expected financial returns are below the benchmark, then it is assumed that the project most likely would not have gone forward without carbon credits and the project is considered additional. It is optional to show that CERs bring the financial returns of the project above the benchmark.
- The barrier analysis describes and presents evidence for the existence of one or several barriers that prevent the proposed CDM project from going forward without the additional income from carbon credit sales.

² A validator is also called a Designated Operational Entity, or DOE.

³ The *Tool for the demonstration and assessment of additionality*, and a version of this tool that is combined with a baseline identification methodology - *Combined tool to identify the baseline scenario and demonstrate additionality* - can be found here: <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

⁴ Internal rate of return (IRR) is the discount rate that would be applied to the cash flow of a project so that the net present value of the project is zero. A higher IRR indicates better financial returns.

Figure 1: Registered CDM projects by host country

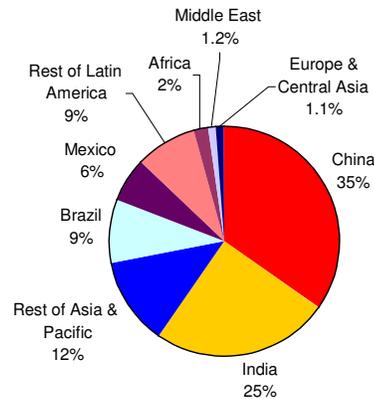


Figure 2: Registered CDM projects by type

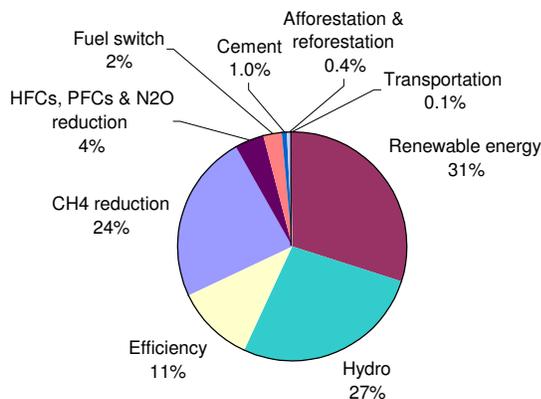
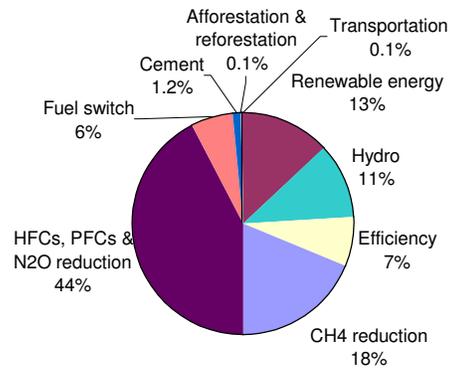


Figure 3: Expected CERs through 2012 from registered CDM projects by type



2.4 Why we should be concerned about additionality

Certainly additionality is a challenge for any climate mitigation program. Estimation of emissions reduced by policies, programs, and projects is often highly inexact in a complex world in which there are multiple influences on behavior and industrial and consumer choices. International funds that pool contributions to support emissions reduction projects in developing countries, the main alternative to crediting mechanisms, could also end up supporting activities that would have happened anyway. There is an important difference between crediting mechanisms and funds in this regard. When a fund supports a BAU project, it fails to reduce emissions through that project; when the CDM supports a BAU project, it also, in effect, weakens an industrialized country target by the amount it claimed to have reduced in the developing country. Secondly, the various risks involved with distributing funds to projects is more transparent. Proponents of project-based offsets commonly assume that emissions

reductions from individual projects can be measured accurately enough. The complex and technical nature of the CDM, and a general trust in the efficiency of market mechanisms, masks the uncertain nature of measuring emissions reductions in an offset program. To have a high likelihood of keeping global temperatures below a two degrees increase, substantial efforts are needed in both industrialized and developing countries. Industrialized countries need to both substantially reduce their own emissions and support mitigation in developing countries. To the extent that CERs are over-credited to CDM projects, the CDM fails in both regards at the same time.

3. Methods

The analysis in this paper is based on over 80 interviews conducted in India during 2004 to 2009, an analysis of project documents from 70 CDM projects registered in India and China, and analysis of the UNEP Risoe CDM project database containing information about all projects currently registered under the CDM and in the application process.⁵ I interviewed individuals involved in CDM project development in various capacities (mostly in India), including project developers, CDM consultants, validators (hired to audit projects applying for CDM registration), carbon traders, employees from banks lending to renewable energy projects, government officials, and members of the CDM governance panels, as well as others involved in renewable energy and hydropower development in India. Some interviews were carried out in the interviewees' offices, and some involved less formal discussions in carbon and climate conferences.

I also analyzed the additionality arguments used to register 70 projects. These projects comprise all of the large (over 15 megawatt (MW)) wind, biomass, and hydro projects registered in India since 2007 and the 20 most recently registered hydro projects in China. The specific analyses performed are described below in the paper sections alongside their results. These four projects types are among the most numerous in the CDM pipeline (see Table 1) and together represent one third of projects (registered and in the validation process). I chose to review only "large" projects since the additionality testing procedures for projects above 15 MW are more rigorous than for "small" projects. I chose to review only projects registered from 2007 because additionality testing was weaker in 2005-6, and has gradually been strengthened with various guidances.

Table 1: Projects analyzed

	Projects analyzed	Total projects in CDM pipeline	
Wind in India	20	320	7%
Biomass in India	16	297	6%
Hydro in India	14	130	3%
Hydro in China	20	819	18%
TOTAL	70	1566	33%

⁵ UNEP Risoe CDM/JI Pipeline Analysis and Database, October 1st, 2009 <http://www.cdmpipeline.org/>

This paper focuses on CO₂ reduction projects, for which CDM credits are typically one among several project benefits, and improve project financial returns by a relatively small amount. Renewable energy, hydropower, coal and natural gas projects, and many efficiency projects are all CO₂ reductions projects, which compose approximately 72% of all registered CDM projects (see Figure 3). In contrast, CERs are often the sole revenue source from HFC and N₂O reduction projects, making these projects more likely to be additional. However, these industrial gas projects pose other problems documented elsewhere (Wara 2007, Wara & Victor 2008) and discussed in brief with the fourth finding of this paper.

4. Wide-spread opinion in India that the CDM is not working

It is the widely held belief among CDM and renewable energy professionals in India that many if not most CDM projects are non-additional and that the CDM is having little effect on renewable energy development in the country. Research for this paper started in the summer of 2004 when I was told by managers of three sugar factories in India that their sugar mill cogeneration plants, being proposed as CDM projects, would be or would have been, built without the CDM. Each manager told the arguments they were using to demonstrate that their projects were additional, even though they had told me they were planning to build the projects regardless of CDM funding. They treated the additionality proof as a bureaucratic hoop they had to jump through to access this funding source, a sentiment repeated often in later interviews.

Since those early interviews, at least nine more developers and consultants told me that the CDM projects that they proposed would have been built anyway, without the CDM. It was surprising how easy it was to find developers who would say this, given their interest in defending the additionality claims in their CDM application documents. Many more developers and consultants responded to my probings with general statements that very few CDM projects are additional. The strongest evidence that a project is non-additional is the admission of developers themselves.

Interviewees commonly made statements such as: CDM revenues are just “cream on the top”; developers decide to build projects “on their own terms,” not based on the small and uncertain change in IRR from carbon credit sales; “any project can be registered under the CDM.” Validators, tasked with auditing CDM additionality claims, believe that current additionality testing procedures are subjective and can be manipulated. One validator described the many “knobs you can turn” to change the results of the financial analysis. Several validators suggested ways to lessen the manipulation, but did not believe that it is possible to prevent it. It is commonly understood in India that banks are not taking carbon credits into account in their lending decisions, due to the uncertainties associated with CDM registration and CER revenues. Representatives from three banks that lend to renewable energy projects confirmed that the CDM is having no or very little effect on their lending decisions. At a carbon markets conference in 2007 in Mumbai, a carbon buyer in the audience criticized a panelist for saying that it is possible to prove the additionality of just about any project. The buyer went on to say that he could agree to the panelist’s statement if they were chatting at a bar, but that the panelist should not make such statements in a public forum where he could be quoted.

If business-as-usual projects are registering under the CDM, we would expect to see evidence of manipulation and fraud as developers seek to prove that their projects require CDM

revenues to go forward when in fact they do not. Indeed, evidence of fraud was surprisingly easy to find in project documents and to hear about in the halls of carbon conferences and workshops.

A murmur of agreement went through the audience at the carbon markets conference in Mumbai when a panelist mentioned that board minutes documenting early consideration of the CDM in the decision to build proposed CDM projects are being forged and post-dated. One validator proudly told me how he discovered one of these forged documents. One CDM consultant told me that he presented two sets of investment analyses to a bank for a single project – one for the CDM application showing that the project would not be financially viable without carbon credits, and a second for the loan application showing that the project is financially viable on its own.

In India, wind power is generally considered a good investment, due in large part to tax benefits offered by the central government. India offers wind power developers the ability to take 80% depreciation for wind project capital costs in the first year of operation along with a 10-year tax holiday. 25 large wind projects totaling 1,600 MW of wind power in India are registered under the CDM. 17 of these use an investment analysis to prove additionality, make the analysis spreadsheet publicly available, and were registered since 2007. The project design documents for each of these 17 projects proves additionality by showing that the project is not financially viable without CER sales revenues. Only one of these projects includes the full tax benefits provided by the government in their financial assessments. This one project uses an unrealistically low estimate of the amount of electricity to be generated by the project.⁶ Only 6 of the other 16 projects justify their failure to account for the full tax benefits offered by the government. They claim that the depreciation benefits are not useful to the developer because of their low profits.⁷ But this claim is not credible for all of these projects.⁸

5. An accurate project-by-project additionality test is infeasible

The poor quality of the *CDM Additionality Tool's* barrier analysis and investment analyses being used to prove project additionality has been well documented (Michaelowa & Purohit 2007, Schneider 2009). These two studies describe how barriers used are highly subjective, not credible, poorly documented, or are so general that they are common to a wide range of CDM and non-CDM projects. Investment analyses leave out or do not document important values affecting the feasibility of the project. Another example of the poor quality of additionality testing is how IRR analyses for wind projects in India commonly leave out or incorrectly calculate the tax benefits provided to these projects described above. Many of these problems could be avoided by stricter standards for additionality arguments and evidence and more rigorous validation requirements. But the question still remains, could additionality testing be made substantially more accurate with stricter standards? That is, are there reasonably accurate and auditable indicators of the decisions of developers, lenders and investors? I

⁶ CDM project titled *22.5 MW grid connected wind farm project by RSMML in Jaisalmer* uses a plant load factor of 16% when the average plant load factor in the state was later determined to be 19% according to a wind project consultant.

⁷ I learned about this problem from Axel Michaelowa.

⁸ For example, the largest of the projects is a 468 mw wind project on three wind sites in Tamil Nadu state in southern India, with 209 separate owners. The investment analyses for this set of projects does not include depreciation benefits. It is very likely that at least some, if not all, of the owners chose to invest in wind in part to avail of the depreciation tax benefits.

examine the ability to test the additionality of wind, biomass and hydropower projects in India. This analysis starts with a brief discussion of the barrier analysis but focuses on the investment analysis, considered to have the higher potential for being accurate, if made more rigorous.

5.1 Barrier analysis

The CDM *Additionality Tool's* barrier analysis presents barriers, often described in terms of risks, which prevent a project from going forward. The CDM can offset those risks by improving the expected returns from the project. The PDDs reviewed that use the barrier analysis, either alone or with the investment analysis, list barriers facing the project, and then as required by the *Additionality Tool*, describe an alternative to the project is not prevented by those barriers.

The most common barriers cited in the reviewed PDDs by project category are: Hydro in India: water flow uncertainty, difficult terrain, small private sector developer new to the power industry; Wind in India: regulatory uncertainty regarding the amount and timing of tariff payments; Biomass in India: technological risks due to little experience in India with the technology, lack of skilled manpower, risk that the electricity utility would lower the tariff; Hydro in China: water flow uncertainty, electricity demand uncertainty during the flooding season, tariff uncertainty, increased investment cost due to new government rehabilitation policies.

It is certainly feasible that any of these risks could be important enough to prevent the developer from going forward with the project without the ability to sell carbon credits. It is also completely feasible that such project risk would not prevent the project from being built. Certainly many projects have been developed with these barriers, but without the help of the CDM.

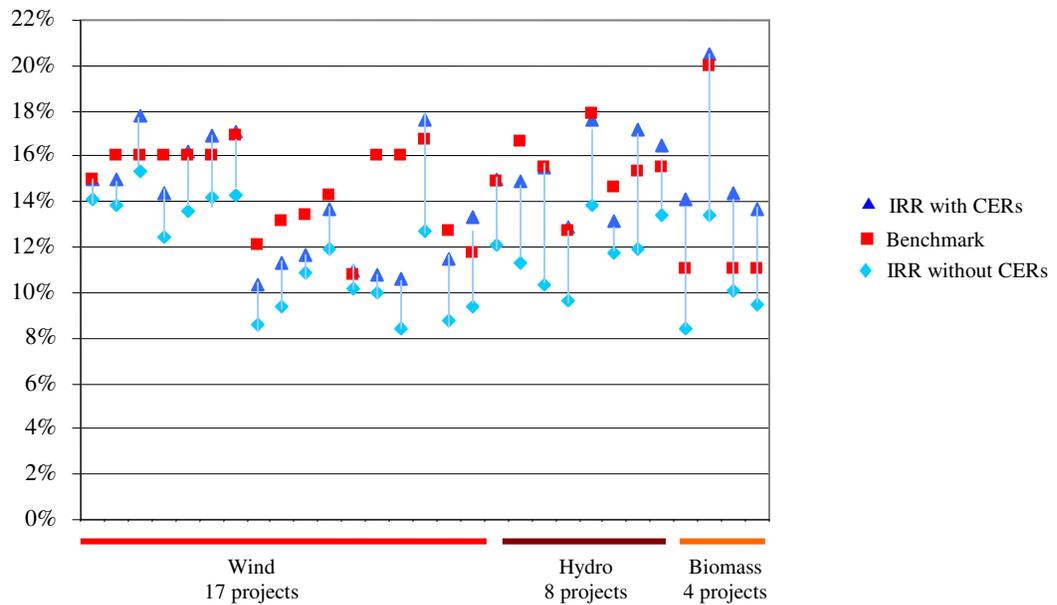
Typically the validator positively validates the project if there is documented evidence that (1) the stated barrier exists and (2) it is significant. They judge if it is feasible that the barrier could have prevented the project from going forward, not that there is a high likelihood that it actually did.

An example might illustrate the subjectivity inherent to the barrier analysis. One of the barriers used to prove the additionality of Patikari Hydro Electric Power Project in India was the difficult terrain where the project is developed posing challenges to project construction. The validation report notes that the validator asked the developer to “provide documentary evidence that these investment barriers are particular to this project activity and not general risks associated with all hydro projects in mountainous regions.” The developer provided a geo-technical report depicting the poor nature of the terrain that might result in the caving in of the tunnel. This report was accepted by the validator as evidence of the existence of this barrier. It is certainly feasible that the risk of tunnel collapse could be important enough to prevent the developer from going forward with the project at its without-CER returns. Or it could be possibly that this risk did not affect the final decision. The validator does not seek to answer that question, for there is little evidence that could document the deliberations of the project developer. Such evidence would be needed for the barrier analysis to be accurate.

5.2 Investment analysis

The investment analysis presumes that it is possible to accurately predict whether a project would be built from the sign (positive or negative) of a single number – the difference between the expected returns from the proposed CDM project and the benchmark. If the returns are below the benchmark, the project would not be built, above it, it would. For illustration, Figure 4 shows the results of the benchmark analysis all of the Indian projects examined for this paper that use the investment analysis to prove additionality and which estimate both with- and without-CER financial returns. Most of the projects analyzed for this paper that use the investment analysis use project or equity IRR as the financial indicator and show with- and without-CER IRRs sitting on either side of the benchmark.

Figure 4: Benchmark investment analysis for all Indian projects analyzed
In chronological order of registration date for each type



It is important to keep in mind that the financial assessment is of a proposed project for which many of the costs and revenues are future projections. The investment analysis indicates additionality only to the extent that developers are unable to choose values to get the desired result – a without-CER result below the benchmark, and a with-CER result above it. That is, it is accurate to the extent that each expected cost and revenue input into the financial returns calculation for the proposed project is a unique and determinable value; and it is accurate to the extent that there is a single benchmark that verifiably tests a decision to go forward with a project. Developers have incentives to choose the benchmark and project cost and revenue inputs that show that their proposed CDM projects are additional, so when a range of values is possible, the values are suspect.

In India, CERs improve the IRRs of wind projects by 0.8% - 4.9% with most between 1.7% and 2.7%. For hydropower the gain is 3% - 5.2%, and the four biomass projects that use the investment analysis show an increase in IRR of 4.2%, 4.3%, 5.7% and 7.1%. These

investment analyses argue that by improving project IRRs by these amounts, the CDM is able to make non-viable projects viable. Therefore, if a developer is able to vary the assumptions that go into the investment analysis enough to lower the expected IRR or raise the benchmark by these amounts, they can show that some viable projects are non-viable in order to demonstrate that they are additional. The rest of this section examines the extent to which the benchmark and IRR assessments can be manipulated by amounts similar to the expected CDM benefits.

Notable in the above Figure 4 are fourteen projects (just under half) that have with-CER IRRs below the benchmark, some by several percentage points. Yet each of these projects was built. This means that the investment analysis was wrong for each of these projects, since it predicted that these projects would not be built even with CDM revenues. This indicates that something is wrong with the investment analysis or the way it is being performed.

Wind projects

Wind in India is a best case for an accurate investment analysis because of the structure of the industry. As described above, wind power is generally considered a good investment in India in large part because of the tax benefits offered by the central government. As a result of these benefits, a common organizational arrangement for wind development involves an agreement between two sets of actors: a wind manufacturer who identifies and secures a site with good wind resources, and single or multiple investors, most often profitable businesses and wealthy individuals who are relatively unfamiliar with the energy industry but wish to avail of the depreciation tax benefits. The manufacturer typically takes full technical responsibility for the project, signing a supply agreement with the investor for the sale of the wind turbines and land, plant construction, and operations and maintenance.

All of the main costs of the project to the investor are typically well documented in the formal supply agreement prior to construction. In addition, this supply agreement often contains a high-end estimate for the amount of electricity the wind turbine is expected to generate to make the project look attractive to the investor. This high-end figure provides a good conservative choice from the perspective of additionality testing. Also, the tariff for the first ten, thirteen or twenty years of the project is signed into a power purchasing agreement with the utility buying the power. The loan interest rate would be documented in a loan agreement.

An analysis of the seventeen available investment analysis spreadsheets for large registered wind projects in India reveals several undocumented assumption that the developer can include from within a range of reasonable values. Most wind developers sign power purchasing agreements (PPAs) with a state electricity utility for ten or thirteen years, leaving the per kilowatt-hour (kwh) tariff unknown after the end of the PPA period. Most of the seventeen wind investment analyses analyzed here assume that the post-PPA tariff will remain the same after the last year of the PPA. Four assume a substantial drop in the post-PPA tariff. If these projects had instead assumed the post-PPA tariff remained constant after the end of the PPA their IRRs would have been 0.7%, 0.9%, 2.0% and 2.2% higher. Lowering the post-PPA tariffs of the other projects by one rupee per kwh, less than three of the four projects that assume a drop, lowers the IRRs of the projects by 0.5% to 2.2%. Table A-1 in the Appendix describes this analysis in more detail.

Second, one project was validated and registered with a deration rate on the assumed production of electricity. The deration rate represents a decline in the amount of electricity generated by the turbine over time as the turbine ages. Without the deration rate the IRR of this project would have been 0.31% higher.

Third, I describe above how almost all large wind developers in India do not account for the full tax benefits available to them in their CDM investment analysis. Several of the PDDs for these projects explain that the investor is unable to avail of the full depreciation tax benefits because they do not expect to earn enough personal income or profits in other parts of their business to absorb the tax benefits. In some cases this claim too can be difficult to audit because it involves assessing an expectation of future profits in another part of the investor's business or personal income. The ability to take 80% depreciation in the first year of the project changes project IRR by 4-5%.

Together these assumptions can alter expected wind project IRRs by amounts comparable with the 1.7%-2.7% expected effect of CERs, or more in cases with uncertain tax benefits. This analysis indicates that some projects whose expected financial returns are already one or two percentage points above the benchmark could vary these assumptions so to bring the expected financial returns to below the benchmark, and then show that CERs bring the returns back up. The investment analysis would prevent the more viable wind projects in India from registering under the CDM, such as those that are able to take the full tax benefits offered by the government, by requiring cost and revenue values to be taken from the supply, loan, and power purchase agreements, and enforcing the correct application of tax benefits. But this means that in order for the investment analysis to be accurate at this level, the decision to build the project would need to be taken before the start of the CDM application process. That is, the supply, loan and PPA agreements should in place before the PDD is finalized, preventing developers from making sure their project is successfully registered under the CDM before making the decision to build it.

Biomass projects

Developers of biomass cogeneration projects typically manage the projects themselves, rather than contracting out project implementation and operations and maintenance through supply agreements as is commonly done for wind projects. The IRR analysis for biomass projects includes many more undocumented or poorly documented values. Biomass prices in particular have been erratic over the past years due to an absence of a developed supply market (Ghosh et al 2006), rainfall variability year-to-year⁹ and rising demand for biomass from pulp and paper mills and for electricity generation.¹⁰ Assumptions about future biomass prices affect the IRRs of biomass projects that purchase all or part of the biomass used for electricity generation from near-by farms.

I examine the effect of the assumed future price of biomass on the project IRRs of biomass projects in India.¹¹ Three registered and one proposed biomass projects purchase biomass from outside their facilities and make their investment analysis spreadsheets publicly available. These four projects use rice husk purchased on the market to supplement the biomass generated by each facility's own rice or sugar processing, and all are in Uttar Pradesh, the Indian state with the most large biomass CDM projects.

The investment analyses of these four projects forecast that future rice husk prices will be 2650, 1200, 1150 and 700 rupees per metric ton with annual escalation rates of 0%, 4%, 2% and 0% respectively. Increasing biomass prices by 300 rupees and increasing the escalation rate by

⁹ Raised in a number of interviews with developers and consultants of bagasse (sugar cane waste) cogeneration projects.

¹⁰ *ibid.*

¹¹ The idea for doing an analysis of biomass prices comes from Sivan Kartha from the Stockholm Energy Institute.

2%, relatively small changes compared to the variation of prices in these PDDs and those documented in various tariff orders and petitions,¹² decreases project IRR by more than CERs increase it in each of these four projects (see Table A-2 in the Appendix for the details of this analysis). These projects all started construction within a year and a half of one another, and the PDDs were written within a year of one another. So the timing of the project development decision and PDD submission does not explain the large variation in their assumptions about future rice husk prices. Biomass price is only one of many assumptions that can be varied by a developer who wishes to show a lower project IRR in their PDDs.

Hydropower projects

Additionality testing is inappropriate for large hydropower in India for three reasons: the development of hydropower is a government decision, large hydropower developers are guaranteed a specified return on their equity investment making an IRR analysis meaningless, and financial assessments have not been a good predictor of hydropower development in the past, nor have they been a good predictor of actual project costs.

Hydropower development is largely a government decision - The Government of India employs a central decision-making process to determine the development of its rivers, in recognition of rivers as a national resource with multiple competing uses – electricity, irrigation, flood control, fishing, etc. River development is determined through a government planning process involving a range of public and private actors. This planning process identifies potential hydropower sites and determines which specific sites will be developed in what order and by which sector – central, state or private. The private sector participates in hydropower development mainly by responding to bids put out by state and central state-owned companies.

Additionality testing requires predictable indicators that a project would be built. The investment analysis is appropriate when a project would only be built if its financial returns are above a certain benchmark. The barrier analysis assumes that the building of a project could be predicted by the presence of a prohibitive barrier. Additionality testing is not meant to predict the decision-making of governments involving multiple considerations.

Developers of large hydropower projects in India are guaranteed a certain return on their equity investment - Developers of large hydropower projects (over 25 MW) in India are guaranteed a pre-determined return on their equity investment, typically 14% or 15.5%.¹³ The

¹² Uttar Pradesh's 2009 tariff order for biomass cogeneration projects assumes a 6% annual escalation rate in biomass prices (Uttar Pradesh Electricity Regulatory Commission. 2009. Draft "(Terms and Conditions of supply of power from Captive and Non-conventional Energy Generating Plants) Regulations, 09". , http://www.uperc.org/UPERC%20CNCE%20Order%20%20_Final.pdf and the biomass tariff suggested by the Central Electricity Regulatory Commission uses a 5% annual escalation rate (Central Electricity Regulatory Commission. 2009. (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations. The expected bagasse prices in Uttar Pradesh in these and other tariff orders and petitions vary between 740 and 2300. See also Uttar Pradesh Electricity Regulatory Commission. 2008. *THE MATTER OF: Suo-moto proceeding on procurement of power through competitive bidding and alternative fuel for use of bagasse based co-generation capacity during off-season*. <http://www.uperc.org/Order%20for%20CNCE%20Regulation%202008%20-%201st%20May%202008.pdf>

¹³ 14% is the return on equity from the Central Electricity Commission's 2005 tariff order and 15.5% is the return on equity from the 2009 tariff order. The CERC order applies to all central plants, and plants whose electricity is traded between more than one state. Each state writes its own tariff policy for its own plants, typically modeled after the CERC policy.

tariff the developer receives per kwh from electricity sales is calculated on a cost-plus basis and adjusted periodically to ensure that the developer receives the agreed return on equity based on their true costs and revenues. This means that most project costs are “passed through,” returned to the developer through the tariff. Therefore, unlike most electricity generation projects with a fixed tariff, the IRR of large hydropower does not increase if a project generates more electricity or has lower costs, since the tariff will be adjusted to ensure a fixed return on equity. In such a case, is project IRR a good measure for whether or not such a project would be built? Project IRR does vary among large hydropower projects in India, because the costs that determine the tariff differ somewhat from the costs included in the project IRR analysis. Figure 5 presents the differences between the costs that are typically used to calculate the tariff and project IRR.

One key difference between the way the IRR and tariff analyses address cost is that the tariff calculation takes into account loan interest payments whereas project IRR does not. Second, to incentivize efficient plant operation, operations and maintenance (O&M) costs are calculated as 2% of capital costs annually with an annual escalation rate in the tariff calculation, regardless of the actual costs.¹⁴ The IRR would use the actual expected O&M costs. Capital costs are not always fully passed-through, depending on a reasonability check by the appropriate electricity regulatory commission.

Figure 5 – Comparison of cost inputs used in the tariff calculation and the project IRR analysis for large hydropower projects

The tariff calculation is based on:	The IRR analysis is based on:
Interest on loan capital & depreciation	Actual capital expenses at the beginning of the project
Interest on working capital	Interest on working capital
Operations and maintenance expenses at a fixed 2% of capital costs with an annual escalation rate	Actual operations and maintenance expenses
Return on equity, at 15.5% of capital costs	

As a result, large hydropower projects with lower-than-average project IRRs are those that (1) are expected to have a higher ratio of O&M to capital costs such that a portion of the actual O&M costs are not passed through, (2) are judged by regulators to be built or managed inefficiently such that the full capital costs are not passed through,¹⁵ (3) are able to attract *better* loan terms, since loan interest payments are passed through in the tariff calculation, but are not included in project IRR calculations, (4) have longer construction times, which typically is the case with larger projects, projects built under more difficult geological conditions, or projects

¹⁴ For projects commissioned after April 2004

¹⁵ Interviews with hydropower consultants indicate that private hydropower developers that experience costs overruns are typically able to pass through the full actual costs through a higher tariff. Public companies can find it more difficult to get cost overruns passed through in full.

against which there is substantial public protest. Longer construction time lowers IRR because of the way IRR takes into account time. The IRR is the discount rate that could be applied to the project so that the present value of the project is zero, so costs and revenues in the early years of the project affect IRR more than later years. The longer the time between when the investment is made and revenues start to be generated the lower the present value of the project.

Only one of the above four reasons reflects the actual viability of a project and could potentially justify CDM benefits – projects with longer construction times. A high O&M to capital cost ratio and poor project management are not necessarily indicators that a project would not likely be built. *Better* loan terms lower the tariff and therefore also lower the calculated IRR, indicating a lower rather than higher likelihood that a project would be built. Therefore, when the tariff is determined on a cost-plus basis to achieve an agreed return on equity, an IRR analysis is not an appropriate indicator of whether a project would be built.

Investment analyses do not reliably predict project development and actual project costs - In India and throughout the world cost effectiveness has not been a good predictor of the development of large hydropower projects. Large hydropower is often built when it is not the least cost option (e.g. Paranjape & K.J.Joy 1995). Also, a financial assessment of a hydropower is especially difficult given its often large ecological impacts, the multiple competing uses of rivers, and the multiple people who benefit and are harmed by different uses that are difficult to weigh against one another. Further, even a simple financial analysis such as is performed in a CDM investment analysis, ignoring externalities and competing uses of the river, are notoriously inaccurate for large hydropower projects. Of the 81 hydropower projects surveyed for the World Commission on Dams report (World Commission on Dams 2000), the average capital costs were 21% over the predicted costs in real terms, while for some they were much higher. 30% of the projects surveyed by the World Commission on Dams experienced construction delays of a year or more.

For all of these reasons, the CDM's investment analysis does not accurately predict if a proposed large hydropower project would be built.

Is there an objective benchmark that predicts if a project would be built?

Even if the IRR analysis were relatively accurate, the benchmark would also need to reflect whether the project would likely be built for the investment analysis to be accurate. Since the CDM has a relatively small effect on the IRRs of CO₂ reduction projects, typically by 1%-5%, leading to projects being proven additional by even smaller IRR margins, the benchmark has to be reasonably accurate. The latest guidance from the CDM EB on the investment analysis offers four options for determining a benchmark: (1) benchmarks supplied by relevant national authorities (for project and equity IRR), (2) local commercial lending rates (for project IRR), (3) weighted average cost of capital (WACC) (for project IRR), and (4) required/expected returns on equity (for equity IRR).¹⁶ All of these have been used by some of the projects analyzed by this paper. The first option, a government-derived benchmark does not necessarily represent the decision-making of developers, lenders and equity providers. For example, the 16% benchmark commonly used in PDDs for wind projects in India is used by the government to determine promotional tariffs for independent power producers, but are not necessarily the benchmark expectation of investors. The second option, local commercial lending rates, can be too low a

¹⁶ Executive Board Report 41, Annex 45, *Guidance on the Assessment of Investment Analysis*, report from EB meeting on 30 July - 02 August 2008 http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03_v02_1.pdf

benchmark since equity investors generally expect higher returns than the lending rate. WACC, the cost of capital to the developer, is composed of the lending rate for the debt portion, and the returns expected by the equity investors for the equity portion. The fourth option used for equity IRR is simply the expected returns of the equity provider. Of each of these possible benchmarks, the most accurate representations of developer and investor decision-making would be the last two, WACC for project IRR, and the returns expected by equity investors for equity IRR. This is because typically developers will not build a project if the returns are under their WACC and typical equity providers would not invest in a project if the expected returns of the project are under the returns they expect from their investment.

The question then is if the expected returns on equity can be accurately and objectively assessed. The latest CDM guidance on the investment analysis¹⁷ makes the following distinction. A project that could only be carried out by the project proponent, such as the retrofitting of an existing sugar factory or cement plant, would use the WACC specific to the specific company. A project that could be built by many companies, such as a stand-alone wind or small hydropower project, would assess the WACC or expected returns on equity for the whole industry. In the latter case, the expected return on equity would reflect the risk premium associated with the specific type of investment. Both cases have the same challenges. The returns expected by equity investors can be fairly subjective since it involves the assessment of the financial risk associated of the specific project, and an assessment of their other competing investment options at the particular time of the investment. The decision could also be influenced by a range of non-monetary factors or factors that are not easily incorporated into the IRR analysis. For example, it is difficult to assess the financial benefits to a company of the reliability offered by a captive generation unit. Investors might be interested in investing in a project with lower financial returns for a range of reasons, including wanting to invest in a good project in their home community or a community where they want political support, interest in the positive publicity that goes along with doing a green project, or doing business with a relative, etc. The possibility of determining a conservative industry-wide benchmark for expected returns on equity under which projects would most likely not be built for different industries is beyond the scope of this working paper. Challenges associated with this have been raised here.

Allowing the developer to choose among several acceptable benchmarks enables them to choose one that is more advantageous for demonstrating project additionality, rather than one that truly represents the decision that enabled the project to go forward. The Xiaogushan hydropower project (XHP) in China presents a good example of this.¹⁸ The project was registered as a CDM project on the basis of having an IRR under the government defined benchmark of 8% for power projects. However, the Asian Development Bank, in its evaluation of the project, describes the project as the least cost project in the entire province.¹⁹ It also states that the project is financially viable because its financial IRR (FIRR) of 7.5% “is compared against the post-tax company WACC of 4.53%. Since the FIRR is higher than the WACC, the XHP component is financially viable.”²⁰ While the developer argues in the PDD that the project is unviable because the expected IRR is under the government-defined benchmark, the Asian

¹⁷ Executive Board Report 41, Annex 45, *Guidance on the Assessment of Investment Analysis*, report from EB meeting on 30 July - 02 August 2008 http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03_v02_1.pdf

¹⁸ I worked out this example together with independent television news producer and journalist Janet Klein.

¹⁹ Asian Development Bank. 2003. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the People's Republic of China for the Gansu Clean Energy Development Project*

²⁰ *ibid.*, p 16

Development Bank states that it decided to lend to the project because the IRR is over the WACC of the company.

5.3 Summary and discussion

Even the best case for an investment analysis – wind projects in India – in which all of the main inputs into the financial assessment are documented, there is still some room to vary assumptions within ranges equivalent to the effect of the CERs in some cases. For most other project types there is much more room for manipulation of cost inputs. The choice of the biomass price for biomass projects in India is one example. The hydropower example suggests that it is important to look at the specific conditions under which technologies are developed to determine if the investment analysis is appropriate for that specific technology. For several independent reasons, large hydropower in India is inappropriate for additionality testing. Multiple factors involved in project development decisions and the subjective nature of project risk assessment seem to preclude a single accurate benchmark for most projects that is meaningful within the relatively small improvements carbon credit revenues have on the IRR of CO₂ reduction projects. Both the IRR analysis and the benchmark IRR are adjustable in tandem. In conclusion, an accurate project-by-project additionality test is impractical for CO₂ reduction projects, and another means for determining which projects are worthy of receiving international support through international climate change agreements is required.

6. The CDM has little influence on project development: the effects of uncertainty and the long CDM registration process

Even if the CDM is unable to filter out business-as-usual projects, does it at least enable projects to go forward that otherwise would not? This section explores how the combination of uncertainty and the long registration application process compromises the effects the CDM could have on unviable or marginally viable projects (the types of projects the CDM is designed to support).

6.1 Risks associated with CDM registration and CER value

The CDM is anticipated to improve the financial returns, measured in terms of IRR, of the projects analyzed for this paper by 1% to 6% according to their PDDs. The CDM typically does so, not through assured upfront payments directly providing project financing, but as an additional revenue stream through the lifetime of the project. In the small proportion of cases in India when CER buyers do offer upfront payments to the project developer, these payments come at a substantial discount per CER generated by the project, often between 40% to 75% of the spot market price for carbon dioxide projects, almost always signed after the project has been successfully registered, and only for credits to be generated up through 2012. The CER revenue stream involves a number of uncertainties, which diminish the value of the CERs at the time that development, lending and investment decisions are being made:

Validation risk: Validators reported at the end of September 2009 that they cumulatively rejected 581 projects.²¹ This is compared with 2,188 projects that have been submitted for registration with positive validations, putting the risk of a negative validation at approximately 21%. We do not know the total number of projects that received positive validations but which have not yet been submitted for registration, implying the validation risk is lower than 21%. On the other hand, validators regularly decline validation requests when they believe the project will most likely not pass validation, implying a higher validation risk for projects that start construction before contracting a validator.

Registration risk: Approximately 5.5% of all projects submitted for registration were rejected by the CDM Executive Board, and at present another 7% are undergoing a review process after not being accepted upon submission.

CER price risk: Once a project is registered, there is uncertainty regarding the value the carbon credits will have once issued. To give some sense of CER price variability, between January 2007 and October 2009, secondary CER prices fluctuated between a high of 23 Euro in June 2008 to a low of 11.5 Euro in October 2009.²² China is mitigating some portion of the CER price risk by implementing a minimum CER price for primary CERs purchased from CDM projects in China.²³

CER value post-2012: At the time that this paper was written, we still did not know the structure of the post-2012 regime and how CER credits can be used under it. There is much uncertainty about the value these credits will have post-2012.

In late 2006 a bank representative expressed his expectation that over time, as banks become more familiar with the CDM, and as more experience is gained with the registration of different types of CDM projects, that his and other banks would start to take carbon credits into account in their loan appraisals. By 2009, the uncertainties associated with the CDM have increased, rather than decreased. Interviewees in 2009 expressed frustration with the increased complexity and time involved in the CDM application process, their perception that the EB's efforts to strengthen the system has led to frequent changes in the CDM requirements and rules, and that the EB is inconsistent and arbitrary in their decisions to reject and review projects. An increase in the number of rejections and reviews, especially over the last year, has also increased uncertainty and risk.

6.2 What does the timing of project development and the CDM application process indicate about the influence the CDM is having?

In light of this uncertainty, the order in which project developers start project construction and submit their projects for CDM validation and registration provides some insight into the effects the CDM is actually having on project development decisions. The process of submitting a project for registration under the CDM, from the start of validation through registration, was seventeen and a half months on average for all CDM projects registered since

²¹ Data taken from UNEP Risoe CDM/JI Pipeline Analysis and Database, October 1st, 2009
<http://www.cdmpipeline.org/>

²² CER prices are taken from PointCarbon's CDM & JI Monitor. Secondary CERs are CERs that were already purchased from the project developer, and are being sold for a second time, often to the end user of the credit.

²³ China's CER price floor is 8 Euro. Prices of CERs bought directly from the developer, called primary CERs, are below those of secondary CERs because of their additional risks.

the beginning of 2008.²⁴ It typically takes at least another year before the first credits are issued. Developers must either wait over a year to assure that their projects are successfully registered under the CDM before going forward with the projects, or accept the risk that their projects will not be successfully registered when deciding to go forward with the project. A commonly expressed sentiment among developers was that they cannot put their project on hold for the long CDM review period since it would be too disruptive to the project to do so.

As of October 1, 2009, approximately three-quarters of all registered CDM projects were operational at the time they were successfully registered under the CDM.^{25 26} This means that a higher proportion had started construction before registration. Further, 66 out of the 70 projects I analyzed for this paper started construction before the beginning of the 30-day public comment period, which typically happens in the first few months of the validation process.²⁷ This indicates that many developers start construction, including acquiring project financing, signing a power purchasing agreement with the government electricity utility, etc., before starting the validation process.

This timing indicates that project developers are not treating the CDM as a part of the necessary financing needed to go forward with a project, and are willing to accept the risk that their projects would not receive CDM revenues. This timing also means that developers probably do not see the CDM as important in helping them acquire a loan or attract investment equity, for if they did, many more developers would start the CDM application earlier, so that if they run into trouble attaining a loan or attracting investment, a positive validation or registration under the CDM could give a boost to the perceived viability of the project. This does not necessarily prove that the CDM is not having an effect on project development decisions. Certainly developers, lenders and investors could be taking the expected but uncertain revenues from the CDM into account when evaluating the viability of a project. The timing does indicate that revenues generated through the CDM are at best having a weak effect. This effect could be strengthened if CER revenues were more certain, and/or if the CDM application process were much shorter.

Construction on 17 of the 70 projects reviewed in this analysis began before the Kyoto Protocol entered into force in February 2005 and before the first project was registered under the CDM in November 2004. The uncertainty at that time regarding whether the CDM would exist as a working mechanism, or how it would work when it did, makes it extremely unlikely that the

²⁴ Calculated from the Risoe CDM Pipeline database as the difference between the “date of registration” and the “comment start” date. The comment start date is the date when the validator began the 30-day public comment period. The public comment period generally comes within the first few months of the validation process. Prior to the start of validation, the developer must write the PDD, which involves additional time.

²⁵ Using data from the UNEP Risoe CDM pipeline database, as of October 1, 2009, 79% of all registered CDM projects have “Credit start” dates equal to, or earlier than, the “Date of registration.” A review of over one hundred PDDs confirms that almost all projects were commissioned on or before the credit start date, suggesting that it is reasonable to estimate that at least three-quarters of all projects were completed at the time of registration.

²⁶ These projects are expected to produce 56% of CERs through 2012 if all registered CDM projects generate the number of credits predicted in their PDDs. The reason the percentage of credits (56%) is lower than the percentage of projects (79%) is that most of the projects that are expected to generate the most CERs – HFC and N₂O projects – are expected to start generating credits at least several months after their date of registration and so are not included in these percentages.

²⁷ The construction start date was taken from the PDDs. The beginning of the 30-day public comment period is listed in the UNEP Risoe CDM pipeline database as the “comment start” date. Typically the validator puts the PDD up for the public comment period in the first few months of validation.

CDM had much effect on these development decision. Two of these projects were registered within the last year.

The claim that the CDM is having very little effect on project development is also supported by the interview responses mentioned above. Particularly, banks seem not to take CERs into account in their decisions to lend to a project because of the uncertainties associated with CDM registration and CER generation. Consultants and developers commonly describe CER revenues as “cream on the top,” and describe developers as building projects on their own merits, not because of a small and uncertain benefit from CER sales.

6.3 Discussion

A high proportion of the risk, time and cost of the CDM application process is associated with additionality testing. PDD consultants and validators describe that a large portion of the time spent writing the PDD and validating the project are devoted to the additionality section. Additionality is the cause of most reviews and rejections by the EB, and is also the most common reason projects do not pass validation.²⁸

Project-by-project additionality testing adds time and uncertainty to the CDM application process, compromising the ability for CERs to influence project development decisions. Additionality testing is also only effective at filtering out some of the most clearly non-additional projects. Therefore, another more effective and predictable means of targeting projects and activities that actually reduce emissions is necessary.

7. Taking a step back: The fundamental structure of the CDM, in certain other ways, leads to the over-generation of credits and limits its ability to reduce emissions

Looking beyond additionality testing, a number of other structural flaws also contribute to the over-generation of credits and weaken the effectiveness of the CDM at supporting projects in real need of support.

Supporting projects in the wrong order - In the power sectors of India, China and other countries, plants are often planned for many years before they are actually built. Hydropower and wind sites are often developed in the order of their attractiveness in terms of resource availability, proximity to demand centers, etc. The Indian government is actively supporting renewable energy and energy efficiency mainly for energy security reasons. From the perspective of most effectively developing these sectors, it makes sense to accelerate the pace at which plants are built, building the most cost effective ones first and supporting current domestic efforts to do so. Instead, the CDM is structured to change the order in which plants are built. Plants that are cost effective are considered “non-additional” while only plants that are less desirable are eligible.

Trade off between project viability and the over-generation of credits - The CDM should result in reductions in emissions in a developing country at least as large as the credits it generates. Once registered, CDM projects are allowed to generate credits for 10 years, if they choose the single credit period option, or 21 years if they choose the 7-year crediting period and renewal

²⁸ Interviews with validators

option. This means that in theory, projects should only register under the CDM if they most likely would not otherwise have been developed for the full crediting period – 10 or 21 years. This would support the development of a portfolio of undesirable projects – the problem mentioned just above. In practice, the PDD requires that projects be tested for additionality at the time of validation only.²⁹ Projects are therefore able to generate credits for 10 or 21 years even if they would have been built within that period, producing more credits than actually emissions avoided by the CDM project.

Improving the profitability of harmful projects - Crediting emissions reductions rather than charging emissions producers such as through a carbon tax could improve the profitability of projects with negative environmental and social impacts. Examples include many large hydropower projects, clean coal, and HFC destruction in HCFC-22 production facilities. HFCs, a potent greenhouse gas (GHG) regulated under the Kyoto Protocol, is a byproduct in the production of HCFC-22, a temporary substitute for CFCs as a refrigerant. Due to the very high global warming potential of HFCs – 11,700 times that of CO₂ – the value of the CERs generated from HFC reduction projects can exceed the profits from the production of HCFC-22 itself, making HCFC-22 production profitable even without selling the HCFC-22 (Wara & Victor 2008). HCFC-22 is an ozone depletor being phased out under the Montreal Protocol, 5% as potent in depleting the ozone layer as CFCs. An international agreement, with financial support to developing countries, would be a more appropriate way to reduce HFC production from HCFC-22 plants than the current CDM process, which overpays the cost of the HFC burning equipment by 47 times (Wara & Victor 2008). Regulations are in place preventing CDM credits from being generated by new HCFC-22 production facilities, or the expansion of existing ones. Still, the CDM creates substantial disincentives for HCFC-22 plant phase out, in direct contradiction with the goals of the Montreal Protocol.

Perverse incentives - One of the early criticisms of the CDM is that it could create perverse incentives for government or the private sector to refrain from implementing policy and taking action to reduce emissions. The need to measure actual emissions against a baseline – a future scenario describing what would likely have happened without the CDM – creates incentives to maintain a high baseline in order to later generate higher amounts of credits per project. Going back to the HCFC-22 example, if a country imposes regulation requiring HCFC-22 production facilities to destroy the HFC gas byproduct, facilities might no longer be able to generate the substantial income from the sale of carbon credits, causing a significant disincentive for such regulation. Of concern is the extent to which the CDM is impeding decarbonization because of perverse incentives that dissuade governments from enacting climate-friendly policies.

Limited in scope - The CDM can only fund activities for which it is believed that emissions reductions can be reasonably estimated, and excludes project types which may have a higher GHG abatement potential at lower cost, but for which emissions reduction estimations are especially complex or uncertain. The CDM is not structured to support many efforts necessary to decarbonize sectors and affect a large-scale deployment of clean technologies – policies, R&D, demonstration projects, information dissemination, etc, because measuring emissions reductions from these efforts may be difficult or infeasible. The dissemination of technologies, such as

²⁹ This decision was clarified in the report from Executive Board Report 43, from the 43rd meeting of the CDM Executive Board, 22 - 24 October 2008, http://cdm.unfccc.int/EB/043/eb43_repan13.pdf

bagasse cogeneration in India, can be limited by multiple barriers requiring a number of different and parallel support efforts simultaneously and over time, many of which could not be supported through a project-based offsetting mechanism (Haya et al 2009). Efforts to affect sectoral change are often best done in the context of an integrated planning process in which multiple goals and interests are addressed together (Halsnaes et al 2008). Revenues from the generation of carbon credits could be only one part of a much larger set of support efforts for both sectors and specific technologies.

8. The large-scale use of offsetting credits poses challenges to near and long term climate change mitigation

Even if we manage to design an international offsetting mechanism that effectively reduces emissions and accurately credits them, what effects does large scale offsetting have on global efforts to mitigate climate change over the next decades? Scenarios put forward by the Intergovernmental Panel on Climate Change (IPCC) suggest that a reduction in industrialized countries by 25% to 40% below 1990 levels by 2020, on a path towards 80% to 95% reductions by 2050, still corresponds with a 2.0-2.4 degree Celsius temperature increase (Box 13.7 from Gupta et al 2007, Table SPM.6 from Intergovernmental Panel on Climate Change 2007). These scenarios correspond with reductions in developing countries by 15% to 30% below business-as-usual growth projections by 2020 (Höhne & Ellermann 2008). Even deeper reductions would be needed globally if we wish to have a high likelihood, rather than an almost 50% chance, of not exceeding a two degree increase. Further, since these scenarios were published, additional research suggests that climate sensitivity (the increase in radiative forcing resulting from the increase in GHGs in the atmosphere) is higher, and feedback effects even greater than the assumptions used to produce the IPCC scenarios (McMullen & Jabbour 2009).

Industrialized countries are proposing high levels of offsetting post-2012, which if used, would put these countries far away from the 25%-40% reductions by 2020 from the IPCC scenarios. At the time this paper was written, the EU was proposing to cut its emissions by 30% below 1990 levels by 2020 within the context of an international agreement, allowing 68% of those reductions to be met through international offsets.³⁰ If all of these offsets are used, the EU would achieve a less than 17% reduction compared to 1990 levels by 2020. In the US, a prominent draft climate bill, the Waxman-Markey American Clean Energy and Security Act of 2009,³¹ would require the US to cut its emissions to 4% below 1990 levels by 2020. This bill allows up to two billion tons of CO₂ as offsets, equal to 28% of its 2005 emissions, allowing a half to three-quarters of these, depending on the availability of domestic offset credits, to be from international sources. The international portion, if used in full, would allow the US to postpone making any reductions in its emissions from current levels until 2020 to 2024. This postponement would be even longer if some portion of domestic offsets is non-additional.

Two justifications are commonly given for high quantities of offsets. The first is simple market efficiency. Trade in emissions reductions allows industrialized countries to reduce

³⁰ Hanley N. 2009. *EU Climate and Energy Package, December 2008*. Presented at the Energy and Resources Group, University of California, Berkeley. *March 18*. The package recommended 50% of all reductions in the ETS, covering approximately 40% of EU emission, can be met with foreign credits and 80% of reductions in non-ETS sectors can be met with foreign credits.

³¹ <http://www.govtrack.us/congress/bill.xpd?bill=h111-2454>

emissions less expensively than if they were required to reduce them domestically. Second, by providing low cost compliance options, offsets help bring buy-in from domestic industries, making it easier and more likely for industrialized countries to accept deeper targets than they would have otherwise.

However, large-scale access to these potential lower-cost compliance options also introduces risk to present mitigation efforts and would most likely make climate change mitigation more difficult in the future. First, domestic reductions are more certain than international offsets.³² Any country has more knowledge about and control over activities within its own borders than it does for projects and activities which it funds elsewhere. Also, measuring emissions, as is done in a cap-and-trade program, is easier than measuring reductions in an offsetting program, as described in detail above. As such, offsets introduce various uncertainties regarding the amount of emissions reductions they actually represent. Any offsetting in developing countries, whether it is project-based or sector-based, involves measuring emissions against a BAU growth scenario, which is inherently uncertain, and politically difficult to set at a low level.

Second, cap-and-trade weakens incentives for innovation by allowing a larger portion of compliance to be met with existing and low cost technologies (Driesen 2003). Decarbonization to 80-95% below 1990 levels by 2050 in industrialized countries will require major shifts in all high emitting sectors. Transportation, the electricity sector, buildings, and agriculture all involve complex systems. Major shifts in each of these sectors requires time to allow for changes in behavior and in support industries, for experimentation and learning, research, development and deployment, etc.

The high level of offsets allowed could easily place the majority of global reductions up to 2020 in developing rather than industrialized countries. In the context of meeting the global reductions suggested in the IPCC scenarios, if 50% of all Annex 1 reductions are made through offsets (remember that the EU and the US are proposing substantially higher than that as upper limits) and that these offset projects are performed in addition to the suggested 15%-30% decrease from BAU in developing countries, then around 70% of all global reductions through 2020 would likely come from developing countries rather than the high per capita emitters.³³

If industrialized countries postpone domestic reductions as they are proposing through the use of offsets, they are either committing to steeper annual reductions in the future, or to long-term inequalities in emissions in the North and the South. Both options make future cooperation more difficult. In industrialized countries, a gradual migration of infrastructure is likely to be less costly than rapid transitions that could require retiring technology and infrastructure before the end of their lifetime. If the costs of mitigation are expected to be high, there will be more resistance from industry.

In addition, a high future dependence of offset credits from developing countries poses compliance risks on industrialized countries. The further actual domestic emissions are in an industrialized country from their targets for a given commitment period through the help of offset credits, the harder it will be for that country to commit to meaningful reductions in the following period. Large quantities of offsets might make it easier for industrialized countries to

³² Here offsets refer to credited emissions reductions generated by any activity whose emissions are not capped under a cap-and-trade program.

³³ Reductions are defined here as reductions from the Kyoto Protocol caps for industrialized countries, and reductions from BAU in developing countries.

take on deeper commitments now, but could also make it harder for them to accept deeper targets in the future.

We live in a world with a widely shared linear view of development and progress (Norgaard 1994). Deep in urban and rural India, visions of “development” and symbols of high status are heavily influenced by images of consumption from the North. The discourse of development used by the World Bank is also used by country governments, and is disseminated through participants in and those affected by World Bank projects. Developing country citizens have learned that they are “backwards” and “underdeveloped” (Escobar 1995, Gupta 1998). Rural electrification has allowed more and more people to view western lifestyles on TV, and TV commercials spreading a culture of consumerism and awareness of not having (Jacobson 2004). Development in India is highly status driven – beyond getting out of poverty is a pursuit of symbols of high status, such as a big car and a new cell phone. In a world dominated by a single vision of “progress” sustainability requires changing the image of what “developed” means. Ultimately, promoting low-carbon development in the South requires demonstrating it in the North.

Advanced developing countries are being asked to join the global community in accepting obligations to mitigate their emissions below BAU growth projections. Will developing countries commit to controlling the growth in their already low per capita emissions if it is clear that there is relatively little willingness in the industrialized world to reduce their much higher per capita emissions? Developing countries will need to make voluntary reductions before it is fair, given how quickly we need to reduce globally. This can happen only in a regime built on trust and mutual cooperation. Politically, it will be unlikely that developing countries will take calls for global cooperation seriously, if industrialized countries do not take on commitments to curb their own emissions as prescribed by the IPCC.

9. Discussion and conclusions

Industries in industrialized countries are putting pressure on their governments to provide options for controlling costs of compliance with post-2012 emissions limits. The CDM is currently seen as a legitimate way to do so. The CDM also provides a way to engage the private sector in climate change mitigation in developing countries. The private sector is seen as well poised to find efficient and innovative options for reducing emissions, while avoiding some of the concerns over funds – corruption, lack of accountability, conditionality and traditionally donor-weighted decision-making. There is also an interest in taking advantage of existing institutions, rather than disbanding them and starting anew. The CDM was promoted with numerous trainings, workshops and promises, and has attracted many new players and new interest into the clean energy, energy efficiency and other low-emitting industries in India and elsewhere. Admitting the CDM was largely a failure could dampen interest in the next instrument.

Researchers and policy-makers have sought ways to reform the CDM to retain these benefits while improving its environmental integrity. In weighing the pros and cons of various options, we need to honestly assess the possibility of improving the environmental integrity of the CDM as a project-based offsetting mechanism, as well as what we need to do in the next commitment period to be on a path towards a high likelihood of not exceeding a global two degrees temperature increase.

A purpose of this paper is to examine the possibility of substantially improving the CDM's environmental integrity and effectiveness as a project-based offsetting mechanism. This paper shows that reasonably accurate project-by-project additionality testing is infeasible given the subjectivity involved in project development, investment and lending decisions. The need to do a test that is fundamentally difficult and inaccurate is disabling the CDM from being able to support truly additional projects, because of the complexity, uncertainty and time it adds to the CDM application process. As a result, the majority of CDM projects, and a large majority of CDM CO₂ reduction projects, are non-additional, evidenced by a range of analysis presented in this paper. Beyond additionality, the CDM is structured to either over-credit, or support a portfolio of projects that would otherwise be unviable for 10 or 21 years. Neither are good options. Because of the challenge of measuring emissions reductions from specific projects, the CDM is unable to support many measures needed, and sometimes more cost effective, for the deployment of technologies and decarbonization of sectors, such as policy, research and development, demonstration projects, and information dissemination. The CDM can also have the opposite effect, creating perverse incentives against the implementation of policy and for delaying the implementation of projects so that developers are able to maintain a high baseline against which to prove additionality and generate CERs. Even if the environmental integrity of the mechanism were ensured, large scale offsetting introduces various challenges to global climate change mitigation efforts over the next decades, especially considering the very weak post-2012 targets being proposed by industrialized countries.

Any post-2012 offsetting program will need to:

- include an alternative means for targeting projects and activities without testing additionality on a project-by-project basis, a process which is essentially subjective and inaccurate;
- be predictable, providing certain benefits to those depending on it; and
- be small in the context of deeper Annex 1 targets.

This could possibly be accomplished through small, targeted offsetting programs designed to help decarbonize specific sectors and promote specific technologies. Such programs could be custom designed through industrialized-developing country partnerships, at national or sub-national levels, to address what is needed to control emissions and promote technologies in their specific local contexts in line with domestic priorities and the expertise the industrialized country can offer. As opposed to the current CDM, such programs can involve multiple coordinated components, some credited and some not credited, that work together to address the barriers and support needs facing a technology or a sector. These programs would require a commitment to cooperate over many years. Additionality would still be a concern for such a program but would be more easily managed than with the CDM. Under the CDM, developers initiate projects, and the CDM EB and other CDM governance bodies mainly respond when projects and methodologies are submitted to them. As described above, it is very difficult to distinguish additional from non-additional projects individually. In contrast, under the offsetting program suggested here, the administrators of the program actively initiate projects and programs based on analysis as to how their involvement could lower emissions.

Experience so far with the CDM does not bode well for the political feasibility of such an approach. We have seen little indication that countries will agree to an offsetting mechanism that is small enough, targeted enough, and with conservative enough baselines, to preserve its environmental integrity, and the environmental integrity of the whole agreement. So far offsetting has not been effective and imposes uncertainty on global climate change mitigation efforts. Attention must be refocused on reductions in countries with emissions caps, with non-

credited support for mitigation efforts in developing countries. Ultimately, promoting low-carbon development in the South requires demonstrating it in the North.

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APPENDIX: Figures and tables

Figure A-1: The CDM Project Pipeline Step-by-Step

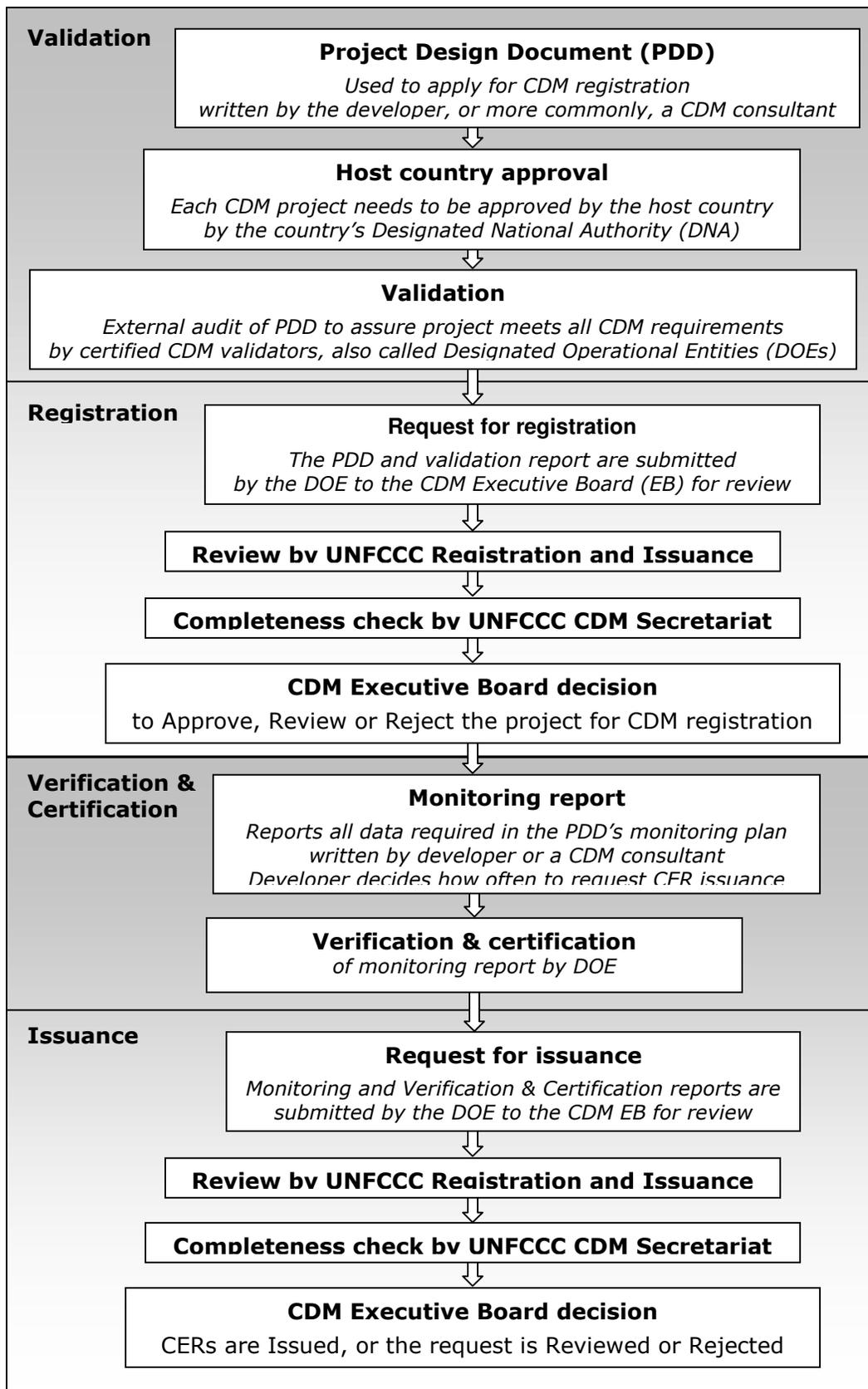


Table A-1 – Effects of the choice of post-PPA tariff and a deration rate on wind project financial returns

Project name	State in India	PPA length (years)	Tariff in year 1 (rp/kwh)	Tariff escalation rate? (rp/yr)	Tariff after end of PPA (rp/kwh)	Tariff escalation rate after end of PPA?	Deration rate?	Change in IRR from	
								Lower tariff 1 rs/kwh after end of PPA or increase to last PPA year ^b	5% deration rate in year 11
Bundled wind energy power projects (2004 policy) in Rajasthan	Rajasthan	13	3.25	0.06 through year 9	3.79 - same as last PPA year	--	--	-0.80%	
22.5 MW grid connected wind farm project by RSMML in Jaisalmer	Rajasthan	10	3.32	0.06	3.92 - same as last PPA year	--	--	-1.12%	
75MW wind power project in Maharashtra by Essel Mining Industries Limited	Maharashtra	13	3.5	0.15	5.3 - same as last PPA year	--	--	-1.26%	
Wind power project by GFL in Gudhepanchani	Maharashtra	13	3.5	0.15	5.3 - same as last PPA year	--	--	-0.49%	
40 MW Grid Connected Wind Power Project	Maharashtra	13	3.5	0.15	3.89	2.50%	--	0.71%	
Wind Electricity Generation Project	Maharashtra	13	3.5	0.15	5.3 - same as last PPA year	--	--	-1.07%	
NSL 27.65 MW Wind Power Project in Karnataka	Karnataka	?? ^a	3.1	--	3.1	--	--	-2.20%	
Tungabhadra wind power project in Karnataka	Karnataka	10	3.4	--	Varies, 1.89 is average	--	--	2.03%	
Enercon Wind Farm (Hindustan) Ltd in Karnataka	Karnataka	10	3.4	--	Varies, 1.82 is average	--	--	2.23%	
29.7 MW Wind Power project in Karnataka	Karnataka	10	3.4	--	3.4	--	--	-1.52%	
Wind power project by HZL in Karnataka	Karnataka	10	3.4	--	3.4	--	--	-1.59%	
42.5 MW Wind Power Project by VRL Logistics Ltd. In Karnataka State	Karnataka	10	3.4	--	3.06	--	-5% in year 11	0.90%	-0.31%
24.8 MW Wind power project by Belgaum Wind Farms Private Ltd. in Gadag, Karnataka	Karnataka	10	3.4	--	3.4	--	--	-1.46%	
150 MW grid connected Wind Power based electricity generation project in Gujarat	Gujarat	13	3.37	--	3.5	--	--	-0.81%	

^a The PPA length is not mentioned in the CDM project documentation. This analysis assumes a 10 year PPA, the same as the PPAs for the other projects in Karnataka.

^b Values in boldface indicate cases where the developer chose a post-PPA tariff lower than the tariff in the last year of the PPA. For this analysis, the post-PPA tariffs of these projects are brought up to the tariff in the last PPA year, rather than reduced an additional one rupee

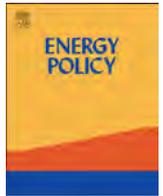
Table A-2 – Effects of biomass price on biomass project financial returns

Project name	CDM Status	PDD Date	Start project construction	Rice husk price in first year Rs./ton	Rice husk price annual escalation rate	Change in IRR or DSCR ^a		
						From CDM	+200 Rs./ton & + 2% esc rate in rice husk prices	+300 Rs./ton & + 2% esc rate in rice husk prices
Rice husk based Co generation project at Dujana unit of KRBL Limited	Registered	Jan-08	Oct-05	2650	0%	0.45	-0.41	-0.53
15 MW Biomass Residue Based Power Project at Ghazipur	Requesting registration	Nov-08	Dec-06	1200	4%	7.86%	<-10%	<-10%
DSCL Sugar Ajbapur Cogeneration Project Phase II	Registered	Feb-07	May-05	1150	2%	7.11%	-7.91%	-10.70%
KM RE project	Registered	Jan-07	Feb-06	700	0%	8.07%	-5.83%	-8.34%

^a DSCR (Debt Service Coverage Ratio) is a common financial metric used by banks to assess loan applications. A DSCR of less than one means that annual project revenues are less than the annual debt service. Here, the first project uses DSCR to measure project viability, and the other three use project IRR.

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Addressing carbon Offsetters' Paradox: Lessons from Chinese wind CDM



Gang He ^{a,b,*}, Richard Morse ^{b,c}

^a Energy and Resources Group, University of California, Berkeley, CA 94720, USA

^b Program on Energy and Sustainable Development, Stanford University, Stanford, CA 94305, USA

^c SuperCritical Capital, Chicago, IL, USA

HIGHLIGHTS

- We investigated 143 Chinese wind CDM projects by the eruption of the additionality controversy.
- We examined the application of additionality in the Chinese wind power market.
- We drew implications for the design of effective global carbon offset policy.
- The underlying structural flaws of CDM, the Offsetters' Paradox, was discussed.
- We charted a reform path that can strengthen the credibility of global carbon markets.

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Offsetters' Paradox

ABSTRACT

The clean development mechanism (CDM) has been a leading international carbon market and a driving force for sustainable development. But the eruption of controversy over offsets from Chinese wind power in 2009 exposed cracks at the core of how carbon credits are verified in the developing economies. The Chinese wind controversy therefore has direct implications for the design and negotiation of any successor to the Kyoto Protocol or future market-based carbon regimes. In order for carbon markets to avoid controversy and function effectively, the lessons from the Chinese wind controversy should be used to implement key reforms in current and future carbon policy design. The paper examines the application of additionality in the Chinese wind power market and draws implications for the design of effective global carbon offset policy. It demonstrates the causes of the wind power controversy, highlights underlying structural flaws, in how additionality is applied in China, the Offsetters' Paradox, and charts a reform path that can strengthen the credibility of global carbon markets.

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1. Introduction

The clean development mechanism (CDM) set by Kyoto Protocol is the leading international carbon market which allows developed countries to meet their mitigation commitments by financing emission reductions in the developing world (UNFCCC, 1997). Project based CDM is seen as an important mechanism to achieve global sustainable development by fostering clean energy development in developing countries and cost-effective reduction of greenhouse gasses in developed countries (Olsen, 2007), and typically allows for nations with emissions commitments to invest in greenhouse gas mitigation projects in host countries without commitments.

International carbon finance has provided a significant boost to Chinese wind development. China's installed wind capacity has been growing at an unprecedented pace, the total installed capacity has reached 75.5 GW as of the end of 2012 (CWEA, 2013). CDM first provided finance for Chinese wind in 2005, and we estimate that about 32% of China's total wind capacity of 25.1 GW has benefited from CDM finance through 2009 (CREIA, 2009).

One of the central criteria used to evaluate CDM projects is "additionality", which is defined as carbon offset payments result in "real" emissions mitigation that "would not have happened otherwise" (UNFCCC, 2006). Controversy over the CDM projects is not new. There have been concerns about the additionality and the economically efficiency of industrial gas projects, for example trifluoromethane (HFC-23), which is inexpensive to cut but received payments via the CDM which may have been many times more valuable than the gas being produced, creating perverse incentives. Scholars have argued that such projects therefore

* Corresponding author at: University of California, Berkeley. Energy and Resources Group, 310 Barrows Hall, Berkeley, CA 94720, USA. Tel.: +1 510 642 1640; fax: +1 510 642 1085.

E-mail address: ganghe@berkeley.edu (G. He).

undermine the effectiveness of CDM (Wara, 2007). But other types of projects, such as renewable energy projects, are usually viewed as comparatively higher quality with lower risk of “non-additionality” or economic inefficiency.

The questionable additionality of many CDM projects has become a central issue in the CDM discussion (Paulsson, 2009). Haya (2010) examined hydro CDM projects in India, and found that there is no accurate verifiable indicator of whether CO₂ reduction projects would be built without the CDM. Those concerns raise the incentive problems created by asymmetric information, include adverse selection and moral hazard, in the offset markets (Bushnell, 2010). However, the implementation of CDM in China is less discussed, and the impact of how and whether CDM might interface with domestic policy and regulatory regimes is not seen in the existing literature.

However, this issue came to a head when the CDM Executive Board (CDM EB) shocked the carbon market by forcing an unprecedented review of whether Chinese wind projects satisfied UNFCCC additionality requirements and then rejected 10 Chinese wind CDM from registration in 2009 (CDM EB, 2009a, 2009b). CDM investors were shocked as the safest CDM bet became the riskiest; the Chinese stakeholders publicly attacked the UN's oversight of carbon markets and criticized the decision “unfair” and “non-transparent” (10 Chinese Wind Power Project, 2009); and the CDM EB prepared itself for an unprecedented fight over how carbon offsets could be verified in the world's largest CDM market. In 2010, the EB's 52nd meeting saw two of the ten wind projects registered after clarification, but the remaining eight projects were rejected (CDM EB, 2010). We call the controversy along the additionality of Chinese wind CDM project the “Chinese wind controversy” (controversy for short).

Additionality is the concept employed to verify that credits for carbon reductions are not payments for business as usual (BAU) (UNFCCC, 2001). Additionality is at first glance a simple counterfactual, but proving a counterfactual is not easy (Haya, 2010; Schneider, 2009; Sutter and Parreño, 2007; Wara and Victor, 2008). The CDM's “additionality tool” attempts to do this by comparing the financial returns of all possible investments, with the logic that businesses will invest in the projects with the highest projected internal rate of return (IRR) (CDM EB, 2008). Project developers wishing to receive CDM credits must demonstrate that the proposed CDM activity is not the most profitable (has lower IRR) when compared to a BAU investment scenario (which might be a coal plant in China, for example), but that with CDM finance it becomes competitive with the alternative investments. Two conditions are necessary for the IRR comparison to be a credible indicator of additionality: (1) the selected baseline that wind is compared to must represent actual BAU in the relevant market, and (2) IRR must be a credible indicator of behavior and investment patterns in the relevant market. As we will show, there are serious problems meeting either of these conditions for Chinese wind because of the complex structure of China's power market.

At the center of the controversy was the concern that the Chinese government might be manipulating power tariffs in order to guarantee additionality and subsidize domestic renewable energy development with carbon finance. If it were, the credibility of the CDM in its largest market would be crippled. It is important to note that the challenges of CDM project validation in China are relevant in most of the developing world. A solution to the controversy is therefore imperative – not just for CDM investment in China – but for preserving the credibility of offsets as a global mitigation regime. In addition to EU Emission Trading Scheme (ETS), the major carbon offsets buyer, national or sub-national schemes are already in place in Australia, New Zealand, Japan, the U.S., Switzerland and Canada, and are planned in South Korea and Brazil (Promethium Carbon, 2013). China has also opened its pilot carbon trading program in June 2013. The

potential for these programs to allow international credits as offsets in national or sub-national carbon pricing schemes and to meet mitigation targets are under discussion. The lessons and experiences from CDM will be essential in the development of standards and procedures among those emerging carbon policies and ETSs around the world.

Yet despite the best efforts of developers, Designated Operational Entities (DOEs), and the EB to address this problem, a comprehensive solution has so far remained elusive. In trying to decide whether the Chinese government was setting artificial power tariffs to “game” additionality, the EB initially suggested a rule which would compare power tariffs for new projects to the highest historical tariffs. Thus if new tariffs were significantly below historical tariffs, the thinking was that this could be an indication of manipulation. However such approaches are not effective because both the Chinese wind industry and Chinese wind power pricing policy have change drastically since 2005, and there exist numerous market-based reasons for altering the tariffs. Thus applying the “additionality tool” to compare power tariffs for new projects to the highest historical tariffs are not effective because both the Chinese wind industry and Chinese wind power pricing policy have change drastically since 2005 (CDM EB, 2008; CREIA, 2009; Li and Gao, 2008), making such comparisons obsolete in a rapidly changing market. The wind industry of 2005 looks very little like the wind industry of 2012. But more importantly, focusing so narrowly on the question of historical tariffs risks missing the forest for the trees. One central question and challenge to solve the Chinese wind controversy is how can the CDM reliably separate the impact of domestic regulations and policies from that of international carbon finance?

The paper addresses this essential question, utilizing a detailed analysis of all Chinese wind projects registered through 2009 when this controversy erupted. First, we demonstrate the structural dependency of IRR-based additionality in state-controlled power sectors on host country regulators. This dependency simultaneously gives host countries control of additionality outcomes while preventing additionality verification by the UN, and is a major cause of such problems. Second, we argue that the available evidence does not suggest that China games the CDM. Finally, we argue that the CDM must upgrade its policy to deal with the reality of power markets where additionality is inherently impacted by domestic policy. However, this challenge presents a paradox for climate policy makers that must be weighed carefully.

2. Data and methods

Data used in this paper was extracted and compiled by the authors from the project design documents (PDDs), investment analysis spreadsheets, and validation reports which are used for CDM project registration provided through the UNFCCC CDM official website (<http://cdm.unfccc.int/Projects/projsearch.html>). PDDs are the key documents involved in the validation and registration of CDM project activities submitted by project developers and validated by DOEs. Key project-based data, including the power tariff, investment costs, IRR with and without CDM, and sensitivity analyses, from all registered PDDs was manually entered to a database and adjusted for consistency of currencies, exchange rates over time, and tax policies. The basic statistics of studied wind CDM projects are presented in Table 1. One hundred forty three projects in total were included and analyzed, representing all Chinese wind CDM projects registered through the end of 2009. Sixty seven projects did not provide complete data in their sensitivity analysis in their PDDs, the authors calculated the sensitivities by extrapolating available data on percentage changes of IRR with changes of power tariff and investment costs.

Table 1

Basic statistics of the studied wind CDM projects.

Key variables	Mean	Max	Min	SD	Sensitivity
IRR with CDM	9.04%	11.87%	7.24%	0.0075	
IRR without CDM	6.40%	8.43%	4.24%	0.0070	
Power tariff (RMB/kWh)	0.5443	0.7600	0.3521	0.0973	11.35%
Investment cost (RMB/MW)	9,549,846	18,071,400	2,358,885	1,488,498	12.03%

3. Key findings

3.1. *Additionality is highly dependent on domestic regulation*

If China were manipulating power tariffs to game the CDM, it would only be possible because the current design of additionality gives them that power. The structural dependency of additionality on Chinese regulators can be clearly demonstrated as follows. Additionality for Chinese wind is largely determined by IRR comparisons of CDM projects to the 8% baselines given in the “Internal Notice on New Project Feasibility Assessment” by the [State Power Corporation \(2002\)](#). And our analysis shows that the single largest factor determining Chinese wind project IRR is the power tariff, in fact the data shows that on average, an 11.35% increase of the power tariff will make Chinese wind farms non-additional while China’s average on-grid power tariff had already increased from 0.3175 to 0.3676, 15.78% increase from 2006 to 2009 ([SERC, 2010, 2007](#)). There have been four major phases in the development of the Chinese wind power tariff system. In the first phase (1986–1993), wind power developments were funded by overseas aid funds and the tariff paid was less than 0.3 RMB/kWh, similar to that for coal-fired plants. In the second phase (1994–2003), the tariff was proposed by local governments and approved by the central government. During this period prices ranged from the relatively low price of 0.3 RMB/kWh up to 1.2 RMB/kWh. In the third phase, from 2003 to 2009, tariffs were decided by a concession process. Projects larger than 50 MW or in special wind-rich areas used this system (projects less than 50 MW were still subject to tariffs appointed by local regulatory decree), in which they submitted bids to the NDRC that included a proposed power tariff and the proposed share of domestically manufactured turbines. NDRC then approved the winning projects. The concession system ended in late 2009 when the NDRC established the “regional flag price” system, which set a single wind power price in major regions that functions like a feed-in tariff. These mandated prices are derived from the principle of “cost+reasonable return (with consideration of available wind resources)” ([CREIA, 2009](#); [NDRC, 2009](#)). The power tariff in those stages is highly dependent to China’s National or Local Development and Reform Commission. Thus the current design of the additionality test makes the Chinese government the most important arbiter of additionality – whether it wants to be or not – because IRR-based additionality is by design a function of NDRC power pricing.

This would not be a problem if China had market-based power pricing that could be validated by CDM regulators because power prices, and thus IRRs, would be a function of market pricing rather than regulatory decree. In this case IRRs would be a reliable indicator of project viability. But China’s power sector is not fully market-oriented. Unlike in liberalized power markets where prices are the result of bids and offers subject to some regulatory constraints, Chinese power prices are either tightly controlled by state regulators or are distorted by the presence of large state owned enterprises (SOEs). Wind is no exception. NDRC is directly determining wind tariffs based on its judgment of appropriate IRR as is China’s sovereign right. In fact, the official NDRC pricing

policy of “cost+reasonable return with consideration of available wind resources” explicitly indicates that the NDRC is determining the “reasonable return” through the tariff. But NDRC does not specify what the appropriate return is or how it is determined which again is China’s right, but a problem for CDM. In this context it is nearly impossible to know whether China is gaming the process or not. IRR-based additionality tests are fundamentally incompatible with state-controlled power pricing regime.

Further, where more market-based pricing mechanisms have been tried, outcomes have been distorted by the presence of major SOEs that are not always motivated by market-based incentives. Investment and operations decisions in the power sector can be more sensitive to politics than profit, and politically driven losses are subsidized from the state balance sheet. In 2008 the “Big 5”, the largest SOE power producers including Huaneng, Datang, Huadian, Guodian, and China Power Investment, alone lost 40 billion RMB because raw coal was worth more than tightly capped power prices and generators were forced to run at a loss, which they wrote off as a “policy loss” that the government would make whole ([He and Morse, 2010](#)). Wind investment and pricing has been afflicted by a similar phenomenon. The national “concession system” for establishing wind power prices, which tried bidding by developers to establish tariffs five times from 2003–2009, certainly helped China move some projects closer to a market-based price discovery mechanism. But major SOEs were known to bid below-market prices in order to win projects and meet central government renewable energy quotas. Accordingly, observers have noted that the tariff outcomes of the concession system were artificially depressed and prices were low enough to discourage investment from private, non-SOE investors ([Li and Gao, 2008](#)). These distorted concession prices heavily influenced the setting of current regional feed-in tariffs ([NDRC, 2009](#)).

3.2. *No evidence of manipulation in China’s wind case*

The empirical analysis of power data for all CDM wind projects in China shows no obvious evidence of dramatic changes in pricing policy that might reveal deliberate price manipulation by the NDRC. While the design of current additionality policy creates the opportunity for manipulation without a way of proving it, the available evidence does not directly suggest that the Chinese government is in fact gaming the CDM. [Figs. 1 and 2](#) below show the trend in Chinese power tariffs granted to registered CDM wind projects since the inception of the CDM in China, and most projects were registered until late 2009. Though policies have changed, prices have not dramatically shifted lower. The single tariff granted higher than 1 RMB/kWh is an offshore wind project and therefore received an exceptional tariff. All tariffs discussed here exclude VAT. It should also be noted that the Chinese feed-in tariff for wind is roughly 1.5 times higher than the average tariff for on-grid power; the average price granted to CDM wind projects was 0.5443 RMB/kWh (excluding VAT), and the average on-grid power price was 0.36034 RMB/kWh in 2008 ([SERC, 2009](#)). The average wind tariff (excluding VAT) for the 10 rejected wind projects is 0.5094, compared to 0.5443 of the total average. Those projects locate in Inner Mongolia, Heilongjiang, Liaoning and

Xinjiang, which have the best wind resources thus are granted lower on-gird wind prices set by NDRC (2009). The average IRR without CDM for those projects is 6.39%, IRR with CDM is 9.99%, and CDM would make 3.6% difference.

Table 2 shows the average wind tariff of the projects registered in a year decreased 5.8% from 2006 to 2008, then increased 3.7% in 2009, an overall 2.3% decrease from 2006 to 2009. At the same time, the reported average wind investment cost had grown 6.2% from 2006 to 2009, which is not consistent with what reported in the industry that the wind investment cost started to fall in 2008 due to the localization of manufacture and economy of scale (Li et al., 2010). As the total wind capacity in China has risen, absolute subsidies for Chinese wind projects have increased dramatically. Total subsidies paid by the Chinese government have rocketed from 229.29 million RMB in 2003 to 2379.94 million RMB in 2008 (CREIA, 2009). However, on a per-MW basis, those subsidies have mostly decreased from 0.4 million RMB in 2003 to 0.2 million RMB in 2008, half of that five years ago.

4. Implications for climate policy

We have shown the additionality test dependent on an IRR generated from Chinese power prices. This problem is not limited to Chinese wind – it applies for almost all renewable energy

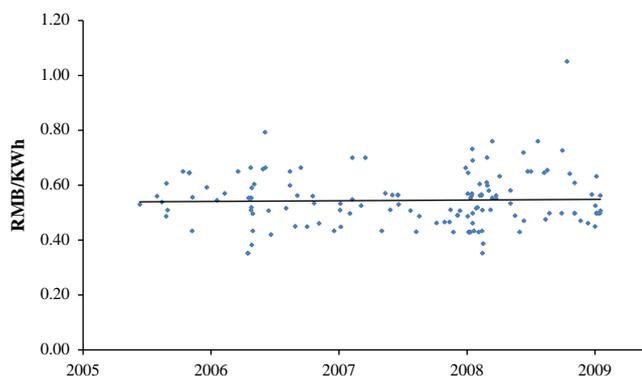


Fig. 1. Wind tariff by registration date for CDM projects.

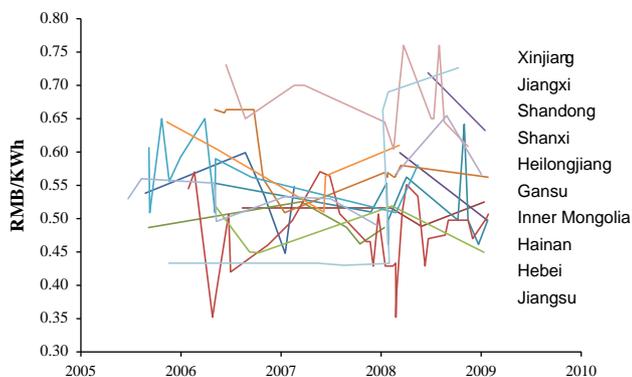


Fig. 2. Wind tariff by province for CDM projects, Note: The provinces are appeared in the order of their 2009 tariffs.

projects in developing countries with state controlled power sectors – and thus could damage the credibility of the CDM (Haya, 2010; Victor, 2011; Wara, 2007). Reform is necessary to use additionality metrics that are less dependent on domestic regulators. Possible reforms in the near term might contemplate using an enhanced barrier analysis that phasing out easy investment projects, interacting with NDRC to better understand domestic pricing policy so to make more transparent and sound observation of the pricing dynamics, or using a more credible baseline that reflect the evolution of China’s changing power sector (He and Morse, 2010). This could be challenging as the projects involve multiple technologies in multiple countries, however, a more transparent, credible baseline will apply immediate improvement to the mechanism. In the long-term, offset policy needs to be agnostic to market structure in developing country power sectors. The thinking on new market mechanisms (NMMs), for example sectoral approaches and program of activities that decouple the host entity from specific activities or policies, mitigates the additionality tests by building a sectoral baseline (Aasrud et al., 2009; IGES, 2013). The NMMs issue allowances based on a sectoral ex-ante, no-lose targets, with penalty for missing target, thus make incentives more compatible.

Even if reforms eliminated the dependency of additionality on domestic power pricing decisions, a more difficult question remains. How should additionality account for the impact of broader changes in domestic policy over time? China’s wind power polices have changed dramatically since 2003, making additionality a moving target (Li and Gao, 2008). “E+/E-” policies were introduced to provide clear rules on how to treat domestic policies impact emissions, “E+” policies increase emissions, “E-” policies reduce them (CDM EB, 2009c). “E+/E-” policies refers to clarifications on the consideration of national and/or sectoral policies and circumstances to be taken into account on the establishment of a baseline scenario, without creating perverse incentives that have impact the host country’s contributions to the ultimate carbon mitigation (CDM EB, 2009c). But they were not designed to accommodate complex issues like Chinese feed-in tariffs where subsidies are embedded within a complicated, state-controlled power pricing regime (Morse et al., 2010; Peng, 2011).

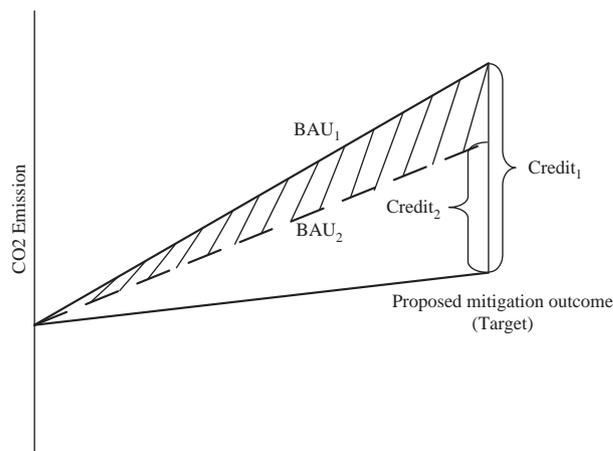


Fig. 3. The Offsetters' Paradox.

Table 2 Average wind tariff and investment cost of registered wind CDM projects by year.

Year	2006	2007	2008	2009
Average project power tariff (RMB/kWh)	0.5613	0.5355	0.5288	0.5485
Average wind investment cost (million RMB/MW)	8.96	8.81	8.99	9.51

Carbon policy must craft rules for the entire CDM that segregate the impact of evolving domestic policy from the impact of carbon finance when judging additionality. Unfortunately, this challenge presents a paradox for policy makers. On one hand, including domestic subsidies in the additionality calculation creates perverse incentives for the host country by making projects less eligible for CDM and therefore discouraging policies that would jeopardize CDM revenues. On the other hand, ignoring these subsidies assures crediting for business as usual projects, which reduces the integrity of global emissions caps (Morse and He, 2010).

This problem applies in nearly any situation where additionality is the central principle because additionality by definition compares a baseline of BAU to a lower emissions trajectory. As shown in Fig. 3, if credits are given for the difference between BAU₁ and target trajectories, any domestic policy that lowers baseline emissions to create BAU₂ reduces carbon payments, and therefore disincentivizes domestic emissions-reducing policies that would shift BAU₁ to BAU₂. Alternatively, if the offset mechanism attempts to solve the perverse incentive problem by crediting against BAU₁ instead of BAU₂ and ignores the domestic mitigation policy, then carbon offsets pay for what would have happened anyway as the shaded area depicts. We call this fundamental tension of additionality the Offsetters' Paradox. Post-CDM offset policy will need to directly confront this problem and decide how to strike an appropriate balance. This will become increasingly important as negotiators push for Nationally Appropriate Mitigation Actions (NAMAs) of developing countries that give domestic policy an even larger role in international climate policy.

5. Conclusion

The analysis presents additionality's dependence on domestic regulators in the near-term and draws an uneasy line between creating perverse incentives and crediting for BAU in the longer-term. The controversy over the additionality of Chinese wind offers key lessons for how the world can design, validate, and implement carbon offsets. This calls into question the integrity of the global carbon cap set under the second commitment period of the Kyoto Protocol. Post-2012 carbon policy should confront these imperfections and seek to reduce them by addressing the type of failures exposed by the Chinese wind controversy. Short-term reforms can immediately make project approval more credible and expeditious. Longer-term, mechanisms that are agnostic to market structure and independent of domestic regulators offer a better chance for avoiding controversy and proving the viability of carbon markets as a sound mitigation regime. Finally, the designs of offset mechanisms and linking of different trading schemes need to directly confront the Offsetters' Paradox because ignoring it will ultimately undermine the ability of the market to function.

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MEASURING THE CLEAN DEVELOPMENT MECHANISM'S PERFORMANCE AND POTENTIAL

Michael Wara^{*}

The Clean Development Mechanism (CDM) of the Kyoto Protocol is the first global attempt to address a global environmental public goods problem with a market-based mechanism. The CDM is a carbon credit market where sellers, located exclusively in developing countries, can generate and certify emissions reductions that can be sold to buyers located in developed countries. Since 2004 it has grown rapidly and is now a critical component of developed-country government and private-firm compliance strategies for the Kyoto Protocol. This Article presents an overview of the development and current shape of the market, then examines two important classes of emission reduction projects within the CDM and argues that they both point to the need for reform of the international climate regime in the post-Kyoto era, albeit in different ways. Potential options for reforming the CDM and an alternative mechanism for financing emissions reductions in developing countries are then presented and discussed.

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^{*} Assistant Professor, Stanford Law School; Program on Energy and Sustainable Development, Freeman Spogli Institute for International Studies. This Article grew out of a close collaboration between myself, Tom Heller, and David Victor, both of whom have played critical roles in the development of my thinking on carbon markets. Comments from Jeremy Carl, Michele Dauber, Larry Goulder, Mike Klausner, Axel Michaelova, and Buzz Thompson helped to improve earlier versions of the Article.

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INTRODUCTION

Global warming is one of the most difficult and important environmental challenges facing the international community. To date, the most substantial effort to address climate change is the Kyoto Protocol (Protocol).¹ Although not ratified by the United States and only recently by Australia,² the Protocol was signed and ratified by every other large developed country and entered into force on February 16, 2005.³ It is likely the largest and most expensive international effort to combat a global environmental commons problem.

The Protocol is a highly innovative international agreement as it both incorporates and allows for numerous trading mechanisms. These flexibility mechanisms were inserted into the text during the negotiation process at the insistence of the United States, its most prominent nonsignatory.⁴ They are quickly becoming, if they have not already become, the preeminent examples of attempts to address an international environmental problem using market-based approaches.

The United States and the international community are at a critical juncture in the effort to address the problem of climate change. Although the United States declined to join the Protocol, regulations to control carbon dioxide (CO₂) emissions are currently being developed by a coalition of seven

1. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22, available at <http://unfccc.int/resource/docs/cop3/07a01.pdf> [hereinafter Kyoto Protocol].

2. *World Briefing: Australia; Kyoto Ratification First Act of New Leader*, N.Y. TIMES, Dec. 4, 2007, at A8, available at <http://query.nytimes.com/gst/fullpage.html?res=9800E7DF1E3BF937A35751C1A9619C8B63>.

3. United Nations Framework Convention on Climate Change, Kyoto Protocol: Status of Ratification, http://unfccc.int/essential_background/kyoto_protocol/status_of_ratification/items/2613.php (last visited June 5, 2006) [hereinafter Kyoto Protocol Status]. The Kyoto Protocol entered into force on the ninetieth day after at least fifty-five parties to the Convention, including Annex 1 parties accounting for at least 55 percent of total 1990 carbon dioxide emissions ratified the treaty. Kyoto Protocol, *supra* note 1, art. 25 § 1.

4. Daniel Bodansky, *Bonn Voyage: Kyoto's Uncertain Revival*, NAT'L INTEREST, Fall 2001, at 5.

northeastern states,⁵ by California,⁶ and are proposed in multiple bills in the U.S. Senate.⁷ In addition, many U.S. firms will be forced to comply with the Protocol in their international operations. Finally, the Protocol is set to expire at the end of 2012, and negotiations for a future global warming treaty, including market-based components, are therefore underway.⁸

The effort to curb global warming will be difficult and costly. Sustaining necessary political support and expenditure will require that policies implemented to achieve climate stabilization are both environmentally sound and cost effective. This Article aims to contribute to the success of this effort by presenting a critical empirical analysis of the current market for greenhouse gases (GHGs) under the Protocol and suggesting possible reforms. It is highly likely that any future global warming treaty will include market-based solutions; all current examples of climate regulation incorporate market-based mechanisms, and such mechanisms may result potentially in substantial cost savings.⁹ These markets for pollution, if they are to succeed in accomplishing a future treaty's environmental goals, must both incorporate the successes and eliminate the shortcomings of previous efforts. Given the rapid development of the Protocol's GHG markets over the last three years and the incipient negotiations over a future treaty, the time is ripe for an analysis that attempts to identify the successes and the failures of the initial experiments in GHG emissions trading.

The Clean Development Mechanism (CDM), a market-based emissions trading mechanism created under the auspices of the Protocol,¹⁰ certifies GHG emission-reduction credits generated by projects in the developing world that can be sold to emitting developed countries facing compliance obligations under the treaty. Payment for the credit is intended to fund the

5. The coalition includes Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont. Memorandum of Understanding From the Regional Greenhouse Gas Initiative *passim* (Dec. 20, 2005), http://www.rggi.org/docs/mou_12_20_05.pdf [hereinafter RGGI Memo].

6. MKT. ADVISORY COMM., CAL. AIR RES. BD., RECOMMENDATIONS FOR DESIGNING A GREENHOUSE GAS CAP-AND-TRADE SYSTEM FOR CALIFORNIA, at iv-v (2007), available at http://www.climatechange.ca.gov/documents/2007-06-29_MAC_FINAL_REPORT.PDF.

7. The most prominent federal proposal to reduce U.S. greenhouse gases (GHG) emissions, which includes a market for GHG emissions, is America's Climate Security Act of 2007, S. 2191, 110th Cong. (2007).

8. The Bali Action Plan lays out a path for negotiation of a post-Kyoto framework. See United Nations Framework Convention on Climate Change, Conference of the Parties, Thirteenth Session, Bali, Indon., Dec. 3-15, 2007, *Decision 1/CP.13: Bali Action Plan*, U.N. Doc. FCCC/CP/2007/6/Add.1 (Mar. 14, 2008), available at <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3> [hereinafter *Bali Action Plan*].

9. Kyoto Protocol, *supra* note 1, arts. 6, 12, 18; RGGI Memo, *supra* note 5; America's Climate Security Act of 2007, S. 2191, §§ 2101-2503.

10. Kyoto Protocol, *supra* note 1, art. 12, § 1.

cost of reducing GHG emissions, thereby facilitating developing-country participation in the international climate regime and assisting in the achievement of sustainable development.¹¹ All emissions reductions certified under the CDM are supposed to be voluntary, real, and additional to any that would occur in the absence of the credit system.¹²

The CDM is the first attempt to address a global atmospheric commons problem using a global emissions trading market.¹³ Over the past three years, the CDM has developed the shape that it will likely have during the first commitment period of the Protocol.¹⁴ The goal of this Article is both to describe this broad outline and to use it to inform the design of future treaty architectures and administrative legal regimes¹⁵ aimed at the control of GHG emissions and global warming.

This analysis builds both on legal scholarship that first identified the potential of emissions trading regimes to reduce the costs of providing environmental goods,¹⁶ and on a relatively extensive body of legal scholarship analyzing the results of attempts to design and to implement emissions trading markets. Empirical work on emissions trading markets has focused on the strategic behavior of market participants,¹⁷ the complicated role of the regulator,¹⁸ environmental justice problems caused by emissions trading markets,¹⁹ and the difficulty of monitoring certain air pollutants necessary for

11. *Id.* art. 12, § 2.

12. *Id.* art. 12, § 5.

13. In contrast, the Montreal Protocol utilized a fund contributed to by developed countries to pay for the cost of emissions reductions of ozone-depleting substances in developing countries. See The Montreal Protocol on Substances That Deplete the Ozone Layer art. 10, *opened for signature* Sept. 16, 1987, 1522 U.N.T.S. 28, available at <http://www.unep.org/OZONE/pdfs/Montreal-Protocol2000.pdf> [hereinafter Montreal Protocol].

14. The first commitment period extends from January 1, 2008 to December 31, 2012. Kyoto Protocol, *supra* note 1, art. 3.1.

15. Regarding the emergence of a body of international administrative law, see Benedict Kingsbury et al., *The Emergence of Global Administrative Law*, 68 LAW & CONTEMP. PROBS. 15 (2005).

16. Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1341–51 (1985).

17. David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 WASH. & LEE L. REV. 289, 310 (1998); Gary C. Bryner, *Carbon Markets: Reducing Greenhouse Gas Emissions Through Emissions Trading*, 17 TUL. ENVTL. L.J. 267, 291 (2004).

18. Lesley K. McAllister, *Beyond Playing “Banker”: The Role of the Regulatory Agency in Emissions Trading*, 59 ADMIN. L. REV. 269, 312–13 (2007).

19. Richard Toshiyuki Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles’ Failed Experiment in Air Quality Policy*, 9 DUKE ENVTL. L. & POL’Y F. 231, 252 (1999); James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 628–29 (2000).

emissions trading.²⁰ To date, however, these analyses have focused on domestic markets. International markets, because they involve both an international regulator as well as developing-country governments and firms, are likely to present both similar and unique challenges.

The CDM was designed around the insight that the marginal cost of emissions reductions in developing, and especially rapidly developing, countries would be less than those faced by developed nations.²¹ The basis for this insight was that the cost of building more efficient, lower-GHG-emitting industrial and energy facilities in the developing world would be far lower than the cost of prematurely retiring or retrofitting existing developed-world capital stock.²² By means of the CDM, GHG emissions reductions could occur in the developing world that would otherwise have occurred in the developed world at far higher cost.²³ The expectation was that by putting a price on GHG emissions in the developing world and by linking that price to developed-world cap-and-trade markets for CO₂, costs of compliance with the Protocol in the developed world could be significantly reduced. This Article will show that what has in fact occurred is something far different: (1) the CDM has primarily proffered an exchange of CO₂ emissions reductions in the developed world for reductions of various non-CO₂ gases in the developing world; (2) substantial strategic behavior has occurred, aimed at manipulating baselines in order to increase the number of offsets created; and (3) as participation in the energy sectors of developing countries has deepened, the regulatory challenge faced by the CDM Executive Board in determining whether a project's reductions are "additional to any that would occur"²⁴ in its absence has become deeply problematic.

The CDM in its current form is, from an environmental perspective, highly imperfect. It is nonetheless creating both powerful political institutions and stakeholders interested in maintaining the current system or something similar.²⁵ Given the relatively poor performance, at least initially,

20. Drury et al., *supra* note 19, at 280–81; Thomas O. McGarity, *Missing Milestones: A Critical Look at the Clean Air Act's VOC Emissions Reduction Program in Nonattainment Areas*, 18 VA. ENVTL. L.J. 41, 57 (1999).

21. See Michael A. Toman, Richard D. Morganstern & John Anderson, *The Economics of "When" Flexibility in the Design of Greenhouse Gas Abatement Policies 2–3* (Resources for the Future, Discussion Paper No. 99-38-REV, 1999).

22. Prepared Testimony of Janet Yellen, Chair, Council of Economic Advisors Before the House Commerce Committee Energy and Power Subcommittee (Mar. 4, 1998), *reprinted in* FED. NEWS SERVICE, Mar. 4, 1998, at 5.

23. Toman, Morganstern & Anderson, *supra* note 21, at 2–3.

24. Kyoto Protocol, *supra* note 1, art. 12, § 5(c).

25. See for example, the membership of the International Emissions Trading Association, a strong CDM supporter which includes many of the largest global financial institutions.

of other markets for atmospheric pollution, the imperfect performance of the CDM is not entirely surprising and should not be a reason to abandon the system. The CDM is failing as a market because its rules, rather than producing real reductions, have accounting loopholes that allow participants to manufacture GHG credits at little or no cost beyond the payment of consultants necessary to surmount the necessary regulatory hurdles. Further, although it is supplying credits to developed signatories of the Protocol at prices less than they would otherwise be, the CDM is an excessive subsidy that represents a massive waste of developed-world resources. It is too late to change the structure of the CDM to address its shortcomings prior to the end of the first commitment period.²⁶ The overarching aim of this Article is to argue that in the period after 2012, both the financial resources devoted to the current CDM architecture and the additional resources likely to be added as developed-world commitments to cut GHGs deepen, might be far more efficaciously allocated in the international effort to stem global warming.

Such reform need not compromise the notable success of the CDM as a political mechanism. The CDM has produced remarkable participation in the developing world. Participation has been most active in countries with relatively high rates of economic growth. In other words, the developing countries whose efforts are most needed to help resolve the global warming problem are the same countries that have been engaged. At the same time, this has created political difficulties within developed countries where the subsidy of nations such as China and India is unpopular and hard to justify given their high rates of growth. Relative levels of developing-world participation and benefit from the CDM have also created tensions among the signatories to the Protocol²⁷ because of the growing perception that the distribution of credit revenues is extremely inequitable; most of the funds flow to a few relatively well-off developing countries.

Two tracks for reform seem possible. One option is to address the current regime's shortcomings while maintaining its basic structure in the post-2012

International Emissions Trading Association, Membership, <http://www.ieta.org/ieta/www/pages/getfile.php?docID=556> (last visited July 15, 2008).

26. The Kyoto Protocol's First Commitment Period, the interval of time during which developed-world parties to the treaty must comply with quantified emissions limits, extends from 2008 to 2012. Kyoto Protocol, *supra* note 1, art. 3.

27. United Nations Framework Convention on Climate Change, Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Bali, Indon., Dec. 3-15, 2007, *Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol in Its Third Session, Held in Bali From 3 to 15 December 2007*, ¶ 36, at 11, U.N. Doc. FCCC/KP/CMP/2007/9 (Mar. 14, 2008), available at <http://unfccc.int/resource/docs/2007/cmp3/eng/09.pdf>; see also, United Nations Framework Convention on Climate Change, The Nairobi Framework-Catalyzing the CDM in Africa, http://cdm.unfccc.int/Nairobi_Framework/index.html (last visited Mar. 31, 2008).

climate regime. This would involve strengthening the administrative procedures within the CDM in order to increase the certainty that projects are producing real reductions that are additional to any that would have occurred without the program. This reform would have to be accomplished without increasing transaction costs or project risks to such an extent that participation in the scheme was reduced below a useful level. The second option would discard the market-based approach of the CDM and adopt a fund-based approach best exemplified by the Montreal Protocol's Multilateral Fund.²⁸ While a fund approach would not necessarily solve all of the problems associated with the CDM, and might create new and as yet unforeseen difficulties, it would improve the efficiency of the system and likely increase its environmental effectiveness.

In Part I, I will first briefly introduce the Kyoto Protocol and the Clean Development Mechanism. I will then present in Part II a description of the current state of supply to the CDM market, followed in Part III by a story of the participation of a particular highly specialized industry that produces small quantities of a very potent greenhouse gas. Part IV explains how the underlying structure of the market has incentivized this particular industry to generate large numbers of CDM credits and thus to dominate the first phase of market growth. I will also tell a second story in Part V about the challenges presented by the recent dramatic increase in the level of CDM participation by China's energy sector. Here, the interaction between international regulators and a state-regulated industry is leading to attempts to generate large numbers of credits for behavior that would have occurred even in the absence of the CDM. Finally, in Part VI I will conclude by sketching out two possible futures for international emissions trading between developed and developing countries that incorporate lessons from the unforeseen problems of the first three years of emissions crediting under the CDM.

I. THE KYOTO PROTOCOL AND THE CLEAN DEVELOPMENT MECHANISM

A. The Kyoto Protocol

The international agreements aimed at controlling greenhouse gas emissions are hierarchically structured. The most general and overarching agreement, known as the United Nations Framework Convention on Climate Change (UNFCCC or Convention), adopts as its goal the stabilization

28. Montreal Protocol, *supra* note 13, art. 10, § 3.

of GHG concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system.²⁹ The UNFCCC has been signed and ratified by 192 countries,³⁰ including all major emitters of greenhouse gases.³¹ Although its goal is ambitious, the UNFCCC contains no provisions that compel action to accomplish it. Rather, it lays out a process through which various protocols containing more specific commitments might be negotiated.³² The first of these protocols was negotiated at Kyoto in 1997.³³ The Kyoto Protocol (Protocol), as it has come to be called, establishes binding caps on emissions for developed nation parties and parties with economies in transition (Annex B parties or Annex B nations).³⁴ These caps are limits on emissions of GHGs during the 2008–2012 period.³⁵ The caps are set as reductions below each party's 1990 emission level³⁶ of six GHGs: CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).³⁷ Emission reduction commitments specified by the Protocol are typically 5 to 8 percent below the 1990 emissions baseline, although some parties successfully negotiated a commitment of no reduction, or even an increase

29. United Nations Framework Convention on Climate Change, New York, U.S., May 9, 1992, art. 2, U.N. Doc. FCCC/Informal/84, available at <http://unfccc.int/resource/docs/convkp/conveng.pdf> [hereinafter UNFCCC Convention].

30. United Nations Framework Convention on Climate Change, Status of Ratification, http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php (last visited July 15, 2008).

31. Compare United Nations Framework Convention on Climate Change, Status of Ratification, available at http://unfccc.int/files/essential_background/convention/status_of_ratification/application/pdf/unfccc_conv_rat.pdf (last visited Apr. 3, 2006), with UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, GREENHOUSE GAS EMISSIONS DATA FOR 1990–2003 SUBMITTED TO THE U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, KEY GHG DATA 21, 92–94 (2005), available at http://unfccc.int/resource/docs/publications/key_ghg.pdf. I define major emitters of greenhouse gases somewhat arbitrarily as those nations emitting more than 500 million metric tons (Mt) of CO₂ or its equivalent in other GHGs (CO₂) per year. As of their latest reports of GHG emissions to the United Nations Framework Convention on Climate Change (UNFCCC), this list included Australia, Brazil, Canada, China, France, Germany, India, Italy, Japan, the Russian Federation, Ukraine, the United Kingdom of Great Britain and Northern Ireland, the United States, and collectively, the European Union. *Id.*

32. UNFCCC Convention, *supra* note 29, at arts. 7, 17.

33. Kyoto Protocol, *supra* note 1, at art. 28.

34. *Id.* art. 3. Note that not all Annex I nations of the UNFCCC adopted commitments as specified in Annex B of the Kyoto Protocol. The most notable of these are the United States and Australia. This Article will use the terminology “Annex B” nation or party to refer to a signatory that did adopt such a commitment. These nations are sometimes referred to as Annex I nations or parties.

35. This period is commonly referred to as the “commitment period” or the “first commitment period.” *Id.*

36. *Id.* art. 3, annex B.

37. *Id.* annex A.

above the baseline.³⁸ Additionally, different levels of economic growth or stagnation since 1990 mean that while some Annex 1 nations face steep cuts, others actually have excess allocations.³⁹

The Protocol includes various flexible mechanisms aimed at reducing the cost of compliance for Annex B parties.⁴⁰ These include provisions allowing parties to trade their allowable emissions (assigned amount units or AAUs)⁴¹ as long as such trading is supplemental to domestic actions.⁴² Also included are provisions allowing Annex B parties to pay for additional emissions reductions within other Annex B parties and then credit them against their own assigned amount units.⁴³ This plan is known as Joint Implementation (JI).⁴⁴ Finally, Annex B parties may pay for emissions reductions within developing (non-Annex B) parties and also credit these against their commitments under the Protocol. The purchasing Annex B nation may then credit these emissions reductions against its assigned amount units. This provision is known as the Clean Development Mechanism (CDM).⁴⁵

The Protocol was ratified by a sufficient number of nations representing a sufficient proportion of global GHG emissions to enter into force,⁴⁶ but it

38. These nations include Australia (108 percent), Iceland (110 percent), New Zealand (100 percent), Norway (101 percent), Russia (100 percent), and Ukraine (100 percent). *Id.* annex B.

39. Compare *id.*, with United Nations Framework Convention on Climate Change, Total Aggregate Greenhouse Gas Emissions of Individual Annex B Parties, 1990–2003, http://ghg.unfccc.int/graphics/graph1_05.gif (last visited Apr. 6, 2006). The Annex B parties with the most headroom are Russia and Ukraine. To date, no nation has purchased assigned amount units (AAU's) from either nation, although there is much discussion of this compliance option. Another nation whose compliance was made far easier by the chosen baseline is Germany. Germany's allocation includes that of the former East Germany, where heavy industry and power demand collapsed after unification. This led to a large decrease in emissions relative to allocation, making the unified Germany's and hence the European Community's compliance challenge much more tractable. See WOLFGANG EICHHAMMER ET AL., GREENHOUSE GAS REDUCTIONS IN GERMANY AND THE UK—COINCIDENCE OR POLICY INDUCED? AN ANALYSIS FOR INTERNATIONAL CLIMATE POLICY 1 (2001), available at <http://publica.fraunhofer.de/eprints/N-6386.pdf>.

40. Lawrence H. Goulder & William A. Pizer, *The Economics of Climate Change*, in THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 10 (Steven Durlauf & Lawrence Blume eds., 2d ed. 2005), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=869644.

41. Indeed, the structure of the agreement is essentially a cap-and-trade system in which AAUs are freely allocated permits to emit that can then be traded between parties via a common registry, administered by the UNFCCC Secretariat. Kyoto Protocol, *supra* note 1, art. 3 ¶ 7.

42. *Id.* art. 17.

43. *Id.* art. 6.

44. Joanna Depledge, *Tracing the Origins of the Kyoto Protocol: An Article by Article Textual History*, 61, 64, delivered to the UNFCCC, U.N. Doc. FCCC/TP/2000/2 (Nov. 25, 2000), available at <http://unfccc.int/resource/docs/tp/tp0200.pdf>.

45. Kyoto Protocol, *supra* note 1, art. 12.

46. *Id.* art. 25 (At least 55 parties to the Protocol representing at least 55 percent of 1990 emissions of GHGs must ratify for the treaty to enter into force.); Kyoto Protocol Status, *supra* note 3.

was not ratified by either the United States or Australia.⁴⁷ It now appears at least possible, if not likely, that one Annex B party, Canada, will either withdraw or fail to comply with the Protocol, while another, Australia, may now join the treaty.⁴⁸ In order to induce a sufficient number of Annex B parties to ratify the treaty, significant concessions were made to particular parties. Notably, the Russian Federation and Ukraine were allowed to join the Protocol with commitments of a zero percent reduction below 1990 levels, although by the time of the negotiations their actual emissions were already far below the 1990 baseline because of the post-Soviet economic contraction.⁴⁹ These nations were able to join the Protocol without fear of facing emissions reductions and with the prospect of future sale of their excess AAU's to countries facing a commitment requiring actual cuts in emissions.⁵⁰

Before and after its entry into force, the Protocol has faced severe criticism: It has been criticized for doing little to combat global warming;⁵¹ for being economically inefficient in requiring nations to reduce emissions too quickly;⁵² for utilizing absolute emissions caps rather than emissions intensity targets or a carbon tax;⁵³ and for not committing the largest developing nations, most notably China and India, to binding emissions

47. *Id.*

48. Both changes are due, of course, to a change in government. In Canada, the election of a conservative government in 2006 led to a reevaluation of Canada's efforts on climate. In Australia, subsequent to the 2007 election, Prime Minister Kevin Rudd's first action was to ratify the Protocol. See, Doug Struck, *Canada Alters Course on Kyoto*, WASH. POST, May 3, 2006, at A16; *World Briefing: Australia; Kyoto Ratification First Act of New Leader*, *supra* note 2.

49. David G. Victor et al., *The Kyoto Protocol Emission Allocations: Windfall Surpluses for Russia and Ukraine*, 49 CLIMATIC CHANGE 263, 264 (2001).

50. ALAIN BERNARD ET AL., MIT JOINT PROGRAM ON THE SCI. & POL'Y OF CLIMATE CHANGE, REPORT NO. 98, RUSSIA'S ROLE IN THE KYOTO PROTOCOL 1-3 (2003), available at http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt98.pdf.

51. William D. Nordhaus, *Global Warming Economics*, 294 SCIENCE 1283, 1283-84 (2001).

52. Joseph E. Aldy et al., *Thirteen Plus One: A Comparison of Global Climate Policy Architectures*, 3 CLIMATE POL'Y 373, 391 (2003). For the argument that economically efficient greenhouse gas reduction trajectories differ little from business as usual in the short term but substantially in the long term, see Alan Manne & Richard Richels, *On Stabilizing CO₂ Concentrations—Cost-Effective Emission Reduction Strategies*, 2 ENVTL. MODELING & ASSESSMENT 251 (1997).

53. William Pizer, *The Case for Intensity Targets 1-2* (Resources for the Future, Discussion Paper No. 05-02, 2005). The case for setting intensity targets, which limit a country's CO₂ emissions per dollar of GDP, is a consequence of Weitzman's insight that when uncertainty exists as to costs of abatement and the slope of the marginal benefit of abatement curve for an environmental good is relatively flat, a tax rather than a quantity control leads to a superior welfare outcome. See William A. Pizer, *Prices vs. Quantities Revisited: The Case of Climate Change 3-4* (Resources for the Future, Discussion Paper No. 98-02, 1997); Martin L. Weitzman, *Prices vs. Quantities*, 41 REV. ECON. STUD. 477 (1974).

reductions.⁵⁴ Finally, its flexible mechanisms also have been criticized as dependent on counterfactuals, namely an emissions baseline, that is either unknowable or politically determined.⁵⁵ Reflecting this criticism, at least thirteen modified treaty architectures have been offered as alternatives or improvements for the post-2012 period.⁵⁶

The most common response to these criticisms is that the Protocol has been, since its negotiation in 1997, the only game in town when it comes to controlling the growth in global GHG emissions and mitigating future harms from global warming. Further, it has spurred the emergence and growth of institutions and capacities that will likely endure beyond its existence, albeit perhaps in altered and improved form. Some of the most notable diplomatic successes of the twentieth century were the result of a long series of negotiations and agreements. Institutions like the GATT and its successor, the WTO, and perhaps most of all, the European Union, that have ultimately delivered tremendous benefits to their members, began with modest and limited agreements. Members were not afraid to tinker with these institutions as they learned by doing. The Protocol has given birth to a whole set of institutions and has fostered capacity development both in the developed and developing world that will prove invaluable in ultimately overcoming the challenges presented by climate change.

This Article's aim is to take a close look at the actual, as opposed to the theoretical, outcome of one of the Protocol's most significant institutional creations—a global market for GHG emission credits. Most or all of the criticisms of the Protocol were made prior to the development of a substantial track record for the CDM and the other flexible mechanisms, so these criticisms were of necessity theoretical in nature. Although to date there has been little use of JI and no sale and purchase of AAUs, there has been an explosion of activity within the CDM that now provides a basis for an empirical critique of the Protocol. This critique aims not to undermine the rationale for the Protocol, but to understand how, in the next phase of the international effort to avoid “dangerous anthropogenic interference”⁵⁷ with the world's climate, trading can accomplish more than it has or is likely to under the Kyoto regime.

54. Prepared testimony of Janet Yellen, *supra* note 22, at 4; Letter From George W. Bush, President of the U.S., to Senators Hagel, Helms, Craig, and Roberts (Mar. 13, 2001), <http://www.whitehouse.gov/news/releases/2001/03/20010314.html>. Since developing nations are involved in the Kyoto Protocol through the CDM, this criticism is the extent of their involvement. Kyoto Protocol, *supra* note 1, art. 12.

55. Chi Zhang et al., *Carbon Intensity of Electricity Generation and CDM Baseline: Case Studies of Three Chinese Provinces*, 33 ENERGY POL'Y 451 (2005).

56. Aldy et al., *supra* note 52, at 373.

57. UNFCCC Convention, *supra* note 29.

B. Clean Development Mechanism

1. Structure of the CDM

The CDM is a market-based approach to the problem of global warming. It allows buyers, who may be Annex B parties or firms within Annex B nations, to purchase credits from emission reduction projects carried out in non-Annex B nations. The CDM builds on experience derived from various regional markets for atmospheric pollutants, most notably the United States' experience with emissions trading under the Clean Air Act.⁵⁸ The developing country (non-Annex B) firms that are sellers of Certified Emission Reductions (CERs), the currency of the CDM system, have no limit to the mass of GHGs that they may emit under the Protocol. This absence of a cap on emissions for designated parties necessitates a far more complex design than had been attempted for most previous pollution markets. Adding further complexity to the program is the fact that the CDM is the first atmospheric pollutant trading program that covers multiple gases and allows conversion between them through the medium of its common currency, CERs.

Further, the CDM is a project-based system. It accomplishes its objectives at the microlevel of individual emission reduction projects that are each validated by designated third party verifiers and then registered by the mechanism's governing body, the CDM Executive Board (CDM EB), as eligible for crediting. Each project wishing to participate in the CDM must prepare a Project Design Document (PDD) that explains in detail how its future emissions reductions will be voluntary, real, additional, and will not induce leakage. It must also either utilize a previously approved monitoring methodology that explains in detail how it will monitor emissions reductions made by the project or propose a new methodology. Voluntary emissions reductions are not compelled by national or provincial law or regulation. Real emissions reductions are monitored with sufficient care to ensure that they actually occur. Additional emissions reductions are those that are in addition to any that would have occurred absent the CDM subsidy. Leakage of emissions occurs when emissions reductions that would have occurred from a CDM project absent the CDM subsidy are displaced to another location because of the subsidy.

58. Prepared testimony of Janet Yellen, *supra* note 22, at 12; see also Robert W. Hahn & Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109, 151-53 (1989) (detailing the successes and disappointments of the EPA program and suggesting that many of the program's failings stemmed from regulators' need to satisfy multiple constituencies with divergent objectives).

All four of these concepts require that a hypothetical baseline of emissions be defined for each project, and in the case of leakage, the world outside the project. This baseline represents the timeline of emissions that would have occurred absent the subsidy provided by the CDM (and thus absent the emission reduction project). It is an attempt to estimate the counterfactual of typical levels of emissions in a world without CDM. The CDM project baseline is described in terms that vary by project type. Nevertheless, several common variables can be seen in most PDDs.⁵⁹ Project proponents often describe the regulatory baseline, that is, the emissions permitted by local law and regulation.⁶⁰ They also often describe the financial baseline, which is the lack of an adequate return on investment without the benefit of the CDM subsidy.⁶¹ They often describe typical technologies applied by the type of project in the PDD and how the CDM-subsidized project exceeds these local standards.⁶² Finally, they sometimes must describe a sectoral or national baseline for installations of the project type.⁶³ Ultimately, the CDM project proponents must quantify, third party verifiers must check, and the CDM EB must certify the hypothetical emissions that would have occurred in the future without the CDM project subsidy.

Project proponents and environmental regulators do not live in a world without CDM. As will be shown below, they have acted strategically in order to maximize many projects' baselines and so maximize the potential for the generation of CER revenues. The fact that most industries involved in CDM projects are already highly regulated makes this strategy attractive

59. PDDs follow a standardized format that includes a general description of the project, a description of how the baseline for the project is determined, a specification of the duration of the project, an explanation of how the project's emissions reductions will be monitored, a quantitative estimate of the project's emissions reductions, a discussion of any other environmental effects of the project, and finally a synthesis of comments on the project by local stakeholders. CDM Executive Bd., UNFCCC, *Guidelines for Completing the Project Design Document (CDM-PDD), The Proposed New Methodology: Baseline (CDM-NMB) and the Proposed New Methodology: Monitoring (CDM-NMM)* (Version 04, 2005), available at http://cdm.unfccc.int/Reference/Documents/GuideL_Pdd/English/Guidelines_CDM_PDD_NMB_NMM.pdf.

60. See, e.g., CDM PROJECT DESIGN DOCUMENT OF THE REPUBLIC OF NORTH KOREA: HFC DECOMPOSITION PROJECT IN ULSAN 20 (2005), available at http://cdm.unfccc.int/UserManagement/FileStorage/FS_302727382.

61. See, e.g., CDM PROJECT DESIGN DOCUMENT: ZHANGBEI MANJING WINDFARM PROJECT 9-11 (2005), available at <http://cdm.unfccc.int/UserManagement/FileStorage/5X09Y9XLJO28P4KEA4GNSWG275CF5T>.

62. See, e.g., CDM PROJECT DESIGN DOCUMENT: EQUIPAV BAGASSE COGENERATION PROJECT (EBCP) 13-14 (2005), available at <http://cdm.unfccc.int/UserManagement/FileStorage/PL0URYPVKVZOV8TIW2MI8EG1Y3CBM1>.

63. See, e.g., CDM PROJECT DESIGN DOCUMENT: WASTE HEAT BASED 7 MW CAPTIVE POWER PROJECT 35 (2006), available at <http://cdm.unfccc.int/UserManagement/FileStorage/6W0JFJIP40XRP77Y7M83R6UVYCBLL>.

and easy to implement. An environmental regulator faced with the choice of preventing an emission with a costly domestic regulation⁶⁴ or by means of the CDM will have obvious political incentives for selecting the international program over new domestic regulation.⁶⁵

The end product of the CDM process is the issuance by the CDM EB of an emission offset to the project participants. This offset can then be sold to an Annex B nation or a party within one that has obligations under the Protocol. The offset, called a certified emission reduction or CER, assuming that certain CDM facilities are established, may be used by Annex B countries in lieu of emissions reductions within their territories in order to meet their targets under the Protocol.⁶⁶ Private parties that are assigned emissions allowances by their governments may also purchase CERs and use them as permits to emit in excess of their assigned allocations, or as an alternative to purchasing allocations from other participants in their domestic market. The European Union and Japan will likely be the major purchasers of CERs during the first commitment period.⁶⁷

The official public process leading to the production of CERs by a CDM project begins with the submission of a PDD to the CDM EB for a period of public comment. This comment process is a part of a project's validation by an independent Designated Operational Entity (DOE).⁶⁸ The project must also receive approval from its host country's Designated National Authority (DNA), typically the host country's environmental ministry, before being submitted for registration to the CDM EB.⁶⁹ Once registered, a project must submit monitoring reports providing data to show how many CERs have actually been generated during a particular period. These reports must be

64. It is costly both from the perspective of total societal costs and from the perspective of allocation of regulator personnel and funding.

65. The incentive not to regulate created by the CDM led the CDM EB to adopt rules specifying the dates after which a new regulation must be taken into account. CDM Executive Bd., UNFCCC, *Twenty-Second Meeting Report, Annex 3: Clarifications on the Consideration of National and/or Sectoral Policies and Circumstances in Baseline Scenarios* (Version 02, 2005), available at http://cdm.unfccc.int/EB/022/eb22_repan3.pdf.

66. Kyoto Protocol, *supra* note 1, art. 12, § 3(b).

67. POINT CARBON, CARBON 2006: TOWARDS A TRULY GLOBAL MARKET 5 fig.2.1 (2006), available at http://www.pointcarbon.com/wimages/Carbon_2006_final_print.pdf. Canada was also likely to have been an important purchaser of Certified Emission Reductions (CERs), but actions by its recently elected conservative government have made it doubtful that it will comply with the Protocol. See Doug Struck, *Canada Alters Course on Kyoto: Budget Slashes Funding Devoted to Goals of Emissions Pact*, WASH. POST, May 3, 2006, at A16.

68. U.N. ENV'T PROGRAM, LEGAL ISSUES GUIDEBOOK TO THE CLEAN DEVELOPMENT MECHANISM 32-34 (2004), available at <http://cd4cdm.org/Publications/CDM%20Legal%20Issues%20Guidebook.pdf>.

69. *Id.*

both consistent with the monitoring plan spelled out in the project's PDD and verified and certified by a DOE.⁷⁰ At that point, the CDM EB will issue CERs into a project participant's account.⁷¹ These CERs will eventually be transferable to a buyer who establishes an account with the International Transaction Log, a yet to be constructed database of Kyoto Protocol GHG accounts.⁷²

2. Goals of the CDM

The CDM was created for three reasons. First, it aims to accomplish the overarching goals of the Framework Convention. Second, it aims to encourage sustainable development in non-Annex B nations. Third, the CDM is intended to reduce the cost of compliance with the Protocol for Annex B nations.⁷³

The CDM is intended, according to the Protocol, to help in accomplishing the Convention's goal of "prevent[ing] dangerous interference" with the climate system.⁷⁴ It aims to do this by assisting developing countries to reduce their emissions of GHGs. Thus, the CDM is significant, and indeed the only way in which non-Annex B signatories to the Protocol will contribute toward achieving the Protocol's goals. A realistic hope for the CDM is that by providing non-Annex B nations with financial incentives for low-carbon intensity development, they might be nudged, however slightly, onto more climate-friendly trajectories.

The second CDM objective—sustainable development—is left largely undefined by the Protocol or the implementing directives of later conferences of the parties.⁷⁵ To the extent that the provision has teeth, it is given them by the requirement under the CDM that the host country DNA of a project must certify that the project meets the DNA's standards of sustainability.⁷⁶ Although some DNAs have prioritized particular types of projects, they have not rejected other types that would otherwise be capable of producing CERs.⁷⁷

70. *Id.*

71. *Id.*

72. UNFCCC, Subsidiary Body for Sci. & Tech. Advice, Twenty-Second Session, Bonn, F.R.G., May 19–27, 2005, *Checks to Be Performed by the International Transaction Log*, at 3–4, U.N. Doc. FCCC/SBSTA/2005/INF.3 (May 13, 2005), available at http://unfccc.int/files/meetings/unfccc_calendar/pre-sessional/application/pdf/inf03.pdf.

73. Kyoto Protocol, *supra* note 1, art. 12.

74. *Id.* art. 12, § 2.

75. *Id.* art. 12, § 2; U.N. ENV'T PROGRAM, *supra* note 68, at 49.

76. U.N. ENV'T PROGRAM, *supra* note 68, at 49.

77. China's official CDM policy favors renewable energy, energy efficiency, and methane capture projects, but the Chinese DNA has approved numerous other types of projects. See Office of Nat'l Coordination Comm. on Climate Change, *Measures for Operation and Management of Clean*

The third CDM goal—lowering the cost of compliance for Annex B parties—was thought possible for two reasons. First, the majority of new energy capacity to be built up during the First Compliance Period will be located in the developing world where rates of economic growth are highest and energy infrastructure is least developed.⁷⁸ Also, the relative cost of prematurely retiring high-carbon-emission intensity power plants is significantly higher than building new low- or zero-carbon emission energy capacity. Thus, if the CDM could be used to subsidize the substitution of new, clean power capacity in the developing world for the premature retirement of old, dirty power capacity in the developed world, it could substantially lower the cost of treaty compliance. Further, such a substitution would not change the environmental outcome, because the location at which an emission reduction of a particular quantity of CO₂ takes place has no impact on the environmental benefit—lower atmospheric greenhouse gas concentrations.⁷⁹ However, as will be shown in our first story about CDM implementation, a substantial proportion of the emissions reductions generated by the CDM are not of this type and are in reality extremely inefficient in terms of the cost of the subsidy compared to the cost of environmental benefits obtained. Our second story regarding CDM implementation will take a close look at the fraction of emissions reductions created by construction of new electric-generating capacity and will show that it is increasingly difficult to tell which CDM projects are producing emissions reductions additional to those that would have occurred in the baseline, and which are claiming credit for nonadditional, anyway credits.

II. RAPID DEVELOPMENT OF THE CLEAN DEVELOPMENT MECHANISM SINCE 2004

The CDM project pipeline began operation in December of 2003, when the first project was accepted for public comment and validation. In

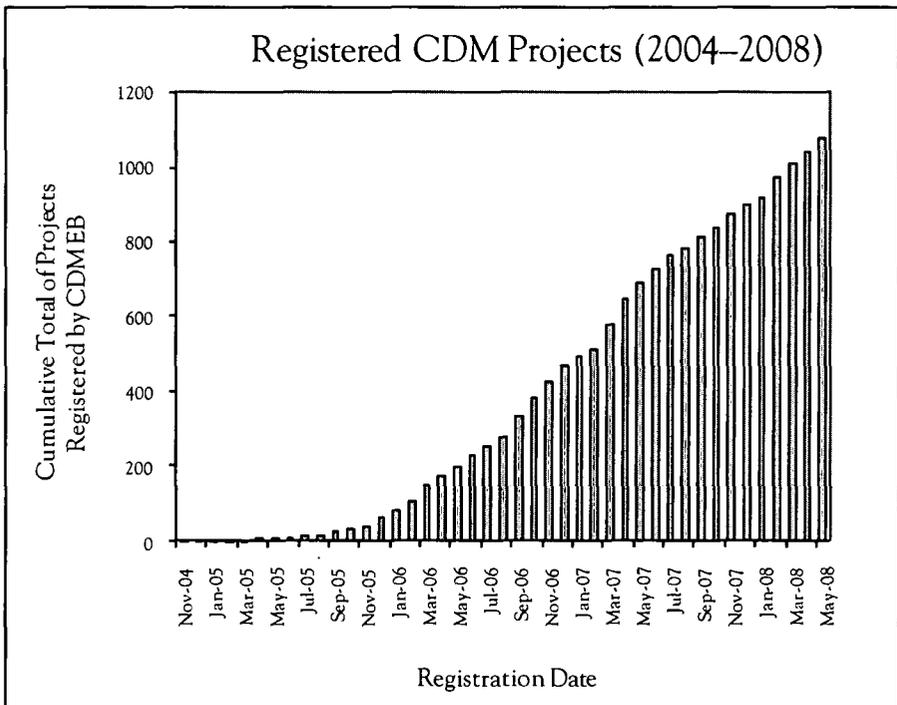
Development Mechanism Projects in China, art. 4 (Nov. 21, 2005), available at <http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=905>.

78. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, INTERNATIONAL ENERGY OUTLOOK 2007, at 61 (2007), available at [http://www.eia.doe.gov/oiaf/ieo/pdf/0484\(2007\).pdf](http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2007).pdf).

79. Because CO₂ is a well-mixed atmospheric gas with a long residence time, the extent to which it causes environmental harm is a function of its concentration in the atmosphere rather than the rate at which it is being added at any one time. William D. Nordhaus, *Life After Kyoto: Alternative Approaches to Global Warming Policies* 6 (Nat'l Bureau of Econ. Research, Working Paper No. 11889, 2005), available at <http://www.nber.org/papers/W11889.pdf>.

November of 2004, the first project was registered by the CDM EB.⁸⁰ Finally, in October 2005, the first CERs were issued to a project participant's account.⁸¹ Since then, there has been extremely rapid growth in the number, type, and total volume of emissions reductions in the CDM pipeline. Figure 1 shows the number of projects completing the registration process by month since the CDM began its activities. Beginning in the second half of 2005, the registration process picked up significant steam so that by the end of 2007, there were 895 projects registered and able to produce CERs for sale in the carbon market.

FIGURE 1: NUMBER OF PROJECTS REGISTERED BY THE CDM EXECUTIVE BOARD SINCE DECEMBER 2003, WHEN PDDs FIRST ENTERED THE CDM PIPELINE⁸²



80. See UNFCCC, Project 0008: Brazil NovaGerar Landfill Gas to Energy Project, <http://cdm.unfccc.int/Projects/DB/DNV-CUK1095236970.6> (last visited Apr. 30, 2008).

81. See UNFCCC, CERs Issued, http://cdm.unfccc.int/Issuance/cers_iss.html (last visited July 15, 2008).

82. Data for Figure 1 comes from UNEP Risø Centre, UNEP Risø CDM/JI Pipelines Database and Analysis, <http://www.cdmpipeline.org/publications/CDMpipeline.xls> (last visited May 2, 2008). As of November 1, 2007, there were 827 projects registered by the CDM EB.

It was not until November of 2005 that the volume of CO₂ reductions deliverable by registered CDM projects to the end of the First Commitment Period began to grow large enough to play a significant role in Protocol compliance for Annex B parties. From the last quarter of 2005 to the present, the potential CDM supply has grown at a breakneck pace. By January 1, 2008, more than 1150 million tons (Mt) CO₂ equivalent (CO₂e)⁸³ had been registered for delivery via the CDM by the end of the first compliance period (see Figure 2).⁸⁴ Another pattern emerging from the project registrations that have occurred is the dominance of large projects in the CDM. As seen in Figure 2, a small number of very large projects dominate the supply of CERs from registered projects. In fact, the 45 largest projects (5 percent of the total number) represent 64 percent of the total supply to the end of the First Commitment Period.⁸⁵

The trend of large projects dominating supply holds for the CDM pipeline as a whole, including projects registered, projects for which registration has been requested, and projects that have entered the validation stage. As of this writing, there are more than 2800 projects in the CDM pipeline that will eventually, if all are registered and deliver reductions as promised in their PDDs, supply more than 2600 Mt CO₂e to the market for Protocol compliance instruments.⁸⁶ This amount represents approximately 2.8 percent of Annex B 1990 GHG emissions for each year of the First Commitment Period.⁸⁷

83. The standard measure of greenhouse gas reduction under the Protocol is 1 ton CO₂e. It is the mass of any one of the six Kyoto gases equal to the 100-year global warming potential (GWP) of one ton of CO₂. GWP is defined as the time integrated radiative forcing from the release of 1 kg of a trace substance to 1 kg of CO₂. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) & TECH. & ECON. ASSESSMENT PANEL, SAFEGUARDING THE OZONE LAYER AND THE GLOBAL CLIMATE SYSTEM: ISSUES RELATED TO HYDROFLUOROCARBONS AND PERFLUOROCARBONS 385 (2005), available at http://www.ipcc.ch/pdf/special-reports/sroc/sroc_full.pdf [hereinafter IPCC].

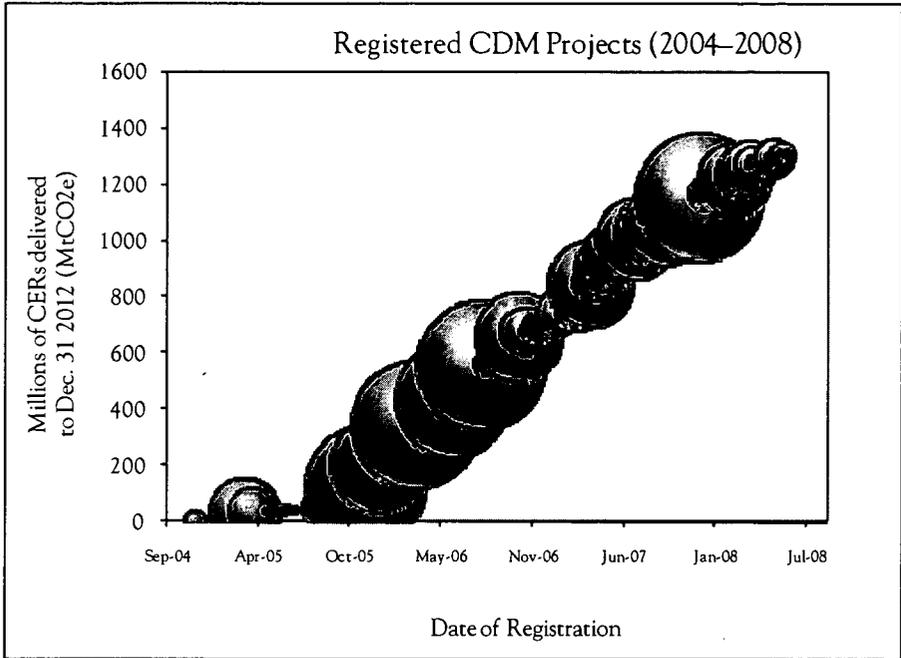
84. See UNEP Risø Centre, *supra* note 82.

85. *Id.*

86. See UNFCCC, CDM Statistics, <http://cdm.unfccc.int/Statistics/index.html> (last visited Jan 7, 2008). I count a project as in the CDM pipeline if it has advanced to the public comment phase of validation. UNFCCC, Validation Projects, <http://cdm.unfccc.int/Projects/Validation> (last visited July 15, 2008).

87. See UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, GREENHOUSE GAS EMISSIONS DATA FOR 1990–2003, *supra* note 31, at 15. Dividing the 2600 Mt CO₂e estimate for production of credits by 5 provides an annual estimate of supply during the First Commitment Period of 520 Mt CO₂e/year. Annex B GHG Emissions in 1990, not including credits for land use, land use change, and forestry, were 18,372 Mt CO₂e. Thus the CDM will provide 520/18,372 or 2.8 percent of Annex B 1990 GHG emissions.

FIGURE 2: PROJECTS REGISTERED IN TERMS OF CER SUPPLY PROJECTED BY END OF FIRST COMMITMENT PERIOD⁸⁸



Projects yet to be registered or yet to even enter the CDM pipeline face a diminishing probability of generating credits as the end of the First Commitment Period draws closer. The flow of projects is likely to diminish over time unless agreement is reached as to the future of the CDM in the post-2012 climate treaty architecture. The shorter the interval before the end of the First Commitment Period, the less money there is to be made from CERs and so the transaction costs associated with registration and monitoring loom larger.⁸⁹ Without certainty about the shape of any future UNFCCC-based trading program or subsidy, financial incentives to invest with post-2012 in mind are absent.⁹⁰ Even for the 2008–2012 market, there is significant

88. Data for Figure 2 comes from UNEP Risø Centre, *supra* note 82. The y-axis shows the total credits promised by December 31, 2012 of CERs to the carbon market from CDM projects; the size of each bubble shows the relative size of the particular project. This figure shows projects registered by November 1, 2007.

89. ERIC HAITES, ESTIMATING THE MARKET POTENTIAL FOR THE CLEAN DEVELOPMENT MECHANISM: REVIEW OF MODELS AND LESSONS LEARNED 63–64 (2004), available at <http://carbonfinance.org/docs/EstimatingMarketPotential.pdf>.

90. *Id.*

demand (and hence price) uncertainty because of the possible competition of CDM with both JI project-based reductions and outright purchases of AAUs from Russia, Ukraine, and the remainder of Eastern Europe.⁹¹ Whether these alternative supplies of AAUs and JI credits are sought out by Annex B parties depends on the costs of domestic compliance, the price of CERs, and other political considerations.⁹²

III. CURRENT SUPPLY OF CERs IN THE CDM PIPELINE BY PROJECT TYPE

The original intent of the CDM was to spur development of low-carbon energy infrastructure in the developing world both through achievement of sustainable development goals and substitution for early retirement of expensive, high-carbon energy infrastructure in the developed world.⁹³ It comes as a surprise, then, to find then that the CDM pipeline bears only a partial relationship to this vision. Instead, the subsidy provided by purchase of CERs to date will largely ensure that high GWP industrial gases such as trifluoromethane (HFC-23) and N₂O as well as CH₄ emitted by landfills and confined-animal-feeding operations (CAFOs) in non-Annex B nations are captured and destroyed. The very large projects dominating the supply of CERs are confined primarily to two relatively obscure industries—adipic acid and chlorodifluoromethane (HCFC-22) production. Adipic acid is the feedstock for the production of nylon-66 and releases abundant N₂O as a production byproduct.⁹⁴ HCFC-22 has two major applications. It is one of two major refrigerants that was phased in to replace the CFC's under the auspices of the Montreal Protocol to Protect on Substances that Deplete the Ozone Layer.⁹⁵ HCFC-22 is also the primary feedstock in the production

91. Russia was granted significant excess AAUs in negotiations leading up to its accession to the Protocol as an inducement to join. SCOTT BARRETT, ENVIRONMENT AND STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING 372–73 (2003). This concession, when combined with the post-Soviet economic contraction, leaves Russia with significantly lower actual emissions than its assigned amount under the Protocol. POINT CARBON, *supra* note 67, at 8; Victor et al., *supra* note 49, at 263. Ukraine and the remainder of Eastern Europe also have excess AAUs due to economic contraction. *Id.*

92. See discussion *infra* Part VI.

93. See discussion *infra* Part I.B.2.

94. R.A. Reimer et al., *Adipic Acid Industry—N₂O Abatement: Implementation of Technologies for Abatement of N₂O Emissions Associated With Adipic Acid Manufacture*, in NON-CO₂ GREENHOUSE GASES: SCIENTIFIC UNDERSTANDING, CONTROL AND IMPLEMENTATION 347, 347 (J. van Ham et al. eds., 2000).

95. A. MCCULLOCH, INCINERATION OF HFC-23 WASTE STREAMS FOR ABATEMENT OF EMISSIONS FROM HCFC-22 PRODUCTION: A REVIEW OF SCIENTIFIC, TECHNICAL AND ECONOMIC ASPECTS 2 (2005), available at http://cdm.unfccc.int/methodologies/Background_240305.pdf.

of PTFE,⁹⁶ more commonly known by its Dupont brand name, Teflon. HCFC-22 production inevitably produces HFC-23 as an unwanted byproduct.⁹⁷ These two relatively small industries represent nearly 55 percent of the supply of issued CERs in the CDM to date.⁹⁸

Contrary to ex-ante predictions, CO₂-based projects, including renewable energy, fuel switching from coal to gas, demand side energy efficiency, waste heat capture, and cement process modification account for less than half of the CER supply to 2012. Renewable energy projects alone account for 28 percent. Nineteen HFC-23 capture projects at HCFC-22 production facilities and three projects that capture the N₂O made as a byproduct of adipic acid or nitric acid production account for the third of the pipeline composed of high GWP industrial gas reduction projects. Finally, CH₄-capture and flaring projects, mostly located at large landfills, coal mines, and CAFOs, account for another 19 percent. Moreover, because the HFC-23, N₂O, and to a lesser extent, CH₄, projects are typically of larger size than the renewable energy projects, they are more likely to overcome the transaction costs associated with registration and production of CERs than the smaller hydro, wind, and biomass energy projects that compose the CDM's renewable portfolio.⁹⁹

To date, relatively small numbers of CERs have actually been issued. This slow trickle will likely turn to a flood in the coming years as registered projects begin submitting monitoring reports to the CDM EB. In order for the issuance of a CER to occur, a third-party monitor must audit a CDM project and certify that monitoring of the emissions reductions was adequate to ensure that they actually occurred.¹⁰⁰ Submission of this report to the CDM EB results in the issuance of CERs to that project participant's account.¹⁰¹ The first CERs were issued by the CDM EB in late October 2005.¹⁰² As of January 1, 2008, only 103 million CERs have been issued and deposited into project participant accounts.¹⁰³ The fact that more than half of these issuances are to HFC-23 abatement projects (55 percent) is likely due to the superior financial and logistical capacity of these projects relative to either the CH₄ or renewable-energy projects. The pattern most evident in the early issuances of CERs is the dominance of large over small projects in terms of actually

96. *Id.*

97. *Id.*

98. UNEP Risø Centre, *supra* note 82.

99. HAITES, *supra* note 89, at 45.

100. U.N. ENV'T PROGRAM, *supra* note 68, at 38–39.

101. *Id.* at 39.

102. UNFCCC, *supra* note 81.

103. This amount represents less than 10 percent of CERs promised by registered projects for delivery to 2012. *Id.*

producing emissions reductions. Early issuance shows once again that the barrier represented by transaction costs is more substantial for small CDM projects. As discussed above, the classes of small and large projects are largely coextensive with the CO₂ projects versus the N₂O, HFC-23, and to a lesser extent CH₄ projects.

Contrary to theory and expectation, the CDM market is not a subsidy implemented by means of a market mechanism by which CO₂ reductions that would have taken place in the developed world take place in the developing world. Rather, most CDM funds are paying for the substitution of CO₂ reductions in the developed world for emissions reductions in the developing world of industrial gases and methane. Indeed, the industrial gas emissions that account for one third of CDM reductions do not even occur in the developed world, not because of an absence of adipic acid or HCFC-22 manufacture, but because Annex B industries, after recognizing the threat posed by these emissions and the low cost of abating them, have opted to voluntarily capture and destroy them.¹⁰⁴

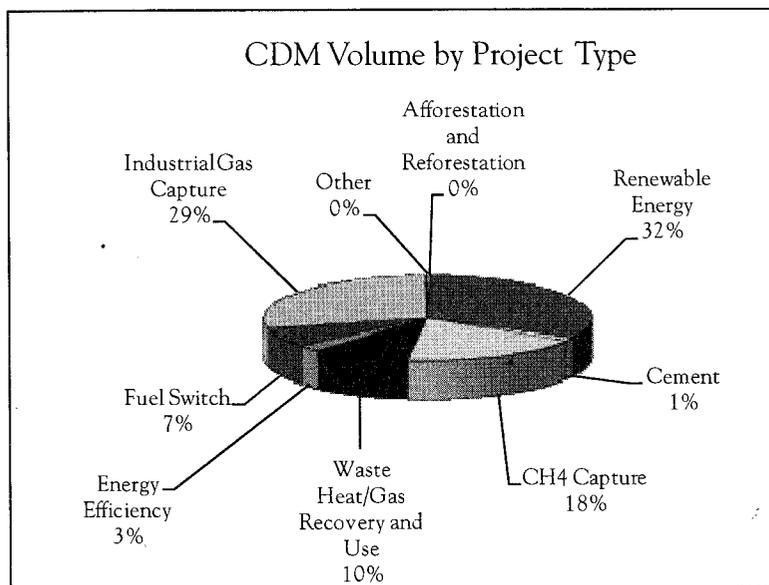
While renewable energy projects do make up 1600 out of 2647 (60 percent) projects in the CDM project pipeline, they account for only 28 percent of the emissions reductions produced. It is important to note that a significant proportion of the CERs generated by biomass power projects are from the CH₄ emissions that are avoided because biomass is burned rather than allowed to biodegrade.¹⁰⁵ Much of the publicity surrounding the CDM has emphasized the number of renewable energy projects sponsored by the CDM while neglecting the relative volume of emissions,¹⁰⁶ hence CERs produced and the relative scale of subsidy provided to various sectors. This emphasis provides a false picture of the true subsidy flows being generated by the international market for carbon (see Figure 3).

104. MCCULLOCH, *supra* note 95, at 18; Reimer et al., *supra* note 94, at 349.

105. Anaerobic digestion of crop residues leads to significant emission of CH₄ that is prevented by collection and use of the waste as a fuel. Many biomass energy projects claim this emission reduction in addition to the fossil-fuel-based energy avoided. See, e.g., CDM PROJECT DESIGN DOCUMENT: CAMIL ITAQUI BIOMASS ELECTRICITY GENERATION PROJECT 7-9 (2005), available at <http://cdm.unfccc.int/UserManagement/FileStorage/7Q7IH03DPAA2EL4SA8AM415CKQ7502>.

106. Compare *infra* fig. 3, with UNFCCC, Registration: Distribution of Registered Project Activities by Scope, <http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html> (last visited May 4, 2006), and The World Bank, Carbon Finance Unit, About World Bank Carbon Finance Unit, <http://carbonfinance.org/Router.cfm?Page=About&ItemID=24668> (last visited May 4, 2006).

FIGURE 3: FRACTION OF CERS SUPPLIED TO 2012 BY PROJECT TYPE FOR ALL PROJECTS CURRENTLY IN THE CDM PIPELINE¹⁰⁷



It is clear that the CDM has induced market participants to produce a large number of emissions reductions in the developing world for sale to those nations with quantified emissions reductions under the Protocol. However, to evaluate whether the CDM as actually realized is a success, more information is required: One must also ask whether Annex B nations get their money's worth. To answer this question, Part IV will examine HFC-23 projects and energy projects in the CDM.

IV. STRATEGIC MANIPULATION OF BASELINES: THE CASE OF HFC-23 ABATEMENT PROJECTS IN THE CDM

A. HFC-23 is a High GWP Byproduct of HCFC-22 Manufacture

Our first story concerns both the strategic behavior on the part of proponents of HFC-23 capture projects, an important class of large projects within the CDM, and the responses of the CDM EB to these attempts to inflate credit issuance. These emission reduction projects are an important component of the emissions market's initial rapid growth. There are

107. Data current as of Dec. 4, 2007. UNEP Risø Centre, *supra* note 82.

nineteen HFC-23 capture projects currently participating in the CDM.¹⁰⁸ These projects consist of the capture and destruction of HFC-23 produced as a byproduct of HCFC-22 manufacture.¹⁰⁹ The primary use of HCFC-22 is as a refrigerant, although its use as a feedstock for fluoroplastics such as PTFE is also significant and growing.¹¹⁰ For every 100 tons of HCFC-22 produced, between 1.5 and 4 tons of HFC-23 are produced.¹¹¹ This group of emission reduction projects have played an important role in shaping the early CDM emissions market and, because of their substantial market share, in determining its environmental performance.

An understanding of the incentives faced by creators of HFC-23 abatement projects must begin with an understanding of the atmospheric chemistry of HFC-23, because this chemistry lies at the heart of what makes them successful CDM projects. HFC-23 is an extremely potent and long-lived greenhouse gas. Its one-hundred-year GWP is 11,700.¹¹² As a consequence of this high GWP and the rules of the CDM, which convert the other six Protocol gases to CO₂e and hence CERs using their GWPs, 1 ton of HFC-23 abated is considered equivalent to 11700 tons of CO₂. In other words, for every kilogram of HCFC-22 produced, between 15 and 30 g of HFC-23 is produced, and potentially captured and destroyed. This 15 to 30 g of HFC-23 is equivalent to 175 to 350 kg of CO₂, or 0.175 to 0.350 CERs.

Although approximately half of HCFC-22 production occurs in the developed world,¹¹³ there are essentially no byproduct emissions of HFC-23 there because major producers have voluntarily adopted measures to capture and destroy it.¹¹⁴ Participation in voluntary abatement programs was substantial but not universal by 2005.¹¹⁵ The situation in the developing world was, prior to CDM, quite different. There, HCFC-22 manufacturers vented all HFC-23 produced to the atmosphere.¹¹⁶ One market analyst predicts that global HCFC-22 production will grow by 6 to 7 percent per year until 2020 and by 16 percent per year in the developing world.¹¹⁷ Thus,

108. This figure is as of Jan. 1, 2008. UNEP Risø Centre, *supra* note 82.

109. CDM Executive Bd., UNFCCC, *Revision to Approved Baseline Methodology AM0001: "Incineration of HFC 23 Waste Streams" 1 (Version 03, 2005)*, available at http://cdm.unfccc.int/UserManagement/FileStorage/AM0001_version3%20.pdf.

110. MCCULLOCH, *supra* note 95, at 4.

111. *Id.* at 10.

112. *Id.* at 21.

113. *Id.* at 4.

114. *Id.* at 18, 21.

115. IPCC, *supra* note 83, at 409.

116. MCCULLOCH, *supra* note 95, at 4.

117. *Id.*

reducing non-Annex B emissions of HFC-23 should be a goal of any treaty aimed at curbing GHG emissions.

Non-Annex B manufacturers of HCFC-22 have, to a remarkable extent, become participants in the CDM. Developing world production of HCFC-22 in 2005 was approximately 237,000 metric tons.¹¹⁸ Assuming a 3 percent HFC-23 production rate, which has been fairly typical for the 19 HCFC-22 plants participating in the CDM,¹¹⁹ this equates to a production of 83 million CERs per year.¹²⁰ Taken together, the PDDs of the nineteen HCFC-22 plants estimate that they will produce 81.8 million CERs per year. Using these estimates, it would appear that essentially all developing world HCFC-22 production, as of 2005, is currently participating in the CDM. This is a remarkable achievement for the CDM and begs the question of how a financial mechanism was able to achieve near total market penetration in an industry so quickly. An examination of the economics of HCFC-22 abatement and HFC-23 capture explains that the reasons may have as much to do with the perverse incentives created by the carbon market as with an ability to identify low cost emissions reduction opportunities.

B. The Perverse Incentives of HFC-23 Abatement as a CDM Project

The economics of HFC-23 projects create incentives for strategic behavior that, if left unchecked, would undermine the environmental efficacy of the CDM (see Table 1). Consider the 1 kg of HCFC-22 produced by a CDM project that the calculation above showed to be equivalent to 0.35 t CO₂ or 0.35 CERs. At current market prices of €10/CER,¹²¹ the production of 1 kg of HCFC-22 will produce a subsidy of €3.51. The cost of HFC-23 abatement is estimated to be on the order of €0.09/kg HCFC-22.¹²²

118. *Id.*

119. See UNEP Risø Centre, *supra* note 82. The average HFC-23/HCFC-22 ratio of the first 10 plants is 2.99 ± 0.58 (data on file with author).

120. $237,000 \text{ Mt HCFC-22} * 0.03 = 7110 \text{ Mt HFC-23}$; $7110 \text{ Mt HFC-23} * 11700 = 83,187 \text{ Mt CO}_2\text{e}$.

121. Data collected from publicly available reported trades of CERs is used to create this estimate. Note that the pricing of CERs is dependent upon when in the regulatory process they are sold. Most sales occur prior to registration of a project, let alone monitoring, verification, and issuance of promised CERs. These forward contracts for CERs are termed "primary CER" sales. Primary CER prices reflect validation, registration, credit, and country risk. Issued CERs, termed "secondary CERs" trade at approximately 80 percent of EU ETS allowance prices. This price spread is expected to decrease substantially once the interconnections required for trading are established between the CDM registry and the EU ETS registry.

122. MCCULLOCH, *supra* note 95, at 12. This value is derived assuming an 8 percent return on the investment in destruction facilities (€240,000/year) plus €200,000 operating expenses and a

Thus, the net from subsidy minus abatement costs to an HCFC-22 producer is approximately €3.41/kg HCFC-22. This subsidy compares quite favorably with the wholesale price for HCFC-22, which as of the fourth quarter of 2005 was approximately €1.60/kg.¹²³ A developing world producer of HCFC-22 can earn more than twice as much from its CDM subsidy as it can gross from the sale of its primary product. Even when CER prices were only half of their current value, HCFC-22 manufacturers found these calculations to be a compelling incentive to enter the CDM process.¹²⁴ Given these incentives, it is perhaps not a tremendous surprise that participation in the CDM by the non-Annex B based HCFC-22 industry is nearly universal.

TABLE 1: ESTIMATING THE VALUE OF THE CDM SUBSIDY
TO HCFC-22 PRODUCERS

Step 1: Calculate CO ₂ e produced by 1 kg HCFC-22	1 kg HCFC-22 → 0.03 kg HFC-23 0.03 kg HFC-23 * 11700 = 351 kg CO ₂ e = 0.351 t CO ₂ e
Step 2: Estimate gross subsidy	0.351 t CO ₂ e * €10/CER = €3.51 Gross subsidy per kg HCFC-22 = €3.51
Step 3: Estimate the cost per kg HCFC-22 (calculations are for a facility capable of capturing and destroying 200 t HFC-23/year)	€3,000,000 investment at 8% interest + €200,000 per year operating costs = €590,000 per year cost.
Step 5: Calculate the cost per kg HCFC-22	€590,000/200 t HFC-23 = €2950/t HFC-23 €2950/t HFC-23 * 3% HFC-23 = €88.5/t HCFC-22 €88.5/t HCFC-22 * 1 t/1000 kg = €0.09 Cost of subsidy per kg HCFC-22 = €0.09
Step 6: Calculate the net CDM subsidy	€3.51 - €0.09 = €3.42/kg HCFC-22

The perverse incentives created by the economics of HFC-23 capture CDM projects were, from a very early stage, a point of controversy.¹²⁵ The CDM methodology, without which HFC-23 projects could not advance to registration, went through several rounds of revision because of fears that

production rate of 200 t HFC-23 per year, equivalent to 6666 t HCFC-22 per year, and a 3 percent HFC-23 production rate.

123. Telephone Interview With Mack McFarland, Environmental Fellow, DuPont Fluoroproducts (Fall 2005) [hereinafter McFarland Interview].

124. Should primary CER prices fall from their current highs of €10 due to the fall in the value of ETS permits, HFC projects will remain economically attractive.

125. Letter From Thomas R. Jacob, Senior Advisor, Global Affairs, Dupont, to Jean-Jacques Becker, Chair, CDM Methodology Panel (June 3, 2004), available at http://cdm.unfccc.int/methodologies/inputam001/letter_Dupont_03/June04.pdf [hereinafter Jacob].

HCFC-22 manufacturers would produce gas simply to generate CERs, thereby diluting the CDM's currency, at least in terms of its environmental effectiveness.¹²⁶ Recall that a key requirement of CERs is that they be "additional to any that would have occurred in the absence of the project activity."¹²⁷ The economics of HFC-23 projects are a *reductio ad absurdum* of this requirement. It is quite likely that no capture of HFC-23 would occur without the CDM. On the other hand, with the CDM, HCFC-22 factories have very strong incentives to create extra HFC-23 specifically to capture and destroy it. Indeed, merely by capturing what they would have made anyway, a manufacturer can triple revenues and, based on the cost estimates presented above, more than triple profits.

C. Imperfect Regulatory Compromise for HFC-23 Plants in the CDM

To deal with the perverse incentives to overproduce HCFC-22 in order to capture and destroy HFC-23, the CDM EB decided to approve only those projects involving previously existing HCFC-22 production capacity.¹²⁸ New plants or added capacity are not currently allowed into the CDM.¹²⁹ In order to qualify for registration, a plant must have been in operation and able to supply both HCFC-22 and HFC-23 production data for at least three years in the 2000 to 2004 period.¹³⁰ This prerequisite creates the obvious problem of incentivizing the capture and destruction of HFC-23 that is emitted incidental to the 16 percent annual growth of HCFC-22 production predicted to occur in the developing world.¹³¹ The Conference of the Parties has asked for guidance on new plant and added capacity from the Subsidiary Body for Scientific and Technical Advice of the UNFCCC.¹³²

Even with these relatively restrictive rules on eligibility, there is circumstantial evidence and very good reason to suspect that HCFC-22 manufacturers participating in the CDM have behaved strategically to direct a greater share of the subsidy to themselves by artificially inflating their

126. On the concept of tradable emissions permits as a property right, see Hahn & Hester, *supra* note 58, at 110, 117; on the concept of tradable emissions permits as a currency, see David G. Victor et al., *A Madisonian Approach to Climate Policy*, 309 *SCIENCE* 1820 (2005).

127. Kyoto Protocol, *supra* note 1, art. 12, § 5(c).

128. CDM Executive Bd., *supra* note 109, at 3.

129. *Id.* at 1.

130. *Id.*

131. MCCULLOCH, *supra* note 95, at 4.

132. *Summary of the Twenty-Second Sessions of the Subsidiary Bodies of the UN Framework Convention on Climate Change: 19–27 May, 2005*, *EARTH NEGOTIATIONS BULL.* (Int'l Inst. For Sustainable Dev., New York, N.Y.), May 30, 2005, at 5, available at <http://www.iisd.ca/download/pdf/enb12770e.pdf>.

base-year production in two ways. First, the fraction of HFC-23 produced by the production of HCFC-22 can be reduced by modification of the conditions under which chemical synthesis occurs. Dupont has consistently produced, in its United States HCFC-22 plant, HFC-23 byproduct percentages as low as 1.3 percent.¹³³ Developing-country manufacturers have not been able to achieve such rates of HFC-23 production, with reported rates between 2 and 4 percent. The economics of HCFC-22 production in the absence of a CDM subsidy dictate that HFC-23 production should be minimized because it is a waste product costing both energy and materials.¹³⁴ For this reason, almost all plants have historically monitored their HFC-23/HCFC-22 ratio in order to optimize productivity of HCFC-22.¹³⁵

Dupont argued in comments presented to the CDM EB that the crediting methodology for HFC-23 projects should be limited to crediting global best practice—the Dupont value. CDM project proponents responded that their plants lacked necessary capacity and could not be expected to perform with the same efficiency as those in the developed world. Presented with these conflicting arguments, the CDM EB forged a crude compromise. The CDM methodology eventually approved for HFC-23 abatement set 3 percent as the maximum percentage of HFC-23 byproduct allowable in the baseline data of a participating plant, a rough average of reported developing world values.¹³⁶ The average of all reported baseline data from the nineteen participating plants is 2.99 percent—very close to the maximum allowable value.¹³⁷ This suggests that even if the project participants were not actually aiming for the 3 percent sweet spot that would minimize their production costs (due to wasted feedstocks) but maximize their CDM subsidy (due to more CERs for a given production rate of HCFC-22), they were certainly not as concerned with minimizing this percentage as developed-world manufacturers who are not eligible for the CDM subsidy. Furthermore, the presence of the CDM and the prospect that crediting may ultimately be allowed for new plants removes any incentive to improve capital stock or process at existing

133. Jacob, *supra* note 125.

134. IPCC, *supra* note 83, at 394, 396.

135. Jacob, *supra* note 125.

136. Letter From Thomas R. Jacob, Senior Advisor, Global Affairs, Dupont, to Jean-Jacques Becker, Chair, CDM Methodology Panel (Oct. 2, 2004), available at <http://cdm.unfccc.int/methodologies/inputam0001>.

137. It is important to note that at the time the CDM EB made its decision, it had data only from two HCFC-22 plants. Compare, UNFCCC, AM0001: Incineration of HFC 23 Waste Streams—Version 5.2, <http://cdm.unfccc.int/methodologies/DB/0MKGF12PM6TSNFNJZUESTSKG581HN6/view.html> (last visited May 2, 2008) (showing approval of Version 3 of AM0001 on May 13, 2005), with UNEP Risø Centre, *supra* note 82 (showing the public comment phase of the third HFC-23 project beginning on June 5, 2005).

plants, or to invest extra capital in state of the art facilities. Rather, it encourages construction of inefficient plants in order to create a high baseline and maximize potential for future CDM revenues.

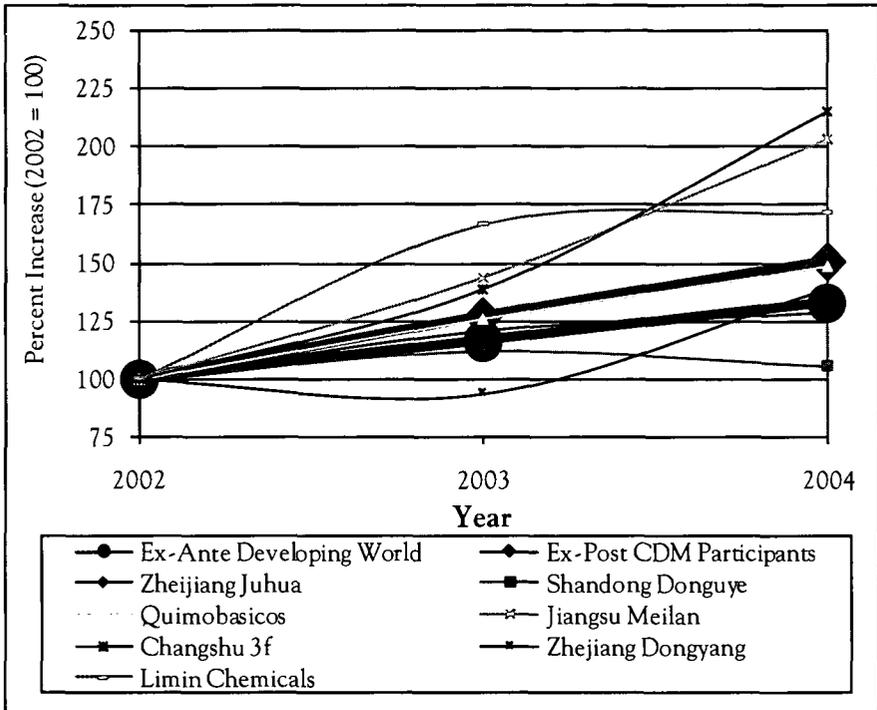
Second, at least some of the HCFC-22 plants participating in the CDM appear to have ramped up production during the baseline period (2000–2004) far beyond expected growth in the sector (15 percent per annum). Figure 4 shows baseline data supplied by plants participating in the program compared with the predicted growth rate for the industry over the 2002–2004 period.¹³⁸ Most plants exceeded the growth rates predicted for the developing-world industry as a whole. The increases in HCFC-22 production among the developing-world manufacturers led to a CDM participant production growth rate of 50 percent rather than 33 percent, as had been predicted ex-ante by market analysts.¹³⁹ Whether these plants increased production because of demand for HCFC-22 or in anticipation of higher CER revenue is impossible to say given existing publicly available information. Nevertheless, circumstantial evidence suggests that, rather than building new plants, HCFC-22 manufacturers elected to add capacity at existing plants during the CDM baseline period in order to take advantage of the CDM subsidy.¹⁴⁰

138. For predicted growth rates, see MCCULLOCH, *supra* note 95, at 4; production data for individual HCFC-22 plants on file with author.

139. *Id.*

140. Adding capacity at some existing plants would have been relatively simple because some developing-world plants are swing plants, able to shift configuration to produce a number of different halocarbon gases. With advance knowledge of the CDM and even a forecast price signal of \$3 to \$5, shifting to near constant HCFC-22 production and away from other halocarbons would have made sense during the baseline period. See TECH. & ECON. ASSESSMENT PANEL, U.N. ENV'T PROGRAM, RESPONSE TO DECISION XVIII/12: REPORT OF THE TASK FORCE OF HCFC ISSUES (WITH PARTICULAR FOCUS ON THE IMPACT OF THE CLEAN DEVELOPMENT MECHANISM) AND EMISSIONS REDUCTION BENEFITS ARISING FROM EARLIER PHASE-OUT AND OTHER PRACTICAL MEASURES 51–55 (2007), available at http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-aug2007.pdf.

FIGURE 4: PERCENTAGE INCREASES AT HCFC-22 PLANTS REPORTING MULTIPLE YEARS OF BASELINE DATA RELATIVE TO EX-ANTE ANALYST PREDICTIONS FOR THE INTERVAL¹⁴¹



In response to the windfall profits enjoyed by their domestic HCFC-22 producers as a result of the CDM, China has imposed a 65 percent tax on CER revenue generated by HFC-23 projects.¹⁴² Revenues from this fund, currently in excess of \$2 billion, are to be devoted to sustainable development, although none have yet been dispersed. In this way, as had been predicted by the critics of the CDM's baseline concept, Chinese environmental regulators, rather than create regulations that would eliminate a CDM project's eligibility, have acted to extract a substantial portion of the subsidy-derived rent. This tax reduces the CERs income to only 60 percent of that derived from the sale

141. The ex-ante developing world growth rate is 16.5 percent. The ex-post CDM participant growth rate is 25 percent. The thick lines show ex-ante (filled circles) and the average CDM participant (filled diamonds) rates of production growth.

142. Office of Nat'l Coordination Comm. on Climate Change, *supra* note 77, art. 24.

of HCFC-22. However, at prices greater than €15, even with a 65 percent tax, it will again make sense to produce gas solely for CER revenue.¹⁴³

The CDM provides perverse economic incentives to HCFC-22 producers that have led to a large fraction of the CER supply being produced by HFC-23 abatement. Even if some fraction of these reductions are voluntary, real, and additional, they still may not be the best use of Annex B resources for addressing non-Annex B GHG emissions. To abate all developing-world HFC-23 emissions would cost approximately \$31 million per year.¹⁴⁴ Instead, by means of a CDM subsidy, the Annex B nations will likely pay between €250 and €750 million to abate 2005 non-Annex B HFC-23 emissions.¹⁴⁵ This is a remarkably inefficient path to an environmental goal.

The case of HFC-23 capture projects, which currently account for nearly 22 percent of the CERs expected for delivery by 2012, illustrates both the success and some fairly significant problems with the CDM market. On one hand, the CDM was successful in identifying a class of emitters with very low marginal abatement costs and inducing near total sectoral abatement. On the other hand, it appears quite likely that the sector is also gaming the system by modifying its behavior in order to generate extra credits that can then be sold to developed countries with compliance obligations. Because of the inherent information asymmetries, the regulator has had a very difficult time, and indeed has not genuinely tried, dealing with these problems. It is not clear under the current system how it could. At the same time, because of the limitation on eligibility for old plants, the problems associated with HFC-23 for the CDM are to some extent limited. It is worth noting, however, that what saves the CDM from being awash in CDM credits does not help the environment. Recent press reports indicate incredibly high rates of growth in the HCFC-22 market, including the construction of new plants. Until these plants are included in the CDM or some other climate regime, they will emit their HFC-23 byproducts into the atmosphere.¹⁴⁶

143. A €15 CER price, taxed at 65 percent will net €1.60 after abatement costs and tax per kg HCFC-22 produced. The market price for HCFC-22 is approximately €1.60. See McFarland Interview, *supra* note 123.

144. MCCULLOCH, *supra* note 95, at 21.

145. 80 Mt CO₂e * €5 = €400,000,000; 80 Mt CO₂e * €20 = €1,600,000,000.

146. At recent climate negotiations, China has been arguing for and the EU against inclusion of new plants and additional capacity in the CDM. At this point, no agreement has been reached as to how to incorporate them into the CDM. Keith Bradsher, *Use of Air-Conditioning Is Widening the Hole in the Ozone Layer*, N.Y. TIMES, Feb. 23, 2007, at C1.

V. ANYWAY CREDITS IN CHINA'S POWER SECTOR

The most recent development in the CDM is the entry of important components of the Chinese electricity sector into the market. Early CDM power projects were mostly small power plants utilizing run-of-river hydro or biomass combustion technologies, mostly with nameplate capacity below 25 megawatts (MW). Recently, that picture has changed dramatically with the entry of significant numbers of large hydro¹⁴⁷ and natural-gas-fired power projects into the project pipeline. These projects present extremely challenging regulatory decisions to the CDM EB because it must decide which projects would or would not have gone forward without the carbon finance funds. Answering the question of whether projects are additional or would have happened anyway is always challenging, but is made particularly difficult by two factors: The energy sector in China is heavily regulated and primarily owned by the Government or state-owned entities, and participation rates by several elements of the sector is near 100 percent. On one hand, this outcome is to be applauded because modifications to the development path of the non-Annex B energy sector were a key goal for the CDM. However, this emerging result also raises important questions regarding the assumptions underlying the CDM as well as its potential for growth beyond 2012. The following section sheds light on these issues by telling the story of recent attempts by natural-gas-fired power plants to generate credits under the CDM.

A. Natural-Gas-Fired Power in China

Ultimately, if the problem of global climate change is to be effectively addressed, the methods by which electricity is generated both in the developed and the developing world will have to change. Currently, most electricity is generated via large coal-fired generating stations.¹⁴⁸ This is because large coal-fired generating stations are, at present, the lowest cost supplier of electricity, particularly in countries like the United States, China, and India,

147. For a discussion of the participation of large hydro in the CDM that reaches similar conclusions for that sector, see BARBARA NAYA, *FAILED MECHANISM: HOW THE CDM IS SUBSIDIZING HYDRO DEVELOPERS AND HARMING THE KYOTO PROTOCOL 4-5* (2007), available at http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf.

148. ENERGY INFO. ADMIN., *supra* note 78, at 62; Gerard Wynn, *U.N. Talks Will Not Decide on New HFC Incentives*, REUTERS, Dec. 8, 2007, available at <http://www.reuters.com/article/latestCrisis/idUSL08166304>.

where coal supplies are abundant.¹⁴⁹ Thus, developing both short-term and long-term alternatives to coal-fired generation capacity is critical to mitigating the impacts of climate change. In China, where new capacity is being added at an extremely high rate in order to meet surging demand for electricity, short-term alternatives are especially important.¹⁵⁰

One currently available alternative to the large coal-fired generating station that is superior from a GHG emissions perspective is large power plants that utilize combined cycle gas turbines (CCGT) technology. These plants are superior from a climate perspective because they produce substantially less CO₂ per MW hour (MWh) of electricity than typical coal-fired power plants.¹⁵¹ In addition, CCGTs emit substantially lower quantities of particulate matter, soot, sulfur oxides, and nitrogen oxides per unit of power produced than do coal-fired power plants, because the fuel they burn is cleaner and combustion is more complete.¹⁵² This cleaner emission makes them extremely appealing for new baseload generation to developing countries that have severe local air pollution concerns. It is for this reason that California in-state baseload generation, in contrast to the United States as a whole, is largely via CCGT.

Even with these environmental advantages, natural-gas-fired power has struggled to gain a foothold in developing countries because of the different underlying prices of coal and natural gas.¹⁵³ Capital costs and construction times are generally far higher for coal than for natural gas, while the reverse is true for fuel prices. Thus, while a coal plant requires significant upfront investment, it is relatively cheap to operate compared to a CCGT plant, which is cheap to build but costly to operate. Overall, the higher fuel costs

149. These three are also the countries with the greatest current and future impacts on climate, precisely for the reason that they are large and generate most of their electricity using coal-fired power plants. ENERGY INFO. ADMIN., *supra* note 78, at 62.

150. China built 114 GW of new fossil-fuel-fired generating capacity in 2006 and is on track to build 95 GW of new fossil-fuel-fired generating capacity in 2007. For comparison, the UK electricity grid has a capacity of 75 GW, and the California Independent System Operator administers 46.5 GW. Both of these grids were built out over decades. Keith Bradsher, *China's Green Energy Gap*, N.Y. TIMES, Oct. 24, 2007, at C1; Envtl. Energies Tech. Div., Lawrence Berkeley Nat'l Lab., *Current Energy: Supply of and Demand for Electricity for California*, <http://currentenergy.lbl.gov/ca/index.php> (last visited July 15, 2007).

151. On average, a subcritical coal-fired power plant produces CO₂ at a rate of 0.92 metric tons CO₂ per MWh while a CCGT has a carbon intensity of 0.35 metric tons CO₂ per MWh. Mike Jackson et al., *Greenhouse Gas Implications in Large Scale Infrastructure Investments in Developing Countries: Examples From China and India* (Stanford Program on Energy & Sustainable Dev., Working Paper No. 54, 2006), available at http://iis-db.stanford.edu/pubs/21061/China_and_India_Infrastructure_Deals.pdf.

152. ENERGY INFO. ADMIN., *supra* note 78, at 62.

153. *Id.*

of gas swamp the higher capital costs of coal. This outcome is especially true in China where coal's capital costs are relatively lower, and CCGT's relatively higher, than global averages.¹⁵⁴ These economics have made gas and the CCGT simultaneously attractive to foreign investors and unattractive to government-controlled power sectors like China's.

In China, these contrasting environmental and economic dynamics have played out via substantial state control of the power sector in ways that have encouraged construction of new CCGT power plants, and at the same time have created substantial uncertainties for their operation. On one hand, the state intervened to insure construction of the West-East Pipeline, opening up a major supply of new gas for the eastern provinces where demand is greatest.¹⁵⁵ Financial viability of this project was assured by take-or-pay contracts for natural gas between the pipeline and the proposed new CCGT's in the coastal provinces.¹⁵⁶ State-owned enterprises are also in the process of constructing multiple new liquefied natural-gas facilities to serve the coastal provinces.¹⁵⁷ In addition, as part of China's eleventh five-year plan, the National Development and Reform Commission, which sets tariffs on China's two electricity grids,¹⁵⁸ is charged with developing the gas industry in an effort to reduce pollution.¹⁵⁹ Although its high costs might make it seem unattractive, the environmental and energy security benefits of increased utilization of gas-fired power have meant that China plans to build twenty-three CCGT power plants between 2005 and 2009, with a combined nameplate capacity of more than 18 GW.¹⁶⁰

154. In China, because the critical components for coal-fired power plants are produced domestically while those for CCGT must be imported, capital cost for subcritical coal-fired power plants may actually be lower than for CCGT. *Id.*; INT'L GAS UNION, GAS TO POWER-CHINA 15 (2005) (on file with author).

155. People's Republic of China, China Factfile: Key National Projects, http://english.gov.cn/2006-02/08/content_182600.htm (last visited July 15, 2008).

156. This support was critical, because in the absence of a well-developed residential and commercial distribution network and demand for gas, a complete pipeline would have insufficient customers to whom it could sell its gas. INT'L GAS UNION, *supra* note 154, at 5, 9.

157. *See id.* at 5.

158. *Id.* at 16.

159. NAT'L DEV. & REFORM COMM'N, PEOPLE'S REPUBLIC OF CHINA, THE OUTLINE OF THE ELEVENTH FIVE-YEAR PLAN FOR NATIONAL ECONOMIC & SOCIAL DEVELOPMENT OF THE PEOPLE'S REPUBLIC OF CHINA, ch. 3: Optimizing and Upgrading Industrial Infrastructure, http://en.ndrc.gov.cn/hot/t20060529_71334.htm (last visited July 15, 2008).

160. For comparison, the entire California Independent System Operator manages 46.5 GW of nameplate capacity. Compare Envtl. Energies Tech Div., *supra* note 150, with INT'L GAS UNION, *supra* note 154, at 2.

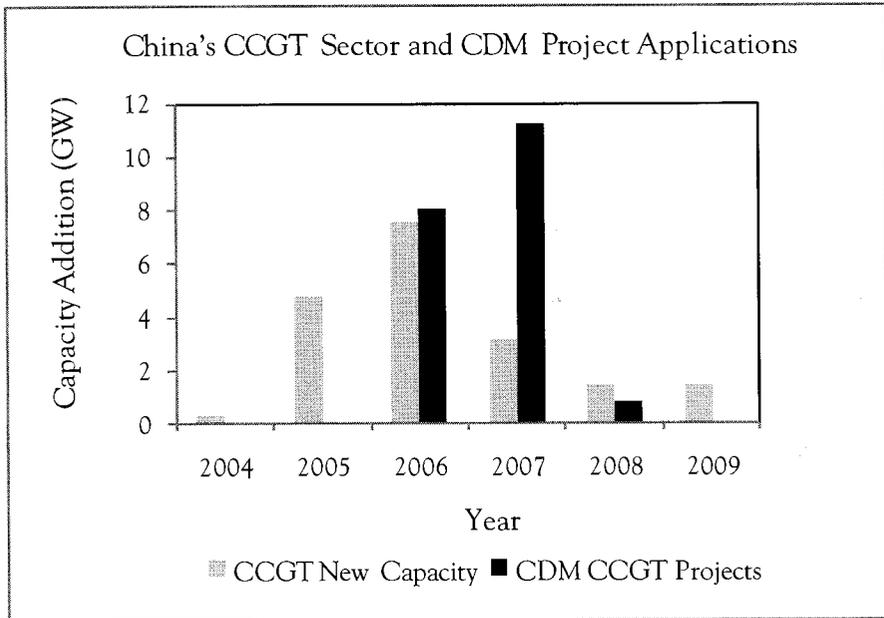
B. Natural-Gas-Fired Power as a CDM Project

Because the primary sources of power to the Chinese electrical grid are subcritical coal-fired power plants and most new builds are either subcritical or supercritical coal,¹⁶¹ construction of a CCGT instead of a coal-fired power plant arguably represents a reduction of GHG emissions. As described in the previous section, the economics in China do not favor the decision to build a CCGT rather than a subcritical coal power plant. Nevertheless, this choice would have clear climate benefits. If such a decision could be influenced by the potential supply of funds from the sale of carbon credits, equal to the difference in GHG emissions between the alternatives, crediting as a CDM project would be possible. Such thinking led to the submission and approval of just such a CDM methodology in mid-2006, called the Baseline Methodology for Grid Connected Electricity Plants Using Natural Gas (AM0029).¹⁶²

161. Subcritical coal-fired power plant boilers operate at temperatures and pressures below the critical point for water—the point at which water no longer turns into steam when heated but instead decreases in density. Supercritical plants operate above this point and as a result achieve significantly higher heat rates and efficiency than is possible for subcritical plants. See World Coal Inst., *Supercritical & Ultra-Supercritical*, <http://www.worldcoal.org/pages/content/index.asp?PageID=421> (last visited Mar. 31, 2008).

162. CDM Executive Bd., UNFCCC, *Approved Baseline Methodology AM0029: "Baseline Methodology for Grid Connected Electricity Generation Plants Using Natural Gas"* (Version 01.1, 2006), available at [http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_KTKZTS1HEG4\)BIETV74WMLZY10061X](http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_KTKZTS1HEG4)BIETV74WMLZY10061X).

FIGURE 5: CONSTRUCTION OF COMBINED CYCLE GAS TURBINE POWER PLANTS IN CHINA AND APPLICATIONS FOR CREDITING UNDER THE CDM BY NAMEPLATE CAPACITY (2004–2009)¹⁶³



By the end of 2007, twenty-four CCGT projects, representing essentially all power plants actually being built (as opposed to planned) in China between 2005 and 2010, had applied under the methodology to claim credit for the difference between their emissions and the baseline established by AM0029 (see Figure 1).¹⁶⁴ All plants built or under construction since 2005 are arguing that they would not have been built but for the CDM. This argument, when presented on a project-by-project basis, sounds plausible. It is only when the comparison between total project applications and the entire natural-gas-fired power sector is made, and the two are found to be roughly equivalent, that it becomes problematic.

163. The total CCGT builds equal 18.4 GW while applications for CDM crediting so far equal 17.6 GW.

164. Planned CCGT power plant builds during the 2004–2009 interval equal 18.37 GW. INT'L GAS UNION, *supra* note 154, at 3. CDM applications to the end of 2007 for crediting of plants entering operation between 2005 and 2008 equal 17.59 GW, UNEP Risø Centre, *supra* note 82.

Of the 24 Chinese CCGT CDM projects currently proposed, six have been registered¹⁶⁵ and a further three have requested registration but the CDM EB has required corrections after review.¹⁶⁶ Registration is automatic eight weeks after it is requested unless a project participant or at least three members of the CDM EB submit a Request for Review (RFR) of the project.¹⁶⁷ An RFR is then considered by the full CDM EB at its next meeting. Decisions on whether to grant review and on the scope of review are then made.¹⁶⁸ To date, all requests for review on Chinese CCGT CDM projects by CDM EB members list concerns about additionality as a reason for the RFR.¹⁶⁹ In other words, the CDM EB members requesting review are concerned that these projects would have been built even in the absence of the CDM, and that any emissions reductions claimed by them would not be in addition to what would have occurred in its absence.

165. Six Chinese CCGT CDM projects have been registered as of July 1, 2008. Five of the six were registered only after Requests for Review by the CDM EB and subsequent corrections. UNFCCC Project 1320: Beijing Taiyanggong CCGT Trigereneration Project [hereinafter UNFCCC Project 1320], <http://cdm.unfccc.int/Projects/DB/SGS-UKL1188570070.22> (last visited Jul. 1, 2008); UNFCCC Project 1343: Xiaoshan Power Plant's NG Power Generation Project of Zhejiang Southeast Electric Power Co., Ltd. [hereinafter UNFCCC Project 1343], <http://cdm.unfccc.int/Projects/DB/DNV-CUK1189665775.96> (last visited Jul. 1, 2008); UNFCCC Project 1344: Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd.'s NG Power Generation Project [hereinafter UNFCCC Project 1344], <http://cdm.unfccc.int/Projects/DB/DNV-CUK1189684459.76/view> (last visited Jul. 1, 2008); UNFCCC Project 1227: Yuyao Electricity Generation Project Using Natural Gas [hereinafter UNFCCC Project 1227], <http://cdm.unfccc.int/Projects/DB/DNV-CUK1183455647.94> (last visited Jul. 1, 2008); UNFCCC Project 1304: Henan Zhengzhou Grid Connected Natural Gas Combined Cycle Power Plant [hereinafter UNFCCC Project 1304], <http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1187936755.18> (last visited Jul. 1, 2008); UNFCCC Project 1373: Beijing No.3 Thermal Power Plant Gas-Steam Combined Cycle Project Using Natural Gas [hereinafter UNFCCC Project 1373], <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1191500853.33> (last visited Jul. 1, 2008).

166. Three projects are currently being revised after the CDM EB required a review of their registration request and corrections. UNFCCC Project 1381: Shanghai Baoshan Grid Connected Natural Gas Combined Cycle Power Plant Project [hereinafter UNFCCC Project 1381], <http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1192083874.4> (last visited Jul. 1, 2008); UNFCCC Project 1243: Sulige Natural Gas Based Power Generation Project [hereinafter UNFCCC Project 1243], <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1184339707.46> (last visited Jul. 1, 2008); UNFCCC Project 1368: Qinghai Ge-ermu Gas Turbine Power Plant Project [hereinafter UNFCCC Project 1368], <http://cdm.unfccc.int/Projects/DB/BVQI1191062063.0> (last visited Jul. 1, 2008).

167. United Nations Framework Convention on Climate Change, Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Montreal, Can., Nov. 28–Dec. 10, 2005, *Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol on Its First Session, Held at Montreal From 28 November to 10 December 2005, Addendum: Part Two: Action Taken by the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol at Its First Session*, 15, U.N. Doc. FCCC/KP/CMP/2005/8/Add.1 (Mar. 30, 2006), available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf>.

168. *Id.*

169. UNFCCC, Project 1343, *supra* note 165; UNFCCC, Project 1320, *supra* note 165; United Nations Framework Convention on Climate Change, *supra* note 167, at 14, 16–17.

In its review of these projects, it is not at all clear that the CDM EB will be able to address the fact that, taken together, current applications for crediting under the CDM of natural-gas-fired power in China imply that no CCGT builds would occur in the absence of carbon finance. Because review is on a project-by-project basis and is limited to determination that the project documents are in compliance with the AM0029 methodology, this is likely beyond the scope of review.¹⁷⁰ The AM0029 methodology determines a project's additionality by reference to a financial calculation comparing the costs of CCGT to alternative options, and by an analysis of whether the project is common practice.¹⁷¹ The investment analysis treats projects as if they were operating in a deregulated, competitive, power generation sector, rather than in a state-controlled or partially deregulated power sector. The common practice analysis, in the context of a coal-dominated energy sector such as China's, is easy to overcome. Neither takes into account the relevant national priorities for energy development that have been set by the China. Thus, the review of CCGT projects is likely to find them to be additional to what otherwise would have occurred, not because this is in fact the case, but rather because the review is constrained by the procedures of the CDM from asking the right questions about the projects.

The decisions made regarding these projects are likely to set an important precedent that could have far-reaching consequences for the CDM in light of another recently approved methodology. In the fall of 2007, the CDM EB approved, after significant controversy, a methodology for crediting supercritical and ultra-supercritical coal-fired power plants for emissions reductions relative to a grid primarily composed of subcritical coal-fired plants (ACM0013).¹⁷² This methodology is very similar to AM0029 with regard to its additionality test,¹⁷³ but will apply to a substantially larger number of power plants both in China and the rest of the developing world. In 2006 and 2007, China built more than 200 GW of new fossil-fuel-fired power plants. China has begun telling power companies that they should choose to

170. A request for review must relate to a project's failure to comply with a specific validation requirement. See United Nations Framework Convention on Climate Change, *supra* note 167, at 15, 54, 55. Validation requirements relevant to the additionality determination are defined in terms of compliance with an approved methodology, such as AM0029. *Id.* at 14, 16–17.

171. See CDM Executive Bd., *supra* note 162, at 3.

172. CDM Executive Bd., UNFCCC, *Approved Consolidated Baseline and Monitoring Methodology ACM0013: "Consolidated Baseline and Monitoring Methodology for New Grid Connected Fossil Fuel Fired Power Plants Using a Less GHG Intensive Technology"* (Version 01, 2007), available at http://cdm.unfccc.int/EB/034/eb34_repan02.pdf.

173. Compare CDM Executive Bd., *supra* note 162, at 3, with CDM Executive Bd., *supra* note 172, at 4.

build supercritical rather than subcritical plants because they use 10 percent less coal.¹⁷⁴ As China shifts from subcritical to supercritical and ultra-supercritical coal-fired generation technology, the potential for the generation of large numbers of CERs that do not correspond to any kind of behavioral change appears possible.

The AM0029 methodology and near 100 percent participation of CCGT power plants in China together have placed the CDM EB in an untenable position. On one hand, natural-gas-fired power is a climate friendly alternative to coal, whose development should be encouraged and fostered by the climate regime. Further, a program to encourage developing-country participation in the global climate change regime would strive to achieve 100 percent participation rates within developing country electricity sectors. On the other hand, it appears that the CDM, because it functions at a project rather than a sectoral level, is likely giving credit for activities that would have occurred without it. These “anyway” credits are especially important given that the CDM credit, “anyway” or not, can be sold to Annex B parties in order to reduce the extent to which they cut their own emissions.

VI. REFORM OF THE POST-2012 REGIME

The parties to both the Kyoto Protocol and the UNFCCC are now considering what to do to accomplish the goal of the UNFCCC after the first compliance period ends in 2012.¹⁷⁵ Global carbon trading is likely to play a role in any future architecture. At the same time, the U.S. Senate is considering proposals for an economy-wide cap-and-trade program for GHGs that would allow extensive utilization of international carbon credits.¹⁷⁶ Thus, consideration of how to improve the performance of the CDM is critical from both a domestic and an international perspective.

This description of the current and likely future state of the CDM is meant to point out that, before we assume that expansion of the current offset trading market is the appropriate route for engaging with developing countries, it is worth looking at the empirical evidence from the trading program as it exists now. That evidence, as detailed in the two examples above, suggests that the CDM is leading to widespread strategic behavior. In the case of the HFC-23 projects, the incentives created by the CDM are

174. Bradsher, *supra* note 150.

175. Bali Action Plan, *supra* note 8.

176. For example, the Lieberman-Warner Bill would allow 15 percent of a covered facility's compliance obligation to be met with international allowances or credits. America's Climate Security Act of 2007, S. 2191, 110th Cong. § 2501 (2007).

leading to undesirable behavior in the name of claiming credit. HFC-23 projects appear to be creating extra GHGs in order to claim credit for their capture and destruction even as they do capture and destroy some emissions that would have contributed to climate change. In the case of the CCGT projects, the incentives created by the CDM are likely leading to no change in behavior except for widespread claims for credits. Furthermore, procedures for project regulation likely limit the CDM EB from examining the issues most central to whether the projects are producing additional emissions reductions.

In addition, both cases present severe information challenges for the regulator. The rules of the game in the CDM systematically create incentives for project proponents to manipulate the transfer of information to the CDM EB while providing it with essentially no other information-gathering resources. In the case of HFC-23, the CDM creates strong incentives for project proponents to conceal the extent to which process efficiencies might lower their GHG production rate. In the case of the CCGTs, the system creates strong incentives for project proponents to misrepresent the motivations for their choice of power plant technology. Unlike in a natural market, buyers of CDM credits have no incentive to disclose information they have regarding projects. Their incentive, just like the generators of credits, is to facilitate the approval of projects and the issuance of credits. This informational problem is particularly acute because the CDM EB is called upon to make decisions requiring technical expertise across a wide array of both countries and industries.

The CDM set three goals: to produce sustainable development, to help developing countries accomplish the objective of the UNFCCC, and to reduce the costs of compliance for parties with quantitative targets.¹⁷⁷ The evidence presented above points to the possibility that the CDM is accomplishing these goals, but only to a limited extent. In one case, strategic but legal behavior is leading to the creation of extra GHGs in conjunction with emissions that would have occurred in order to generate a mix of additional and anyway credits. In another case, strategic disclosure of information and limitations on the scope of review will potentially lead to wholesale crediting of behavior that would have occurred anyway. Both indicate a need to consider reform, either by improving the CDM or by replacing it with an alternative mechanism for developing-country engagement.

177. Kyoto Protocol, *supra* note 1, art. 12.

A. Reforming the CDM

Limited reforms to the existing CDM structure might improve its ability to detect and deter strategic behavior by participants. Under the current regime, the third party verifiers charged with validating project applications face unavoidable conflicts of interest when it comes to substantive review of project proponents' claims. These DOEs are currently paid by the project proponents and face a competitive business environment.¹⁷⁸ One potential reform measure might be to include the costs of third-party verification in CDM project application fees. The CDM EB would then have adequate resources to contract directly with DOEs, who would have incentives to disclose as much as possible regarding CDM projects to avoid loss of business. Another reform possibility is to clarify that DOEs are responsible for checking not only that a project's additionality analysis is performed consistently with the applicable CDM procedures, but also that key facts and assumptions underlying it are accurate.¹⁷⁹ Standardized accounting procedures might also be specified in order to limit the extent to which creative accounting is used to argue that projects would not have gone forward without the sale of carbon credits.¹⁸⁰ Finally, under the current regime, project proponents must "take[] due account"¹⁸¹ of comments received by the public during the validation process. All of these incremental reforms would likely reduce the extent to which project proponents can game the system, increase the incentives that DOEs have for monitoring strategic behavior, and help to simplify the extremely difficult regulatory choices with which the CDM EB is often faced. These procedures might, to a great extent, help to deal with the HFC-23 case.

Nevertheless, they do not resolve the issue of how to separate additional from nonadditional projects in regulated and state-owned industries like the Chinese energy sector. Ultimately, this issue looms larger than any other because of the emissions associated with the explosive growth in the Chinese and Indian economies. Fully addressing it will likely require transforming the CDM into a system that can deal directly with the actors that matter most in these industries—the government policy makers that set energy development priorities.

178. LAMBERT SCHNEIDER, *IS THE CDM FULFILLING ITS ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT OBJECTIVES? AN EVALUATION OF THE CDM AND OPTIONS FOR IMPROVEMENT 56* (2007), available at http://assets.panda.org/downloads/oeko_institut_2007_is_the_cdm_fulfilling_its_environmental_and_sustainable_developme.pdf.

179. *Id.* at 55.

180. *Id.* at 59.

181. United Nations Framework Convention on Climate Change, *supra* note 167.

B. Border Controls for CERs

If agreement on incremental reform proves impossible, but individual Annex B nations still want to improve the quality of the CDM market, they can do so, albeit at the cost of some market fragmentation. Nations are not required to purchase, or to allow private entities within their borders to purchase, CERs for compliance purposes. This is an option that Europe has chosen to adopt and it is one that Europe, or a future U.S. program could utilize to encourage the kind of CDM that all had hoped for, and to discourage the accounting gimmicks and oversubsidization that are present within the current market. The Linking Directive of the European Commission lays out the rules by which CERs may be imported into the EU Emissions Trading Scheme (ETS).¹⁸² It would be easy for the European Commission to modify this directive to enable additional review of CERs before their use is allowed in the EU. Currently, the Linking Directive already specifies special import criteria for CERs created by large hydro projects.¹⁸³ The United States, if it passes climate legislation including a cap-and-trade system with provision for use of international offsets, could also implement additional review of projects. Because the European ETS currently is the largest consumer of these credits, as the United States would be if it were to adopt such legislation, it has significant influence over the market. Were either country to enact CER standards tougher than mandated by the CDM EB, these standards would likely be adopted by all project proponents in order to allow sale of their credits into key markets. To some extent, this might lead to market fragmentation, with separate prices developing for EU- or U.S.-qualified CERs, but fragmentation is already a hallmark of carbon markets.¹⁸⁴

C. An Alternative to the CDM

Ultimately however, without radical reform of the incentive structure facing market proponents, the accounting tricks illustrated by the HFC-23 and CCGT examples are unlikely to be eliminated entirely. At the same time, simply eliminating the CDM without replacing it with an alternative method for engaging developing countries is unwise. It would leave many

182. Council Directive 2004/101 Amending Directive 1003/87/EC Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community, in Respect of the Kyoto Protocol's Project Mechanisms, 2004 O.J. (L 338) 18 (EC).

183. CERs derived from hydro projects larger than 20 MW must insure that these dams meet the criteria specified by the World Commission on Dams. *Id.* at 21.

184. And fragmentation is not necessarily a bad thing. It can promote faster learning and evolution of effective trading structures. Victor et al., *supra* note 126, at 1820.

low-cost reduction opportunities on the table, increase costs for developed-nation emitters in the short term, and both delay and increase the cost of eventual acceptance of caps by developing countries.

There is an alternative. The international community has significant experience in compensating developing countries for the reduction of dangerous atmospheric emissions in another context. The Multilateral Fund of the Montreal Protocol has been very successful at accomplishing the phase out of the most harmful ozone depleting substances (ODSs).¹⁸⁵ This fund has operated on the principle that developed nations should pay any additional costs incurred by developing countries in transitioning away from ODSs to new, ozone-friendly chemicals.¹⁸⁶ Under a future climate change protocol, this model could be adopted for the purposes of engaging developing-country sectors that are state-controlled or particularly subject to gaming while still allowing for use of the CDM in some sectors. Alternatively, a climate fund could completely supplant the CDM as the major tool for engagement with developing countries.

A climate fund might have numerous advantages over the CDM. Agreed incremental costs or a reverse auction could generate a marginal cost-abatement curve for applicants to the fund. The climate fund could then invest in projects with the lowest marginal abatement cost until its resources were exhausted. Price setting via a reverse auction would encourage low-cost reduction opportunities to surface without having to pay them substantially more than the costs of abatement, as occurs in the current system. Inframarginal rents would thus be reduced.

Another advantage of this approach is that state-managed sectors, like electric power in China, may be more effectively addressed by direct discussions with governments about priorities and costs rather than through the distorting filter of State Owned Entities. Further, low-cost emissions reduction opportunities such as building standards and avoiding deforestation, which require state intervention and regulation, can be accessed.¹⁸⁷ Finally, transaction costs of emissions reductions would likely be reduced because project proponents would not have to prove that their project would not have gone forward without the sale of carbon credits.

A climate fund approach could also continue to fulfill the function of cost control for Annex B nations that have committed to caps on their GHG

185. RICHARD ELLIOT BENEDICK, *OZONE DIPLOMACY* 265–68 (1998).

186. *Id.* at 254–65.

187. Emissions reductions must be voluntary to qualify under the CDM. Voluntary has been interpreted by the CDM EB to mean not caused by domestic law or regulation. Kyoto Protocol, *supra* note 1, art. 12.

emissions. GHG abatement in the developing world with resulting emissions reductions could be credited to Annex B countries based on their contributions to the fund or an alternative agreed upon metric. In this way, cost control would be at the national level rather than at the firm level as in the EU ETS. A nation participating in the fund could simply reduce the scarcity of permits and hence their price in its cap-and-trade system rather than, as now, allowing covered entities to surrender CDM credits in lieu of domestic tradable permits.

Perhaps the biggest advantage of this type of fund would be that it reduces the incentives of firms and governments to misrepresent their business-as-usual emissions and costs to the regulator. Under the current system, the more a project proponent can inflate its baseline, the more money there is to be made. Under a climate fund in which nations agree on incremental costs or allow a reverse-auction to establish them, firms and regulators would have at least some incentive to report a more accurate estimate of their emissions and costs. In a context in which emission reduction projects are competing for a limited pool of emissions reduction funds and where the odds of receiving payment for an activity increase as the costs of marginal abatement fall, sellers of credits have an incentive to report the lowest costs for emissions reductions that they can reasonably deliver.

The incentives created by this type of system are admittedly imperfect—governments or firms might still attempt to inflate baselines in order to lower marginal costs of abatement. The advantage, though, is that the fund manager would have information from other bidders with similar projects on the costs of abatement. The odds of collusion among governments or individual emitters in order to systematically misrepresent abatement costs or baselines are lower than the odds of such misrepresentation by individuals within the current system.

A climate fund would address many of the defects of the current system. It would allow direct engagement with domestic regulators in developing countries and an honest discussion regarding policy baselines. It would potentially reduce the costs of emissions reductions through a utilization of a reverse auction price-setting mechanism rather than allowing prices to be set by the cost of emissions reductions in developed-country cap-and-trade markets. Finally, it would likely modify the incentives facing project proponents and so lead to a better information transfer to the fund manager than is currently in the CDM. Nonetheless, it would almost certainly have its own problems. No system as complicated as the global carbon market, or a global climate fund, is likely to operate flawlessly or avoid all unintended consequences.

CONCLUSION

Climate change is a long-term problem that requires long-term solutions. Active, broad engagement of both developed and developing countries is absolutely essential for success. The preceding analysis has illustrated that the global carbon market does not live up to its current hype. Too often, market participants behave strategically to generate credits for activities that do not merit them. At the same time, the analysis shows that the incentives produced by the global carbon market do indeed have the potential to induce significant participation on the part of developing nations in the global effort to combat climate change.

The challenge for the international community is to maintain this active participation while honestly facing up to the flaws in the CDM. If it can manage this, a more environmentally effective system is possible. Moving forward, and as developed-world investment in developing-country climate mitigation increases, more effective methods must be developed. Either the CDM needs significant reform, major buyers of CERs should adopt domestic controls that raise crediting standards, or an alternative mechanism such as a carbon fund should be devised to engage the developing world in fighting climate change.



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Co-benefits and additionality of the clean development mechanism: An empirical analysis

Junjie Zhang^{a,*}, Can Wang^b^a School of International Relations and Pacific Studies, University of California, San Diego, 9500 Gilman Drive #0519, La Jolla, CA 92093 0519, United States^b School of Environment, Tsinghua University, China

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ABSTRACT

The Clean Development Mechanism (CDM) allows industrialized countries to comply with the Kyoto Protocol by using carbon offsets from developing countries. There are two puzzles within this carbon market: additionality (the proposed activity would not have occurred in its absence) and co-benefits (the project has other environmental benefits besides climate mitigation). This paper proposes an econometric approach to evaluate the CDM effect on sulfur dioxide emission reductions and assess its additionality indirectly. Our empirical model is applied to China's emissions at the prefecture level. We found that the CDM does not have a statistically significant effect in lowering sulfur dioxide emissions. This result casts doubt on additionality of these CDM activities, that is, they would have happened anyway.

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1. Introduction

The Clean Development Mechanism (CDM) is a project-based carbon market which enables industrialized countries to reduce costs of compliance with the Kyoto Protocol by implementing climate mitigation projects in developing countries. The CDM has been successful in mobilizing the investment of public and private sectors from both developed and developing countries for reducing greenhouse gas (GHG) emissions. By the year 2009, there were more than 4200 projects in the pipeline that are expected to reduce GHG emissions by more than 2900 million metric tons of carbon dioxide equivalent (CO₂e) by the end of 2012. The CDM emission reduction is not trivial, in that it is around 40% of the U.S. emissions in 2007.¹

The CDM is nonetheless facing mounting criticism, in which the most serious challenge is its environmental integrity [1–3]. Since there are no emission caps for developing countries, the usefulness of the CDM hinges on whether the proposed project would have occurred in its absence. This assessment is known in the literature as additionality. Lack of rigorous criteria to establish additionality, however, may result in some projects receiving an excess of carbon credits. Even worse, some “business-as-usual” (BAU) activities might be wrongly registered as CDM projects. In this case, the credit buyers' increased emissions may not be fully offset by real emission reductions in the CDM activity. This may jeopardize on the effectiveness of the international emission trading system [4].

Another criticism is that the CDM insufficiently promotes sustainable development, although it is stipulated as one of its dual goals in the Kyoto Protocol [5,6]. The CDM is expected to improve environmental quality in host countries because

* Corresponding author. Fax: +1 858 534 3939.

E-mail address: junjiezhang@ucsd.edu (J. Zhang).

¹ Source: The CDM project statistics are from <http://cdm.unfccc.int/index.html>. The U.S. emissions data are from “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007” available at <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>.

GHG emission reductions may also lower emissions of other pollutants such as sulfur dioxide (SO₂). The so-called co-benefit is one of the major reasons for developing countries to be involved in climate mitigation. However, while there is a price for CO₂, the local pollutants may not be monetized. Since the carbon market is only responsive to price signals, CDM developers have limited interest in generating other benefits besides carbon credits.

Additionality and co-benefits are two puzzles within this carbon market. Little is known empirically about whether the CDM has achieved these two goals. A major barrier for empirical studies is that the GHG emission data is not reported at the subnational level in developing countries. We address this problem by exploiting the connections between GHG and its co-pollutant emission reductions. To our knowledge this is the first paper that simultaneously evaluates additionality and co-benefits. Furthermore, the proposed econometric framework is not just applicable to the CDM. It has the potential to contribute to emerging policy debates about other baseline-and-credit programs such as voluntary carbon markets and energy efficiency credits.

As for the co-benefits of the CDM, we focus on sulfur dioxide (SO₂) emission reductions because of its broad environmental and health impacts.² Emissions of sulfur dioxide and GHGs are closely correlated with fossil-fuel use [8]. A separate analysis of either pollutant may not be able to provide a sufficient analytical framework [9]. More importantly, since GHG data are not widely available, SO₂ abatement may be useful for inferring GHG emission reductions. The rationale is that if fossil-fuel power generation is replaced by renewable energy, both CO₂ and SO₂ emissions will be reduced. If there is no observed change in SO₂ emissions, the efficacy of the CDM to reduce CO₂ would be called into question. Note that our additionality test is conditional on non-zero co-benefits. Therefore, we are not able to assess additionality for those projects that do not reduce sulfur emissions.

The econometric framework is an extension of the literature that investigates the determinants of SO₂ emissions [10–15]. Our model is adapted from, without relying on, the environmental Kuznets curve (EKC). Realizing that the classical polynomial EKC model may be too restrictive [16], we apply a fixed-effect semiparametric model that does not specify the functional form between emissions and income.

Our model augments a typical specification of SO₂ emissions through the inclusion of a policy variable reflecting CDM activities (measured by carbon credits). Identification of the causal effect of a CDM project is achieved through the inclusion of fixed effects, as well as the fact that CDM activities are determined well in advance of current SO₂ emissions because CDM approval is a lengthy process. Project developers have to wait at least one year between public comments and registration. The fixed effects capture resource endowment and industrial base, both of which are critical in the selection of CDM projects. Because resource endowment and industrial base change slowly, they can be regarded as fixed over the sample period. Therefore, conditional on the observables and the fixed effects, the selection of CDM activities is independent of sulfur emissions.

In this paper, we estimate the effect of the CDM in reducing SO₂ emissions at China's prefecture level. China is the world's largest GHG and SO₂ emitter. It is also the dominant player on the CDM market. The prefecture is the most disaggregated administrative unit that documents SO₂ emissions consistently, and this unit of analysis provides sufficient cross-sectional and temporal variation. Our econometric model shows no empirical support that the CDM has led to lower SO₂ emissions. This finding casts doubt on additionality—specifically, that these project activities would have happened without the CDM.

2. Background and data

We first briefly discuss some key issues in the Clean Development Mechanism, including the baseline and co-benefits. We then discuss the CDM activities in China. Finally, we present the data set used in our study.

2.1. Key issues in the CDM

The Clean Development Mechanism is the only “flexible mechanism” under the Kyoto Protocol that engages developing countries in climate mitigation.³ Because the marginal abatement costs in developing countries are lower than those of developed ones, the CDM helps the latter to reduce their costs of compliance with emission reduction commitments. Reciprocally, the host countries can benefit from financial assistance, technology transfer, and non-GHG emission reductions.

The CDM employs a baseline-and-credit program. It is distinguished from the cap-and-trade system by the fact that there are no explicit caps for carbon credit suppliers.⁴ Theoretically, these two systems are numerically equivalent if the baseline implies the same level of caps. Since the baseline describes a hypothetical emission scenario that would have occurred without the project, how to construct a baseline becomes the central problem of the CDM. Project developers

² It is worth noting that reducing SO₂ emissions may have an unintended consequence on global warming. Its product sulfate aerosol, a major component of atmospheric brown clouds (ABCs), has a climate cooling effect by reflecting visible solar radiation [7].

³ The other two are emission trading (ET) and joint implementation (JI) among annex I countries. The ET is an allowance-based carbon market while the CDM and the JI are project based.

⁴ According to the principle of “common but differentiated responsibility”, annex I countries (industrialized countries and economies in transition) are subject to quantified emission limitation and reduction commitment while developing countries have no emission caps.

have incentives to overstate BAU emissions to maximize credits. Even worse, some projects that would have occurred otherwise might enter the CDM pipeline and hence additionality requirements are violated.

In order to avoid awarding carbon credits to projects that would have happened anyway, the CDM Executive Board (EB) has set rules to determine additionality.⁵ This overarching additionality framework consists of four steps: (1) identification of alternatives to the project activity, (2) investment analysis to demonstrate the proposed activity is not the most economically or financially attractive, (3) barrier analysis, and (4) common practice analysis. Although official criteria have been designed for assessment purposes, their implementation is highly subjective and often lacks documented evidence to substantiate additionality [17]. Overall, the methodology does not achieve its intended objective of establishing a valid counterfactual.

The CDM is supposed to achieve dual goals: lowering abatement costs and promoting sustainable development. As for the first objective, the certified emission reductions (CERs), being equal to one metric ton of CO₂e, consistently sell at a discount to the European Union Allowances (EUAs).⁶ However, when it comes to the sustainability goal, some argue that its role is largely marginalized [5]. The carbon market cannot optimally allocate resources for non-monetized sustainability. The low-cost emission reduction projects are not necessarily aligned with the sustainability priority in the host countries. Examples include industrial gas projects such as hydrochlorofluorocarbons (HFCs) and nitrous oxide (N₂O). These projects can generate large volumes of CERs at low costs, but they have very little sustainability benefit other than climate change.

The controversial industrial gas projects are gradually being phased out due to the saturation of project opportunities and stringent regulations. Renewable energy and energy efficiency have become the mainstream project types. These projects have strong co-benefits beyond climate mitigation. Fig. 1 shows a breakdown of CDM projects by types. For example, renewable power replacing fossil-fuel power plants will reduce not only GHGs, but also other air pollutants such as sulfur dioxide, nitrogen oxide, and particulates. As long as the CDM activities of these types are additional, we should be able to observe associated co-benefits.

2.2. The CDM in China

China is the biggest supplier on the primary CDM market. It accounts for 35% of registered projects and 59% of expected annual reductions as of 2009. The concentration of the market is mainly due to abundant opportunities for emission reductions. China has risen to become the world's largest GHG emitter since 2007 and the momentum will likely be maintained in the future.⁷ According to Auffhammer and Carson [18], the projected increase in China's emissions out to 2010 is several times larger than the amount reduced in Kyoto Protocol. In addition to total emissions and the size of industrial base, factors that attract foreign direct investment (FDI) also increase the flow of international carbon credit investment. In this regard, economies of scale and the business environment all contribute to China's market share [19].

China's preference for the CDM is aligned with its national strategy in energy and climate change [20]. According to China's National Climate Change Program, energy efficiency and renewable energy supplies are top priorities in climate mitigation [21]. Specifically, industrial and residential energy efficiency, hydro power, coal-bed/mine methane, bio-energy, wind, solar, and geothermal energy are all actively supported. These project types account for the majority of the CDM activities.

Environmental pollution is another incentive for China to be engaged in the CDM. Coal is the dominant fuel source in China's primary energy consumption. According to China's Statistical Yearbooks, its share has varied between 66% and 76% over the last two decades. Emissions of SO₂, NO_x, and particulates from coal consumption have created severe environmental and health problems. It is estimated that SO₂ caused over 213 billion Chinese Yuan (CNY) in health damage in 2003 [22].⁸ Another study finds that acid rain, which is mainly caused by SO₂ emissions from fossil fuel use, causes 30 billion CNY in crop damage and 7 billion CNY in building damage [23]. The expectation that the CDM helps reduce local and regional air pollutants besides GHGs makes participation even more attractive for China.

2.3. The data

In this paper, the unit of analysis is a prefecture. A prefecture, literally translated as a region-level city, is an administrative unit ranking immediately below a province and above a county. It typically includes both urban and rural areas. A prefecture is the most disaggregated level that consistently documents economic and environmental data and information. The economic data are from China's City Statistical Yearbooks (2000–2008). China has 333 prefectures, of which 287 are covered by the Yearbooks. The prefectures that are not included are those with low economic significance. On average a prefecture had a population of 4.27 million, an area of 16,448 square kilometers, and a GDP of 112.5 billion Chinese Yuan (CNY) in 2008. Table 1 reports summary statistics for the variables used in our analysis.

⁵ Source: "Tool for the demonstration and assessment of additionality" by the CDM-EB, available at http://terrass.pbworks.com/f/Additionality_tool.pdf.

⁶ The prices of CERs and EUAs are available at the European Climate Exchange <http://www.ecx.eu/>. The discount on the primary CDM market is greater than the secondary market. The primary market discount reflects the risks of CER issuance. The secondary market discounts may reflect that CERs are not completely fungible to EUAs.

⁷ Source: "CO₂ Emissions from Fuel Combustion 2009 Highlights" by the International Energy Agency. Available at http://www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2143.

⁸ 1 U.S. Dollar ≈ 6.8 Chinese Yuan in 2009.

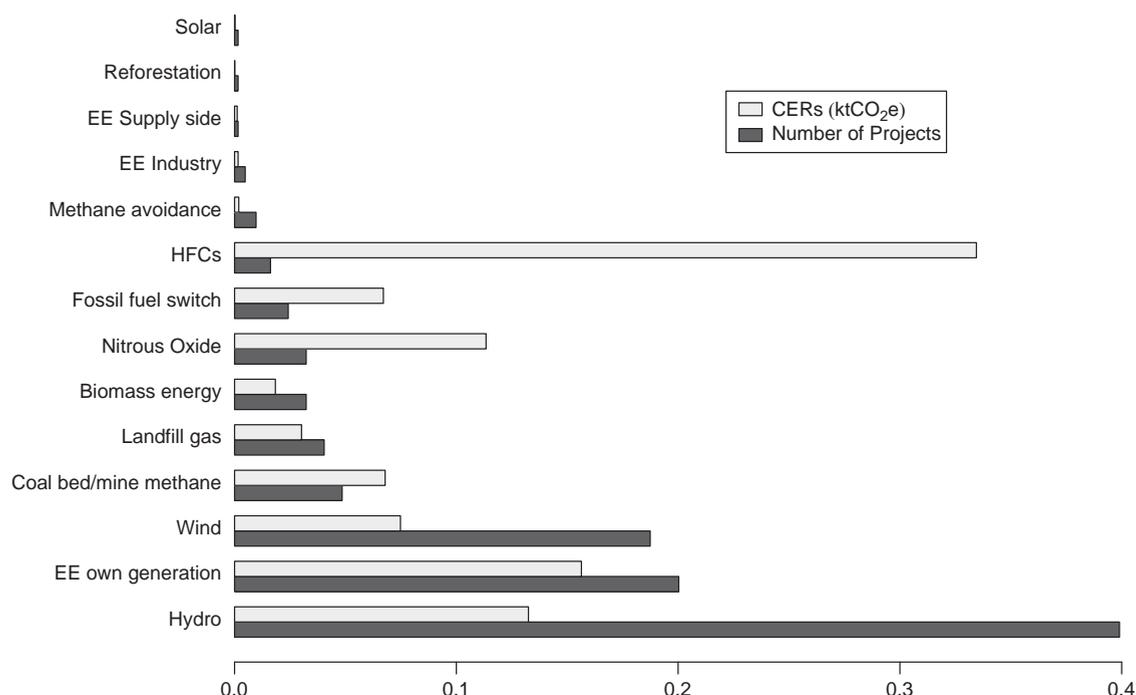


Fig. 1. Shares of CDM projects by types.

Table 1
Summary statistics.

Variable	Definitions	N	Mean	Std dev	Min	Max
SO2P	SO ₂ emitted by power plants (10 ⁵ ton)	831	0.42	0.63	0.00	4.63
SO2T	SO ₂ generated by all industries (10 ⁵ ton)	1711	1.12	1.46	0.00	13.09
SO2E	SO ₂ emitted by all industries (10 ⁵ ton)	1711	0.66	0.72	0.00	7.91
GDPPC	GDP per capita (10 ⁵ CNY)	2239	0.17	0.22	0.02	3.42
POPDEN	Population density (10 ⁻¹ /km ²)	2243	0.42	0.40	0.00	11.56
EE	Industrial output/electricity use (100 CNY/kWh)	2223	0.20	0.48	0.01	21.09
KL	Fixed asset investment/number of employees (10 ⁵ CNY)	2243	0.74	0.62	0.00	7.19
ESPC	Expenditure on education and R&D per capita (10 ³ CNY)	2239	0.24	0.29	0.00	4.96
FDIR	FDI as a ratio of fixed asset investment (10 ⁻²)	2161	0.90	1.53	0.00	32.74
CCO2	Prefecture-level CERs (10 ⁶ ton)	2296	0.55	2.49	0.00	41.64
PCO2	Province-level CERs (10 ⁶ ton)	2296	0.63	1.39	0.00	8.07
GCO2	Grid-level CERs (10 ⁶ ton)	2296	0.23	0.49	0.00	2.83
HYDRO	Hydropower CERs (10 ⁵ ton)	2296	0.09	0.62	0.00	9.07
WIND	Wind energy CERs (10 ⁵ ton)	2296	0.08	0.67	0.00	16.66
ENERGY	Energy efficiency CERs (10 ⁵ ton)	2296	0.20	1.66	0.00	34.95
OTHER	Other CERs (10 ⁵ ton)	2296	0.11	1.19	0.00	41.24

Notes: All monetary values are real values.

We have two sources of data for SO₂ emissions. First, information on SO₂ emissions from power plants is provided by the Institute of Air Pollution Control at the Tsinghua University. The emission data are generated from their internal database of national power plant inventory; this detailed data set has not been used in the economics literature studying SO₂ emissions in China. Although the data are only available in 2000, 2005, and 2007, it covers a period before and after CDM activities, which enables us to identify the CDM effect in a difference-in-difference framework.

Second, the Yearbooks have documented SO₂ emissions from all industries during 2003–2008. Although SO₂ emissions before 2003 were also reported, their measurement was inconsistent with those after 2003 so they are not used. The power and heating industry accounts for about 60% of total emissions. Two industrial SO₂ variables are used in the analysis: the amount of SO₂ generated and the amount of SO₂ released into the atmosphere. The two variables are related by the following equation:

$$\text{SO}_2 \text{ emitted} = \text{SO}_2 \text{ generated} - \text{SO}_2 \text{ removed.}$$

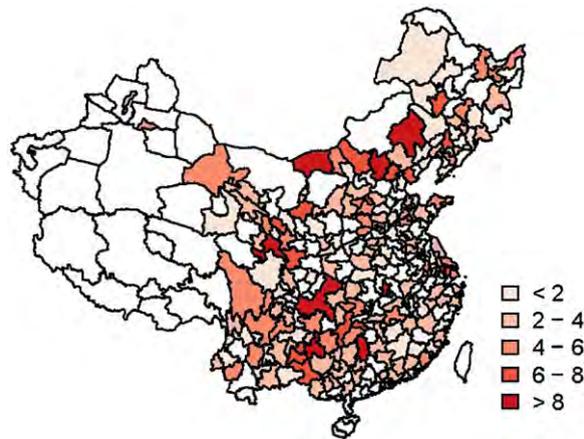


Fig. 2. CDM activities in China by the number of projects.

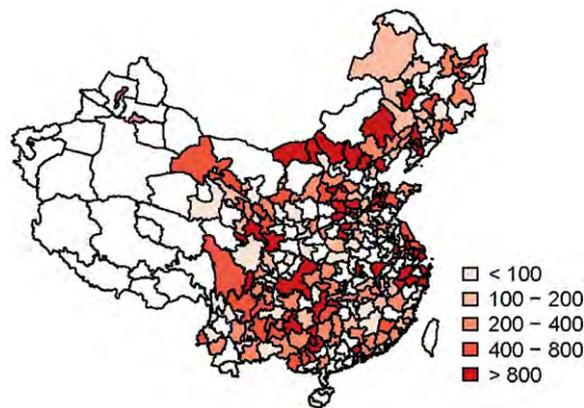


Fig. 3. CDM activities in China by CERs (10^3 ton).

We analyze industrial emissions because the CDM also affects non-power SO_2 emissions, which is the so-called “leakage effect.” Although a CDM project can reduce emissions within the boundary (power sector), it may cause additional emissions elsewhere. For example, the construction and operation of CDM projects may boost local economic activities and increase emissions out of the boundary.

The CDM data are from the United Nations Framework Conference on Climate Change (UNFCCC), which maintains a database that includes project design documents (PDDs) for every registered project. Only the projects in China that were registered before 2008 are used because of the constraint posed by the economic and emission data. The United Nations Environmental Program (UNEP) Risoe Center provides a compiled list of all CDM projects.⁹ The first CDM project in China was a wind farm in the Liaoning Province which started in 2003. The credit start date is used to match the economic data because this is the time when the project starts emission reductions. As of 2008, 191 prefectures in all provinces except Tibet had CDM activities. The locational distributions of the CDM projects are depicted in Figs. 2 and 3.

3. Empirical strategy

The emission reduction of a CDM project is measured by the difference between the baseline emissions and the project’s real emissions. A baseline is a scenario that represents GHG emissions in the absence of the CDM. Let t index time and k index pollutant. Let y denote the project emission, y^* denote the baseline emission, and r denote the emission reduction. A project’s emission reduction is

$$r_{kt} = y_{kt}^* - y_{kt}. \quad (1)$$

Note that the emission reduction is positive only if its emission level is below the baseline. While it is straightforward to monitor a project’s real emissions, it is tricky to determine what the emissions would otherwise be. Different baselines

⁹ Source: <http://www.cdmpipeline.org/>.

may imply significantly different amounts of emission reductions. In this section, we present two approaches that can be used to construct emission baselines.

3.1. Engineering model

Most CDM activities replace fossil-fuel power generations by delivering electricity generated from renewable energy sources. Hence the emissions reduction attributed to a CDM project is the avoided emissions of the displaced power plants/units. Instead of identifying the exact source of displaced generations, a grid-level emission baseline can be used to quantify the emission reduction

$$r_{kt} = e_t f_{kt}^{\text{grid}} - l_{kt}. \quad (2)$$

In this form, e is the net electricity supply by the CDM project (MWh), f_{kt}^{grid} is a grid-level emission factor (ton/MWh), and l is the leakage. The leakage is the increased emissions attributable to CDM activities that occur outside the project boundary. For renewable energy projects, there are no emissions and leakage is often treated as zero.

One method to calculate the emission factor is the operating margin (OM). The OM assumes that it is the electricity from marginal power plants that is displaced. A marginal plant is defined as the power plant on the top of the grid system dispatch order without CDM activities. It is apparent that the OM measures the short-run effect of CDM activities. The CDM Executive Board suggests the operating margin emission factor can be calculated by generation-weighted emissions from all grid-tied power plants excluding low-cost and base-load plants/units.¹⁰

Another method is to use the build margin (BM) emission factor. It assumes that CDM activities delay or cancel the construction of new power plants/units. The BM can be calculated in the same ways as the OM, except that a different sample of power plants is used. In general, the newly built plants are equipped with better technology and thus emit fewer pollutants than existing plants. This implies that the build margin is normally smaller than the operating margin.

In this section, we outline an engineering model that can be used to compute emission factors. This model is based on the simple OM method since it is widely used in CDM project designs. The grid-level emission factor is calculated by

$$f_{kt}^{\text{grid}} = \frac{\sum_{\text{plant}} e_t^{\text{plant}} f_{kt}^{\text{plant}}}{\sum_{\text{plant}} e_t^{\text{plant}}}, \quad (3)$$

where f_{kt}^{plant} is a plant-level emission factor. It is worth noting that not all power plants/units in the grid are included in the calculation. The project developers, following guidelines in host countries, propose how to select the sample. The proposed baseline needs to be validated by independent audits.

If multiple fuels are involved, the plant-level emission factor is then

$$f_{kt}^{\text{plant}} = \frac{\sum_{\text{fuel}} c_t^{\text{fuel}} \nu_t^{\text{fuel}} f_{kt}^{\text{fuel}} (1 - \lambda_{kt})}{e_t^{\text{plant}}}. \quad (4)$$

In this form, c is the amount of fuel consumed (mass or volume unit), ν is the energy content (GJ/mass or volume unit), and λ is the fraction of pollutants removed. Carbon capture and storage (CCS) can remove CO₂ but it is not yet commercialized, so that $\lambda_{\text{CO}_2} = 0$. As for SO₂ emissions, all new and existing coal-fired power plants in China are required to install flue gas desulfurization (FGD) equipment. The average removal rate in 2008 is around 78.7%.¹¹

In calculating emission factors, either the *ex ante* or *ex post* approach is allowed. All CDM projects in China employ *ex ante* information to establish the baseline because it reduces the risks of carbon credit generation. The most recent available information of already built power plants/units is included in the sample group (three years before the submission of PDDs). In addition, the emission factor is generally fixed or adjusted according to a predetermined rate during the project crediting period.

According to Eqs. (2)–(4), it is apparent that there is a connection between CO₂ and SO₂ emission reductions. To simplify this illustration, suppose that a renewable energy project with zero leakage delivers electricity to a grid. The grid's baseline emissions can be characterized by average emission factors f_{SO_2} and f_{CO_2} , as well as average the SO₂ removal rate λ_{SO_2} . The ratio of emission reductions for these two pollutants is then

$$\frac{r_{\text{SO}_2}}{r_{\text{CO}_2}} = \frac{f_{\text{SO}_2} (1 - \lambda_{\text{SO}_2})}{f_{\text{CO}_2}}. \quad (5)$$

In this form, if all parameters are known, we can use CO₂ emission reductions to estimate the abatement of SO₂ emissions.

Note that Eq. (5) is greatly simplified. When the engineering approach is used to estimate SO₂ emission reductions, the emission factors take into account multiple plants and multiple fuels. The emission factors of China's power industry are adapted from Cao and Wang [24] and are reported in Table 2. In this table, the combined margin (CM) is just a simple average of the operating margin and the build margin.

¹⁰ Source: "Tool to calculate the emission factor for an electricity system (October 2009)". Available at <http://cdm.unfccc.int/methodologies/PAMethodologiesapproved.html>.

¹¹ Source: "Emission Reductions of Power Plants in 2008" by the State Electricity Regulatory Commission. Available at www.serc.gov.cn/ywdd/200911/W020091102328545684394.doc.

Table 2
Emission factors for China's power industry.

Grid	CO ₂			SO ₂		
	OM	BM	CM	OM	BM	CM
North	1.007	0.780	0.894	0.009	0.002	0.006
Northeast	1.129	0.724	0.927	0.007	0.002	0.004
East	0.882	0.683	0.783	0.007	0.002	0.005
Central	1.126	0.580	0.853	0.013	0.002	0.008
Northwest	1.025	0.643	0.834	0.010	0.002	0.006
South	0.999	0.577	0.788	0.009	0.002	0.005
Hainan	0.815	0.730	0.773	0.007	0.002	0.005

Notes: Unit: ton/MWh. The CO₂ emission factors are from "Emission Factors of China's Regional Electricity Grid 2009" published by China's National Development and Reform Commission. Available at http://qhs.ndrc.gov.cn/qj/zjz/t20090703_289357.htm. The SO₂ emission factors are from Cao and Wang [24].

3.2. Econometric identification

The engineering approach can be used to quantify co-benefits if CO₂ emission reductions are real (or additional). However, if we only observe carbon credits instead of real emission reductions, this approach is correct only if the carbon credits are issued based on an appropriate baseline. An exaggerated baseline results in overallocated carbon credits and exaggerated co-benefits. To estimate co-benefits without assuming that carbon credits reflect real emission reductions, we propose an econometric approach in this section.

An alternative treatment of Eq. (5) is to regard the emission ratio as a parameter. If CO₂ and SO₂ emission reductions are known, this parameter can be estimated by regression analysis. Let $\sigma \equiv f_{SO_2}(1 - \lambda_{SO_2}) / f_{CO_2}$, then Eq. (5) is rewritten as

$$r_{SO_2} = \sigma r_{CO_2}. \tag{6}$$

However, this model is not estimable because emission reductions in CO₂ and SO₂ are not directly observable.

Suppose that a CDM project receives a credit of c_{CO_2} , while the real emission reduction is $r_{CO_2} = \rho c_{CO_2}$, where ρ is an unknown parameter. If the project is awarded more than what it actually reduces, then $\rho < 1$. If $\rho = 1$, then the carbon credit issuance is fair. If $\rho > 1$, it means that the emission baseline is too conservative. According to Eq. (6), the reduction in SO₂ emissions is $\sigma \rho c_{CO_2}$. The relationship between SO₂ emission reductions and carbon credits is

$$r_{SO_2} = \sigma \rho c_{CO_2}. \tag{7}$$

In this form, the empirical challenge is that the SO₂ emission reductions attributed to the CDM activities are not directly observable. According to Eq. (1), SO₂ emission reductions are estimated by the difference between baseline and real emissions. Combining Eqs. (1) and (7) and denoting $\gamma \equiv -\sigma \rho$, we obtain

$$y_{SO_2} = y_{SO_2}^* + \gamma c_{CO_2}. \tag{8}$$

Eq. (8) can be used to evaluate the effectiveness of the CDM on SO₂ emission reductions. It also provides an indirect test for additionality. Based on the engineering model, σ can be estimated and used as the prior information. If $-\gamma < \sigma$ or equivalently $\rho < 1$, it suggests that there is an over-issuance of the carbon credits. Even worse, if $\gamma = 0$, it implies that the CDM activities may not be additional at all. Note that our argument is based on the assertion that $\sigma \neq 0$. Since we have excluded all industrial gas projects that have zero co-benefits, the assumption is true for all other projects. The argument is supported by the environmental engineering studies, for example Aunan et al. [8].

Let i index prefecture ($i = 1 \dots n$) and t index year ($t = 1 \dots T$). The baseline emission $y_{SO_2}^*$ is modeled as

$$E(y_{it}^* | w_{it}, x_{it}, u_i, v_t) = m(w_{it}) + x'_{it} \beta + u_i + v_t.$$

The pollutant subscripts are ignored to reduce notational clutter. According to Eq. (8), the CDM effect is additive and proportional to the project scale, which implies that

$$E(y_{it} | w_{it}, x_{it}, c_{it}, u_i, v_t) = m(w_{it}) + x'_{it} \beta + \gamma c_{it} + u_i + v_t. \tag{9}$$

In this form, w_{it} is income measured by real GDP per capita (GDPPC), $m(\cdot)$ is a flexible function that we define below, and x_{it} includes prefecture- and time-variant control variables other than income. The prefecture fixed effects u_i controls for time invariant unobservables such as resource endowment, industrial base, and institutional capacity. The time effect v_t controls for unobserved trends such as national emission regulations and technological progress as well as year-specific shocks to emissions.

The causality of the regression follows that if the CDM decreases fossil fuel consumption, SO₂ emissions will also be reduced since sulfur emissions result from energy use. A CDM project is determined before the current SO₂ emissions because its approval is a lengthy process. Project developers have to wait at least one year from public comments to registration. In addition, the selection of the CDM projects hinges on resource endowment and industrial base. Hydro, wind, solar, coal-bed methane, and biomass projects depend on the abundance of their respective natural resources. The

remaining energy efficiency projects depend on the industrial base and the energy intensity of the economy. Because resource endowment and the industrial base change slowly, they can be regarded as the fixed effects. Energy intensity can also be controlled for. Therefore, conditional on the observables and the fixed effects, the selection of CDM activities is independent of sulfur emissions.

The included explanatory variables are widely used in the empirical studies that investigate the determinants of SO₂ emissions (see [13] for a review). The causal relationship of income and pollution is a concern [15]. The argument that income causes emissions is fully discussed in Antweiler et al. [11]; changes in real income have contemporaneous effect on pollution, but environmental policies that determine pollution level respond to income levels slowly. To further address this issue, we use lagged income to replace current income in the robustness checks as is suggested by the growth literature.

In the set of control variables x_{it} , population density (POPDEN) is a measure of land area per capita. This demographic is a determinant of pollution but it responds to pollution slowly because migration takes time to realize. In addition, residential migration is constrained by the family register system (*hukou*) in China. Energy efficiency (EE) is a measure of real industrial output per kilowatt of electricity use. Pollution is a consequence of energy use and so it hinges on the energy intensity. The capital-to-labor ratio (KL) is defined as a ratio of fixed asset investment to number of employees. The inclusion of KL controls for the factor endowment effect. Both EE and KL enter the model with a quadratic term to account for nonlinearity. Expenditure on education and R&D per capita (ESPC) controls for the knowledge and technology effect. The empirical decomposition of pollution into scale, composition, and technique effects is attributed to Antweiler et al. [11].

We also include FDIR, which a ratio of foreign direct investment (FDI) as a share of fixed asset investment. The endogeneity of this trade variable might be a concern. According to Frankel and Rose [14], geographical variables can be used as instruments for endogenous trade based on trade theory. However, this approach is not applicable to panel data, because these instruments are time invariant. In any case this particular instrumental variable approach is not superior to a panel method that uses individual fixed effects to control for geographical attributes. In addition to the prefecture effects, we use subnational time dummies to control for time-variant unobservables that may be correlated with both FDI and emissions.¹²

3.3. Specification and estimation

The classical environmental Kuznets curve (EKC) model posits an inverted-U relationship between income and pollution [10]. It claims that emissions increase with income at an early development period and then decrease after passing some income thresholds. Although the EKC model has many limitations [12,13,15], it provides a basic structure to predict pollution at the aggregate level. Although our approach does not rely on the EKC framework, it motivates us to specify a nonlinear income–emission relationship.

A prefecture is the unit of analysis in this paper, but the CDM activity does not necessarily replace carbon-intensive generators in the same prefecture. It may replace generators in the same province or even in the same grid. It is therefore important to incorporate the spillover effect in a spatially explicit model. Following the approach proposed by Duflo and Pande [25], we incorporate the effects of the CDM activities in adjacent areas.

With the above two assumptions, our parametric regression is specified as

$$y_{it} = \alpha_1 w_{it} + \alpha_2 w_{it}^2 + \alpha_3 w_{it}^3 + \alpha_4 x'_{it} \beta + \gamma_1 c_{it}^c + \gamma_2 c_{it}^p + \gamma_3 c_{it}^g + u_i + v_t + \varepsilon_{it}. \tag{10}$$

In this form, c_{it}^c designates prefecture-level carbon credits generated from the CDM activities. c_{it}^p designates carbon credits in the same province excluding c_{it}^c . c_{it}^g designates carbon credits in the same grid excluding c_{it}^p , and α , β , and γ are parameters to be estimated. ε_{it} is an error term which captures deviations between actual and estimated baselines emissions. Under the assumption of strict exogeneity, its mean is zero conditional on the observables and the fixed effects.¹³

Although a cubic term is included to accommodate more curvatures in Eq. (10), the polynomial specification is still very restrictive. Millimet et al. [16] suggest that a semiparametric model is more appropriate because the parametric model is rejected by their specification test. We generalize their model to accommodate CDM activities and other variables. Specifically, we propose a semiparametric partially linear model, in which the conditional mean of SO₂ emissions has an unknown relationship in income and is linear in other variables. The semiparametric model is then

$$y_{it} = m(w_{it}) + \alpha_4 x'_{it} \beta + \gamma_1 c_{it}^c + \gamma_2 c_{it}^p + \gamma_3 c_{it}^g + u_i + v_t + \varepsilon_{it}, \tag{11}$$

where $m(w_{it})$ is a smooth function that is unknown to the researcher. For simplification, the above model can be written as

$$y_{it} = m(w_{it}) + z'_{it} \pi + u_i + \varepsilon_{it}, \tag{12}$$

where z_{it} includes all time-variant explanatory variables other than income w_{it} . The time effects are lumped into z_{it} as dummy variables. To estimate the above model, we can use the first difference or de-meaning to cancel out fixed effects.

¹² To further address the concern of endogenous FID, we have estimated all models without FDI. These additional robustness checks do not change our results.

¹³ Our identification strategy rests on the timing of the CDM application process in light of the strict exogeneity requirement. If CDM is related to past unobserved determinants of baseline emissions, the results will be biased.

A first difference of Eq. (12) leads to

$$\Delta y_{it} = \Delta m(w_{it}) + \Delta z'_{it} \pi + \Delta \varepsilon_{it}. \tag{13}$$

The profile-kernel method proposed by Henderson et al. [26] is employed to estimate the differenced partially linear panel data model. This approach shows that a consistent estimator of π is given by

$$\hat{\pi} = \left(\sum_{i=1}^n \Delta \ddot{z}_i \Omega^{-1} \Delta \ddot{z}_i \right)^{-1} \left(\sum_{i=1}^n \Delta \ddot{z}_i' \Omega^{-1} \Delta \ddot{y}_i \right). \tag{14}$$

In this form, $\Omega = \text{cov}(\Delta \varepsilon_{it}, \Delta \ddot{z}_{it} = \Delta z_{it} - (\hat{m}_z(w_{it}) - \hat{m}_z(w_{it-1})))$ and $\Delta \ddot{y}_{it} = \Delta y_{it} - (\hat{m}_y(w_{it}) - \hat{m}_y(w_{it-1}))$. $m_z(w)$ (or $m_y(w)$) represents estimates from a nonparametric regression of z (or y) on w alone. This estimator in (14) is \sqrt{n} -consistent, and the asymptotic variance can be estimated by

$$\text{Avar}(\hat{\pi}) = \frac{1}{n} \sum_{i=1}^n \Delta \ddot{z}_i \hat{\Omega}^{-1} \Delta \ddot{z}_i.$$

A consistent estimator of the variance–covariance matrix Ω is

$$\hat{\Omega} = \hat{\sigma}_v^2 (I_{T-1} - e_{T-1} e'_{T-1}).$$

In this form, I is an identity matrix, e is a vector of ones, and $\hat{\sigma}_v^2$ is estimated by

$$\hat{\sigma}_v^2 = \frac{1}{2n(T-1)} \sum_{i=1}^n \sum_{t=2}^T (\Delta \ddot{y}_i - \Delta \ddot{z}_i' \hat{\pi})^2.$$

With a consistent estimate of π , let $\hat{y}_{it} = y_{it} - z_{it}' \hat{\pi}$. With this model (12) can be converted to a nonparametric fixed effect regression

$$\hat{y}_{it} = m(w_{it}) + u_i + \varepsilon_{it}. \tag{15}$$

Multiple methods are available to estimate this model including the series method and the profile-kernel method [27,28]. We utilize the nonparametric iterative kernel estimator proposed by Henderson et al. [26] because it accounts for the variance structure and semiparametric efficiency. The estimation is implemented in Matlab. The code is available upon request.

4. Results and discussion

4.1. Engineering results

First, we estimate the effect of CDM activities in reducing SO₂ emissions by means of the engineering approach. The grid-specific combined margin emission factors are used, which is a simple average of the operating margin and the build margin. The combined margin is shown in Table 2. We report the resulting grid-level emission reductions from the CDM activities in Table 3. The emission data are for 2005, which is the most recent available information. The CO₂ data are also included for comparison. The figures show that the CDM activities are expected to reduce 35.8 million tons of CO₂ annually, which is about 1.6% of total emissions from all grids in 2005. In terms of SO₂ emissions, they are expected to reduce 0.27 million tons annually, or 1.4% of 2005 emissions from all grids. According to the national data, σ is estimated to be 0.0076 ton-SO₂/ton-CO₂, which implies that one ton of CO₂ emission reduction will lower SO₂ emissions by 0.0076 ton at the grid level.

Table 3
Annual emission reductions by hydro and wind CDM activities.

Grid	CO ₂		SO ₂	
	Emissions	Reductions	Emission	Reductions
North	651.753	6.820	5.812	0.039
Northeast	207.338	3.100	1.089	0.012
East	499.415	2.002	4.037	0.011
Central	360.321	7.655	3.938	0.087
Northwest	147.440	7.131	1.365	0.067
South	310.883	9.077	2.543	0.055
Hainan	5.999	0.021	0.048	0.000
All	2183.877	35.805	18.848	0.272

Notes: Unit: million tons/year. The emissions data are for 2005. The reductions data are based on CDM projects registered before 2008. Only small hydro and wind power projects are included.

It is worth noting the engineering estimate does not have an associated standard error. The parameters that we are using, mostly from the literature and official documents, only report the mean values instead of confidence intervals. Another important point is that only small hydro power and wind power projects are included in the analysis, because they have zero emissions. These two project types account for 59% of total registered projects as of 2008. CDM activities other than industrial gas projects can also reduce SO₂ emissions. However, their own emissions need to be taken into account. If other project types are included, the estimated coefficient would be smaller than the current estimate.

The engineering approach assumes that the BAU emissions can be extrapolated from the *ex ante* information. Specifically, the baseline is calculated by using present and past emission factors of existing power plants. This approach reduces risks for project developers because the expected carbon credits are known in the future. However, uncertainties arise in the environmental integrity because the static baseline does not make adjustment for future changes. Most CDM projects use static baselines. Even if a “dynamic” baseline is used, the adjustment is linear and the slope is predetermined [29,30]. In a fast changing economy, this methodology does not perform well. For example, if renewable energy increases exponentially as is observed in some developing countries, the engineering baseline would set the BAU emissions too high and lead to an inflation of carbon credits.

4.2. Econometric results

In this section, we present the results for the econometric models that use *ex post* information to evaluate the CDM's co-benefits on sulfur emissions. We estimate the parametric model (10) and the semiparametric model (11) using the prefecture-level data in China. The CDM effect on power generation is the focus of this study, which determines if the CDM has co-benefits and additionality within the power sector. The semiparametric model is our preferred specification because of its flexibility, while the parametric model is used for comparison purpose. The estimates of central interest are the coefficients for carbon credits at the prefecture level (CCO₂), province level (PCO₂), and grid level (GCO₂). The estimation results are reported in Table 4. A Wald test of model 1.2.1 for the joint significance of the CDM effect results in a *p*-value at 0.99, which rejects the null hypothesis that the CDM reduces SO₂ emissions. A joint test of the parametric model 1.1.1 leads to the same conclusion.

It is interesting to test the econometric estimate against the engineering estimate. If the CDM activities receive a fair amount of carbon credits, both estimates should be close. Since the econometric models are estimated using the prefecture-level data, the CDM effect needs to be aggregated to the grid level to be compared with that of the engineering model.¹⁴ The test results show that we fail to reject the null hypothesis that engineering and econometric estimates are being equal. The fact that we are not able to rule out co-benefits and additionality is at odds with the previous result. This is likely because the data do not provide precise enough estimates to distinguish between two vastly different hypotheses.

Although the treatment effect is insignificant, the sign of the estimate is still interesting. If CDM activities have lowered sulfur dioxide emissions, the coefficients of carbon credits should be negative. However, the estimates for provincial and grid CERs are positive. This may be explained by the fact that fossil-fuel power plants are built to match with renewable power generation. For example, wind power is highly variable in electricity output at different time scales. Additional power plants are needed to stabilize intermittent power supply and safeguard against blackouts. The coal-fired power is often used as a backup because of its availability and reliability. It is possible that the CDM helps ramp up thermal power capacity as it promotes wind farms. In this case, the effect of the CDM activity – a combination of wind and coal-fired power – hinges on the baseline scenario. If the baseline is coal-fired power, the CDM reduces emissions unambiguously. If the baseline is renewable power, the CDM actually increases emissions. If the baseline is a wind–coal combination, the CDM has no effect at all. In all other cases, the CDM has an uncertain effect in emission reductions. Table 7 summarizes the hypothetical effect of the CDM activity under different baseline scenarios.

The econometric results suggest that the CDM activities in China are not effective at reducing SO₂ emissions, and therefore cast doubt on additionality. That is, without the compensation of carbon credits, these projects may still have occurred. There is some evidence to support this hypothesis. As of 2008, the cumulative installed capacity of wind power in China was 12,152.79 MW, of which 11,389.58 MW was installed during 2005–2008.¹⁵ In the same period, the CDM wind farms generated a total capacity of 5154.92 MW. This suggests that about 55% of wind power projects have been built without the assistance of the CDM. During a recent CDM-EB meeting in December 2009, 10 of China's wind power CDM projects were not approved. The decision was made on the grounds that these projects do not meet the additionality requirement.

This is not to say that project developers intentionally manipulate additionality requirements. Rather, it is the current CDM baseline methodology that fails to predict future emissions in a fast changing economy. China's central planners made the same mistake as they set a 2010 wind power target of 5000 MW in the Renewable Energy Planning Report of 2007. In fact, in the same year that the Plan was published, China's total capacity reached 5906 MW. The rapid growth of

¹⁴ The null hypothesis $\gamma_1 + \gamma_2 + \gamma_3 = \sigma$ is tested. The engineering estimate is the grid level reduction in SO₂ from a carbon credit unit. So, we need the econometric estimate of a grid level reduction. If a carbon credit is issued in prefecture *i*, then CCO₂ goes up by one unit and SO₂ changes in *i* by γ_1 . But, then SO₂ changes in each other prefecture in the same province by γ_2 , and in each other prefecture in the grid, but outside the province, by γ_3 .

¹⁵ Source: “China Wind Power Installed Capacity Statistics 2008” by the China wind power Association. Available at www.cwea.org.cn/upload/20090305.pdf.

Table 4
Regression results: dependent variable-SO₂ emitted by power plants.

	Parametric models			Semiparametric models		
	1.1.1	1.1.2	1.1.3	1.2.1	1.2.2	1.2.3
GDPPC	2.995*** (0.741)	2.270*** (0.760)	1.424*** (0.763)			
GDPPC ²	-2.910*** (0.825)	-2.305*** (0.849)	-1.785*** (0.828)			
GDPPC ³	0.740*** (0.233)	0.593*** (0.239)	0.491*** (0.232)			
POPDEN	0.139 (0.125)	0.148 (0.143)	0.181 (0.136)	0.178 (0.128)	0.165 (0.121)	0.278** (0.118)
EE	0.625*** (0.237)	0.528*** (0.233)	0.350*** (0.222)	0.618** (0.265)	0.536** (0.252)	0.526** (0.258)
EE ²	-0.384** (0.167)	-0.371** (0.165)	-0.230** (0.157)	-0.340* (0.187)	-0.324* (0.179)	-0.325* (0.180)
K/L	0.281** (0.136)	0.164** (0.136)	0.007** (0.150)	0.394*** (0.097)	0.251* (0.132)	0.642*** (0.127)
(K/L) ²	-0.107* (0.057)	-0.063* (0.058)	-0.015* (0.059)	-0.126*** (0.046)	-0.088 (0.054)	-0.232*** (0.051)
ESPC	-0.084 (0.111)	-0.091 (0.109)	-0.064 (0.113)	-0.019 (0.079)	-0.063 (0.082)	0.070 (0.081)
FDIR	0.001 (0.009)	-0.005 (0.009)	-0.010 (0.010)	0.003 (0.010)	-0.006 (0.009)	-0.007 (0.010)
CCO ₂	0.007 (0.064)	0.014 (0.062)	-0.051 (0.057)	-0.000 (0.072)	0.025 (0.067)	-0.021 (0.063)
PCO ₂	0.005 (0.020)	0.007 (0.027)		0.002 (0.023)	-0.013 (0.030)	
GCO ₂	-0.001 (0.009)			0.002 (0.010)		
Time effects	YES			YES		
Prefecture effects	YES	YES	YES	YES	YES	YES
Grid-time effects		YES			YES	
Province-time effects			YES			YES

Notes: Number of observations 758. The SO₂ emission data for power plants are only available for 2000, 2005, and 2007. Block bootstrapping standard errors in parenthesis. Significance level: *10%, **5% and ***1%.

wind power is partially explained by the favorable on-grid power tariff. It also reflects the fact that state-owned power companies have attempted to grab market share without cost considerations [31]. If this is true, it shows that wind power projects are still not the most economically or financially attractive. Under the current additionality criteria, wind projects should still qualify as CDM activities.

Our model sheds some insight on the environmental Kuznets curve. The estimated coefficient is highly significant for all parametric models. The result supports a nonlinear relationship between SO₂ emissions and income. However, the relationship is not an exact inverted U-shape because the coefficient for the cubic term is significantly different from zero. Instead, the pollution-income relationship is better described by an N-shape curve. The semiparametric model does not specify the functional form. The nonparametric estimate of the relationship is depicted in Fig. 4. The solid line is $\hat{m}(w)$ estimated by the iterative kernel method. Two dashed lines outline a 95% confidence interval for each point estimate.

A visual inspection of Fig. 4 shows that there are multiple maxima and minima in the environmental Kuznets curve. This implies that the parametric model is misspecified because the cubic model only has one local maximum and one local minimum. A formal specification test is needed to show that the semiparametric model performs better. This can be implemented by the bootstrapping method proposed by Henderson [26]. However, since different specifications produce the same qualitative results for the policy variables, we leave this specification test for future research.

The econometric model also yields reasonable estimates for other parameters. The coefficient for population density (POPDEN) is positive but it is not statistically significant. It may be a net effect of: (1) fossil-fuel power generation is located close to demand factors such as population centers and (2) pollution is more regulated in population centers because of public health concerns. Energy efficiency (EE) has a significant nonlinear effect on power SO₂ emissions. At first, as the industrial output per kilowatt increases, demand for electricity as well as emissions climb. After some threshold, improving energy efficiency will lower the demand for electricity and hence SO₂ emissions. The capital-to-labor ratio (KL) has a significant nonlinear effect as well. If the capital endowment is low, increasing capital can cause more constructions of power plants and induce more SO₂ emissions. However, if the capital endowment is large enough, an increasing capital-to-labor ratio leads to lower emissions because of investment in capital-intensive cleaner industry or pollution abatement. The investment in education and R&D per capita (ESPC) reduces SO₂ emissions but the effect is not significant. The level of foreign direct investment (FDIR), which is measured as a ratio of FDI to fixed asset investment, has an ambiguous effect on

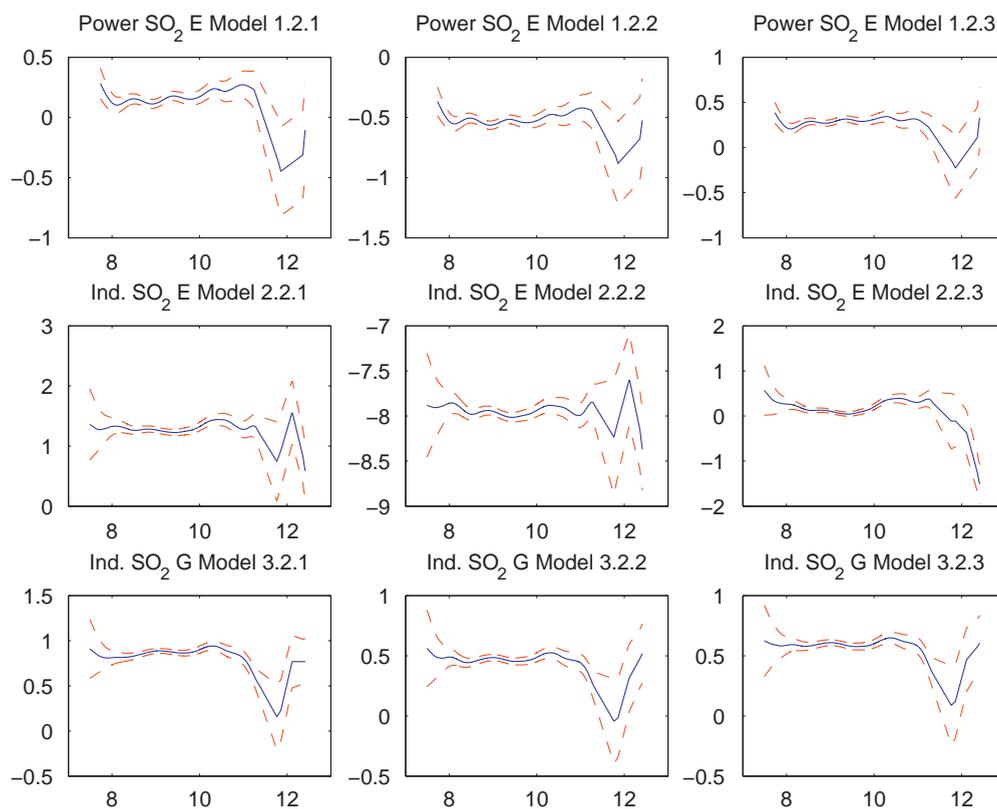


Fig. 4. Nonparametric estimate of the pollution–income relationship $m(w)$.

emissions. Its estimate is statistically insignificant. The insignificant effect of FDI might be due to a complex interaction between the “pollution haven” effect and the “gain from trade” effect [11,32,33].

5. Robustness checks

The first robustness check is concerned with the dependent variable. Besides power generation, we also evaluate the CDM effect on SO_2 emitted (SO2E) and generated (SO2T) by all industries. The CDM effect on all industries is not necessarily the same as that of the power sector because of the spillover or leakage effect. Estimation results for industrial SO_2 emissions are reported in Table 5. The semiparametric specification is still preferred because of its flexibility. For the main specification 2.2.1, the p -value of the Wald test for the joint significance of the CDM effect is 0.21, so that we cannot reject the null hypothesis of no effect at the 90% confidence level. The empirical results do not support the notion that CDM activities reduce total industrial SO_2 emissions.

As for SO_2 generated from all industries, the coefficients for CCO2, PCO2, and GCO2 are positive as is shown in Table 6. The Wald test for model 3.2.1 has a p -value less than 0.01, which means that the null hypothesis of no effect is rejected at the 99% confidence level. This result suggests that the CDM has increased SO_2 generated by all industries. This can be explained by the leakage effect. An increase in pollution induced by CDM activities outside the project boundary could fully offset the effect within the boundary. The magnitude of the CDM effect is the greatest at the prefecture level and the weakest at the grid level. This is sensible, because the leakage effect comes from project construction and operation, and thus the prefecture that hosts the projects undergoes the major impact.

To address the concern that locational and time-varying unobservables may affect CDM projects and SO_2 emissions simultaneously, we include province-by-time and grid-by-time dummies. When subnational time dummies are included, the time effects are not necessary because of multicollinearity. It is also worth noting that provincial CERs are almost absorbed by the province-by-time dummies. Note that PCO2 is defined as the difference between provincial and prefecture CERs. Because provincial CERs are much larger than prefecture CERs, prefectures within the same province have very little variation in PCO2. Including both PCO2 and province-by-time dummies causes the data matrix to be close to singularity. This is also true for the grid-by-time dummies. Therefore, when the grid-by-time dummies are present, the grid CERs are removed for identification purpose; when the province-by-time dummies are present, both grid and provincial CERs have to be removed.

Our empirical results are robust to the inclusion of the subnational time effects. For the emissions from power plants, the CDM effect is still insignificant with additional dummies. Other parameters yield the same qualitative results. A notable

Table 5
Regression results: dependent variable-SO₂ emitted by all industries.

	Parametric models			Semiparametric models		
	2.1.1	2.1.2	2.1.3	2.2.1	2.2.2	2.2.3
GDPPC	0.933 (0.803)	0.960 (0.849)	1.133 (0.824)			
GDPPC ²	-1.359* (0.764)	-1.397* (0.801)	-1.492* (0.753)			
GDPPC ³	0.368* (0.199)	0.380* (0.206)	0.402* (0.191)			
POPDEN	-0.167 (0.199)	-0.160 (0.201)	-0.091 (0.182)	-0.009 (0.156)	-0.009 (0.151)	-0.016 (0.142)
EE	0.075 (0.233)	0.044 (0.236)	-0.049 (0.223)	0.083 (0.205)	0.008 (0.206)	-0.060 (0.206)
EE ²	-0.213 (0.163)	-0.176 (0.165)	-0.149 (0.152)	-0.204 (0.145)	-0.152 (0.143)	-0.144 (0.140)
K/L	0.316*** (0.093)	0.290*** (0.095)	0.292*** (0.104)	0.460*** (0.065)	0.342*** (0.080)	0.275*** (0.087)
(K/L) ²	-0.098*** (0.025)	-0.094*** (0.026)	-0.093*** (0.025)	-0.132*** (0.019)	-0.109*** (0.021)	-0.097*** (0.021)
ESPC	-0.051 (0.104)	-0.072 (0.106)	-0.122 (0.104)	-0.054 (0.070)	-0.108 (0.072)	-0.176*** (0.068)
FDIR	-0.035 (0.022)	-0.049 (0.023)	-0.007 (0.025)	-0.047** (0.019)	-0.038** (0.019)	-0.026 (0.022)
CCO ₂	-0.032 (0.038)	-0.035 (0.038)	-0.022 (0.036)	-0.028 (0.034)	-0.031 (0.033)	-0.046 (0.031)
PCO ₂	0.009 (0.012)	0.010 (0.014)		0.007 (0.009)	0.009 (0.012)	
GCO ₂	-0.006 (0.004)			-0.007 (0.004)		
Time effects	YES			YES		
Prefecture effects	YES	YES	YES	YES	YES	YES
Grid-time effects		YES			YES	
Province-time effects			YES			YES

Notes: Number of observations 1608. Time period 2004–2008. Block bootstrapping standard errors in parenthesis. Significance level: *10%, **5% and ***1%.

difference is that the coefficient for population density is now significantly positive. For SO₂ emitted by all industries, there is no significant CDM effect either. However, including provincial time dummies makes the parameter for FDI insignificantly negative and that for ESPC significantly negative. Subnational time dummies do not change the qualitative results for SO₂ generated by all industries. Similar to the previous case, the significance of the FDI effect disappears with subnational dummies, which suggests that locational differences that affect FDI may be time variant [33].

The causality of the pollution–income relationship is another concern. According to the growth theory, lagged income can be used as an instrument for current income [14]. Because the income parameters are not our focus, we adopt the reduced form strategy and use lagged GDP per capita as a regressor. Since the model yields very similar results to the one that uses current income, we do not report the full estimation results here, but they are available upon request.

The last robustness check is to separate out the treatment effect by project types. The CDM is divided into four categories: hydropower (HYDRO), wind energy (WIND), energy efficiency (ENERGY), and other activities (OTHER). Table 1 reports the summary statistics for these variables. Our specification includes province-by-time dummies. The estimation results support our main conclusion. For power plants, none of the parameters for CERs yields significant results. The CDM effect on industrial SO₂ emissions is also insignificant. As for SO₂ generated by all industries, the only significant effect is that the energy efficiency projects increase SO₂ generation. Results for these regressions are also available upon request.

6. Conclusion

Utilizing the relationship that CO₂ and SO₂ are co-pollutants of fossil-fuel combustion, we propose an econometric approach to evaluate the co-benefits of the Clean Development Mechanism and indirectly assess its additionality. Using China's prefecture-level economic and emission data, we find that the CDM does not have a statistically significant effect on SO₂ emissions. Our empirical findings contradict the results predicted by the engineering model. It thus casts doubt on the additionality assumption on which the engineering model is based. These results lend support to the previous conjectures that some CDM activities would have happened anyway.

Nevertheless, our paper is limited by the available data. We only include the registered CDM projects, while there are many more in the pipeline. If all these projects are eventually approved and implemented, it is possible that some non-negligible co-benefits will be observed. At present, the number of projects is relatively small, and the time period is

Table 6
Regression results: dependent variable-SO₂ generated by all industries.

	Parametric models			Semiparametric models		
	3.1.1	3.1.2	3.1.3	3.2.1	3.2.2	3.2.3
GDPPC	5.921*** (1.300)	5.758*** (1.362)	6.367*** (1.436)			
GDPPC ²	-3.128** (1.231)	-3.087** (1.280)	-3.443** (1.311)			
GDPPC ³	0.493 (0.320)	0.496 (0.329)	0.563 (0.332)			
POPDEN	0.574* (0.318)	0.522* (0.319)	0.619* (0.315)	-0.045 (0.301)	-0.135 (0.289)	-0.016 (0.283)
EE	0.010 (0.376)	-0.057 (0.380)	0.024 (0.390)	0.112 (0.402)	-0.172 (0.400)	0.141 (0.414)
EE ²	-0.054 (0.262)	-0.012 (0.264)	-0.051 (0.264)	-0.029 (0.282)	0.072 (0.276)	-0.112 (0.280)
K/L	0.265* (0.155)	0.309* (0.157)	0.091* (0.187)	0.476*** (0.129)	0.282* (0.161)	0.280 (0.182)
(K/L) ²	-0.191*** (0.042)	-0.203*** (0.042)	-0.181*** (0.045)	-0.173*** (0.037)	-0.145*** (0.041)	-0.159*** (0.043)
ESPC	0.114 (0.166)	0.085 (0.169)	0.095 (0.179)	0.488*** (0.135)	0.340** (0.140)	0.460*** (0.137)
FDIR	-0.009 (0.038)	-0.009 (0.039)	-0.021 (0.046)	-0.077** (0.039)	-0.028 (0.040)	-0.031 (0.049)
CCO ₂	0.187*** (0.061)	0.185*** (0.061)	0.134*** (0.063)	0.202*** (0.066)	0.188*** (0.064)	0.190*** (0.062)
PCO ₂	0.043** (0.019)	0.022** (0.023)		0.033* (0.018)	0.023 (0.024)	
GCO ₂	0.015** (0.006)			0.004 (0.005)		
Time effects	YES			YES		
Prefecture effects	YES	YES	YES	YES	YES	YES
Grid-time effects		YES			YES	
Province-time effects			YES			YES

Notes: Number of observations 1557. Time period 2004–2008. Block bootstrapping standard errors in parenthesis. Significance level: *10%, **5% and ***1%.

Table 7
Hypothetical effect of the CDM activity under different baseline scenarios.

Baseline scenario	Effect of the CDM activity (wind+coal)	
	SO ₂ emitted	SO ₂ generated
Wind/other renewable energy	+	+
Wind+coal	0	0
Natural Gas	±	±
Coal	-	-
Other combinations	±	±

Notes: The CDM activity is building a wind farm. A companion coal-fired power plant is built for backup supply. Each baseline scenario generates the same electricity output.

relatively short for the CDM to make a difference. Methodologically, our micro-econometric approach is appealing for further tests of additionality, since project-level information is also available. We leave this for future research.

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Perverse effects of carbon markets on HFC-23 and SF₆ abatement projects in Russia

Lambert Schneider* and Anja Kollmuss

Carbon markets are considered a key policy tool to achieve cost-effective climate mitigation^{1,2}. Project-based carbon market mechanisms allow private sector entities to earn tradable emissions reduction credits from mitigation projects. The environmental integrity of project-based mechanisms has been subject to controversial debate and extensive research^{1,3–9}, in particular for projects abating industrial waste gases with a high global warming potential (GWP). For such projects, revenues from credits can significantly exceed abatement costs, creating perverse incentives to increase production or generation of waste gases as a means to increase credit revenues from waste gas abatement^{10–14}. Here we show that all projects abating HFC-23 and SF₆ under the Kyoto Protocol's Joint Implementation mechanism in Russia increased waste gas generation to unprecedented levels once they could generate credits from producing more waste gas. Our results suggest that perverse incentives can substantially undermine the environmental integrity of project-based mechanisms and that adequate regulatory oversight is crucial. Our findings are critical for mechanisms in both national jurisdictions and under international agreements.

The Kyoto Protocol's project-based mechanisms, the Clean Development Mechanism (CDM) for emission reductions projects in developing countries and Joint Implementation (JI) for projects in industrialized countries, provided industrialized countries flexibility in meeting their greenhouse gas (GHG) reduction commitments. Numerous sub-national and national jurisdictions are implementing similar mechanisms around the world, often in combination with emissions trading schemes².

Projects abating waste gases with a high global warming potential (GWP) can generate large volumes of emission reductions at low abatement costs^{1,15}. Under the CDM, the two largest waste gas project types—incineration of hydrofluorocarbon-23 (HFC-23) from hydrochlorofluorocarbon-22 (HCFC-22) production and destruction of nitrous oxide (N₂O) from adipic acid production—account for only 0.3% of the registered projects but generated about half of the 1.5 billion emission reduction credits issued so far¹⁶. For such projects, revenues from credits can significantly exceed GHG abatement costs and, in some instances, the costs of producing the main product^{10,11}. This can create perverse incentives for plant operators to increase production or waste generation beyond levels that would occur in the absence of crediting^{12–14,17}. If more waste gas is generated owing to the incentives from crediting, emission reductions are overestimated; the emissions baseline is inflated compared to the emissions that would actually occur without crediting, and, in consequence, excess credits are issued.

Such perverse incentives can be avoided through appropriate safeguards in methodological standards for the calculation of emission reductions, mainly by capping the amount of production

and waste generation to historically observed levels or conservative benchmarks for the purpose of calculating emission reductions. Under the CDM, safeguards to prevent perverse incentives were gradually introduced and strengthened over time, following observations that the initial safeguards may not have been adequate^{13,14,18}. Whereas the CDM requires using internationally agreed standards and international approval for registering projects and issuing credits, JI allows using a project-specific approach for calculating emission reductions, and either the host countries or the international Joint Implementation Supervisory Committee (JISC) execute regulatory oversight. Under host country oversight, countries can largely establish their own rules for approving projects and issuing credits without international oversight. The host country can determine whether it deems emission reductions as additional. Under international oversight, the JISC oversees project approval and issuance of credits.

This Letter assesses perverse incentives in the context of JI. We evaluate JI projects that incinerate high GWP waste gases, as these project types were particularly vulnerable to perverse incentives under the CDM. Four such projects were registered under JI, all of them under host country oversight. They account for 54 out of the 863 million credits issued to the 604 JI projects registered as of 1 April 2015 (ref. 16). The four projects involve five plants: two hydrochlorofluorocarbon-22 (HCFC-22) and two sulphur hexafluoride (SF₆) production plants in Russia, and one trifluoroacetic acid (TFA) production plant in France. The production of HCFC-22 generates hydrofluorocarbon-23 (HFC-23) as an unwanted waste gas; in the production of SF₆ a waste stream of SF₆ is generated at rectification; and the production of TFA generates various unwanted fluorinated waste gases. The amount of waste gas generated depends on the production level of the main product—HCFC-22, SF₆ and TFA—and the waste generation rate, which is defined as the quantity (mass) of waste gas generated per quantity (mass) of product produced¹⁴. The waste generation rate depends on factors, such as plant design, product purity requirements, and degree of process optimization¹⁹. In the absence of regulations, incentives, or voluntary commitments by the industry, the waste gases are usually vented to the atmosphere. The five registered JI plants capture and incinerate these waste gases (see Supplementary Documentation).

The plant in France aimed to address perverse incentives by capping the emission reductions to the historical emissions of the installation. However, data on historical and monitored production and waste gas generation are not available to assess whether the cap adequately prevented perverse incentives.

Three plants in Russia initially applied caps on the production and waste generation rate to avoid perverse incentives, drawing upon CDM standards. In the second quarter of 2011, the plant operators decided to retroactively change the way emission reductions

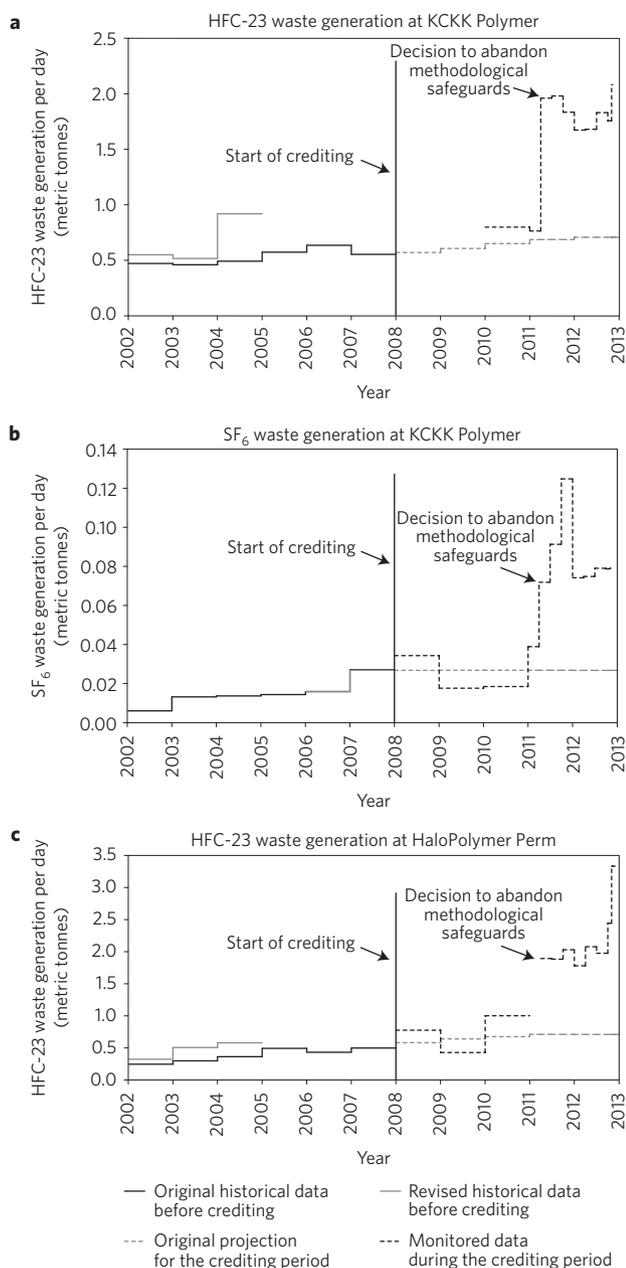


Figure 1 | HFC-23 and SF₆ waste generation at three plants in Russia.

a, HFC-23 waste generation at the KCKK Polymer plant. **b**, SF₆ waste generation at the KCKK Polymer plant. **c**, HFC-23 waste generation at the HaloPolymer Perm plant. Waste generation increased in all three plants beyond previously reported levels when plant operators decided in 2011 to abandon methodological safeguards to prevent perverse incentives.

are calculated as of 1 January 2010, removing the caps and crediting all waste gas destroyed. Moreover, data and information provided in the original project documentation was considered incorrect, or not applicable, and replaced (see Supplementary Information). Figure 1 shows that waste gas generation increased in all three facilities to unprecedented levels compared to both historical and originally projected levels, after abandoning methodological safeguards in 2011.

The project at the fourth plant in Russia was developed and approved in 2011/2012 and claimed credits retroactively as of 1 January 2008. The project did not apply any methodological safeguards to avoid perverse incentives; all waste gas destroyed was credited. For the period 2008 to 2010, for which data on both

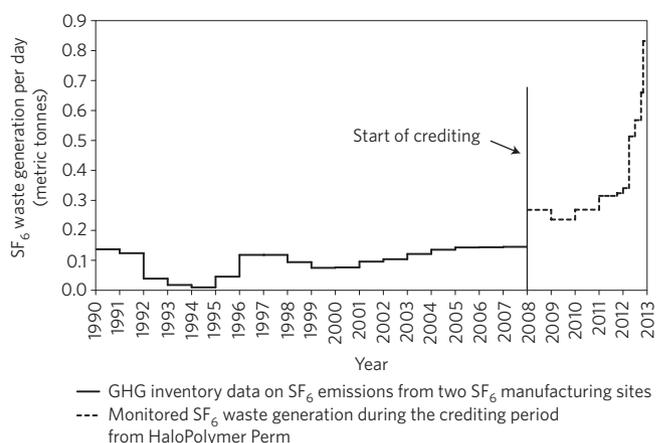


Figure 2 | SF₆ waste generation at the HaloPolymer Perm plant. The GHG inventory data includes emissions from both SF₆ production plants in Russia (KCKK Polymer and HaloPolymer Perm). After the start of crediting, the waste generation from HaloPolymer Perm increased beyond historical emission levels reported in the Russian GHG inventory from both plants.

SF₆ production and SF₆ waste generation are available, the average waste generation rate was 16.9%, which considerably exceeds the default value of 0.2% suggested by the Intergovernmental Panel on Climate Change (IPCC; ref. 20) or the average historical waste generation rate of 2.0% observed at the KCKK Polymer plant. A comparison with GHG inventory data reported by Russia to the United Nations Framework Convention on Climate Change (UNFCCC; ref. 21) shows that waste generation significantly increased with the implementation of the JI project (Fig. 2). Before project implementation, the GHG inventory emissions from SF₆ manufacturing—which cover both SF₆ plants and which may not only include waste gas emissions from SF₆ production but also emissions from handling of SF₆ at the production site, and thus represent the upper end of the possible range—varied between 4 and 53 tonnes of SF₆ over the period 1990 to 2007, whereas after project implementation the plant reported an average annual waste gas generation of 117 tonnes of SF₆.

The abrupt increase occurred in all four plants exactly at the point in time when plant operators could generate (more) credits by producing more waste gas, and higher levels of waste generation were sustained thereafter. The increase in waste generation is mostly attributable to an increase in the waste generation rate, and not in production levels (see Supplementary Information). There was also no reporting of any changes in plant capacity, design, or product specifications which might have affected the waste generation rate. Without credit revenues, plant operators would have economic incentives to reduce rather than increase waste generation^{13,14}.

Absent methodological safeguards to prevent perverse incentives, increasing waste gas generation beyond levels that would occur in the absence of crediting leads to excess issuance of credits. The extent of such over-crediting is uncertain; it depends on how much waste gas the plants would otherwise have generated. We assess the magnitude of over-crediting using three scenarios to estimate the plausible range of waste gas generation that would have occurred in the absence of crediting (see Methods). We conclude that, in the periods where methodological safeguards were not applied, about 28 to 33 million credits were issued in excess, corresponding to 66 to 79% of the credits issued for these periods.

Several lessons can be learned from this analysis. First, although previous research indicated that perverse incentives affected plant operations, the extent and implications were more confined^{13,17,18}. Our results suggest that perverse incentives arising from project-based mechanisms can have rather substantial adverse impacts on environmental integrity, with about two-thirds of the credits

being issued in excess in periods when no safeguards were applied. Second, regulatory oversight by the host country alone may not be sufficient to ensure environmental integrity. Under the Kyoto Protocol, Russia had no incentives to ensure environmental integrity of JI projects; it had an emissions target well above its actual emissions and could issue credits from its emissions budget without repercussions for meeting its target. For the three plants in Fig. 1 the methodological safeguards were removed at a point in time when perverse incentives from HFC-23 CDM projects received wide media and policymaker attention, leading ultimately to a ban of HFC-23 credits under the EU's emissions trading scheme and a revision of the applicable methodological standard under the CDM (refs 14,22). Third, the Accredited Independent Entity (AIE) performing the relevant auditing functions—Bureau Veritas Certification—did not address the perverse incentives. Although AIEs were accredited by the JISC, the projects were implemented under oversight by the host country, in which case the JISC did not assess the performance of auditors or apply any sanctions in cases of non-performance. Finally, we note a lack of transparency, with project information being only partially publicly available.

These lessons are critical for both ongoing international discussions on the review of JI and market-based mechanisms under the new climate agreement, as well as the growing use of domestic carbon markets around the world. Our findings confirm earlier research that project-based mechanisms are exposed to significant risks of over-crediting, for example, due to the information asymmetry between project operators and auditors or regulators^{4,5,7,8}. If crediting mechanisms are further pursued, it is essential that adequate international oversight be executed for any mechanisms involving international transfer of credits, that methodological standards be internationally accepted and include appropriate safeguards to prevent perverse incentives, that mechanisms monitor the performance of auditors and apply effective sanctions in the case of non-performance, and that information on credited activities is transparent and publicly accessible.

Methods

Methods and any associated references are available in the [online version of the paper](#).

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Author contributions

L.S. evaluated the data and analysed the results. L.S. and A.K. wrote the paper.

Additional information

Supplementary information is available in the [online version of the paper](#). Reprints and permissions information is available online at www.nature.com/reprints. Correspondence and requests for materials should be addressed to L.S.

Competing financial interests

L.S. is member of the CDM Executive Board under the Kyoto Protocol.

Methods

Data on production and waste gas generation was gathered from project design documents (PDDs) and monitoring reports, published by the UNFCCC (<http://ji.unfccc.int>) and the Russian Registry of Carbon Units (<http://www.carbonunitsregistry.ru>), and audited by AIEs. The monitoring and verification reports publicly available are incomplete for four out of the five plants: for HFC-23 and SF₆ abatement at KCKK Polymer, the first and second monitoring report covering the years 2008 and 2009 are lacking. For HFC-23 abatement at HaloPolymer Perm, the first, second and fourth monitoring report, covering the years 2008 and 2009 and the period 1 January to 31 March 2011, are lacking, as well as the fourth verification report for the period 1 January to 31 March 2011. Moreover, as of 1 January 2012, HaloPolymer Perm reports only HFC-23 incineration but no longer HFC-23 generation. We conservatively assume that all HFC-23 generated was incinerated. If HFC-23 was partially vented or sold, the actual HFC-23 generation in 2012 would be even higher than presented in Fig. 1. Finally, monitoring reports are not publicly available for the plant in France.

Project-based mechanisms generally calculate emission reductions by comparing an emissions baseline with monitored project emissions and adjusting for any indirect upstream or downstream leakage emissions occurring as a result of the project:

$$ER = BE - PE - LE$$

where ER are the emission reductions, BE are the baseline emissions, PE are the project emissions and LE are the leakage emissions (all expressed as metric tonnes of CO₂ equivalent). Whereas project emissions can in most cases be directly measured, baseline emissions are estimated based on a counterfactual, hypothetical scenario. Baselines often aim to reflect the emissions level that would most likely occur if the project was not implemented, but could also be set at a lower, more conservative level—for example, to address uncertainties or to prevent perverse incentives. Over-crediting, or excess issuance of credits, occurs if the estimated baseline is higher than the emissions level that would occur if the project was not implemented (or if project or leakage emissions are underestimated).

Absent methodological safeguards, the four projects determine baseline emissions as the observed waste gas generation, that is, assuming that the same amount of waste gas would be generated and emitted in the absence of crediting. We estimate the extent of excess issuance of credits as the difference between the claimed baseline emissions (BE_{claimed}) and different assumptions on plausible baseline emission levels (BE_{plausible}):

$$E = BE_{\text{claimed}} - BE_{\text{plausible}}$$

where E are the credits issued in excess, BE_{claimed} are the baseline emissions specified in the monitoring reports of the plants and BE_{plausible} is our estimate of the plausible range of baseline emissions (both expressed in metric tonnes of CO₂ equivalent).

We use three scenarios to reflect the range of plausible baseline emissions (BE_{plausible}). For the three plants in Fig. 1, historical data on waste generation is available. We estimate the magnitude of over-crediting over the period 1 April 2011 to 31 December 2012, when methodological safeguards were not applied, assuming that the three facilities would have produced the same amount of waste gas per day as before the start of crediting, as during the crediting period before their decision to abandon the methodological safeguards, or as originally projected when the project was approved. The credits issued in excess would amount to 19.7, 17.3, or 17.6 million, respectively, corresponding to 69%, 61%, or 62% of the 28.3 million credits issued to the three facilities over that period.

For SF₆ abatement at HaloPolymer Perm in Fig. 2 the magnitude of over-crediting is more uncertain because historical data is not available. We determine plausible baseline emission levels based on the SF₆ production and a range of plausible assumptions on the waste generation rate:

$$BE_{\text{plausible}} = P_{\text{SF}_6} \times w_{\text{SF}_6} \times \text{GWP}_{\text{SF}_6}$$

where P_{SF_6} is the SF₆ production at the plant (in metric tonnes of SF₆), w_{SF_6} is the waste generation rate expressed as metric tonnes of SF₆ waste gas generated per metric tonnes of SF₆ produced, and GWP_{SF_6} is the global warming potential of SF₆ valid for the first commitment period under the Kyoto Protocol (metric tonnes of CO₂ equivalent per metric tonnes of SF₆). We estimate the magnitude of over-crediting for the period 2008 to 2012 when methodological safeguards were not applied. For the period 2008 to 2010 we use the SF₆ production data reported by the plant. For 2011 and 2012, SF₆ production data is not reported; we conservatively assume that the plant would operate at its maximum production capacity. We use three scenarios to estimate the plausible range of the waste generation rate, assuming that the plant would have operated at a waste generation rate of 0.2%, as suggested by the IPCC, 2.0%, as observed before crediting at the KCKK Polymer SF₆ production plant, or 3.8%, as approximated based on SF₆ emissions data reported in the Russian GHG inventory (see Supplementary Information). The credits issued in excess would amount to 13.5, 11.9, or 10.2 million, respectively, corresponding to 99%, 87%, or 75% of the credits issued over that period.

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA
FOURTH APPELLATE DISTRICT, DIVISION ONE

SIERRA CLUB,

Petitioners and Respondents,

v.

COUNTY OF SAN DIEGO,

Defendant and Appellant.

Case No. D075478

San Diego County Superior Court, Case Nos. 37-2018-00014081-CU-TT-CTL, 37-2018-00013324-CU-TT-CTL, No. 37-2012-00101054-CU-TT-CTL

The Honorable Timothy Taylor, Judge

**AMICUS BRIEF OF THE CALIFORNIA
ATTORNEY GENERAL IN SUPPORT OF
PETITIONERS AND RESPONDENTS**

XAVIER BECERRA
Attorney General of California
SALLY MAGNANI
Senior Assistant Attorney General
SARAH E. MORRISON
Supervising Deputy Attorney General
JANILL RICHARDS
Principal Deputy Solicitor General

SHANNON CLARK
Deputy Attorney General
State Bar No. 316409
1515 Clay Street, 20th Floor
P.O. Box 70550
Oakland, CA 94612-0550
Telephone: (510) 879-1973
Fax: (510) 622-2270
E-mail: Shannon.Clark@doj.ca.gov
*Attorneys for Amicus Curiae the
California Attorney General*

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INTRODUCTION

The California Attorney General respectfully submits this brief as amicus curiae in support of Petitioners and Respondents Sierra Club¹ and Golden Door Properties (collectively, Respondents) pursuant to Rule 8.200(c)(7) of the California Rules of Court. This brief is submitted in the Attorney General's independent capacity and not on behalf of any State agency or entity.

At issue in this case is San Diego County's (County) revised Climate Action Plan (CAP), which was adopted to mitigate greenhouse gas (GHG) emissions from the County's 2011 General Plan Update, and the CAP's accompanying Supplemental Environmental Impact Statement (SEIR). The Attorney General has long advocated the use of local climate action plans, or other GHG reduction plans, to address GHG emissions. Such plans allow cities and counties to analyze impacts and identify mitigation opportunities at the programmatic level that may be lost on project-by-project review.² The County's decision in 2011 to address mitigation of GHG emissions from future development through a CAP was an important step in the right direction from a legal, policy, and environmental standpoint. However, the County's CAP cannot provide adequate

¹ Sierra Club files with Respondents Center for Biological Diversity, Cleveland National Forest Foundation, Climate Action Campaign, Endangered Habitats League, Environmental Center of San Diego, and Preserve Wild Santee.

² See, e.g., AR 11:8602-8610 (Attorney General's Comment Letter on San Diego County General Plan Update Draft Environmental Impact Report (August 31, 2009)); Attorney General's Comment Letter on Tulare County General Plan and Recirculated Draft Environmental Impact Report (May 27, 2010); Attorney General's Comment Letter on City of Pleasanton's Proposed General Plan Update and Final Environmental Impact Report (May 8, 2009), available at <https://oag.ca.gov/environment/ceqa/letters>.

mitigation as required by the California Environmental Quality Act (CEQA). Instead, its heavy, unfettered use of offsets allows status quo development to continue, locking the County into increased local emissions that work against the State’s long-term GHG reduction targets.

This amicus brief supplements the Respondents’ briefs by explaining why reducing vehicle use, referred to as vehicle miles traveled (VMT), is crucial to achieving the State’s climate objectives. Reducing VMT requires cities and counties to engage in forward-thinking and innovative land use planning. The County’s failure to meaningfully address VMT in the CAP will interfere with the region’s ability to achieve needed infrastructure changes consistent with long-term climate objectives, and ultimately prevents the CAP from serving as legally adequate mitigation. Moreover, the lack of limits, standards or other criteria for the CAP’s use of offsets, allows developers to avoid making crucial onsite reductions and instituting measures to reduce vehicle use, rendering the CAP unenforceable.

Further, the SEIR for the CAP hides the inconsistencies with State and regional climate objectives from the public by failing to disclose or analyze these conflicts, in violation of CEQA. The County also violates CEQA by not considering compact growth alternatives that reduce VMT, and by failing to analyze impacts of increased VMT on air quality or environmental justice communities. This amicus brief aims to provide guidance on how the County and other local entities can create GHG reduction plans that reduce VMT, adopt enforceable programmatic mitigation for land use development, and as the California Supreme Court requires, do their part to ensure that their CEQA analysis “stays in step” with State climate objectives. (*Cleveland Nat’l Forest Found. v. San Diego Assn. of Gov’ts* (2017) 3 Cal.5th 497, 519 [hereafter *SANDAG*].)

STATEMENT OF INTEREST

The Attorney General, as the State’s chief law enforcement officer, has a duty to ensure that the State’s laws are appropriately enforced and a duty under the Government Code to protect the environment and natural resources of California. (Cal. Const., art. V, § 13; Gov. Code, §§ 12600-12612; *D’Amico v. Bd. of Medical Exam’rs* (1974) 11 Cal.3d 1, 14-15.)

The Attorney General has a particular interest in ensuring the proper interpretation of CEQA and of the regulations implementing CEQA (Cal. Code Regs., tit. 14, § 15000 et seq. [CEQA Guidelines]). The Attorney General also has a unique role with respect to actions concerning pollution and adverse environmental effects that could affect the public or the natural resources of the State. (Gov. Code, §§ 12600-12612.) Government Code section 12600 specifically provides that “[i]t is in the public interest to provide the people of the State of California *through the Attorney General* with adequate remedy to protect the natural resources of the State of California from pollution, impairment, or destruction.” (Emphasis added.)

The California Attorney General has actively participated in CEQA litigation regarding GHG emissions and climate change impacts at the local level. In 2006, the Attorney General’s Office submitted its first comment letter arguing that climate change is an environmental impact that must be addressed under CEQA. Ultimately, the Attorney General’s position was codified in 2007 with the passage of Senate Bill 97 (Pub. Resources Code, § 21083.05) and is reflected in CEQA’s implementing regulations (CEQA Guidelines § 15064.4). In submitting this amicus brief, the Attorney General furthers its efforts to ensure that CEQA is enforced in a way that discloses impacts from land use development plans and projects, and ensures the consistency with State laws and policies.

ARGUMENT

I. THE COUNTY'S CLIMATE ACTION PLAN IS INADEQUATE MITIGATION FOR GHG IMPACTS ANTICIPATED UNDER THE COUNTY'S GENERAL PLAN UPDATE

The CAP, by incorporating mitigation measure GHG-1 (referred to in this brief as the Offset Provision, or Provision),³ allows future development requesting a general plan amendment in the County to mitigate emissions largely through the purchase of carbon offsets. Carbon offsets represent discrete GHG reduction events that take place offsite of a proposed development, and, in many cases, outside of the County entirely. While offsets can be a positive part of a robust and comprehensive GHG emissions plan, the Offset Provision relies almost exclusively on offsets to the exclusion of long-term, carbon-efficient planning. The Provision does not, for example, require or incentivize developers to locate projects in already dense, urban areas to limit residents' daily vehicle trips.

As a consequence, and as discussed in detail in the Respondents' briefs, the CAP will foreseeably increase vehicle use in the County, creating inconsistencies with Senate Bill 375 (SB 375), a State law designed to reduce vehicle-related GHG emissions through smart growth land use planning and transportation design. (Gov. Code §§ 65080 et seq.; see also *Sierra Club Br.* at 62-70; *Golden Door Br.* at 75-82.)⁴ The CAP

³ The County insists that the Offset Provision is not a part of the CAP but a part of the SEIR for the CAP. (*County Reply Br.* at 21.) However, given that the Offset Provision is discussed in the CAP, is a mitigation measure adopted to reduce the CAP's impacts below the threshold of significance, and that CEQA mandates that agencies consider "the whole of an action," this brief considers the CAP and the Offset Provision to be part of the same action under CEQA. (CEQA Guidelines § 15003, subd. (h); see also AR 1340:58761.)

⁴ Since the approval of the CAP, several new general plan amendment projects using offsets to mitigate GHG emissions have been approved. (CT 10:2385-87; CT 13:3300; see also *Sierra Club Br.* at 18; (continued...))

will also conflict with the sustainable communities strategy developed by the regional transportation planning body, the San Diego Association of Governments (SANDAG) to comply with SB 375's targets (hereafter SANDAG Plan). (Sierra Club Br. at 62-70; Golden Door Br. at 75-82.)

Ultimately, the CAP in its current form will perpetuate current sprawling development patterns, which will impede the ability of the region and State to reach their long-term climate objectives. This is particularly concerning because of the crucial role of local governments in obtaining important VMT reductions. Moreover, the County cannot avoid implementing necessary compact land use development designed to reduce vehicle use entirely by adopting the Offset Provision, which in addition to increasing VMT, requires no meaningful standards or criteria to ensure enforceable GHG reductions. Thus, the CAP is inadequate mitigation for the impacts of the 2011 General Plan Update.

A. Sustainable, Long-Term GHG Reductions Cannot Be Achieved Without Addressing Vehicle Miles Traveled

The County asserts that so long as GHG reductions are being achieved somewhere, by some means, for some period of time, the CAP serves its mitigative purpose. (County Opening Br. at 48 [hereafter County Br].) Not only is this position incorrect, it reveals a deep misunderstanding of the importance of VMT reductions to meeting not only the goals in relevant

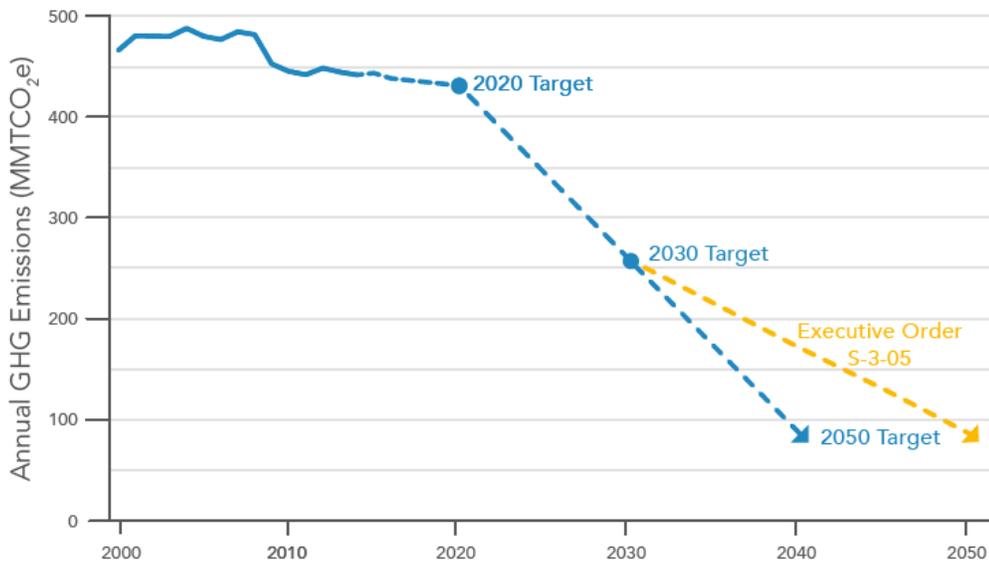
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Golden Door Br. at 50-51.) All are large-scale housing projects located well outside of urban centers that will increase VMT. For example, the Harmony Grove Village South project, which was recently approved by the County, will increase vehicle miles traveled by 11.5 million miles annually. (CT 10:2451 [Harmony Grove Village South Draft Final Environmental Impact Report (May 2018) p. 2.7-17].) Similarly, the Newland Sierra project will increase vehicle use by 294,804 miles *daily*. (CT 15:3918; see also Newland Sierra Final Environmental Impact Report (June 2018) p. 2.7-38].)

State and regional programs and plans, but also California’s larger climate objectives. Without significant VMT reductions across the State, California simply will not be able to achieve its GHG reduction targets.

A review of California’s climate laws reveals that reducing vehicle use is a crucial element of California’s policy and regulatory framework to reduce the State’s GHG emissions and the consequences of extreme changes in climate. California took the lead in reducing GHG emissions by enacting the Global Warming Solutions Act of 2006, also known as AB 32, which set the State’s original target of reducing GHG emissions to 1990 levels by 2020. (Health & Saf. Code, §§ 38500 et seq.) In 2016, California passed Senate Bill 32 (SB 32), which set a target of reducing GHG emissions 40 percent below 1990 levels by 2030. (*Id.* at § 38566.) Looking further to the future, Executive Order S-3-05 sets a goal of reducing GHG emissions to 80 percent below 1990 levels by 2050. (Governor’s Exec. Order No. S-3-05 (June 1, 2005).)

As required by AB 32, the California Air Resources Board (Air Resources Board) developed the Scoping Plan, which outlines a framework of GHG reduction strategies and a path for the State to meet AB 32’s 2020 targets, and, as updated in 2017, SB 32’s 2030 targets. (Health & Saf. Code, § 38561; AR 1026:55038 [Air Resources Board, 2017 Scoping Plan (2017) p. ES 3, hereafter Scoping Plan].) The Scoping Plan emphasized that the State’s reduction “targets have not been set in isolation. They represent benchmarks, consistent with prevailing climate science, charting an appropriate trajectory forward that is in line with California’s role in stabilizing global warming below dangerous thresholds.” (*Ibid.*) Represented graphically, our climate challenge is significant:

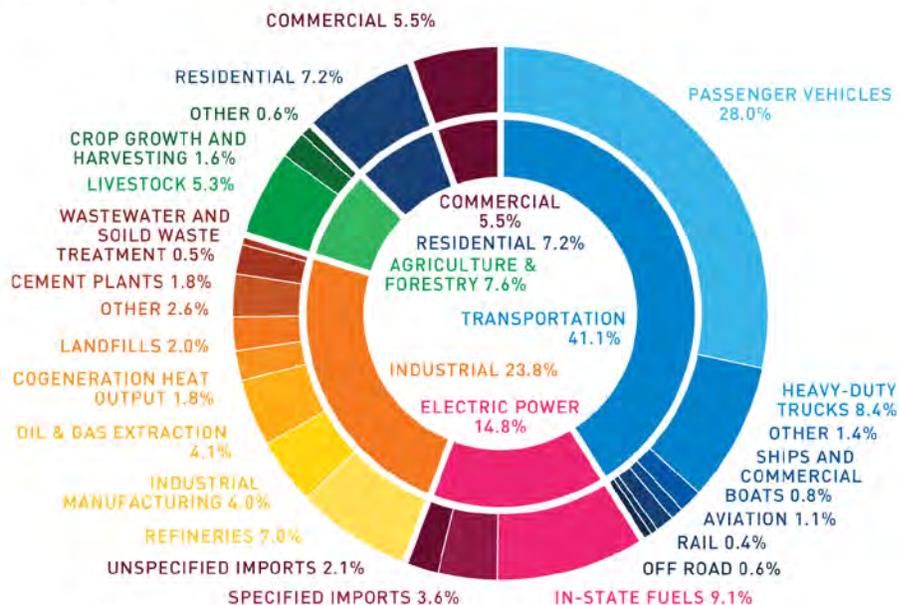


(*Id.* at 55071 [Scoping Plan at p. 18, fig. 5, “Plotting California’s Path Forward”].)

Within this significant undertaking to reduce GHGs, emissions from transportation represent a particular challenge. Transportation is the largest source of GHG emissions in the State, totaling almost half of statewide GHG emissions. (AR 1026:55063 [Scoping Plan at p. 10].)

Figure 2. Greenhouse Gas Emissions by Source

CALIFORNIA, 2017



(Next 10, California Green Innovation Index (2019),⁵ p. 7 [data source: Air Resources Board, California Greenhouse Gas Inventory – By Sector and Activity (2019)].)

In light of these significant transportation emissions, the Scoping Plan specifically noted that reductions in VMT are necessary to achieving California’s 2030 targets and “must be a part of any strategy evaluated in the [Scoping] Plan.” (AR 1026:55128 [Scoping Plan at p. 75].) In fact, the Air Resources Board has emphasized that “California *cannot* meet its climate goals without curbing growth in single-occupancy vehicle activity.” (Air Resources Board, 2018 Progress Report, California’s Sustainable Communities and Climate Protection Act (2018) p. 28, hereafter Progress Report [emphasis added].)⁶

⁵ Available at <https://www.next10.org/publications/2019-gii>.

⁶ Available at <https://ww2.arb.ca.gov/resources/documents/tracking-progress>.

Implementation of SB 375 is a primary strategy identified in the Scoping Plan to reduce GHG emissions from the transportation sector. (AR 1026:55154 [Scoping Plan at p. 101].) SB 375 aims to achieve GHG reduction goals specifically by reducing regional GHG emissions from light duty vehicles through coordinated land use transportation planning. (Gov. Code, § 65080 subd., (b)(2)(B)(vii).) Under SB 375, regional planning organizations develop plans to achieve the GHG reduction targets set by the Air Resources Board. (*Id.* at § 65080.) These regional plans, or sustainable communities strategies, integrate “land use, transportation, and housing planning” to reduce emissions from driving, curtail traffic, preserve natural resources, reduce air pollution, and expand clean transportation options. (Progress Report at p. 16.) In order to meet the intent of SB 375, these regional plans should achieve their emissions targets “predominantly through strategies that reduce [VMT].” (AR 22:20413 [Air Resources Board, Final Staff Report on the Proposed Update to the SB 375 GHG Emissions Reduction Targets (Oct. 2017) p. 19].)

SANDAG’s sustainable communities strategy was created to be consistent with this intent. The SANDAG Plan specifies that GHG reductions are to be achieved through land use planning methods that are designed to reduce vehicle miles traveled, including “using land in ways that make developments more compact, conserving open space, and investing in a transportation system that provides people with alternatives to driving alone.” (AR 430:39941.) Indeed, one of the “five building blocks” of the SANDAG Plan is to implement “policies and other measures designed to reduce the number of miles that people travel in their vehicles.” (*Id.* at 39870.) Thus, the County’s assertion that the SANDAG Plan does not require reductions in VMT is directly contradicted by the plain language of the document.

Moreover, the SANDAG Plan emphasizes that achieving GHG reductions through more compact development designed to reduce vehicle use is important for numerous reasons. Specifically, the SANDAG Plan discusses how smart growth land development decreases air pollution, preserves open space and agricultural land, improves water quality, and promotes healthier lifestyle choices, among other benefits. (AR 430:39934-35; see also AR 1026:55117, 55127 [Scoping Plan at pp. 64, 74] [noting that compact development that reduces VMT also demands less energy per capita, preserves natural and working lands, uses less water per capita and encourages physical activity].)

Thus, VMT reduction is an integral part of California’s climate laws and policies, as well as the SANDAG Plan. The CAP’s Offset Provision allows the County and future development projects to avoid consideration of whether the proposed project is properly located, sufficiently dense, and adequately supported by existing infrastructure, services, and public transportation. (See *Golden Door Br.* at 76-81; *Sierra Club Br.* at 62-70.) In this way, the CAP allows VMT-inefficient projects to continue to be built, locking the County into emissions for decades to come.

B. Local Governments Have an Essential Role to Play in Meeting the State’s Climate Objectives, Including Reducing Vehicle Miles Traveled

By failing to place any meaningful limitations or criteria for offsets, and by not requiring developers to make reductions in VMT, the County is effectively abdicating its land-use planning role. But local governments are necessary partners in reducing GHG emissions from land use and transportation. As the California Supreme Court has recognized, “[l]ocal governments ... bear the primary burden of evaluating a land use project’s impact on greenhouse gas emissions.” (*Ctr. for Biological Diversity v. Cal. Dep’t of Fish and Wildlife* (2016) 62 Cal.4th 204, 230.) The Scoping Plan

also emphasizes that local governments are critical players in achieving the State’s climate stabilization goals. (AR 1026:55150 [Scoping Plan at p. 97]; see also *id.* at 55072, 55115, 55125, 55140, 55144, 55150-55155 [pp. 19, 62, 72, 87, 91, 97-102].) In particular, the Scoping Plan relies on local governments to achieve reductions from land use planning and transportation, and states that local governments “can develop land use plans with more efficient development patterns that bring people and destinations closer together in more mixed-use, compact communities that facilitate walking, biking, and use of transit.” (*Id.* at 55150 [Scoping Plan at p. 97].) Because of this unique position, local government actions to combat severe changes in climate can in many cases be more effective, less costly and provide more environmental and economic co-benefits than regulating at the State level. (*Ibid.*)

In recognition of the important role that local jurisdictions have in GHG reductions and land use planning, many local jurisdictions have developed program-level GHG emissions reduction plans, such as CAPs. These plans outline city-, county- or regional-level frameworks that detail the specific actions a local agency will implement to reduce GHG emissions to a specified emissions level that is consistent with the State’s long-term climate objectives. (Governor’s Office of Planning and Research, General Plan Guidelines (2017) p. 226-229.)⁷ CAPs, when done correctly, provide a comprehensive approach to reducing GHG impacts on the local level and allow the local government to disclose, analyze, and mitigate impacts that may not be sufficiently analyzed and mitigated if projects are only reviewed one at a time. (*Id.* at 223.)

⁷ Available at http://opr.ca.gov/docs/OPR_COMPLETE_7.31.17.pdf.

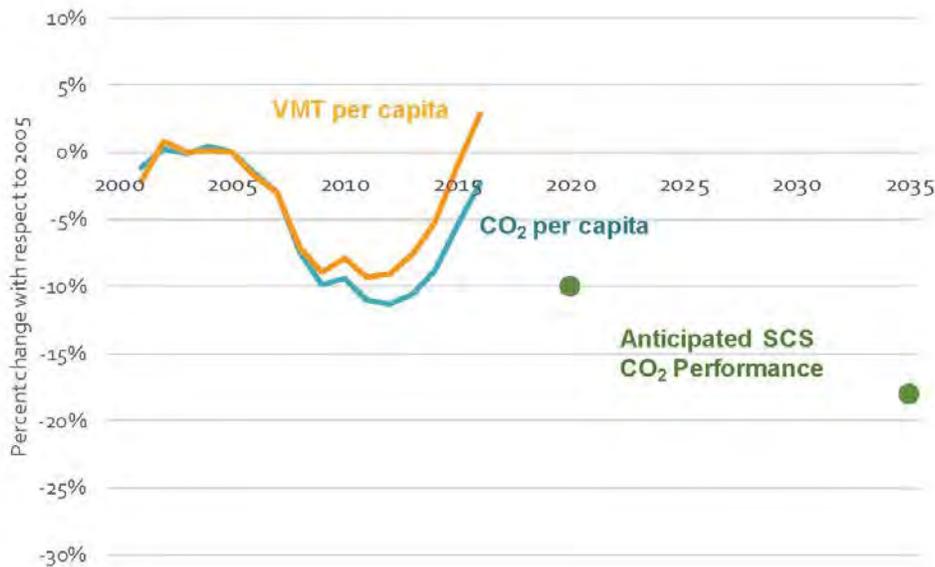
One of the key benefits of a properly prepared CAP is its ability to integrate GHG reductions with land use development plans. (General Plan Guidelines at pp. 222-224.) For example, by developing a CAP alongside a region’s general plan, a jurisdiction can consider methods of GHG reduction not available on a project-by-project-basis, such as zoning for compact development to decrease reliance on vehicles. (*Ibid.*) Moreover, the CEQA Guidelines allow well-designed CAPs that are consistent with State and regional climate goals to “streamline” future projects – meaning that future projects that comply with the CAP can appropriately reduce their GHG emissions to less than significant. (CEQA Guidelines § 15183.5, subd. (b).) This can allow local entities to more easily approve needed development, such as additional housing, or low-income housing, in existing, compact communities that reduce VMT.⁸ Thus, well designed CAPs provide excellent opportunities to achieve long term GHG reductions through dense development and can complement regional sustainable communities strategies’ and SB 375’s VMT reduction goals.

SB 375, too, relies on local planning innovation and leadership. The goals of regional sustainable communities strategies, including the SANDAG Plan, cannot be achieved if the County and other local entities operate with no regard for the compact growth principles. Recent data on compliance with SB 375 reflect this important point. In November 2018, the Air Resources Board released its 2018 Progress Report pursuant to SB 150,⁹ a State law that requires the preparation of a report every four years analyzing the progress made under SB 375. (Progress Report at p. 3.) The

⁸ The County claims that Petitioners are attempting to prevent all development in San Diego County. (County Reply Br. at 9-10.) However, had the County developed an adequate CAP, it could have actually *facilitated* dense development.

⁹ Gov. Code § 65080, subd. (b)(2)(J)(iv).

Progress Report found that despite the preparation of sustainable community strategies designed to comply with SB 375 by all the regional planning organizations, actual GHG emissions and VMT per capita have not declined, and California is not on track to meet its SB 375 targets. (*Id.* at 22.) In fact, VMT per capita and carbon dioxide emissions per capita are increasing¹⁰:



Source: CDTFA, U.S.EIA, U.S. EPA, CARB

(*Id.* at 23.)

The wide gap between the actual, measured VMT per capita and the targets of the sustainable community strategies reflects, among other things, that the regional plans are “not being implemented as envisioned.” (Progress Report at p. 24.) Further, the Progress Report warns that continued growth of urban sprawl could create barriers to achieving the compact land use patterns outlined in the regional plans. (*Id.* at 52.) The

¹⁰ CO2 and VMT in the chart calculated based on California Department of Tax and Fee Administration gasoline fuel sales data.

Air Resources Board advised that “structural changes and additional work by all levels of government are still necessary to achieve State climate goals and other expected benefits.” (*Id.* at 7.) This includes the County.

Thus, neither the State nor the San Diego region can achieve their climate goals if local entities, such as the County, persist in expanding urban sprawl, and consequently VMT. The County cannot disregard VMT reductions in the CAP without creating potentially significant and long-lasting impacts on the region’s ability to comply with the SANDAG Plan, SB 375 and consequently, California’s 2050 goals. These foreseeable conflicts with State and regional laws and plans prevent the CAP from adequately mitigating the impacts of the General Plan Update.

C. Offsets Are Not a Substitute for Efficient, Long-Term Land-Use Planning and Carbon-Efficient Project Design

GHG offsets can be a valuable and useful tool for achieving additional reductions that cannot be attained through onsite or VMT reduction measures alone. (AR 1026:55155 [Scoping Plan at p. 102].) For example, where a properly sited project has agreed to implement all feasible design changes and on-site mitigation, but will still have significant GHG emissions, it may be appropriate to consider the purchase of rigorously quantified and verified offsets to further reduce the project’s impacts. But in the land-use planning context, offsets—particularly offsets that are not tied to local projects—have distinct disadvantages as compared to on-site mitigation or other direct emission reduction measures. These disadvantages, combined with the lack of any adequate criteria to ensure enforceability of the offsets purchased in this case, conspire to make the CAP ineffective and unreliable as a mitigation measure for the General Plan Update.

The Offset Provision provides only vague pronouncements and little accountability.¹¹ It does not require any minimum amount of reductions to be made onsite before a project applicant can turn to offsets. (AR 38:22771.) In fact, the only standard that the Offset Provision requires is the satisfaction of the County and the Director of Planning and Development Services (PDS) that onsite reductions were considered first before turning to offsets. (*Ibid.*) Without any measurable guidance or standard for what “feasible” onsite reductions are, it is unclear how much onsite reduction will actually be required of future general plan amendment projects. What is clear, however, is that the County has recently approved developments using mitigation measures nearly identical to the Offset Provision that achieve onsite reductions for a very small portion of overall emissions. For example, the approved Newland Sierra project mitigates a staggering 82 percent of its emissions with offsets. (AR 22:18678.)

The Offset Provision also states that if offsets are used, the project “shall first pursue offset programs locally within unincorporated areas of the County of San Diego to the extent such carbon offset credits are available and financially feasible, as reasonably determined by the Director of PDS.” (AR 38:22772.) Again, the County provides no detail as to what “financially feasible” means, nor what criteria the Director of PDS will use to make its determination. Further, the evidence in the record shows that there are few carbon credits available within the County, meaning that most offset purchases

¹¹ Like all mitigation under CEQA, any mitigation measure that utilizes offsets must be enforceable. “Mitigation measures must be fully enforceable through permit conditions, agreements, or other legally-binding instruments.” (CEQA Guidelines § 15126.4, subd. (a)(1)(D).) “The purpose of these requirements is to ensure that feasible mitigation measures will actually be implemented as a condition of development, and not merely adopted and then neglected or disregarded.” (*Lincoln Place Tenants Assn. v. City of Los Angeles* (2007) 130 Cal.App.4th 1491, 1508 [citing Pub. Resources Code, § 21002.1].)

will inevitably occur outside of the County. (AR 38:23110-11.) Once all “available and financially feasible” in-County offsets have been considered, the Offset Provision allows projects to turn to out-of-county offsets. (*Id.* at 22771.) While the Provision requires that developers should prioritize in-state and in-country offsets (again without minimum amounts of reduction achieved by in-state or in-country offsets), it ultimately permits projects to purchase international offsets as well, unrestricted by any geographic boundaries. (*Ibid.*) This lack of meaningful criteria or limitations renders the Offset Provision unenforceable.

Moreover, the County’s attempts to justify the Offset Provision lack merit. The County asserts that the CAP’s allowance of offsets is no different than the use of offsets by the Air Resources Board’s Cap and Trade program.¹² (County Br. at 32-33.) This is untrue. Unlike the Offset Provision, offsets used in the Air Resources Board’s Cap and Trade Program are subject to detailed compliance protocols that were developed pursuant to the State’s public rulemaking process. (Cal. Code Regs., tit. 17, § 95972.) Further, and of critical importance, these requirements only allow offsets to comprise a maximum of 8% of any compliance entity’s compliance obligation.¹³ (*Id.* at § 95854, subd. (b).)

The County further argues that the Offset provision is no different than the use of offsets for the Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan, which the Scoping

¹² The County also concludes that because the Air Resources Board did not comment on the EIR, that the Board does not find the Offset Provision problematic. (County Br. at 49.) However, the County has provided no evidence to support this conclusion.

¹³ With the passage of Assembly Bill 398 in 2017, this maximum percentage has been further reduced to 4% of emissions from 2021-2025 and 6% for emissions from 2026-2030. (Assem. Bill No. 398 (2017-2018 Reg. Sess.) § 4(c)(E)(i).)

Plan identified as an example of a development project that will help the State meet its climate goals. (County Br. at 33 citing AR 1026:55154-55155 [Scoping Plan at pp. 101-2].) This is also untrue. The Newhall Ranch development required more than 50% of offsets to be local and limited international offset purchases to 20%. (AR 22:19785, 19796.) Moreover, offsets were only permitted after very extensive onsite reductions and measures to reduce VMT were implemented. (*Id.* at 19645-56.) Thus, the County cannot rely on the Newhall Ranch development to justify the shortcomings of the Offset Provision.

Crucially, what regional and State plans to reduce VMT require, and what the County cannot achieve through offsets, is long-term structural change. While the Offset Provision results in the purchase of GHG reductions for a 30-year lifespan, building in structural urban sprawl throughout the County will create GHG emissions far beyond 2050. (AR 38:22770, 24183.) Under the Offset Provision, rather than achieving the low-carbon 2050 that California’s climate laws and plans envision, the San Diego Region will see a sharp *increase* in GHG emissions around 2050, when recently approved projects’ 30-year offsets will expire. (AR 1026:55128; see also CT 15:3907, CT 10:2458 [reflecting that both the Newland Sierra and Harmony Grove Village South projects purchased offsets for a 30 year period].)

In order to truly be able to reach its 2050 goals, California, and particularly the local governments who manage land use throughout the State, must make the hard infrastructure changes needed to create dense communities that are not heavily reliant on vehicle use for travel. Despite this, the CAP ignores VMT reductions in favor of providing an easy solution for developers that kicks the can down the road and saddles a future generation of Californians with the costs of climate change. The County attempts to characterize the Offset Provision as an “additional burden”

on developers seeking a general plan amendment. (County Reply Br. at 10.) In reality however, it is an attempt to provide a backdoor for developers to purchase CEQA compliance while avoiding the difficult work that achieving our 2050 goals will require. As a result, the CAP's Offset Provision cannot deliver the same level of reliable, verifiable, substantial, and long-term GHG emissions reductions that active planning by the County, and smart project design by developers, can. Moreover, the County cannot assert consistency with SB 375 and the SANDAG Plan while the Offset Provision stands in its current form.

For these reasons, the CAP cannot serve as adequate mitigation for the General Plan Update.

II. THE SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT FOR THE CLIMATE ACTION PLAN FAILS AS AN INFORMATIONAL DOCUMENT UNDER CEQA

“The fundamental purpose of an EIR [pursuant to CEQA] is ‘to provide public agencies and the public in general with detailed information about the effect which a proposed project is likely to have on the environment.’” (*Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 428 [citing Pub. Resources Code, § 21061].) An EIR serves as “‘an environmental alarm bell’ whose purpose it is to alert the public and its responsible officials to environmental changes before they have reached ecological points of no return.” (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 392 [citation omitted].) In conducting an EIR for broader planning documents, the California Supreme Court has emphasized that planning agencies “must ensure that CEQA analysis stays in step with evolving scientific knowledge and state regulatory schemes.” (*SANDAG, supra*, 3 Cal.5th at p. 519.)

Here, where the CAP will create foreseeable VMT increases that will lock in emissions in the County long into the future, the County is obligated to disclose these environmental changes to the public. Instead, the SEIR provides no analysis of the CAP’s foreseeable conflicts with regional and State plans calling for land use planning decisions that reduce VMT, nor the air quality and environmental justice impacts that will also follow from increased VMT. This prevents the public and other agencies from adequately understanding how the CAP could impact future land use development, public health, and communities in the region. Moreover, the SEIR does not consider any alternatives that would reduce VMT in the region, and thus minimize the significant impacts created by the Offset Provision. For these reasons, the SEIR violates CEQA.

A. The County Did Not Adequately Evaluate Conflicts with the SANDAG Plan and SB 375

Despite the Offset Provision’s inconsistency with the SANDAG Plan and SB 375, the SEIR offers no analysis of these conflicts. This directly contravenes CEQA’s requirements. The CEQA Guidelines require that EIRs “shall discuss any inconsistencies between the proposed project and applicable general plans and regional plans... [including] regional transportation plans.” (CEQA Guidelines § 15125, subd. (d).) Further, “[i]f a mitigation measure would cause one or more significant effects in addition to those that would be caused by the project as proposed, the effects of the mitigation measure shall be discussed” (*Id.* at § 15126.4, subd. (a)(1)(d).) While such impacts can be discussed “in less detail than the significant effects of the project as proposed,” the impacts of mitigation measures cannot be ignored. (*Ibid.*) In addition, any inconsistency with the SANDAG Plan or SB 375 would strongly suggest that the CAP will work against the State’s overarching environmental objective: to reduce statewide emissions of GHGs by 2050 to a level that is consistent with

climate stabilization (80 percent below 1990 levels). (AR 1026:55152 [Scoping Plan at p. 99].)

In contrast to CEQA’s mandates, the SEIR does not even acknowledge that the Offset Provision will foreseeably result in increased VMT, let alone provide a complete analysis of its consistency with the SANDAG Plan. (County Br. at 46-49; AR 38:22773-4.) Instead, the County argues that it need not evaluate its consistency with the SANDAG Plan because the County is “not required to make its ‘land use policies and regulations, including its general plan ... consistent with the [SANDAG Plan] or an alternative planning strategy.’” (County Br. at 47, citing Gov. Code, § 65080, subd. (b)(2)(J).) However, this explanation is irrelevant to whether the County has complied with CEQA. CEQA is a document of public disclosure and accountability, meant to provide the public, along with other government agencies, information on how the County’s actions may impact the environment, and other land use plans. (See *Ctr. for Biological Diversity v. Cnty. of San Bernardino* (2010) 185 Cal.App.4th 866, 882.) Here, the Offset Provision will foreseeably impact the ability of the region to meet its VMT reduction goals under the SANDAG Plan – an impact that could have regional environmental consequences long into the future. CEQA requires that the SEIR must discuss and analyze those impacts, even if, as the County argues, it does not have to make its General Plan Update consistent with the SANDAG Plan. It must, under CEQA, disclose and discuss the inconsistency.

The County’s other attempts to justify its lack of analysis are similarly unavailing. First, the County states that the SANDAG Plan does not require reductions in VMT, and that reducing GHG emissions with offsets is consistent with the SANDAG Plan and SB 375. (County’s Br. at 48.) However, as discussed above, SB 375 and the SANDAG Plan both require GHG reductions through land use changes designed to reduce VMT, and so

the County cannot achieve consistency with the goals of these laws and plans with a CAP that increases VMT. Second, the County claims that other provisions of the CAP and the General Plan Update will reduce VMT, and so it need not discuss any increases caused by the Offset Provision. (*Id.* at 46-47; AR 1340:58773-78, 58780-88.) However, the County fails to explain how the CAP measures it discusses, none of which prevent or reduce VMT from new residential development projects in unincorporated land, will prevent the increases in VMT caused by the Offset Provision. Moreover, the County does not address how provisions in the General Plan Update will minimize VMT increases caused by general plan *amendments*, which, by definition, do not conform to the General Plan's requirements.

Finally, the County argues that consistency with SB 375 and the SANDAG Plan will be considered by future GPA projects and that the development of future general plan amendments is too speculative to be analyzed now. (County's Br. at 48, 50.) However, the environmental review of future projects does not relieve the County of its requirement evaluate the Offset Provision's consistency with the SANDAG Plan and SB 375 under CEQA. (CEQA Guidelines § 15125, subd. (d).) Further, CEQA requires that the County consider the impacts of *foreseeable* general plan amendment projects. (Pub. Resources Code, § 21065.) At the time the SEIR was drafted, the County identified numerous pending general plan amendment projects, many of which had published climate changes analyses as part of draft or final EIRs, and analyzing their foreseeable use of offsets would have required no speculation. (AR 38:22490-92.)

Thus, the SEIR's failure to disclose and analyze the inconsistency of the Offset Provision with SB 375 and the SANDAG Plan (and thereby with the State's long-term climate objectives) violates CEQA.

B. The County Did Not Analyze Air Quality or Environmental Justice Impacts from Increased VMT

Transportation is a major source of air pollution statewide and can produce impacts such as “smog forming and toxic air pollutants. (AR 55100, 55127 [Scoping Plan at pp. 47, 74].) As the Scoping Plan acknowledges, “[a]ir pollution from tailpipe emissions contributes to respiratory ailments, cardiovascular disease and early death.” (*Id.* at 55127 [Scoping Plan at p. 74].) In particular, these adverse health outcomes disproportionately impact “vulnerable populations such as children, low income communities and communities of color,” referred to in this brief as environmental justice communities.¹⁴ (*Ibid.*) By increasing vehicle use, the CAP will foreseeably increase tailpipe emissions that contribute to poor air quality and disproportionate health impacts on environmental justice communities in the County. Yet, the County offers no analysis in the SEIR of these impacts, and consequently prevents the public from understanding the full environmental consequences of the CAP. “A sufficient discussion of significant impacts requires not merely a determination of whether an impact is significant, but some effort to explain the nature and magnitude of the impact.” (*Sierra Club v. City. of Fresno* (2018) 6 Cal. 5th 502, 519.) The County’s lack of analysis violates CEQA.

C. The County Did Not Adequately Consider Alternatives that Would Prioritize Density

CEQA requires that lead agencies consider “a range of reasonable alternatives to the project.” (CEQA Guidelines § 15126.6, subd. (a).) “[T]he discussion of alternatives shall focus on alternatives to the project or

¹⁴ The Government Code defines “environmental justice” as the “fair treatment of people of all races, cultures and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws regulations and policies.” (Gov. Code, § 6540.12, subd. (e).)

its location which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly.” (*Id.* at § 15126.6, subd. (b); see also *Ctr. for Biological Diversity v. Cnty. of San Bernardino, supra*, 185 Cal.App.4th. at p. 882-83.) Here, despite extensive evidence presented in comments on the SEIR that the Offset Provision would create significant increases in VMT and conflict with the regional SANDAG Plan and SB 375, the County did not even consider an alternative that would limit sprawl and prioritize development in dense, urban areas. (See AR 38:22953-23034; see also AR 22:18424-25, 18440-41.)

The County asserts that it is not required to consider “every imaginable project alternative.” (County’s Br. at 52 [citing *Cherry Valley Pass Acres & Neighbors v. City of Beaumont* (2010) 190 Cal.App.4th 316, 354].) However, consideration of an alternative that would reduce VMT and prevent urban sprawl that could impact the whole region is patently reasonable and already envisioned by the SANDAG Plan. (See CEQA Guidelines § 15126, subd. (f) [“The range of alternatives required in an EIR is governed by a ‘rule of reason’ ... alternatives shall be limited to ones that would avoid or substantially lessen any of the significant effects of the project.”].) Moreover, this appellate district has recently found that a plan to reduce GHG emissions which failed to include an alternative that would “significantly reduce total [VMT]” was inadequate. (*Cleveland Nat’l Forest Found. v. San Diego Assn. of Gov’ts* (2017) 17 Cal.App.5th 413, 436 [noting that “the state’s efforts to reduce greenhouse gas emissions from on road transportation will not succeed if the amount of driving, or vehicle miles traveled, is not significantly reduced.”].) The County’s failure to consider an alternative that would prioritize density and other

carbon-efficient development strategies results in inadequate environmental review.

Thus, for these reasons, the SEIR violates CEQA.

CONCLUSION

The Superior Court's judgment should be affirmed.

Dated: October 29, 2019

Respectfully submitted,

XAVIER BECERRA
Attorney General of California
SALLY MAGNANI
Senior Assistant Attorney General
SARAH E. MORRISON
Supervising Deputy Attorney General
JANILL RICHARDS
Principal Deputy Solicitor
General

/s/ Shannon Clark
SHANNON CLARK
Deputy Attorney General
Attorneys for the State of California

CERTIFICATE OF COMPLIANCE

Per California Rule of Court § 8.204(c), I certify that this brief uses a 13 point Times New Roman font and contains 6,844 words.

Dated: October 29, 2019

XAVIER BECERRA
Attorney General of California
SALLY MAGNANI
Senior Assistant Attorney General
SARAH E. MORRISON
Supervising Deputy Attorney General
JANILL RICHARDS
Principal Deputy Solicitor
General

/s/ Shannon Clark
SHANNON CLARK
Deputy Attorney General
Attorneys for the State of California

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I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Date: October 29, 2019

DEBRA BALDWIN
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APP-009E – Item 4

Sierra Club, et al. v. County of San Diego

Fourth Appellate District, Division 1

Case No. D075478

Appeal From the Superior Court of San Diego

Case Nos. 37-2018-00014081-CU-TT-CTL

37-2018-00013324-CU-TT-CTL

37-2012-00101054-CU-TT-CTL

On October 29, 2019, based on a court order or an agreement of the parties to accept service by electronic transmission through TrueFiling, I caused the foregoing document described as:

**AMICUS BRIEF OF THE CALIFORNIA ATTORNEY GENERAL IN SUPPORT OF
PETITIONERS AND RESPONDENTS**

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<p>Judge Timothy B. Taylor Superior Court of San Diego County Department C-72 330 West Broadway San Diego, CA 92101</p> <p><i>(Via U.S. Mail only)</i></p>	<p>Attorneys for Plaintiff & Respondents <u>Sierra Club, et al.</u> Jan Chatten-Brown Josh Chatten-Brown CHATTEN-BROWN, CARSTENS & MINTER LLP 302 Washington Street, #710 San Diego, CA 92103</p> <p>E-mail: jrcb@cbcearthlaw.com jcb@cbcearthlaw.com</p>
<p>Attorneys for Appellant <u>County of San Diego</u> Thomas E. Montgomery, County Counsel Joshua Heinlein, Sr. Deputy Counsel Office of County Counsel 1600 Pacific Highway, Room 355 San Diego, CA 92101</p> <p>E-mail: joshua.heinlein@sdcounty.ca.gov</p>	<p>Attorneys for Defendant and Appellant <u>County of San Diego</u> Michael H. Zischke Linda C. Klein COX CASTLE & NICHOLSON, LLP 50 California Street, Suite 3200 San Francisco, CA 94111-4710</p> <p>E-mail: mzischke@coxcastle.com lklein@coxcastle.com</p>

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Attorneys for Plaintiff & Respondents
Golden Door Properties, LLP

Christopher W. Garrett

Samantha Seikkula

Taiga Takahashi

LATHAM & WATKINS LLP

12670 High Bluff Drive

San Diego, CA 92130

E-mail: Christopher.Garrett@lw.com

Samantha.Seikkula@lw.com

Taiga.Takahashi@lw.com



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This page last reviewed February 15, 2018

Offset Project Registries

Background

The Cap-and-Trade Regulation allows ARB to approve Offset Project Registries to help administer parts of the Compliance Offset Program. Offset Project Registries must meet specific regulatory criteria to be approved under the Regulation. Offset Project Registries will help facilitate the listing, reporting, and verification of offset projects developed using the Compliance Offset Protocols, and issue registry offset credits. Registry offset credits **cannot** be used for compliance with the Cap-and-Trade Program. Registry offset credits must be converted to ARB offset credits to be eligible for use in the Cap-and-Trade Program.

List of ARB Approved Offset Project Registries

All offset projects developed under an ARB Compliance Offset Protocol must be listed with an ARB approved Offset Project Registry. Offset Project Registries will help facilitate the listing, reporting, and verification of compliance offset projects, and issue registry offset credits. A list of approved Offset Project Registries can be found below.

- [American Carbon Registry \(ACR\)](#)
- [Climate Action Reserve \(CAR\)](#)
- [Verra](#) (formerly Verified Carbon Standard)

Guidance and Frequently Asked Questions (FAQs) for Offset Project Registries

ARB has developed guidance for Offset Project Registries. This guidance is intended to help Offset Project Registries and other offset program participants understand the role of the Offset Project Registries and how they interact with ARB and Offset Project Operators. In addition, ARB will develop Frequently Asked Questions (FAQs) that will be continuously updated as answers to specific questions are established. FAQs will be developed for general issues around Offset Project Registries.

- **[\(Coming Soon!\) Guidance for Approved Offset Project Registries](#)**
- **[\(Coming Soon!\) FAQs on Offset Project Registry Related Issues](#)**

Forms Made Available by Offset Project Registries

ARB has developed forms for use in the Compliance Offset Program. These forms may be used by program participants for submitting information related to listing, reporting, verification, and issuance of ARB offset credits. ARB will make all forms available on the [Compliance Offset Program Forms web page](#). In addition, each approved Offset Project Registry will make all forms available on its own public web page.

Application for Potential Offset Project Registries

Offset Project Registries must be approved by ARB to perform registry services under ARB's Compliance Offset Program. To become approved, potential Offset Project Registries must submit an

application and meet the requirements for education and experience as defined in section 95986 of the Regulation.

- The application below must be completed and submitted to ARB to begin the Offset Project Registry application process. If the applicant satisfies all the requirements of the regulation, they will be notified of the dates and times of approved ARB Compliance Offset Program and Compliance Offset Protocol training classes. Upon successful completion of training classes by Registry Staff the Executive Officer may approve the Offset Project Registry. Submission of this form and checking the appropriate box in Part IV will also suffice for applying to be an Early Action Offset Program.
- [Application for Offset Project Registry Approval](#) 

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CONTACT US

(800) 242-4450 | helpline@arb.ca.gov
1001 I Street, Sacramento, CA 95814
P.O. Box 2815, Sacramento, CA 95812

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CORE VALUES AND OPERATING PRINCIPLES

Quality California Credits: Participating air districts will only quantify credits for projects in California that follow protocols approved by the CAPCOA Board. Properly trained or certified air district staff or individuals that are CARB- certified, if applicable, will provide third-party verification of credit projects.

Collaboration: Participating air districts will work together to create and maintain an Exchange bulletin board that lists all available credits registered under respective air districts.

Integrity: The Exchange services will be provided with the utmost integrity so our customers can be confident that the credits they are providing, purchasing, or using are of the highest quality possible.

Security: The Exchange will be built with stringent measures to ensure that projects and trades are tracked carefully so credits are accurately issued and are used (or retired) only one time.

Transparency: Information on all aspects of the Exchange will be fully disclosed and easy to obtain to foster trust and respect.

Low Transaction Costs: The Exchange will seek to keep transaction and other costs as low as possible.

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Project ID	<input type="text" value="Choose"/>	Project Name	<input type="text" value="Choose"/>
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Hydropower in the CDM:

Examining Additionality and Criteria for Sustainability

Barbara Haya* and Payal Parekh

* Energy and Resources Group
University of California, Berkeley

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Executive Summary

Hydropower makes up 16% of installed electricity capacity worldwide and is in many cases already cost competitive and/or strongly supported by government policies. Hydropower makes up 30% of all carbon offsets projects registered under the Kyoto Protocol's Clean Development Mechanism (CDM) – just over 1000 projects as of 1 September 2011, the most of any project type. Hydropower also often has negative and sometimes severe impacts on river ecosystems and communities, including displacement of communities, loss of agricultural land, and decline in biodiversity. This means that effective criteria to ensure that accepted CDM hydropower projects generate new and additional emissions reductions and do not cause substantial social and environmental harm is critical. Otherwise, allowing hydropower to participate in the CDM risks generating large numbers of credits from business-as-usual projects that do not represent real emissions reductions, and risks transferring costs of climate change mitigation from polluters in the North to poor communities in the South.

This paper examines means for filtering CDM projects that have high likelihoods of generating real and new (additional) emissions reductions, and of avoiding substantial adverse social and environmental impacts. We focus the additionality analysis on China and India with a combined 78% of registered hydropower CDM projects, and on the Least Developed Countries (LDCs) which are the only host countries from which the European Union (EU) will accept CDM carbon credits for projects registered post-2012. We also evaluate the EU's assessment of compliance with World Commission on Dams (WCD) guidelines, a requirement for all large hydropower projects that wish to sell carbon credits into the European Emissions Trading Scheme.

ADDITIONALITY

The CDM requires each approved project to be 'additional': that it only went forward because of the extra financial support provided by the sale of carbon credits and would not have gone forward otherwise. Assuring that each project is additional is integral to the integrity of the CDM. Each business-as-usual project that is allowed to register under the CDM allows an industrialized country to emit more than their targets without causing the equivalent emissions to be reduced in a developing country.

Most large and small hydropower project proponents use the *Additionality Tool's investment analysis* to prove additionality, generally viewed as having the most potential to be accurate if performed well. The investment analysis is used to show that a project is not financially viable without additional funding available through the sale of carbon credits. The CDM's *Additionality Tool* also requires a common practice assessment as a credibility check; if a technology type is common practice, the proposed CDM project is not eligible for CDM crediting unless it can be shown to be "essentially distinct" from other similar projects in the same region.

Our analysis of factors that influence hydropower development decisions suggest the following conclusions:

Large hydropower should be excluded from the CDM in all countries because it is common practice, unlikely to be additional and additionality testing is inaccurate.

Large hydropower is a conventional technology that is being built in large quantities worldwide without carbon credits and should be considered common practice. China and India, the two countries with most hydropower CDM projects, have aggressive targets for building out their hydropower resources in attempts to meet soaring power demand and to address energy security concerns related to growing dependence in both countries on imported coal.

Furthermore, additionality testing is inherently inaccurate for large hydropower. First, financial return is not a good predictor of whether a large hydropower project will be built because non-financial factors have a large influence on decisions to develop these projects. In China, India, the LDCs and other countries, the government plays a dominant role in deciding how much and which hydropower projects are built; additionality testing is not meant to predict the planning processes of governments that take into account many factors other than those directly related to cost. The interest in building large hydropower in China, India and other countries supersedes the relatively small effect CDM carbon credits have on hydropower project financial return. Second, uncertainty in investment analysis inputs – particularly in the viability benchmark, expected capital costs, and cost and production risk – allows project developers to choose input values strategically in order to show that their projects are less financially viable than they really are.

Small hydropower projects should only be allowed under the CDM where they are not already being built or are being built at much slower rates than they would with carbon credits, and in countries in which the governments are less able to financially support the technology. Small hydropower typically benefits from less political backing than large hydropower and so is more likely to involve private developers, making financial return more predictive of the development decision. However, the investment analysis is unreliable for small hydropower projects for the same reason it is unreliable for large hydropower – uncertainty in input values. Small hydropower is already being built in some countries at substantial rates and therefore would not pass the common practice test in those areas. In countries where there already is development of small hydropower projects, such as in China and India with supportive subsidies and tariffs, allowing small hydropower projects to register under the CDM means potentially allowing a substantial portion of non-additional projects to register. Instead, types of small hydropower, defined by their size, location, and perhaps other objective characteristics, should be used to identify projects that are not currently being built, but which could be effectively enabled by the help of carbon credits. The effects of the CDM should be evaluated over time and should be clearly discernible for project types to continue to be eligible for crediting.

The common practice assessment should be strengthened. Our assessment of how the common practice test is being applied to hydropower projects shows that the definition of what constitutes common practice needs to be more stringent. At present, by allowing the boundaries of the assessment to be defined narrowly, and “essentially distinct” to be defined broadly, practically any project can be shown to not be common practice. Projects under construction and projects in the CDM pipeline should be included in the common practice assessment for technologies such as hydropower that are already being built without the CDM. If a technology is deemed to be common practice through the common practice assessment, a proposed CDM

project of that technology type should also be considered common practice; the ability to argue that a project is “essentially distinct” from other similar projects can easily be abused and should therefore be removed as an option under the common practice test.

SUSTAINABILITY CRITERIA

Hydropower projects can have negative and sometimes severe impacts on river ecosystems and communities, including displacement of communities, loss of agricultural land, and decline in biodiversity. The World Commission on Dams (WCD), established in 1998 in response to growing public scrutiny of large dams, developed a comprehensive framework for energy and water planning to ensure that adverse impacts from dam projects are minimized and the benefits and costs are more evenly distributed among stakeholders. The report is considered the most comprehensive, independent and thorough review of large dams to date.

To address concerns that hydropower projects can have serious environmental and social impacts the EU requires all credits from CDM hydropower projects larger than 20 Megawatts (MW) sold in the EU Emissions Trading Scheme to meet World Commission on Dams environmental and social standards, but similar standards are not required by the CDM itself.

Shortcomings in the EU’s assessment of WCD compliance

While the EU took a laudable step to operationalize the WCD guidelines, the current rules in many instances do not go far enough. Below we outline the shortcomings we find in the EU’s assessment of WCD compliance.

Inherent conflicts of interest in WCD compliance evaluations. The WCD requires that projects be appraised by auditors that are institutionally and financially independent from the project developers. The EU guidelines require that the project developer hire and pay a Designated Operational Entity (DOE) to conduct the assessment. An inherent conflict of interest exists when those performing or verifying project assessments are hired directly by those with vested interests in the projects going forward. In our interviews and e-mail exchanges with European DNAs, we did not find a single instance where a project was rejected by a DNA because of an insufficient WCD evaluation. We recommend:

- The Designated National Authority (DNA) of the buyer country, or another government agency, rather than the project developer, should choose WCD auditors. Project developers should be charged a fee that covers the costs of those audits and the oversight tasks of the government agency.
- The quality of WCD verification reports should be reviewed carefully. Future auditor hiring decisions should be based on whether previous assessments were performed rigorously and conservatively.
- Auditor performance should be evaluated periodically during a process of re-accreditation.
- The accreditation and re-accreditation processes should involve conflict of interest assessments.

Weak guidelines for and evaluation of stakeholder involvement. The WCD emphasizes that throughout project planning and implementation project-affected people must have the opportunity to actively participate in the decision-making process. Where projects affect indigenous and tribal peoples, decision-making processes must be ‘guided by their free, prior

and informed consent'. But the EU guidelines do not require mutual agreement of key issues such as compensation packages with all recognized adversely affected people; they had merely to be planned 'in consultation' with affected people. Furthermore, the proof of 'free, prior and informed consent' from indigenous or tribal peoples is not required. We recommend:

- Auditors should receive additional guidelines and requirements on how to assess stakeholder involvement. These could be modeled and expanded based on Gold Standard processes and requirements.
- The EU should require formal agreements regarding compensation and rehabilitation plans and the distribution of benefits from the dam between the project developer and project-affected persons in order to demonstrate acceptance of key decisions.
- The EU should require the proof of free, prior and informed consent of indigenous people.

Uneven access to compliance reports. Member States are required to provide publicly accessible information on projects that have been approved. We found that Member States interpret this requirement quite differently. While some, such as Germany, make all the WCD compliance reports available on their website,¹ others such as Sweden, France, the UK, Spain and the Netherlands do not. We recommend:

- EU member states should be required to provide online access to compliance reports and other relevant project information.

Only large hydropower projects must comply with WCD guidelines. Categorizing hydropower by size is somewhat arbitrary, as there are no clear relationships between installed capacity and general properties of hydropower (Kumar et al. 2011) or impacts (Kibler 2011). Furthermore smaller projects are subjected to fewer regulations and scrutiny in India and China, which represent over 70% of all small hydropower projects in the CDM pipeline (CDM/UNEP Risoe 1. Sept. 2011) and is likely to be the case for other countries as well. We recommend:

- All hydropower projects, large and small, should be required to meet WCD criteria.

CONCLUSION

Over 1000 hydropower projects are already registered under the CDM and another 700 are applying for registration. The consequences of registering non-additional projects and those with substantial adverse environmental and social impacts undermine climate mitigation goals by actually increasing emissions and placing the costs of climate change mitigation on those communities that most vulnerable to the impacts of climate change. Excluding large and some small hydropower projects from the CDM and strengthening WCD compliance evaluations are important steps the European Union could take to strengthen the integrity of its climate change mitigation goals.

¹ <https://www.jicdm.dehst.de/promechg/pages/project1.aspx>

Hydropower in the CDM: Examining Additionality and Criteria for Sustainability

Barbara Haya² and Payal Parekh³

Abstract

This paper examines the effectiveness of additionality and sustainability criteria being applied to hydropower projects applying for carbon crediting under the Kyoto Protocol's Clean Development Mechanism (CDM). We examine the conditions under which hydropower development decisions are commonly made, with a focus on China and India where the majority of CDM hydropower projects are hosted. We find that the CDM is having little effect on large hydropower development, and that the basic conditions needed for an accurate additionality assessment are not met. In particular, non-financial factors such as energy security heavily influence decisions to build large hydropower, and uncertainty in investment analysis inputs allows project developers to choose input values strategically in order to show that their projects are less financially viable than they actually are. Further, large hydropower and some small hydropower are being built in large quantities worldwide, are heavily supported by governments, and therefore should be considered common practice and ineligible for CDM crediting. We recommend that large hydropower be excluded from the CDM, and that small hydropower be accepted only in places where it is not already being built. The second part of this paper examines the European Union's (EU's) assessment of compliance of hydropower projects with World Commission on Dams (WCD) guidelines. We identify several shortcomings including auditor conflicts of interest, weak guidance for the assessment of public consultations, lack of documented acceptance of projects by project-affected persons, and insufficient access to compliance reports by the general public. We provide concrete recommendations to strengthen the EU's assessment of WCD compliance.

1 INTRODUCTION

The Kyoto Protocol's Clean Development Mechanism (CDM) allows industrialized countries (Annex 1) to partially meet their Kyoto Protocol commitments by reducing emissions in developing countries (non-Annex 1) and using the resulting emissions reduction credits towards their Kyoto targets. The CDM plays a pivotal role in the international climate change regime helping emitters in industrialized countries lower their costs of compliance and providing funds for renewable energy, energy efficiency and other emissions reducing activities in developing countries. An appeal of the CDM is efficiency – the CDM is designed to create a more global market for emissions reductions, allowing regulated emitters to reduce emissions wherever in the world it is least expensive to do so. However, critics of the CDM have

² Completed PhD degree in Energy and Resources from the University of California, Berkeley, in December 2010, bhaya@berkeley.edu

³ Independent consultant, Berne, Switzerland. Completed PhD degree in Oceanography from the Massachusetts Institute of Technology & Woods Hole Oceanographic Institution Joint Program, Cambridge & Woods Hole, in 2003. payal@climate-consulting.org

challenged the program's efficiency claims, arguing that large numbers of CDM projects are generating credits that do not represent real additional emissions reductions (He & Morse 2010, Lazarus & Chandler 2011, Michaelowa & Purohit 2007, Schneider 2009, Wara & Victor 2008) and do not contribute to sustainable development (Boyd et al. 2009, Schneider 2007).

Hydropower makes up 16% of installed electricity capacity worldwide and is in many cases already cost competitive and/or strongly supported by government policies (Kumar et al. 2011). Hydropower makes up 30% of all registered CDM projects, just over 1000 projects (CDM/UNEP Risoe 1. Sept. 2011), the most of any project type. This means that the criteria applied to proposed CDM projects to ensure that accepted projects generate new and additional emissions reductions must be accurate and effective. If they are not, allowing hydropower to participate in the CDM risks generating large numbers of credits from business-as-usual development of a conventional technology.

In addition, hydropower projects can have negative and sometimes severe impacts on river ecosystems and communities, including displacement of communities, loss of agricultural land, and decline in biodiversity. To address this, the European Union (EU) requires all credits from CDM hydropower projects sold in the EU Emissions Trading Scheme (EU-ETS) to meet World Commission on Dams (WCD) environmental and social standards, but similar standards are not required by the CDM itself.

The analysis in this paper centers around a practical policy question – how to ensure that CDM credits from hydropower projects have a high likelihood of being additional and of avoiding substantial adverse social and environmental impacts? We focus the additionality analysis on China and India with a combined 78% of registered hydropower CDM projects (CDM/UNEP Risoe 1. Sept. 2011), and on the Least Developed Countries (LDCs) which are the only host countries from which the EU will accept CDM carbon credits (Certified Emissions Reductions – CERs) for projects registered post-2012. We focus the assessment of sustainability criteria on the World Commission on Dams guidelines and the EU's assessment of WCD compliance.

Section 2 provides background information on different types of hydropower and a summary of the hydropower projects in the CDM. Section 3 examines the additionality of large and small hydropower projects, and the accuracy of additionality testing in the case of hydropower. Section 4 describes the common social and environmental impacts of hydropower projects of different sizes and types. Section 5 discusses World Commission on Dams (WCD) guidelines created to minimize adverse impacts from dams and the EU's assessment of WCD compliance. Section 6 presents our conclusions and recommendations.

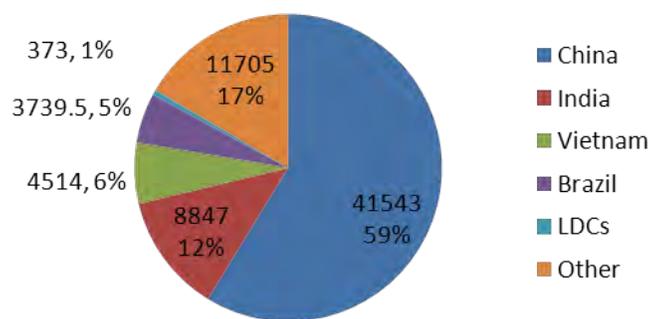
2 ABOUT HYDROPOWER AND CDM HYDROPOWER PROJECTS

There are over 37,000 large dams listed in the World Register of Dams, a database maintained by the International Commission on Large Dams (ICOLD), which defines a large dam as one with a height of at least 15 m from the foundation. No reliable data exist for the number of small dams worldwide (Anisfield 2010). Dams are built primarily for irrigation purposes. Hydropower, domestic and industrial use, and flood control (in descending order of use) are the other main reasons for building dams. During the 1990s, the majority of financial investments in dams were for hydropower projects (WCD 2000).

Currently hydropower is the largest source of non-fossil fuel electricity globally. In 2008 hydropower accounted for 16% of electricity supply worldwide with an installed capacity of 926 Gigawatts (GW), producing 3,551 billion kilowatt hours per year (Kumar et al 2011). Its growth is expected to continue in part due to its low carbon emissions.

China, Brazil and India are the 1st, 2nd and 6th largest hydroelectricity producer countries with installed capacities of 200, 84 and 38 GW, respectively (IJHD 2010). Hydropower constitutes 15.5 and 17.5% of the domestic grid in China and India, while it accounts for 84% of Brazil’s domestic electricity production (IJHD 2010). We highlight these three countries, because they represent over 75% of the hydropower projects in the CDM pipeline (Figure 1).

Figure 1: Total Installed Capacity (MW) in CDM Pipeline by Country



(Source: CDM/UNEP Risoe 1. Sept. 2011).

2.1 SIZE CLASSIFICATIONS

While dams of all purposes are usually classified as large or small based on dam wall height, hydropower dams are usually classified by installed capacity (megawatts - MW). Hydropower dams can vary tremendously in size. In the CDM for example, the smallest project is 0.1 MW (Bhutan) whereas the largest is 1200 MW (Brazil). There is no consensus for setting the size threshold (Egré and Milewski 2002). For example, Sweden classifies a hydropower plant as large if its installed capacity exceeds 1.5 MW (European Small Hydro Association 2010), while in Canada and China the cut-off is 50 MW (Natural Resources Canada 2009, Ministry of Water Resources – China 2002). Defining hydropower by size is somewhat arbitrary, as there are no clear relationships between installed capacity and general properties of hydropower (Kumar et al. 2011) or impacts (Kibler 2011). This is because hydropower is site specific (Kumar et al 2011, McCully 2001) and definitions of categories by government agencies are chosen to match local energy and resource management needs (Kumar et al 2011).

The CDM considers all renewable energy including hydropower projects with an output capacity up to 15 MW (or appropriate equivalent) small (Decision 17/CP.7, paragraph 6(c)). The EU Linking Directive on the other hand, considers hydropower with an installed capacity greater than 20 MW large (Directive 2004/101/EC, article 11a (6)).

2.2 RUN-OF-RIVER VERSUS RESERVOIR HYDROPOWER PLANTS

The two main types of hydropower are run-of-river (RoR) and reservoir (Figure 2 and Figure 3). Depending on the hydrology and topography of the watershed, both types can be large or small (Kumar et al 2011).

A reservoir hydropower plant stores water behind a dam for times when river flow is low, resulting in power generation that is more stable and less variable than RoR plants (Figure 3). Often the reservoir is an artificial lake located in an inundated river valley. In mountainous regions, existing high latitude lakes are sometimes turned into (larger) reservoirs. Reservoir hydropower plants can have major environmental and social impacts due to the flooding of land for the reservoir.

Figure 2: Schematic diagram of a Run-of-River hydropower plant

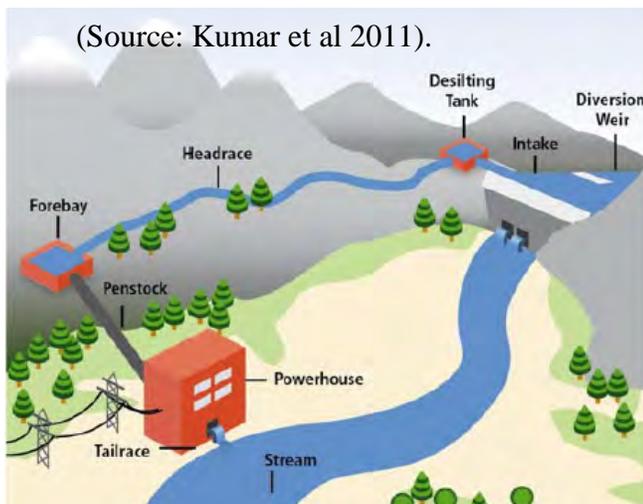
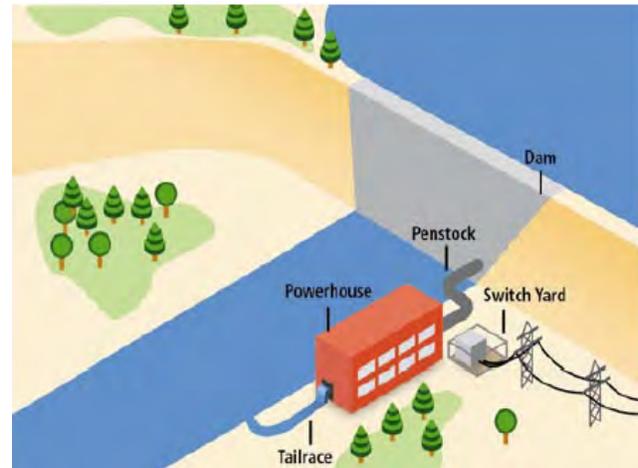


Figure 3: Schematic diagram of a reservoir hydropower plant

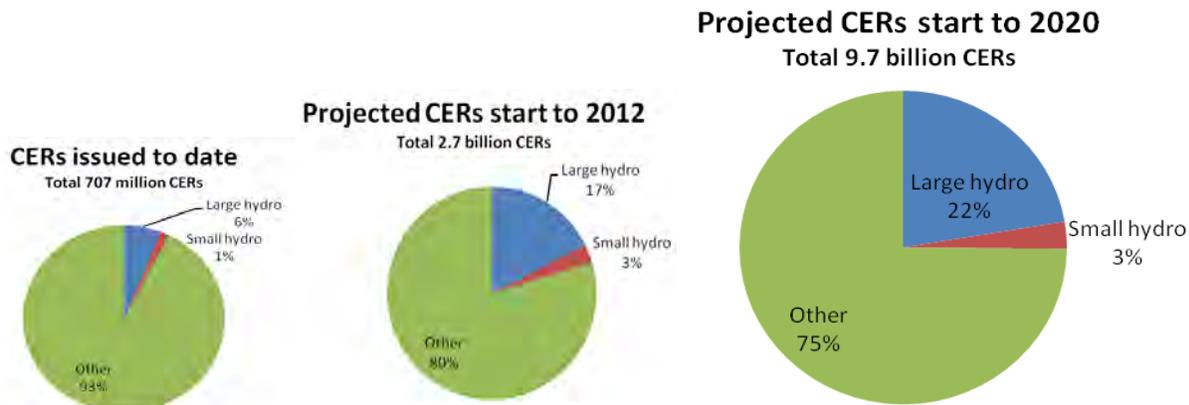


A RoR plant primarily draws energy from the available flow of the river (Kumar et al 2011), taking advantage of the natural elevation drop of a river. Therefore it is suitable for streams or rivers that have a minimum flow all year round or those that are regulated by a larger dam and reservoir upstream (Raghunath 2009). Water is diverted into a penstock or pipe and channeled to the turbine and then returned to the river (Figure 2). The elevation difference between the intake and the powerhouse provides the kinetic energy needed to power the turbine and produce electricity. The longer the diversion, the higher the environmental impacts can be. Power generation tends to be variable at RoR plants, depending on the extent of storage and the natural fluctuations in seasonal flow (Kumar et al 2011). RoR plants have either no storage or short-term storage; such reservoirs are usually smaller than those of reservoir hydro power plants. Yet RoR reservoirs can be quite large and there is no maximum size specified for RoR reservoirs above which they would be considered a reservoir hydro power plant. RoR dams can be ten to twenty meters high and can have gates to allow for water storage (McCully 2001). Impacts of RoR and reservoir hydropower plants are discussed in more detail in Section 4.

2.3 HYDROPOWER IN THE CDM

Hydropower is the most prevalent project type in the CDM pipeline (under validation and registered) comprising 26% of all projects. Hydropower accounts for 7% of CERs issued to date; it is expected to generate 20% of all CERs by 2012 and 25% by 2020 (CDM/UNEP Risoe August 1st 2011, see Figure 4). Hydro projects can register under the CDM either as small scale projects (<15 MW) or as large scale projects (>15 MW).⁴ While there are more small hydro projects (≤ 15 MW) in the CDM pipeline, larger projects account for over 80% of CERs from hydropower generated by 2012 and for over 85 % in 2020 (Figure 4; CDM/UNEP Risoe 1. August 2011).

Figure 4: Percentage of CERs from large and small hydropower in 2011, 2012 and 2020



Although hydropower is the most prevalent project type in the CDM, they are located in a small number of countries. Almost 90% of all hydro projects in the CDM pipeline are located in China, India, Vietnam and Brazil, countries considered emerging economies. Three of the four countries (China, India, and Brazil) are ranked within the top ten hydroelectric producing countries globally (IJHD 2010). China is expected to generate the most credits from small and large hydro (Figure 5, Figure 6, Figure 7, Figure 8). In contrast, less than 1% of registered projects are hosted in Least Developed Countries (LDCs).

⁴ Large hydro projects primarily (99%) use methodology ACM0024, which was developed for grid-connected electricity generation from renewable sources. All small hydro projects use the AMS-I.D.4 methodology, which was developed for grid-connected renewable electricity generation for small projects. Some small scale projects use AMS-I.A.4 or AMS-I.F.4 in conjunction with AMS-I.D, which account for electricity generation by the user; and captive use and mini-grid, respectively.

Figure 5:

Number of Registered Small Hydro (15 MW or less) by Country

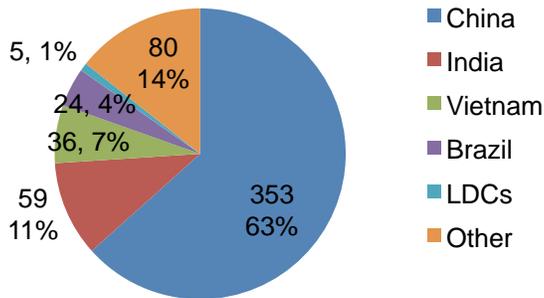


Figure 6:

Number of Registered Large Hydro Projects (> 15 MW) by Country

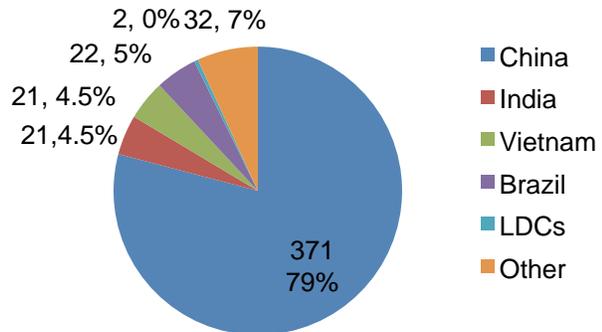


Figure 7:

Small Hydro Projects (15 MW or less) in the CDM Pipeline by Country

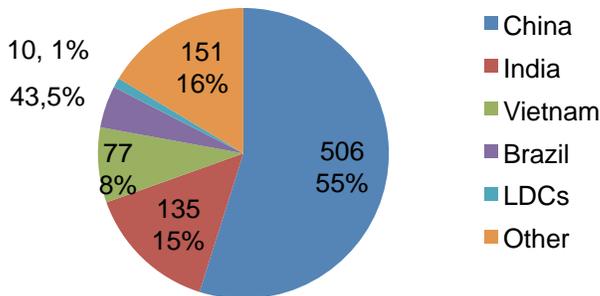
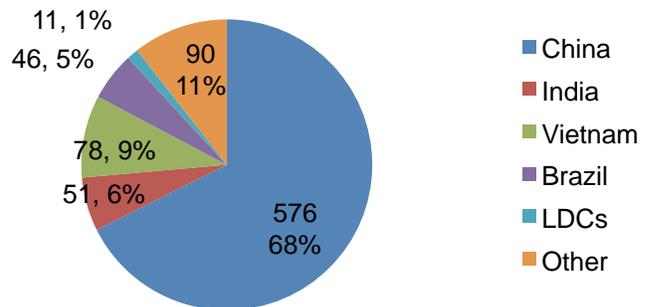


Figure 8:

Large Hydro Projects (> 15 MW) in CDM Pipeline by Country



(Source: CDM/UNEP Risoe 1. Sept. 2011; Rejected and Withdrawn projects are not included).

3 EVALUATING THE ADDITIONALITY OF HYDROPOWER CDM PROJECTS

The CDM requires that a project prove that it is ‘additional’: that it only went forward because of the extra financial support provided by the sale of carbon credits and would not have gone forward otherwise. Assuring that each project is additional is integral to the integrity of the CDM. Each business-as-usual project that is allowed to register under the CDM allows an industrialized country to emit more than their targets without causing the equivalent emissions to be reduced in a developing country. Verifying that an activity is additional is difficult because it involves assessing the considerations of a project developer under a counterfactual scenario in which there was no CDM.

The “Tool for the demonstration and assessment of additionality,”⁵ is the most common method used for proving the additionality of proposed CDM projects. The *Additionality Tool* has three basic steps. The project proponent must:

- identify alternatives to the project activity.
- conduct an investment analysis and/or a barrier analysis to prove the project would not otherwise proceed.
 - The investment analysis demonstrates that a project is not financially attractive without CER revenues.
 - The barrier analysis documents barriers that would prevent the project from going forward without the additional support from CER sales.
- undertake a common practice analysis as a “credibility check” to filter out project activities that are already commonly implemented.

In order to probe whether additionality testing is able to effectively filter out non-additional hydropower projects if performed more rigorously, we examine whether the conditions under which hydropower development decisions are being made are conducive for additionality testing.

Most large and small hydropower project proponents use the investment analysis to prove additionality, either alone or in combination with the barrier analysis. Most attention placed on improving project-by-project additionality testing focuses on improving the accuracy of the investment analysis, viewed as having the most potential to be accurate if performed well.

Two conditions are necessary for the investment analysis to be accurate: (1) Financial return must be a good predictor of whether a project will be built. And (2) an investment analysis must accurately and verifiably reflect the real financial considerations of key project decision-makers. We explore whether these two conditions are true for hydropower, and then examine whether large and small hydropower meet the CDM’s requirement that projects not be common practice.

⁵ The *Tool for the demonstration and assessment of additionality*, and a version of this tool that is combined with a baseline identification methodology - *Combined tool to identify the baseline scenario and demonstrate additionality* - can be found here: <http://cdm.unfccc.int/methodologies/PAMethodologies/approved.html>

3.1 IS FINANCIAL RETURN A GOOD PREDICTOR OF HYDROPOWER DEVELOPMENT?

In this section, we examine how large hydropower development decisions are being made with a focus on China, India and the LDCs to assess whether financial return is a good predictor of hydropower development and the likely influence of the CDM on hydropower development decisions.

3.1.1 Large hydropower in China

China's *Middle and Long Term Development Plan for Renewable Energy* calls for a doubling of China's hydropower capacity from around 150 GW to 300 GW between 2007 and 2020 (NDRC 2007). This hydropower expansion, in the country that already has the world's largest hydropower capacity, is unprecedented in its scale. Much of this growth is expected to come from the large and largely untapped hydropower capacity in the southwest of the country.⁶ Plans include a series of large back-to-back reservoirs along western rivers such as the Lancang and the Nu as a part of China's Great Western Development campaign. Much of the electricity from these dams will be brought to meet electricity demand in population and industrial centers in China's east (Magee & McDonald 2009).

China is heavily promoting hydropower and renewable energy as a way to decrease its reliance on coal. The high proportion of coal on China's grid (78% in 2009) is of concern because of increasing coal prices, growing reliance on imports and air quality impacts (Kahrl et al 2011). China has identified hydropower as the most important replacement of coal in terms of its percentage of power on the grid (ibid). There is also strong interest in hydropower development at the provincial and local government levels because of its potential to support local economic growth (ibid) and to ensure adequate electricity supply to attract industry.^{7 8}

Government in China plays a large role in determining how much and which hydropower is developed. The central government sets national goals for the sector as a whole, most importantly through its five-year plans. The government controls the amount of hydropower that is built by setting the tariffs for hydropower projects, which are set by China's National Development and Reform Commission (NDRC) on a project-by-project basis (Kahrl et al 2011). Despite steps China has taken towards introducing competition into its power sector through a series of reforms, the tariff-setting process maintains a top-down approach to carrying out policy objectives (ibid). The Chinese government also supports hydropower development by providing access to low-interest loans (Bogner & Schneider 2011).

Further, China's hydropower sector is predominantly state-owned. China's large hydropower development (defined in China as greater than 250 MW) is allocated to "the big five" – the five large state-owned companies that were created when China's monopoly state-

⁶ Shanghai Daily, (January 6, 2011). *China Ready for Flood of Hydropower*. (<http://business.globaltimes.cn/industries/2011-01/609534.html>, accessed 3 November 2011)

⁷ Interview with Kristen McDonald, on 9 October 2011

⁸ In the last five-year plan, China did not meet its goal for hydropower approvals, but this was due to tensions within the government between the Premier and the Ministry of Water on the one hand which rejected projects based on their expected environmental impacts, and the local governments and hydropower developers on the other which wish to build these projects (Magee & McDonald 2009), considerations that would not be influenced by the CDM. Hydropower in the CDM: Examining Additionality and Criteria for Sustainability 8

owned power company was broken up in 2002. Medium hydropower, defined as between 50 and 250 MW, is typically built by companies owned by some combination of subsidiaries of the big five, municipalities, and banks and private investors.⁹ These hydropower developers sell their power to the two state-owned grids, or less frequently to municipalities.¹⁰ Most banks in China are state-owned (Naughton 2007). Sinohydro, China's national hydropower developer, built around 65% of China's hydropower capacity.¹¹ State-owned enterprises in China generally do not lack capital resources or access to debt financing on good terms and receive various other forms of government support.¹²

Within this context, it seems highly unlikely that the CDM can lead to additional hydropower development in China. The government has a strong interest in supporting large scale hydropower development and has the means to effectively carry those goals forward. China's interest in building large hydropower supersedes the relatively small effect CERs have on hydropower project return. The investment analysis with its sole focus on financial return measured against a clear viability benchmark is not predictive of how large and medium hydropower development decisions are being made in China, given the range of consideration being made by government in China at all levels of decision-making.

3.1.2 Large hydropower in India

India is also expanding its power sector very quickly to meet soaring power demand and chronic power shortfalls. It anticipates quadrupling its electricity supply between 2005 and 2030, a tremendous undertaking. It intends to do so through pursuing all fuel options (Planning Commission of the Government of India 2006). India's Eleventh Five Year Plan called for 16.5 GW of hydropower to be built between 2007 and 2012 (Planning Commission of the Government of India 2008). The Central Electricity Authority recommends that 30 GW be pursued during the twelfth five year plan between 2012 and 2017 (Central Electricity Authority 2008).¹³

Hydropower is viewed as an attractive source of power because it is a domestic resource without the energy security concerns of coal and natural gas, a serious concern for India since it expects imports of coal and natural gas to increase in the future (Planning Commission of the Government of India 2006). Hydropower is also considered the best option for providing peak power (Planning Commission of the Government of India 2006).

In India, river development is determined through a government planning process involving a team of public and private actors. This planning process identifies potential large hydropower sites and determines which specific sites will be developed in what order and by which sector – central, state or private (Central Electricity Authority 2008). These plans follow India's five-year planning cycle. The private sector is involved in hydropower development by participating in the planning process, and by responding to bid requests put out by national- and state-owned power companies.

⁹ Interview with Kristen McDonald, on 9 October 2011

¹⁰ *ibid*

¹¹ <http://www.hydrochina.com.cn/English/pages/aboutus/brief.jsp>, accessed 17 October 2011

¹² Interview with Kristen McDonald, on 9 October 2011, and noted in a number of CDM application documents for hydropower projects in China that are built by privately owned hydropower developers.

¹³ With the expectation that 25 GW is feasibly attainable.

Additionality testing is not meant to predict the planning decisions of governments, which consider a wide range of factors in their planning process beyond those directly related to cost. In the case of Indian hydropower, the planning commission takes into account energy security concerns, displacement of people, the need for peak power, and the competing uses of rivers for irrigation and flood control, all concerns that are not easily monetized and integrated into an investment analysis with a reliable benchmark (Central Electricity Authority 2008).

The Indian government has mapped out its hydropower resources by river basin, ranking the attractiveness of potential hydropower sites (Central Electricity Authority 2008). This ranking contributes to the decision of which plants will be built in what order. When hydropower sites are mapped out and ranked for future development, the most influence the CDM might have on planning decisions is to accelerate the pace at which some hydropower facilities are being built, not whether they are built at all, perhaps justifying only a few years of credits for some projects if the acceleration effect is discernible. This would be true for many countries in addition to India and China that have assessed potential hydropower sites with the intention of expanding their hydropower capacity.

The effect of CDM revenues on India's planning process is not clearly apparent. Neither India's 11th Five Year Plan nor its 12th Hydropower Plan mention the CDM or carbon credits as a factor in its decisions to support and develop hydropower and renewable energy (Central Electricity Authority 2008, Planning Commission of the Government of India 2008: Chapter 10-Energy). The few times the CDM is mentioned, it is only mentioned to highlight India's contribution to global climate change mitigation efforts, rather than as a factor helping India develop its hydropower resources (Planning Commission of the Government of India 2006).

The CDM is also unlikely to have much influence on private sector involvement in hydropower development in India. The tariff paid to hydropower developers per kilowatt hour produced is calculated on a cost-plus basis for each hydropower facility and is adjusted periodically to ensure that the developer receives a pre-agreed return on equity based on their true costs and power output. This return on equity investment is typically 14% or 15.5%.¹⁴ This means that most project costs are "passed through," since they are returned to the developer through the tariff. Therefore hydropower developers take little of the risk that there will be cost overruns during construction, or that less power will be produced than expected. As a result, the financial return to a large hydropower developer varies only minimally between projects. When the tariff is determined on a cost-plus basis per project, a financial return analysis has little meaning, and is not an appropriate indicator of whether a project would be built. Since tariffs are set to guarantee each developer a pre-determined return on their equity investment, the investment analysis is not meaningful in distinguishing the feasibility of individual hydropower projects.

3.1.3 Hydropower in general, with a focus on the Least Developed Countries (LDCs)

¹⁴ 14% is the return on equity from the Central Electricity Commission's 2005 tariff order and 15.5% is the return on equity from the 2009 tariff order. The CERC order applies to all central plants, and plants whose electricity is traded between more than one state. Each state writes its own tariff policy for its own plants, typically modeled after the CERC policy.

Of the twelve hydropower projects above 10 MW in the CDM pipeline (both registered and in the validation stage) in LDC countries, all but two document direct government involvement in the project in their CDM application documents (project design documents – PDDs).¹⁵

As our description of hydropower decision-making in China and India show, decisions to build hydropower are complex and political, and involve a range of considerations beyond those directly influencing cost. Large hydropower is often treated in a similar manner to mining; rivers are an exploitable resource that the government can use as political currency, giving the right to build a facility to public and private entities.

Government involvement, including through international, bi-lateral lending agreements and loan guarantees, is also common with hydropower development due to its nature as an infrastructure project, large upfront capital requirements, and high levels of uncertainty and risk associated with its construction costs and electricity output. Lending decisions can be based on political rather than purely financial grounds. For example, Chinese banks provide loans to Chinese hydropower development in Africa often as a part of much larger agreements for trade and investment between itself and the African country (Bosshard 2008).

Almost half of all hydropower plants with dams greater than 15 meters in height worldwide are considered multipurpose.¹⁶ These dams can be used for irrigation, flood control and/or other services in addition to electricity generation. Quantifying the benefits of these other uses, such as by attributing a portion of project capital costs to these other purposes, is far from straightforward. Benefits from other project uses are not commonly quantified in investment analyses for CDM hydropower projects. This means that hydropower CDM projects that serve multiple purposes can appear to be less cost effective than they actually are if benefits from other uses are left out of the investment analysis or are given a low value.

The influence of non-financial factors in hydropower development decisions is evidenced by the fact that large hydropower projects are typically more costly than predicted, sometimes by more than double (World Commission on Dams 2000: chapter 2), yet decisions to build large hydropower projects are repeatedly approved by governments as well as international and bi-lateral finance institutions based on low cost estimates.

Certainly cost affects the decision to build a large hydropower project, but given the relatively small effect of CERs on project return and the range of influences on project development beyond cost factors, the effect of CERs is in the noise and is not predictive of project development.

3.1.4 Small hydropower

Small-scale hydropower facilities, with their smaller electricity output and financial requirements, typically draw less political interest, involve different decision-making processes

¹⁵ Six are built directly by government developers, one was built by private developers responding to requests for proposals from the government, and one project mentions a government loan guarantee. One was a part of a larger economic, cultural and technical science cooperative agreement between the governments of Lao and Vietnam, and another involved an agreement to sell electricity from the project in Myanmar into the Chinese grid.

¹⁶ International Commission on Large Dams (ICOLD), Register of Dams, General Synthesis (http://www.icold-cigb.org/GB/World_register/general_synthesis.asp, accessed 3 November 2011)

and government support, and are more likely to be initiated by private sector actors compared to large hydropower. In some countries, like India and China, small hydropower formally involves different tariff-setting and planning processes. With regard to additionality testing, small-scale hydropower shares some features of large hydropower and some emerging technologies like wind, depending on location and size.

Many of the factors that make large hydropower a political decision are less important with small hydropower, including the importance for meeting electricity demand, potential for corruption, scale of the financial risk, and involvement of international lending institutions.

Both India and China actively support the development of small hydropower, defined as less than 25 MW in India, and less than 50 MW in China. Already in 2009 China had 55 GW of hydropower capacity, the most in the world. China's 2007 Renewable Energy Plan defined a goal of expanding China's small hydropower capacity to 75 GW by 2020. China is promoting small hydropower with a combination of tax benefits and dedicated and low interest loans, technical training and preferential tariffs (Jiandong 2009). Instead of defining the tariff for each project individually as is done with large hydropower, provinces should define preferential tariffs that are paid to private developers that choose to build small hydropower projects. China has a strong interest in supporting small hydropower, considered the best means for extending electrification to 100% of households, a priority goal of the government (Jiandong 2009). About one-third of China's counties rely on small-scale hydropower as their main power generation source (International Energy Agency 2007).

India also has goals to provide full rural electrification (Planning Commission of the Government of India 2006); small hydropower is viewed as an important way to provide electricity access to remote areas.¹⁷ India's 12th five year plan includes a goal of increasing its small hydropower capacity from just under three GW at the beginning of 2011 to around six GW in 2017.¹⁸ The Government of India has instructed the states to set preferential tariffs for small hydropower tariffs (Central Electricity Regulatory Commission 2009) and offers financial incentives including capital subsidies (Ministry of New and Renewable Energy 2009).

In both India and China, the preferential tariffs set at the state and province level mean that any approved hydropower project will receive that tariff, regardless of its costs.¹⁹ In this context, as opposed to cost-plus tariff determinations for large hydropower in both countries, the CDM could improve the financial returns of a project and could potentially spur more development. Still, the challenges with assessing the additionality of small hydropower are not unlike those of large hydropower. By setting goals for small hydropower development, defining promotional tariffs, and creating incentives the Chinese and Indian governments are substantially affecting the amount of small hydropower built. He and Morse (2010) describe how, by setting the tariff for wind, the Chinese government in effect decides what wind projects are additional and not additional. The same argument applies to small hydropower in both India and China. If the government does not see enough small hydropower being built, it can raise the incentives, or

¹⁷ From the Government of India, Ministry of New and Renewable Resources web site, <http://www.mnre.gov.in/>, accessed 19 October 2011

¹⁸ *ibid*

¹⁹ In practice this is not always the case. Tariffs for many of the small hydropower projects registered under the CDM in both China and India are set in the same way as they are for large hydropower.

if it sees that small hydropower is being built quickly, it can lower its incentives and invest those funds elsewhere.

This discussion suggests that the CDM is more appropriate for small hydropower in countries where the government is investing fewer financial resources to incentivize the development of small hydropower and where small hydropower would not be considered common practice (discussed below in Section 3.3). Ensuring small hydropower projects accepted for crediting have high likelihoods of being additional will also depend on the accuracy of the investment analysis for this technology (discussed in the next section).

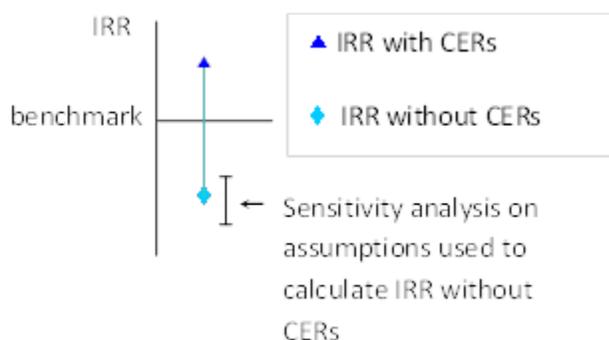
3.2 IS THE INVESTMENT ANALYSIS ACCURATE AND VERIFIABLE FOR HYDROPOWER PROJECTS?

In this section we assess the accuracy and verifiability of the inputs that go into the investment analysis. We first provide a more detailed description of the investment analysis, and then assess the level of uncertainty in two major investment analysis inputs – the benchmark and project capital costs.

3.2.1 The Additionality Tool’s investment analysis

The investment analysis is used to show that a project is not financially viable without carbon credits. A benchmark is determined that represents the threshold financial return, or hurdle rate, defining whether the project would likely go forward. For renewable energy and hydropower projects, the benchmark is most commonly defined in terms of project or equity internal rate of return (IRR).²⁰ If the expected financial return of the project is below the benchmark, then it is assumed that the project most likely would not have gone forward without carbon credits and the project is considered additional. The financial assessment is tested with a sensitivity analysis of the most important cost and revenue inputs. It is optional to show that CERs bring the financial return of the project above the benchmark. Figure 1 illustrates the investment analysis for a project that is additional and uses IRR as the metric used to assess project financial return.

Figure 9: The Investment Analysis



3.2.2 Examination of the benchmark

Hydropower developers have used all four options recommended by the CDM Executive Board in their latest guidance on the investment analysis²¹ to determine the viability benchmark in their CDM application document. These four options are: (1) Local commercial

²⁰ Internal rate of return (IRR) is the discount rate that would be applied to the cash flow of a project so that the net present value of the project is zero. A higher IRR indicates better financial return.

²¹ Executive Board Report 51, Annex 58, *Guidelines on the Assessment of the Investment Analysis (version 3)*, report from EB meeting ending 4 December 2009, http://cdm.unfccc.int/EB/051/eb51_repan58.pdf

lending rates (for project IRR), (2) weighted average cost of capital (WACC)²² (for project IRR), (3) required/expected return on equity (for equity IRR), and (4) benchmarks supplied by relevant national authorities if the validator can validate their applicability (for both project and equity IRR).²³ Chinese hydropower developers almost exclusively use the fourth option, benchmarks supplied by the government. In India, most use the second option – the weighted average cost of capital (WACC).

Calculation of WACC typically involves a combination of two values – the cost of debt, and the expected return on equity investment, which is estimated with a market analysis. Following CDM Executive Board guidance in 2008 (CDM Executive Board 2009), hydropower projects registered in India in the last two years commonly calculate the expected return on equity using the Capital Asset Pricing Model (CAPM). CAPM estimates the equity return required by investors from a project as a risk free rate (e.g. government securities), plus a risk premium that takes into account the higher expected IRR needed to counterbalance the risk associated with the particular project type. CAPM uses the following formula based on historical return on equity:

$$\text{investor expected return} = \text{risk free rate} + (\text{market rate} - \text{risk free rate}) * \text{beta}$$

where government securities are typically used for the risk free rate, the market rate is the rate of return from the stock market generally, and beta captures the correlation between the fluctuation of the value of stocks in the specific industry of the project being analyzed and the stock market generally. For example, the milk industry should have a low beta, since purchases remain relatively steady regardless of the state of the economy, but luxury goods have high betas, since their purchase rates increase and decrease according to the state of the economy. In other words, beta indicates if hydropower investments are more risky or less risky than the stock market in general.

The risk free rate is fairly straightforward – this is the rate of return on investments that have very low risk, such as government bonds. The market rate and beta are both less straightforward, and values have differed considerably among the CDM applications of similar projects in a single country.

The CAPM model, while considered one of the most reliable ways of determining expected return on investment, is very dependent on assumptions used. We provide a simple example to illustrate this. Bhilangana III, a 24 MW hydropower project in India registered under the CDM in 2011, defines their viability benchmark using WACC. The interest rate on their debt is taken as the prime lending rate from the Reserve Bank of India as 9.62% at the time the development decisions was made. The CAPM model is used to estimate the expected investment return.

We examine just one of the inputs into the CAPM model – the market rate, which is the expected return of the stock market. The developers of Bhilangana III calculate the market rate as the average annual percentage increase on stock market values of the top 500 companies on

²² Weighted Average Cost of Capital (WACC) is the cost of capital to the project developers, normally combining two components: the costs of a loan (loan interest rates) and the costs of equity (return on equity required by an equity investor).

²³ Executive Board Report 51, Annex 58, *Guidelines on the Assessment of the Investment Analysis (version 3)*, report from EB meeting ending 4 December 2009, http://cdm.unfccc.int/EB/051/eb51_repan58.pdf

the Bombay stock exchange (BSE 500) between February 1999 and February 2006. The choice of end date is the month that the investment decision was made. They chose the beginning date, February 1999, as the year of inception of BSE 500. The benchmark derived is 13.18%. If instead, February 2000 had been the first year with available BSE 500 data, the market rate would have been 3% lower, generating a benchmark WACC as 10.11%. The IRR of the project without carbon credits is calculated as 10.49%. The IRR of the project would have been above the benchmark and the project would not have been considered non-additional if the market return calculation started in February 2000 instead of February 1999, an arbitrary choice.

Other hydropower projects registered in India around the same time calculate benchmarks that range from 11.0% to 15.8% using the same method, by choosing different CAPM model parameters.

3.2.3 Examination of IRR analysis

We start this discussion with wind power development in India – a best case technology for an accurate IRR analysis – and then draw a comparison with hydropower. Wind power in India is a best case for an accurate IRR analysis because almost all investment analysis inputs are recorded in legal agreements before construction starts. Wind development in India involves a supply agreement between a wind developer and an investor whereby all of the major costs are agreed in formal documents before construction starts. In addition, most states in India publish their wind power tariffs paid to the project owner per kilowatt hour produced that would apply to all new wind development. Even so, for the majority of large wind projects registered in India, the choice of assumption about one cost input that is not pre-determined in the majority of cases – the tariff after the end of the first power purchasing agreement – can affect expected project financial return by around the same amount as expected increase by carbon credits (Haya under preparation). This means that wind power developers have some leeway to choose investment analysis inputs that could show that a feasible wind project is infeasible.

An investment analysis for a hydropower project involves much more uncertainty than for a wind project. For one, from the perspective of the project investor, the costs contained in wind project supply agreement are the actual costs that will be paid to the wind manufacturer. For a hydropower project, the capital costs documented in documents cited in the CDM project applications (Detailed Project Reports, feasibility studies, techno-economic clearance report, loan agreements, etc.) are best estimates. Actual costs can be less or more than what is written in these documents. Cost predictions for a single project often vary between project documents for a single project as cost estimates are revised over time. Hydropower is notorious for large cost overruns, but also in some instances has been less expensive than predicted (World Commission on Dams 2000). In addition, the perceived risk of cost overruns or project underperformance certainly influence project development decisions, but is not recorded in a citable document.

Further, as discussed above, there are many benefits of hydropower that are not easily quantified in an investment analysis, but when not quantified lead to a project appearing less cost effective than it actually is. Such benefits include energy security, the flexibility of being able to be used for base load and for peak load, and other uses for multi-purpose dams.

The investment analysis is accurate to the extent that developers report the same cost and revenue assumptions and benchmark in their CDM applications as they use in their internal decision-making. Uncertainty in investment analysis inputs enables a range of possible values,

from which the project proponent could choose strategically to show the project is less viable than it may actually be. This analysis of ranges of acceptable benchmarks and capital cost estimates shows that in the case of hydropower there is substantial room to choose assumptions.

3.2.4 More evidence that the IRR analysis is not filtering out non-additional projects

The timing of the start of project construction of CDM hydropower projects provide additional evidence that many non-additional hydropower projects are currently registered under the CDM. The *starting date of the project activity* documented in each PDD gives the date when project construction started or otherwise when “real action of a project activity begins/has begun” (CDM Executive Board 2008). Starting dates for 16% of all registered hydropower projects (180 projects) were prior to when the Kyoto Protocol entered into force on February 16, 2005.²⁴ Of these, 60% were registered in 2007 or later. The starting dates of 89% of all registered hydro projects were before the start of the validation process (start of the public comment period) indicating that certainty about a positive validation or registration was not needed for the decision to build the project to be made.²⁵

3.3 WHEN SHOULD HYDROPOWER BE CONSIDERED COMMON PRACTICE?

The *Additionality Tool's* common practice assessment provides a “credibility check” on the investment and barrier analyses. The common practice assessment requires discussion of activities that are in operation and are similar to the proposed CDM project in terms of location, technology and scale. As per the *Additionality Tool*, if similar activities are “widely observed and commonly carried out,” the developer must explain “essential distinctions” between the proposed project and other similar activities in terms of financial attractiveness or the presence of barriers. Projects in the CDM pipeline are excluded from the comparison.

3.3.1 Is hydropower common practice?

Worldwide hydropower is a conventional technology. Around 8,700 hydropower projects with dams at least 15 meters in height²⁶ and an uncounted number of smaller dams produce 16% of global electricity supply (Kumar et al 2011). As discussed above, hydropower is common practice in China and India. In Vietnam, with the third largest number of hydropower CDM projects, 36% of the country’s electricity production is from hydropower.²⁷ In Brazil, the country with the fourth largest number of proposed and registered CDM projects, 84% of the country’s electricity generation is from hydropower.²⁸ Hydropower is a mature technology, which has played an important part in electricity generation since the beginning of electricity generation.

The extent to which small and micro hydropower is common practice is less clear than for large hydropower and would need to be assessed for different size classes for each country,

²⁴ The starting dates for all registered CDM projects and projects in the validation stage are listed in IGES Institute for Global Environmental Strategies (IGES). 2011. IGES CDM Project Database. Japan: 1 September 2011

²⁵ The start of the public comment period is listed in the same database.

²⁶ Listed in the World Register of Dams, a database maintained by International Commission on Large Dams (ICOLD)

²⁷ International Energy Agency website http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=VN, accessed 21 October 2011

²⁸ US Energy Information Administration website <http://www.eia.gov/countries/cab.cfm?fips=BR>, accessed 21 October 2011

and if appropriate for different states or provinces. As mentioned above, small hydropower is defined differently in different countries, and typically attracts less government interest and government involvement than large hydropower. But small hydropower is already common practice in some countries. For example, China's small hydropower should be considered common practice due to the capacity that already exists in the country, and China's plans to continue to build small hydropower as the main way to meet China's rural electrification goals.

3.3.1 How common practice is being assessed

In China, 739 hydropower projects in China passed the common practice assessment and were successfully registered under the CDM. Many of them passed the test by defining "similar" projects narrowly, and then describing how the proposed CDM project faces more hardship in at least one way compared to each of the projects that are still considered similar to it. For example, Longjiang 240 MW Hydropower Project in Yunnan Province (CDM ref #4859) in China's southwest noted eleven medium-sized hydropower projects (50-300 MW) that started construction in the province after 2002 (when structural changes were made to China's electric power sector) and were in operation by 2008 (narrowly defined assessment boundaries). Of these eleven projects, seven projects are excluded from the analysis because they are in the CDM pipeline, registered under a voluntary offsets program, or sold power to a different grid within China. The following essential distinctions are then described between the proposed CDM project and the four remaining "similar" projects: the proposed CDM project expected lower financial return compared to one project, was offered a lower tariff compared to two projects, and expected a higher cost per kilowatt compared to the last similar project. Other reasons commonly used by Chinese hydropower project developers to describe their projects as distinct include that the expected capacity factor is lower than for other projects, and that the project developer is a private sector developer while most hydropower is built by state owned enterprises with preferential treatment from the government. Each of these distinctions may indeed be factually true for a particular comparison between two projects. However, if a project is considered distinct if it less attractive than a similar project in only one way among many, it can always prove that it is distinct. By allowing "similar" to be defined so narrowly, and "essentially distinct" so broadly, practically any project can show it is not common practice, even if it is sitting in a sea of hydropower development.

It is important to mention one more problem with the way common practice assessments are carried out. If additionality testing were perfectly accurate, it would be appropriate to leave out other similar projects that are in the CDM pipeline from the common practice analysis. In China, well over half of all hydropower projects that came on line in 2007 are in the CDM pipeline (Bogner & Schneider 2011). If some of these projects are in fact non-additional, which we are arguing could easily be the case for a large proportion of them, then they would be incorrectly excluded from the common practice analysis and the effectiveness of the common practice test as a credibility check would be compromised.

Our assessment of how the common practice test is being applied to hydropower projects in China indicates that the common practice assessment is not being used in a meaningful way. The boundaries defining what projects are "similar" to the proposed CDM project must be judged conservatively in the conditions of the particular sector and technology. A change in the structure of a sector, such as the breakup of the national Chinese power company in 2002, should not mean that projects built after 2002 are dissimilar from those built before 2002, since

hydropower development was supported before and after the change in the sector. Projects under construction and other projects in the CDM pipeline should be included in the common practice assessment. If a technology is deemed common practice, then projects using that technology should be considered common practice without the ability to show that they are “essentially distinct” which has been shown to be easy to do and therefore not meaningful.

3.4 DISCUSSION

In examining the additionality of large hydropower CDM projects we find three main reasons why large hydropower does not meet the CDM’s additionality requirements:

- Financial return is not a good predictor of whether a project will be built because non-financial factors have a large influence on the decision to develop large hydropower projects.
- Uncertainty in investment analysis inputs allows project developers to choose input values strategically in order to show that their projects are less financially viable than they really are. These first two points mean that the investment analysis is inappropriate and inaccurate for large hydropower.
- Large hydropower is a well-established technology that is heavily promoted by governments and therefore does not meet the requirement that CDM projects should not be common practice.

Small hydropower typically benefits from less political backing and is thus more likely to involve private developers for whom financial return is more predictive of the development decision. However, the investment analysis is unreliable for small hydropower for the same reason as for large hydropower – because of uncertainty in input values. In some countries small hydropower is already being built at substantial rates and therefore should not pass the common practice test. In countries where there already is development of small hydropower projects, such as in China and India with supportive subsidies and tariffs, allowing small hydropower project to register under the CDM means potentially allowing a substantial portion of non-additional projects to register. Instead, types of small hydropower, defined by their size and location, and perhaps other objective characteristics, should be identified that are not currently being built, but which could be effectively enabled by the help of carbon credits. The effects of the CDM should be evaluated over time and should be clearly discernable for those projects types to continue to be eligible for crediting.

4 SOCIAL AND ENVIRONMENTAL IMPACTS OF HYDROPOWER

4.1 ENVIRONMENTAL IMPACTS

Dams, interbasin transfers and diversion of water for irrigation purposes have resulted in the fragmentation of 60% of the world’s rivers (Revenga et al. 2000). In the following sections we summarize the main environmental impacts of hydropower plants.

4.1.1 Impacts by size and type of hydropower plant

It is difficult to correlate the damage caused by dams to their size or type, as the impacts depend on local conditions. Generally small dams for non-energy purposes are considered to be less environmentally damaging than large dams and hydropower dams, but there have been

fewer studies documenting the impacts of smaller dams (Kibler 2011) and run-of-river dams. Gleick (1992) found that small hydropower facilities in the United States (< 25 MW) tended to exert greater ecological cost per unit of electricity produced compared to larger projects. A comparison of small and large hydropower projects on the Nu River in China also found that small projects more adversely impacted habitats, water quality and hydrology on per megawatt basis, relative to large dams (Kibler 2011).

Also, small hydropower projects are subjected to fewer regulations and less scrutiny in many countries. In China, small hydropower plants (< 50 MW) can be approved at the prefectural or provincial level, rather than the national level (Kibler 2011) and therefore are subjected to fewer additional checks (Kibler 2011). Small projects are permitted as individual projects, therefore cumulative impacts of multiple dams within a watershed are not considered. While large projects in India are granted clearance from the central government and required to carry out an Environmental and Social Impact Assessment, small projects are not required to conduct such an assessment except under special conditions (MOEF 2006). Projects between 25 and 50 MW require clearance from the environmental entity of the state that the project is located in, while projects smaller than 25 MW do not require any permits (MOEF 2006).

Run-of-river hydropower plants are generally less damaging than reservoir power plants, because it is not necessary to flood large areas upstream of the project for storage. Yet in some cases run of river impacts can also be severe due to river diversion over long stretches of the river. Also there is no standard defining the maximum storage size allowed for a RoR plant. Thus there have been cases of developers taking advantage of this ambiguity to misclassify their project as RoR so that it appears more environmentally benign (McCully 2001).

4.1.2 Impact of reservoirs

Dams have major impacts on the physical, chemical and geomorphological properties of a river (McCully 2001, WCD 2000). Environmental impacts of dams have largely been negative (WCD 2000). Worldwide, at least 400,000 square kilometers have been flooded by reservoirs (McCully, 2001). Impacts of hydro power projects extend to the construction of the support infrastructure including the construction of roads and power lines (Egré and Milewski 2002). Other secondary impacts include clearing of land upstream by communities that have been displaced (WCD 2000, McCully 2001). Such clearing can lead to further loss of biodiversity and increases in erosion.

Large dams with reservoirs significantly alter the timing, amount and pattern of riverflow. This changes erosion patterns and the quantity and type of sediments transported by the river (WCD 2000, McCully 2001, Kumar et al 2011). Sedimentation rate is primarily related to the ratio of the size of the river to the flux of sediments (McCully 2001, Kumar et al 2011). The trapping of sediments behind the dam is a major problem (WCD 2000, McCully 2001, Kumar et al 2011). Every year it is estimated that 0.5 to 1% of reservoir storage capacity is lost due to sedimentation (Mahmood 1987). Trapping of sediments at the dam also has downstream impacts by reducing the flux of sediments downstream which can lead to the gradual loss of soil fertility in floodplain soils.

Dams can also lead to changes in temperature and chemistry of the water in the reservoir and downstream. These changes often create more favorable conditions for non-native species (Thomas 1998). For example, aquatic weeds such as water hyacinths and orange fern have

become problematic in tropical and African reservoirs (WCD 2000, McCully 2001). A rise in temperature and accumulation of nutrients in the reservoir can cause algal blooms (WCD 2000 McCully, 2001), which in turn can lead to anoxic conditions during decomposition. Increases in certain types of bacteria in reservoirs can lead to the release of mercury from sediments and lead to the bio-accumulation of mercury in fish, a common problem in reservoirs (WCD 2000, McCully 2001).

4.1.3 Impact of river diversion

While both RoR and reservoir types of hydropower dams may divert water, this is always the case with RoR plants, since they seek to increase kinetic energy with an increased head. The length of diversion can range from a few meters or less to kilometers (km). For example, the Teesta V RoR dam in northeastern India diverts water for a 23 km long stretch of the river (Neeraj et al 2010). Eventually the diverted water is returned to the river. There have been fewer studies documenting the impacts of RoR and diversion projects. Nevertheless impacts can be significant. Often downstream flows are reduced considerably or even completely eliminated during certain periods of time with sudden intervals of high flows (Englund and Malmqvist 1996, Kibler 2011). Such drastic variability in water flow impacts the structure of aquatic ecosystems often leading to a loss of biodiversity (Englund and Malmqvist 1996, Kibler 2011). A decrease in fish populations has been observed in dewatered reaches below diversions (Amodovar and Nicola 1999, Kubecka et al 1997, Anderson et al 2006). After long periods of little to no flow some species may not be able to recover and go extinct (Kibler 2011). Also, under normal conditions, increased sediment transport from low to intermediate flows provides a warning to aquatic organisms that high flows may follow. Abrupt changes from low to high flows obliterate this cue, making it difficult for organisms to respond to impending environmental changes (Kibler 2011).

4.1.4 Impact on fisheries

Dams and river diversion can impact freshwater, as well as marine fisheries. Estuarine and marine fisheries are dependent on estuaries and rivers as spawning grounds and the transport of nutrients from the river to the sea. For example, the productivity in Mediterranean coastal waters is lower due to the reduction of nutrients transported to sea because of the construction of the Aswan dam (Aleem 1972, Drinkwater and Frank 1994).

Migratory fish are especially vulnerable to the impacts of dam construction. Dams can prevent migrating fish such as salmon and eel to reach their spawn grounds (WCD 2000). A survey of 125 dams by the WCD reported that blocking the passage of migratory fish species has been identified as a major reason for freshwater species extinction in North America. Lower catch is a common side effect of dams and has been reported worldwide (WCD 2000). There have been cases where fishery production below a dam has increased due to controlled discharge of the sediments. For example at Tucurui Dam in Brazil there have been an increase in the productivity of the fishery, but there are fewer number of species found (WCD 2000).

4.1.5 Impacts of multiple dams

Few studies have analyzed the cumulative impacts of multiple dams on a particular river, but the WCD (2010) has documented some. Placing 24 dams on the Orange-Vaal River in South Africa has led to changes in temperature on almost two-thirds of the river (2,300 km), which

affects the habitat of flora and fauna. Cumulative impacts of multiple small dams is especially important, since multiple small dams are often built on one river and its tributaries to increase power output. An analysis of proposed small (< 15 MW) hydropower projects on the Salmon River in the United States found that the combined effect of the dams proposed on that river could exceed those associated with the sum of the effects of each single project on their own (Irving and Bain 1993). Further studies are needed to increase our understanding of the interplay between multiple small dams.

4.1.6 Greenhouse gas emissions from reservoirs

Freshwater reservoirs can emit substantial amounts of the greenhouse gases methane and carbon dioxide as organic matter submerged in a reservoir decays under anaerobic and aerobic conditions, respectively (St. Louis et al. 2000, Fearnside 2004, Giles 2006).

From the limited number of measurements, GHG emissions from hydropower reservoirs in boreal and temperate region are low relative to the emissions from fossil fuel power plants, but higher relative to lifecycle emissions from wind and solar power (Mäkinen and Khan 2010). Tropical reservoirs with high levels of organic matter and shallow reservoirs have higher emission levels (Soumis et al. 2005). A recent compilation of greenhouse gas emissions from reservoirs found a correlation between the age of the reservoir and latitude (Barros et al. 2011). Younger reservoirs and those in low latitudes are the highest emitters. For example, one study of four Brazilian dams in the Amazon, showed that the GHG emissions factor of the electricity produced by those hydropower dams exceed those from a coal-fired power plant (Fearnside 2004, Kemenes et al. 2007).

To account for these GHG emissions the CDM Executive Board uses a threshold criterion to determine the eligibility of hydroelectric plants for CDM projects. Table 1 below summarizes the thresholds.

Table 1: How GHG emissions from hydropower projects are treated under the CDM
(Source: Mäkinen and Khan 2010).

Power Density (W/m ²)	CDM Rules
< 4	Excluded from using currently approved methodologies
4-10	Allowed to use approved methodologies, but project emissions must be included at 90 g CO ₂ eq/kilowatt hour
> 10	Allowed to use approved methodologies and project emissions can be neglected.

Projects with low power densities (< 4 Wm²) are not explicitly excluded from the CDM, but developers of such projects would need to create a new methodology and gain approval in order to apply for registration under the CDM. We tested the thresholds on a number of tropical hydropower reservoirs and found that they are effective at preventing projects with high greenhouse gas emissions from entering the CDM pipeline and can also account for emissions from hydropower reservoirs with power densities lying in the middle range.

4.2 SOCIAL IMPACTS

Similar to other large infrastructure projects, dams have both negative and positive social impacts. The benefits of hydropower include electricity from a local resource that has negligible

GHG emissions in most cases, delivery of peak power, and the avoidance of the health and environmental impacts associated with fossil fuels, especially coal. Multipurpose dams can also reliably deliver water and flood control as well as other ancillary services. On the other hand, displacement, loss of livelihood, poorer health and loss of cultural heritage²⁹ are some of the worst impacts (WCD 2000, McCully 2001, Kumar et al 2011). Often groups that bear the social and environmental costs of dams are not the ones who reap the benefits. Poor, vulnerable groups such as rural populations, subsistence farmers, indigenous communities and ethnic minorities often bear a disproportionate share of the negative impacts, while the main beneficiaries are urban dwellers, commercial farmers and industries (WCD 2000).³⁰

4.2.1 Displacement

It is estimated that 40-80 million people have been physically displaced by dams worldwide (WCD, 2000). In India and China alone, 26-58 million people have been displaced between 1950-1990 due to dam projects (Fernandes and Paranjpye 1997). These figures do not include displacement from other factors such as construction of canals, powerhouses or project infrastructure. In-depth case studies of eight large dams on four continents by the WCD (2000) found that in each case the expected number of displaced persons was initially underestimated by 2,000 – 40,000 people. Among dams funded by the World Bank, 47% more people were displaced than initially estimated (WCD 2000). The WCD case studies show that downstream communities, landless peasants and indigenous people are often not counted as project-affected and therefore often do not receive compensation. The impacts for down-stream communities are often only clear after the dam comes into operation and often impacts worsen over time. (WCD 2000). Resettlement has mostly been involuntary and there has been little meaningful participation of those affected in the resettlement and rehabilitation process (Cernea 1999, Bartholeme et al. 2000, Scudder 2005). In the most extreme cases, violence has been employed to force eviction.³¹

Compensation usually only occurs once as a cash payment or in the form of an asset such as housing and/or land (Bartolome and Danklmeier 1999, WCD 2000b). Lands provided for resettlement are often resource-depleted and environmentally degraded areas (WCD 2000). The focus of resettlement programs is on physical relocation, rather than economic and social development (Cernea 2000, WCD 2000b). In China, almost half (46%) of those displaced are living in extreme poverty (Driver 2000). In India, 75% of people displaced by dams have not been rehabilitated³² (Cernea 2000). The larger the number of people displaced from a project, the less likely that resettlement will be adequate due to lack of enough suitable land (WCD 2000).

²⁹ The socio-cultural impacts of displacement by large dams on communities has been poorly documented because socio-cultural impacts are intangible, making them difficult to monetize (McCully 2001, Koenig and Diarra 2000, Pandey 1998). Displacement often results in the loss of sacred land and common property resources (Caspary 2007). A study of a village displaced by the Rengali Dam in eastern India found a breakdown in family and community structures (Behura and Nayak 1993). Alienation and marginalization are major risks for displaced communities (Cernea 1999).

³⁰ For example, although indigenous people are 8% of India's population, they comprise 60% of those displaced by dams there (WCD 2000a). Almost all of the large dams in the Philippines that have been built or proposed are on the land of indigenous people (WCD 2000a).

³¹ For example: Over 350 Maya Achi people were killed during the forced eviction at the Chixoy Dam Site in Guatemala (Stewart et al. 1996). Over 1,000 people of the Ngobe tribe have been forcibly removed from their homes due to construction of Changuinola Dam in Panama (UN 2009).

³² Rehabilitation refers to economic, social and psychological adjustment after displacement.

4.2.2 Health impacts

Impacts on human health from large dams include an increase in vector-borne diseases in tropical regions, lower water quality and food insecurity (WCD 2000). The edge of tropical reservoirs and irrigation canals provide ideal conditions for disease-vectors such as insects and snails. McCully (2001) has documented numerous examples of the spread of schistosomiasis³³ after the construction of dams. Increases in transmission of malaria due to the construction of reservoirs and irrigation canals in malaria-prone areas have also been reported (World Bank 1999). Other health impacts include the release of toxins by cyanobacteria³⁴ due to rapid eutrophication in new dams and the bioaccumulation of mercury in fish, which is released from soil by bacteria decomposing organic matter in the reservoir (WCD 2000).

4.3 CONCLUSION

While hydropower dams can produce power with low GHG emissions and can in the case of multi-purpose dams also deliver flood and irrigation control, the adverse social and environmental costs can be substantial, as we have described above. Such negative impacts are not compatible with the promotion of sustainable development, one of the core objectives of the CDM. Evidence indicates that on the whole the CDM has not effectively fulfilled its sustainability objective (Boyd et al. 2009, Schneider 2007). This seems to hold true for hydropower projects as well. There is much anecdotal evidence that some hydro projects have been registered under the CDM despite their significant negative impacts. Table 2 gives a few examples of such projects.

The increase in opposition to large dams in developing countries by projected-affected persons and their supporters has led to the development of frameworks and standards to analyze and minimize project impacts that are dam specific, most notably the World Commission on Dams (WCD) criteria and guidelines. In the next section we discuss how the EU has used the WCD criteria to screen hydro projects that sell CERs into the EU-ETS. We also include a discussion of how the EU's process could be improved to increase the effectiveness of the screening.

³³ Schistosomiasis or bilharzia, is a parasitic disease caused by trematode flatworms. Schistosomiasis causes damage to the bladder, kidneys, liver, spleen and intestines.

³⁴ Humans are affected with a range of symptoms including skin irritation, stomach cramps, vomiting, nausea, diarrhea, fever, sore throat, headache, muscle and joint pain, blisters of the mouth and liver damage.

Table 2: A selection of registered hydropower projects with considerable adverse impacts

Allain Duhangan Dam (192 MW), India, Approved May 2007

The project has suffered from inadequate rehabilitation of affected villages and environmental violations. The Office of the Compliance Advisor/Ombudsman of the International Finance Corporation (2005) verified that the project developer had not ensured enough irrigation and drinking water for affected villages. The project was also temporarily halted and fined for violations of Indian forest conservation law due to illegal felling of trees, dumping of waste and road construction.³⁵

Bhilangana (22 MW), India, Approved January 2007

Affected villagers never consented to the project and actively opposed the project.³⁶ Villagers opposed to the project were jailed multiple times and 29 people were arrested in November 2006 were forced to sign a document stating that they would stop resisting the project.³⁷ Significant physical abuse by the police was reported.³⁸

Jorethang Loop (96 MW), India, Approved February 2008

A survey of the affected villages by an Indian NGO after the public hearing found that many villagers were not informed about the meeting (McCully 2008). Requests by villagers and NGOs of project documents including the environmental impact assessment were ignored by the project developer (McCully 2008).

Xiaoxi (135 MW), China, Approved December 2008

A field report commissioned by International Rivers³⁹ documented problems include the forced eviction of 7,500 people, a failure to restore pre-eviction incomes, arbitrary and inadequate compensation for resettlers, a lack of legal recourse for those who suffered losses, and a non-independent EIA process marred by conflict of interest.

El Chaparral (65 MW), El Salvador, Approved March 2010

The public consultation process has been criticized as being neither open nor transparent. Adverse impacts include the displacement of 10,000 families in three municipalities, habitat loss of endangered flora and flooding of archaeological artifacts. The dam has divided and destabilized the community between those in favor and those opposed.⁴⁰

Barro Blanco (29 MW), Panama, Approved January 2011

Although the dam site is in an area recognized by the Panamanian government as collective property of the Ngobe indigenous people, only members of non-indigenous population were consulted. The project developer has also been accused of human rights abuses. An investigation by the European Investment Bank into human rights abuses at the dam site resulted in the project developer retracting their loan request and only then applied for registration under the CDM.⁴¹

³⁵ <http://www.internationalrivers.org/en/blog/payal-parekh/cdm-changing-lives-worse>
Hydropower in the CDM: Examining Additionality and Criteria for Sustainability

5 ASSESSING THE EUROPEAN UNION'S SCREENING CRITERIA FOR HYDROPOWER

In order to minimize the negative impacts of hydropower effective screening criteria are needed. Yet assessing and mitigating the social and environmental impacts of hydropower projects is difficult and complex at best. Deciding whether the benefits of constructing a hydropower plant outweigh the costs requires multiple factors to be considered and weighed. Many of the impacts such as loss of traditional ecological knowledge or biodiversity are difficult to monetize and compare against one another (Koenig and Diarra 2000, Pandey et al. 1998). A cost-benefit approach is also problematic in cases when those that bear the social and environmental costs of a dam are not the same as those who benefit. As shown in the previous section, neither size (installed capacity) nor type are effective predictors of environmental and social impacts of hydropower dams. Additionally, empirical data from which to draw robust relationships is sparse (Poff and Hart 2002). Therefore classifying environmental and ecological impacts of dams based objective criteria such as dam size or type is difficult because impacts are influenced by the interactions among natural processes, dam characteristics and management practices (Poff and Hart 2002).

In the following sections we discuss efforts that have been made to develop such screening criteria. We summarize the World Commission on Dams criteria and discuss how they have been implemented in the European Union. In our analysis on the effectiveness of such criteria we also highlight the Gold Standard stakeholder process and discuss how the evaluation and verification processes could be improved to strengthen the effectiveness of such screening criteria.

5.1 WORLD COMMISSION ON DAMS CRITERIA

In 1998 the International Union for the Conservation of Nature (IUCN) and the World Bank established the World Commission on Dams (WCD) in response to growing public scrutiny of large dams. The mandate given to the Commission was to

- *review the development effectiveness of large dams and assess alternatives for water resources and energy development; and*
- *develop internationally acceptable criteria, guidelines and standards for the planning, design, appraisal, construction, operation, monitoring and decommissioning of dams.*

Dams and Development (WCD, 2000), the report of the commission includes a comprehensive framework for energy and water planning to ensure that adverse impacts from dam projects are minimized and the benefits and costs are more evenly distributed among

³⁶ SANDRP Comments on Bhilangana PDD, see <http://www.internationalrivers.org/global-warming/carbon-trading-cdm/sandrp-comments-bhilangana-hydro-project-uttaranchal-india>

³⁷ Asian Human Rights Commission, available at <http://www.humanrights.asia/news/urgent-appeals/UP-164-2005>

³⁸ Ibid.

³⁹ <http://www.internationalrivers.org/en/node/3006>

⁴⁰ CESTA Letter to CDM Board on El Chaparral Hydroelectric Project, see <http://www.internationalrivers.org/en/am%C3%A9rica-latina/cesta-letter-cdm-board-el-chaparral-hydroelectric-project-el-salvador>

⁴¹ Letter to the CDM Executive Board, see <http://www.internationalrivers.org/node/6215>

stakeholders. The report is considered the most comprehensive, independent and thorough review of large dams to date.⁴²

The WCD criteria go beyond a simple Environmental Impact Assessment (EIA), as it creates a process meant to address the complex set of considerations involved in dam development decisions. These include the recognition that most dams have negative impacts, and that the distribution of costs and benefits among different sectors of society is often unequal. Seven strategic priorities based on principles of equity, efficiency, participatory decision-making, sustainability and accountability were defined. They are:

1. **Gaining Public Acceptance:** There must be public acceptance of the project by affected people. Indigenous and tribal communities should give free, prior and informed consent.
2. **Comprehensive Options Assessment:** All possible options for water and energy resource management should be considered. Social and environmental aspects should be weighted equally as financial and economic factors.
3. **Addressing Existing Dams and Hydroelectric Projects:** New projects should be considered only after existing projects are at maximal efficiency.
4. **Sustaining Rivers and Livelihoods:** Location of a new dam should be chosen so as to minimize adverse environmental and social impacts.
5. **Recognizing Entitlements and Sharing Benefits:** Projected affected persons must be adequately resettled and rehabilitated and mitigation strategies should be implemented to sustain ecosystems and livelihoods.
6. **Ensuring Compliance:** Compliance by the developer of regulations, guidelines and agreements must be ensured.
7. **Sharing rivers for peace, development and security:** There should be cooperation and agreement for dam construction on transboundary rivers.

The WCD developed a decision-making process with five stages in order to fulfill the priorities. They are 1. Needs assessment; 2. Selection of alternatives; 3. Project preparation; 4. Implementation of project; 5. Operation of project. A further set of 26 guidelines outlines how to assess options, plan and implement dams projects in order to fulfill identified criteria for each stage of decision-making.

This short summary of WCD substance and process criteria make it clear that WCD requirements are extensive and complex. In the next section we discuss how the EU has used these criteria for their requirements for large CDM hydro project that wish to sell their CERs into the EU-ETS.

5.2 THE EUROPEAN UNION'S WCD CRITERIA TO ASSESS CDM HYDRO PROJECTS

⁴² The World Commission on Dams was a multi-stakeholder body that established the most comprehensive guidelines for dam building. The twelve members of the Commission were drawn from industry, government, academia and civil society. The Commission created a 68 member Stakeholder Forum with participants on various sides of the dam debate that served as an advisory group to the Commission. To gather information and data for the assessment, the WCD organized four regional consultations, performed case studies of eight large dams on five continents, commissioned country studies of China and India, undertook 17 thematic reviews of a wide range issues from environmental to institutional issues and conducted a global survey of 125 dams in 56 countries to "cross-check" the findings of individual studies.

The EU-ETS, launched in 2005, covers about 50% of the EU's CO₂ emissions and is currently the largest cap-and-trade system in the world and also the largest buyer of CERs.⁴³ The EU has placed several restrictions on what types of CERs can be used in the EU-ETS. To address concerns that hydropower projects can have serious environmental and social impacts, the EU added additional requirements for projects larger than 20 MW:

[...] Member States shall, when approving such project activities, ensure that relevant international criteria and guidelines, including those contained in the World Commission on Dams November 2000 Report "Dams and Development A New Framework for Decision-Making", will be respected during the development of such project activities. (Article 11b(6) of the Linking Directive)

The issue of how and if to restrict the use of credits from CDM hydro projects was contentious and the opinions between Member States varied considerably.⁴⁴ The final document was approved in 2004 and requires WCD criteria to be met for hydropower plants that are larger than 20 MW.

The language of Article 11b(6) of the linking directive is vague. For example, the text states that Member States are obliged to comply with 'relevant' international criteria and guidelines, 'including' those contained in the WCD. Up until 2008 there was no harmonized approach in the EU and the requirements for large hydro projects were interpreted differently by each Member State and implemented with varying degrees of rigor. This raised doubts about the environmental and social integrity of CERs entering the ETS and led to uncertainty and fragmentation in the European CER market. Many carbon exchanges excluded CERs from large hydro for fear that individual EU member states may refuse to accept them. In other words, "there was a danger that mutual recognition by Member States of national project approval decisions might break down" (Scott, 2011).

While the WCD evaluation and criteria are very comprehensive (the report is several hundred pages long), they do not include an evaluation process that could be used to assess WCD compliance ex-post. In 2008, the EU launched an effort to do exactly that: operationalize and harmonize the WCD criteria for the evaluation of large CDM hydropower projects. The European Commission launched an ad-hoc process of 'voluntary coordination' of Member State regulation of large hydro projects. In late 2008, all 27 Member states adopted uniform guidelines on the application of the linking directive's hydropower requirements (EU, 2008a), and a common compliance report template (EU, 2008b). All EU Member States agreed to use these harmonized criteria as of 1 July 2009:

⁴³ The EU-ETS is linked to the CDM via its 'linking directive' (Directive 2004/101/EC). This makes it possible for installations covered under the EU-ETS to use a certain proportion of CERs to meet their emission reduction obligations. In the 2nd and 3rd trading periods (2008-2020), up to half of the EU-ETS emission reductions can be met by using CERs and credits from Joint Implementation (JI). About 277 million CERs have been surrendered in the EU-ETS to date. 2% of those credits have come from large hydro projects (Sandbag, personal communication). Total demand for CERs in the EU-ETS until 2020 is estimated to be around 2.7 billion. In the sectors not covered under the ETS, such as agriculture and transportation, it is the EU member states that can choose to purchase CERs to achieve compliance with European emission reduction obligations.

⁴⁴ Germany, the Netherlands, Sweden and Belgium pushed for the inclusion of WCD requirements whereas Spain, France, Portugal, Italy, Greece, Austria, Finland and Estonia were opposed. There was also controversy about the threshold (10 MW or 20 MW) and a particularly fierce debate was held over whether compliance with WCD standards should be mandatory or whether Member States should simply be required to take them into account. For a more detailed history on the negotiations around the linking directive, see Hægstad Flåm, 2007.

Once a project activity has received a Letter of Approval (LoA) from an investor country upon the submission and positive assessment of a validated Article 11b(6) Compliance Report, all Member States agree to accept CERs/ERUs from this project for use in their national registries under the EU ETS. (EU WCD guidelines, 2008)

This means that in addition to the CDM application materials required by the UNFCCC, project developers are required to submit an Article 11b(6) Compliance Report to the Designated National Authority (DNA) of the Member State. The Compliance Report must be validated by a Designated Operational Entity (DOE).

The *Guidelines on a common understanding of Article 11b (6) of Directive 2003/87/EC as amended by Directive 2004/101/EC*, as the guidelines are officially called, include nine pages of guidelines including background information on the linking directive and the WCD spells out the procedural and content requirements needed for compliance.

The template of the compliance report, called *Compliance Report Assessing Application Of Article 11 B (6) Of Emissions Trading Directive To Hydroelectric Project Activities Exceeding 20 MW* is 17 pages long and includes specific questions on the seven strategic priorities of the WCD to evaluate compliance, these include:

Section 1: Description of the project, includes questions on dam height, total submerged area, number of displaced inhabitants and information on related infrastructure being build (e.g. access roads).

Section 2: Assessment of compliance with the WCD criteria:

1. Gaining public acceptance, includes questions on the number of people affected by the project, how stakeholders were identified, informed and involved in the in the decision-making process, and how compensation and benefit agreements correspond with the identified needs and rights of the stakeholders negatively affected upstream and downstream due to the project. It also includes a question on how transparency was ensured.

2. Comprehensive options assessment, includes questions about the needs for hydropower, potential alternatives and reasons for project choice and site selection.

3. Addressing existing dams/hydroelectric projects, includes questions on national monitoring requirements for social and environmental issues and questions about how social and environmental issues of existing dams have been resolved.

4. Sustaining rivers and livelihoods, includes questions about impact assessment (environmental and social) and cumulative impacts.

5. Recognizing entitlements and sharing benefits, includes questions about mitigation, resettlement and development plans and compensation packages.

6. Ensuring compliance, includes questions about complying with relevant laws, regulations, agreements (including resettlement and compensation agreements) and about the legal nature of the compensation agreements.

7. Sharing rivers for peace, development and security, includes questions about trans-boundary impacts

The EU took a laudable and important step in developing these two documents to operationalize the WCD guidelines. It is a difficult and complex task to come up with guidance and requirements that capture the criteria in a meaningful and yet implementable way. Although

the harmonization effort has led to a more uniform application of the WCD guidelines, it did not succeed in fully capturing the criteria set out in the WCD. The shortcomings of the implementation documents can probably at least partially be explained by the process that was used to develop the current guidelines and template. The process that led to the adoption of the EU's WCD guidelines and compliance report template was informal and notably lacked transparency and public consultation.⁴⁵ For example, neither the European Parliament nor direct representatives of dam-affected peoples were involved (Scott 2011).

In order to avoid or minimize harm of such complex projects as hydropower, the WCD requires that planning and implementation processes be based on effective and fair stakeholder involvement, participatory decision-making and accountability. The EU evaluation is a one-time, ex-post check to make sure that the process was carried out in a satisfactory manner. Ensuring WCD requirements have been met ex-post is difficult given the complexity of the processes, and the subjectivity involved with assessing whether the WCD strategic principles were met in a meaningful way. In the following section we suggest concrete improvements in EU's assessment of WCD compliance.

5.3 DISCUSSION OF THE EU WCD EVALUATION REQUIREMENTS

5.3.1 Independent evaluation of WCD criteria is needed

The WCD report requires that projects be appraised by auditors that are institutionally and financially independent from the project developers. The EU guidelines require that the project developer hire and pay a Designated Operational Entity (DOE) to conduct the assessment (Scott 2011, Herz and Schneider 2008). This process is also used under the UNFCCC for the validation and verification of CDM projects. An inherent conflict of interest exists when those performing or verifying project assessments are hired directly by those with vested interests in the projects going forward. The lack of independence of these auditors has been criticized as one of the fundamental flaws of the CDM process (see for example, Schneider 2009 and Schneider and Mohr 2010). In informal conversations with the authors, project developers freely admitted that it is quite simple to get a WCD validation from a DOE. Also in our interviews and e-mail exchanges with European DNAs, we did not find a single instance where a project was rejected by a DNA because of an insufficient WCD evaluation.

The independence of the verifier is especially important if the assessment being made involves subjective judgments, as does the WCD evaluation. For example, while the WCD requires stakeholder participation at all stages of project development, evaluating the quality of that involvement can be quite subjective. The public consultation requirement can be deemed fulfilled even if community members were not properly informed of the impacts of the projects or given the opportunity to meaningfully express their opinions, or if opinions received are ignored when project design decision are made.

⁴⁵ There were no formal rules of procedure and no minutes of the various meetings were kept. The main actors included the European Commission and representatives from the Member States. A number of stakeholders were invited to participate, yet aside from 2 NGOs (International Rivers and WWF) these stakeholders were limited to carbon market participants, (project developers and consultants).

Recommendations on improving independent verification

- The designated national authority (DNA) of the buyer country, or another government agency, rather than the project developer, should choose WCD auditors. Project developers should be charged a fee that covers the costs of those audits and the oversight tasks of the government agency.
- The quality of WCD verification reports should be reviewed carefully. Future verifier hiring decisions should be based on whether previous assessments were performed rigorously and conservatively.
- Verifier performance should be evaluated periodically during a process of re-accreditation.
- The accreditation and re-accreditation processes should involve conflict of interest assessments.

5.3.2 Improving stakeholder involvement and evaluation of stakeholder involvement

Public consultations are difficult to conduct effectively even when those conducting them have the best of intentions of creating a participatory and informed decision-making process. Consultations are especially difficult to conduct effectively when there are power imbalances among members of the affected communities. Those who are more powerful often can more forcefully or effectively express their opinions (Mosse 1995, Rosenberg 2001) and the consultation leader must work to ensure a range of voices are heard.

Sound and thorough stakeholder involvement is especially important for hydro projects with their potential to cause serious harm to local ecosystems and communities. The WCD emphasizes that throughout project planning and implementation project-affected people must have the opportunity to actively participate in the decision-making process. Where projects affect indigenous and tribal peoples, decision-making processes must be ‘guided by their free, prior and informed consent’ (WCD 2000). The EU compliance report template asks project developers to report on a variety of issues involving the participation of stakeholders in the decision-making process, but it falls short of requiring that project developers demonstrate the acceptance of key decisions by them. The template for example asks: *Were compensation and benefit agreements planned in consultation with affected groups?* And: *Were the affected people satisfied with the compensation packages?* But the template does not require that compensation packages had to be mutually agreed with all recognized adversely affected people, but had merely to be planned ‘in consultation’ with affected people. Furthermore, the report template does not require proof of ‘free, prior and informed consent’ from indigenous or tribal peoples.

The stakeholder process under the UNFCCC has long been criticized for being inadequate. To address and potentially improve guidance and requirements for stakeholder involvement, the CDM Executive Board recently launched a public call for inputs on how stakeholder consultations could be improved. Nevertheless the CDM Executive Board has continued registering projects that were implicated in creating significant harm; for example the Board recently registered a project that has been linked with serious human rights abuses (Bajo Aguan #3197⁴⁶) and several other projects that have been criticized for inadequate stakeholder

⁴⁶ <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1260202521.42/view> Also see: <http://www.fian.org/news/press-releases/united-nations-under-pressure-to-denounce-human-rights-abuses-in-carbon-offsetting-scheme>

consultations in the face of stiff local opposition to the project (for example Barro Blanco #3237,⁴⁷ and Rampur hydro-electric project #4568⁴⁸).

It seems that the EU should be legally required to guarantee transparency and public participation: The EU has ratified the UN/ECE Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention). The Aarhus Convention is a multilateral environmental agreement that grants the public rights regarding access to information, public participation in decision making and access to justice.⁴⁹ Yet the EU's harmonized procedures for approval of hydro projects do not specify clear mechanisms for the public to participate in credit application decisions, as required by the Aarhus Convention.

Recommendations on improving stakeholder involvement

More detailed requirements on how to conduct and verify stakeholder consultations and how to resolve contentious issues are especially important because WCD compliance assessments involve subjective judgments. The guidelines for carrying out and auditing stakeholder consultations prepared by the Gold Standard⁵⁰ (GS) could serve as a template for examining whether stakeholder involvement has been adequate. The GS guidelines require two stakeholder consultations. The first meeting is similar to what the UNFCCC requires, but much more guidance for organizing the meeting and content to be covered during the meeting is provided by GS. The second meeting is an opportunity for stakeholders to give feedback on how their comments were incorporated. The developer is required to submit a report detailing the outcome of the stakeholder consultations. The Gold Standard furthermore requires a "No Harm" assessment, guided by the UNDP Millennium Development Goals. Human rights, labor standards, environmental protection, and anti-corruption are assessed. The project developer is required to assess the risk of breaching 11 safeguarding principles and identify mitigation measures. For example, respect of rights of indigenous people and no involuntary settlement are principles listed under for the human rights category.

- Verifiers should receive additional guidelines and requirements on how to assess stakeholder involvement. These could be modeled and expanded based on Gold Standard processes and requirements.

⁴⁷ <http://cdm.unfccc.int/Projects/DB/AENOR1261468057.59/view> Also see unsolicited letter by CDM Watch to the CDM Executive Board: http://www.cdm-watch.org/wordpress/wp-content/uploads/2011/02/Unsolicited-letter_Barro-Blanco-PA-3237_March-2011.pdf.

⁴⁸ <http://cdm.unfccc.int/Projects/DB/BVQI1299859361.8/view> For more information see: <http://www.internationalrivers.org/node/1428>

⁴⁹ Article 1 of the Convention states:

In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.

Access to information: any citizen should have the right to get a wide and easy access to environmental information. Public authorities must provide all the information required and collect and disseminate them and in a timely and transparent manner.

Public participation in decision making: the public must be informed over all the relevant projects and it has to have the chance to participate during the decision-making and legislative process.

Access to justice: the public has the right to judicial or administrative recourse procedures in case a Party violates or fails to adhere to environmental law and the convention's principles. (Rodenhoff 2003).

- The EU should require formal agreements regarding compensation and rehabilitation plans and the distribution of benefits from the dam between the project developer and project-affected persons in order to demonstrate acceptance of key decisions.
- The EU should require the proof of free, prior and informed consent of indigenous people.

5.3.3 Improving access to compliance reports

According to the guidance document, ‘Members States are to provide publicly accessible information on projects that have been approved as fulfilling the requirements of Article 11(b)(6) as well as indicating the entities accepted to carry out a validation of the Compliance Report in each Member State.’

We found that Member States interpret this requirement quite differently. While some, such as Germany, make all the WCD compliance reports available on their website,⁵¹ others such as Sweden, France, the UK, Spain and the Netherlands do not. Sweden for example stated “The principle of public access does not mean that all documents are available online, but made available on request.” (e-mail communication with Swedish Energy Agency).

Recommendations on access to compliance reports

The lack of web-access to the compliance reports makes it difficult for stakeholders in host countries to get information needed to evaluate if a project has been sufficiently assessed. This could easily be remedied by requiring DNAs to make all the compliance reports available online.

- The transparency rules should be further harmonized: Member states should be required to provide online access to compliance reports and other relevant project information.

5.3.4 Requiring all hydropower projects comply with WCD criteria

Currently only hydropower projects over 20 MW are required by the EU to meet WCD standards. As discussed earlier, the distinction based on size of installed capacity is not adequate to filter out projects that cause substantial environmental and social harm. Furthermore smaller projects are subjected to fewer regulations and scrutiny in India and China, which represent over 70% of all small hydropower projects in the CDM pipeline (CDM/UNEP Risoe 1. Sept. 2011) and is likely to be the case for other countries as well. In China, small hydropower plants (< 50 MW) can be approved at the prefectural or provincial level, rather than the national level (Kibler 2011), resulting in fewer checks. While large projects in India are granted clearance from the Central Government and required an Environmental and Social Impact Assessment, small projects are not required to conduct such an assessment except under special conditions (MOEF 2006).

Recommendation on extending criteria

- Small hydropower projects providing credits to the EU should also comply with WCD requirements and procedures.

⁵¹ <https://www.jicdm.dehst.de/promechg/pages/project1.aspx>

6 CONCLUSIONS

This paper evaluated the additionality of hydropower projects in the CDM and sustainability criteria applied to these projects. Hydropower makes up 30% of all registered CDM projects and is expected to deliver close to a quarter of all CERs by 2020 (UNEP Risoe CDM/JI Pipeline Analysis and Database, 1 September 2011). Our analysis shows that the CDM's *Additionality Tool* is not effective at filtering out non-additional hydropower projects. We also find weaknesses in the EU's assessment of compliance with WCD guidelines. In the following conclusions we summarize the policy changes we recommend in order to ensure that CDM credits from hydropower projects have a high likelihood of being additional and of avoiding substantial adverse social and environmental impacts.

Large hydropower should be excluded from the CDM in all countries because it is unlikely to be additional and additionality testing is ineffective. Hydropower is already a conventional technology that is being built in large quantities worldwide without carbon credits. India and China, the two countries with most hydropower CDM projects, have aggressive targets for utilizing their hydropower resources in attempts to meet soaring power demand and to address energy security concerns related to growing dependence in both countries on imported coal. The interest in building large hydropower in both countries supersedes the relatively small effect CERs have on hydropower project financial return.

Furthermore additionality testing through the assessment of financial return is not a good predictor of whether a large hydropower project will be built because non-financial factors have a large influence on decisions to develop these projects. Uncertainty in investment analysis inputs allows project developers to choose input values strategically in order to show that their projects are less financially viable than they really are.

Small hydropower projects should only be allowed under the CDM where they are not already being built or are being built at much slower rates than they would with carbon credits, and in countries in which the governments are less able to financially support the technology. Small hydropower typically benefits from less political backing than large hydropower and so is more likely to involve private developer, making financial return more predictive of the development decision. However, the investment analysis is unreliable for small hydropower projects for the same reason it is unreliable for large hydropower – because of uncertainty in input values. Small hydropower is already being built in some countries at substantial rates and therefore would not pass the common practice test. In countries where there already is development of small hydropower projects, such as in China and India with supportive subsidies and tariffs, allowing small hydropower project to register under the CDM means potentially allowing a substantial portion of non-additional projects to register. Instead, types of small hydropower, defined by their size and location, and perhaps other objective characteristics, should be used to identify projects that are not currently being built, but which could be effectively enabled by the help of carbon credits. The effects of the CDM should be evaluated over time and should be clearly discernible for those projects types to continue to be eligible for crediting.

The common practice assessment should be strengthened. Our assessment of how the common practice test is being applied to hydropower projects shows that the definition of what constitutes common practice needs to be more stringent. Projects under construction and projects

in the CDM pipeline should be included in the common practice assessment for technologies such as hydropower that are already being built without the CDM. If a technology is deemed to be common practice through the common practice assessment, a proposed CDM project of that technology type should also be considered common practice; the ability to argue that a project is “essentially distinct” from other similar projects can easily be abused and should therefore be removed as an option under the common practice test.

Large and small CDM hydropower projects seeking to sell their CERs in the European Union should fulfill World Commission on Dams (WCD) sustainability criteria.

Since hydropower projects of all sizes and types can have substantial, and sometimes severe, negative social and environmental impacts, all hydropower projects should be evaluated for their social and environmental impacts. Further, small hydropower is usually subject to fewer regulations and scrutiny than large hydropower. It would therefore be prudent that the EU’s WCD criteria be expanded to include hydropower projects below 20 MW.

The EU’s assessment of WCD compliance should be further strengthened. The EU’s efforts to operationalize the WCD guidelines are commendable but current rules and procedures do not fully capture the criteria set out in the WCD. Shortcomings include auditor conflicts of interest, weak guidance for the assessment of public consultations, and insufficient access to compliance reports by the general public. The current EU WCD requirements could be strengthened as follows:

- The designated national authority (DNA) of the buyer country, or another government agency, rather than the project developer, should choose WCD auditors. Project developers should be charged a fee that covers the costs of those audits and the oversight tasks of the government agency.
- The quality of WCD verification reports should be reviewed carefully. Future auditor hiring decisions should be based on whether previous assessments were performed rigorously and conservatively.
- Auditor performance should be evaluated periodically during a process of re-accreditation.
- The accreditation and re-accreditation processes should involve conflict of interest assessments.
- Auditors should receive additional guidelines and requirements on how to assess stakeholder involvement. These could be modeled and expanded based on Gold Standard processes and requirements.
- The EU should require formal agreements regarding compensation and rehabilitation plans and the distribution of benefits from the dam between the project developer and project-affected persons in order to demonstrate acceptance of key decisions.
- The EU should require the proof of free, prior and informed consent of indigenous people.
- EU member states should be required to provide online access to compliance reports and other relevant project information.
- All hydropower projects, large and small, should be required to meet WCD criteria.

Over 1000 hydropower projects are already registered under the CDM and another 700 are applying for registration. The consequences of registering non-additional projects and those with substantial adverse environmental and social impacts undermine climate mitigation goals by actually increasing emissions and placing the costs of climate change mitigation on communities most vulnerable to the impacts of climate change. Excluding large and some small hydropower

projects from the CDM and strengthening WCD compliance evaluations are important steps the European Union could take to strengthen the integrity of its climate mitigation goals.

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Agrarian livelihoods under siege: Carbon forestry, tenure constraints and the rise of capitalist forest enclosures in Ghana

Moses Mosonsieyiri Kansanga ^{*,1}, Isaac Luginaah ²

Department of Geography, University of Western Ontario, London, Canada



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ABSTRACT

Drawing on theoretical insights from agrarian political economy, and based on empirical research in the High Forest Zone of Ghana using in-depth interviews and participant observation, this paper examined the context-specific but often less highlighted impacts of REDD+-based carbon forest development activities on local agrarian livelihoods. We find that although REDD+ intends to align local communities to benefit financially for contributions to carbon forestry, its uptake in the Ghanaian context has created entry points for the displacement of smallholder farmers through unregulated profit-driven and restrictive plantation-style carbon forest activities. This yields landless smallholder farmers whose labour is craftily integrated into a capitalist carbon forestry regime as tree planters, with many others striving to reproduce themselves through exploitative sharecropping arrangements and corrupt 'backdoor' land deals. We emphasize that, 'more than carbon' accumulation engendered by REDD+ is fast moving beyond land grabs to a more complex dimension in which the labour and financial resources of marginalized groups are further appropriated by forest investors, and their relatively powerful counterparts in what we term *intimate exploitation*. Given the ongoing plight of smallholder farmers, particularly the multitude of 'hungry' migrant farmers who seek 'salvation' in the High Forest Zone, it is obvious that REDD+ is pushed at the expense of ensuring food security. To sustainably address current land-related agricultural production bottlenecks and empower local communities to directly benefit from REDD+, we recommend that rather than centralizing both carbon rights and land rights in the hands of the state and a few private investors, community forestlands should be returned to local people under community-led forest management approaches. Local control of both land and carbon stocks will promote sustainable coexistence of smallholder agriculture and carbon forestry.

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1. Introduction

The Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks (REDD+) initiative emerged to strategically align local communities in developing countries to benefit³ financially for contributions to climate change mitigation through community reforestation and enhancement of carbon stocks (Hiraldo & Tanner, 2011; Leach & Scoones, 2013; Lemaitre, 2011; Lyons & Westoby, 2014; Sunderlin

et al., 2014). Based on claims of robust economic returns and the promise of a 'new salvation' for biodiversity conservation and climate change mitigation, private sector investment in carbon forestry⁴ under the REDD+ has grown in importance across sub-Saharan Africa (SSA) over the last decade (Asiyanbi, Arhin, & Isyaku, 2017; Leach & Scoones, 2013). Designed purposely to support developing countries' REDD+ efforts, the Forest Investment Programme (FIP) is one of the three funding windows of the Climate Investment Fund (CIF). It provides scaled-up financing in the form of grants and low interest loans to developing countries through partner multilateral development banks (MDBs) to implement reforms outlined in national REDD+ plans (World Bank, 2015).

Ghana was selected as a pilot country for the FIP in 2010 with a grant of USD 50 million to support national REDD+ activities. Through coordination between government and the private sector,

* Corresponding author.

E-mail addresses: mkansang@uwo.ca (M.M. Kansanga), iluginaa@uwo.ca (I. Luginaah).

¹ ORCID: 0000-0001-8566-396X.

² ORCID: 0000-0001-7858-3048.

³ Benefits broadly denote the direct or indirect incentives and payments that derive from actions associated with reducing emissions from deforestation and forest degradation.

⁴ The process of 'conserving and enhancing forest carbon stocks, and trading these values in emerging carbon markets' (Leach & Scoones, 2013)

Ghana's REDD+ strategy focuses on rehabilitating degraded natural forests, supporting off-reserve forest plantation development and promoting climate-smart agriculture especially in cocoa growing areas in the High Forest Zone. Through the Dedicated Grant Mechanism (DGM) of the FIP, a National Executing Agency provides demand-driven grants to organizations for carbon forestry activities (World Bank, 2015). The strategy aims to stimulate private sector investment in carbon forest plantation development in both on-reserve and off-reserve areas in the High Forest Zone (Ministry of Lands and Natural Resources, 2014). Critical to the implementation of REDD+ in the Ghanaian context, however, are the crucial questions of how to adequately reconcile the interests of project financiers with those of forest communities and ultimately, how local communities can be aligned to benefit from carbon forestry.

Despite the promise that stimulating private sector investment in forest plantation development and carbon financing will yield sustainable benefits to local farming communities and enhance carbon stocks, the outcome of close to a decade implementation of REDD+ in Ghana is arguably the reverse (see Asiyambi et al., 2017; Saeed, McDermott, & Boyd, 2018). In this paper, we analyse the political economy of REDD+ in Ghana by examining how private sector entry into the carbon forest development trajectory has influenced local farming livelihoods. Drawing on the experiences of smallholder farmers in the High Forest Zone where forest community lands are massively targeted for carbon forest plantation development, we interrogate how corporate penetration in the carbon forestry sector has engendered 'new' agricultural land access and labour relations that are detrimental to smallholder agriculture. This analysis contributes to the broader debate on the rise of transnational corporations (TNCs) in global resource management and agriculture, and the resultant 'depeasantization' of rural populations (Makki, 2012; Weis, 2007). From our choice of methodology, we contribute to the literature by 'telling the smallholder story, the smallholder way'.

Against the universalized claim that REDD+ will improve land tenure security in local farming communities in developing countries (Corbera, Martin, Springate-Baginski, & Villaseñor, 2017; Harvey, Dickson, & Kormos, 2010), the materialization of these benefits is heavily dependent on an array of contextual factors including the underlying power relations that structure access and control over forest resources among diverse actors, local land tenure dynamics, and the effectiveness of REDD+ implementation and regulatory frameworks (Asiyambi, 2016; Sanders, da Silva Hyldmo, Ford, Larson, & Keenan, 2017). Indeed, Peskett, Schreckenbergh and Brown (2011) argue that using carbon financing for REDD+ in developing countries introduces new actors, interest and rules in the forest sector, with the potential to alter existing forest management practices in ways that have potential adverse implications on the livelihoods of weaker groups. With the increased involvement of the private sector in carbon forest plantation development in local communities in the Ghanaian context, coupled with the fact that these activities are profit-driven and rely mainly on external donor support, it is possible that existing agricultural land access arrangements and labour relations could be reconfigured in ways that adversely affect agrarian livelihoods. In the context of competing land uses from urbanization, mining and grazing in the forest sector, these ambiguities may be further reinforced (see Armah, Luginaah, Yengoh, Taabazuing, & Yawson, 2014; Kleemann et al., 2017; Kuusaana & Bukari, 2015; Owusu-Nimo, Mantey, Nyarko, Appiah-Effah, & Aubynn, 2018; Taabazuing, Luginaah, Djietror, & Otiso, 2012). Yet, the basic requirement to ensure a coexistence of farming activities and carbon forest development as stipulated in the national REDD+ implementation framework remains unenforced by the state and is largely at the discretion of private investors. Little attention has

been paid to the property rights the state devolves to private actors in the management of community forest resources.

Given that the High Forest Zone has relatively favourable climatic and edaphic conditions, and serves as a haven for many food insecure smallholder farmers from impoverished parts of the country, these tenure complexities could exacerbate food insecurity. In a regional analysis of the impact of REDD+ on food security, Tabeau, van Meijl, Overmars, and Stehfest (2017) finds that, SSA is the most adversely affected region. Compared to Central and South America (with 16.2% and 12.4% decreases in land use and agricultural output respectively) and China (with 7.1% and 1.3% decreases in land use and agricultural output respectively), reductions in land use and food production were more pronounced in SSA (19.9% and 18.1% respectively) (Tableau et al., 2017). Despite the fact that these regional statistics offer a general picture of the negative impacts of REDD+ on food production, a rigorous context-specific analysis of the lived experiences of smallholder farmers⁵ is crucial. In the Ghanaian context for instance, Asiyambi et al. (2017) give a hint on the local level inclusion-exclusion politics that characterize REDD+, and call for in-depth context-specific analysis of the experiences of forest-based communities.

Although a number of studies have recently explored forest management in Ghana (see Acheampong, Insaiddoo, & Ros-Tonen, 2016; Foli, Ros-Tonen, Reed, & Sunderland, 2017; Murray, Agyare, Dearden, & Rollins, 2018; Ros-Tonen, Derkyi, & Insaiddoo, 2014; Teye, 2013), little research attention has been paid to REDD+ despite the uptake of carbon forestry activities in farming communities in the High Forest Zone since 2010. Furthermore, while REDD+ is currently piloted in other countries in sub-Saharan African (SSA) where livelihoods are generally dependent on land-based resources, existing studies on its implementation have mostly focused on understanding its design, institutional frameworks of governance and benefit sharing arrangements (see Andersson et al., 2018; Asiyambi et al., 2017; Leach & Scoones, 2013; Saeed, McDermott, & Boyd, 2017; Saeed et al., 2018; Sills et al., 2017). Invariably, there are no studies that examine the distributional impacts of the uptake of carbon forestry on local livelihoods activities and food security. It is to this salient gap in the literature that this study contributes.

What we explore in this paper are opportunities for knowledge sharing, inclusiveness and sustainability towards finding a common ground for the reconciliation of environmental conservation and agricultural production in forest communities across the developing world. While this paper does not suggest a blueprint for carbon forestry, it takes a preliminary stance at stimulating the discussion on the distributional impacts of REDD+ on farming communities with the goal of broadening the scope of options policymakers and local communities can draw upon to ensure sustainable coexistence of food production and carbon forestry. This analysis further demonstrates the continuous relevance of the agrarian question in the developing world and highlights the critical need to reconcile the increasingly neglected food security concerns of local farming communities with ongoing environmental conservation objectives. This connects to the clarion call by Asiyambi (2016, p. 146) for researchers to, "also engage with more-than-carbon accumulations justified by carbon".

In this paper, we argue that beyond 'green colonialism' and the widespread land grabs engendered by carbon forestry across different geographical contexts (see Asiyambi, 2016; Barbier & Tesfaw, 2013; Ickowitz, Sills, & de Sassi, 2017; Lund, Sungusia, Mabele, & Scheba, 2017; Phelps, Webb, & Agrawal, 2010; Saeed et al., 2018; Sunderlin et al., 2014), neoliberal accumulation under

⁵ Small-scale farmers who cultivate for consumption and sell surplus for income (Chamberlin, 2008). Production is largely based on simple tools and inputs (Kansanga, 2017).

the REDD+ is rapidly moving into non-carbon frontiers in the Ghanaian context whereby the labour and financial resources of displaced local farmers are further appropriated through corrupt 'backdoor' land deals and exploitative labour relations. In the context of these challenges, we make several recommendations for restructuring the current carbon forest development approach.

2. Background

2.1. Forest resource management in Ghana

Prior to state-led forest management in Ghana, community forestlands were administered through customary law. Chiefs who are the custodians of the land held forestlands in trust for the people who possessed user rights (Owubah, Le Master, Bowker, & Lee, 2001; Teye, 2005). As timber became a major source of revenue in the colonial era, concessions of stool lands⁶ were zoned as forest reserves under the Forest Ordinance of 1927 and controlled by the colonial government (Owubah et al., 2001). Post-independence governments maintained this top-down state-led community forest management approach. Over the years, a number of policies were enacted to regulate forest resource use including the Forest Commission Act of 1960; Forest Concessions Act of 1962; Land Administration Act of 1984; Control and Prevention of Bushfires Law of 1990; Forest and Wildlife Policy of 1994; and the Forest and Plantation Development Act of 2000. These policies supported a concessional forest governance approach in which forest timber rights are vested in the president in trust for local communities (Owubah et al., 2001). To harvest timber under this system, a stumpage fee determined based on the standing value of the timber concession is paid to the GFC after which a Timber Utilization Contract is reached with the logger (Ministry of Lands and Natural Resources, 2014). Concerns over the unfair benefit sharing and the lack of access to forest lands by local communities led to the evolution of integrated community forest management schemes. For instance, as part of the Voluntary Partnership Agreement (VPA) under the European Union's Forest Law Enforcement Governance and Trade (FLEGT) program, the timber rights allocation procedure was revised to make it open to all citizens. However, the processing cost of putting in a bid still excluded many actors at the local level. To enhance the sustainable flow of benefits to local communities, Community Resource Management Areas (CREMAs) were created in 2000 as integrated forest governance avenues through which local knowledge systems and community needs can be brought to bear on decision making on forest resource conservation and utilization (Murray et al., 2018).

These co-management efforts were later consolidated under the Modified Taungya Scheme (MTS) in 2002 – a collaborative reforestation initiative between the GFC and local farmer groups in forest communities aimed at ensuring coexistence of local livelihood activities and reforestation projects (Ros-Tonen et al., 2014). Under this scheme, farmers were given degraded portions of forestlands to cultivate while taking care of trees planted by the GFC until the trees close canopy (usually after three years). The benefit sharing framework of the MTS allocated 40% of timber revenue to the Forestry Commission, 40% to each gang of farmers, 15% to traditional landowners, and 5% to the forest-adjacent community (Acheampong et al., 2016). The MTS did not result in tenure security after all – a situation which made aggrieved farmers to deliberately retard tree growth in order to prolong their tenure (Acheampong et al., 2016; Ros-Tonen et al., 2014). Since the last decade, the Land Use, Land-Use Change and Forestry (LULUCF) sec-

tor in the High Forest Zone became a net emitter of greenhouse gases – a development that justified the need for intense forest conservation (Kansanga, Atuoye, & Luginaah, 2017).

Against this background, Ghana as a party to the United Nations Framework Convention on Climate Change (UNFCCC), subscribed to REDD+ in order to mitigate deforestation through plantation development in both on-reserve and off-reserve lands (Ochieng, Visseren-Hamakers, & Nketiah, 2013). Initially, Ghana's REDD+ strategy embraced a 'learning from the ground up' approach in which about seven pilots were implemented to provide lessons for scaling up. Following the failure⁷ of these pilots, Ghana's REDD+ strategy has since shifted to, "the implementation of large scale, sub-national programmes that follow ecological boundaries (jurisdictions) and are defined by major commodities and drivers of deforestation and degradation" (Government of Ghana, 2015, p. 25). Although other REDD+ activities are planned for later implementation in the savannah zones, Ghana's REDD+ strategy currently focuses on enhancing carbon stocks in the High Forest Zone.

Ghana's REDD+ activities are implemented in two major phases. The first phase involved policy reforms and institutional strengthening aimed at advancing the design and implementation of policy reforms to create the necessary institutional capacity for sustainable carbon forest development. The second phase, which is the core of Ghana's REDD+ agenda is currently implemented through three major forest investment projects (World Bank, 2015). Project 1 aims at enhancing natural forests in agroforest landscapes in forest corridors in the High Forest Zone. Project 2 focuses on securing and enhancing trees in agroforestry and cocoa cultivation areas in the High Forest Zone with emphasis on the Brong-Ahafo and Western Regions. While extending forest conservation into target off-reserve community lands, this project is supposed to provide incentives for farmers on 'admitted farms'⁸ especially for the production of climate-smart cocoa. Project 3 focuses on, "enhancing carbon stocks through facilitation of plantation investment in severely degraded landscapes" towards linking several Forest Reserves in the High Forest Zone (World Bank, 2015, p. 12). It also aims to build private sector engagement in the REDD+ process. Unlike project 2 where provision is made for 'admitted farms' in off-reserve areas, project 1 and 3 have no such provision for farmers, especially migrant smallholder farmers who were already farming on these forestlands while taking care of trees planted by the GFC under collaborative forest landscape restoration projects.

Key stakeholders in the implementation of the REDD+ in Ghana include MDBs, the Ministry of Lands and Natural Resources (MLNR), the GFC (which hosts Ghana's National REDD+ Secretariat), the Ghana Cocoa Board (COCOBOD), the Ghana Investment Promotion Centre (GIPC), Local government units (Districts and Unit Committees), private forest investors, Civil Society Organizations (CSOs), local community members and traditional leaders (see Fig. 1) (Saeed et al., 2018; World Bank, 2015). MDBs under the direction of the World Bank provide overall funding for the REDD+ in the form of low interest loans and grants. The MLNR is the lead implementing agency and is responsible for overall management and coordination of carbon forestry activities at the country level, and reporting to the UNFCCC on behalf of the government of Ghana. The GFC hosts the National REDD+ Secretariat. It is the implementation arm of MLNR and coordinates carbon forestry activities in forest communities. COCOBOD has the mandate of

⁷ According to the Ghana Forestry Commission (2017, p. 35) these pilots failed due to the lack of technical expertise and financial backing. Moreover critical concerns such as tree tenure reforms, required national level policy decisions that were beyond the scope of the pilots.

⁸ Refers to farms that were already on community lands before they were rezoned as forest conservation reserves. Per Ghana's REDD+ implementation arrangements, owners of these admitted farms are entitled to continue to farm in these areas while project activities continue.

⁶ Local community lands administered through traditional customary practices under the leadership of the chief. In southern Ghana, chiefs are enstooled and sit on stools. The stool is a symbol of traditional authority.

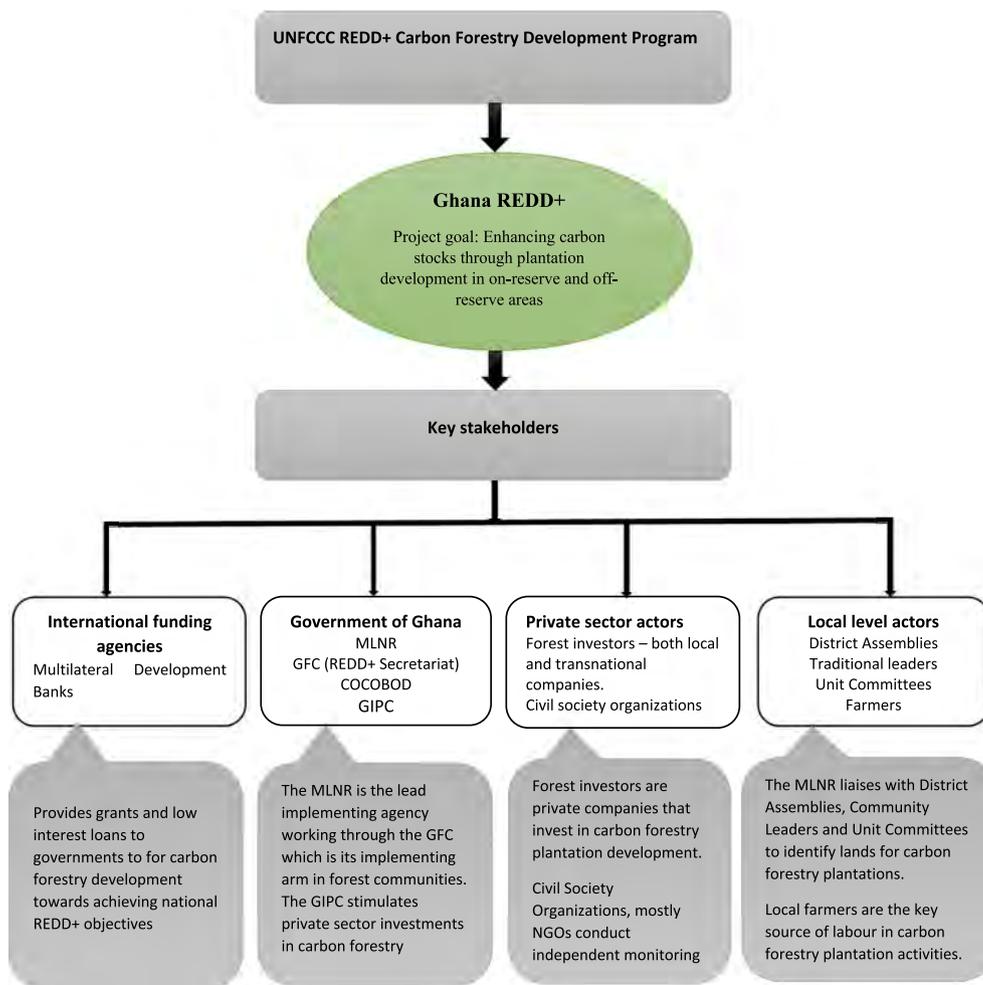


Fig. 1. Key stakeholders in the implementation of REDD+ in Ghana. Source: Adopted and modified from the Ghana REDD+ Strategy Report, 2015.

providing incentives and technical assistance to local farmers to support climate-smart crop production (particularly cocoa). The GIPC is responsible for creating incentives to stimulate private sector investment in carbon forest plantation development. It also spearheads the development of Public Private Partnerships (PPP) for the forest sector under REDD+. District Assemblies collaborate with local communities and traditional leaders to identify suitable degraded lands in forest communities for plantation development. Local farmers offer labour for day-to-day conservation activities. CSOs, mostly NGOs, are expected to engage in independent project monitoring and evaluation.

Currently, private sector involvement in forest plantation development includes the role of private investors as developers and owners of forests plantations; providers of technical services for tree development and buyers of timber (Ghana Forestry Commission, 2017; Saeed et al., 2018; World Bank, 2015). It is important to mention that private sector involvement in forest management in Ghana is not a novelty. In the past, private companies⁹ have been contracted by the state to offer secondary services to the GFC in previous state-led reforestation initiatives including the supply of seedlings and forest valuation. In recent times under the REDD+ however, their role in direct forest development has increased tremendously. For instance, between 2002 and 2010, 280 private forest investors were operating in 12 forest districts in the

country following the Expanded Plantation Programme that extended forest conservation activities from on-reserve areas to off-reserve community lands (Insaidoo, Ros-Tonen, Hoogenbosch, & Acheampong, 2012; Ros-Tonen et al., 2014). In the last ten years the GFC has released forestlands to a number of private forest investors, majority of whom are transnational corporations for plantation development in the High Forest Zone. Some of these companies include Portal Limited, FORM Ghana Limited, Mere Plantations Limited, Ecotech Services Limited, Zoil Services Limited, Kwadkoff Company Limited, Logwood Industries Limited and GroTeak Afforestation Limited.

Although benefit sharing plans under the REDD+ in the Ghanaian context are yet to be finalized as of the time of writing this paper (see also Saeed et al., 2018), the National REDD+ strategy outlines three broad benefits to be generated through carbon forestry on which any benefit sharing framework will likely be based. The first entails up-front indirect benefits including enhanced access to agricultural inputs, technical services and credits to support climate smart farming in forest areas. The second category include performance-based indirect benefits such as corporate social responsibility initiatives in forest communities. Direct performance-based benefits are the third category identified in the Government's REDD+ strategy report. These benefits include cash payments to local community CREMA funds for protection of designated off-reserve forest areas and the volume of climate-smart cocoa produced (Fox, 2017).

⁹ The category private is herein used to refer to large scale companies of both national and international origin involved in carbon forestry development in Ghana.

A number of salient issues underpin this potential benefit structure, especially when considering how local people can participate to improve their livelihoods. First, it is rather ironic that performance-based benefits to local communities are not determined based on the market value of the amount of carbon dioxide emissions local people's contributions to REDD+ initiatives are able to reduce. Rather these benefits are based on the amount of climate-smart cocoa produced by farmers. Secondly, access to the carbon markets under the REDD+ is restricted to government and so-called organized and financially capable investors. This limits the options available to local people to directly engage in carbon markets. Even among local farmers, cocoa farmers are prioritized while smallholders, particularly migrants, who produce food crops have no clearly stipulated direct benefits from carbon forest revenue. What is more pressing is that, with the current desire to extend carbon forest development into off-reserve forest community lands on which local farmers depend, coupled with the fact that restrictive plantation forestry has become the dominant carbon forest development approach (Leach & Scoones, 2013), the reproduction of local livelihoods may be grossly impacted.

2.2. Research sites

This study draws on the experiences of smallholder farmers from agrarian communities in the Bosomoa-Kintampo and Offinso forest districts (see Fig. 2). These forest districts are located in the High Forest Zone of Ghana which falls within the West African Biodiversity Hotspot. Some of the largest forest reserves in Ghana including the Bosomkese, Bosomoa, Afram Headwaters, and Afransu-Brohoma Forest Reserves are found in these study areas.

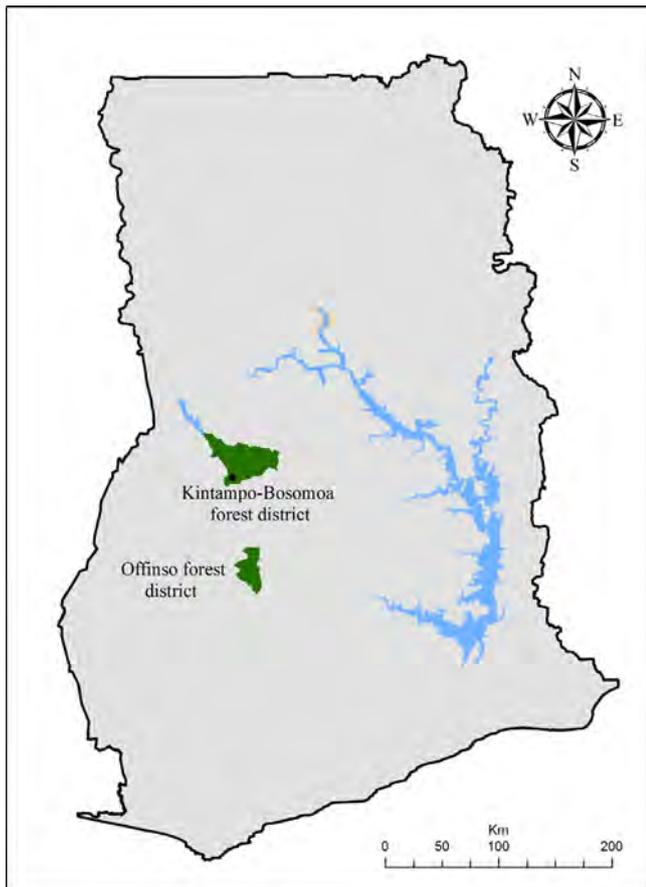


Fig. 2. Map showing the two forest districts of the study. Source: Author's construct, 2018.

The Bosomoa and Afram Headwaters Reserves for instance each span about 20,000 ha, comprising both natural and plantation forest. The High Forest Zone is the major food crop-producing zone in Ghana and attracts farmers from other regions.

The socioeconomic structure of the study context raises some salient concerns that make our analysis crucial. With increasing pressure on smallholder agriculture from climate change in recent times, the High Forest Zone in general is a key safety net for smallholder farmers from various poverty-stricken and relatively drier parts of the country, especially the three northern regions (see Kuire, Mkandawire, Luginaah, & Arku, 2016; Nyantakyi-Frimpong & Bezner Kerr, 2017; Rademacher-Schulz, Schraven, & Mahama, 2014; Van der Geest, 2011). Also, smallholder farming is a fundamental part of the organization of social life in local communities in the High Forest Zone. As a result, local livelihoods are heavily dependent on community forest lands.

3. Theoretical framework

Theoretically, this paper illuminates the socioeconomic and political situatedness of the impacts of REDD+ on local agrarian livelihoods in Ghana. Specifically, it examines the nature and extent to which smallholder farming livelihoods are shaped and reshaped in the struggle for agricultural land following carbon forest development. Theoretical developments on land grabbing in the Ghanaian context have for some time now focused on large-scale agricultural land deals involving transnational corporations in the middle belt and savannah zones (see Aha & Ayitey, 2017; Boamah, 2014; Boamah & Overå, 2016; Choi, 2018) with little attention paid to the forest zone despite the ongoing leasing of community lands to private investors for carbon forest plantations. To adequately understand the outcomes of such local forest community land deals which often involve varied actors and interests, there is the need to situate particular land struggles within the broader agrarian political economies of land access and control (Hall, Hirsch, & Li, 2011; Montefrío, 2017; Peluso & Lund, 2011).

Despite the centrality of the concept of access to research on natural resource governance and utilization in forest communities (Faye & Ribot, 2017; Kansanga, Andersen, Atuoye, & Mason-Renton, 2018; Larson, Cronkleton, Barry, & Pacheco, 2008; Osborne, 2011), it has been defined differently in the literature. That notwithstanding, Ribot and Peluso's (2003) conceptualization of access as 'the ability to derive benefits from things' is useful to our analysis and gives a broader conceptual base for understanding how carbon forest development activities may be shaping smallholder farmers' access to forestland in Ghana. Ribot and Peluso's (2003) definition connects directly to the agrarian question and allows for a broader interrogation of the fate of smallholder farmers in a neoliberal natural resource management regime as capital rapidly moves into local agrarian spaces (Osborne, 2011; Watts, 1989).

In their concept of 'powers of exclusion', Hall et al. (2011) identified four powers (regulation, market, force and legitimation) that interact to shape land access relations. They argued that, instead of counter-posing 'exclusion' to 'inclusion' in understanding natural resource access and utilization at the theoretical level as already highlighted in the forest belt of Ghana by Asiyambi et al. (2017), emphasis should be placed on who is excluded, how, why, and with what consequences. Proceeding on this theoretical tangent, we consider the opposite of 'exclusion' not to be 'inclusion' but 'access'. This position is based on the realization that including local people in REDD+ processes does not necessarily guarantee them access and control over forest resources and carbon revenue. We therefore proceed on a broader theoretical lens grounded on the understanding that carbon forestry development not only occurs

through a governmentality which shapes livelihoods in a given context, but also influences the broader relations that make such social reproduction possible (Paprocki, 2016).

Moore (2013) draws attention to a critical dimension of the agrarian question that is directly relevant to the analysis in this paper. Moore (2013) argues that capitalism, owing to its inability to accumulate further through agriculture, has shifted its frontiers to other resources in the ecological sphere – particularly investment in forest as exemplified by the increased desire by transnational corporations to invest in carbon forestry in tropical areas of the developing world. Within the ecological sphere, ‘capitalism’ strives to redefine existing structural provisions in human-environment interaction such as customary tenure practices in order to create entry points that engender new political economies (Makki, 2012; Moore, 2017). These premeditated changes to the socioeconomic structure then provide strategic positional spaces for natural resource appropriation and the eventual crafty separation of local people from land-based resources in what Tobias and Richmond (2014) term environmental dispossession. This swift movement of capital from international into national and local agrarian frontiers is largely grounded on the desire to build neoliberal natural resource management and agricultural production regimes with value chains that facilitate accumulation (Bernstein, 2014; Myers et al., 2018; White, Borrás Jr, Hall, Scoones, & Wolford, 2012). Critics have argued that by privatizing and globalizing market economies, national sovereignty and state capacity are weakened as transnational capital moves into national spaces (Lyons & Westoby, 2014; Sassen, 2013). Lyons and Westoby (2014) observe that, ‘there is then a positive feedback cycle in which such investments lead to an increased debt regime’ thereby pushing weakened states to further disassemble national frontiers and legitimize foreign investment in local spheres including agriculture and forestry.

According to Tobias and Richmond (2014) separation of local communities from natural resources eventually sets in; directly through physical separation from land, and indirectly through processes of acculturation and assimilation. Drawing on the concept of ‘powers of exclusion’ (Hall et al., 2011) and environmental dispossession (Tobias & Richmond, 2014), our analysis interrogates how the uptake of REDD+ in the Ghanaian context produces new avenues for the displacement and exploitation of smallholder farmers. In particular, we highlight the mediating role of two powers of exclusion: ‘regulation’ and ‘market’ in shaping smallholder farmers’ access to farmland.

4. Methodology

As observed by Jacobs (2017), the complexities in the struggle over land-based resources cannot be resolved entirely on theoretical grounds since class struggle is not just an element in theory, but also a subject of empirical enquiry. This study is based on a five-month qualitative research conducted from May 2016 to September 2016 in the Bosomoa-Kintampo and Offinso forest districts in the High Forest Zone of Ghana using participant observation and in-depth interviews. We conducted in-depth interviews with 46 local farmers, 4 traditional leaders, and 4 local-level government representatives to uncover the experiences of farming communities with the uptake of REDD+. Participant farmers were sampled through a preliminary visit to the forest to obtain a first-hand experience of ongoing carbon forest activities. This approach helped us to locate farmers who were directly affected by carbon forest development.

We sampled participants to reflect the diverse socioeconomic backgrounds of farmers in the study context. Our sample included two broad categories: migrant and native farmers, majority of

whom were males. Female farmers mostly cultivated on lands within the immediate environs of the community. Male farmers were mostly those who went deeper into the forest to establish farms. Moreover, because family farming is the common farming arrangement in the study area, men who are culturally ascribed family heads mostly cultivated with their wives and were at the forefront of acquiring land. As a result, women were mostly removed from these agricultural land deals. There were however two cases where migrant women who initially settled with their husbands and farmed in the forest under the MTS continued to farm there after the demise of their spouses.

In terms of socioeconomic characteristics of sampled farmers, migrant farmers were mostly from resource-poor areas of the country especially the northern sector. Since they have no right of ownership over customary lands, they mostly farm under sharecropping arrangements with native farmers. Previous state-led integrated forest management schemes which allowed farmers to cultivate while taking care of trees planted by the GFC, further attracted most of these farmers to the forest belt. Most of these migrant farmers, in the attempt to maximize time on the farm and avoid the extra financial burden of renting homes in the community erected temporary structures close to their farms in the forest where they stayed and farmed with their nuclear families and only occasionally coming to town, mostly on market days. Native smallholder farmers on the other hand had relatively better socioeconomic status compared to migrant farmers. Unlike most migrant farmers who lived in deep hideouts in the forest, all native smallholder farmers lived in the town and were therefore able to engage in extra socioeconomic activities such as petty trading to supplement farm income. Following the extension of carbon forestry activities into off-reserve lands, some of these native farmers who previously owned lands in these areas before their re-designation for forest plantation development benefited from the ‘admitted farms’ provision and became forest caretakers¹⁰ for private companies. Most native farmers were therefore able to still engage in some form of cultivation albeit relatively minimal since production mostly has to conform to the permissible crop range of forest developers. Farmers in this category also served as ‘middlemen’ who helped migrant farmers to get temporal farming space under sharecropping arrangements. Educational attainment was low among both category of farmers for which reason interviews were conducted in the local dialect (Twi).

Data from interviews were complemented with secondary data from relevant academic literature, and government policy documents including Ghana’s REDD+ Proposal by the MLNR, and the 2016 – 2035 National REDD+ Strategy Report by the GFC. Direct quotations from the interview transcripts are used to substantiate key themes, contextualize responses, and maintain participants’ voices.

5. Findings and discussion

5.1. Growing trees in place of food? Agrarian displacements through REDD+

Contrary to the underlying requirement that REDD+ should be executed in partnership with local communities particularly to foster mutual benefits for all stakeholders, we find that local farming communities are rather being distanced from forestlands that they ‘must’ depend on for survival. Private forest investors have become the main developers of carbon forest plantations and are displacing

¹⁰ Forest caretakers are mostly community-level representatives/liasons who take care of forest concessions for private companies. These are mostly native farmers and are usually allowed to farm on portions of the forest while taking care of the trees.

local farmers on technical grounds of ownership through their largely unregulated and profit-driven plantation development activities. Central to this complexity over access to forestland are conflicts over meaning about customary and formal land tenure arrangements between farmers and forest investors. While local farmers still see themselves as legitimate co-managers of forest as was previously done under state-led integrated forest management initiatives, private investors regard themselves as 'new' owners of forestlands with the right to make new rules on forest development and resource utilization. These new rules have not only displaced local farmers, but technically frames them as 'illegal intruders' on private forest lands.

Our findings indicate that private forest developers involved in the rehabilitation of degraded forestlands evicted local farmers who were cultivating the land under previous state-led integrated forest management to allow for fresh forest plantation development. We argue that the rhetoric of 'painting' carbon forest development as a pathway to consolidating tenure security is a mere façade at the practical level. This strategic displacement of smallholder farmers by private forest developers is what [Asiyanbi et al. \(2017\)](#) term 'carbonised exclusion'. In the Ghanaian context these displacements were spontaneous and mostly without sufficient prior communication from the GFC or private forest developers. This eventually produced a landless class of smallholder farmers whose labour has been craftily integrated into a corporatized forest management system as forest caretakers and tree planters. Meanwhile, due to the limited nature of such jobs, the majority who do not get forest jobs constantly strive to reproduce themselves through unfulfilling 'backdoor' temporary land access transactions and sharecropping arrangements. A farmer expressed frustration at this displacement saying:

Since these lands [referring to forest concessions] were given to the companies and we were banned from farming there, I have since moved my farm from one hideout to another through the seasons. (Interview, 10 May 2016)

Even the few influential native smallholder farmers who were able to formally negotiate access to private company forest concessions to cultivate while taking care of trees had a different but equally challenging story. One native smallholder farmer observed:

When I finally got permission to use this land I am cultivating now, I was told the company would clear the land and supply seedlings. However, the company later complained of faulty chainsaws and instructed us to cut the trees ourselves which most of us did with our personal resources. Recently, we were asked to suspend all farming activities until after the national elections [referring to the December 2016 presidential and parliamentary elections]. (Interview, 10 May 2016)

Some displaced farmers who were unable to negotiate access to company lands through these backdoor mechanisms were left with no option but to return to portions of the forest that were already rehabilitated through the MTS. Meanwhile, cultivating in these deep hideouts in the forest comes with a key risk of having their crops destroyed during routine forest tours by the taskforce¹¹ of the GFC. A migrant farmer who lamented over his constant inability to renegotiate access to land said:

Four years ago, we were asked to stop farming on a portion of the forest the GFC allocated to us under the taungya Scheme since a new company had taken over the reforestation process. In my case, attempts at renegotiating access to land

under the management of the new company failed. As I speak, there is no other land to go to apart from parts of the forest already rehabilitated by the GFC. [...] This has been the only resort for most of us. Yet, the GFC taskforce keeps destroying our farms (Interview, 16 May 2016)

Despite the general difficulty in renegotiating access and the fact that women were mostly not involved in these land struggles in deeper areas of the forest, the predicament of a 49-year-old widow speaks to a gendered dimension in the gender-differentiated capacity of displaced farmers to renegotiate temporary access to agricultural land through backdoor means:

Since I relocated here with my husband, we lived and farmed in the forest until the company people [referring to a forest investors] came. Even so, my husband was mostly able to obtain a small parcel of land in the forest to sustain us until his demise. [...] Ever since, I have continuously struggled through the seasons to get a meaningful piece of land to cultivate. My children and I are still living in this bush here in the hope of getting some capital in order to go and settle in town (Interview, 12 May 2016).

In spite of the promise of efficiency in forest conservation with private sector involvement, local farmers adjudged private sector forest development activities as relatively more problematic. Most farmers held the opinion that previous state-led initiatives were arguably less restrictive even though they were not entirely immune to problems. The narrative of a 51-year-old displaced migrant farmer contrasts his experiences with the state-led MTS and the current carbon forest plantation development under REDD+. Highlighting how the latter is deepening the plight of smallholder farmers, he observed:

When I came into this community 15 years ago, I obtained land to farm under the taungya scheme while caring for trees planted by the GFC. We farmed under this arrangement for several years until it was rumoured four years ago that some concession of the forest was given to a private company called Mere Plantations Limited. The company asked us to stop farming on the land, cleared the land and started a forest plantation [...]. It is sad that several years since our eviction, more than half of the land still lies vacant with no trees planted. (Interview 11 August 2016)

[Phelps et al. \(2010\)](#) have argued that in the face of challenging capital requirements in forest development, developing country governments tend to revert decentralized forest regimes to meet the conditions of external forest development funding agencies. Eventually the frontiers of forest regulation shift in favour of investors who now make new rules to favour their profit-oriented activities ([Benjaminsen & Bryceson, 2012](#); [Ribot, Agrawal, & Larson, 2006](#)). It is this exclusionary potential of the shift in the mandate for resource 'regulation' [Hall et al. \(2011\)](#) call attention to in their concept of 'powers of exclusion'.

Building on the observation of [Lund et al. \(2017\)](#), we argue that a 'carbon Green Revolution' is underway in the forest belt of Ghana – an agenda whose tenets and underlying politics are geared towards producing forest and greening forest landscapes at the expense local farming livelihoods. The main vehicle for this agenda is the private sector, whose involvement in carbon forest development has not only deepened the agricultural land access challenges that arose in previous state-led reforestation initiatives but created new and more complex ones. Through the REDD+, private capital has now moved into forest landscapes in the ecological sphere and forestlands that were previously under state control have been privatized for carbon forest plantation development activities. By means of these crafty displacements described by [Benjaminsen &](#)

¹¹ These are trained forest guards of the GFC who ensure compliance to forest regulations at the local level. They conduct forest patrols to detect illegal activities and arrest perpetrators (see also [Hansen, 2011](#)).

Bryceson (2012) as 'green grabbing', non-capitalist agrarian forest spaces in the Ghanaian context are being opened-up for capitalist accumulation.

In contrast to the Mexican context where Osborne (2011) finds that smallholder farmers continue to have formal land rights following the uptake of REDD+ and can grow their own carbon-sequestering trees as a source of income, in Ghana, local farmers' rights to forestland under REDD+ are not guaranteed. Even usufruct rights to forestland previously granted by the GFC under state-led reforestation schemes have been truncated and redefined in ways that give private forest investors the 'ultimate' power to make decisions over forest resources with the government now playing a mere passive monitoring role. Beyond the theoretical imagery of perfect integration of local communities and their farming livelihoods contained in policy documents of REDD+, lies in practice, the very traits of capitalism which Marx (1978) describes as preoccupied with creating and expanding capital in ways that engender social relations of production centred on turning people (labour) and the environment into resources. In this emerging carbon green revolution, private sector investment in plantation forestry is giving rise to 'neoliberal forest enclosures' in farming communities which are used to further extend the contours of accumulation into non-carbon spheres.

5.2. Land access ambiguities as avenues for exploitation of smallholder farmers

This paper argues that beyond the widespread land grabs and green grabs engendered by carbon forestry across different geographical contexts (see Asiyambi et al., 2017; Barbier & Tesfaw, 2013; Bumpus & Liverman, 2011; Saeed et al., 2018; Teye, 2013), accumulation under REDD+ in the Ghanaian context has assumed a more complex dimension in which the labour and financial resources of displaced smallholder farmers are further appropriated under exploitative labour relations and backdoor land deals. By displacing local farmers and altering existing land access and labour relations, a conducive atmosphere is further created for accumulation. This resonates with Osborne's (2011) observation that such 'crafty' alterations of the socioeconomic and political context of resource access and control further acts as enclosure mechanisms that constrain the reproduction of rural agrarian livelihoods and determine local farmers' continuous availability and willingness to succumb to exploitative demands in the quest to survive.

Indeed, a growing body of literature highlight various tenure complexities that underscore carbon forestry development in tropical countries (de Aquino, Aasrud, & Guimarães, 2011; Holland et al., 2014; Ickowitz et al., 2017; Phelps et al., 2010; Sunderlin et al., 2014). Unique to the Ghanaian context, the unanticipated halt on smallholder farming that characterized the designation of off-reserve local community lands for carbon forestry, produced uncertainties and new exploitation mechanisms in forest communities. Left at the mercy of private investors, most displaced farmers are sometimes compelled to work through 'middlemen' to negotiate temporary access to forestland. A critical appraisal of these backdoor mechanisms that underlie smallholder farmers' struggle for forestland reveal the crucial but less highlighted mechanism we conceptualize as '*hierarchical corruption*'. This involves a chain of corrupt transactions whereby farmers are compelled to offer inducements to obtain agricultural land 'illegally' either directly from local forest caretakers or on sharecropping basis from other influential natives who also have to 'oil the lips'¹² of forest officials to obtain temporary user rights. Consistent with the obser-

vation of Nel (2015) in the Ugandan context, there is eventually a "blurring of the lines between legality and illegality" where the negative impacts of the 'new carbon rules' are felt disproportionately by relatively less powerful smaller farmers who in this context, bear the burden of pushing through illegal means to gain temporary access to land at exorbitant prices. Lamenting on the exploitation and differential access possibilities that characterize the backdoor land access system, a displaced farmer observed:

These days, to get even temporary access to farmland in the forest you have to pass through an influential person using money. Land in fertile portions of the forest under these companies can be rented as high as 1500 Ghana Cedis [Equivalent to about 350 USD] per hectare for a planting season. [Sighs]. We are really suffering. It is only the rich among us with good connections [referring to networks] who get access to private company concessions. (Interview 4 June 2016)

Further highlighting the frustration and exploitation associated with the current struggles over accessing farmland, another smallholder farmer observed:

My main frustration with the involvement of these private companies is that the very land we were asked to vacate to allow for tree planting is now rented out to their 'favourites' under fraudulent arrangements for farming activities [...] I do not see any special attention being given to tree planting. (Interview 26 July 2016)

Because the lands are transacted on illegal grounds, and paid for by farmers, enhancement of carbon stocks which is the ultimate purpose for the implementation of the REDD+ is rather neglected by farmers who struggle to meet the financial conditions of these illegal leases at the end of each planting season. Even with these informal payments, local farmers are not guaranteed a secure tenure. Farmers alleged that occasionally, investors destroy their farms when they are spotted. A displaced farmer who expressed worry about the uncertainty and insecurity associated with farming on such backdoor basis said:

Even though I paid to farm here this season, I am always afraid of my farm being destroyed if spotted by the GFC taskforce. [Farmer asks rhetorically] how can we produce enough to feed to even think of expanding our farms under this situation? (Interview 12 August 2016)

While we argue that restrictive and 'market-driven' carbon forest plantation development is the foremost and major catalyst for the displacement and eventual exploitation of smallholder farmers in the Ghanaian context, we also draw on Hall et al. (2011) idea of intimate exclusion to highlight that local farmers themselves are agents of exclusion and exploitation under REDD+. In the next section, we demonstrate how relatively richer native farmers deepen the exploitation of poorer migrant smallholders in what can best be described as '*intimate exploitation*'.

5.3. From exclusion to 'intimate exploitation'

Akin to the observation of Holmes & Cavanagh (2016), we argue that neoliberal forest conservation under REDD+ has widened existing inequalities and levelled a disproportionate land access burden on migrant smallholder farmers. There is no doubt that migrant farming has become a key strategy in tackling food insecurity in Ghana (Kuire et al., 2016; Nyantakyi-Frimpong & Bezner Kerr, 2017). Contextualizing the political economy of the study context for instance, it is evident that the local farming population is a microcosm of the national population with smallholder farmers congregating from different parts of the country in search of

¹² A local term used to describe the act of paying inducement to obtain a favour.

fertile lands and better rainfall patterns (Kansanga et al., 2017; Kuuire et al., 2016; Nyantakyi-Frimpong & Bezner Kerr, 2017). That notwithstanding, migrant smallholder farmers who in most cases are escaping the shackles of poverty from resource-poor source regions end up in 'new poverties' of extreme labour and financial exploitation. Relatively wealthier native farmers by virtue of their financial 'muscle' and social networks are able to negotiate access either by being forest caretakers or through backdoor land deals and in turn appropriate the labour of displaced migrant farmers under exploitative sharecropping arrangements. Thus, we argue that these 'new' land and labour relations under the REDD+, tend to favour 'some' but disadvantage 'many'. A migrant farmer recounts his experience:

For the past two years, I have been struggling to access farmland. Just to keep myself in active farming life, I took to share cropping with a native who helped me with this land. Because now it is not only the native landowners we share the farm produce with, but also the local forest caretakers, we end up making losses. (Interview, 10 May 2016)

While under conventional sharecropping practice in southern Ghana two-thirds of the annual farm produce goes to the landowner and the remaining one-third to the farmer, migrant farmers are getting even lesser of the farm produce in the already unfair produce distribution system following the uptake of REDD+. Unlike the conventional sharecropping practice where farm produce is shared between just the farmer and the landowner, current produce sharing arrangements feature 'new actors' mostly middle men and forest guards who work to shelter the farming activities of migrant smallholder farmers in strategic hideouts in the forest. Although there is no generally agreed system of sharing produce under these 'new' sharecropping arrangements that have evolved, most migrant farmers pointed to the fact that they mostly have to settle all other middle men from their one-third share of the total produce after sharing with the key individual from whom they obtained the land. As observed earlier, this exploitation is deepening largely because, the REDD+ in its design, prioritized some smallholder farmers especially cocoa farmers, most of whom either benefited from the 'admitted farms' provision under the REDD+ or are relatively well networked and able to negotiate access to forestlands at the expense of relatively poor food crop growing migrant farmers. Because migrant farmers have no customarily recognized rights to land compared to native smallholder farmers, they often do not grow cash crops like cocoa and therefore did not benefit from the 'admitted farms' provision and the incentives for small-scale cocoa farmers under the REDD+. Another displaced migrant farmer highlights the unprofitable nature of the new labour relations that underscore farming in forest communities saying:

'Since I lost my land, I have been working as a tree planter with a private plantation development company. I also cultivate on a sharecropping basis with a native of a neighbouring community [...]. Despite this current busy hustle, compared to my life prior to displacement, I can hardly make any profit to take care of family needs these days. (Interview, 2 September 2016)

From the above account, it is evident that, the REDD+ has reshaped existing power relations between migrant and native smallholder farmers, which further acts as an avenue for the exploitation of the former by the latter. Rowe (2015) calls attention to the potential adverse impacts of such unbalanced power relations at the local level arguing that all stakeholders may not have equal access to positions of influence in their struggle to leverage benefits or minimize negative impacts from REDD+.

Whereas a formidable alliance by smallholder farmers would be a potential pathway for seeking redress, the differential manoeuvring prospects available to native and migrant farmers have worked against the formation of any such meaningful community-level smallholder farmer movement. A migrant farmer expressed frustration at the futility in repeated efforts to seek redress from the government. He said:

Even in the midst of this suffering, we are not able to form any strong group to get our voices heard by the government. The influential community members who could join us to make this possible are rather benefitting from this situation. [...] The GFC is aware we are suffering like this, yet they are reluctant in intervening (Interview, 2 September 2016).

This farmer's account recalls Asiyanbi's (2016) description of 'tacit evasion of tenure ambiguities' in which efforts to recognize the tenure rights of local people to forest resources especially in migrant-dominated areas has often been evaded by stakeholders. These dynamics are further contextualized in the next subsection.

5.4. Strategic relegation of local communities and emerging unfair benefit sharing approaches

Following Nel (2015), we argue while the state plays a crucial role in the privatization of forest development under the REDD+, there is a 'tacit reluctance' in ensuring the proper integration of farmers into ongoing carbon forestry activities and the materialization of the widely touted positive gains REDD+ 'promises' local communities. The government through the MLNR and GFC is expected to exercise overall regulatory responsibility in the carbon forest development process. In reality however, like smallholder farmers, local community leaders complained about the passive role of the GFC. In the current REDD+ funding arrangement in Ghana, forest investors are given grants and low-interest loans from the FIP for plantation development (see Ministry of Lands and Natural Resources 2014). Because this funding is not comprehensive, and where investors use their own resources, they tend to maintain absolute control over forest concessions with little room for integration of local farming activities. This is consistent with the observation by Sikor, He, and Lestrelin (2017) that such shifts in natural resource governance often engender new regulatory mechanisms that entrench the control of project financiers and eventually skew benefit sharing arrangements in their favour.

As indicated earlier, although the benefit sharing framework for REDD+ has not been finalized, the government of Ghana has already laid out some broad category of benefits to local communities. These include direct benefits from payments to community CREMA funds and provision of inputs to cocoa farmers, and indirect benefits in the form of corporate social responsibility projects. It is rather ironic that carbon forestry activities under the REDD+ have been ongoing for close to a decade and yet no concrete benefit scheme has been concluded by the government. This reluctance has left local communities in uncertainty as to what they are entitled to and from who to make such claims. While the carbon benefit sharing framework is pending, Insaiddoo et al. (2012) allude to existing benefit sharing arrangements that have characterized the activities of large scale forest investors in off-reserve areas in the High Forest Zone in which 90 percent of total revenue from timber goes to the investor and six percent, two percent and two percent to the landowner, GFC and the adjacent community respectively. Compared to previous state-led landscape reforestation projects such as the MTS in which 40 percent and 10 percent of timber revenue went to farmers and the local communities respectively, it becomes evident that private sector entry has

shaped, and may continue to shape benefit sharing systems to the detriment of local farming communities. A member of the local Unit Committee¹³ described existing unfair timber benefit sharing arrangements saying:

Revenue allocation from forest resources is one of the biggest problems we have had with stakeholders for some years now. It is sad that even today things have even become worse for us. With this new system, our share of timber revenue has decreased. People now resort to other unsustainable backdoor strategies to derive their share from forest resources. (Interview, 12 August 2016)

Traditional leaders lamented about the complex chain of procedures involved in accessing timber revenue and the lack of clarity in terms of which institutions to direct such revenue claims in recent times. A traditional leader said:

Now, even the little timber revenue we are entitled to in recent times is often denied us. Tracing it becomes difficult as we are often tossed up and down in bureaucratic arrangements. We do not even know whether to approach the GFC or private forest companies for benefits. (Interview, 20 August 2016)

Consistent with Hall et al. (2011) typology of 'powers of exclusion', we argue that, the emerging relegation of local communities in forest management is largely due to two powers of exclusion: legitimation and market. By legitimizing itself over community forest resources through statutory provisions that allow the acquisition of community forest lands, the state, in turn leases some of these lands to private investors to develop forest plantations thereby opening community forest resource spaces to capitalist accumulation. Local people end up having no opportunity to plant their own carbon trees and engage meaningfully in the carbon market and more critically, reproduce themselves as smallholders. While researchers and policy makers are still fascinated about the 'hungry farmer paradox' in SSA including Ghana, we stress that under the prevailing carbon forestry regime, the food insecurity situation will worsen if these tenure ambiguities are not promptly addressed.

6. Conclusions and recommendations

The political economy of REDD+ in the Ghanaian context exhibits a set of complex processes, namely displacement, exploitation and corruption. These processes work interactively to distort traditional agricultural land and labour relations in local forest communities. Carbon forest plantation development facilitated corporate control over forest community lands and reinforced the marginalization and exploitation of migrant smallholder farmers in the High Forest Zone. REDD+ activities facilitated the crafty appropriation of the labour and financial resources of migrant farmers under unfair sharecropping arrangements and backdoor land deals by their native counterparts who act as middlemen. The politics of the implementation of the 'admitted farms' provision which provides for the integration of local farming activities into ongoing REDD+ projects, favoured native farmers who possess customarily recognized user rights to community lands to the neglect of migrant farmers who have no stake over community lands. These migrants, most of whom 'escaped' to the forest belt in search of better farming conditions are rather caught up in 'new webs' of poverty and food insecurity as they struggle to reproduce themselves.

These complex political economy dynamics especially the dispossession and exclusion of relatively poorer migrant farmers in

the Ghanaian case, points to the fact that even in the context of general resource access constraints under REDD+, the magnitude of adverse impacts may not be the same for all actors at the local level. The ongoing *hierarchical corruption* and *intimate exploitation* of non-native farmers in the Ghanaian context add a salient extension to Hall et al. (2011) typology of intimate exclusion. Beyond exclusion lies an opportunity for intimate exploitation whereby even among the same category of farmers, relatively powerful groups such as native farmers, tend to deepen the exploitation of their migrant counterparts.

This paper calls for an alternative forest management regime that reconciles local farming activities and forest conservation in a manner that guarantees local people's rights to land and forest resources. We recommend a radical restructuring of the current carbon forest regime away from viewing forest landscapes as 'global resources' to viewing them as 'territories' (McCall, 2016) in order to properly situate and legitimize the entitlements of forest communities. Rather than centralizing community forest lands and carbon rights in the hands of the state and a few forest investors, we call for a Community Forest Management approach (see Agrawal & Angelsen, 2009) in which local communities will lead the implementation of forest conservation activities. Returning forest lands to local communities has the potential to resolve most of the adverse outcomes of REDD+. As demonstrated in our findings, the increased exploitation of food insecure migrant farmers is connected to the widespread displacement and eventual change in conventional labour relations between native and migrant farmers.

We make this recommendation on the premise that apart from the so-called direct and indirect benefits promised local communities under the REDD+, local food production is a fundamental priority that should never be neglected for conservation gains. Indeed, there is mounting evidence that local people, through indigenous knowledge systems, can lead carbon forestry activities in ways that sustainably integrate local livelihood activities and forest conservation. Community-led carbon forestry will therefore promote food security and ensure that local people benefit directly from carbon revenue. While we make this seemingly radical recommendation, we are cognizant of the fact that solutions to the current complexities from the uptake of REDD+ are not forthcoming. That notwithstanding, a good starting point for repossessing customary lands especially in off-reserve areas, will require rigorous community action and advocacy at the grassroots level to seek redress.

In SSA in particular where the diverse land administration systems feature a range of actors including states, transnational corporations, and unique tenure arrangements, it is very crucial for the design and implementation of REDD+ projects to go beyond the universalized expectation that local people will always benefit from carbon forest investments. Stakeholders must therefore hold context very important and understand existing land tenure dynamics in order to align carbon forestry goals with local community needs. Considering the longstanding 'tacit evasion' of tenure ambiguities in local communities by the government of Ghana following the uptake of REDD+, we recommend that the UNFCCC in vetting carbon forestry applications from countries should clarify in detail the prevailing land tenure dynamics, and require governments to make the necessary provisions in cases where local people's rights to forest are not guaranteed. Indeed, environmental conservation and food security are both central to the Sustainable Development Goals, hence the need to pursue them in a coordinated manner. It is important for stakeholders to recognize that a 'hungry' and 'poor' population will not support sustainable environmental conservation and climate change mitigation. Notwithstanding these policy recommendations, political ecologists must actively engage the aggressively changing nature of accumulation engendered by REDD+.

¹³ Local Unit Committees are part of the decentralized governance system in Ghana. Members are elected from the local community to facilitate local level development.

7. Conflicts of interest

None.

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The REDD menace: Resurgent protectionism in Tanzania's mangrove forests

Betsy A. Beymer-Farris^{a,*}, Thomas J. Bassett^b

^a Department of Earth and Environmental Sciences, Furman University, 3300 Poinsett Highway, Greenville, SC 29613, USA

^b Department of Geography, University of Illinois at Urbana-Champaign, 607 S. Mathews Ave., Urbana, IL 61801 USA

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ABSTRACT

Reduced Emissions from Deforestation and Degradation (REDD+) is being proclaimed as “a new direction in forest conservation” (Anglesen, 2009: 125). This financial incentives-based climate change mitigation strategy proposed by the UNEP, World Bank, GEF and environmental NGOs seeks to integrate forests into carbon sequestration schemes. Its proponents view REDD+ as part of an adaptive strategy to counter the effects of global climate change. This paper combines the theoretical approaches of market environmentalism and environmental narratives to examine the politics of environmental knowledge that are redefining socio-nature relations in the Rufiji Delta, Tanzania to make mangrove forests amenable to markets. Through a case study of a “REDD-readiness” climate change mitigation and adaptation project, we demonstrate how a shift in resource control and management from local to global actors builds upon narratives of environmental change (forest loss) that have little factual basis in environmental histories. We argue that the proponents of REDD+ (Tanzanian state, aid donors, environmental NGOs) underestimate the agency of forest-reliant communities who have played a major role in the making of the delta landscape and who will certainly resist the injustices they are facing as a result of this shift from community-based resource management to fortress conservation.

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1. Introduction

Reduced Emissions from Deforestation and Degradation (REDD+) is a financial incentives-based climate change mitigation initiative designed to compensate national governments and subnational actors in return for demonstrable reductions in carbon emissions from deforestation and degradation and enhancements of terrestrial carbon stocks (Agrawal et al., 2011). This paper examines this “new direction” (Anglesen, 2009) in carbon forestry by analyzing the politics of environmental knowledge that are redefining socio-nature relations in the Rufiji Delta, Tanzania, to be amenable to markets. We investigate the environmental narratives that inform a case study of World Wide Fund for Nature (WWF) and Tanzanian

state carbon forestry projects¹. These narratives portray local resource users, the Warufiji, in negative terms as recent migrants who are destroying the mangrove forests. This mistaken view forms the basis of a resurgent protectionism which aims to expel the

¹ The Rufiji Delta is listed as a WWF Tanzania REDD readiness site for REDD pilot projects, <http://www.reddtz.org/images/110310/a%20map%20showing%20pilot%20areas%20for%20redd%20activities.pdf> (Accessed on 30 November 2011). For a map showing approximate location of REDD related civil society actors (e.g. WWF) in the Rufiji Delta, Tanzania, see United Republic of Tanzania, October 2010, National REDD Information and Communication Strategy 2010-2012, (p. 46), [http://www.reddtz.org/images/Indepthstudy/redd information and communication strategy.pdf](http://www.reddtz.org/images/Indepthstudy/redd%20information%20and%20communication%20strategy.pdf) (Accessed on 30 November 2011). The TZ-REDD Newsletter (Issue 5, September 2011, pg. 14) states “WWF has conducted awareness-raising campaigns on the REDD project in Mbeya, Iringa, and Rufiji Districts” see <http://www.tnrf.org/files/REDDNewsletter5.pdf> (Accessed on 30 November 2011). For the contract between the Norwegian Ministry of Foreign Affairs and the WWF Tanzania Country Office that is “one of nine REDD+ pilot projects undertaken by NGOs under the Tanzania-Norway partnership” with reference to the Rufiji Delta, see http://www.norway.go.tz/PageFiles/253880/WWF_contract.pdf (Accessed 30 November 2011). Information on WWF’s “Building Mangrove Resilience” project in the Rufiji Delta can be found at <http://www.climateprep.org/2009/12/04/building-mangrove-resilience-to-climate-change/> (Accessed on 30 November 2011).

* Corresponding author. Tel.: +1 864 294 2505; fax: +1 864 294 3585.
E-mail addresses: betsy.beymer-farris@furman.edu, babeymer@gmail.com (B.A. Beymer-Farris), bassett@illinois.edu (T.J. Bassett).

Warufiji from lands they have occupied for millennia (Havnevik, 1993; Chami and Mswema, 1997).

Carbon forestry management plans have so far assumed that “forest” is a clearly understood category (Noordwijk and Minang, 2009). We argue that current forest definitions within the context of REDD+ do not take into consideration the environmental history or the agency of forest-reliant communities in the making of forested landscapes. We seek to demonstrate how the Rufiji Delta is a socio-natural landscape shaped by past and present resource management practices, a “forest” definition that complicates the prevailing narratives that inform carbon forestry management.

At the center of our critique is the framing of the “environmental problem” in which the Warufiji are depicted by foresters, environmentalists, and donors as poor stewards of the mangrove forests. We argue that this representation builds upon a “misreading” of the human–environmental history of the Rufiji Delta (e.g. Fairhead and Leach, 1996; Forsyth and Walker, 2008). Our counter-narrative provides an alternative environmental history that presents the Warufiji in a very different light. It also highlights the politics of environmental knowledge in which carbon forestry is presented as a “sustainable” alternative to indigenous resource management practices which are demeaned as “destructive” and “illegal”. We suggest that a major consequence of this ahistorical framing is a paradigmatic shift in natural resource conservation from community-based natural resource management (CNBRM) to fortress conservation, a shift that has been aptly called “resurgent protectionism” (Adams, 2009; Forsyth and Walker, 2008; Wilshusen et al., 2002). The protectionist conservation paradigm views human use of nature as inimical to biodiversity conservation and by extension to carbon storage. This normative view contrasts with more recent approaches that assume that human–environmental interactions can produce sustainably utilized environments (Zimmerer, 2006; Bassett, 2010).

Climate change mitigation plans for the Rufiji Delta currently focus on the anticipated impacts of climate change (sea-level rise) for a particular biophysical exposure unit (mangrove forests) that needs to be offset by adaptation and mitigation strategies to enhance the resilience of that biophysical unit (mangrove reforestation) (O'Brien et al., 2007). Within the context of the Tanzanian state and WWF's climate change “adaptation strategy” (Cook, 2009), mangrove reforestation reduces the ability of Rufiji farmers to cultivate rice for subsistence needs and thus poses a direct threat to their livelihoods. Indeed, after the forests are made more “valuable” for the carbon market (“REDD ready”), the Tanzanian state plans to relocate villagers out of the delta². Although current REDD+ policy frameworks do not explicitly seek to exclude people from living in forests or utilizing forest resources, the proposed eviction plan for the Warufiji is one portentous example of how human rights may be subservient to the monitoring and verification requirements of carbon forestry. The removal of the Warufiji³ “simplifies” the mangrove forests in order to make levels of carbon sequestration “legible” for carbon markets (Scott, 1998). We illustrate how this shift from a CNBRM to an ecosystem-centered vulnerability approach for forest conservation supersedes priorities that seek to balance livelihood

and environmental concerns. In the ecosystem-centered vulnerability approach, the concern with sustainable livelihoods and social vulnerability are of secondary importance.

Our goal in writing this paper is to draw attention to the potential for “lose–lose” scenarios of climate change mitigation and adaptation projects that fail to integrate environmental justice concerns with conservation priorities. This is important as the success of carbon forestry hinges on the compliance of local populations to new power relations implicit in REDD+ policies. We argue that forest-reliant communities will resist these policies to the extent that they undermine local livelihoods and are viewed as unjust. Local resentment and resistance will increase to the extent that carbon forestry projects marginalize those communities that live in proximity to and depend on key resource areas. Resource users in developing countries throughout the world are beginning to organize and demand access to land and their right to a decent livelihood (Perfecto and Vandermeer, 2008). The Warufiji are no exception. They have a history of fiercely resisting claims on their resources and labor by outsiders. By highlighting the environmental historical role of the Warufiji in the making of the delta landscape, we provide insights into the opportunity for local resource users to contribute to the creation of an agricultural and forestry matrix that is socially just and politically stable and that has the potential to conserve biodiversity in the long run (Perfecto and Vandermeer, 2008).

This paper discusses the implications of market-oriented conservation approaches that may threaten equity-oriented projects and the environmental justice dimensions to climate change despite its “rights-based and participatory approaches” (Anglesen, 2009). REDD+ threatens to shift control and management of natural resources from local to national and global actors. REDD+ may also have an unintended consequence of undermining decentralized forest management in Tanzania and elsewhere (Phelps et al., 2010). Our counter-narrative seeks to provide insights into natural resource management alternatives that are more socially just, desirable, and feasible. These alternatives are desirable because they have the potential to address conservation goals and feasible because the environmental history of the Northern Rufiji Delta illuminates the possibilities for sustainably utilized environments.

2. Theoretical approach

The remaking of human–environmental relations for REDD+ in the Rufiji Delta is an ambitious project that involves conceptualizing forest use in ways that are amenable to carbon markets. It entails a significant turnaround in conservation thinking where ecosystem health is prioritized over multiple land-use policies in which local communities assume some resource management authority. Before showing how this “new direction in forest conservation” (Anglesen, 2009) is unfolding in the Rufiji Delta, we introduce two key concepts that inform our theoretical approach: market environmentalism and environmental narratives.

2.1. Market environmentalism

Market environmentalism is the recognition that “nature” (as transformed into raw materials or resources) can be a key constraint on or opportunity for the location and organization of economic activity (Jonas and Bridge, 2003). Production processes based on the use of natural resources pose both obstacles and opportunities for capital and reveal the contradictory political-economic dynamics that shape everyday landscapes through which nature is produced, consumed, and regulated (Henderson, 1998; Jonas and Bridge, 2003). In its production and commodification, nature is enclosed, measured, and given market value (Lovell et al., 2009). This increasing incorporation of ecological conditions into global circuits of capital accumulation via

² Eviction plans are discussed in the “Report of the Meeting of the Division of Forestry and Bee-Keeping with Councillors, Executive Officers of the Wards and Villages in the Wards of Salale, Mtunda, Maparoni, and Ruaruke in Rufiji District” held in Nyamisati on 3 November 2009 (Personal communication, January 2010). See also “Government Issues Eviction Order to Forest Invaders” *Bilham Kimati in the Tanzania Daily News*, 29 January 2011.

³ For an update see, “Villagers Evicted from Mangrove Site” Finnigan Wa Simbeye, *Tanzania Daily News* 30 October 2011, <http://dailynews.co.tz/home/?n=25016&cat=home> (Accessed on 30 November 2011) and “WWF Fears Backlash on Rufiji Delta Mangrove Forest Initiative” Finnigan Wa Simbeye, *Tanzania Daily News* 14 November 2011, <http://www.dailynews.co.tz/business/?n=25497&cat=business> (Accessed on 30 November 2011).

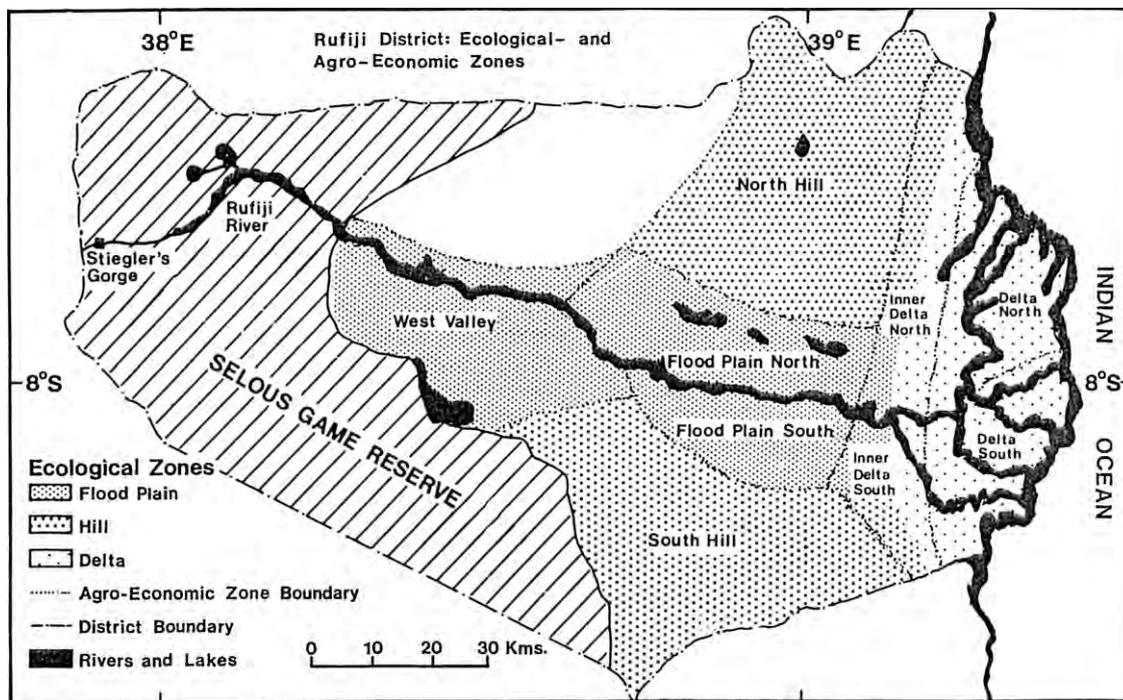


Fig. 1. Ecological and Agro-Economic Zones of the Rufiji District, Tanzania.
Source: Havnevik (1993). Used with permission of the author.

production and commodification has been referred to as “green capitalism” (Prudham, 2009: 1596). An example of green capitalism is the creation of markets for environmental services which effectively turn ecological processes and products into commodities that can be sold. Within this process the important question is not what a commodity is, but rather, what kind of characteristics do things take on when they *become* commodities (Castree, 2003: 277).

Green capitalism approaches view nature and society as conceptually distinct in the context of conservation (McAfee and Shapiro, 2010). It then reconnects them by subsuming ecology within the market economy (McAfee and Shapiro, 2010). The “splitting” of complex ecosystems simplifies them into legally definable and economically tradable property rights (Castree, 2003). This is particularly true for carbon markets. Carbon markets are one of a line of conversions of parts of nature into tradable commodities, including water, biodiversity, fish, and wetlands (Bumpus and Liverman, 2008).

For carbon to be exchanged and generate revenue, carbon reduction must be turned into a tradable commodity (Bumpus and Liverman, 2008). Offsets are generally commodified into saleable units through development of specific emission–reduction projects, the outputs of which can be quantified, owned and traded. Examples include the management of forests specifically to sequester carbon (Bumpus and Liverman, 2008). Complex forest ecosystems must be simplified into discrete processes and objects in order to define, standardize, and universally agree on their carbon content (Boyd, 2009). In the process, a fictitious commodity (Polanyi, 1944) is created in the form of “carbon credits” that are generated from emission reductions and international investments in emission reduction projects (Liverman, 2009).

In the course of “selling nature to save it” (McAfee, 1999), elite political and economic actors wield considerable power in negotiating prices and regulating market participation (Liverman, 2004). Many indigenous groups in the global south criticize carbon sequestration projects for their simplified portrayal of terrestrial systems and lack of information on the socio-economic, political, and institutional implications of carbon sequestration (Boyd,

2009). One concern is that carbon trading will allow the global North to maintain high levels of resource consumption by paying southern communities a pittance for offsetting carbon emissions generated by inefficient industries (Liverman, 2009).

2.2. Environmental narratives

The analysis of environmental narratives is a useful approach to examine the ways environmental issues are framed by showing how and why environmental problems are defined the way they are (Taylor and Buttel, 1992). An environmental narrative is a simplified explanation of cause and effect relationships that assigns roles to different actors who are implicated (or not) in an environmental problem. They are stories that simultaneously simplify and stabilize complex and uncertain processes such as “deforestation causes biodiversity loss” (Forsyth and Walker, 2008). Narratives influence the questions asked, the knowledge produced, and the policies and responses that are prioritized (Forsyth, 2003; O’Brien et al., 2007). They also reveal much about the politics of environmental knowledge (Boyd, 2009; Forsyth and Walker, 2008). The knowledge that informs environmental narratives is always conditioned by values, power relations, and institutional histories and commitments. Knowledge production is highly selective in terms of who participates in problem definition and policy making (Scoones, 2009; Forsyth and Walker, 2008). Like all narratives, environmental narratives shape popular perceptions and appeal to policy makers seeking simple solutions (Forsyth and Walker, 2008). It is important, therefore, to consider the broader contexts of legibility and simplification, as well as the political economic conditions that give form and meaning to narratives (Scott, 1998; Watts, 2002).

The case study of the Rufiji Delta contributes to a growing body of literature that illustrates how powerful political interests have embraced the neoliberal project of market environmentalism and employ environmental narratives to design an international response to climate change (Liverman, 2009). As states and international environmental NGOs act on these narratives, these stories transmute into “received ideas” (Leach and Mearns, 1996) and have real effects for local resource users. Mangrove carbon

forestry projects in the Rufiji Delta illustrate these dynamics. Environmental narratives that label human activities as “unnatural” and that portray landscapes in ahistorical terms as pristine or “Edenic” in which nature is emptied of humanity but filled with wildlife and vegetation are used to vilify local subsistence level resource users as mangrove “destroyers” and “invaders” (Neumann, 1998; West et al., 2006). In the following sections, we argue that the Tanzanian state and WWF’s portrayal of human–environmental relations represents a misreading of the environmental history of the Rufiji Delta. In contrast, we offer an historical account that portrays both the landscape and people in a very different light.

3. Rufiji Delta, Tanzania case study

The Rufiji Delta contains the largest continuous block of estuarine mangrove forest in Africa, and is of considerable economic and conservation importance (Bryceson, 2002). Our focus is on carbon forestry projects in the northern Rufiji Delta islands, referred to as the Rufiji Delta North (Fig. 1). Observations and semi-structured interviews in Rufiji Delta villages (mainly Mshinzi and Mchele⁴), with the Forestry and Beekeeping Division (FBD) of the Ministry of Natural Resources and Tourism (MNRT), and WWF Tanzania representatives during doctoral dissertation fieldwork from 2008 to 2009, as well as continual communications with villagers through 2010, inform the case study.

3.1. Mangrove forest governance

All of Tanzania’s mangrove forests have protected status. The Forest Ordinance of 1957 allowed for the creation of forest reserves by government decree after considering any objections by interested parties to this *de jure* transfer of rights from local communities to the state (United Republic of Tanzania, 1994). The FBD of the MNRT is currently responsible for mangrove forest management. The Tanzanian state has repeatedly used its authority over mangrove forests to exert control over Rufiji Delta communities and resources. For example, on September 2, 1987, the Forestry Division declared a ban on the cutting of all mangroves in the northern Rufiji Delta (Semesi, 1992). To enforce this ban, the state trained and posted forest officers to the area. The 1998 National Forestry Policy was replaced by the 2002 Tanzania Forest Act which forbids any person, without a license or other lawful authority, to cut, burn, or damage mangrove trees in the forest reserve area. This includes a ban on the expansion or opening of new rice farms (Semesi, 1991). Further, the Mangrove Management Plan established in 1991 designates the majority of the north Rufiji Delta mangroves as “total protection zones” which legally restricts forest access to scientific uses and protective functions only (Semesi, 1991). These restrictions remain in force today.

In addition to employing forest guards to enforce its policies, the Tanzanian state established agreements with forest communities to jointly manage the forest reserves. In 1998, the FBD initiated a joint management agreement (JMA) with villages in the Rufiji Delta North Mangrove Forest Reserve (Akida and Blomley, 2006). Communities are divided into villages, which are managed by elected village councils (Blomley et al., 2010). The 2002 Forest Act recognizes two different types of participatory forest management (PFM) (Blomley et al., 2010). The first is community-based forest management (CBFM) that enables village-level communities to establish village, group or private forest reserves on village land in which communities are both forest owners and managers. The second type is joint forest management (JFM) which takes place on reserved forest land that is owned and managed by

the national or district-level governments (typically managed by the FBD). With the state and potentially other forest owners, village-level elected councils and environmental council representatives can sign joint management agreements (JMAs) for sharing the costs and benefits and responsibilities of forest management. Under this arrangement, village-level elected councils are “co-managers” of forests otherwise owned by the district or national governments. In theory, village governments have primary protection and management responsibility of the forest. The Forest Act of 2002, however, does not explicitly state how benefits of forest management under JMA are to be equitably shared with participating communities (Blomley and Iddi, 2009).

In Tanzania, research shows that there are few tangible benefits to villages participating in JMAs, especially in areas of high conservation value (e.g. Vihemäki, 2009 citing Kajembe et al., 2005; Blomley and Ramadhani, 2006). The paradox of the JMA project in the Rufiji Delta is that JMAs are presented as promoting “community participation” with Warufiji villagers, while at the same time the FBD prosecutes these same forest users for planting rice (Bryceson et al., 2005). For example, many Rufiji farmers were restricted from accessing JMA areas to grow rice because of mangrove reforestation policies. Rufiji villagers argue that this restriction has created conflicts and deprived them of their livelihoods (e.g. Bryceson et al., 2005; Akida and Blomley, 2006). Villagers also stated that the FBD now bears the sole responsibility of distributing licenses for logging mangrove poles. Villagers complain that their role as co-managers of forests is not taken seriously:

“We still have no say in how our forests are managed. The foresters still come here, fine us, and put us in jail if we are caught cutting mangroves for our rice fields. (JMA) agreements did not change things for us because we are still restricted from using the forests” (Personal communication, October 2010).

Despite their presence within the delta for over 2000 years, the existence of ancestral burial grounds, and villages that have been formally registered (NEMC, 1997), the Warufiji’s land rights remain highly uncertain. According to the Forest Ordinance of 1957, the Warufiji are regarded as “squatters” as they are occupying land declared as Forest Reserves (NEMC, 1997). Land tenure insecurity in Tanzania is further compounded by the National Land Policy (1995) which explicitly states that the President owns all land in Tanzania in trust for present and future generations and that the state can dispossess customary owners for “public interest” because land is “public property” (Shivji, 2006). Within forest reserves, the Director of the FBD recently stated that villages were registered “illegally and that directives have already been issued for the Commissioner of Lands and respective district councils to de-register the villages according to the Forest Act Cap 323 as revised in 2002” (Rugonzibwa, 2009).

3.2. REDD ready in Rufiji: climate change programs and proposals

The Rufiji Delta mangrove forests have attracted international attention for their conservation importance. The International Union for the Conservation of Nature (IUCN) designated the forests as part of the Rufiji-Mafia-Kilwa Ramsar wetland site in 2004 (IUCN, 2004). At the same time, WWF initiated the Rufiji-Mafia-Kilwa Seascape Program (RUMAKI) (WWF Tanzania, No Date). The RUMAKI Program aimed to address the “fundamental links between environment and poverty and between biodiversity conservation and sustainable livelihood development.”⁵ Initial

⁴ To protect our research subjects, we have changed the names of individuals and communities discussed in this paper.

⁵ See WWF Rumaki, Kilwa, Rufiji Seascape Programme Tanzania Factsheet, July 2004–June 2009, <http://assets.panda.org/downloads/seascapefactsheet.pdf> (Accessed 30 November 2011).

program goals included the “improved socio-economic well-being of coastal communities through sustainable, participatory, and equitable use and protection of their marine and coastal natural resources.”⁶

WWF recently shifted its emphasis in the Rufiji Delta from conservation-with-development to conserving ecosystem health, in which the human development component is significantly diminished.⁷ With funding from the Global Environmental Facility and the United Nations Environment Program, WWF has created a climate adaptation project called “Coastal Resilience to Climate Change” (Cook, 2009). For this project, WWF is working directly with the FBD (Cook, 2009).

This WWF mangrove conservation program is premised on the urgent need to improve the management and protection of mangroves, which are described as “the most critically threatened ecosystem in the world” (Cook, 2009). The program aims to “protect mangrove forests from the impacts of climate change, particularly sea level rise” (Cook, 2009). Project goals are to assess the vulnerability of mangroves to climate change impacts, and to develop and promote adaptation strategies that respond to these impacts (Cook, 2009). Adaptation strategies include reforestation with “climate smart” mangrove species (Cook, 2009). Project documents declare that one of the main “threats” to the mangroves is rice farming by local people (Cook, 2009).

To prepare for climate change, WWF is working directly with FBD officials at national and district levels to “replant and restore mangrove habitats degraded by illegal rice farming” in the Rufiji Delta North (Cook, 2009). District level WWF “adaptation coordinators” oversee and enforce mangrove reforestation in the Rufiji Delta North (Personal communication, FBD, January 2010). The FBD has been involved in mangrove reforestation in the Rufiji Delta since the establishment of the Mangrove Management Plan (Semesi, 1991). Some villagers describe the mangrove planting scheme as a long standing “tug of war” between themselves and the FBD. Renewed interest by WWF in the Rufiji Delta has intensified mangrove reforestation as a climate change adaptation strategy (Cook, 2009). The “Building Mangrove Resilience” reforestation project includes villages within the Delta North (Fig. 1). Many Rufiji Delta rice farmers stated they are resisting this mangrove reforestation project, particularly in their rice farms, by planting mangrove seedlings upside down or not planting them at all. Some villagers stated that they refused to plant mangroves because they were not given the choice. Villagers declared “tulilazimishwa” in Kiswahili, which translates to “we were forced or obliged” English (Awde, 2000) to plant mangroves. The consensus in one village, Mshinzi, is a formal “rejection” against the mangrove planting project. In another village, Mchele, the village leadership agreed to the project and a small number of villagers participate. The majority, however, are against the project. This reluctant group stated they would consider participating in mangrove planting project as long as they are able to continue rice cultivation, but most refuse to comply.

One villager stated, “How can they [WWF adaptation coordinators and the FBD] tell us to stop planting rice? We are hungry because they have taken away our daily bread.” WWF is aware of the Warufiji’s resistance to previous mangrove reforestation efforts as illustrated in a quote by a Warufiji rice farmer in a 2002 WWF publication, “We are really surprised by this government, we do not know what they are thinking about us.

We are required to plant mangroves in our paddy farms; will they send us food in the future?” (Wood et al., 2000: 320). Directly prior to the 2010 national Tanzanian elections, villagers from Mshinzi stated that mangrove reforestation strategies suddenly changed and they were given the choice to plant mangroves (Personal communication, October 2010). Meetings were held in Mshinzi village and elders warned that the handing out of small funds for planting mangroves was a “common tactic prior to elections” and “after the elections, things will change, and they [the FBD and WWF adaptation coordinators] will be against us [the villagers]” in terms of impeding villagers from farming rice. The village government and environmental council in Mshinzi stated that their decision to object to the project was superseded by higher authorities at the district level. The JMA co-management agreement exemplifies what Chhatre (2008) calls weak political “articulation” reflected in a lack of devolved power for decision making to representative and accountable local actors (Agrawal and Ribot, 1999).

In contrast to the WWF RUMAKI program’s emphasis on poverty alleviation through CBNRM, new carbon forestry management plans are threatening to deepen poverty through dispossession. The Rufiji Delta is listed as one of six WWF Tanzania REDD readiness sites for REDD Pilot Projects.⁸ REDD+ strategies for Tanzania list the “enhancement of state reserve lands” as a way to reverse the “drivers” (e.g. cultivation) of forest deforestation and degradation.⁹ This is exemplified by the FBD’s plans to begin a process of relocating rice farmers out of the delta.¹⁰ The Director of the FBD made a statement in September 2009 that villagers residing in Tabora and Rukwa regions of coastal Tanzania will be evicted for invasions of forest reserves (Rugonzibwa, 2009). The Deputy Minister of MNRT also stated that “eviction exercises will later spread to the rest of the forest reserves countrywide and all settlers in forest reserves would be moved as stipulated by the law” (Rugonzibwa, 2009). Current plans are for farmers to plant trees in areas previously used for rice cultivation until they are relocated out of the delta (Personal communication, January 2010). This will result in evictions of more than 18,000 Rufiji Delta North village residents (Fig. 1).

In order to minimize the political fallout over the controversial eviction plans, the timing of relocations was on hold until the conclusion of the national elections in October 2010¹¹ (Personal communication, December 2009). In the meantime, the FBD and WWF adaptation coordinators organized meetings with villagers in the northern Rufiji Delta to “sensitize” them to the relocation project (Personal communication, January 2010). The FBD informed villagers of “what the consequences will be and how severe they will be” (Personal communication, December 2009). In response to the “sensitizing campaigns,” village elders stated that they were trying to find documentation of their formal objections to the designation of the mangrove forests as Forest Reserves in 1957. Although village elders state that they “were not listened to at that time and there was no outcome,” such documentation is needed to mount a legal case in Tanzanian courts against planned evictions.

We argue that the objective of WWF’s carbon forestry projects¹² and the Tanzanian government’s eviction plans are to make the Rufiji Delta “REDD ready” (Tanzanian REDD Initiative, 2010). The

⁸ See footnote 1, “WWF Tanzania’s REDD Pilot Projects Sites” and related documents.

⁹ Tanzania’s National REDD Strategy Development: Supporting REDD Readiness in Tanzania, November 2009, http://www.reddtz.org/component/option,com_docman/task,doc_download/gid,22/Itemid,18/. (Accessed on 30 November 2011).

¹⁰ See footnote 2, “Report of the Meeting” and “Government Issues Eviction Order to Forest Invaders.” For an update, see footnote 3 “Finnigan Wa Simbeye Tanzania Daily News.”

¹¹ In January 2011, the FBD issued a two-week eviction order to all “invaders of reserved forests countrywide” including the Rufiji Delta (Kimati, 2011). For an update, see footnote 3 “Finnigan Wa Simbeye.”

¹² See footnote 1 carbon forestry programs.

⁶ See footnote 5, “WWF Rufiji, Mafia, Kilwa Seascape Programme.”

⁷ Compare the WWF RUMAKI Seascape project, <http://assets.panda.org/downloads/seascapefactsheet.pdf> (Accessed 30 November 2011), with the WWF “Building Mangrove Resilience” project, <http://www.climateprep.org/2009/12/04/building-mangrove-resilience-to-climate-change/> (Accessed 30 November 2011).

main donor for REDD+ in Tanzania is Norway which has committed NKr 500 million towards the formulation and implementation of a national REDD+ strategy in Tanzania over the next five years. The FBD of the MNRT, with technical support from the Institute of Resource Assessment (IRA), is responsible for coordinating aspects of REDD+ and REDD-readiness activities (*Tanzanian REDD Initiative, 2010*). The role of WWF in Tanzanian REDD+ projects is outlined in REDD+ project documents, which state that “WWF can have a key role to play in supporting the implementation of the [REDD] strategy”¹³ and “existing NGOs, may be in charge of overseeing the fair distribution of REDD+ funds through village level bodies in Tanzania” (*Chiesa et al., 2009: 7*). The threat of evictions and loss of access to important resources for livelihood security is another example of how international conservation interests can either directly or indirectly legitimate the state’s use of “force” in resource management and contributes to the disenfranchisement of the Warufiji’s resource claims (*Peluso, 1993*).

Tanzania is often heralded as the vanguard for local democratic forest resource management, due mostly to its decentralized state institutions (*Blomley et al., 2010*). Accordingly, Tanzanian REDD+ policies are currently being designed on existing forest management strategies such as joint forest management agreements (JMAs) (*Burgess et al., 2010*). However, we show how devolved decision-making in policy discourses do not necessarily lead to justice and equity in terms of resource access and actual local-level decision-making. Critiques of decentralized resource governance in Tanzania, particularly within the wildlife sector, are numerous and well documented by a number of scholars (*Neumann and Schroeder, 1999; Igoe and Croucher, 2007; Igoe and Brockington, 1999; Goldman, 2003*). This case provides a cautionary note for any REDD+ project modeled after a decentralized forestry scheme that is not decentralized in practice. It is a serious shortcoming in the context of REDD+ programs in Tanzania and elsewhere (*Thomas and Twyman, 2005*).

It is difficult to reconcile Tanzania REDD’s participatory and benefit sharing goals (*United Republic of Tanzania, 2010; Tanzanian REDD Initiative, 2010*) with the rhetoric, practices, and plans of the Tanzanian state. Indicative of the contradiction between REDD+ policy and Tanzanian forest management is the statement made by the Director of Forestry and Beekeeping Department in November 2009, “I am here to make sure that forests are protected and therefore I will not wait to see these forests turning into deserts and we will do all we can, including the use of force, because for such a serious matter as this one, we do not need negotiations” (*Saiboko, 2009*).

If REDD+ programs genuinely seek to apply “rights-based and participatory approaches” in practice, then forest-reliant communities’ calls for land tenure security and the development of compliance procedures and accountability mechanisms for its activities in Tanzania must be addressed (*Griffiths, 2009*). These same communities have been unable to benefit from payment for ecosystem services, such as Clean Development Mechanisms, because their land rights are not legally recognized (*Blomley et al., 2010; Yanda, 2009*). Therefore, the ambiguity around land tenure in forest reserves in Tanzania such as the Rufiji Delta legitimates concerns over scaling up REDD+ before land tenure is clarified (*Sunderlin et al., 2009*). In order for villagers to receive compensation directly from REDD+, the “legal quagmire” (*Homewood, 2006* citing *Shivji, 1994*) of land tenure in Tanzania, particularly within Forest Reserves, must be addressed.

3.3. Environmentalists’ narrative of the Rufiji Delta

The conceptualization of carbon forestry projects in the Rufiji Delta builds upon a narrative of environmental change that is shared by international conservation organizations, the Tanzanian state, and aid donors. In this section, we present the common elements that frame this narrative. In the following section we offer an alternative reading of environmental history. Both the narrative and counternarrative demonstrate the centrality of politics and political economy in the framing of environmental problems and solutions.

The environmental narrative used by WWF and the Tanzanian state to support their carbon forestry activities pivots around the problem of adaptation to climate change (*Cook, 2009; Wagner and Sallem-Mtui, 2010*). The narrative has two major parts. The first is future oriented and predicts that a main consequence of global climate change will be a rise in sea level. The second part underscores the importance of maintaining the integrity of mangrove forests as both a bulwark against rising sea levels as well as to preserve biodiversity. The main problem in preserving the forests and its biodiversity is the presence of people who are viewed as “invaders” and “destroyers” of mangrove forests. Biodiversity loss is attributed primarily to illegal rice cultivation (*Cook, 2009*).

WWF project documents indicate sea level rise as the main climate change threat to mangrove forests in the Rufiji Delta (*Cook, 2009; Wagner and Sallem-Mtui, 2010*). The 2007 Intergovernmental Panel on Climate Change (IPCC) estimates a rise in sea level of 18–59 cm by the year 2100 (*IPCC, 2007*). The impact of sea level rise in the Rufiji Delta could be the loss of coastal habitats as a result of flooding and erosion, and the loss of biological productivity (*Ngusaru et al., 2001; Wagner and Sallem-Mtui, 2010*). Since mangrove forests are widely viewed as buffering the coasts from higher seas and storms, their preservation is a top climate adaptation priority.

The narrative of causality also paints a picture of relatively recent immigration and forest degradation in the north delta area. “In the past,” the people of the Rufiji Delta cultivated rice in the Rufiji valley flood plain (*Ngusaru et al., 2001*). After the “devastation” that occurred from a massive flood in 1968,¹⁴ when the Rufiji river level rose by ten feet, President Nyerere ordered the relocation of flood plain communities to the northern part of the delta. This resettlement program was known as the villagization campaign “Operation Rufiji.” The displaced farmers purportedly began clearing mangrove forests to “adapt rice farming in new areas in response to this rather adverse situation” thus causing a new and major threat to the mangrove forest in the Rufiji Delta North (*Ngusaru et al., 2001: 10; Wagner and Sallem-Mtui, 2010: 7*). The abrupt shift in the main course of the Rufiji River towards the northern part of the delta is also believed to have changed the patterns of erosion, deposition, and salt penetration.

The less saline conditions that were enabled by the aforementioned “northward shift of the Rufiji River flow” allowed farmers to expand rice cultivation into new areas in the Rufiji Delta North (*Wood et al., 2000*). In addition, the IUCN (2004) reports that the technique for the “environmentally unfriendly” and “illegal practice” of large scale cutting of mangroves for rice farming is said to hinder natural regeneration of mangrove forests due to alterations of the soil microclimate and the lack of seed-bearing trees as seed sources. The FBD Director expressed concern at a Southern African Development Community (SDAC) meeting on

¹³ See footnote 1, “United Republic of Tanzania, October 2010,” p. 19.

¹⁴ Others argue 1978 marks the time period when the main flow of the Rufiji River was directed northward towards the Delta North (*Wagner and Sallem-Mtui, 2010: 35*). Also refer to “Report of the Meeting” (footnote 2).

REDD in Arusha, Tanzania stating, “the rapid annihilation of the country’s green cover is now going out of control” (Nkwame, 2010). In REDD+ project documents, the Rufiji Delta North is cited as having one of the highest cultivation rates, making it the “main driver” of mangrove deforestation and degradation.¹⁵

The extent of deforestation is reported in a land cover change study by Wang et al. (2003). The authors found a 1769 ha decline in mangrove forest cover in the Rufiji Delta between 1990 (49,799 ha) and 2000 (48,030 ha). Using satellite images, this study attributes “agricultural practices” as the principle cause of mangrove forest loss. The study is cited in Tanzanian REDD+ documents to chart trends in mangrove destruction (Kilahama et al., 2009). This quantitative measure justifies urgency to both protect and reclaim the mangrove forest to the natural state that purportedly characterized the Rufiji Delta prior to the expansion of rice cultivation. The politics that stem from this narrative are the strict protectionist measures, including evictions that currently define Tanzanian forestry policy for the Rufiji Delta. The take home message of the narrative is that rice farming must be stopped and mangrove trees planted if the mangroves are going to provide the critical ecosystem services needed in the context of rising sea-levels and the development of carbon markets.

3.4. An environmental historical and scientific lens of the Rufiji Delta

The environmental narrative that informs Tanzanian REDD project documents and REDD-readiness activities is flawed in three fundamental ways. First, it inaccurately describes the history of movement and settlement of people in the Rufiji Delta North. The narrative paints a picture of a relatively recent immigration of people, but archival records show the delta to be a socio-natural landscape in which farming and intensive logging were widespread since at least the nineteenth century. The area was yielding at least two rice harvests per year and mangrove poles were traded within local, regional, and international circuits. Second, the environmental science and environmental history that informs the narratives are exceedingly shallow. They do not take into account the patchy nature of the Rufiji Delta landscape that is derived in part from the fluvial geomorphology and in part from human use. This patchiness is described by 19th century explorers, colonial foresters, and contemporary environmental historians. Lastly, the threat of sea-level rise for coastal Tanzania is uncertain.

The claim that contemporary rice farmers in the Rufiji Delta North are recent immigrants that date from the villagization campaigns in 1968–1974 is historically and geographically inaccurate. The area where the villagers were planned to be relocated was not in the northern part of the delta, but further inland on higher and infertile escarpments referred to by Havnevik (1993) as North Hill (Fig. 1). Delta residents refused to comply with the government orders to move away from the fertile flood plain they had cultivated for generations (Sandberg, 1974; Sandberg, 2010). Rather than being recent immigrants, the Warufiji have populated the delta for centuries.

The Warufiji’s refusal to leave the area during villagization is consistent with a long history of resistance to outside influences. The British consul to Mozambique, James Elton, visited the Rufiji Delta North in the late-1870s. In Elton’s account of his travels, he stated that the “Rufiji sell but few slaves to the Arabs, who do not care to meddle with them” (Elton, 1879: 100). The most dramatic example of the Warufiji’s resistance to external claims on their labor and resources was their resistance to the forced cotton cultivation policies of the German Colonial Government in 1902. The brutality of forced cultivation and its effects on rural livelihoods led to the largest peasant uprising in colonial Africa

known as the Maji Maji rebellion (1905–1907) in which over 75,000 Africans were killed. Sunseri (2003, 2005, 2009) argues that the Maji Maji rebellion was sparked by the Warufiji’s refusal to recognize the colonial state’s claims to forest resources and their resistance to wage labor as wood cutters and tree planters for German colonial foresters. The Warufiji were also considered by President Nyerere to be the most supportive against the British in the struggle for Independence (Hyden, 1980). In 1996–1997, the Warufiji resisted attempts of foreign investors to build the world’s largest industrial prawn farm in the delta. This history of delta resistance is tremendously important for what we might anticipate if the proposed evictions take place.

In contrast to environmentalists’ portraits of an “Edenic” landscape prior to the 1970s, late 19th century explorers encountered a working landscape in the Rufiji Delta. The history of the region is intimately tied to the development of the coastal Swahili culture based on nearly two thousand years of trading connections between Zanzibari, Somali, Arab, Persian, and Indian traders and the coast (Havnevik, 1993; Chami and Msemwa, 1997). After 1730, the Omani engaged in extensive trading along the East African coast for mangrove poles. James Elton documented extensive settlements and trade during his travels along the Rufiji River in 1879. In the Rufiji Delta North, he described villages as “well built and populous near mangrove creeks in order for the large important trade for copal, ivory, wax, woods, and grain” (Elton, 1879: 91). In 1881, William Beardall was commissioned by the Sultan of Zanzibar to collect information of the country and people of the Rufiji Delta (Beardall, 1881). He described the Rufiji Delta North as “avenues of mangrove trees with inhabitants beginning to get in their second crop of rice” (641). In 1901, the German Captain Prussing also navigated through the same area and described loading places for wood and very suitable land for rice growing (Anonymous, 1901). In 1938, a British colonial forester stated that the area supported native villages, Indian and Arab shops, and some “good agriculture” (Grant, 1938).

Coastal traders highly valued mangrove poles from the Rufiji Delta. In the late 19th century, Rufiji was the main source of the mangrove trade for the Red Sea and Arabia (Sunseri, 2009). In 1899, the Sultan of Zanzibar had the right to exploit the Rufiji Delta for mangrove poles free of charge, despite the area being under control of the German Forest Department. At this time, fleets of Arab and Persian dhows that could load up to two hundred mangrove poles landed in the Rufiji Delta to load wood. Eighty to ninety percent of all wood exported from German East Africa originated in the Rufiji Delta (Schabel, 1990). In a five-month period from 1902 to 1903, the colonial government consumed approximately 280,000 logs of varying lengths for its steam engines (Sunseri, 2009). To maintain these forest resources, silviculture became a common practice. The German Forestry Department planted mangrove species for which demand was greatest. Merchants also prized the bark used for tanning and making resins (Barker, 1936). By the end of German rule, up to 78 percent of all mangroves in German East Africa were leased to bark exploiters (Sunseri, 2009). Mangrove forest exploitation accelerated considerably in the 1940s under British rule. In 1948, a mangrove concession was considered to be a “gold mine” (Havnevik, 1993).

A second theme in the environmental narrative of mangrove forest destruction is centered on flooding. A massive flood is believed to have caused an abrupt change in the Rufiji river course northward bringing freshwater to areas that were previously too saline to cultivate. This component of the narrative neglects the historical accounts of rice cultivation as well as the dynamic ecosystems of river deltas. All river deltas continuously change their flow patterns and courses at differing scales in time and space (Sandberg, 2010). Furthermore, fluctuations and variability in

¹⁵ See footnote 9 “Tanzania’s National REDD Strategy Development.”

flooding has occurred throughout the Rufiji river delta's history with new patterns of flooding every year, particularly during the long rains, that bring fresh water to places that were previously too saline (Marsland, 1938; Havnevik, 1993). Despite a continuous change in the patterns and courses of the Rufiji river delta, all of its river mouths tend to turn northwards as they reach the coast due to the overall net northward long-shore drift.

The Warufiji's complex shifting rice cultivation practices rely on this historical seasonal variability. They combine mangrove silviculture with rice paddy farming by abandoning rice paddy fields when they become too saline due to seasonal changes (small temporal scale) or river course changes (long temporal scale). Thus, Warufiji rice farmers plant and farm rice seasonally in relation to their predictions for salinity changes. It also makes it impossible for the Warufiji to grow rice everywhere at all seasons. Moreover, the closer to the mouth of the Rufiji River the greater the exposure is to salt water intrusion which reduces the area suitable for growing rice. The Warufiji also allow the mangroves to regenerate naturally while preparing new rice fields in less saline areas. Mangroves have a great propensity to regenerate themselves (Primavera, 2009). Natural regeneration of mangrove forests also contributes to higher biodiversity than silviculture, which often involves the planting of just a few species.

This extensive use of the Rufiji Delta North for farming, fishing, logging, and forestry demonstrates that the mangrove forests were a highly utilized environment that could hardly be described as "Edenic." Furthermore, the restrictions placed on mangrove forest land use by the FBD demonstrates how current land use in the Rufiji Delta North is not nearly as extensive as it was during the 18th and 19th centuries and even earlier. This environmental history illustrates how (1) it is problematic to suggest that a single major flood event would cause such an abrupt change in the course and direction of rivers in the Rufiji Delta to allow penetration of freshwater into an entire area it previously did not reach; and (2) Warufiji land use (e.g. rice cultivation) patterns take a mosaic form that mirrored the flooding, silting, and shifting river pattern.

In light of this mosaic land cover pattern, it is difficult to imagine the extent of environmental degradation projected by Wang et al. (2003). Mangrove vegetation is quite patchy, especially across multiple intersecting gradients of elevation, water and salinity levels, soil types, and wave exposure. These gradients affect the species composition, size, and growth patterns of mangrove trees on scales that are much finer than the satellite imagery resolution of 15 m and 30 m used by Wang et al. (2003). It is difficult to define the outer boundaries of a mangrove, and impossible to delineate the variations within a mangrove forest. One indicator of the difficulty in measuring land cover change in Tanzanian mangrove forests is the contradictory data. The World Mangrove Atlas (Spalding et al., 1997; Spalding et al., 2010), indicates that total mangrove forest cover in Tanzania has increased from 1155 km² in 1993 to 1286 km² in 2010.

The anticipated impacts of climate change, particularly sea-level rise, are considered to make conditions even more precarious for mangroves and heighten the urgent need to improve their management and protection (Cook, 2009). Using recent data from the University of Hawaii Sea Level Center, Benjaminsen et al. (2008) show that sea level in Tanzania is not rising. In fact, it appears to be falling. Mean sea level fall in the southern Indian Ocean are also corroborated by Wenzel and Schroter (2010), Woodroffe and Horton (2005), and Woodworth et al., 2007. Falling rates of sea-level are attributed to the rise of the coastline from thousands of years of tectonic plate movements associated with the East African Rift Valley (Benjaminsen et al., 2008). Therefore, at present, the Tanzanian coastline does not appear to be threatened by sea-level rise. Assumptions to the contrary do not take into consideration tectonic plate movements.

The long-standing practice of shifting rice cultivation combined with natural regeneration may have positive implications for biodiversity by creating minor perturbations and small changes and openings within environments as well as new niches for a wider variety of plant and animal species. These subsistence rice farming systems have also been recognized for at least two centuries in the Rufiji Delta and demonstrate that Delta North is an agroecological landscape. Thus, the question arises is what will happen to this complex and relatively stable socio-ecological system when carbon foresters and conservationists supplant the Warufiji in the Rufiji Delta North?

4. Revisioning REDD through an environmental justice lens

This paper has focused on the politically charged issues of environmental justice in the Rufiji Delta of Tanzania in the context of WWF and Tanzanian state carbon forestry programs to make the Rufiji Delta North "REDD ready." We have shown how in the case study of the Rufiji Delta, carbon forestry activities unfolding in anticipation of REDD+ are redolent with environmental injustices that threaten the livelihoods of the Warufiji. Our findings are four-fold. First, this case study validates the social and environmental justice concerns within the global climate change mitigation and adaptation literature associated with carbon forestry (Griffiths, 2009; Sikor et al., 2010). It shows how carbon forestry initiatives are redefining socio-natural relations in ways that threaten access to, control, and management of natural resources. In the process of making the Rufiji Delta "REDD ready" for carbon forestry markets, resource control and management appear to be shifting from local people in the Rufiji Delta to global actors.

Second, the study also demonstrates the ways this local to global shift in resource control and management are legitimated by narratives of environmental change (forest loss; rising sea levels) that have little basis in environmental history. Along with Sunseri (2009), we have demonstrated how the depiction of the Warufiji as invaders and destroyers of mangroves and forest loss as recent and abrupt, "erases the history of these forests as peopled spaces" (184). This misreading of the Rufiji landscape persists because it is central to the framing of environmental problems in ways that allow national and global actors to intervene in the landscape and livelihoods of the Warufiji. When this narrative is placed in the context of rising sea levels, it suggests an urgent need for intervention. In contrast, to this environmental crisis narrative, our case study suggests that the mangrove forests of the Rufiji can be reasonably described as sustainably utilized environments particularly when compared to historical forest use (e.g. timber extraction during pre-colonial and German colonialism). This re-reading of landscape and history reveals the injustices in current interpretations and recommends a conservation-with-development approach that supports existing practices of the Warufiji rather than their forcible removal from the forest.

Our third finding is that the Warufiji are resisting efforts to make the Rufiji Delta North "REDD ready" on the grounds that these efforts will increase their vulnerability and displacement. The Warufiji have a long history of resisting the claims on their labor and resources by outsiders. This begs the question in the formulation of REDD+ strategies, what incentives do REDD+ programs actually provide in order to change a history of resistance? The core issue at stake is the Warufiji's historical rights to land and water resources which national land laws and forest acts sometimes respect and sometimes reject. This is particularly relevant to the ability of REDD+ programs to constrain deforestation without seriously compromising food and livelihood security (Grieg-Gran, 2010).

Lastly, our case study legitimates concerns posed by Phelps et al. (2010), "does REDD+ threaten to recentralize forest

governance?" REDD+ sees decentralization of forest resource management as the key to empowering local communities. However, the Rufiji Delta case study reveals that the Warufiji have very limited representation with accountability and reduced access to significant material resources (Ribot et al., 2008). WWF, on the other hand, gains power by aligning itself with the Forestry and Beekeeping Division, while resisting downward accountability (Poteete and Ribot, 2011). Thus, resistance may be the only means for many Warufiji to defend themselves against the menace of REDD+, if it is implemented based on current carbon forestry governance in the Rufiji Delta. In order for REDD+ to result in both sustainable forestry and poverty reduction, the historical exclusion of forest-reliant communities from land ownership must be addressed. Equitable distribution in the form of securing the Warufiji's land tenure rights to resources is of primary concern. To carbon traders, however, an uninhabited forest greatly simplifies the logistical tasks of monitoring and paying for ecosystem services. The case study of the Rufiji Delta suggests that this "new direction in forest conservation" (Anglesen, 2009) may be overwhelmingly opposed by the people who stand to lose the most from such climate mitigation schemes.

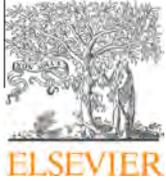
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Virtual nature, violent accumulation: The ‘spectacular failure’ of carbon offsetting at a Ugandan National Park



Connor Cavanagh*, Tor A. Benjaminsen

Department of International Environment and Development Studies (Noragric), Norwegian University of Life Sciences, Universitetstunet 1 (Tivoli), P.O. Box 5003, NO-1432 Ås, Norway

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ABSTRACT

In East Africa, financially strained governments increasingly experiment with voluntary, market-based carbon offset schemes for enhancing the public management of protected areas. Often, conservationists and governments portray these as ‘triple-win’ solutions for climate change mitigation, biodiversity preservation, and local socioeconomic development. Examining such rhetoric, this paper analyses the rise and decline of an integrated carbon offset and conservation initiative at Mount Elgon National Park in eastern Uganda, involving a partnership between the Uganda Wildlife Authority (UWA) and a Dutch NGO, Face the Future. In doing so, the paper reveals the ways in which the uncompensated dispossession of local residents was a necessary precondition for the project’s implementation. Although external auditors expected the project to sequester 3.73 million tons of carbon dioxide equivalent (tCO₂e) between 1994 and 2034, conflicts forced the scheme to cease reforestation in 2003. Noting this rapid decline, we problematize the ways in which Face the Future and other carbon market intermediaries represented their activities via project documents and websites, obscuring the violence that was necessary for the project’s implementation. In so doing, we argue that the maintenance of a ‘triple win’ spectacle is *itself* integral to the management of carbon sequestration projects, as it provides consumers with a form of ‘ethical’ use value, and greatly enhances the capacity of carbon market brokers to accumulate exchange value by attracting ‘green’ investors. Consequently, what we term a ‘spectacular failure’ manifests in at least two ways: first, in the unravelling of the heavily mediated spectacle of harmonious, profitable conservation, and, second, in the deleterious nature of the consequences that accrue to local communities and ecosystems alike.

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Introduction

Upon visiting greenseat.nl, the homepage of a Dutch organization that markets carbon offset services to airline, train, and bus passengers, one is immediately greeted with an imperative to ‘travel greener now!’ On this website, and at the mere click of a mouse button, consumers ostensibly pay for both a clear environmental conscience and a healthier atmosphere. At present, GreenSeat markets carbon offsets derived from ‘voluntary’ clean energy projects, such as those involving solar and wind power. Between 1993 and 2003, however, the organization allegedly sold offsets sourced from tree plantations sponsored by a Dutch NGO – now known as ‘Face the Future’ – at Mount Elgon National Park in Uganda (Checker, 2009; Faris, 2007; Lang and Byakola, 2006; Sullivan, 2011).¹ Today,

by contrast, one cannot find mention of this initiative in the websites or organizational literature of either GreenSeat or Face the Future. Similarly, recent studies of conservation at Mount Elgon make little or no mention of the project and its relationship to the history of forest governance in the region (Norgrove and Hulme, 2006; Petursson et al., 2011; Petursson et al., 2013a,b; Sassen and Sheil, 2013; Sassen et al., 2013).² What happened? Examining the disappearance of this project from global ecosystem service markets, this paper analyses the rise and decline of Face the Future’s scheme at Mount Elgon; the problematic ways in which it represented its operations via the internet; and the violence that was simultaneously experienced by local people.

Such an inquiry is warranted, we claim, given that similar attempts to link Ugandan protected areas to a global “economy of repair” (Fairhead et al., 2012, 242) through carbon markets have decidedly exhibited what MacDonald (2013) – following the philosophers Peter Sloterdijk and Slavoj Žižek – terms “cynical

* Corresponding author. Tel.: +47 48302046.

E-mail addresses: connor.cavanagh@nmbu.no, connor.j.cavanagh@gmail.com (C. Cavanagh).

¹ ‘Face the Future’ was originally known as the Forest Absorbing Carbon Emissions (FACE) Foundation (see also Lang and Byakola (2006) and <http://www.face-thefuture.com>).

² Sassen et al. (2013, 260) note the existence of the UWA-FACE project in a summary table of the last one hundred years of conservation governance at Mount Elgon, but do not further examine or explain its disappearance.

reason”, or strategic attachment to a disingenuous set of rhetorical claims. Differently put, although brokers of the voluntary carbon market frame these initiatives as a ‘triple-win’ for biodiversity conservation, climate change mitigation, and socioeconomic development (National Forestry Authority [NFA], 2011; Uganda Wildlife Authority [UWA], 2011), a growing body of evidence documents the deleterious consequences of forest conservation for local populations in both Uganda and elsewhere in East Africa (Benjaminsen and Bryceson, 2012; Benjaminsen et al., 2013; Beymer-Farris and Bassett, 2012; Brockington, 2002; Gardner, 2012; Igoe and Croucher, 2007; Nel and Hill, 2013; Neumann, 1998; Norgrove and Hulme, 2006). Likewise, NGOs and activists have published controversial accounts of the dispossession of rural populations for Ugandan carbon offset forestry projects in particular (Friends of the Earth, 2012; Lang and Byakola, 2006; Nel and Sharife, 2012), including the notable case of more than 20,000 people allegedly evicted for a project managed by a British firm, the New Forests Company (Carrere, 2009; Oxfam International, 2011). In such instances, it would appear that these exploitative attempts to pursue carbon offset forestry in Uganda are emblematic of both ‘green grabbing’ processes (Fairhead et al., 2012) and the ‘global land grab’ more broadly (e.g. Borras et al., 2011).

The primary objective of this paper, however, is not *only* to present an empirical account of green grabbing. Additionally, we focus on what Corson et al. (2013, 5) term “grabbing green”, or on the various “inter-relations, systemics, logics, and mechanisms” that both UWA and Face the Future have utilized to pursue their respective agendas under a global environmentalist mandate, and how these mechanisms ultimately unravelled. Indeed, these organizations’ representation of carbon offset forestry as a ‘triple win’ is no simple task, as it necessarily entails the enrolment and stabilization of a vast network of actors, technologies, expertise, and institutions. In other words, these projects denote the need for “socially necessary abstractions” (Robertson, 2012, 389), or the conceptual output of processes of measurement and representation that allow certain aspects of ecosystems to be isolated, standardized, and circulated through markets. Crucially, the production of these abstractions is a profoundly *virtual* process, or an attempt “to make the world around us look like and conform to an abstract model of it” (MacDonald and Corson, 2012, 160). Such virtualism has characterized efforts to conserve biodiversity at least since the colonial era (West et al., 2006), in which fundamentally Western or ‘modern’ (Latour, 1993) conceptions of the distinction between nonhuman ‘nature’ and human ‘society’ were territorialized in the form of protected areas (Adams and Hutton, 2007). Yet, new technologies add a novel dimension to these already virtual processes, best encapsulated perhaps by the term “Nature 2.0” (Büscher, 2013). Through conservation websites and blogs, social media platforms like Facebook, Twitter, and Youtube, and the integration of conservation finance into everyday consumptive practices (Igoe, 2013), consumers increasingly experience nature itself as a spectacle, or as a series of consumable images and representations (Sullivan, 2013).³ In many ways, conservation has thus become ‘spectacularized’, generating profits through what we might term ‘spectacular accumulation’ (Igoe, 2010, 378; Tsing, 2000, 139), as it increasingly relies upon an array of mediating technologies to link capital with the often-distant places that it is now meant to conserve.

In relation to the synthesis of carbon offsetting and more conventional forms of biodiversity conservation, spectacular

accumulation operates through representations of the presumed global commensurability of greenhouse gas emissions (Bumpus and Liverman, 2011; Fairhead et al., 2012). That is, through a series of abstractions that allow one tonne of carbon dioxide equivalent (tCO₂e) emitted by industry in the Global North to be rendered as precisely equivalent to another sequestered by forests (or via an alternative scheme) in various ‘frontier’ (Tsing, 2005, 59) regions of the Global South. This point should not be misunderstood as a methodological critique – we do not question that forests at least temporarily sequester carbon dioxide in the amounts estimated by project managers, although many analysts have raised salient technical issues related to carbon leakage and permanence (Ascui and Lovell, 2011; Bachram, 2004; Galik and Jackson, 2009; Lovell and Liverman, 2010). Rather, we contribute to this rapidly growing literature by arguing that spectacularization constitutes a *necessary* component of the production of a carbon offset. As we will see, the maintenance of a ‘triple win’ spectacle is itself integral to the management of carbon sequestration projects, as it provides consumers with a form of ‘ethical’ use value, and greatly enhances the capability of carbon market brokers to generate exchange value by attracting ‘green’ investors. Consequently, when these projects fail to maintain a coherent triple-win representation, what we term a ‘spectacular failure’ manifests in two interrelated ways: first, in the unravelling of the heavily mediatized imagery of harmonious, profitable conservation, and, second, in the extent of the deleterious consequences that accrue to local communities and ecosystems alike.

This argument is supported in five sections. First, we examine recent approaches to the political ecology of carbon offsetting, and draw particular attention to the ways in which these processes necessarily involve spectacular forms of accumulation. Second, we highlight the ways in which the violent and uncompensated dispossession of local residents was a necessary precondition for the UWA-FACE project’s implementation, effectively constituting a process of interrelated accumulation and *naturalization* by dispossession. Third, we identify a number of antinomies between the ‘triple-win’ rhetoric that characterized the FACE Foundation’s literature with UWA’s struggles to contain local resistance and legal challenges to conservation in the area. Fourth, we specifically examine the ‘spectacular failure’ of the UWA-FACE project at Mount Elgon, and present findings regarding the impacts of these activities on both forest plantations and local communities. Finally, we conclude with a discussion of the implications of these events for other proposed schemes to trade in carbon offsets over voluntary markets in East Africa and elsewhere.

Virtual nature, or: Why carbon forests have spectacular social lives

Much recent work in political ecology has critically engaged with the production of ostensibly ‘socio-natural’ commodities (Arsel and Büscher, 2012; Büscher and Arsel, 2012; Büscher et al., 2014; Fletcher, 2012; Peluso, 2012; Roth and Dressler, 2012), and especially so within the politicized context of global environmental change (McAfee, 2012; Peet et al., 2011). Following influential conceptualizations by Castree (e.g. 2003b, 2008) and McCarthy and Prudham (2004), these inquiries increasingly share an interest with the ways in which new ‘green’ markets result in both the reproduction of old-, and the generation of new-, inequalities, dispossessions, or restrictions of access to natural resources (Büscher et al., 2012; Fairhead et al., 2012). Interestingly, then, rather than constituting a radical limit for capital accumulation (O’Connor, 1988), this literature interrogates the ways in which the environment frequently now provides a new frontier for the generation of surplus value (Sullivan, 2013), and/or a

³ See, for example, the new website launched by the Uganda Wildlife Authority with assistance from USAID’s Sustainable Tourism in the Albertine Rift (STAR) programme, featuring built-in connectivity for a variety of social media platforms, as well as endorsements from TripAdvisor, CNNTravel, National Geographic, and Lonely Planet (<http://ugandawildlife.org/>).

'spatial-environmental fix' for the resolution of intertwined economic and ecological crises elsewhere in the capitalist system (Harvey, 2003; Smith, 2007). Consequently, these concerns further compound related discussions about both climate and environmental justice, which seek to prevent the mitigation of largely Northern-induced processes of global environmental change at the expense of vulnerable communities in the developing world (Agarwal and Narain, 1991; Beymer-Farris and Bassett, 2012; Marino and Ribot, 2012).

To understand the complex ways in which these concerns intersect with the production of carbon offsets, however, we must first examine the basic character of these commodities, which is simultaneously both 'social' and 'natural'. For example, Bumpus (2011, 616) notes four distinct, yet simultaneous, 'types' or dimensions of existence for each individual carbon offset:

"the carbon that continues to be emitted by the offset buyer (type 1); the carbon that would have been emitted if it had not been displaced by the project activity (type 2); the lower emissions as a result of the project activity (type 3); and the tCO₂e (type 4) that is produced by the difference in emissions as a result of the project activity and baseline."

Here, we see that a carbon offset is primarily relational or 'hybrid' (Castree, 2003a), as it necessarily problematizes the conceptual nature-society distinction that Bruno Latour (1993, 29) terms the 'modern constitution'. In the case of reforestation projects, for example, tCO₂e have a material existence in the sense that it is possible to measure the amount of carbon dioxide that is stored in a given portion of forest (Ascuí and Lovell, 2011). However, a given tCO₂e stored in forests is not, clearly, the very same tCO₂e that was released elsewhere in the world. Consequently, in contrast to the biophysical sequestration of carbon dioxide, the *production of a carbon offset* is co-dependent on the (often transnational) construction of relationships between those who emit, those who sequester, and the ecosystems and technologies enrolled by both. If one of these components functions as required, but another falters, the carbon offset unravels as an entity and ceases to exist.

Such co-dependency forces proponents of carbon offsetting to constantly engage in acts of "translation" in order to keep these relationships functioning smoothly (Mosse, 2005, 9). Project managers must constantly employ measurement, certification, and accounting technologies in order to assure the consumers of carbon offsets that they are, in fact, purchasing something that exists (Ascuí and Lovell, 2011; Lovell and MacKenzie, 2011). Yet, for offsetting arrangements that involve afforestation or reforestation, carbon is 'uncooperative' in the sense that it is significantly more difficult to measure and quantify than with other technologies (Bumpus, 2011). This is particularly true in contrast with, for example, the destruction of industrial gases like nitrous oxide and hydrofluorocarbon-23, which is an inherently more controllable and measurable process (Lovell and Liverman, 2010, 258). In particular, forestry projects are specifically afflicted by the twin problems of 'leakage' and 'permanence'; whereas 'leakage' refers to the possibility that deforestation activities will simply be displaced outside the project area, 'permanence' refers to the omnipresent risk of stored carbon being released through fire, disease, pests, human encroachment, or a variety of other contingencies (Galik and Jackson, 2009; Wunder, 2008). Thus, for Bumpus and Liverman (2011, 210), a carbon offset is best conceived as being created through a process of "hemming in" that involves the use of monitoring procedures, baseline calculations, guarantees of

additionality, and robust offset methodologies. When these components become more loosely coupled, the offset's own existence becomes less certain. Consequently, we again see how the existence of a carbon offset is inseparable from the collective functioning of biophysical systems, mediating technologies, and the 'social work' of monitoring, evaluation, auditing, and disseminating results to prospective consumers through interactive websites, applications, and blogs.

We note, moreover, that it is precisely in relation to the latter task that the business of carbon offsetting necessarily proceeds through practices of spectacular accumulation. Here, we do not draw a simple distinction between 'actual' empirical realities and falsely spectacular representations of these by conservationists and their financiers. Rather, following Igoe's (2010, 376) reading of Debord (1967) and Tsing (2000, 2005), spectacles are "not different and separate from the conditions that they portray, they are produced by them and, in turn, define and reproduce them." As such, we instead encounter a virtual relationship between the biophysical world and instrumental representations of it, wherein the spectacle of 'pristine' carbon-sequestering landscapes enables the generation of resources to both create new enclosures and more effectively govern existing ones. In other words, financial transfers for carbon offsetting must be "imagined" or "conjured" before they can be actualized, creating a situation in which, as Tsing (2000, 118) puts it, "[t]he more spectacular the conjuring, the more possible an investment frenzy."

Hence, although conservationists' attempts to produce such an 'investment frenzy' have rendered a commodified version of African 'nature' more visible to international audiences than ever before, this spectacular set of images and representations is thoroughly fetishized. Of course, for Marx (1995 [1867], 47), commodity fetishism refers to the ways in which capitalist production masks the social relations implicated in the production of a particular good or service, where "the relation of the producers to the sum total of their own labour is presented to them as a social relation, existing not between themselves, but between the products of their labour." In other words, fetishism occurs when commodities are consumed "without reference to the relationships and contexts from which they were produced" (Igoe, 2010, 378). In the case of markets for ecosystem services, therefore, fetishization obscures the ways in which both legal and extra-legal violence and dispossession are often necessary to implement the land use changes required for the production of carbon offsets and similar commodities (Peluso and Lund, 2011; Springer, 2013).

When the political-ecological relations of exploitative carbon offsetting initiatives are rendered visible, however, what we will term a 'spectacular failure' ensues. This entails, first, the unraveling of the heavily mediatized imagery of harmonious, profitable conservation often presented in websites and project documents. Yet, such failures are also 'spectacular' in an additional sense; that is, in the extent to which they reveal an enormous gap between 'representation' and 'execution' in project activities, and the ways in which this gap entails deleterious consequences for local communities and ecosystems alike. Subsequent portions of this paper provide an empirical discussion of such a 'spectacular failure' by analysing a voluntary carbon offset and conservation scheme at Mount Elgon National Park (MENP), known as the Uganda Wildlife Authority-Forest Absorbing Carbon Emissions (UWA-FACE) project. In doing so, we seek to problematize the ways in which the UWA-FACE project represented the political-ecological relations that governed the project's sequestration of carbon dioxide to prospective consumers of the resulting carbon credits.

Naturalization by dispossession? The commodification of carbon sequestration at Mount Elgon, Uganda⁴

In 1992, a Dutch NGO – the Forest Absorbing Carbon Emissions (FACE) Foundation⁵ – approached the Ugandan Ministry of Trade, Tourism, and Industry (MoTTI) with a proposition to reforest degraded sections of the Mount Elgon Forest Park.^{6,7} The FACE Foundation knew that many of Uganda's protected areas were severely degraded during the tumultuous post-independence period, and during the civil war that eventually brought current President Yoweri Museveni to power in 1986. At Mount Elgon, this damage was particularly substantial, as approximately 25,000 ha of the reserve's forest cover were lost during this time (Norgrove and Hulme, 2006; White, 2002). Since Uganda's economy also suffered greatly during this period, few internal revenues were available for the rehabilitation of national parks and forest reserves. Indeed, the World Bank notably ranked Uganda as the worst performing economy in Sub-Saharan Africa for the period between 1961 and 1989 (Norgrove, 2002, 70–71), and the implications for the government's capacity were understandably substantial.

As a result, the MoTTI favorably received the FACE Foundation's interest in Mount Elgon. According to the original contract between these two parties (FACE Foundation, 1992), FACE agreed to cover the costs of reforestation, including those incurred for labor and procurement. In return, the MoTTI and its subsidiary, Uganda National Parks (UNP),⁸ were required to relinquish the rights to market the carbon dioxide stored in the new forest compartments, and to guarantee the security of these new plantations for a period of 99 years. Further, the contract stipulated that these compartments would sequester a minimum of “5500 kg CO₂ per hectare per year” (FACE Foundation, 1992, 7). As noted earlier, carbon credits generated by this scheme were also allegedly marketed via a Dutch organization known as GreenSeat – which sells voluntary carbon offsets to airline, bus, and rail passengers – and its parent organization, the Climate Neutral Group (Checker, 2009, 46; Lang and Byakola, 2006, 9; Sullivan, 2011, 336). As such, prospective consumers were ostensibly invited to “travel greener” by purchasing carbon credits from the FACE Foundation's plantations at Mount Elgon (GreenSeat, 2012).

Presumably unbeknownst to many potential consumers, however, the Dutch Electricity Generating Board (known as ‘N.V. Sep’) originally established the FACE Foundation in 1990 (FACE Foundation, 2000, 2001a). Officially, N.V. Sep's objective was to ensure that the foundation would “provide enough CO₂ credits from afforestation and reforestation projects to offset the CO₂ emissions from a new coal fired power station” in the Netherlands

(Société Générale de Surveillance [SGS] Agrocontrol, 2001, 4).⁹ Although the FACE Foundation formally “decoupled” from N.V. Sep in 2000 (FACE Foundation, 2001a), European electricity firms apparently continued to constitute a large portion of the FACE Foundation's clientele (FACE Foundation, 2000, 2001a). Unsurprisingly, the organization generally downplays this connection with coal-fired electricity generation, and asserts that its main objective “is to establish and protect forests [...] sustainably and responsibly, in suitable areas, wherever in the world, and by so doing to contribute to reducing the amount of CO₂ in the atmosphere” (FACE Foundation, 2001a, 2). Thus, although the organization is ‘non-profit’ in a strictly technical sense, the foundation is only thinly separated from the for-profit apparatus of N.V. Sep and its other clients, who increasingly seek to reduce environmental criticisms of their operations without changing the core of their business practices, perhaps also increasing their competitiveness over firms that are not so ‘environmentally savvy’ in the process.

In the early 1990s, this type of contract was virtually unprecedented in sub-Saharan Africa. Indeed, the world's first voluntary carbon offset arrangement was implemented only a few years prior in 1989, in an agreement signed between the AES Corporation (a US electricity firm) and an agroforestry project in Guatemala managed by CARE International (Bumpus and Liverman, 2008, 133). Also a pioneer, the FACE Foundation had established a carbon offset forestry projects in Ecuador in 1990 (Bumpus, 2004), and perceived Uganda's newfound political stability as a potentially feasible entry-point for expanding their operations to East Africa. Given that the UNFCCC itself was only established after the Rio Earth Summit in 1992, and the Kyoto Protocol even later in 1997, these activities long preceded the ‘compliance’ carbon offset schemes initiated under the framework of the UNFCCC and its Clean Development Mechanism (CDM). As the ensuing discussion aims to show, however, the ‘triple-win’ spectacle of the FACE Foundation's project was undermined by the manner in which its activities were ultimately implemented. Specifically, the violent evictions that characterized this process of (re)naturalization on Mount Elgon suggest that one might accurately describe these events as a form of “primitive accumulation” (Corson and MacDonald, 2012; Kelly, 2011), or environmentally-justified “accumulation by dispossession” (Benjaminsen and Bryceson, 2012; Fairhead et al., 2012). This holds both in relation to the outright enclosure of land and resources, and the alteration of conservation institutions in ways that restricted local access to livelihood-supporting resources such as water, fuelwood, and non-timber forest products – all the while creating new sources of income for UWA and the FACE Foundation.

Accumulation by dispossession, selective history, and the (re)production of ‘nature’ at Mount Elgon

Within a year of the original MoTTI-FACE Foundation contract being signed in November 1992, the Ugandan government resolved to upgrade Mount Elgon to national park status, and to remove ‘encroachers’ from within its boundaries (Gosalamang et al., 2008; Norgrove and Hulme, 2006; White, 2002). Although it is difficult to retrospectively open up the strategic ‘black box’ surrounding this decision (Mosse, 2005, 20), one should note the correlation between financial incentives provided by both the FACE

⁴ Empirical findings in this section are the result of fieldwork conducted by the first author during September–December 2009 and July–December 2011, consisting of 53 semi-structured interviews, content analyses of project documents, and five focus group discussions with UWA-FACE plantation-adjacent communities. First, data on the establishment of UWA-FACE forest compartments at Mount Elgon, their distribution around the protected area, and local encroachment were gathered through semi-structured interviews with employees of the Uganda Wildlife Authority and other Ugandan environmental management agencies, as well as through content analyses of official documents, accounts, and project records.

⁵ The FACE Foundation has since rebranded itself as ‘Face the Future’.

⁶ According to Lang and Byakola (2006, 59), this initial series of negotiations was brokered by one Jan Bettlem, a Dutch national then working as a Technical Advisor for IUCN in Uganda.

⁷ Mount Elgon Forest Reserve was re-designated as a Forest Park in 1991, and as a National Park in 1992–3.

⁸ Uganda National Parks later merged with the Game Department to form the Uganda Wildlife Authority (UWA) in 1996, in accordance with the 1996 Uganda Wildlife Statute.

⁹ In March 2008, the Dutch television programme ‘Zembla’ aired a documentary on Dutch coal-fired electricity and carbon offsetting at Mount Elgon, entitled ‘Het CO₂ Alibi [The CO₂ Alibi]’ (available at <http://zembla.incontxt.nl/seizoenen/2008/afleveringen/02-03-2008>). The programme generated significant public controversy in the Netherlands, which in turn paralleled international debates following the publication of a widely-read report by Chris Lang and Timothy Byakola (2006) for the World Rainforest Movement.

Foundation and other donors, such as USAID's (1991) US\$ 30 million National Action Plan for the Environment (NAPE),¹⁰ and the Government of Norway's support to the Mount Elgon Conservation and Development Programme (MECDP), which was first implemented in conjunction with IUCN in 1988 (White and Hinchley, 2001). Indeed, among scholars of conservation and natural resource management in East Africa, substantial debates exist regarding whether such decisions are generally 'organic', or undertaken largely at the behest of international pressures from NGOs and donors (Gibson, 1999; Gosalamang et al., 2008). The reality is complex, and, we assert, arises in response to varying combinations of the interests of political elites, NGOs, multilateral and bilateral donors, and the financial incentives provided by these actors.

In contrast to the multiplicity of these interests, however, the process of upgrading the Mount Elgon Forest Park to a National Park in 1993 was singularly violent. Beginning in 1993, the 25,000 ha of degraded parkland targeted for reforestation by the FACE Foundation were cleared of 'encroachers' by paramilitary UNP rangers and National Resistance Army¹¹ soldiers (Norgrove, 2002; Norgrove and Hulme, 2006; White, 2002). These evictions were reportedly characterized by widespread violence and human rights abuses, and may have involved little or no prior warning at many locations (Himmelfarb, 2012; Hurinet Uganda, 2011; Lang and Byakola, 2006; Norgrove, 2002; Norgrove and Hulme, 2006; Vangen, 2009). While the Ugandan Constitution and relevant land-use legislation afford the right to the state to seize land when it is deemed to be in the national interest (Government of Uganda, 1995; Hunt, 2004; Okuku, 2006), they also stipulate that both due warning and compensation must be provided to evictees. Official records of the evictions were not kept, however, and estimates now vary regarding the exact number of people displaced. For instance, Checker (2009, 45) – reviewing empirical work by Himmelfarb (2006, 16) – claims that the project resulted in the eviction of 6000 people. This figure is also cited by Sullivan (2011, 336). However, Himmelfarb's fieldwork was limited only to a specific portion of the northern edge of Mount Elgon National Park, known as the Benet Resettlement Area, which is located in two of the least populated of the eight districts that currently border the protected area (Uganda Communications Commission [UCC], 2010). Indeed, estimates of human displacement from the national park as a whole tend to be much higher: Vangen (2009, 135) roughly estimates that the overall figure could exceed 150,000 persons. Likewise, Sean White (2002, 2–3) – then IUCN's Chief Technical Advisor for the Mount Elgon region – estimates that the 25,000 ha of encroached forest could have fed as many as 84,000 households, or approximately 580,000 people at current household sizes. Regardless of the exact extent of the evictions, communities were not provided with official compensation either for the loss of land and property, nor for injuries sustained as a result of the evictions (Gosalamang et al., 2008, 44). Finally, one should note that while the bulk of these activities occurred in 1993, lower intensity paramilitary evictions continued over the next decade, and especially when the 1993 boundary was re-gazetted in 2002–3 with financial assistance from the World Bank's Protected Areas Management for Sustainable Use (PAMSU) programme (Cavanagh, 2012; Norgrove and Hulme, 2006; White, 2002). Such paramilitary activities continue to prevent access to land, cultural sites, and forest resources in territory that was formerly occupied by communities.

Conversely, the Ugandan government and UNP¹² claim that these evictions were perfectly legal, and that allegations of abuse remain unproven. For UNP, especially, inhabitants of the Mount Elgon Forest Park were perceived as 'squatters' or 'encroachers', who simply and illegally appropriated public land for their own private use (NFA, 2011; UWA, 2009a, 2011). However, this position is complicated by our archival research on Mount Elgon's management history. First, as noted in the original working plan for the Mount Elgon Forest Reserve (Webster, 1954, 6),

“[r]ather unwillingly, the [Forest] Department agreed to a field investigation early in 1940 by an administrative officer and a forest officer. As a result of their recommendations, the [park boundary] line was adjusted in twenty places between Bulago and Bumbo [parishes]. These excisions amounting to about six square miles, were not surveyed nor was the gazetted area or the reserve altered. In addition to the excisions, licenses were issued to about 70 families who were allowed to remain and cultivate in the reserve. These licenses were issued for life and, if the original licensee died, the license could be transferred to one of the sons.”

In addition to such excisions, the 1962 *Public Land Act* and 1969 *Public Lands Act* likewise complicated the overarching tenure situation, as both were often interpreted as affording farmers the right to deforest unoccupied public land for agricultural purposes without prior consent from the government or other authorities (Mugambwa, 2007; Petracco and Pender, 2009, 6). Later, land tenure relations were further destabilized by Idi Amin's 1975 Land Reform Decree, which claimed all land in Uganda as state property (Hunt, 2004, 176; Okuku, 2006, 10–11). In some instances, farmers were encouraged to appropriate land as they pleased, the logic being that this would reduce the dependence of rural populations on the state and mitigate the effects of its increasingly dysfunctional management of the national economy. Simultaneously, Amin's government also simply distributed portions of protected areas to supporters when such actions were deemed politically expedient (Turyahabwe and Banana, 2008, 650). Further, as noted by Norgrove and Hulme (2006, 1098), settlement of the forest reserve also occurred during Milton Obote's second regime, during which allegedly corrupt Forest Department officials sold illegitimate land titles to farmers at Mount Elgon. Today, however, many conservationists systematically ignore these inconvenient pieces of Uganda's land tenure history, and instead strategically adopt a legalistic, uncritical, and ahistorical perspective on communities living within protected areas (see, for example, NFA, 2011 or UWA, 2011). Here, we perhaps see what both Peluso and Lund (2011, 674–676) and Springer (2013, 533) describe as 'law's violence', or the ways in which the law itself can be utilized as a tool of dispossession, especially when it overwrites traditional and customary forms of land possession and use.

In light of such violence, one can observe “conservation practice as primitive accumulation” (Kelly, 2011) at Mount Elgon in two distinct forms: (i) in the uncompensated expropriation of land and physical assets; and (ii) in the expropriation of rights of access to common property resources. Indeed, whereas the former component is well documented in the social scientific literature on conservation at Mount Elgon, researchers have frequently analyzed the latter only in the economic sense, as a lost asset for park-adjacent household economies. In a political-economic sense, however, the expropriation of rights to common property also entails the proletarianization of subsistence farmers, or the heightened exposure of their household's demand for basic commodities

¹⁰ With this programme, USAID played a crucial role in both financing and conceptualizing Uganda's initiative to regain control over its protected areas. In the original grant document, USAID (1991) emphasizes the need to clearly demarcate the boundaries of reserves, remove existing encroachers, and involve nongovernmental organizations in the management of protected areas.

¹¹ The National Resistance Army was renamed the Uganda People's Defence Forces (UPDF) in 1995, and is Uganda's official military force.

¹² UNP and the Game Department merged to form the Uganda Wildlife Authority (UWA) in 1996. Here, we refer to actions undertaken by UNP, as they occurred prior to the passing of the 1996 Uganda Wildlife Statute.

(such as food, fuelwood, herbs, other non-timber forest products) to market forces. Differently put, whereas households would otherwise acquire these inputs by accessing commonly-owned stocks in forest locations, the expropriation of these access rights forces households to acquire such resources through market transactions, and further embeds them within the cash-based economy. In addition, while one could object to the status of conservation enclosure as primitive accumulation on the grounds that it involves the creation of public rather than private property (Kelly, 2011, 687), evictions at Mount Elgon enabled the generation of exchange value through the sale of both carbon offsets and ecotourism experiences. Differently put, while seized land and forests were not privatized, they were certainly commodified and marketized (Castree, 2008). Further, although the expropriated land was converted from customary to public property, the benefit stream resulting therefrom was appropriated by a variety of state, nongovernmental, and private actors.¹³ In essence, then, this constitutes a process of both accumulation and *naturalization* by dispossession, in which the removal of smallholding farmers enabled the production of a 'pristine' landscape for both tourists and brokers of the then-emerging carbon market, such as the FACE Foundation.

Indeed, 'degraded' areas of the forest reserve had not been merely stripped of forest cover. In many cases, communities had established permanent human settlements within the reserve's boundaries, including homesteads, schools, trading centers, and basic health facilities (Himmelfarb, 2012). In the process of evictions, UNP and NRA personnel razed these structures (Norgrove and Hulme, 2006; Vangen, 2009), and it is conceivable that their ruins were still present when reforestation activities began in 1994. Yet, the FACE Foundation continues to deny that its organization's activities have had any impact on land use conflicts at Mount Elgon. For example, when the first author contacted one of the organization's Netherlands-based executives in an attempt to record the FACE Foundation's perspective, he curtly responded as follows:

"If you are doing fieldwork I suggest you contact UWA. [...] We do not have a role in the conflict, but were only involved in a reforestation project" (FACE Foundation executive, email communication, 11.09.2011).

Unsurprisingly, evicted populations resent the violent nature of this process, and do not relish enduring attempts to obscure the relationship between the region's history of uncompensated eviction and existing carbon offset projects. In further developing this discussion, the next section examines the ways in which UWA and the FACE Foundation selectively ignored such inconvenient aspects of the region's resource management history, instead focusing rather disingenuously on the 'benefits' that were said to accrue to local populations.

Maintaining a 'triple-win' spectacle

Despite the exceedingly violent and ongoing nature of this process of naturalization by dispossession, UWA and the FACE Foundation continued to represent their activities as an unreservedly 'triple-win' case of integrated conservation and carbon offsetting. For instance, nearly a decade after large-scale evictions took place on Mount Elgon, the FACE Foundation's 2001 annual report declared that the

"involvement of the owners and local population are crucial factors to the success of projects. Because these parties have a

social and economic interest in maintaining the forest, Face pays much attention to the project region's social-economic context when selecting its locations [...] Besides the sequestration of CO₂, the forest offers other benefits to the local environment, including social and economic development such as employment" (FACE Foundation, 2001a, 2).

In addition, a project brochure describes UWA-FACE's activities at Mount Elgon National Park and related initiative at Kibale National Park thusly:

"The government has re-enforced the integrity of the national parks in the early 1990s. Since 1994 a large number of local tree species are being planted by the projects to rehabilitate the forests and their habitats for plants and animals, therewith enhancing biodiversity. The projects collaborate with IUCN, which supports conservation and sustainable development programs with the adjacent farmer communities [...] The FACE Foundation owns the CO₂ credits, while the forest and all other proceeds belong to UWA" (FACE Foundation, n.d.-a).

Moreover, concerning its rationale for choosing Mount Elgon as a project area, another FACE Foundation annual report simply notes that "one quarter of the area of the national park is damaged. The areas that will not recover naturally in the short term are being replanted by UWA-Face" (FACE Foundation, 2000, 12). Indeed, neither these brochures and annual reports – nor the contracts signed between UWA and FACE (FACE Foundation, 1992, 2001b) – make any mention of the violent and fiercely contested removal of settled agrarian communities from the areas slated for reforestation. Only passing mention of the disputed park boundary can be found in another early, undated project brochure, which somewhat cryptically notes that between "1988 and 1992 the boundary of the forest reserve was resurveyed and planted with eucalyptus trees. Agricultural encroachments were for the greater part terminated, while a sustainable development programme was initiative to improve the local livelihoods" (FACE Foundation, n.d.-b).

Yet, documents produced by the Uganda Wildlife Authority suggest that the scale and character of these evictions may have been well-known to the FACE Foundation. In a retrospective overview of project activities, for example, UWA (2011) argues that the project was necessary precisely as a consequence of agricultural encroachment and settlement of the protected area, and that conflicts arising as a result of evictions posed perhaps the greatest challenge to reforestation activities. "There are conflicts/disagreement about the ownership of land along the Park boundary", the report's authors write, resulting in a "feeling among some of the local communities that they have lost property [...] people feel they have the right to cultivate crops and as such they have sued the government for grabbing their ancestral land" (UWA, 2011, 4).

Here, UWA refers to a series of lawsuits targeting Mount Elgon National Park and the Ugandan Attorney General that were launched by communities in the Manafwa, Sironko, and Kapchorwa districts in the early 2000s. In the latter case, ActionAid and an NGO known as the Uganda Land Alliance supported local communities, which resulted in a favorable consent judgment – delivered in 2005 – that recognized the community as the "historical and indigenous" inhabitants of the Mount Elgon forest (see Cultural Survival, 2005; Okwaare and Hargreaves, 2009). Lawsuits launched by two groups of farmers in Manafwa district and one in Sironko district have also been ongoing for nearly a decade, and court injunctions were granted in the mid-2000s to prevent further evictions and destruction of community property by UWA.

Given that the plaintiffs in each of these cases formally named UWA and its personnel at Mount Elgon as respondents, relevant staff members have been required to attend relevant court proceedings, as the first author witnessed during fieldwork in 2011.

¹³ For a discussion of the ways in which primitive accumulation through conservation often involves the appropriation of benefit streams from land and natural resources rather than the appropriation of those resources *as such*, see also Benjaminsen and Bryceson (2012).

Consequently, UWA retains a detailed understanding of the nature of these conflicts, and their potential impacts on UWA-FACE reforestation activities in the corresponding sections of Sironko and Manafwa districts. And yet, these grievances have not been identified as challenges in sections of relevant annual reports and general management plans that relate to the governance of the UWA-FACE project (see [FACE Foundation, 2000, 2001a,b](#); [UWA, 2000, 2009a,b](#)). In short, the violence entailed in evictions from land slated for reforestation, the launching of lawsuits against UWA, and related conflicts are facts of material significance that appear to have been simply excluded from FACE Foundation documents, thereby preventing prospective consumers and donors from fully appreciating the controversial status of forest conservation at Mount Elgon. Further problematizing these omissions, the next section proposes several related mechanisms that eventually led to the collapse of the project's ability to conceal such conflicts, and thus also to internationally market its carbon offsets to consumers.

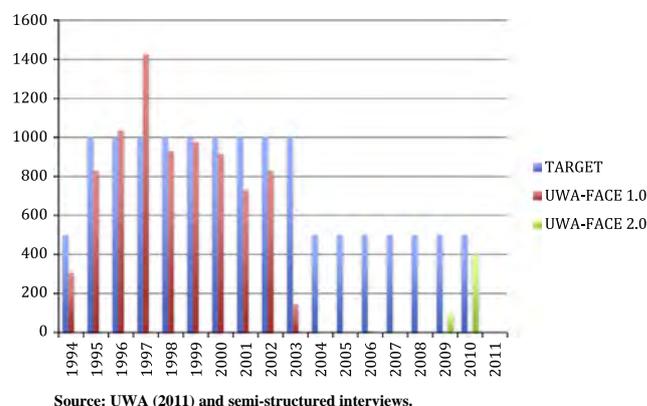
Uncooperative carbon, unruly people: Dissecting the 'spectacular failure' of the UWA-FACE project

Beginning in 1995, the UWA-FACE¹⁴ project established reforestation targets of 1000 ha per year ([Fig. 1](#)). Generally, these were either achieved or exceeded until the year 2000, after which reforestation activities began to decline. By 2004, UWA-FACE restoration had almost entirely ceased, despite reformulated management targets of 500 ha per year.

Essentially, the decline of the UWA-FACE project began when its managers sought certification from the Forest Stewardship Council (FSC) for its carbon offset operations at Mount Elgon National Park in 2000. By the late 1990s, consumers had already grown sceptical of both the environmental and social benefits of carbon offsetting, and the FACE Foundation felt that such doubts could be allayed if they opened their operations to a rigorous audit. Accordingly, as part of the FSC certification process, the UWA-FACE project was subjected to a series of independent examinations by the Société Générale de Surveillance (SGS) Agrocontrol (and later by SGS Qualifor), one of the world's largest and most respected inspection firms.

In a 2001 appraisal, the assessors concluded – based on the plantations established at the time – that the project would sequester 3.73 million tonnes of carbon dioxide over the first certification period, which was deemed to last until 2034 ([SGS Agrocontrol, 2001, 36–45](#)). Of these, 1.62 million credits were set aside as a 'risk buffer', so that the remaining "2.11 million *virtually risk free* GHG credits...[could be] delivered between 1996 and 2034" – at which time plantations were due for re-inspection ([SGS Agrocontrol, 2001, 9, emphasis added](#)).

Yet, as interceding years have shown, the claim that these credits were "virtually risk free" was highly problematic. Indeed, the SGS auditors themselves originally raised a number of substantive concerns about the future security of UWA-FACE plantations, which led them to propose two "corrective actions" – one major and one minor – before the FSC could grant certification ([SGS Agrocontrol, 2001, 57–58](#)). These concerns revolved around the 'major' lack of a preexisting social impact assessment for UWA-FACE activities, and the 'minor' lack of a robust environmental impact assessment of the project's ability to guarantee the sequestration of carbon dioxide. Regarding the social impacts of the project, the assessors noted, simply, that UWA-FACE's "[s]ocial impact assessment is not adequate. Negative social impacts have not been identified and steps have not been taken to reduce those negative impacts" ([SGS Agrocontrol, 2001, 55](#)). Essentially, it was clear to



Source: UWA (2011) and semi-structured interviews.

Fig. 1. Actual UWA-FACE reforestation vs. management targets (in hectares).

the assessors that neither UWA nor FACE had seriously considered the implications of widespread local resistance to the project for both the consumers of carbon offsets and their actual climate change mitigation effects.

In particular, the auditors raised concerns about "political and social instability", or the ability of both UWA and FACE to protect their new plantations from local encroachment for the proposed period of 99 years. As the report's authors observed,

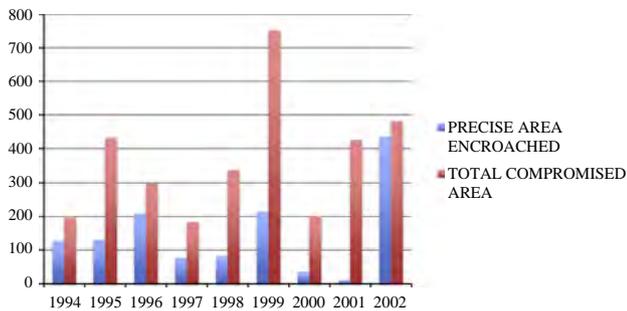
"[t]he political situation in the land surrounding Mt. Elgon is quite tense. There is a very high population density and land for cultivation is in very short supply. The decision to evict encroachers from the National Park has only served to increase the pressure on land outside the park. There is no doubt that local politicians can gain significant support by successfully arguing for a re-alignment of the park boundaries to afford their constituents access to more land" ([SGS Agrocontrol, 2001, 40](#)).

As noted by [Lang and Byakola \(2006, 27\)](#), it would have been virtually impossible to predict, in the early 1900s, the sort of land use regime that would prevail at Mount Elgon in the year 2000. Population dynamics have undergone massive changes, and the region has witnessed incredibly tumultuous political, economic, and social upheavals since the beginning of the 20th century. Among these were the rise and fall of British colonialism; several periods of civil war and recurring *coups d'état*; state-led programmes of political and ethnic cleansing; bio-political crises (such as the HIV/AIDS pandemic); and chronic environmental-social shocks, such as recurring drought and ensuing famines ([Bunker, 1991](#); [Mamdani, 1976](#)). From this perspective, it is arguably both naïve and potentially misleading to offer guarantees to prospective consumers regarding the future sanctity of forest plantations – in a contested region, nonetheless – until the year 2034, much less 2093.

As hindsight now demonstrates, these concerns were well-founded. From the outset of the project, agricultural encroachment and subsequent deforestation constituted omnipresent problems for UWA-FACE's plantations. Project records show that, even in the 1990s, up to 450 ha per year were compromised by community encroachment ([Fig. 2](#)). By 2004, these reforestation targets had become obviously unsustainable, and were beginning to intermingle with allegations of human rights abuse directed at UWA employees.¹⁵ Further, as noted in the previous section, portions of the land

¹⁴ After UNP and the Game Department merged to become UWA in 1996, the FACE Foundation's project at Mount Elgon became known as the 'UWA-FACE project' in policy documents ([UWA, 2009b](#); [FACE Foundation, 2001b](#)).

¹⁵ Here, perhaps the most notable are reports and analysis by [Byakola and Lang \(2006\)](#), [Lang and Byakola \(2006\)](#), [Faris \(2007\)](#), [Honigsbaum \(2007\)](#), and [Checker \(2009\)](#). A highly critical TV programme about the UWA-FACE project was aired by the Dutch programme 'Zembla' in 2008 (available at <http://zembla.incontxt.nl/seizoenen/2008/afleveringen/02-03-2008>), and a documentary film on alleged human rights abuses at Mount Elgon – entitled *Cry from the Ranges* – was released by Hurinet-Uganda in 2009 (available at <http://www.youtube.com/watch?v=O1DTRS09exY>).



Source: UWA (2011) and semi-structured interviews.

Fig. 2. Encroachment into UWA-FACE plantations, 1994–2002.

slated for reforestation had become subject to lawsuits from a number of local communities, and High Court injunctions had made reforestation legally impossible in a number of areas (Hurinet-Uganda, 2011; Okwaare and Hargreaves, 2009).

From a carbon offset marketing perspective, physical encroachment is also compounded by the problem of ‘*de facto* encroachment’, or the manner in which carbon offsets become difficult to ‘translate’ when entire forest compartments are compromised by partial deforestation. For example, while communities physically encroached upon 1137 ha of the UWA-FACE project’s approximately 7500 ha of new plantations by the end of 2002, the total area compromised by such encroachment – when measured in compartments that were compromised – amounted to 3308 ha, or approximately 44% of the total reforested area. When encroachment exceeds the allowance of a predetermined ‘buffer zone’ – which in this case was also 44% of total sequestration capacity (SGS Agrocontrol, 2001) – the amount of carbon sequestered in said compartments may need to be recalculated. Otherwise, the danger arises of issuing carbon credits for environmental services that were not in fact provided. Indeed, when market transactions are involved, to do otherwise would effectively risk engaging in a form of fraud (Bachram, 2004).

In addition, the technical crisis of calculating carbon sequestration is further compounded by the crisis of legitimacy that arises from persistent encroachment. Arguably, the ‘spectacle’ involved in the construction of a market for carbon offsets relies on the ability of individual projects to maintain ‘triple-win’ representations of their activities. Consequently, incentives exist for ‘distancing’ evidence of encroachment from consumers (Kosoy and Corbera, 2010), as such extensive deforestation rightfully poses critical questions of leakage and permanence (Galik and Jackson, 2009), as well as concerns about the human rights and socio-economic wellbeing of adjacent populations. Consequently, one might hypothesize that, rather than retaining equal status, the use value of available tCO₂e offsets quickly declines in relation to increases in experiences with both social contestation and the intentional deforestation of the project area.

Differently put, a significant portion of a carbon offset’s use value is ethical or moral in nature. When consumers purchase carbon offsets, they seek not just a reduction in their carbon footprint, but also the right to advertise their membership in a socially and environmentally responsible community. When offsets derive from contested sources, therefore, use value to the consumer proportionally declines. In this sense, the ‘conjuring trick’ (Tsing, 2000, 118) of carbon offsetting is the production and reproduction of a triple-win representation that purports to simultaneously conserve forests, mitigate climate change, and benefit local people. Individual use value aside, the performance of this spectacle is likewise necessary for the generation of exchange value, given that it is necessary to attract both economic investors and political

supporters. Essentially, then, carbon offsetting reflects what both Tsing (2000) and Igoe (2010) term an ‘economy of appearances’, insofar as its functioning depends of the circulation of virtual representations rather than simply on the production and sale of tangible goods or services.

Further, when this economy of appearances begins to unravel, we encounter what we have termed a ‘spectacular failure’. For example, as a result of the aforementioned contestations and allegations of human rights abuse, no additional trees were planted by the UWA-FACE project between 2004 and 2008. FACE and its financiers were presumably (and understandably) frustrated by the arguable failure of their investment, and UWA was highly cognizant of the negative press being attracted by the scheme. Truly, the manner in which the UWA-FACE project came to a halt during this period is indicative of how vulnerable such initiatives are to the judgments of both the international media and civil society. As one UWA warden explained the decline of the project:

“Their image has been tarnished, so carbon credit operations have halted. You know, it is because of the conflicts and the human rights people crying out, most of them on the internet” (UWA warden, interview 28.07.2011).

Again, since carbon credits enable organizations and individuals to claim ‘carbon neutral’ status, their primary benefit from the consumer’s point of view is that they confer what can be described as ‘normative capital’, or the right to advertise one’s presumably robust ethics. If one overarching lesson from the project’s decline can be drawn, therefore, it is this: If the ethical basis on which these carbon credits are ‘produced’ is challenged – in other words, if they are de-fetishized, de-spectacularized, and have their exploitative political–ecological relations of production exposed – both their use-value for the consumer and exchange value for ‘green’ investors rapidly decline. To avoid this, above all else, a stable ‘translation’ (Mosse, 2005) of the social, political, and ecological relations involved in the offset project must be maintained among all actors involved.

Conclusion

This article has critically examined the rise and decline of an integrated carbon offset and conservation scheme at Mount Elgon National Park in eastern Uganda. While the UWA-FACE project advertised itself as a ‘triple win’ for climate change mitigation, biodiversity conservation, and local development (FACE Foundation, 2001a; UWA, 2009b), a political–ecological and historical analysis of the project suggests that such rhetoric is decidedly selective. The main findings of this analysis are three-fold: First, the original forest restoration agreement, signed between the FACE Foundation and the Ugandan government in 1992, was closely followed by one of the largest-scale forest eviction campaigns in Uganda’s post-colonial history. Local people were evicted from the same 25,000 ha of degraded forest that were slated for UWA-FACE rehabilitation, and have not been compensated for the loss of land, property, and livelihoods that accrued as a result, despite potentially valid legal claims to their property. From this perspective, one can therefore perceive the uncompensated dispossession of local people as a simultaneous process of both accumulation and *naturalization* by dispossession, which essentially subsidized the participation of the UWA-FACE project in global carbon offset markets.

Second, in addition to its socially controversial nature, the project was likewise unable to achieve its carbon sequestration objectives. Indeed, only approximately 8000 of 25,000 planned hectares were reforested before the project was forced to cease its operations. By 2004, up to 44% of the project’s newly

established forest compartments had been compromised from a carbon offset perspective, and project activities stalled as a result (UWA, 2011). Such levels of encroachment exceeded the ‘risk buffer’ established by the project’s carbon sequestration auditors (SGS Agrocontrol, 2001), resulting in a high degree of uncertainty regarding the quantity of environmental services rendered. It does not appear that public records were made available by either UWA or FACE about carbon credits exchanged through this scheme prior to 2004, however, and it is thus nearly impossible to retroactively verify whether carbon credits were issued for actually existing environmental services.

Third, these findings present a number of second-order implications for similar forest-based carbon offset schemes in East Africa. Of particular interest is the ways in which brokers of the carbon offset market can attempt to conceal deleterious project effects by maintaining a conceptual and geographical disconnection between offset consumers and actual sites of carbon sequestration. In the Mount Elgon case, such efforts are visible in attempts to disassociate the UWA-FACE project from the violent eviction process that was necessary for its establishment. In effect, such disconnection at least temporarily enabled the FACE Foundation and its collaborators to maintain stable ‘translations’ of offset commodities to consumers and donors, especially in project documents and over the Internet, which obscured the above-discussed social and ecological controversies involved in the project’s implementation.

More broadly, and although a now-expansive body of literature interrogates the oppressive nature of both colonial and early post-colonial conservation in Africa (for a review, see Adams and Hutton, 2007), the violence that marks emerging forms of ‘green grabbing’ remains largely hidden from the international public sphere. Instead, spectacular ‘win-win’ or ‘triple-win’ representations of environmental management and land acquisition dominate conventional academic, donor, and policy-based discourses on the subject (Benjaminsen and Svarstad, 2010; Igoe, 2010; Sullivan, 2013). Thus, the rhetoric of integrated conservation and carbon offsetting is always ‘future positive’ (Mosse, 2005, 1), in that it inexorably advocates for the technical refinement and improvement of projects, as opposed to acknowledging the often-contentious politics implicated in their actual implementation. As noted by Büscher et al. (2012, 16, emphasis original),

“conservation thus becomes an essential contribution to neoliberalism’s most profound contradiction: the ability of its proponents to produce and favor discourses that are seemingly free of contradictions [...] A major part of neoliberalism’s attractiveness and pervasiveness lies precisely in this ability to hybridize and stimulate consensus-oriented discourses, despite their increasingly contradictory realities.”

Indeed, precisely despite evidence of the dispossession and impoverishment of rural populations, organizations such as Face the Future continue to enjoy sterling reputations among Western publics, and are generally presumed to secure environmental management outcomes that conform to their official, allegedly socially responsible rhetoric. Not least, this is evident in the IUCN’s (2012) decision to offset the carbon footprint from its 2012 World Conservation Congress in Jeju, South Korea, by purchasing carbon credits from Face the Future’s plantations in Indonesia. ‘People benefit from the project too,’ the IUCN’s (2012) press release declared, ‘as it creates employment based on forest restoration [...] [i]n short, the project provides a model of how carbon finance can deliver climate change mitigation, while enhancing biodiversity and supporting local livelihoods.’ As we have argued, however, the use of these glossy triple-win representations of conservation constitutes a form of ‘spectacular accumulation,’ given that it generates substantial revenues for government agencies, firms,

and NGOs, but silences a wide range of dissenting voices that cannot be translated into an advertisement for a decidedly neoliberal version of ‘nature’. Accordingly, these findings suggest the need for further critical examinations of attempts to link protected areas to a global “economy of repair” (Fairhead et al., 2012) through markets for ecosystem services, which are capable of identifying other cases of ‘spectacular failure’ in the production and circulation of carbon offsets and other socio-natural commodities.

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Moreno Valley Planning Commission
c/o City Hall / Clerk's Office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is ^{ANNIE}Ana Burch and I am a resident of Moreno Valley. I know that the World Logistics Center project was approved by the city some years ago. Our city desperately needs an economy boost, and I strongly believe this Industrial park will bring the money and the jobs that our city lacks. Please, Let's not delay the project any further. The E.I.R has been updated, and I Urge you to approve it in order for our community to be able to reap the Benefits.

Thank you for your time.

Sincerely,



^{ANNIE}
Ana Burch

25105 Fir Ave. Apt 316
Moreno Valley, CA 92553

City Clerck
Planning Commission
14177 Frederick St
Moreno Valley, Ca 92553

Estimada City Clerck y miembros de la Comisión de Planeamiento, Mi Nombre es Ana Lilia Cárneros vivo en la Ciudad de Moreno Valley ya por muchos años, mis hijos han crecido y estudian aquí hace 5 años yo ya habia escuchado acerca del Proyecto World Logistic Center y desde el primer día se me hizo un buen proyecto ya que traerá trabajo a nuestra ciudad, trabajos de los cuales se beneficiaría mis hijos, así como las siguientes generaciones. Yo les pido que aprueben lo más pronto posible estos cambios que se han hecho en el proyecto relacionada al medio ambiente, y por lo tanto pido que ya en este año se resuelva y se empiece a construir

ATTE: Ana Lilia Cárneros
15071 Elm Ct #A
Moreno Valley, CA 92551

14177 Frederick Street
Moreno Valley, Ca. 92553

Dear Members of the Planning
Commission our name is Joel and Ana Villaverde
we are a marriage that when we got
married we decided to start our family
in Moreno Valley since it is a beautiful city
to raise our children.

We support the World Logistic Center project
100% since the first day that someone
went to my house to talk to us about
the project, we have a good project
where many families would benefit from
the jobs and even the same city and
residents that we live in Moreno Valley
we can be benefits that the city will
have by having this great project
I ask you to please vote yes to the
World Logistic Center so that it can
be built as soon as possible.

25845 Harold Lane
Moreno Valley Ca 92551

sincerely

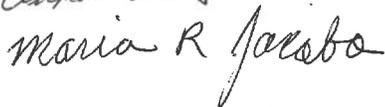

Ana Lilia Pazo
Villaverde.

Moreno Valley Planning Commission
c/o City Hall / Clerk's office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is Aureliano Jacobo and my wife's name is Maria Jacobo,
we are residents of Moreno Valley for 16 years,
As a home owners and business owners we feel that the WLC project will benefit
Our city, with the revenue the WLC will bring to our city it will boost our economy
And, therefore will benefit all the local businesses and the entire region.
We are eagerly waiting for the WLC to start breaking ground and start reaping all
The benefits this amazing project will bring.
All my family support this project because Moreno Valley is our home and this is
Where we will continue to support the creation of new local jobs.
We are looking forward to Planning Commission and the City Council to make the
Right decision for our city and approve the necessary items for the WLC project
To move forward.
Thank you very much,

Aureliano and Maria Jacobo
14909 Meridian Place
Moreno Valley, CA 92555

Planning Commission of Moreno Valley
c/o City Hall/Clerk's Office
14177 Frederick Street,
Moreno Valley, California 92553

Dear members of the Planning Commission,

I'm happy to express myself through this letter. I pray for your office that God gives you the wisdom to make the best decisions for our city.

My name is Beatriz Garcia, I have been a resident of Moreno Valley for about 26 years. I'm a mother of three children. Some of my children already graduated and they can't find jobs in Moreno Valley. For me this is a big issue because my husband commutes for up to 6 hours for work. This is a cruel reality and I don't want my children ending up in the same situation. My family will eventually get sick and stressed from all the commuting hours.

I am thankful for CEO Iddo Benzeevi, and his great vision to bring jobs to our city and keep families together. Please approve revisions made to the WLC environmental analysis. Thank you for your attention.

Beatriz Garcia,
24289 Dimitra Dr.
Moreno Valley, California 92553
(District 3)

Beatriz Garcia

Planning Commission of Moreno Valley
of City Hall / Clerk's office
14177 Frederick St
Moreno Valley, CA 92553

Dear Planning Commission of Moreno Valley

I'm writing this letter of the excitement my family and I have regarding the world Logistic Project. we are on board 100% with this project. It will bring more income to our city and help or communities.

Sincerely *Bertha Garcia*

Bertha Garcia
14371 Redwing Dr.
moreno Valley CA 92553

Planning Commission
City Council of Moreno Valley
CLO CITY HALL / Clerk's OFFICE
14177 FREDERICK STREET
Moreno Valley cal 92553

To The members of the planning commission
My name Bertha Lozano and want
to tell you through this
letter I support The World Logistics
Center and ask you to please vote
for the new changes in The project as it
would benefit thousands of people in the
city and the economy would grow and
with that there will be many
benefits to all The community of
Moreno Valley Thanks for your attention
Cincerely Bertha Lozano
15085- EIM Ct Apt. B
Moreno Valley cal 92551

Planning Commission of Moreno Valley
% city Hall / clerk's office
14177 Frederick Street,
Moreno Valley CA. 92553

DEAR PLANNING COMMISSIONER
MY NAME IS CARLOS REZA A RESIDENT OF
MORENO VALLEY (104R) I
I KNOW YOU ARE GOING TO REVIEW THE
(S) ENVIRONMENTAL POINTS THAT THE JUDGE ASK
FOR AND YOU ALSO KNOW THAT THE RESULTS
WERE LESS THAN SIGNIFICANT
I SUPPORT THE WOLD LOGISTIC CENTER (WLC)
SINCE ITS BEGINNING FOLLOW THE LAWSUIT
PROCESS AND NOW THIS I HOPE THIS IS THE FINAL
PAGE AND THE BEGINNING OF BREAKING
POINT FOR OUR SO WANTED PROJECT.

PLEASE APPROVE THIS ENVIRONMENTAL
CHANGES AND MOVE FORWARD

SINCERELY

Carlos Reza
CARLOS REZA

Olga Reza
OLGA REZA

City Council of Moreno Valley
c/o City Hall / clerk's office
14177 Fredericks street
Moreno Valley CA 92553

To the Members of the planning Commission

Hi My Name is Delfina Gómez
I lived in Moreno Valley for many
years. I struggled a lot through many
years living here. I would like to
see more opportunities not just for me
but for the new generation. I want
to see more money spent in our city.
Improvements and jobs. The WLC will
be helping the city to bring more
jobs opportunities on tax revenue
so the city will look better and
thank you very much for your attention.

Sincerely Yours
Delfina Gómez
Delfina Gómez

15113 Norton Ln
Moreno Valley CA
92551

Planning Commission of Moreno Valley
c/o City Hall/ Clerk's office
14177 Frederick Street
Moreno Valley CA 92553

Dear Planning Commissioners

My name is Frances Saldaña I have been a resident of Moreno Valley for over 20 years. I am raising my voice through this letter, letting you know that I am in support of The World Logistics Center Project like many in our city that want progress. Our city has been blessed with a visionary investor like Mr. Iddo Benzeevi who is a Moreno Valley resident for more than 30 years like many of us. He saw the very lack this city has from its roots. No jobs, jobs that this project will provide.

Soon you will be having a public meeting and I hope that your decision will be to move this project to a closer break ground. Waiting is costing our city too much money.

Sincerely,

A handwritten signature in black ink that reads "Frances Saldaña". The signature is written in a cursive style with a large, sweeping initial "F".

Frances Saldaña

10853 Anemone Circle
Moreno Valley CA 92557

Cell: (951) 413-9166

Moreno Valley Planning Commission.

C/O City Hall / Clerk's Office

14177 Frederick Street.

Moreno Valley, California 92553

My name is Inés Arriaga. I have been living in Moreno Valley, for 22 years. When I heard about WLC project, I'm really excited about all prosperity and blessings that is coming to our city. I'm currently unemployed. I'm looking for a job and I find it very difficult to find a local job.

I believe it will make our lives easier if we have more jobs in our city.

I urge you to please among all those who make decisions please move this project forward. We need the jobs and the tax revenue.

Sincerely

Inés Arriaga Inés A.

24391 Postal ave #5

Moreno Valley, Ca. 92553

city clerk
planning Commission
14177 frederick st.
Moreno Valley Ca. 92553

Dear city clerk and members of the planning
Commission.

My name is Inez Gonzalez and I live in the
city of Moreno Valley for 24 years. The reason
for this letter is to tell you that my family
and I strongly continue supporting the world
Logistic Center project since it will bring many
benefits to our city as well as jobs that
many families would benefit from.

Inez Gonzalez
14689 joshua tree ave
Moreno Valley, Ca.
92553

Moreno Valley
PLANNING COMMISSION
C/O CITY HALL / CLERK'S OFFICE
14177 Frederick Street.
Moreno Valley CA 92553

Dear planning COMMISSIONERS

My name is IRMA PADILLA and as a resident of Moreno Valley for 26 years I would like to express my strong support to the development of the WLC project because it will impact our city and the entire region in a great way.

The WLC will be built with the highest technologies which will represent an asset to our city. This kind of project keeps families together and helps us grow as a community. This project will offer thousands of job opportunities that will make our city thrive. Please allow this great project to break ground soon with no further delays.

THANKS VERY MUCH.

IRMA PADILLA

IRMA PADILLA

29219 BOY AVE MORENO VALLE CA 92555

City Council Of Moreno Valley
c/o City Hall/Clerk's Office
14177 Frederick Street
Moreno Valley, CA 92553

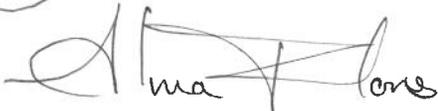
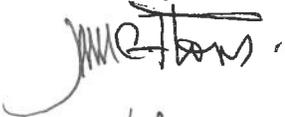
Dear Planning Commissioners,

Our names are Israel and Alma Flores. We have lived in Moreno Valley for 21 years. When our family moved here, there were barely any houses or traffic. We have seen Moreno Valley grow little by little from being a bedroom town to a prosperous city. We, here in Moreno Valley, would like our city to be a job-based city such as San Diego, Irvine, and Orange County. The World Logistic Center (WLC) project would allow us to become a self-sufficient city like the ones mentioned before.

Riverside County will be blessed to receive more than \$5.7 million dollars every year of city funds and the residents will be blessed to have a variety of job opportunities to support their families. We would see a decrease in homelessness and unemployment.

We respectfully ask that you please pass the 5 reviewed environmental impact results from the WLC's Environmental Impact Report (EIR) as soon as possible. As you know, these results were less than significant making the EIR more powerful. Please think about all the job opportunities and the revenue that will help our city and county grow; and it will also prepare us for the future.

Sincerely,



Israel Flores and Alma Flores

40 'CITY HALL / CLERK'S OFFICE'
14177 FREDERICK STREET
MORENO VALLEY, CA 92553

DEAR MEMBERS OF THE PLANNING COMMISSION,

OUR NAME IS JOEL & ANA VILLAVERDE,
WE ARE A MARRIAGE THAT WHEN WE DECIDED TO
START OUR FAMILY IN MORENO VALLEY SINCE
IT IS A BEAUTIFUL CITY TO RAISE OUR CHILDREN.

WE SUPPORT THE WORLD LOGISTIC CENTER
PROJECT 100% SINCE THE FIRST DAY THAT
SOMEONE WENT TO MY HOUSE TO TALK TO US
ABOUT THE PROJECT, WE HAVE A GOOD PROJECT
WHERE MANY FAMILIES WOULD BENEFIT FROM
THE JOBS & EVEN THE SAME CITY & RESIDENTS
THAT WE LIVE IN MORENO VALLEY, WE CAN BE
BENEFITS THAT THE CITY WILL HAVE BY
HAVING THIS PROJECT. I ASK YOU TO PLEASE
VOTE YES TO THE WORLD LOGISTICS CENTER
SO THAT IT CAN BE BUILT AS SOON AS
POSSIBLE.

SINCERELY,
JOEL E. VILLAVERDE

25845 HORADO LN.
MORENO VALLEY, CA 92551

Ana
Ana Lilia Razo Villaverde

Planning Commissioners
~~City Council of Moreno Valley~~
c/o City Hall/Clerks office
14177 Fredrick street
Moreno Valley California 92553

Dear Planning Commissioners

my name is John Peikert.
I have resided at 24730
Firavenue m.v. Ca 92553
Since 1973, The population
growth since 1973 has been
enormous. In my opinion the
W.L.C. would be good in many
ways. It would provide jobs
for local residents which would
bring in tax revenue for our city.
Also it would keep our residents
from being stuck on the freeway
for hours commuting.

Please do the right thing
to help our city create jobs
and revenue. Please vote
yes on the W.L.C. E.I.R.

John W. Peikert 24730 Firave
m.v. Ca 92553 John W. Peikert
951 742 1932

Planning Commission of
City Council of Moreno Valley c/o City Hall /
Clerk's Office
14177 Frederick Street
Moreno Valley CA 92553

Dear Planning Commissioners
My name Joseph S Martinez, and I want to
tell you through this letter that I and my wife
support the World Logistics Center Project and I
ask you to please vote for the new changes in
the project as it would benefit thousands of peo-
ple in the city as throughout the inland empire,
the economy would grow and with that there will
be many benefits for the city.

Sincerely Joseph S Martinez and Silvia
Delgado

Joseph S Martinez


23450 Gerbera St
Moreno Valley CA 92553

Planning Commission

14177 FREDERICK Street

Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is Juanita Boné, I am a resident of Moreno Valley for 12 years. I am a strong supporter of the WLC project. I would love to see my city grow and flourish.

I would love for my kids and grandkids to be able to find a local job. My kids and grandkids have to commute every day and I am concern about their well being every day being on the road exposed to all kind of danger in order to make a living.

It's not fair that we have to wait for the WLC project this long.

Hope that we have this marvelous project in our city soon.

Thank you for your consideration

Juanita Boné

15930 Widow Drive

Moreno Valley, CA 92551

951-385-7391

Juanita Boné

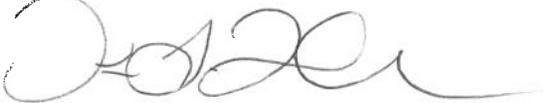
City Council Of Moreno Valley
c/o City Hall/Clerk's Office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is Karen Flores and I have lived in Moreno Valley for 20 years out of my 26 years of life. Moreno Valley use to be dirt, a few schools, and a few fast food places. One thing that I remember the most is the fact that no one I ever spoke to knew what Moreno Valley was; today that remains the same. There have been positive developments thanks to the projects of Iddo Benzeevi. The World Logistics Center is another world class project that will create an abundance of job opportunities, increase revenue, and contribute to the green initiative. The Environmental Impact Agencies have gone out of their way to place lawsuits despite the fact that the Environmental Impact Report is in the project's favor. The agency attempted to do the exact same thing with the Sketchers facility, however, this facility was awarded the gold lead award for being the most environmentally self sufficient building in the nation. The World Logistics Center is going to be built with the same gold standards to help our environment. All five Environmental Impact Reports were reviewed and showed that they were less than significant.

As a millennial and part of the future generation, I ask for you to please approve the Environmental Impact Reports that were reviewed and move forward with this great project. With this project our city will not only grow in profits but we will become the paragon of change.

Sincerely,

A handwritten signature in black ink, appearing to read 'Karen Flores', written in a cursive style.

Karen Flores

Planning Commission
c/o City Hall/ Clerk's Office
14177 Frederick St.
Moreno Valley, Calif. 92553

Dear Member of the Planning Commission,

My name is Keith Howerton. I have lived in Moreno Valley for 36 years. I have supported the World Logic Center from almost its beginning. I believe it will be a great thing for our city. I would ask that you do all that is necessary to move this project along. I speak specifically about the Environment Impact Report.

Thank you for your consideration.

Keith Howerton
25350 Santiago Dr. #106
Moreno Valley, Calif. 92551
(951)924-3984
BKHOWRU@live.com



Planning Commission of Moreno Valley
c/o City Hall/ Clerk's office
14177 Frederick Street
Moreno Valley CA 92553

Dear Planning Commissioners

My name is Laysha Saldaña, a resident of Moreno Valley for many years. I work at TJ Maxx here in the city. I am one of the fortunate few that don't have to deal with commuting. I am in support of The World Logistics Center which is the subject that I want to address. The project was approved in 2015. The process has been long and tedious. We are at the end of the process soon you are going to have a meeting and discuss the decision of the changes made to the original environmental (EIR) the majority of our city wants this project.

Please consider the benefits that this mega project will bring just in tax revenue not counting \$22 million that will benefit our school and colleges. I urge you to accelerate the progress of this project so we can break ground soon.

Sincerely,

A handwritten signature in black ink, appearing to read 'Laysha Saldaña', with a long horizontal flourish extending to the right.

Laysha Saldaña

10853 Anemone Circle
Moreno Valley CA 92557

Cell: (951) 413-9166

PLANNING COMMISSION
CITY COUNCIL OF MORENO VALLEY
c/o CITY HALL / CLERK'S OFFICE
14177 FREDERICK STREET
MORENO VALLEY CA 92553

TO THE MEMBERS OF THE PLANNING COMMISSION:

MY NAME IS LUIS BUENROSTRO
I AM A MORENO VALLEY RESIDENT FOR
YEARS.

I STRONGLY SUPPORT THE WORLD LOGISTIC
CENTER

AS A RETIRED PERSON I THINK THAT IS A
GOOD OPPORTUNITY THAT THE CITY HAS,
AN EXCELLENT PROJECT WANTS TO BE
BUILT IN MORENO VALLEY.

I PERSONALLY WORKED ALL MY LIFE
OUTSIDE OF MORENO VALLEY BECAUSE
THERE WERE NO JOBS HERE AND
WITH THIS PROJECT MANY PEOPLE WOULD
BENEFIT AND THE ECONOMY OF THE CITY
WOULD GROW IN LARGE PERCENTAGES

PLEASE VOTE YES ON THE
WORLD LOGISTIC CENTER

SINCERELY

Luis Buenrostro

LUIS BUENROSTRO
14685 HAMBY COURT
MORENO VALLEY CA. 92553

Planning Commission of Moreno Valley
c/o City Hall/ Clerk's office
14177 Frederick Street
Moreno Valley CA 92553

Dear Planning Commissioners

My name is Maria Hernandez resident of Moreno Valley for 24 years and I have seen the city slowly grow. We came from Orange County and my husband used to commute every day to go to work hours on the freeway to feed his family, hours that he could have spent with us, that is one of the reasons why I believe that the World Logistics Center (WLC) project is going to be a blessing for many residents here in our city and the entire region.

I ask you, to please consider passing the reviews. I think it's time to move forward.

Sincerely,



Maria Hernandez

10853 Anemone Circle
Moreno Valley CA 92557

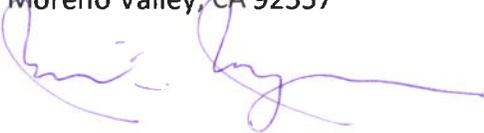
Cell: (951) 413-9166

Moreno Valley Planning Commission
c/o City Hall / Clerk's office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is Maria Mereyman and I am a resident of Moreno Valley for many years. I can't wait for the WLC project to move forward and start breaking ground soon To provide all the jobs that are so needed in our city. I have children and grandchildren Growing up and living in Moreno Valley and it's only fair that they will be able to find A local job in the near future, that is why I am urging you to please allow the WLC Business Park to move forward with no further delays so that my family as well as the Community of Moreno Valley can start taking advantage of all the benefits the WLC Project will bring to our city.
Thank you for considering my letter

Maria Mereyman
23318 Harland Drive
Moreno Valley, CA 92557



Planning Commissioners and
City Council of Moreno Valley
e/o City Hall/Clerk's Office
1477 Frederick St.
Moreno Valley, CA 92553

Dear Planning Commissioner

- My name is Maura Garcia; I'm retired.
I have been living in Moreno Valley for the
past 20 years. - I had the saddest experience
with my son. He was looking for job in
our city, now he has to commute to other
city. - We need more jobs in Moreno
Valley. -

The world Logistics Center will help
our city, "creating more jobs; not only
for my son; but for my great grand
children will benefit. -

Thank you for your attention

Maura Garcia ~~Maura~~
24169 Eucalyptus Ave # 136
Moreno Valley CA 92553
tel. 951 413 6362

To the members of the Planning Commission,

My name is Miguel Gutierrez, I'm a resident of Moval for 11 years @ the same address. (home)

I moved to Moreno Valley in 2009, been happy here for all these years. My only problem is that for the first 8 years, I had to commute to L.A county, sometimes as far as the city of Santa Clarita. Many times, I had to stay and sleep in my truck in one of my job sites. My vehicle and body took a lot of stress and beating, taking that long trip every day. I'm happy that the World Logistics Center is going to be built, and a lot of people are excited that this project is being planned. I believe that this project will benefit, my family, especially my son. He will be graduating in 2021, and I would like that he stays and work in Moreno Valley and don't have to move out of the city or that he doesn't have to make that long commute to another county (L.A) (San Diego) We need the World Logistics Center built ASAP. Thanks

Miguel Gutierrez

24700 Webster Ave.

Moreno Valley CA 92553

909-753-5784

Planning Commission
City Council of M. Valley
c/o City Hall / Clerk's Office
14177 Frederick St
Moscow Valley, Ca. 92553

Miguel Gutierrez
909-753-8984

2-12-2020

to the Members of the Planning Commission,

My Name is Miguel Gutierrez. I'm a resident
of M. Val. for 11 years @ the same address. (Home)

I move to Moscow Valley in 2009. I've been happy here for
all this years... My only problem is that for the
first 8 years I had to commute to L.A. County
same times as far as the City of Santa Clarita.
Many times I had to stay and sleep in my truck
or in one of my jobs sites.

My vehicle and body took a lot of stress and
betting... Making that long trip... every day.

I'm happy that the World Logistics Center is
being build, and a lot of people are excited
that this project is being planned.

I believe that this project will benefit my family
especially my son. He will be graduating in
2021; and I would like that he stay and
work in Moscow Valley and don't have to move
out of the city or that he doesn't have
to make that long commute to another County
(L.A.), (San Diego). We need the World Logistics
Center build. A.S.A.P.

Thank's

Miguel Gutierrez
24700 Webster Ave
909-753-8984

Planning Commission of Moreno Valley
c/o City Hall / Clerk's office
14177 Frederik St
Moreno Valley, CA 92553

Dear Planning Commission of Moreno Valley

Mi nombre es Nelly Martínez, soy residente de Moreno Valley por 27 años.

Mi familia y yo apoyamos el Proyecto Logístico Mundial desde el principio en el año 2015 y seguimos aprobándolo 100%.

Creo que nosotros como residentes de Moreno Valley queremos que esta ciudad progrese y mejore en todas las áreas y creo que con este proyecto se va a poder lograr

Gracias por su atención

Nelly Martínez
24809 El Dorado Dr.
Moreno Valley CA 92557
Nelly Martínez

Planning Commission of Moreno Valley

c/o City Hall / Clerk's Office
14177 Frederick Street
Moreno Valley, CA 92553

Subject: Comment letter in Support of the World Logistics Center

Dear Planning Commissioners,

As a homeowner in Moreno Valley, I am writing this letter to express my support of the World Logistics Center. I strongly believe that this project will do exactly what it has been created to do. I understand all the concerns that have been brought up such as energy, biological resources, noise, farmland and cumulative impacts. As you can clearly see in the last revision of the EIR, these areas of concern have been reevaluated to ensure that this project will be of huge benefit to our city.

I see many new warehouses being built within 2 miles of my home and I've yet to receive a letter or notice or hear about them in the news asking for my permission or approval. I am not against these businesses, but I am a little concerned that the WLC project has received so much scrutiny while other projects have not. I understand this project is much more on a grander scale however, every single new construction, big or small that is erected in our city or any city for that matter, impacts the air, noise levels, biological resources etc., but I understand that these effects are necessary and come as a result of our growing city.

I especially support Highland Fairview because I can see that they have done their due diligence in making sure they address and mitigate the concerns listed above. This project is good, and our city needs it.

Sincerely,



Nelly Menjivar
14830 ARTISAN ST.
MORENO VALLEY CA 92555.

city council of Moreno Valley
c/o city Hall/clerk's office
14177 Frederick street,
Moreno Valley, California 92553

Dear Planning Commissioners
my name is Maria Galaza and I've been living in
Moreno Valley for more than 21 years.
I love my city and I want the best for
my community. and the world Logistic Center
its a wonderful project for the whole city
I approved this project 100%

23622 Tamada 2 W.
M. V. ca 92557.
Maria Galaza.

Planning Commission
City Council of Moreno Valley
40 City Hall / Clerk's office
14177 Frederick street,
Moreno Valley, California 92553

To the members of the planning commission
my name is Noemi Cisneros a resident of Moreno-
Valley California for 9 year all ready. I have seen
our city grow little by little. I support the
World Logistic Center because I know this mega-
project will give our city the job base we don't have

I know about the 5 environmental impacts
that the Judge order to be reviewed in order
to continue with the project as you all know
the results of it were LESS THAN SIGNIFICANT
I ASK you to please move forward with
it, pass this 5 environmental impacts for
our WLC project break floor soon.

Thank you all very much.

Sincerely:

Noemi Cisneros

Planning Commission
14177 Frederick Street
Moreno Valley, California 92553

Dear Planning Commissioners

My name is Norma Preciado and I am a resident of the city of Moreno Valley for 12 years. The WLC Project will be very beneficial to our city and Region once the Project breaks ground.

A good example of the need of WLC Project is that my daughter just graduated from high school and she is struggling to find a local job. We are counting on this great Project to provide a better future for our children and the generations to come.

I urge you to take immediate action and approve this great Project.

Thank you very much for considering my letter

Norma Preciado
13882 Caspian Way
Moreno Valley CA 92553
323-440-6862

PLANNING COMMISSION OF MOVAL
C/O CITY HALL / CLERKS OFFICE
14177 FREDERICK ST.
MORENO VALLEY CA 92553.

Dear Planning Commission.
My name is Olegario Rojas,
a resident in Moreno Valley
for over 10 years.
I understand that the
WLC's E.I.R. was updated
and I would like to en-
courage you all to
approve its revisions
Thank you!

Sincerely
Olegario Rojas
13078 Sunlit St. Moreno Valley CA

Olegario ROJAS

Planning &
City Council of Moreno Valley
c/o City Hall / clerk's office
14177 Frederick street
Moreno Valley, CA 92553

Dear: Members of the Planning Commission

I Pascuala Urista live in
Moreno Valley for about 15 years
and during those years it was
lack of jobs and struggled alot
for my kids. I worked many
hours with low payment so my
children wouldn't suffer alot.
I used to work for the
newspaper printer in Santa Ana Ca.
for many years.

I support the WLC to come
to our city so there will be
more jobs and opportunities
for the residents to have a better
live than mine

Sincerely yours

~~Pascuala Urista~~ PASCUALA URISTA-
15113 Norton Ln
Moreno Valley CA 92551

Moreno Valley Planning Commission
c/o City Hall / Clerk's office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is Petra Avina, I am a resident of Moreno Valley since 2009.
I am retired and I am a home owner.

Through this letter I would like to express my continue support for
The WLC project. As a resident of Moreno Valley for 11 years, I see
The great need our city has for jobs, but not only jobs is what our city
Needs, we need all the revenue that the WLC will generate. This revenue
Will be utilized to improve our city and specially our schools that will be
Beneficial for our children and future generations.

My grandkids biggest desire is to be able to find a local job once they
Graduate so that they won't have to move out of the state due to the
Lack of jobs. Please don't delay the WLC project any longer and lets
Make this amazing project a reality as soon as possible.

Sincerely,

Petra Avina
15327 Adobe Way
Moreno Valley, CA 92555



City council of Moreno Valley
c/o City Hall/ Clerk's office
14177 Frederick Street,
Moreno Valley, California 92553

Dear planning commissioners

My name is Porfirio G Siordia I've been a resident of Moreno Valley for 15 years and I am a heavy equipment engineer operate I've been working in construction of more about 40 years and I know how frustrating it is to drive in traffic for more than 2 hours to get to work and sometimes 2 and a half to three hours to get back home, Hours that I should have spend with my family. That is why I am in pro of the WLC project. Because, many like me go through the same thing in order to feed their families .

So please I humbly ask you to please pass 5-re-viewed environmental impacts from the WLC and EIR the results as you know were less than significant making the EIR stronger than ever. Think about the revenue this will bring to our city the prosperity of our community with more people working in Moreno Valley we will be a self sufficient city like Irvine California or San Diego California just to mention a few.

Sincerely,



Porfirio G Siordia

Planning Commission of Moreno Valley
c/o City Hall/ Clerk's office
14177 Frederick Street
Moreno Valley CA 92553

Dear Planning Commissioners

My name is Rodolfo Lepe and I have been living in Moreno Valley for 20 plus years and I work on the west coast and paint company thank god I have a job. When I heard about The World Logistics Center I knew it was going to be a big change in our city it is the very first mega project for our city and the first thing that came to my mind was the job opportunities in the city and the entire region. I know you are going to have meetings where you are going to make a decision in regards to the updates of the environmental impact report.

I just want to ask you and urge you at the same time to move forward with this project we have waited long enough and the city is losing money while this project is still on hold.

Sincerely,



Rodolfo Lepe

10853 Anemone Circle
Moreno Valley CA 92557

Cell: (951) 413-9166

City Council Of Moreno Valley
c/o City Hall/Clerk's Office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

Our names are Roger Flores and Ruth Perez and we have lived in Moreno Valley for 20 years. Moreno Valley use to be dirt, a few schools, and a few fast food places. There have been positive developments thanks to Mr. Iddo Benzeevi' projects. The World Logistics Center is another world class project that will create an array of job opportunities, will increase revenue, and will contribute to the great green initiative. The Environmental Impact Agencies have placed lawsuits despite the fact that the Environmental Impact Report is in the project's favor. They tried doing the same thing to the Sketchers facility, but no matter what they did, this facility was awarded the gold lead award for being the most environmentally self sufficient building in the nation. The same standards will be applied to the World Logistics Center. All five Environmental Impact Reports were reviewed and showed that they were less than significant.

We ask for you to please approve the Environmental Impact Reports that were reviewed so that this great project can move forward. This project will help our city grow in revenue and will be a row model for change.

Sincerely,

Handwritten signatures of Roger Flores and Ruth Perez. The signature of Roger Flores is on top, and the signature of Ruth Perez is below it.

Roger Flores and Ruth Perez

Planning Commissioning
c/o City Hall / Clerk's office
14177 Frederick Street
Moreno Valley, CA 92553

Dear Planning Commissioners,

My name is Santiago Hernandez, I have been living in Moreno Valley for 27 years.
I am a Business owner.

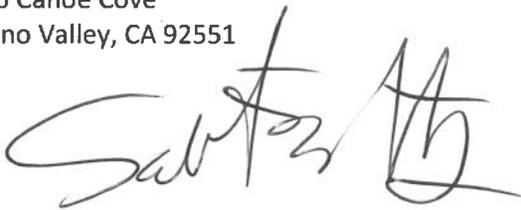
When I moved to Moreno Valley in 1993 I used to commute to Torrance every single Day. I was on the road for over 4 hours each day and my children were little and sadly I wasn't around to spend quality of time with them because I was always busy driving And working. My biggest fear was that when my children grow up they will have to Follow my footsteps and have to commute like I did because of the lack of jobs in Our city. That's when I decided to get really involved and started attending all the City Council meetings and to get informed in all the events that will bring improvement to our City.

When I heard about the WLC project, I knew right away that this project will be an economic transformation not only to our city but the entire region. I knew right away that a project of such a magnitude will bring thousands of jobs and our residents will be able to work in their own city.

Please start building this project as soon as possible.

Thank you very much.

Santiago Hernandez
16756 Canoe Cove
Moreno Valley, CA 92551

A handwritten signature in black ink, appearing to read 'Santiago Hernandez', written in a cursive style.

City Council of Moreno Valley
% City Hall/Clearks Office
14177 Frederick St.
Moreno Valley, CA. 92553

Dear Members of the Planning Commission,

My name is Teodora Garcia. I ~~had~~ been living in Moreno Valley for approximately 16 years. I love my city and I enjoy living here. But there is one inconvenience; my husband commuted the first 8 years to Fullerton city and for the last 8 years he is going up to Nebraska city. I would like to see in our city better job opportunities so our families do not have to commute long distances.

I ask to our council members, our Mayor, and the planning commissioners to let the WLC be built.

This project will help our city bringing jobs.

Thank you!

Teodora Garcia *Teodora Garcia*
25783 Margaret Ave. Moreno Valley Ca. 92551

Moreno Valley Planning Commission
c/o City Hall / Clerk's Office
1477 Frederick Street,
Moreno Valley, Ca. 92553

Dear Planning Commissioners

My name is Vilma Restrepo, I am a resident of Moreno Valley for 26 years.

As a Moreno Valley resident I fully support The WLC project. My family and I will be highly impacted if this project succeeds. With new developments comes growth and the creation of new jobs and therefore economic prosperity. Our City needs jobs and prosperity and The WLC project offers that to our community.

Many of our residents travel long distance to work, which diminishes the quality of time they spend with their families.

Please keep bringing projects like this to our community.

Thank you for your consideration

Vilma Restrepo
12980 Paris Blvd. apt. 212
Moreno Valley, Ca. 92553

Vilma Restrepo

Planning Commission of Moreno Valley
c/o City Hall / Clerk's Office
14177 Frederick Street
Moreno Valley CA 92553

Dear Members of the Planning Commission

Hi. I am writing you in regards of The World Logistics Center Project EIR. I understand that it is been updates to the latest standards. While we wait, we lose. Change is necessary in our city. Don't delay any further.

As a resident of Moreno Valley, for many years and a family man, I have followed the process of this Project that has been much accepted by The Community for the benefits that It represents, I am a truck driver who is going from state to state in order to support my family. We need a job base in our city there is no doubt about it.

Thank you very much for your attention.

Sincerely

A handwritten signature in black ink, appearing to read 'Walter Guinea', with a stylized flourish at the end.

Walter Guinea

24349 Kurt Court
Moreno Valley CA 92551
951-522-8985