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By e-mail (Gregory.mattson@sdcounty.ca.gov, Mark.Slovick@sdcounty.ca.gov)

Gregory Mattson
Mark Slovick
Planning & Development Services
5510 Overland Avenue, Suite 310
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Re: Sierra Club's Comments on "Additional Information Regarding Carbon Offset Protocols for Greenhouse Gas Emission Reduction" for Otay Ranch Resort Village (Village 13)

Dear Gregory Mattson and Mark Slovick:

The law firm of Chatten-Brown, Carstens, & Minteer represents the Sierra Club on matters relating to the Otay Ranch Resort Village (Village 13). At the Sierra Club's request, we have reviewed the County's additional information on Village 13's carbon offset protocols, including its Mitigation Measures M-GCC-7 and M-GCC-8.

While the Sierra Club recognizes that the County of San Diego ("County") has revised Mitigation Measures M-GCC-7 and M-GCC-8 in response to the Fourth District Court of Appeal's recent decision in *Golden Door Properties, LLC, Sierra Club v. County of San Diego* (2020) 50 Cal.App.5th 467 ("*Sierra Club*"), the revised carbon offset mitigation measures still violate the California Environmental Quality Act ("CEQA"). The County's proposed use of Mitigation Measures M-GCC-7 and M-GCC-8 appear to be an attempt to evade the substantive mandate of the Court of Appeal's decision and proceed with "business as usual" urban sprawl development through its unfettered use of carbon credits from voluntary carbon offset registries. As made painfully and abundantly clear by the recent, ongoing wildfires in San Diego County and throughout California, climate change poses a real and present threat. The County committed to reducing its in-County greenhouse gas ("GHG") emissions and the Village 13 GHG mitigation measures prevent the County from achieving this goal.

I. M-GCC-7 & M-GCC-8 Violate CEQA.

Despite the clear guidance from the Court of Appeal, the County still fails to make the necessary changes to its GHG mitigation measures to comply with CEQA. While

Sierra Club recognizes and appreciates that the County has removed its allowance of international carbon offsets, much of the County's revisions consist of importing language from the Fourth District Court of Appeal's decision and describing the "requirements" of the three main voluntary registries it had previously allowed under M-GHG-1, without concurrent substantive changes that address the Court of Appeal's identified legal violations.

A. M-GCC-7 & M-GCC-8's Performance Standards Are Unenforceable Because of Their Reliance on Voluntary Registries.

Under the state's Cap-and-Trade program, GHG reductions "must be real, additional, quantifiable, permanent, verifiable, and enforceable." (Cal. Code Regs., tit. 17, § 95802, subd. (a).) While there are significant concerns as to whether Compliance Offsets under the Cap-and-Trade program are even achieving these requirements, as described in more detail below, the Village 13 GHG mitigation measures certainly do not ensure that the allowed offsets meet these same requirements.

1. The Village 13 Mitigation Measures Do Not Ensure Permanent GHG Reductions.

GHG mitigation measures that allow for offsets must ensure permanent reductions. The County's revised mitigation measures offer no substantive changes to ensure the permanency of offsets allowed under the Village 13 mitigation measures. Rather, the County merely adds to its definition of "permanent" to include that "registries maintain a number of un-retired carbon offsets in a separate 'buffer pool' that can be used in the event that a previously implemented reduction is reversed." (Village 13 Project's Global Response R1: Carbon Offsets (Global Response R1).) The County fails to *actually revise* its mitigation measure here to ensure permanency because it continues to allow offsets outside of the County and state through voluntary registries.

The Court of Appeal expressed concerns over voluntary registries' ability to ensure permanency, especially in comparison to the strict requirements of the California Air Resources Board ("CARB"). (*Golden Door Properties, LLC, supra,* 50 Cal. App. 5th at 522 ["To ensure permanency, CARB requires there be 'no opportunity for a reversal of the avoided emissions.' This is implemented, for example, in CARB's forestry protocol, which requires sequestering carbon 'for at least 100 years'"].) The County should only permit use of offsets with a CARB-approved "Compliance Offset Protocol" to avoid this concern.[1] The County previously pointed to M-GHG-1's requirement that offsets be

[1] In stark contrast to M-GCC-7 & M-GCC-8, the County's Climate Action Plan ("CAP") included a measure T-4.1 that required its direct investment project to comply with "established protocols that have been approved by ... CARB, the California Air Pollution

purchased from a CARB-approved registry as a "sufficient safeguard" to ensure permanency, yet the Court distinguished CARB-approved registries from CARB-approved protocols. (*Sierra Club, supra,* 50 Cal.App.5th at 513).

Moreover, the presence and need for an entire "buffer pool" under M-GCC-7 & M-GCC-8 raises uncertainties about the efficacy of the voluntary registries in the first place. (Otay Ranch Resort FEIR Response to Comments, p. 3 ["Recognizing that unanticipated events are possible, and in order to ensure permanency, registries maintain a number of un-retired carbon offsets in a separate 'buffer pool' that can be used in the event that a previously implemented reduction is reversed. Continuing with the forestry example, offsets from a buffer pool could be used to replace reductions lost due to fire"].)

CARB's offset regulations, authorized by Health and Safety Code ("HSC") section 38562, subd. (d), provide for compliance grade offsets that are far more credible and limited than those allowed by M-GCC-7 and M-GCC-8 and their allowable voluntary registries. CARB regulations require that offsets also be "permanent," which means that the GHG reductions are either irreversible or endure for at least 100 years. (17 CCR § 95802, subd. (a)). CARB has the enforcement authority to hold a particular party liable and to take appropriate action, including penalties, if any of the regulations for CARB offset credits are violated, thus ensuring actual permanency. (17 CCR § 95802, subd. (a); 17 CCR §§ 96013, 96014.) In contrast, the Village 13 mitigation measures rely on offsets from voluntary registries and fail to ensure permanency.

The presence of a "buffer pool" does not ensure actual permanency of the offsets. The County has not identified how it will monitor offset usage and ensure that a registry's buffer pool can provide sufficient permanent offsets. This presents issues with the County's ability to enforce adequate protocols on a voluntary registry, should that registry fail to ensure permanency. While the County's addition of the "buffer pool" language was intended to strengthen the permanency requirement of voluntary carbon credits, the County has also failed to demonstrate that the developer will be required to use this buffer pool after completion of the project. The use of a "buffer pool" is not mandatory. For example, under the American Carbon Registry:

> The project proponent can choose one of three mechanisms to recover offsets in the event the reductions are reversed. … The first and primary mechanism is the ACR Buffer Pool. … Under the third option, the project proponent may propose an insurance product as a risk mitigation mechanism. For example, a project proponent could provide bonds, letters of credit, or other financial assurances to ACR in an amount sufficient to ensure ACR can retire offsets should the project suffer reversal of

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Control Officers Association (CAPCOA), or the San Diego County Air Pollution Control District." (*Sierra Club*, supra, 50 Cal. App. 5th at 492.)

> reductions. The form of the insurance product and its amount are subject to ACR approval.

(Attachment GR.R1.1, p. 311.) There is no such similar provision under the other two authorized carbon registries. (*Ibid.*) To avoid this concern, the County should enforce further on-site mitigation measures and facilitate in-County GHG mitigation.

Further, M-GCC-8 only requires that the "total carbon offsets value as identified in the certified EIR for the Project is consistent with the commitment to achieve and maintain carbon neutrality [] for the 30-year life of the Project." Yet, operation-related emissions do not cease after 30 years. The County incorrectly adds in its Global Response R1: "The Fourth District Court of Appeal's decision in *Sierra Club v. County of San Diego* (Case No. D075478) also affirmed the County's use of a 30-year period in the Supplemental EIR's carbon offsets mitigation measure for its Climate Action Plan, explaining that the 30-year period was disclosed and substantiated by cited air district guidance." Yet, the Court only dismissed arguments that the County's CAP and SEIR did not *disclose* M-GHG-1's "30-Year Shelf Life." (*Sierra Club*, p. 71). The Court itself did not state that the 30-year-period was substantiated. Rather, it only cited to evidence of disclosure in the SEIR. Since the GHG emissions from the Village 13 project will occur for the entire project duration, and that duration is far greater than 30 years, the Project's GHG mitigation measures fail to ensure the permanent reduction of project-related operational emissions.

2. The Village 13 Mitigation Measures Are Not Verifiable.

The Village 13 Mitigation Measures rely on voluntary registries that do not ensure the offsets are verifiable. The County must require further on-site mitigation measures and only allow for in-County offsets to ensure offsets are verifiable. The California Office of Planning and Research's "CEQA and Climate Change Advisory" states that "requiring on-site mitigation may result in various co-benefits for the project and local community, and *that monitoring the implementation of such measures may be easier.*" (OPR, p. 17, emphasis added.).

MGCC-7 and M-GCC-8 do not specify the mechanisms for enforcing the offset emission reductions, nor do they contain any formal protocols governing offset projects, like those vetted and approved by CARB. CARB administers its Compliance Offset Protocols administers through an Offset Project Registry (OPR), ensuring verifiable offsets. In contrast, the Village 13 mitigation measures rely on voluntary carbon credits issued pursuant to protocols that have not been reviewed or approved by CARB. The voluntary market is completely separate from the compliance market, and the CARB Office of Communications Director made clear both that registries perform only administrative functions under Cap-and-Trade and that CARB does not oversee the voluntary market in any way to ensure its effectiveness. The fact that the County does not require offsets through CARB-approved protocols and allows offsets both out of the County and anywhere in the United States prevent it from actually verifying the adequacy of the offsets.

M-GCC-7 and M-GCC-8 still do not provide any authority nor any practical manner to verify or enforce offsets outside of the County.

3. The Village 13 Mitigation Measures Are Not Additional.

GHG offsets must be additional, ensuring “greenhouse gas emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario.” (Cal. Code Regs., tit. 17, § 95802.) M-GCC-7 and M-GCC-8 fail to ensure that offsets from the voluntary registries are actually additional.

The County only expands its definition of “additional” to explain what “additional” entails (i.e., the “legal requirement test”) and summarily requires offsets to satisfy CEQA additionality requirements, yet does not provide substantive changes to ensure that its offsets are actually additional.[2] The County only doubles down on its use of voluntary registries, citing to the registries’ manuals for support that the offsets will be additional. Voluntary registries fail to ensure additionality.

The Court of Appeal emphasized the deficiency of voluntary registries in assuring additional offsets, in contrast to CARB-approved protocols. (*Sierra Club*, p. 45). A CARB Protocol must “‘[e]stablish [] the eligibility and additionality of projects using standard criteria, and quantif[y] GHG reductions and GHG removal enhancements using standardized baseline assumptions, emission factors, and monitoring methods.’ Furthermore, a specific project may qualify for an offset credit only by meeting both the additionality requirements set forth in the regulation and any additionality requirements in the applicable [CARB] [P]rotocol.” (*Sierra Club*, p. 45, citations omitted). Voluntary registries fail to ensure offsets are additional.

[2] “Mitigation measures M-GCC-7 and M-GCC-8 explicitly require all carbon offsets to satisfy additionality requirements consistent with CEQA. Specifically, both measures require carbon offsets to represent the ‘...reduction or sequestration of one metric ton of carbon dioxide equivalent that is ‘not otherwise required’’ (CEQA Guidelines §15126.4(c)(3)) . . . Further, the measures define ‘additional’ as that term is used by the Climate Action Reserve, American Carbon Registry and Verra to ensure the integrity of carbon offsets from projects that each registry administers.” (Village 13 Project’s Global Response R1: Carbon Offsets).

B. M-GCC-7 & M-GCC-8 Do Not Require Offset Protocols That Meet AB-32 Criteria.

1. The County's Continued Reliance on Voluntary Registries Fails to Remedy the CEQA Violations the Court of Appeal in *Sierra Club* Identified.

a. Use of Voluntary Protocols Do Not Ensure Enforcement.

M-GCC-7 and M-GCC-8 do not escape the Court of Appeal's conclusion that "offset protocols developed by CARB- approved registries [] do *not by that fact alone* meet the offset criteria in Assem. Bill No. 32." (*Sierra Club*, p. 49). The Village 13 mitigation measures still rely on three registries — the Climate Action Reserve, the American Carbon Registry, or Verra (previously, the Verified Carbon Standard) — named in M-GHG-1 that CARB specifically referred to in its discussion of the perils of reliance on voluntary protocols, as quoted by the Court of Appeal:

> Voluntary offset programs such as the American Carbon Registry, Climate Action Reserve, Verified Carbon Standard, and others may submit protocols to [C]ARB for review. However, regardless of how the voluntary protocols are developed, [C]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. . . . *This process ensures that any voluntary protocol . . . demonstrates the resulting reductions meet the offset criteria in [Assem. Bill No. 32] . . . .*
>
> <u>Protocols developed by the voluntary programs are not Compliance Offset Protocols as they are not developed through a rulemaking process, *may not meet the [Assem. Bill No. 32] and Cap- and-Trade Regulation criteria,* and were not approved by [CARB].</u>

(*Sierra Club*, p. 49, emphasis added, quoting **Exhibit A**, p. 9).

Ultimately, the County doubles down on its use of voluntary registries that the Court of Appeal had specifically noted concerns over. This does little to assuage the Court's concerns that voluntary registries' protocols are not AB 32 compliant. As discussed above, these voluntary registries do not provide adequate protocols to ensure enforceable standards.

The County states that "[e]ach protocol contains standards specific to the carbon offset project type that is the subject of the protocol and addresses items required by the program manuals," including standards for "eligibility rules, including locational limits, project start dates and crediting periods, and criteria for establishing additionality . . . monitoring requirements and reporting parameters . . . and verification and confirmation standards." (Global Response R1, p. 6.) The County relies on voluntary registries' own protocol plans. However, the voluntary registries are not CARB-approved, AB-32 compliant protocols.

b. The County Program Lacks a Methodology for Public Participation with Regard to Subsequently Adopted Mitigation Measures.

Additionally, while the County adds the requirement that registries' protocols ensure "adequate" public consultation and expert involvement, it does not define specific requirements for adequate public consultation. CARB-approved protocols avoid this uncertainty since, before approving a protocol, CARB subjects the proposed offset protocol to public notice, a comment period, and a public hearing. (Cal. Code Regs., tit. 17, §§ 95970, subd. (a)(2), 95971, subd. (a).) There is no similar process for voluntary registries.

The County allows an unlimited percentage of project emissions to be offset through voluntary registries. The Court of Appeal noted that under Cap and Trade, "[e]ntities can use offsets to fulfill only up to 8 percent of their compliance obligation. (Id., § 95854, subd. (b).)" (*Sierra Club*, pp. 7, 51.) The trial court had similarly noted this distinction in concluding that "requiring offsets be purchased from CARB-approved registries is 'not remotely similar to the CARB program.'" (*Sierra Club*, p. 36.) The County responds to this concern by stating:

> Entities regulated by the Cap-and-Trade Program . . . generally have direct operational control of the long-term GHG emissions from the source profile. On the other hand, *land use developers do not have continuing control and authority over most, if not all, of the sources of GHG emissions*. . . Practically speaking, this limits the suite of on-site reduction strategies that a land use developer can use to reduce GHG emissions, unlike those covered entities under the Cap-and- Trade Program.

This distinction demonstrates precisely why voluntary market offsets are inappropriate to achieve the reduction of GHG emissions for GPA projects' operations. In fact, this supports Sierra Club's contention that sprawl projects such as Village 13 that cause a vast increase in VMTs and what the County suggests are "unavoidable" emission increases should not be approved if they cannot be adequately mitigated.

While the County has eliminated the use of offsets from international projects, the County confirms that Mitigation Measures M-GCC-7 & M-GCC-8 "exclusively permit the use of in-County, in-State and <u>in-U.S. offsets</u>." (Village 13 Project's Global

Response R1: Carbon Offsets, p. 21, emphasis added.) The County previously acknowledged that there are no in-County offsets currently available. It would be incumbent upon the County to develop this program. The County could set up a local offset program, but it has failed to do so. Thus, as a practical matter, most, if not all, offsets will be sourced from offset projects outside of the County. M-GCC-7 and M-GCC-8 do not require any efforts by the County or project developer to create in-County offsets. Without real in-County offset opportunities, these revisions accomplish little to increase in-County offsets. Therefore, 100% of out-of-County project offsets –and even out-of-state offsets—could still be allowed if no "available" in-County emissions are available. As far as Sierra Club is aware, the County has not even studied the feasibility of requiring in-County offsets.

The Village 13 Mitigation Measures' allowance of offsets anywhere in the United States is especially concerning. The *Sierra Club* Court of Appeal explained, "Under cap-and-trade, legislative safeguards seek to ensure that out-of-state offsets reflect genuine GHG reductions. For example, CARB may approve out-of-state offsets only if the Governor makes findings to ensure the linked jurisdiction's offsets are genuine, verifiable, and enforceable under law that is at least as strict and enforceable as is California law. (Gov. Code, § 12894, subd. (f))." The Court of Appeal added:

> *The fundamental problem, unaddressed by M-GHG-1, is that the County has no enforcement authority in another state*, much less in a foreign country. M-GHG-1 does not require a finding that an out-of-state offset site has laws at least as strict as California's with respect to ensuring the validity of offsets.

(*Sierra Club*, pp. 50-51, emphasis added.) Likewise here, the County has no enforcement authority in another state and M-GCC-7 & M-GCC-8 also do not require a finding that an out-of-state offset site has laws at least as strict as California's with respect to ensuring the validity of offsets.

2. CARB's Certification of AB 900 Projects That Use Voluntary Offsets Does Not Signal Their Compliance with AB 32 or Adequate Protocols.

In the Village 13 Project's Global Response R1, the County adds a section entitled "CARB's Certification of AB 900 Projects Establishes Precedent for Use of Voluntary Carbon Offsets by Land Use Development Projects to Achieve Net Zero Emissions." This argument is unavailing. Under AB 900, the Governor may certify a project for streamlining pursuant to AB 900 if certain conditions are met. One condition is that the "project does not result in any net additional emission of greenhouse gases, including greenhouse gas emissions from employee transportation, *as determined by the California Air Resources Board …*" (**Exhibit B**, emphasis added.) For AB 900 projects, CARB specifically reviews the GHG quantification methodologies and mitigation measures prior to certifying the project. In sharp contrast, CARB does not review the GHG quantification methodologies and mitigation measures for M-GCC-7 & M-GCC-8.

C. M-GCC-7 & M-GCC-8 Improperly Defer Mitigation.

CEQA only permits deferred mitigation in very limited circumstances, requiring, among other criteria, that the agency "adopt specific performance criteria that mitigation will achieve." (CEQA Guidelines § 15126.4, subd. (a)(1)(B).) "Deferred mitigation violates CEQA if it lacks performance standards to ensure the mitigation goal will be achieved." (*Sierra Club*, p. 62). "'Formulation of mitigation measures shall not be deferred until some future time.' (Guidelines, § 15126.4, subd. (a)(1)(B).) However, the specific details of a mitigation measure . . . may be developed after project approval when it is impractical or infeasible to include those details during the project's environmental review provided that the agency (1) commits itself to the mitigation, (2) adopts specific performance standards the mitigation will achieve, and (3) identifies the type(s) of potential action(s) that can feasibly achieve that performance standard and that will considered, analyzed, and potentially incorporated in the mitigation measure.'" (*Sierra Club*, p. 60).

The County's continued reliance on voluntary registries—each with their own host of specific protocols—does not provide sufficiently defined and specified offset protocols to ensure that the mitigation measures actually ensure real, permanent, additional, verifiable offsets. The County notes the potential for the voluntary registries to change the methodologies and performance standards of its three chosen voluntary registries:

> The County has reviewed the registry-administered protocols and methodologies for the carbon offset project types included in M-GCC-7 Attachment 'A,' and has determined that such protocols and methodologies – *including updates to those protocols and methodologies as may occur from time to time by the registries* in accordance with the registry documentation listed in the prior paragraph to ensure the continuing efficacy of the reduction activities – are eligible for use under this mitigation measure, provided that any updated protocols shall be provided for County review as required by the Reporting and Enforcement Standards below prior to the County's acceptance of offsets based on such updated protocols.

(Village 13 Project's Mitigation Measures M-GCC-7 and M-GCC-8, p. 2, emphasis added). This constitutes improper deferral of mitigation.

D. The County Lacks Enforcement Power to Ensure Adequate and Real Mitigation Outside of the County.

The Otay Village GHG Mitigation Measures do not provide any authority to verify or enforce offsets outside of the County, nor do their terms provide for enforcement of offset requirements via a continuing contractual agreement after the developer has completed the project. The measures also have no provision for enforcement if offset projects are terminated or GHG reductions are reversed (e.g., the trees planted as offsets later burn or are cut down). While the revised measures note the presence of registries' "buffer pools," this does not ensure the County can enforce use of those buffer pools (much less ensure adequate performance standards of the pools). Since extensive use of out-of-county offsets can reasonably be expected, this makes oversight and enforcement of the mitigation measures impractical, if not impossible. What is the County's recourse if it discovers a voluntary registry offset is not adhering to its own reported standards? The County's revisions only focus on the legal obligation of the developer and ignore the County's limited jurisdictional power.

The County claims that the revised measures assure that the County has sufficient enforcement avenues because the issuance of grading and building permits is tied to and contingent upon the satisfactory retirement of carbon offsets compliant with the articulated mitigation standards. The County also points to its Mitigation Monitoring and Reporting Program (MMRP). However, these measures fail to address concerns for what will happen when non-compliant or inadequate protocols are discovered after completion of the project. Carbon offsets' requirement of permanency directly highlights the enforcement deficiency in the County's mitigation measures. After the completion of the project, which may only take two to three years, the County surrenders its only true enforcement mechanism.

Further, the MMRP does not grant the County jurisdictional power to enforce out-of-County offsets. The County's wholesale allowance of out-of-state offsets pales in contrast to CARB's strict "linkage" requirements. Overall, the County lacks the enforcement power that CARB possesses.

II. The County Should Pursue an In-County GHG Mitigation Program Because Out-of-Jurisdiction Carbon Offsetting Cannot Guarantee the Production of Legitimate Offsets.

In a May 2019 Harvard Kennedy School Working Paper entitled "California Compliance Offsets: Problematic Protocols and Buyer Behavior" (attached as **Exhibit C**), the author analyzed California's compliance offset market and questioned "whether carbon offset policy can guarantee the production of legitimate offsets— those that represent additional, permanent, enforceable, real, quantifiable, and verifiable greenhouse gas emissions reductions." (*Id.* at 3.) The paper analyzed four compliance offset protocols that have supplied more than 145 million offsets to the California Compliance Market and found that all four have the potential to generate illegitimate offsets. The analysis concluded that "US Forest Projects Protocol is both the most productive and most problematic; so far, it has *produced more than 115.6 million illegitimate offsets*, 79% of California's total compliance offset supply." (*Ibid.*) Other analyses have also identified significant concerns with out-of-jurisdiction carbon offsetting. (See **Exhibits D-F**.)

In June 2019, the University of California San Diego and Scripps Institute of Oceanography prepared a white paper entitled "*Carbon Offsets in San Diego County: An Analysis of Carbon Offset Policy Effectiveness, Best Practices, and Local Viability in the San Diego County Region*" (hereinafter, "*Carbon Offsets in San Diego County*") (**Exhibit G**.) This paper identified many of the problems with out-of-jurisdiction carbon offsets:

> Carbon offsets are criticized for not truly meeting net neutrality goals because it is nearly impossible to tell if a carbon offset project is additional, i.e., would not have happened without the influence of the offset incentive. Non-additional projects would not meet offset goals but are difficult to identify. Carbon offsets are also criticized for being prohibitively difficult to measure and verify and for slowing progress on emissions reductions strategies.

(*Id.* at p. 4.) The authors then made the following recommendations:

> Both required and voluntary offsets can benefit from investing in local projects where they are easiest to verify and the co-benefits (such as green space or clean energy production) are kept local to the carbon emissions they are offsetting and the negative externalities of those operations. The San Diego region many opportunities for potential offsets.

(*Ibid.*) The paper then recommended including local requirements. "Requiring a portion of offset projects to be developed locally improves ability to measure and verify projects. Local projects keep co-benefits of the projects local to the communities that may experience negative externalities of emissions being offset." (*Ibid.*) The paper also noted that "[c]urrently, there are no carbon offset projects in the San Diego Region" and recommended investing in local offset projects. (*Ibid.*)

Carbon Offsets in San Diego County discusses the importance of using offsets from in-County GHG reduction projects, explaining that "[c]arbon offset projects based in the San Diego region are a valuable opportunity because of the co-benefits generated from local projects and available resources for more thorough monitoring." (*Id.* at 13.) The paper further explained:

> Keeping offset projects local to the activities that they are offsetting helps bridge the gap between the co-benefits of offset projects and the added negative externalities of carbon emitting practices. The theoretical basis of carbon offset policies is that atmospheric carbon is well mixed, so the geography of the projects relative to the emissions source should not matter. However, carbon emitting processes often have other externalities that are not accounted for in the greenhouse gas emissions pricing scheme like particulate matter that stay local. Conversely, carbon offset projects often have co-benefits such as additional energy production, creation of greenspace, or habitat restoration.

(*Id.* at p. 11.)

The County must analyze the feasibility of in-County GHG reductions prior to authorizing out-of-County carbon offsets.

III. Projects Relying on M-GCC-7 & M-GCC-8 Prevent Mitigation of General Plan Amendment GHG Emissions Within the CAP's Emission Projections, Leading to Inconsistency with the General Plan Update.

The County correctly notes that the Court of Appeal in *Sierra Club* concluded that the *2018 CAP* was "not inconsistent" with the County's General Plan Update. However, the County erroneously concludes from this fact that the use of out-of-County offsets is not inconsistent with the General Plan Update. The Court of Appeal found it unnecessary to decide whether M-GHG-1 projects were consistent with the General Plan Update because the Court of Appeal had already concluded that M-GHG-1 violated CEQA.

If approved with M-GCC-7 & M-GCC-8, Village 13 would violate the commitment the County made in its General Plan Update to reduce its emissions within the County. As adopted in 2011 and amended in 2018, the General Plan committed to achieving GHG reductions *within* the County. In contrast, M-GCC-7 & M-GCC-8 would *increase* GHG emissions within the County by enabling sprawl development in reliance on offsets outside of the County and California. The County's reliance on voluntary registries, allowance of out-of-of County offsets, inadequate on-site mitigation measures, and lack of limitations on the percentage of emissions a project may offset prevents General Plan Amendment projects from fully mitigating their GHG emissions to remain within the CAP's emission projections, leading to a conflict with the GPU.

IV. The County Should Not Approve the Village 13 Project Prior to the Development of a Smart Growth Plan.

In concluding that the County failed to analyze a smart-growth alternative in the CAP SEIR, the Court of Appeal in *Sierra Club* stated:

> VMT reduction is an integral part of California's strategy to reach 2030 and 2050 GHG emission reduction targets. However, M-GHG-1 would potentially allow GPAs to mitigate 100 percent of their in-County GHG emissions by purchasing out-of-County (including international) originating offsets. In so doing, *M-GHG-1 is inconsistent with the Regional Plan because it ignores whether GPAs are located consistent with smart growth policies.*

(Sierra Club, p. 100.)

Likewise here, the potential approval of this Project prior to the development of a Smart Growth Plan would ignore whether this GPA project is located consistent with smart growth policies. It is vital to locate new residential development that was not previously identified in the General Plan Update in smart growth areas near transit and jobs. Changing land use patterns must favor smart growth over sprawl.

V. The County Must Adopt Additional Feasible On-Site and In-County GHG Mitigation Measures.

Before relying on specious offset credits to "mitigate" the Project's GHG impacts, we urge the County to adopt all feasible on-site Project-level and countywide mitigation measures.

First, the County must adopt *on-site* feasible mitigation measures for the Project before using offset credits that will not reliably reduce GHG emissions. These Project-level mitigation measures include:

- All residential and commercial development shall be all-electric with no plumbing for natural gas. Accordingly, no gas-powered water heaters, stoves/cooktops, fireplaces, or any other gas-powered appliance shall be allowed.
- Photovoltaic solar panels and batteries shall be included in the project design to provide 100 percent of the Project's residential electricity needs, and the maximum amount of the Project's commercial needs.
- Electric vehicle charging stations shall be included in the project design to provide charging capacity adequate to service all anticipated vehicles utilizing residential and commercial development. Each residential unit will have a 220-volt outlet in or near its carport so that future recharging on site will be facilitated if desired.
- Electric heat pumps shall be included in the project design to provide 100 percent of water heating and cooling for swimming pools and all residential and commercial air and water heating and cooling.
- Gas-powered landscape maintenance equipment shall be prohibited.

- Increased frequency of bus service to the public transit centers shall be sought. Parking by the transit center will be provided and bike paths and walking paths will access the transit center.

Further, the Sierra Club urges the County to reject out-of-county offset credits until *all* countywide feasible mitigation measures have been implemented. The Sierra Club recommends that the County work with the South Coast Air Quality Management District and other local jurisdictions to develop in-county mitigation projects. Below is a list of in-county mitigation measures that we urge the County to adopt.

- Adopting a Community Choice Aggregation Program. The goal should be to achieve 90% clean energy goal by 2030 consistent with local cities such as San Diego, Del Mar, Solana Beach and Encinitas.
- Committing to electrification of the Port of San Diego, to the extent that such measures are not already required and/or funded.
- Establishing an urban tree-planting program.
- Extending mass transit throughout the County, to the extent that such measures are not already required and/or funded.
- Ensuring methane recapture from farms and landfills. Existing landfills emit over 10% of San Diego County GHG. An aggressive solid waste diversion program and capture of methane and other GHG gas from landfills should be included in the San Diego County Climate Action Plan.
- Providing incentives for carpooling.
- Building bike trails and protected lanes of bikes and scooters.
- Providing incentives to the public for purchase of low emission vehicles.
- Providing free parking for electric vehicles.
- Constructing solar and wind power additions to county buildings.
- Providing dividend account parking to County employees, so that they can choose to pay for a parking space or find alternative transportation and keep the money.
- Systematically promoting, via rules or subsidies, the sale of locally grown foods and products.
- Installing electric vehicle charging stations at all county parking lots.
- Promoting the expansion of public electrical vehicle charging stations throughout the county.
- Committing to 50% electric landscaping equipment by 2030 and all leaf blowers should be electric or battery powered by 2025.
- Increasing purchase of sensitive land for permanent habitat and additions to the Multiple Species Conservation Program (MSCP).
- Increasing preservation and restoration of wetlands and marshland throughout the County to facilitate carbon sequestration.
- Building a People Mover from the San Diego Airport to downtown and the trolley.

The County should specifically implement the following for new and existing development within the County:

- Providing subsidies for weatherization of homes.
- Providing tax incentives for residents to install renewable energy infrastructure.
- Prohibiting gas from all new construction. Committing to 100% electric for all new construction.
- Prohibiting inclusion of gas fireplaces and gas water heaters in new construction.
- Creating incentives for conversion from propane to electric.
- Providing subsidies for conversion of home and business from gas power to electric.
- Avoiding conversion of farmland.

In addition to implementing these measures, the County should include an Environmental Justice/Social Equity component in the San Diego Climate Action Plan. Climate change impacts everyone, but it disproportionally impacts low-income communities and communities of color. Reduction of impacts to and the creation of green jobs in these communities should be a primary priority.

VI. Conclusion

Despite the County's modifications to Mitigation Measures M-GCC-7 & M-GCC-8, they still violate CEQA. These measures are unenforceable because of their reliance on voluntary registries that do not have consistent protocols reviewed by CARB. Moreover, the County lacks enforcement power to ensure the GHG reductions are in fact achieved. The approval of the Village 13 project would also violate the General Plan's commitment to achieve in-County GHG reductions. No approval of this Project should be considered until the County analyzes an in-County GHG mitigation strategy and there is a Smart Growth Plan in place. Finally, prior to authorizing the use of out-of-County carbon credits, the County must adopt all additional feasible on-site and in-County GHG mitigation measures.

Thank you for your consideration.

Sincerely,

Josh Chatten-Brown

EXHIBIT A

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/remository/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 conservative[3] 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

EXHIBIT B

Jobs and Economic Improvement through Environmental Leadership Act Assembly Bill 900

Process for Greenhouse Gas Methodologies and Documentation Submittal to CARB

Governor Brown signed the “Jobs and Economic Improvement through Environmental Leadership Act” (Act) in September 2011. The Act requires the Governor to establish procedures for applying streamlined judicial review for certain qualified projects. Guidelines for applying to the Governor for the streamlining under Public Resources Code Section 21178 et seq. are available from the Governor’s Office of Planning and Research.

As described in the guidelines, for purposes of California Public Resources Code section 21183 (c), an applicant shall submit electronically to CARB a proposed methodology for quantifying a project’s net additional Greenhouse Gas Emissions (GHG) and documentation that the project does not result in any net additional GHGs. Both submissions can be emailed to AB 900 CARB Submittal.

In addition, applicants are encouraged to contact CARB via the same email address with any questions about CARB’s review. CARB requests that any questions or initial contact via the email address include a simple description of the project. This will help CARB assign the appropriate technical staff and facilitate a quicker response.

CARB’s Role and Process

The Governor may certify a project for streamlining pursuant to AB 900 if certain conditions are met. One such condition is that the “project does not result in any net additional emission of greenhouse gases, including greenhouse gas emissions from employee transportation, as determined by the California Air Resources Board pursuant to Division 25.5. (commencing with Section 38500) of the Health and Safety Code.” (Pub. Resources Code 21183 (c).) CARB’s determination on greenhouse gas emissions under the Act is for the limited purpose of the Governor’s findings and certification.

If the applicant is not the lead agency, CARB encourages the applicant to work closely with the lead agency to identify GHG quantification methodologies and mitigation measures before submitting their documentation for CARB's determination. CARB wants to ensure that its determination is based on the best information about the project design, quantification methodologies, and mitigation measures that the lead agency will consider.

CARB suggests that the following steps be taken for the submittal/evaluation of GHG methodologies and documentation, although CARB's review and process of any particular application may differ based on the individual facts and circumstances of that application:

For applicants that are also the lead agency:

1. Applicant sends CARB an email indicating its intent to submit proposed GHG methodologies and documentation along with a simple description of the proposed project so that CARB can assign the appropriate technical staff to respond.
2. CARB holds a pre-submittal meeting with the applicant regarding the project in an effort to provide direction on the submittal and associated process.
3. Applicant submits its GHG methodologies and documentation to CARB.
4. CARB evaluates the submittal.
5. CARB drafts its evaluation and shares it with the applicant.
6. CARB finalizes its determination and transmits it to the Governor's Office.

For applicants that are not a lead agency:

1. Applicant meets with the lead agency to discuss the proposed project including emission quantification methodologies and potential mitigation measures.
2. Applicant makes any adjustments to the project, emission quantification methodologies, or mitigation measures per direction from the lead agency.
3. Applicant sends CARB an email indicating its intent to submit proposed GHG methodologies and documentation along with a simple description of the proposed project as well as the lead agency contact so that CARB can assign the appropriate technical staff to respond.
4. CARB contacts the lead agency for the proposed project to discuss their perspective on the emission quantification methodologies and any mitigation measures.
5. CARB holds a pre-submittal meeting with the applicant regarding the project in an effort to provide direction on the submittal and associated process.
6. Based on the applicable facts the CARB will: 1) encourage the applicant to proceed with submitting GHG methodologies and documentation; 2) recommend that the applicant follow-up with the lead agency on outstanding questions before submitting GHG methodologies and documentation; or 3) schedule a coordination meeting that includes the lead agency and applicant prior to submitting GHG methodologies and documentation.
7. Applicant submits its GHG methodologies and documentation to CARB.

8. CARB evaluates the submittal in consultation with the lead agency.
9. CARB drafts its evaluation and shares it with lead agency.
10. CARB finalizes its determination and transmits it to the Governor's Office.
11. The above steps apply provided the lead agency is available to work within the schedule established for CARB under the Act. If this is not possible, CARB may seek additional time as provided for under the Act or proceed with finalizing its evaluation and determination under the Act.

To facilitate efficient evaluations, CARB suggests GHG methodologies and documentation submitted to CARB should follow the principles listed below:

- GHG methodologies and documentation should include the technical basis for characterizing and quantifying GHG emissions from all sources.
- GHG methodologies and documentation should provide the technical basis for characterizing and quantifying the GHG reduction potential of proposed GHG reduction strategies.
- GHG reduction strategies should fully offset calculated GHG emissions generated by the project.
- All determinations should be supported by reasoning and evidence to be included in the GHG methodologies and documentation.

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California Governor

Gavin Newsom

Secretary for Environmental Protection

Jared Blumenfeld

California Ai… ard is one of six boards, departments, and offices under the umbrella of the
…fornia Environ… ion Agency .

Chair, California Air

Mary D. Nichols

EXHIBIT C

HARVARD Kennedy School
MOSSAVAR-RAHMANI CENTER
for Business and Government

California Compliance Offsets: Problematic Protocols and Buyer Behavior

2019 John Dunlop Thesis Prize Winner

Jack B. Smith

May 2019

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California Compliance Offsets:
Problematic Protocols and Buyer Behavior

A Thesis Presented By

Jack B. Smith

to

The Committee on Degrees in Environmental Science and Public Policy

in partial fulfillment of the requirements
for a degree with honors
of Bachelor of Arts

Harvard College
Cambridge, Massachusetts

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Abstract

Carbon offsetting is a ubiquitous feature of emissions mitigation strategies that reduces the cost of compliance with mandatory greenhouse gas regulation and enables unregulated firms to meet voluntary emissions goals. Worldwide, compliance and voluntary offset markets have generated more than three billion offsets, which, in theory, each represent one metric ton of CO_2-equivalent emissions that have been prevented, sequestered, or otherwise mitigated outside of a regulatory regime. In practice, it is unclear whether carbon offset policy can guarantee the production of legitimate offsets—those that represent additional, permanent, enforceable, real, quantifiable, and verifiable greenhouse gas emissions reductions. California's compliance offset market, given its size, transparency, and recent establishment, presents a perfect opportunity to study the extent to which current carbon offset policy can produce legitimate offsets. This thesis analyzes four compliance offset protocols that have supplied more than 145 million offsets to the California Compliance Market and finds that all four have the potential to generate illegitimate offsets, compromising the integrity of California's cap on greenhouse gas emissions. The current US Forest Projects Protocol is both the most productive and most problematic; so far, it has produced more than 115.6 million illegitimate offsets, 79% of California's total compliance offset supply. To reduce the risk of protocols generating illegitimate offsets in California and other markets, this thesis will suggest improvements to additionality tests and emissions quantification that can be added to current and future offset protocols. It will also suggest alternatives to offset policy that can deliver emissions reductions with less risk to the integrity of emissions reduction goals. Last, this thesis will argue that even if offset protocols guarantee legitimate offset production, achieving carbon neutrality via voluntary carbon offsetting hinders progress toward a zero-emissions future.

Table of Contents

Abstract	**ii**
Table of Contents	**iii**
List of Figures	**v**
List of Acronyms	**vi**
Acknowledgements	**vii**
Introduction	**1**
Offset Fundamentals	3
The Voluntary Market	3
The Compliance Market	5
The Need for Offset Policy Investigation	7
Chapter 1: Benefits and Criticisms of Offsetting	**11**
Benefits of Carbon Offsetting	12
Criticisms of Carbon Offsetting	14
Additionality	14
Permanence	18
Enforceability	25
Reality, Quantifiability, and Verifiability	27
Unintended Consequences	32
Chapter 2: California Compliance Market Policy Analysis	**39**
California Compliance Market (CCM) Background	39
California Compliance Offset Protocol Analysis	46
U.S. Forest Protocol	47
Ozone Depleting Substances (ODS) Protocol	55
Livestock Protocol	62
Mine Methane Capture (MMC) Protocol	68
Chapter Conclusions and Summary	74
Chapter 3: Market Trends and Case Studies in the California Compliance Market 2013-2016	**76**
Market Trends in the CCM	77
Types of Offsets Submitted	79
Case Studies	**80**
Case Study: City of Colton	81
Case Study: CP Energy Marketing (US), Inc.	93

Case Study: The University of California 100
Case Study: The Los Angeles Department of Water and Power 107
Chapter 3 Discussion and Conclusions 112
Conclusion: 116
Recommendations for Policymakers and Firms Engaged in Offsetting 116
Flaws Identified in California's Offset Protocols 116
Implications for Global Offset Policy 118
Recommendations for Policymakers 120
Two Ways Forward: Better Offset Policy or Alternative Policy 124
Options for Offset Policy Improvement 124
Policy Alternatives 125
Recommendations for Firms that Utilize Offsets 129
Seeking Quality in Compliance Markets 130
Demonstrating Climate Leadership in the Voluntary Market 130
Appendix I 138
Appendix II 145
Bibliography 147

List of Figures

Chapter 1

Figure 1.1	Types of Additionality Tests	15
Figure 1.2	Radiative Forcing Over Time of Methane and Carbon Dioxide	33
Figure 1.3	Temperature Trajectories Under Different Mitigation Strategies	34

Chapter 2

Figure 2.1	Offsets Produced by California Compliance Offset Protocols	40
Figure 2.2	Annual and Triennial Compliance Obligations	40
Figure 2.3	Reversal Risk Categories and Description	138
Figure 2.4	Contributions to Project Reversal Risk Rating: Financial Risk	138
Figure 2.5	Trigger Rates for Mandatory Leakage Repair of ODS Equipment	56
Figure 2.6	Residence Times and Global Warming Potentials of ODS Gasses	139
Figure 2.7	Global Warming Potentials of Replacements for HCFC-22	140
Figure 2.8	CARB Economic Analysis of Modeled Dairy Manure Digester	140
Figure 2.9	Value of Methane Sold as Natural Gas vs. Destroyed for Offset Generation	72
Figure 2.10	Mine Methane Protocol New Additionality Test	74
Figure 2.11	Summary of Chapter Conclusions and Recommendations	75

Chapter 3

Figure 3.1	Firms in Case Studies	76
Figure 3.2	California Compliance Firms' Total Covered Emissions vs. Percentage of Offsets Submitted, Compliance Period One	141
Figure 3.3	California Compliance Firms' Total Covered Emissions vs. Percentage of Offsets Submitted, Compliance Period Two	141
Figure 3.4	Average Annual Emissions Obligations of Three Largest Emitters in Compliance Period One and Compliance Period Two	78
Figure 3.5	Offset Submissions in Compliance Period One and Compliance Period Two	142
Figure 3.6	Offsets Submitted by Type	142
Figure 3.7	Offset Submissions Compared to Offset Supply	143
Figure 3.8	Offset Submissions of Sub-Groups of firms	143
Figure 3.9	Firm in Case Studies	81
Figure 3.10	LADWP Power Mix 2003-2017	144
Figure 3.11	LADWP Renewable Power Supply 2003-2006	145

List of Acronyms

ACR	American Carbon Registry
BAU	Business as Usual
BC	British Columbia
CAISO	California Independent System Operator
CAP	Climate Action Plan
CAR	Climate Action Reserve
CARB	California Air Resources Board
CAT	Cap-And-Trade
CCM	California Compliance Market
CDM	Clean Development Mechanism
CER	Certified Emissions Reduction
CEU	City of Colton Electric Utility
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPEM	CP Energy Marketing (US), Inc.
CP1	Compliance Period One (2013-2014)
CP2	Compliance Period Two (2015-2017)
DNDC	Denitrification Decomposition
ERU	Emissions Reduction Unit
GHG	Greenhouse Gas
GWP	Global Warming Potential
ICAO	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
LADWP	Los Angeles Department of Water and Power
MMC	Mine Methane Capture
ODS	Ozone Depleting Substance
PCAST	Presidential Council of Advisors on Science and Technology
RAU	Recovery and Use

REDD	Reduced Emissions from Deforestation and Degradation
RGGI	Regional Greenhouse Gas Initiative
RPS	Renewable Power Standard
SLCP	Short Lived Climate Pollutant
tCO_2e	Metric Ton of Carbon Dioxide Equivalent
UC	University of California
UNFCCC	United Nations Framework Convention on Climate Change

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Introduction

As policymakers strive to set and meet greenhouse gas emissions reduction goals, they also design policies aimed at reducing the cost of greenhouse gas (GHG) mitigation. Carbon offsetting has emerged across all major emissions mitigation policies as a method for reducing the cost of compliance with mandatory GHG regulation while also enabling unregulated firms to voluntarily reduce their carbon footprints. Those voluntary reductions are often touted as a means for achieving net-zero carbon emissions or "carbon neutrality," a status that has gained popularity in the public and private sectors despite uncertain environmental benefits.

Carbon offsetting is based upon the idea that firms do not need to reduce their GHG emissions themselves to reduce the total stock of GHGs in the atmosphere. Instead, they can neutralize or "offset" their emissions by paying firms outside the scope of emissions regulation to reduce *their* emissions. This concept has given rise to numerous government policies and private companies that allow firms to buy and sell emissions reductions in standard units called "carbon offsets." Each offset represents one metric ton of CO_2-equivalent (tCO_2e) emissions that has been voluntarily averted, sequestered, or otherwise mitigated through a variety of eligible emissions-reducing activities.

Emissions reductions that produce offsets must, of course, be carefully accounted for and credited. If illegitimate offsets are bought and sold alongside legitimate offsets, total atmospheric emissions can become much higher than intended, compromising the integrity of mandatory emissions limits and voluntary emissions reduction goals. Unseen emissions increases like this not only intensify climate change, but also represent wasted investment in nonexistent climate benefits.

This thesis will argue that four offset policies currently operating in California do not guarantee the production of legitimate offsets that deliver their intended emissions reductions. Consequently, these policies compromise the integrity of California's mandatory cap on emissions while wasting time, effort, and resources. Three of California's policies, which focus on mine methane destruction, livestock manure methane destruction, and ozone depleting substance destruction, can produce both legitimate and illegitimate offsets and can be improved to increase the number of legitimate offsets generated. The fourth, however, which sequesters carbon in forests, overvalues temporary emissions reductions by assuming they are able to compensate for atmospheric emissions, rendering all 115.6 million offsets it has produced illegitimate.[1] Since forests are widely considered the largest potential source of carbon offsets on the planet, this fundamental flaw must not be replicated in future offset protocols.

This thesis will begin by describing the fundamentals of carbon offsetting—the types of markets in which they are bought and sold, the magnitude of carbon emissions involved, and the need for policy investigation in California. It will then continue in Chapter One with a discussion of the intended benefits and potential drawbacks of offsetting that underlie any analysis of specific offset policies. Chapter Two will focus on California's offset market and the four protocols currently producing offsets, arguing how they fail to ensure the production of legitimate offsets. Once Chapter Two identifies problems in California's protocols, Chapter Three will put California offset production in context by examining general offset utilization trends and the behavior of four specific

[1] CARB, "Compliance Offset Program"

firms participating in the market. Finally, the Conclusion will offer recommendations for policymakers and firms engaged in carbon offsetting and close with a wider argument about the relationship between offset use and climate leadership.

Offset Fundamentals

Carbon offsets are purchased in two types of markets: voluntary markets and compliance markets. Within these two types of markets, different offset suppliers provide many different types of offsets of varying levels of quality. Overall, voluntary and compliance markets that publish their offset production have produced more than three billion known carbon offsets, a lower bound on the total number of offsets produced globally.[2] California's compliance offset market, given its transparency, recent establishment, and offset production, provides an ideal opportunity to study offset policy today.

The Voluntary Market

Voluntary markets are created by individuals and firms whose emissions are not regulated, but who want to voluntarily neutralize their emissions to meet personal or organizational emissions reduction goals. Often, voluntary carbon offsetting is a central component of achieving net-zero carbon emissions, also known as "carbon neutrality."

[2] Joint Implementation has produced 871 million (JI, "JI ERU Issuance."), the Clean Development Mechanism 1.96 billion ("CDM: CDM-Home."), the California Compliance Market 145 million (CARB, "Compliance Offset Program"), and the Chicago Climate Exchange 84 million ("CORE: Chicago Climate Exchange.").

In 2016, the total estimated volume of voluntary offset transactions topped one billion tCO_2e, but it is nearly impossible to determine the exact quantity produced since the voluntary market operates worldwide and is highly decentralized.[3] Numerous organizations called "standard bodies" generate voluntary offsets according to their own rules and promise to provide offsets that represent legitimate, real emissions reductions.

Over time, voluntary buyers have consolidated their trust in a handful of well-regarded standard bodies that now dominate voluntary market transactions. In 2016, the leading standards included the Verified Carbon Standard (58% of total transactions), the Gold Standard (17%), Climate Action Reserve (8%), ISO-14064 (4%), and American Carbon Registry (3%). Among these leaders, average offset prices vary from $0.4 per tCO_2e (ISO-14064) to $4.6 per tCO_2e (Gold Standard).[4] In the market at large, prices range even further, from one cent per tCO_2e, up to $70 or more.[5] This range reflects the subjectivity of the voluntary market. Buyers do not treat every ton of CO_2e as equal—they care about how offsets are generated, where they are generated, who generates them, and what co-benefits are attached. One buyer for example, might consider reforestation more important because they went camping as a child, increasing their willingness-to-pay relative to another buyer who grew up in a city.

Buyer preferences have not only produced a wide range of prices, but have also spawned offset protocols in nearly every possible emissions-reduction category: renewable energy, forestry, land-use, methane, efficiency, household devices,

[3] Hamrick and Gallant, "Unlocking Potential: State of the Voluntary Carbon Markets 2017."
[4] Hamrick and Gallant, "Unlocking Potential: State of the Voluntary Carbon Markets 2017."
[5] Hamrick and Gallant, "Voluntary Carbon Markets Insights: 2018 Outlook and First-Quarter Trends."

transportation, gas destruction, and countless other niche categories.[6] Like markets for soft drinks, offset protocols have been developed to suit every taste to attract more buyers to the market.

The Compliance Market

Compliance markets are created by cap-and-trade (CAT) systems, a type of government regulation that puts a limit or "cap" on the total quantity of CO_2e that all covered firms can emit. A government will then issue or auction emissions permits called "allowances" that add to that limit and require that firms periodically surrender allowances equal to their individual emissions. Over time, the cap on emissions decreases, and firms that can most easily reduce their emissions have an opportunity to mitigate more than is necessary, creating surplus allowances that they can sell to firms that have a harder time reducing their emissions. In theory, CAT systems thereby incentivize the easiest, cheapest emissions reductions first, minimizing the overall cost of regulatory compliance.

Offset policy prescribes specific methods for firms outside the regulatory regime of the CAT system to voluntarily reduce their emissions, generating offsets that may be bought, sold, or turned in within the CAT system equivalently to allowances. Since compliance firms consider all offsets equally capable of fulfilling their compliance

[6] Hamrick and Gallant, "Unlocking Potential: State of the Voluntary Carbon Markets 2017."
Lovell and Liverman, "Understanding Carbon Offset Technologies."

obligations, offset prices are therefore uniform within each compliance market regardless of how offsets are generated.[7]

Today, 10 CAT systems operate throughout the world, covering the European Union, Switzerland, Kazakhstan, South Korea, New Zealand, Quebec, parts of China, nine northeastern states in the United States, California, and Tokyo.[8] Each CAT system includes its own specific rules for compliance offsetting domestically and in many cases internationally, creating enormous demand for compliance offsets.

Most demand for offsets worldwide has been met by two international mechanisms implemented in 2005 via the Kyoto Protocol: Joint Implementation (JI) and the Clean Development Mechanism (CDM). Both use terms other than "offsets," but the concept is the same—JI establishes rules for developed countries to fund emissions reductions in other developed countries, earning emission reduction units (ERUs) that may be used to meet Kyoto emissions targets. Similarly, the CDM establishes rules for developed countries to fund emissions reductions in developing countries, earning saleable certified emission reduction (CER) credits. So far, JI and the CDM have produced more than 871 million[9] and 1.96 billion offsets, respectively.[10]

[7] The CA compliance market does separate offsets into three price categories based upon the risk associated with the offset's generation, but this multi-price system remains uniform compared to the voluntary market.
[8] "International Carbon Action Partnership (ICAP)."
[9] JI. "JI ERU Issuance."
[10] "CDM: CDM-Home."

The Need for Offset Policy Investigation

Multiple international, national, and sub-national offset protocols are in development and will look to existing offset policy for design inspiration and guidance. At the international level, the United Nations Framework Convention on Climate Change (UNFCCC) and United Nations' International Civil Aviation Organization (ICAO) are currently designing two offset programs that will have wide ramifications for global greenhouse gas mitigation. The UNFCCC's offset mechanism, initiated by Article 6.4 of the Paris Agreement, will replace the CDM and promote greenhouse gas mitigation and sustainable development between Parties to the Paris Agreement.[11] Standardized rules, modalities, and procedures that will allow Parties to generate carbon reduction credits for sale will be adopted at the 25th Conference of the Parties in 2019.[12] ICAO is currently setting up a voluntary Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which is expected to enter a Pilot Phase from 2021 to 2023.[13]

At the national level, United States Congresswoman Alexandria Ocasio-Cortez's "Green New Deal" has proposed that the United States commit to "net-zero carbon emissions" by 2030.[14] While the Green New Deal is only a proposal, the inclusion of

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[11] United Nations Framework Convention on Climate Change, "Paris Agreement."
[12] "COP24: Key Outcomes Agreed at the UN Climate Talks in Katowice."
[13] United Nations International Civil Aviation Organization, "Resolution A39-3: Consolidated Statement of Continuing ICAO Policies and Practices Related to Environmental Protection – Global Market-Based Measure (MBM) Scheme."
[14] Ocasio-Cortez, "Text - H.Res.109 - 116th Congress (2019-2020)."

such an expansive, near-term carbon neutrality goal indicates the potential for carbon offsetting in future U.S. climate change mitigation strategies.[15]

At the sub-national level, California's passage of AB 398 in 2017 committed it to adopting new offset protocols for its CAT system,[16] while Quebec continues to design additional protocols in the agriculture and land-use sector.[17] As these programs take shape, it is essential to learn from existing markets, particularly the extent to which current offset protocols ensure climate benefits. It is also necessary to study what drives regulated firms to purchase specific types of offsets to understand how the co-benefits created by different emissions mitigating activities contribute to environmental health.

The voluntary market is ill-suited to studying these questions; private transactions render it extremely non-transparent, and as an unregulated market, incentives to develop stringent offset protocols are less strong than in compliance markets. To protect buyers, 99% of voluntary offsets today are third-party verified, but the stringency of the protocols against which offsets are verified varies. The defining principle of the voluntary market is *caveat emptor*—with so many standard bodies each developing their own rules for offset generation, fully understanding the quality of a standards' offsets is difficult and assessing the overall quality of offsets in the market is impossible. Even assessing the

[15] While the Green New Deal specifies a 100% renewable energy goal or the United States, continued emissions unrelated to energy production will require one or both of two methods for achieving net-zero carbon emissions: offsetting and carbon capture and storage. Of these two, carbon offsetting is likely to be the primary component of current carbon neutrality goals. Carbon capture and storage may be technologically feasible, but it remains many times more expensive than offsetting and has never been deployed on a large scale, while several billion tCO_2e have been mitigated via carbon offsets worldwide.

[16] Garcia, Assembly Bill 398.

[17] Quebec Environment et Lutte contre les changements climatiques, "Offset Credits."

overall quantity of offsets sold in the voluntary market is difficult since many transactions are private.[18]

The CDM and JI, which to date have supplied more offsets for sale than any other program, are also ill suited for study in this thesis. A wide body of research addresses the strengths and weaknesses of both offset programs, and their enormous scope and many protocols complicate comprehensive study.

This thesis will focus on the California Compliance Market (CCM), a relatively new and understudied compliance offset market. California's CAT system, what The New York times called a "Grand Experiment to Rein in Climate Change," took effect in 2013 and was designed to learn from and improve upon offsetting in the voluntary market and CDM.[19] After the CDM and JI, the CCM is the largest compliance offset market in the world, and includes six offset protocols that each focus on a major category of unregulated emissions: Ozone Depleting Substances (adopted 2011), Livestock (2011), US Forest (2011), Urban Forest (2011), Mine Methane (2014), and Rice Cultivation (2015). Of these six protocols, only four have produced offsets (Figure 1), but those four have produced more than 145 million.[20] All of California's protocols are publicly viewable online alongside market data that describes how many of each type of offset has been produced, which firms have surrendered offset to the Californian government, and

[18] The leading voluntary market resource, "The State of the Voluntary Offset Market" released annually by Ecosystems Marketplace, relies upon voluntary information disclosure gathered from offset sellers via survey.

[19] Barringer, "In California, a Grand Experiment to Rein in Climate Change - The New York Times."

[20] The exact value is 145,994,499 offsets. This total includes early action offsets and was taken from CARB's offset registry March 8, 2019. See CARB "Compliance Offset Program."

how many of each type of offset firms have surrendered. As the most recent effort to establish a compliance offset market, California's offset protocols represent the cutting edge of offset policy, and the UNFCCC and ICAO will look to California as an example for how to design international offset policies. The combination of the CCM's size, transparency, and importance as a model for future markets make it an ideal, essential study of whether offset protocols can deliver their intended benefits.

Protocol	Ozone Depleting Substances	Livestock Manure Management	U.S. Forest	Urban Forest	Mine Methane Capture	Rice Cultivation	**Total**
Compliance Offsets Issued	18,913,976	5,6078,361	115,610,154	0	5,863,008	0	145,994,499

Figure 1

Chapter 1: Benefits and Criticisms of Offsetting

Across voluntary and compliance markets, offset protocols must produce offsets that truly compensate for emissions or else they compromise the integrity of their associated CAT systems or voluntary emissions reduction goals. Over time, the fundamental criteria for high-quality offsets have settled into six terms recognized across most markets: real, permanent, quantifiable, verifiable, enforceable, and additional.[21] When offset protocols uphold these criteria, offsets can provide a wide variety of benefits. In practice, however, it is difficult for offset policy to guarantee these six criteria, so offsets in the real world do not always yield their intended benefits. This chapter will describe the intended benefits of offsets and criticisms of offset policy's ability to uphold the six offset criteria. It will also describe unintended negative consequences that can occur as a result of offsetting even if protocols uphold the six criteria.

[21] Many markets use this exact language, e.g. RGGI ("Offset Requirements | RGGI, Inc.") and the California Compliance Market (Health and Safety Code §38562(d)(1) and (2)). There is some slight variation, for example the CDM, which only uses the terms "real, measurable, verifiable and additional," but all approach the same meaning (United Nation Framework Convention on Climate Change, "The Kyoto Protocol Mechanisms.").

Benefits of Carbon Offsetting

Lower the Cost of Compliance Inside CAT Systems

CAT systems include offset policy as a cost-containment mechanism. Since potential emissions reductions outside the coverage of a CAT system are typically cheaper than those within it, offset policy creates access to cheaper, lower-hanging sources of reductions for regulated firms, reducing their compliance costs. Lower compliance costs increase the economic efficiency of emissions regulation and can create an opportunity to increase emissions mitigation ambition within the CAT system, accelerating the transition to a low-emissions economy.

Accelerate Sustainable Development Among Unregulated Firms

Many offset protocols are designed to generate emissions reductions while also establishing new best-practices that create financial and environmental co-benefits outside the CAT system among unregulated firms. In the agricultural sector, this can include more efficient use of manure and nitrogen fertilizer, reducing methane and nitrous oxide emissions while improving air and water quality and decreasing agricultural input costs. Offset protocols can also incentivize landowners to improve their management of forestland or reduce the conversion of grassland, forestland, and wetland to farmland, fortifying local ecosystems while providing ecosystem services. In the industrial sector, multiple offset protocols incentivize the destruction of gasses that, in addition to contributing to climate change, damage the ozone layer and enable harmful UV rays to reach the earth’s surface.

Offset protocols can also steer streams of capital into sustainable infrastructure development, including renewable energy generation, improved water pumping efficiency, and increased rapid transit efficiency.[22] The ability of offset policy to "contribute to the mitigation of greenhouse gas emissions and support sustainable development" was a primary motivator for the international offset mechanism established by Article 6.4 of the Paris Agreement.[23]

Positive Public Relations

The opportunity to buy offsets can enable firms to demonstrate corporate social responsibility and environmental values. By funding offset projects that support community health and sustainability, firms can improve their relationships with local community stakeholders and cast themselves in a positive light for the public. Carbon "neutrality"—that is, offsetting all of a company's emissions—is a growing trend among businesses worldwide. Many dominant businesses have already claimed carbon neutrality, including Google since 2007,[24] Microsoft since 2012,[25] Marks & Spencer since 2012,[26] and many others. Still more business leaders (e.g. Siemens and REI) have committed to carbon neutrality in the future in an effort to communicate their sustainable values.[27]

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[22] UNFCCC, "CDM: Approved Baseline and Monitoring Methodologies for Large Scale CDM Project Activities."
[23] UNFCCC, "Paris Agreement"
[24] Dreyfuss, "How Google Keeps Its Power-Hungry Operations Carbon Neutral."
[25] Microsoft, "Commitment to Carbon Neutral – Microsoft Environment."
[26] Marks and Spencer, "On the Road to Carbon Reduction."
[27] Siemens, "Siemens Is Going Carbon Neutral by 2030." and https://www.rei.com/stewardship/core-practices

Criticisms of Carbon Offsetting

Despite the potential benefits of offsetting, the six fundamental criteria for high quality offsets—additional, permanent, enforceable, real, quantifiable, and verifiable—can be impossible to guarantee. Even if offsets do meet all six criteria, they can cause unintended negative consequences for the climate and human populations. The following sections will describe the six offset criteria, criticisms of offset policy's ability to guarantee them, and potential unintended consequences of offsetting.

Additionality

Description

For offsets to compensate for atmospheric emissions, they must be additional—that is, they must represent action above and beyond what would have happened in the absence of an offset program. Determining what would have happened without an offset program in a business-as-usual (BAU) scenario is the central question of additionality.[28]

Offset protocols include various "tests" for additionality that attempt to model the BAU scenario. Standard bodies including the Clean Development Mechanism (CDM),[29] American Carbon Registry (ACR), [30] Climate Action Reserve (CAR),[31] and California Air Resources Board (CARB)[32] each utilize the same basic combination of tests (Figure

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[28] Bennett, "Additionality."
[29] United Nation Framework Convention on Climate Change, "Tool for the demonstration and assessment of additionality Version 07.0.0"
[30] American Carbon Registry, "Hybrid Additionality Approach."
[31] Climate Action Reserve, "Criteria for Protocol Development : Climate Action Reserve."
[32] CARB, "California Air Resources Board's Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap-and-Trade Regulation"

1), although which tests are used and the scale at which they are applied differs. The CDM assesses projects individually, while CAR reduces transaction costs by using the same standard additionality criteria for all projects. CARB and ACR both utilize hybrid approaches based upon a desire to reduce transaction costs while accounting for project site-specific characteristics and anomalies. Thoroughly running these tests is time consuming and expensive, creating a trade-off between regulatory stringency and project financial feasibility.[33]

Test	Description	If Yes	If No
Financial Feasibility	Does the project need offset revenue to be financially viable?	Pass	Fail
Regulatory Compliance	Does the project go above and beyond practices that are legally required?	Pass	Fail
Common Practice	Is the project the first-of-its-kind or a significant departure from common practice?	Pass	Fail
Other Barriers	Are there other social, environmental, or political barriers that prevent the project from occurring?	Pass	Fail

Figure 1.1

Criticism

Many argue that regardless of additionality tests, a business-as-usual scenario is impossible to know or prove.[34] Professor Robert Stavins, Director of Environmental Economics at Harvard University, commented to the Washington Post, “That’s

[33] Meyers, “Additionality of Emissions Reductions from Clean Development Mechanism Projects.”
[34] Murray, Sohngen, and Ross, “Economic Consequences of Consideration of Permanence, Leakage and Additionality for Soil Carbon Sequestration Projects.”

essentially unobserved, and fundamentally unobservable, I mean, who knows what you would have done?"[35]

Additionality scandals that have taken place in spite of additionality tests have also shown that tests are not always foolproof. One such scandal took place from 2009 to 2013 and involved offsets generated through the CDM for destroying the gas HFC-23. HFC-23 is produced as a byproduct of manufacturing the refrigerant HFC-22, which takes place primarily in India and China. Although HFC-23 is only produced in small quantities, it is an extremely potent GHG—11,700 times more potent than CO_2—so destroying even small quantities can yield tremendous value in CO_2e offsets.[36]

From 2009 to 2011, the average price of CDM offsets was near $20, about 70 times the true cost of destroying HFC-23. Chinese and Indian chemical manufacturers, recognizing a new opportunity for revenue generation, increased HFC-22 production specifically to produce and destroy HFC-23 and cash-in on offsets. In all, nearly 500 million HFC-23 credits were issued, inundating the CDM market with non-additional offsets that permitted increased emissions without compensating for them. By 2013, 362 million offsets had been issued to Chinese HFC-23 projects alone. Much of that revenue drained into government coffers; a 65% tax on CDM revenue enabled the Chinese government collected an estimated 1.98 billion USD by 2013.[37]

A temporary HFC-23 offset ban took effect in 2010 following initial indicators that the CDM's HFC-23 protocol was creating perverse incentives to expand gas

[35] Quoted from Fahrenthold, "Caps, Trades and Offsets."
[36] IPCC, 2013
[37] Wara and Victor, "A realistic policy on international carbon offsets"

production. It took until 2013, however, to formally ban all offsets generated by HFC-23 destruction, enabling more non-additional offsets to infiltrate the CDM's market. In total, more than $5 billion went to refrigerant manufacturers, the Chinese government, and offset brokers for HFC-23 projects, while the actual cost of HFC-23 abatement has been estimated at less than $114 million.[38]

The 2013 ban not only validated doubts in the ability of offset policy to guarantee additionality, but it also set off a secondary scandal. In the month following the HFC-23 offset ban, some Chinese and Indian chemical manufacturers demanded that HFC-23 payments continue, or else they would release all HFC-23 into the atmosphere. In the words of Mark Roberts, International Policy Advisor for the Environmental Investigation Agency, "Chinese and Indian companies are holding the world hostage by threatening to set off a climate bomb if they don't receive millions of dollars for the destruction of the HFC-23 that they are producing."[39]

Western offset buyers, primarily in Europe, were already deeply upset that they had been paying for non-additional emissions and putting their dollars into the Chinese government's pocket. This reaction from gas manufacturers was salt in an open wound, and today, the HFC-23 scandal is remembered as a prime example of what can go wrong when offsets are non-additional.

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[38] Wara and Victor, "A realistic policy on international carbon offsets"
[39] "Explosion of HFC-23 Super Greenhouse Gases Is Expected."

Permanence

Description

For carbon offsets to compensate for regulated firms' emissions, they must also be permanent—that is, they must represent emissions reductions that can never be released back into the atmosphere. If offsets are generated by impermanent emissions reductions, they permit regulated firms to release GHGs without counterbalancing them, undermining the central mission of a CAT system and of voluntary emissions reduction goals.

Certain types of offset protocols incentivize emissions reductions that are inherently permanent. Avoided consumption of a product that will create GHGs, for example, will permanently reduce emissions since it is impossible to travel back in time and opt to consume more of the product. Avoided fuel consumption and avoided fertilizer application, which create offsets in the voluntary market, fit into this category since both products produce GHGs when consumed.

Protocols that alter the irrigation regimes of rice cultivation represent a second category of permanent offset, since they involve changing the natural product of decomposing organic matter from methane to carbon dioxide. Protocols that involve destroying GHGs comprise a third category of permanent offset. Livestock manure and coal mine protocols focus on destroying methane by burning it, which releases CO_2, a less potent GHG. Similar protocols incinerate or otherwise transform potent ozone depleting substances (ODS) into less potent forms. Offset protocols like these cannot reduce emissions to zero, since combustion releases some CO_2, but they reduce the overall global warming potential of emissions, and their combusted products can never spontaneously revert to their pre-combusted forms, rendering their emissions reductions permanent.[40]

Protocols that rely upon carbon sequestration, however, include an inherent risk of impermanence. Protocols that involve planting or managing forestland fall into this category, since projects earn offsets up-front for storing carbon in biomass that may not exist forever. Other sequestration-reliant protocols focus on maintaining or creating carbon stocks in agricultural soils and grassland soils through improved tillage practices or preventing the conversion of grassland to cropland.[41]

Sequestration protocols are vulnerable to two types of carbon releases, or "reversals." The first is natural, relatively unpredictable, and uncontrollable: if a forest burns, experiences a pest outbreak, severe weather event, or is struck by blight, the carbon contained in the forest's biomass can be released back into the atmosphere. Grassland offsets are considered less vulnerable to fire, since soil carbon remains if grass burns away,[42] but disease and a wide variety of climate-related factors can affect soil decomposition, threatening permanence.[43] The second type of reversal is intentional and includes cutting down forestland, ceasing forest management, returning from no-till to conventional tillage, and converting grassland to cropland.

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[40] CARB, "Compliance Offset Program"
[41] Murray, Sohngen, and Ross, "Economic Consequences of Consideration of Permanence, Leakage and Additionality for Soil Carbon Sequestration Projects."
[42] Climate Action Reserve, "Grassland Project Protocol."
[43] Davidson and Janssens, "Temperature Sensitivity of Soil Carbon Decomposition and Feedbacks to Climate Change."

All standard bodies include features in their sequestration protocols that are designed to minimize reversal risk. Many standard bodies withhold a certain percentage of each project's offsets in a buffer pool, which acts as an insurance mechanism. Should a reversal ever cause a project's offsets to be invalidated, an equivalent quantity of offsets within the buffer pool are nullified to compensate for the illegitimate offsets at large in the market. By reducing the number of offsets in circulation, buffer pools build an implicit safety premium into offset price.

In addition to buffer pools, standard bodies also set contractually-required minimum project lengths to ensure that sequestration continues over time. CAR and CARB have set the longest mandatory project lengths, requiring that sequestration continues for 100 years beyond the date of the last offset awarded to a project. If an offset is awarded 99 years after the project start date, for example, that means that the project's carbon must remain stored until 199 years after the project's start date.[44] Other standard bodies offer a range of contract periods: Verra stipulates 20-100 years, while ACR requires a minimum of 40 years with an opt-out option if project owners replace their offsets.[45]

To boost the economic appeal of forest protocols, some standards include provisions for timber harvest from sequestration projects, which affects permanence calculations. Verra, for example, allows a project's trees to be cut down, but weights the project's offsets by the expected life of the wood products crafted from the timber. The

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[44] American Carbon Registry, "Methodology for the Quantification"
CARB, "US Forest Project Compliance Offset Protocol"
[45] Verra, "VCS Standard v3.7."

carbon storage of short-lived products (decaying within three years) are totally subtracted from a project's offsets, medium-lived products (3-100 years) register a 1/20th decrease in carbon storage for 20 years, and long-lived products (greater than 100 years) face no discount or decrease in their carbon storing value.[46] ACR utilizes a similar approach in its Afforestation and Reforestation of Degraded Lands protocol, which "calculates the proportion of wood products that have not been emitted to the atmosphere 100 years after harvest and assumes that this proportion is permanently sequestered."[47]

Criticism

Buffer pools and minimum project lengths have both been subject to severe criticism. The central challenge of buffer pools is that they must be large enough to cover potential reversals without withholding so many offsets from each project that projects become financially infeasible or unattractive.[48] The standard bodies Verra, the Climate Action Reserve (CAR), and American Carbon Registry (ACR) manage this tradeoff by mandating project-specific risk assessments that determine what percentage of a project's offsets must be withheld.[49] As some have pointed out, however, the "potential for large-scale reversals to undermine such a risk-management system is troubling."[50]

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[46] Verra, "Approved VCS Methodology VM0003 v1.2: Methodology for Improved Forest Management Through Extension of Rotation Age."
[47] American Carbon Registry, "Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals From Afforestation and Reforestation of Degraded Land Version 1.2."
[48] Galik et al., "Alternative Approaches for Addressing Non-Permanence in Carbon Projects."
[49] Verra, "Approved VCS Methodology VM0003"
American Carbon Registry, "Methodology for the Quantification"
Climate Action Reserve, "Rice Cultivation Project Protocol"
[50] Murray and Kasibhatla, "Equating Permanence of Emission Reductions and Carbon Sequestration."
Galik and Jackson, "Risks to Forest Carbon Offset Projects in a Changing Climate."

Minimum project lengths are problematic because they equate a finite period of sequestration, often 100 years, with permanent sequestration. This convention is usually explained by referencing the Intergovernmental Panel on Climate Change's use of a 100-year horizon to calculate the Global Warming Potential (GWP) of different GHGs.[51] Such references implicitly accept that a 100-year span was chosen arbitrarily because it is a round number at the far limits of a feasible and realistic policy horizon, not because it reflects the residence time of CO_2 in the atmosphere. Emissions of CO_2 into the atmosphere do not disappear after 100 years; 25-40% of a pulse of CO_2 will remain in the atmosphere for thousands of years, and 10-20% will persist for tens of thousands of years.[52] It follows that in order for a carbon sink to completely offset a pulse of CO_2, it must continue to sequester CO_2 for tens of thousands of years, orders of magnitude longer than the minimum project lengths mandated by offset protocols today.[53]

When a carbon sink releases sequestered carbon, it will ultimately yield the same increase in global temperature as if it had not been sequestered—the only effect it may yield is a delay in warming. Some members of the scientific community argue that the delay in warming created by temporary storage still warrants carbon crediting. They cite reasons like "buying time" for technological advancement, learning, and capital turnover,[54] smoothing out emissions peaks to limit maximum impacts,[55] and the hope that

[51] A convention that has, itself, been challenged repeatedly. Keith P. Shine, one of the lead authors of the IPCC's first assessment report, called the use of the GWP_{100} an "inadvertent consensus" in his 2009 article "The Global Warming Potential—the Need for an Interdisciplinary Retrial."

[52] Archer and Brovkin, "The Millennial Atmospheric Lifetime of Anthropogenic CO2." found through Shoemaker and Schrag, "The Danger of Overvaluing Methane's Influence on Future Climate Change."

[53] Murray and Kasibhatla, "Equating Permanence of Emission Reductions and Carbon Sequestration."

[54] Marland, Fruit, and Sedjo, "Accounting for Sequestered Carbon."

[55] Dornburg and Marland, "Temporary Storage of Carbon in the Biosphere Does Have Value for Climate Change Mitigation: A Response to the Paper by Miko Kirschbaum."

"some temporary sequestration may turn out to be permanent."[56] These arguments may well be true, but none of them go as far as to say that temporary sequestration is *equally* valuable as permanent emissions reduction. Dornburg and Marland (2007), who vehemently argue that "even sinks that are known to be temporary have value," accept that "permanent sinks are obviously preferable to temporary sinks."[57] Consequently, offsets generated by carbon sequestration should not be viewed as equivalent to permanent offsets in the policy community or the marketplace—their price and importance in emissions mitigation strategies should reflect their actual value, which is less than a legitimate, permanent offset.

Just how valuable is the delay created by temporary sequestration? That ultimately depends on unknowable factors including the future rate of technological innovation and level of ambition to cut business-as-usual emissions during the time "purchased" with temporary sequestration. One way to begin assessing the value of delay, however, is to ask how much delay can be achieved with an ambitious rate of sequestration. High estimates of the global capacity of forests to sequester carbon are about 4 billion tCO_2e per year,[58] while global CO_2 emissions are about 32.5 billion tCO_2 per year.[59] If sequestration were to continue at that same rate for 100 years, 400 billion tCO_2 would be sequestered. Even assuming that the rate of global CO_2 emissions stays

[56] Chomitz, "Evaluating Carbon Offsets from Forestry and Energy Projects."
[57] Dornburg and Marland, "Temporary Storage of Carbon in the Biosphere Does Have Value for Climate Change Mitigation: A Response to the Paper by Miko Kirschbaum."

[58] Coren, Streck, and Madeira, "Estimated Supply of RED Credits 2011–2035."
Cannell, "Carbon Sequestration and Biomass Energy Offset."
[59] "Global Energy & CO2 Status Report."

the same and that 50% of those emissions are instantaneously absorbed by the ocean and biosphere,[60] atmospheric CO_2 concentrations would only be delayed by 25 years.[61]

Even if these emissions assumptions hold true in the next 100 years, 4 billion tons of sequestered carbon per year dwarfs the rate forest offset issuance in the real world, suggesting that temporary carbon sequestration already achieved via offsetting has created very little delay in rising CO_2 concentrations and, therefore, on global average temperature rise. Ecosystems Marketplace estimates that between 2005-2018, global forest and land-use offsets issued in the voluntary market (including the CDM) totaled 95.3 million tCO_2e.[62] The California Compliance market adds about another 115 million more offsets to total global sequestration-based offset generation.[63] Even if every single one of those offsets remains sequestered for 100 years, 210.3 million tons across 20 years is infinitesimal compared to 4 billion tons per year for 100 years. The total value of delay that sequestration-based offsets have therefore produced in global temperature rise is minute, reinforcing the conclusion that short-term carbon sequestration in temporary sinks ‘‘achieves effectively no climate-change mitigation.’’[64]

Arguments for valuing delay and for enforcing sequestration for 100 years or longer also introduce the extraordinary administrative challenge of holding firms liable

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[60] This value comes from an approximation in the National Oceanic and Atmospheric Administration’s article, “Ocean-Atmosphere CO2 Exchange.”

[61] These assumptions deliberately underestimate global emissions in the next 100 years to show that even at an emissions rate that is lower-than-expected, the delay that forest sequestration can create in rising CO_2 concentrations is small. The delay in global average temperature rise is therefore also expected to be small. Determining the precise delay in global average temperature rise if all 400 billion tCO_2 were released after 100 years is outside the scope of this thesis but warrants further research.

[62] Hamrick and Gallant, “Voluntary Carbon Markets Insights: 2018 Outlook and First-Quarter Trends.”

[63] CARB, “Compliance Offset Program.”

[64] Kirschbaum, “Temporary Carbon Sequestration Cannot Prevent Climate Change.”

for carbon reversals decades or centuries after they generated or purchased offsets—a problem of enforceability.[65]

Enforceability

Description

An offset is enforceable if the emissions reductions that created it are "supported by legal instruments that define their creation, provide for transparency, and ensure exclusive ownership."[66] In practice, this means that offsets are backed up by a legally enforceable contract between seller and buyer to ensure that offsets meet agreed-upon criteria. One of the most challenging criteria, as described earlier, is permanence. Since permanent sequestration requires many decades of continuous activity under current protocols, offset contracts include legal penalties for carbon release that must remain enforceable for the duration of a project. In California's US Forest Protocol for example, project owners who discontinue sequestration activities less than 100 years after their last offset is issued are contractually obligated to either replace the offsets that their project generated or face legal consequences.[67]

As Palmer et al. (2009) point out, current compliance offset markets (e.g. California) also create a private sector incentive to purchase enforceable emissions reductions by assigning liability to replace invalidated offsets to the offset buyer. Since

[65] Sedjo and Marland, "Inter-Trading Permanent Emissions Credits and Rented Temporary Carbon Emissions Offsets: Some Issues and Alternatives:"
[66] Gero, "The Role of Carbon Offsets in Cap-and-Trade."
[67] CARB, "Compliance Offset Protocol U.S. Forest Projects."

the "buyer risks the loss of his investment if the seller decides to switch land use," it is in buyers' best interest to seek out offsets that will be enforced. Of course, Palmer et al. (2009) fail to mention that once a buyer does purchase offsets, the effect reverses—both buyer and seller will be incentivized to ignore enforcement issues to avoid losing their investment.

Criticism

Enforceability relies upon government and judicial institutions' capability to enforce contracts. Today, that capability varies between countries, complicating international offsetting. Weak contract enforcement in many developing countries is an accepted reality in international offsetting; the potential for opportunistic offset producers to breach contracts whenever an "attractive outside option arises" is a constant risk that disincentivizes investments in carbon offset projects.[68]

Within countries where government and judicial institutions enforce contracts today, the long timescales demanded by permanent sequestration still make enforceability uncertain. Since true permanence requires virtually eternal sequestration, enforceability requires that contracts remain binding far beyond the horizon of political certainty. To argue that enforcement is possible hundreds of years from today, one must assume that government and judicial institutions honor and enforce contracts signed today and that third-party verifiers are still paid to periodically inspect projects to determine whether project activities continue. There is no way to be sure that a government will enforce

[68] MacKenzie, Ohndorf, and Palmer, "Enforcement-Proof Contracts with Moral Hazard in Precaution."

sequestration contracts long enough to render sequestration offsets permanent, and at the multi-century scale, third-party verification may become financially impossible; the capability of any terrain to sequester carbon is limited, so the offset-related value of sequestration is also limited. As third-party verification continues over centuries, the cost will eventually overcome offset revenue and make verification financially impossible. Once there is no way to pay verifiers, there is no way to check in on projects to ensure that sequestration activities continue.

As protocols currently stand, the political decision to equate 100-year sequestration with permanent sequestration implicitly concedes that 100 years is the furthest realistic horizon of reliable enforcement. This does help to create certainty in enforcement. Given a finite time horizon, contract structures like those suggested by MacKenzie et al. (2012) in which sellers receive a payment upon delivery of a permanent offset also become possible. Enforcing a non-permanent offset, however, is no better than failing to enforce a permanent offset, since neither yield the climate benefits they were intended to create. This illuminates the tradeoff between permanence and enforcement inherent to sequestration projects. As a project's permanence increases, its enforceability decreases.

Reality, Quantifiability, and Verifiability

Description

The criteria "real," "quantifiable," and "verifiable" are closely tied together. A project is real if it took place and was carried out according to the standards and activities of an offset protocol, it is quantifiable if its emissions reductions can be precisely calculated, and it is verifiable if a third party (a "verifier") can check to make sure that activities occurred and were properly quantified. Verifiability is the keystone criterion of these three; a project's claims of reality and quantifiability are meaningless unless an unbiased third-party verifier can validate them.

Quantifiability can consist of direct measurements of project emissions, which is possible for projects that destroy methane produced by anaerobic manure digestion, for example, or it can consist of modeling project emissions based upon project-specific data inputs. For most types of offsets (e.g. forest, rice paddy emissions, fertilizer efficiency, soil carbon sequestration), direct measurement is infeasible, so process-based biogeochemical models are utilized to predict baseline emissions and avoided emissions.[69]

Third party verifiers are independent organizations who are responsible for establishing "reasonable assurance" that a project meets offset protocol criteria.[70] They are trained according to the methodology of an offset protocol and conduct required investigations of each offset project. Verification typically has two parts: a desk review of submitted project materials and a project site-visit. The frequency of both types of review varies between protocols and between standard bodies. Verifiers are also required to sign a form stating that they have no conflicts of interest for each project they verify.

In compliance markets like the CDM and CCM, where a centralized body has jurisdiction over the market, various policy tools hold verifiers accountable and

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[69] CARB, "Compliance Offset Protocol Rice Cultivation Projects."
[70] CARB, "Technical Guidance for Offset Verifiers Verification of Offset Project Data Reports."

standardize verification. These include a centralized board performing its own final review of project documentation after verification but before offset issuance and in-depth audits by a centralized body of projects and project verification. As CARB states, "Audits associated with the offset verification program should not be viewed as adversarial; the purpose of auditing is for CARB to monitor and oversee functioning of the offset program and offset verification program, and to ensure quality, rigor, and consistency across verification bodies."[71]

Criticism

Quantifiability

Process-based, biogeochemical models can calculate emissions with great accuracy once calibrated and validated for a specific project, but the ways they account for uncertainty and the potential for omitted variables pose a risk to accurate offset crediting. The De-Nitrification De-Composition (DNDC) model, utilized in California's compliance Rice Protocol, exemplifies these risks. Two types of uncertainty determine the accuracy of DNDC-calculated emissions reductions. The first is "input uncertainty," which is determined by the accuracy of the data that offset project owners can collect and feed into the DNDC model. This type of uncertainty is very difficult to quantify since different projects utilize different data collection techniques and the quality standards for data collection may vary between projects. The second type of uncertainty is "structural uncertainty," an inherent component of "process-based models that remains even if all

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[71] CARB, "Technical Guidance for Offset Verifiers Verification of Offset Project Data Reports."

input data were error-free."[72] Across all agricultural protocols that utilize process-based, biogeochemical models like the DNDC, the level of uncertainty can at times exceed modeled emissions reductions, preventing offset crediting.

Protocols attempt to minimize over-crediting due to modeling uncertainties by deducting a quantity from each project's emissions reductions. Those deductions, however, vary by protocol and by offset registry. In California's compliance Rice Protocol, for example, standard input uncertainty and structural uncertainty deductions are applied to all rice projects, while in the voluntary market, rice protocols calculate custom deductions for each project.[73] These differences highlight that each California rice offset likely represents a different precise quantity of climate benefits than each voluntary rice offset, even when both are generated by identical activities and purport to represent one avoided tCO_2e.

The DNDC-rice model used in the California Rice Protocol also exemplifies the potential for process-based, biogeochemical models to omit important variables that affect emissions reductions calculations. While the DNDC model is very effective for calculating CH_4 emissions,[74] it can significantly underestimate the emissions of N_2O, a GHG 265 times more potent than CO_2 on a 100-year timescale.[75] As a result, the increase in N_2O emissions can overcome the decrease in CH_4 emissions caused by project

[72] CARB, "Compliance Offset Protocol Rice Cultivation Projects."
[73] American Carbon Registry, "Rice Management Systems."
Climate Action Reserve, "Rice Cultivation Project Protocol."
[74] Jagadeesh et al., "Field Validation of DNDC Model"
Katayanagi et al., "Validation of the DNDC-Rice Model"
[75] IPCC, 2013

activities, increasing net GHG emissions even as projects are credited with offsets.[76] Capturing GHG trade-offs like this is essential to accurate GHG accounting when offset protocols rely on emissions modeling.

Verification

Offset project verifiers are often subject to perverse incentives and conflicts of interest. Since an offset's buyer and seller both want projects to produce the largest number of offsets possible at the lowest cost possible, they are both incentivized to overestimate baseline emissions or otherwise inflate their offset calculations while demanding the cheapest verification possible. Offset verifiers, regardless of whether they are paid by an offset buyer or seller, face incentives to meet the desires of their employer and to approve projects and the offsets they create at low cost.[77] Even if verifiers are paid regardless of whether they approve a project and its offsets, the desire to sustain advantageous business relationships in a competitive market of verifiers puts pressure on verifiers to approve projects and cut costs.

Since the term "verifier" refers to many non-standardized, third-party groups, the standards and stringency of verification may also vary according to each verifier's concept of "reasonable assurance" of legitimate offset production. In CARB's words, verifiers must use their "professional judgment," a concept that may vary between verifiers within compliance and voluntary markets. In the voluntary market, few if any standard bodies have "specific procedures in place to review the approved auditors nor to

[76] Majumdar, "Methane and Nitrous Oxide Emission"
[77] Wara and Victor, "A realistic policy on international carbon offsets"

allow for sanctions against or the discrediting of an underperforming auditor."[78] Although verifiers in some compliance markets may be subject to auditing, the effectiveness of audits is determined by their frequency, for which there is no mandated minimum in the CDM or CCM.

Unintended Consequences

Even if offsets are additional, permanent, enforceable, real, quantifiable, and verifiable, offsetting can cause unintended negative consequences that raise serious questions about the value of offsetting. These include higher long-term global average temperatures from trading short-lived emissions for long-lived emissions, rebound effects, and displaced impacts caused by altering where emissions reductions occur.

Trading Short-Lived Emissions for Long-Lived Emissions

The emissions reductions that generate carbon offsets are converted to "CO_2-equivalent" so that multiple different greenhouse gasses can be traded equivalently. While this conversion allows carbon credit markets to operate smoothly, it does not acknowledge that trading GHGs with different residence times in the atmosphere can have profound environmental impacts.

Figure 1.2 shows the radiative forcing of a pulse of CO_2 compared to a pulse of CH_4 (methane) as natural processes remove both from the atmosphere. As the graphs indicate, methane's short-term effect on radiative forcing is much higher than CO_2's (note the different y-axis scales), but methane is removed from the atmosphere much

[78] Kollmuss, Zink, and Polycarp, "A Comparison of Carbon Offset Standards."

more quickly, so its ability to warm the atmosphere declines to zero after a few decades.[79] Many other short-lived climate pollutants (SLCPs) including black carbon, tropospheric ozone, and hydrofluorocarbons exhibit similar behavior. CO_2's peak radiative forcing may be lower, but CO_2 remains in the atmosphere for an extremely long time; as mentioned earlier, 25-40% of a pulse of CO_2 will remain in the atmosphere for thousands of years, and 10-20% will persist for tens of thousands of years.[80]

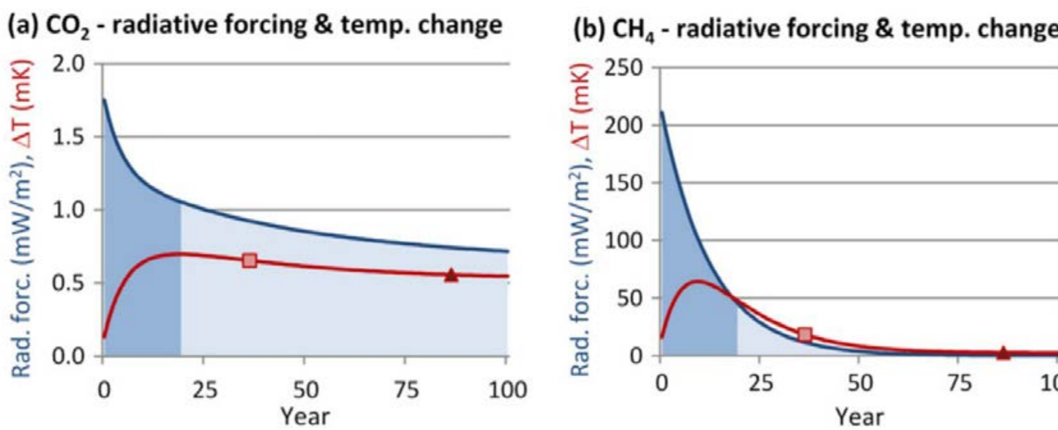

Figure 1.2

Emissions mitigation strategies that increase ambition to destroy SLCPs at the expense of ambition to decrease CO_2 therefore affect long term global warming trajectories. In the short term, peak temperatures can be avoided, but in the long term, temperatures are guaranteed to be higher (Figure 1.3).[81]

[79] Figure 1.2 from Persson et al., "Climate Metrics and the Carbon Footprint of Livestock Products."
[80] Archer and Brovkin, "The Millennial Atmospheric Lifetime of Anthropogenic CO2." found through Shoemaker and Schrag, "The Danger of Overvaluing Methane's Influence on Future Climate Change."
[81] Shoemaker et al., "What Role for Short-Lived Climate Pollutants in Mitigation Policy?"

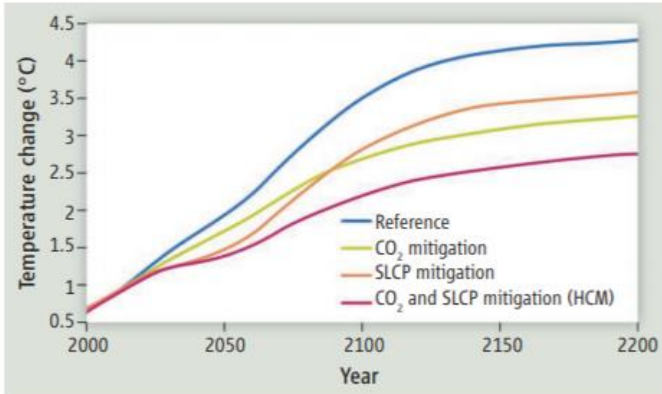

Figure 1.3

The red trajectory in Figure 1.3 indicates that SCLP mitigation is still an essential component of achieving the lowest possible warming trajectory, but as the yellow and orange trajectories show, reducing CO_2 emissions is ultimately necessary to minimize long-term temperature rise.

Carbon offsets protocols that compensate for regulated firms' CO_2 emissions by destroying methane (e.g. livestock manure management protocols and mine methane capture protocols) explicitly trade methane emissions for CO_2 emissions, creating short-term benefits at the expense of future generations, who will bear the cost of higher temperatures in perpetuity.

Offsets' ability to facilitate the trade of SLCPs like methane for CO_2 is, in some sense, evidence of offset policy's most celebrated benefit—lower compliance costs. Mitigating methane is cheaper than mitigating CO_2, so methane-generated offsets are cheap, available, and help firms lower their compliance costs, increasing overall economic efficiency. In this case, however, offsets' ability to seize low-hanging fruit also presents a case against offset generation. CO_2 mitigation—the only way to minimize long-term warming trajectories—requires technological innovation and invention, processes that only occur with the proper market incentives. Utilizing methane-derived offsets to decrease CAT compliance costs decreases financial incentives to develop technology that can cheaply reduce CO_2 emissions, ultimately delaying CO_2 emissions mitigation and locking in a higher long-term warming trajectory. As Shoemaker and Schrag (2013) show, for every 15 years of delayed action to decrease rising CO_2 concentrations, long term temperatures will rise by ¾ degrees Celsius.[82]

Rebound Effects

Rebound effects occur when a product or service designed to make an undesirable behavior less dangerous causes people to exhibit more of the behavior. Examples include drivers who become more reckless as car safety standards increase and individuals who consume more energy as appliances become more efficient. In the context of offsets, there is concern in the voluntary market that offsetting will decrease "green guilt" and provide buyers with the moral license to pollute more.[83]

It is unclear whether offsetting rebound effects exist on a large scale. Some studies have found evidence of modest rebound effects from offsetting, while others have not.[84] Nevertheless, concern that offsets will increase polluting behavior and reduce public will to make meaningful emissions reductions has affected the landscape of

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[82] Shoemaker and Schrag, "The Danger of Overvaluing Methane's Influence on Future Climate Change."
[83] Kotchen et al., "Do Voluntary Carbon Offsets Help Counteract Greenhouse Gases, or Are They Just a Way for Guilt-Ridden Consumers to Buy Their Way out of Bad Feelings?"
[84] Ibid.
Harding and Rapson, "Do Voluntary Carbon Offsets Induce Energy Rebound? A Conservationist's Dilemma."

voluntary offsetting. Responsible Travel, one of the first travel companies to provide customers with an opportunity to offset their emissions in 2002, cancelled their program after Managing Director Justin Francis noticed helicopter tours and other decadent emitters offering compensatory offsets. "The carbon offset has become this magic pill, a kind of get-out-of-jail-free card," Francis stated to the New York Times in 2009, "It's seductive to the consumer who says, 'It's $4 and I'm carbon-neutral, so I can fly all I want.'"[85]

Displaced impacts

Since CO_2 is a uniformly mixed pollutant in the atmosphere, CO_2 emissions reductions create the same global climate benefits wherever they occur. CO_2 (and CO_2-equivalent) emissions reductions, however, are tied to a wide variety of co-benefits and co-costs that impact their local environment. Since carbon offsetting facilitates the trade of carbon emissions reductions across space, it also shifts co-benefits and co-costs between areas, creating unanticipated negative consequences for populations that lose co-benefits and experience new co-costs.

The first type of population that can experience negative impacts from offsetting is the population immediately around offset buyers. These impacts arise because in many cases, emissions reductions from reduced fossil fuel use yield local co-benefits. Burning less coal, for example, will not only decrease CO_2 emissions, but will also decrease the quantity of harmful particulate matter in local air and reduce acid rain in the surrounding

[85] Rosenthal, "Paying More for Flights Eases Guilt, Not Emissions - The New York Times."

area. When fossil fuel users buy offsets, they don't have to mitigate as much of their operational emissions, and co-benefits that would have otherwise been enjoyed locally disappear, exchanged for co-benefits at the location where offsets are produced. Concerns that offsetting can therefore lead to emissions hot-spots around buyers and negatively impact communities covered by a CAT system have historically caused policymakers to limit the quantity of offsets that each firm can use, ensuring that most emissions reductions and co-benefits are achieved locally. In California, for example, regulated firms may only use offsets to meet 8% of their compliance obligations through 2020.[86]

A second type of co-cost created by offsetting occurs at the site of offset production when emissions reduction activities negatively impact local populations. The most striking examples of these impacts have occurred because of Reduced Emissions from Deforestation and Degradation (REDD) projects, which aim to financially compensate developing nations for the preservation or expansion of their forestland. REDD projects are primarily intended to prevent the release of forest carbon to generate offsets, but they are also purported to yield a host of co-benefits including reduced flooding, runoff, erosion, and river siltation, and preserved fisheries, investments in hydropower, biodiversity, cultures, and traditions.[87] The United Nations Food and Agriculture Organization has assisted over 80 countries across Africa, Asia Pacific and Latin America and the Caribbean in preparing and implementing REDD projects.[88]

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[86] CARB, "Climate Change Scoping Plan a Framework for Change."
[87] Stickler et al., "The Potential Ecological Costs and Cobenefits of REDD."
"What Is REDD+?"
[88] Food and Agriculture Organization of the United Nations, "REDD+ Reducing Emissions from Deforestation and Forest Degradation."

Forestlands throughout the world, however, are occupied by between 350 million and 1.2 billion people, whose ways of life and relationships with forestland are not always taken into account when REDD projects are established. Many indigenous global forest dwellers are economically poor, "live outside the reach of global financial and market structures," or lack recognition as citizens or lack a legal right to their lands.[89] These disadvantages reduce or preclude the ability of indigenous populations to participate in the development of REDD projects.[90] Pilot projects, notably the Noel Kempff National Park project launched in 1997 in Bolivia, have demonstrated that the top-down design and implementation of REDD projects can exclude indigenous populations while strengthening state and private sector control over forests. This power dynamic prevents indigenous populations from capturing the financial benefits of REDD projects even as they face restrictions on hunting, fishing, and cultivation practices or, at worst, as they are expelled from their traditional lands.[91] Numerous case studies and publications illuminate current and potential threats to indigenous peoples' rights, autonomy, and way of life caused by REDD projects.[92] Whether REDD will ultimately benefit or marginalize local communities will depend on the extent to which local populations can participate in the systems of rights, rules, and institutions that shape REDD projects throughout the world.

[89] Colchester, "Beyond Tenure: Rights-Based Approaches to Peoples and Forests Some Lessons from the Forest Peoples Programme."
[90] Schroeder, "Agency in International Climate Negotiations."
[91] Griffiths, "Seeing 'RED'? 'Avoided Deforestation' and the Rights of Indigenous Peoples and Local Communities."
[92] Lemaitre, "Indigenous Peoples' Land Rights and REDD."
Cotula and Mayers, *Tenure in REDD*.

Chapter 2: California Compliance Market Policy Analysis

California Compliance Market (CCM) Background

The CCM, established in 2013 by Assembly Bill 32 (AB 32), capped the emissions of all Californian firms that emit more than 25,000 tCO_2e per year—a list that includes more than 450 power plants, energy utilities, mining companies, product manufacturers, and universities. Together, these firms contribute approximately 85% of California's GHG emissions. In 2015, California's emissions cap expanded to also include emissions from fuel distribution.[93]

Offset protocols in the CCM must be adopted by the California Air Resources Board (CARB), the regulatory body that oversees the implementation of AB-32. To aid in the management of offsets and development of new offset protocols, CARB has approved three voluntary market standard bodies to act as Offset Project Registries (OPRs): the American Carbon Registry (ACR), Climate Action Reserve (CAR), and Verra (formerly the Verified Carbon Standard). Together, OPRs provide an initial bulwark of review and stringency to ensure that projects follow the protocols adopted by CARB and to ensure that only real, additional, quantifiable, permanent, verifiable, and enforceable emissions reductions are rewarded with offsets. Once OPRs generate offsets according to CARB's protocols, all offsets must pass a final review of documentation by CARB to become California Compliance Offsets. This symbiotic relationship is designed

[93] CARB, "Cap-and-Trade Regulation Instructional Guidance, CHAPTER 1: HOW DOES THE CAP-AND-TRADE PROGRAM WORK?"

to increase regulatory stringency and to create a testing ground in the voluntary market for new offset policy. So far, the six compliance protocols that CARB has adopted have produced varying numbers of offsets (Figure 2.1).[94]

Protocol	Ozone Depleting Substances	Livestock Manure Management	U.S. Forest	Urban Forest	Mine Methane Capture	Rice Cultivation
Compliance Offsets Issued	18,913,976	5,6078,361	115,610,154	0	5,863,008	0

Figure 2.1

Compliance Obligations and Offset Limits

Just as in other CAT systems, firms in the CCM must turn in allowances and offsets according to a government-set timetable. Through 2020, AB 32 divides that timetable into three multi-year Compliance Periods (Figure 2.2).[95]

Annual and Triennial Compliance Obligations			
First Compliance Period			
Covered Emissions Year	**Compliance Obligation Due Date**	**Percent of Compliance Obligation Due**	**Eligible Vintages of Allowances**
2013	November 1, 2014	30% of 2013 covered emissions	Vintage 2013 only
2014	November 1, 2015	70% of 2013 and 100% of 2014 covered emissions	Vintages 2013 and 2014, any combination
Second Compliance Period			
2015	November 1, 2016	30% of 2015 covered emissions	Vintages 2013-2015, any combination
2016	November 1, 2017	30% of 2016 covered emissions	Vintages 2013-2016, any combination
2017	November 1, 2018	70% of 2015 and 2016, and 100% of 2017 covered emissions	Vintages 2013-2017, any combination
Third Compliance Period			
2018	November 1, 2019	30% of 2018 covered emissions	Vintages 2013-2018, any combination
2019	November 1, 2020	30% of 2019 covered emissions	Vintages 2013- 2019, any combination
2020	November 1, 2021	70% of 2018 and 2019, and 100% of 2020 covered emissions	Vintages 2013-2020, any combination

For more details, see section 95856 of the Cap-and-Trade Regulation.

Figure 2.2

[94] Values include early action offsets and were taken from CARB's online offset registry March 8, 2019. See Carb, "Compliance Offset Program."
[95] CARB, "20130419 Guidance Document Chapter 3: What Does My Company Need to Do to Comply with the Cap-And-Trade Regulation?"

Firms can use offsets to meet up to 8% of their compliance obligations in each compliance period until 2020. This 8% limit has been contentious; While regulated firms would have preferred unlimited access to offsets—thereby seizing the maximum cost savings possible—CARB regulators determined in AB 32's 2008 Scoping Plan that "While some offsets provide benefits, allowing unlimited offsets would reduce the amount of reductions of greenhouse gas emissions occurring within the sectors covered by the cap-and-trade program. [The 8%] limit will help provide balance between the need to achieve meaningful emissions reductions from capped sources with the need to provide sources within capped sectors the opportunity for low-cost reduction opportunities that offsets can provide."[96] Limiting offset use to 8% per compliance period still allows a significant quantity of emissions to be offset—so far over 145 million have been generated and sold into the market.[97]

AB 398, which passed in 2017, extended California's CAT system to 2030 and established new limits on carbon offsetting post 2020. From 2021 to 2025, firms can utilize offset to meet 4% of their compliance obligations, and from 2025 to 2030, offset use can increase to 6%. In both periods, at least 50% of the offsets any firm turns in must come from projects with "direct environmental benefits" for the State of California, a nebulous term that has recently been accepted by CARB to mean that they were generated by offset projects located within California.[98] AB 398 also mandates that CARB develop new protocols for carbon offsetting in addition to those already adopted.

[96] CARB, "Climate Change Scoping Plan a Framework for Change."
[97] CARB, "Compliance Offset Program"
[98] Garcia, Assembly Bill 398.

The quantity of emissions that may be offset in the CCM and the push to develop new protocols are both motivators to closely review California's current protocols to maintain the integrity of California's cap on emissions. Ensuring that lessons from the CCM's offset protocols are illuminated and that offset policy continually improves is also essential to the integrity of future international emissions mitigation.

Additionality in California

Methods for ensuring additionality in California have generated controversy since their inception. CARB defines additional practices as those that are "beyond any reduction required through regulation or action that would have otherwise occurred in a conservative business-as-usual scenario."[99] Californian regulation defines the business-as-usual scenario as 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."[100]

This definition includes three types of additionality tests that appear in California's offset protocols.

1. A project is considered additional if it is only financially viable due to offset revenue

[99] CARB, "California Air Resources Board's Process for the Review and Approval of Compliance Offset Protocols in Support of the Cap-and-Trade Regulation."
[100] Title 17, California Code of Regulations, section 95802(a).

2. A project is considered additional if it goes above and beyond all current laws and regulation
3. A project is considered additional if it goes above and beyond economic and technological trends

A third-party verifier can observe the first two criteria since they are based in observable fact. As long as both are included in specific offset protocols, they can help ensure that a project is additional. The third test, however, includes a subjective assessment of whether current economic and technological trends render a practice commonplace and therefore non-additional, or better enough than average to qualify as additional. To prevent inconsistencies between projects, that judgement is built into protocols in the form of performance standards intended to "establish a threshold that is significantly better than average […] for a specified activity, which, if met or exceeded by a project developer, satisfies the criterion of 'additionality.'"[101]

On March 28, 2012, the Citizens Climate Lobby and Our Children's Earth Foundation filed a lawsuit against CARB over the subjectivity of its performance standards, provoking a case that has illuminated how difficult it is for Californian offset protocols to definitively prove additionality.

[101] CARB, "Proposed Regulation to Implement the California Cap-and-Trade Program PART IV STAFF REPORT AND COMPLIANCE OFFSET PROTOCOL LIVESTOCK MANURE (DIGESTER) PROJECTS."

Our Children's Earth Foundation v. California Air Resources Board

Our Children's Earth Foundation based the suit on a claim that the performance-standard-based approach to additionality used in all four then-approved protocols (Livestock Projects, Ozone Depleting Substances, Urban Forest Projects, and US. Forest Projects) was "flawed because offset activities which are merely 'significantly better than average' or beyond 'common practice' include, by definition, activities which already exist, are ongoing, and, therefore, do not produce greenhouse gas reductions or removals which [in accordance with California law,] are in addition to any greenhouse gas emission reduction that otherwise would occur."[102] The plaintiffs further argued that CARB's performance standards were so vulnerable to subjectivity that all four offset protocols were "arbitrary and capricious."[103]

CARB maintained that "[e]ach protocol provides clear criteria to support the generation of offsets that meet the AB 32 offset criteria," and that "There is no subjectivity left to verifiers to assess whether or not the project meets the AB 32 criteria."

The judge ruled in CARB's favor, upholding its carbon offset program on January 25, 2013, but Our Children's Earth Foundation appealed, continuing to "demand a perfect additionality determination that precisely delineates between additional and non-additional reductions […] for 'each, every, and all'" offset. Two years later in 2015, the

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[102] Hays and Costa, "First Amended Petition for Writ of Mandate and Complaint for Declaratory and Injunctive Relief; Verifications"

[103] Our Children's Earth Foundation v. California Air Resources Board, February 23 2015, case A138830

Court of Appeals also ruled in CARB's favor. Three aspects of the second ruling continue to frame CARB's approach to additionality:

(1) The court affirmed for posterity (regarding additionality), "the fact that it is virtually impossible to know what otherwise would have occurred in most cases. Whether a project would have been implemented without the offset incentive 'is hypothetical and counter-factual—it can never be proven with absolute certainty.'"[104]

(2) "Legislature delegated rule-making authority to the [Air Resources] Board to establish a **workable method** of ensuring additionality with respect to offset credits" (emphasis added).[105]

(3) The court affirmed that it "will not, 'in the guise of a challenge' to an agency's statutory authority, […] substitute [its] judgment for that of the agency with respect to such things as the existence and weight to be accorded the facts and policy considerations that support the regulation."[106]

Impact on Additionality

By formally acknowledging the impossibility of proving additionality while giving CARB the discretion to define a "workable method" for assessing additionality, this court decision perpetuated the possibility for non-additional offsets to enter the

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[104] Ibid.
[105] Ibid.
[106] Ibid.

CCM. CARB cannot guarantee additionality, yet the court will not challenge CARB's judgement of how stringent additionality tests must be. This means that if current protocols allow non-additional offsets to enter the CCM, CARB could assert that protocols nevertheless meet its definition of a "workable method" and are effective enough. At the same time, this court case renewed CARB's independent authority to continually fine-tune offset protocols, innovating to bring the probability of producing additional offsets ever-higher. Today's offset protocols represent the latest iteration of CARB's attempt to maximize the number of additional offsets in the CCM. As this chapter will argue, however, California's protocols can still improve.

California Compliance Offset Protocol Analysis

The remainder of this chapter will analyze the four California compliance offset protocols that have produced offsets to date: the US Forest Protocol, Livestock Protocol, Ozone Depleting Substances Protocol, and Mine Methane Capture Protocol.[107] It will focus specifically on permanence in the US Forest Protocol, California's only productive sequestration-based protocol, quantification in the ODS Protocol, and additionality in the Livestock and MMC Protocols. This chapter's purpose is to describe the risk of each protocol producing illegitimate offsets and to suggest policy changes that can mitigate that risk.

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[107] CARB, "Compliance Offset Protocol Ozone Depleting Substances Projects."
CARB, "Compliance Offset Protocol Mine Methane Capture Projects."
CARB, "Compliance Offset Protocol U.S. Forest Projects."
CARB, "Compliance Offset Protocol Livestock Projects."

U.S. Forest Protocol

Background

The US Forest Protocol provides requirements and methods for quantifying and reporting the "net climate benefits of activities that sequester carbon on forestland." Those activities can take three forms: (1) reforestation involving restoring tree cover on land that has minimal short-term commercial opportunities, (2) improved forest management involving implementing management techniques that increase carbon stocks relative to a baseline, and (3) avoided conversion, which prevents the conversion of forestland to a non-forest land-use by dedicating the land to continuous forest cover through a Qualified Conservation Easement. Projects may be credited with offsets for 25-year crediting periods that may be renewed indefinitely. All forest projects must continue to monitor, verify, and report offset project data for 100 years following the date that the last offset was issued to the project, after which forest land use may change and release carbon back to the atmosphere without penalty. The US Forest Protocol is by far the most productive offset protocol—it has produced more than 115 million California Compliance Offsets to date.[108]

California's US forest protocol, like many forest-related protocols, contains multiple features designed to ensure permanence: a buffer pool, which guards against unintentional reversals, a requirement to replace offsets if an intentional reversal occurs, and a minimum project length of 100 years beyond the issuance of a project's final offset.

[108] CARB, "Compliance Offset Program."

Forest Buffer Pool

According to the latest version of the protocol adopted in June 2015, forest project owners must each submit between 9 and 18% of their projects' offsets to CARB's buffer pool, depending on a project-specific "reversal risk rating."[109] Project owners calculate that risk rating by adding together the reversal risk in each of four categories defined by CARB (Figure 2.3, Appendix I). Each category's contribution to reversal risk is chosen from a multiple-choice box (e.g. Financial Risk, seen in Figure 2.4, Appendix I) containing between one and three risk values also calculated and provided by CARB.

Replacement Requirement

The replacement requirement describes the penalty for intentionally ending sequestration activities before the end of a project. If a project owner intentionally releases the carbon from their project, that project owner must send CARB a quantity of compliance instruments (either allowances or offsets) equal to the quantity of released carbon. If the project owner cannot afford to do so or chooses not to, the necessary number of offsets is retired from the forest buffer account and the project owner is considered in violation of the law.

Minimum Project Length

The US Forest Protocol states that, "For purposes of this protocol, 100 years is considered permanent." After a project's final offset is issued, project owners must

[109] Values calculated according to Appendix D of the Compliance Offset Protocol U.S. Forest Projects adopted by CARB June 25, 2015. (See CARB, "Compliance Offset Protocol U.S. Forest Projects.")

continue to keep carbon sequestered and must continue to undergo site visits by third-party verifiers every six years for a minimum of 100 years.

Permanence Analysis

Buffer Pool

The most immediate concern about any buffer pool is whether it is large enough to protect against all potential unintentional reversals. Although assessing the accuracy of the specific values CARB has calculated for different categories of risk rating is outside the scope of this thesis, the potential for low-probability, high-magnitude reversal events (e.g. catastrophic wildfires) poses a risk to any sequestration-based scheme.[110] It is also disconcerting to note that if a forest project is highly vulnerable to every risk type defined by CARB—that is, if its owner is on the brink of bankruptcy and if the project is highly susceptible to illegal logging, wildfire, disease, insect attack, flooding and severe winds all at once—the maximum quantity of offsets it must contribute to the buffer pool is only about 18%. For a hypothetical project that is almost sure to experience a significant reversal, that seems remarkably low; a hypothetically sure-to-reverse project ought to contribute 50% of its offsets to the buffer pool, ensuring that when a reversal occurs, the high-risk project does not reduce the buffer pool's ability to protect against other projects' potential reversals.

[110] Although recent catastrophic fires naturally prompt questions about how that contribution to risk, for example, ought to change address future changes in wildfire scale and frequency.

Defenders of the current Reversal Risk Rating system might rightly argue that it is unlikely for a single project to be vulnerable in every defined risk category. They might also point out that Contributions to Reversal Risk Rating are calculated according to average risk; they don't need to precisely describe the risk of any individual project; a risky project should be compensated for by a low-risk project. Pooled risk is, after all, the foundational concept behind a buffer pool.

This kind of assumption brings buffer pools into dangerous terrain. Calculating risk ratings based upon historical data describing reversals does not account for changing conditions over the course of the next century, which demand constantly reviewed and updated calculations of risk. In addition, only assigning a single Contribution to Reversal Risk Rating for each Project Specific Circumstance (as seen in Figure 2.4) offers no incentive to develop low-risk projects. Since projects that are high-risk in a given risk category and project specific circumstance contribute the same (or nearly the same) buffer contribution as low-risk projects, forest offsets at high-risk of unintentional reversal can enter the CCM as easily as those at low-risk, and it becomes impossible to track how many high-risk versus low-risk projects are generating offsets. This allows the ratio of high-risk offsets to low-risk offsets to change, unseen, over time, threatening the assumption that project risk will balance out. It also perpetuates the asymmetry of information between project developers and project buyers, who have no way of knowing how reversal-prone a specific offset may be.

Replacement Requirement

The risk that the Protocol's replacement requirement poses to the forest buffer pool is likely very small. Few rational forest project owners will voluntarily place themselves in violation of the law or in bankruptcy by intentionally ending a sequestration project. Most will only end a project if they can meet the replacement requirement. The primary challenge to the replacement requirement is whether it can be enforced on long timescales—issues discussed above in Chapter One, under Enforcement.

Minimum Project Length

The 100-year minimum project length mandated by the protocol is its Achilles heel. As discussed in Chapter One, no scientific research supports the declaration that "for the purposes of this protocol, 100 years is considered permanent." This assumption prevents the protocol from generating permanent offsets and renders all 115.6 million offsets generated by the protocol to date illegitimate.[111] Although the protocol allows projects to be renewed indefinitely, limits on a forest's ability to sequester carbon limit the capital available to pay third-party verifiers to continue verifying project activities. This naturally imposed limit prevents projects from extending eternally and from achieving permanence.

Since the current protocol ensures that sequestration will occur for at least a century, California's emissions cap is not in immediate danger. The problem of global average temperature rise, however, is not confined to a single century, and the current Forest Protocol threatens the integrity of California's emissions cap on a longer, climate-relevant timescale. Ignoring the current protocol's inability to guarantee permanence "can

[111] This offset total includes early action offsets and was taken from CARB's offset registry March 8, 2019 (CARB, "Compliance Offset Program.").

cause long-term global warming impacts to be hidden by short-term storage solutions that may not offer real long-term climate change mitigation."[112] Increasing the mandatory project length to span multiple centuries cannot solve the Forest Protocol's permanence problem; as discussed in Chapter One, as the timescale of a project (i.e. its nearness to permanence) increases, the certainty of enforcement decreases.

One Option for Improvement: Ton-Year Accounting

Even though the benefits of temporarily stored tons of CO_2e cannot equal those of permanently stored tons of CO_2e in a 1:1 ratio, multiple peer reviewed authors have asserted that there may be a higher ratio that captures the benefits of temporary sequestration on global average temperature rise. Attempts to define that ratio have led to the "ton-year accounting" method, which calculates the total number of permanent offsets that each impermanent sequestration project ought to be worth based upon how long it lasts.[113] Although ton-year accounting has not been incorporated into any offset protocols to date, it is a potential alternative method for crediting carbon sequestration with offsets.

Under a ton-year accounting approach, each year that a ton of CO_2e is sequestered within a project contributes one "ton-year" to the overall project—a unit of measure that standardizes the valuation of different-lengthed projects over time. As a project progresses, it accumulates more ton-years, gradually increasing its value. The central question of ton-year accounting is how many ton-years are equivalent to one permanently sequestered ton. That number has changed over time. In 2000, a study performed by

[112] Jørgensen and Hauschild, "Need for Relevant Timescales When Crediting Temporary Carbon Storage."
[113] Moura Costa and Wilson, "An Equivalence Factor between CO2 Avoided Emissions and Sequestration – Description And Applications in Forestry."

EcoSecurities Ltd. found that approximately 55 ton-years yielded the same climate benefits as one ton of permanently sequestered carbon.[114] In a more recent 2013 study, Duke University's environmental economist Murray and atmospheric chemist Kasibhatla argue that it takes 120 ton-years to equal one ton of permanently stored CO_2.[115] This lack of consensus makes it difficult to justify shifting to a ton-year approach and indicates that more research is needed before offset protocols put it into practice.

Ton-year accounting also significantly reduces the financial attraction and feasibility of sequestration projects, reducing the political economy of shifting to a ton-year approach. Under current protocols, forest project owners receive an up-front tranche of offset credits worth between 57-100 tons per acre. This payment may dwarf future earnings—which in the long-term settles between 0-3 tons per acre—but provides a very strong incentive for market entry. In the words of one consultant forester, some forest owners "do the math ... and say, 'You could have 2.5 million credits coming in the market at $11.50 and wow, that's payday.'"[116]

Ton-year accounting, in contrast, provides gradual payments over the lifetime of a project, eliminating up-front rewards for enrollment. In addition, the nature of converting ton-years to permanent tons means that value accumulates exponentially, rewarding later years much more than early years. That means that the net present value for foresters today is comparatively low. Over decades-long, multi-generational projects, most of the benefits of enrollment will not be enjoyed by the individual who enrolls. Further, ton-

[114] Ibid.
[115] Murray and Kasibhatla, "Equating Permanence of Emission Reductions and Carbon Sequestration."
[116] Kelly and Schmitz, "Forest Offsets and the California Compliance Market."

year accounting significantly decreases the total offsetting value of forestland compared to current protocols—by 55 to 120 times, due to the conversion of impermanent to permanent tons. A tract of forest currently worth $15,000 per year, for example, would plummet to $125 per year under a ton-year accounting approach.[117] The more land a forest owner owns, the more he or she stands to lose from a shift to ton-year accounting.

This value reduction would decrease forest owner profits and make it financially impossible for many to participate in offset protocols. The costs associated with monitoring, verifying, and reporting forest project data are enormous—between $250,000 and $500,000 net present value over the life of a 100-year project—requiring significant gross offset value to make projects economical.[118] A shift to ton-year accounting would make only the largest projects possible.

Reducing the productivity and financial attractiveness of the Forest Protocol is no reason to avoid improving it. If it is too expensive or politically difficult to ensure that forest projects generate legitimate offsets, forest projects should be barred from generating offsets to preserve the integrity of caps on emissions. From the perspective of forest landowners involved in the current protocol, however, changing to ton-year accounting looks less sensible. Shifting away from the current approach to permanence, while necessary, may therefore prompt stiff opposition. Nevertheless, the potential for ton-year accounting to more accurately assess the benefits of temporary carbon sequestration seems to address both permanence and enforcement concerns with

[117] 1000 tons per year multiplied by $15 per ton yields $15,000. 1000 ton-years and converted to permanent tons in a 1:125 ratio yields $125.

[118] Kelly and Schmitz, "Forest Offsets and the California Compliance Market."

California's current U.S. Forest Protocol and may enable sequestration activities to generate legitimate offsets in the future.

Ozone Depleting Substances (ODS) Protocol

Background

Ozone depleting substances (ODS), which include chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), and hydrochlorofluorocarbons (HCFCs), are utilized in air conditioning and refrigeration equipment. In the U.S., ODS are tightly controlled by federal regulation. Section 608 of the 1990 Clean Air Act prohibits the knowing release of any ODS during the maintenance, service, repair, and disposal of air-conditioning and refrigeration equipment, and the EPA requires proper refrigerant management practices by appliance disposal facilities, owners and operators of refrigeration and air-conditioning systems, technicians, reclaimers, and others to prevent ODS release.[119] According to EPA mandate, "For equipment that is typically disassembled on-site before disposal (such as retail food refrigeration, central air conditioners, and chillers), the refrigerant must be recovered in accordance with EPA's requirements for servicing. For equipment that typically enters the waste stream with the charge intact (such as household refrigerators and freezers and room air conditioners), the final person in the disposal chain (such as a scrap metal recycler or landfill owner) must ensure that the refrigerant is recovered from the equipment before its disposal."[120] After ODS have been

[119] Clean Air Act § 601-618; United States Code § 7671-7671q
[120] US EPA, "Technicians and Contractors."

recovered, they are either "reclaimed"—purified and used again in new equipment—or incinerated.

The only legal type of ODS release is leakage from operating refrigeration equipment (as opposed to during maintenance, servicing, repair, or disposal of equipment). The rate and quantity of this leakage is unregulated for all equipment containing less than 50 pounds of refrigerant, which includes essentially all residential air conditioning and refrigerator units in the United States.[121] For equipment that contains over 50 pounds of refrigerant, the EPA mandates that leaks must be repaired once their rate of flow hits specific "trigger rates," which were updated from their original values for the first time January 1, 2019 (Figure 2.5).[122] Since the updated regulation still allows for a quantity of legal, business-as-usual leakage across all equipment that uses ODS, it creates an opportunity for generating ODS offsets by preventing that leakage from taking place.

Appliance Type	**Current Leak Rate**	**Leak Rate Effective 1/1/2019**
Industrial process refrigeration[a]	35%	30%
Commercial refrigeration	35%	20%
Comfort cooling	15%	10%
All other appliances	15%	10%

Figure 2.5

[121] AC units require more refrigerant than refrigerators, and range in the US from 1.5-5 "tons," a measure of cooling capacity. In general, an industry rule of thumb is 2-4 lbs. of refrigerant per ton of capacity, meaning that even a 5-ton AC unit will likely require around 20 lbs. of refrigerant—far less than the 50 lb. cut off for mandatory leak monitoring and repair ("What Size Central Air Conditioner Do I Need?" ; "How Many Pounds of Freon or Refrigerant, Does an AC or Heat Pump Need?").

[122] US EPA, "Stationary Refrigeration - Prohibition on Venting Refrigerants."

California's ODS offset protocol prevents ODS leakage by destroying ODS gasses recovered from retired equipment, preventing it from being recycled into new equipment and leaked over time.[123] Once the ODS have been destroyed, projects are credited with offsets based upon ten future years of assumed BAU leakage. Since ODS are more potent GHGs than CO_2 (Figure 2.6, Appendix I), offsetting potential can be very high. The additionality of ODS offsets therefore depends on whether ODS recovered from old equipment would have been reclaimed and recycled (thereby gradually leaked) or destroyed anyway.

Additionality

The decision to reclaim and recycle or to destroy recovered ODS in the absence of an offset incentive depends on the cost of reclamation, recycling, and destruction and the potential market value of reclaimed and recycled ODS. The market value of reclaimed ODS is driven by the quality of the material, whether a convenient market exists for the material, whether shipping to another location makes economic sense, and how high the demand is for the specific ODS. As regulations such as the Montreal Protocol progressively phase out various ODS, making their manufacture and import into the US illegal, their resale value after reclamation generally increases while the ODS are still required for servicing existing equipment.[124] Among reclaimed ODS that have market value, however, contamination, lack of adequate reclamation training, and lack of access

[123] Here retired means no longer in service, disposed of, mothballed, etc.
[124] Stratus Consulting Inc., "Analysis of Equipment and Practices in the Reclamation Industry."

to reclamation facilities still necessitate that some ODS are destroyed rather than recycled.

Each year, more ODS are reclaimed than destroyed. In 2016 for example, 10,804,918 lbs. of ODS refrigerant were reclaimed in the US, while 3,174,657 lbs. of ODS refrigerant were destroyed, including those ODS destroyed to generate offsets.[125] Since 2010, reclamation trends have remained relatively stable, while destruction of ODS in the US has decreased by 50%—more than 4.5 million pounds.[126] Although reclamation is the leading use of recovered ODS, it is in the hands of third-party verifiers to determine with reasonable assurance that ODS offsets are generated only by destroying ODS that would have been reclaimed and recycled, not those that would have already been destroyed.

Discussion

Updating mandatory leakage repair trigger rates in 2019 to become more stringent was a step in the right direction, but it also perpetuated two fundamental issues with current federal ODS regulation. First, basing the trigger point for mandatory leakage repair upon a leakage rate ignores the difference in residence times between CFCs, HCFCs, and HFCs. For HCFCs and HFCs, which have relatively short atmospheric residence times, a trigger rate makes sense since the damage they do depends on their flow rate into the atmosphere. Damage to the environment from CFCs, however, which

125 US EPA, "ODS Refrigerant Reclamation Totals by Year."

126 A small portion of this decrease is due to a decrease in ODS imported specifically for destruction, which decreased 2010 to 2016 by over 90 percent, from approximately 550 metric tons to less than 50 metric tons (ICF International, Inc., "ODS Destruction in the United States and Abroad.").

have long atmospheric residence times (Figure 2.6, Appendix I), is a function of their total stock in the air, not a function of their flow rate.

It follows that repairs for equipment utilizing CFCs ought to be triggered once a certain quantity of emissions has been released, not once a certain rate of leakage has been reached. Under current rules, refrigeration equipment can leak substantial quantities of ODS pollution over time and may never need to be repaired as long as leaks do not exceed trigger rates.

Second, exempting ODS equipment that uses less than 50 lbs. of ODS from mandatory leakage repair allows for many refrigeration systems and air conditioners to leak unchecked, and creates no financial incentive for manufacturers of refrigeration and air conditioning units of in this size category to innovate and design equipment that further minimizes ODS leakage.

If ODS leakage regulation accounted for ODS residence times and were more stringent, ODS offsetting would be unnecessary to reduce ODS emissions. Indeed, past updates to section 608 of the Clean Air Act have demonstrated the effects of updating federally-mandated best practices on ODS emissions. By requiring improved handling of refrigerants in 2016, the EPA calculated an annual emissions reduction of 7.3 million metric tons of CO_2e, equivalent to the annual emissions of 1.5 million cars, and greater than the average annual emissions reductions credited with ODS offsets.[127]

[127] US EPA, "Updates to the Section 608 Refrigerant Management Program."

As the protocol currently stands, it is in the hands of third-party verifiers to assess and guarantee additionality. Even if they do, however, ODS offsets do not necessarily provide net climate benefits. The impact of ODS offset generation on net emissions depends on the difference in global warming potential between the specific gas that is destroyed and the gas that replaces it in new equipment—a calculation that is unaccounted for in the current protocol's quantification methodology. When a unit of ODS is destroyed rather than reclaimed, a new unit of refrigerant gas must be produced to take its place in new equipment. As CFCs have been phased out under the Montreal Protocol, HCFCs have largely taken their place. By 2020, HCFCs, will, like CFCs, also be illegal to produce or import, so HFCs will replace destroyed HCFCs in new equipment. The faster CFCs and HCFCs are destroyed, the faster HFCs will be produced and installed in their place. From the perspective of preserving the ozone layer, this transition is an improvement—HFCs are not ozone depleting substances. From the perspective of GHG emissions, accelerating the transition to HFCs while leakage rates remain constant can increase net emissions, causing the ODS Offset protocol to backfire and undermine California's emissions cap.

Currently, HCFC-22 (GWP100 1,810) is the most widely used ODS refrigerants in the US. As HCFC is replaced by alternatives, the global warming potential of leakage may increase, depending on the specific replacement that is used (Figure 2.7, Appendix I). According to the EPA, "If HFC growth continues on the current trajectory," particularly due to increased demand for refrigeration and air conditioning in developing countries, "the increase in HFC emissions is projected to offset much of the climate benefit achieved by phasing out ODS."[128]

Under October 2016's Kigali Amendment to the Montreal protocol, developed nations will begin to reduce HFC consumption in 2019 and freeze consumption by 2024, hopefully driving innovation to develop new, lower GWP refrigerants. Numerous private sector companies have also made pledges to phase out HFC use.[129] Until HFCs are completely replaced by a climate-friendly alternative in the US, however, producing ODS offsets under California's ODS protocol can continue to enhance greenhouse gas emissions from leaking refrigeration and AC equipment. These differences in emissions are not captured by the current ODS protocol because it does not account for the leakage of the refrigerants that replace destroyed ODS in new equipment.[130] Given the different global warming potentials of the many CFCs, HCFCs, and HFCs, it is therefore impossible to know how accurately offsets have been awarded to ODS offset projects, calling into question the validity of the 18.9 million offsets generated by the ODS protocol.[131] Future iterations of the ODS protocol must account for the emissions from the leaking refrigerants that will replace destroyed ODS to ensure conservative and accurate offset crediting.

[128] US EPA, "Recent International Developments under the Montreal Protocol."
[129] "Timeline of Actions on HFCs."
[130] CARB, "Compliance Offset Protocol Ozone Depleting Substances Projects."
[131] This offset total includes early action offsets and was taken from CARB's offset registry March 8, 2019 (CARB, "Compliance Offset Program.").

Livestock Protocol

Background

The livestock protocol, adopted in 2011, defines methods for capturing and destroying methane from manure lagoons. Lagoons one or more meters deep release methane into the atmosphere, a GHG 28 times more potent than CO_2,[132] and are associated with numerous other public health and environmental concerns including foul odors, airborne particulate matter, and bacteria.[133]

Livestock offset projects involve installing anaerobic manure digesters in place of manure lagoons. Digesters come in multiple sizes and designs, but all are essentially tanks that collect manure and create the controlled, anaerobic conditions for bacteria to decompose manure into methane and solids. Methane is then captured and can be flared, burned to generate on-site electricity, or sold to local natural gas distributors. While each molecule of combusted methane releases CO_2 to the atmosphere, preventing livestock offset projects from completely eliminating emissions, livestock offset projecta earn offsets based upon the calculated reduction in net global warming potential created by converting methane to CO_2. Project owners can also earn supplemental revenue from project co-benefits including electricity savings, natural gas sales, and other digester byproducts, which can be used as fertilizer or animal bedding. So far, the Livestock Protocol has produced more than 5.6 million California Compliance Offsets.[134]

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[132] IPCC, 2013
[133] Zhang, "Air Quality and Community Health Impact of Animal Manure Management."
[134] This offset total includes early action offsets and was taken from CARB's offset registry March 8, 2019 (CARB, "Compliance Offset Program.").

Additionality

The Livestock Protocol utilizes two additionality tests: a legal-requirements test and a performance standard. Projects must pass both tests to generate additional offsets. The livestock protocol's legal requirements test mandates that "Emission reductions achieved by a Livestock Project must exceed those required by any law, regulation, or legally binding mandate," and that "If no law, regulation, or legally binding mandate requiring the destruction of methane at which the project is located exists, all emission reductions resulting from the capture and destruction of methane are considered to not be legally required, and therefore eligible for crediting under this protocol." This test is intuitive and sensible—obeying the law should not require additional incentives such as offsets. Since no laws mandate that livestock owners anaerobically digest manure, all projects satisfy this test. The Livestock protocol's performance standard has two parts:

(a) Emission reductions achieved by a livestock project must exceed those likely to occur in a conservative business-as-usual scenario.

(b) The depth of the anaerobic lagoons or ponds prior to the offset project's commencement must be sufficient to prevent algal oxygen production and create an oxygen-free bottom layer which means at least one meter in depth at the shallowest area.

Part (b) is specific, directly measurable, and easily verified via a site visit. Part (a), however, is dangerously subjective.[135] It is this first criterion that remains vulnerable, since the Livestock Protocol does not account for the financial opportunities that manure

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[135] This subjectivity is what sparked the 2012 additionality court case against CARB discussed in earlier.

digesters create aside from offset revenue and other non-offset incentives to install digesters. Together, the scale of the non-offset revenue and the current lack of any method for disentangling multiple incentives to install anaerobic digesters can erode livestock project additionality.

The Economics of a Livestock Project

Livestock offset projects have very high up-front costs, but may also have high potential to generate non-offset revenue once they are up and running. This is unlike California's other protocols, which require offset revenue on an ongoing basis to be financially feasible. From one perspective, this is extremely beneficial. If California's offset policy were to disappear, livestock owners would be more likely to continue to utilize installed manure digesters regardless of lost offset revenue, staying on track to a low-carbon future, while many other types of offset projects revert to a cheaper, higher-emissions business-as-usual. California's Livestock Protocol counts on this technological lock-in. Projects only earn offsets for 10 years, incentivizing adoption, then allowing other benefits of digesters to take over.

This approach to additionality prompts an important question not asked by the current protocol: if non-offset revenue is assumed to be sufficient for maintaining a digester's feasibility after 10 years, is offset revenue necessary for the adoption of an anaerobic digester in the first place? This is the precise question asked by additionality tests that focus on financial feasibility. If the answer is "no, offset revenue is not necessary for revenue to exceed costs," then projects fail the financial feasibility test and should not be considered additional. Since the current Livestock Protocol does not include a built-in financial feasibility test of additionality, livestock projects so far have not been examined to see if there were existing financial incentives for digester installation. Given data provided by the United States Environmental Protection Agency (EPA) and CARB, it seems possible that a quantity of emissions reductions achieved by the Livestock Protocol would have occurred without it, necessitating further investigation of how offset revenue compares to non-offset incentives for digester installation.

According to the EPA, installing an anaerobic digester today costs between $400,000 and $5,000,000, with an average cost of $1,200,000—a significant financial barrier to adoption. Once digesters are in place, however, they can provide substantial financial benefits. Besides producing offsets, the methane that digesters generate can be sold as natural gas or burned to generate on-site electrify, digester effluent can be sold or utilized as a variety of products including fertilizer and animal bedding, and project owners may earn tipping fees from accepting non-farm waste streams. While the EPA has not conducted site-specific digester analyses and acknowledges that site conditions including energy contracts and permitting requirements affect the financial feasibility of specific projects, it stated in 2018 that a positive financial return appears most likely on all dairy operations with more than 500 cows and swine operations with more than 2,000 swine.[136]

To understand site-specific dairy manure digestion in California, CARB conducted an in-depth analysis of dairy farm methane capture in 2017.[137] CARB's analysis examined the specific economics of a stylized 2,000-cow dairy farm

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[136] AgSTAR, "Market Opportunities for Biogas Recovery Systems at U.S. Livestock Facilities."
[137] CARB, "Short-Lived Climate Pollutant Reduction Strategy." found through Lee and Sumner, "Dependence on Policy Revenue Poses Risks for Investments in Dairy Digesters."

participating in a cluster of farms operating a local, centralized digester system. Today, CARB estimates that the San Joaquin Valley could contain 55 such clusters, collecting manure from 1.05 million cows responsible for nearly 60% of milk cows in California.

CARB's economic analysis did not include subsidies and financing options that decrease the financial barriers to adoption, and it did not include potential revenue from offset generation, products derived from digester effluent, or tipping fees—all of which make anaerobic digester projects more financially feasible. Even so, CARB's estimate for a digester project's net present value over a 10-year lifespan was $6,203,000—not only positive and large, but $5 million more than the EPA's calculation of the average cost of a digester.[138] To further contextualize this value, $6 million is more than $2 million more than the value of a dairy farmers entire 2,000-cow herd.[139] This result highlights the significant financial incentives for participation in anaerobic digestion regardless of offset policy.

CARB's cost-revenue analysis (Figure 2.8, Appendix I) reveals that national and Californian biofuel credit programs comprise most of the revenue for the modeled dairy digesters. "RIN credits" (or "RINs", in Figure 2.8, Appendix I) are federal credits generated through the Renewable Fuel Standard, a national policy that requires refiners to replace a portion of their petroleum-based fuels with renewable fuels. Methane generated by manure digestion qualifies as a renewable fuel, and therefore for RIN crediting. "LCFS credits" are generated through the California-specific "Low Carbon Fuel

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[138] AgSTAR, "Market Opportunities for Biogas Recovery Systems at U.S. Livestock Facilities."
[139] Lee and Sumner, "Dependence on Policy Revenue Poses Risks for Investments in Dairy Digesters."

Standard," a similar program to the RFS that assigns eligible transportation fuels lifecycle carbon intensities and mandates that the fuel mix provided by oil refineries and distributors meet declining targets for carbon intensities. Under current LCFS rules, manure-based biofuels are assigned the lowest carbon intensity of any fuel, −276 gCO_2e per megajoule, which creates large potential for LCFS credit generation and financial incentives for digester installation.[140] While the market price of LCFS credits has fluctuated between $20 and $125 per metric ton of CO_2e since 2013, prices today exceed $100 per metric ton—nearly 10 times the value of a California compliance offset.[141]

As RIN and LCFS credits improve the financial benefits of anaerobic digesters, grants and subsidies provided by state agencies the cost of installation, amplifying incentives to install digesters. In 2017, the Dairy Digester Research and Development Program (DDRDP) of the California Department of Food and Agriculture (CDFA) provided $35 million to 18 digester projects. Also in 2017, $99 million of California's Greenhouse Gas Reduction Fund were made available for constructing digesters on dairy farms, of which more than $60 million will be distributed by the DDRDP to construct anaerobic digesters on Californian dairy farms.[142]

Between revenues from co-benefits, biofuel credits, and installation subsidies, dairy farmers face multiple incentives for installing anaerobic digesters aside from offset revenue. Disentangling the relative effects of these incentives to determine whether offset revenue was indeed the last straw necessary to convince a livestock owner to install a

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[140] CARB, "Short-Lived Climate Pollutant Reduction Strategy."
[141] CARB, "LCFS Credit Trading Activity Reports."
[142] Lee and Sumner, "Dependence on Policy Revenue Poses Risks for Investments in Dairy Digesters."

digester would only be possible with an in-depth review of each project's finances. Since the Livestock Protocol does not include a financial feasibility test of additionality, we cannot know how many projects would have been feasible without offset revenue and are therefore non-additional. This reality calls into question all 5.6 million livestock offsets generated so far and necessitates future investigation into livestock project finances.

Mine Methane Capture (MMC) Protocol

Background

Both coal and trona, a source of sodium bicarbonate, co-occur with strata that leak methane, the primary constituent of natural gas. This creates a suffocation and explosion hazard within mines and a significant source of unregulated greenhouse gas emissions—US mine methane emissions in 2015 totaled approximately 70 million tCO_2e.[143]

Since the 1990s, however, long before California's MMC Protocol was adopted, the U.S. has been the global leader in capturing methane released by coal and trona extraction and using it to generate economic and safety benefits. Mine methane recovery and use (RAU) projects today utilize mine methane for power generation, natural gas pipeline injection, vehicle fuel, industrial process feed stocks, onsite mine boilers, mine heating, and home heating distribution systems. All these uses involve burning or otherwise destroying mine methane, maintaining safe concentrations of the explosive gas within mines while creating financial returns and climate benefits. In 2015 alone, RAU

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[143] US EPA, "Coal Mine Methane Country Profiles."

projects reduced methane emissions by nearly 1.1 billion cubic meters.[144] While this is a substantial emissions reduction, 2015 also saw more than 2.5 billion cubic meters of mine methane released to the atmosphere. Financial barriers to mine methane RAU projects are responsible for a large portion of this release; the proximity of a mine to pipeline infrastructure, state-specific alternative or renewable energy incentives, and location-specific disputes over ownership of methane produced from coal seams all affect the financial feasibility of mine methane RAU projects.[145] California's MMC Protocol is intended to incentivize the destruction of mine methane at mines where RAU projects are infeasible without additional financial incentives.

Additionality

The same two additionality tests built into the Livestock Protocol are also built into the MMC Protocol to ensure that mine methane destroyed by offset projects would not have been destroyed anyway by RAU projects: a legal requirement test and a performance standard.

The MMC Protocol's legal requirement test mandates that a project's emissions reductions must exceed those required by any law, regulation, or legally binding mandate to be credited with offsets. Since destroying or utilizing captured mine methane is not legally required in the US, all treatments of captured mine methane are considered additional according to this test.

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[144] US EPA, "Coal Mine Methane Developments in the United States."

[145] Colorado, Indiana, Ohio, Pennsylvania, and Utah currently consider coal mine methane an "alternative" or "Renewable" energy resource (US EPA, "Coal Mine Methane Developments in the United States.")

The performance standard states for both active and abandoned mines that pipeline injection of mine methane is "common practice and considered business-as-usual, and therefore ineligible for crediting under this protocol," while "destruction of extracted mine methane via any end-use management option except [pipeline injection] automatically satisfies the performance standard evaluation because it is not common practice nor considered business-as usual, and is therefore eligible for crediting under this protocol."[146]

Discussion

The two additionality tests embedded in the MMC protocol tests are inadequate; projects can produce non-additional offsets while in compliance with both existing tests in two scenarios. First, by singling out pipeline injection as the only non-additional end-use of mine methane, the MMC performance standard contradicts the EPA's assertion that US mines engage in other types of profitable, business-as-usual mine methane use. Utilizing mine methane onsite for mine heating, for example, may already generate financial returns, but is nevertheless eligible for offset crediting, creating an opportunity for non-additional offsets to infiltrate the CCM.

A second non-additionality scenario can arise if an RAU project and an offset project are both financially feasible, but an offset project is more financially attractive at a mine location. If potential offset revenue exceeds potential RAU revenue, then a mine that would have destroyed methane via pipeline injection, for example, will develop an

[146] CARB, "Compliance Offset Protocol Mine Methane Capture Projects."

offset project instead and generate offsets. These offsets are non-additional, but will still satisfy current MMC additionality tests, allowing them to enter the CCM and undermine California's emissions cap. Comparing the offset revenue from destroying 1000 ft^3 of methane to the average wellhead price of 1000 ft^3 of methane shows that this scenario has been possible in the past and may be possible today.

Potential Revenue from Selling Natural Gas per 1000 ft^3

The average net revenue of destroying 1000 ft^3 of methane to generate offsets is $4.18 (see Appendix II for calculations). In order to compare net revenue of offset and RAU projects, it would be necessary to know the average profit margin of producing 1000 ft^3 of natural gas for pipeline injection. This could be found by subtracting the average breakeven price of natural gas production from the average wellhead price of natural gas. Since both are variable across time and space, and to emphasize the scale of the additionality risk illustrated here, the wellhead price is assumed equal to net revenue. In other words, for the purposes of these calculations the breakeven price for pipeline injection is assumed to be $0. Although this assumption reflects reality at select locations where methane is produced as a byproduct of oil production, it does not reflect the reality of producing methane from coal and trona mines. Rather, assuming that the breakeven price is $0 significantly undervalues the costs of methane production from mines.

Since the US Energy Information Administration has only released average wellhead price data through 2012, the Henry Hub Price is used here as a proxy for the wellhead price.[147] Since the Henry Hub Price is generally higher than the average

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[147] US EIA, "U.S. Natural Gas Wellhead Price (Dollars per Thousand Cubic Feet)."

national wellhead price, using it as a proxy further overvalues the potential revenue of selling methane as natural gas.

If the average revenue from offset generation exceeds this highly inflated estimate of revenue from pipeline injection, therefore, the average revenue from offset generation will exceed the actual revenue from pipeline injection by an even larger margin.

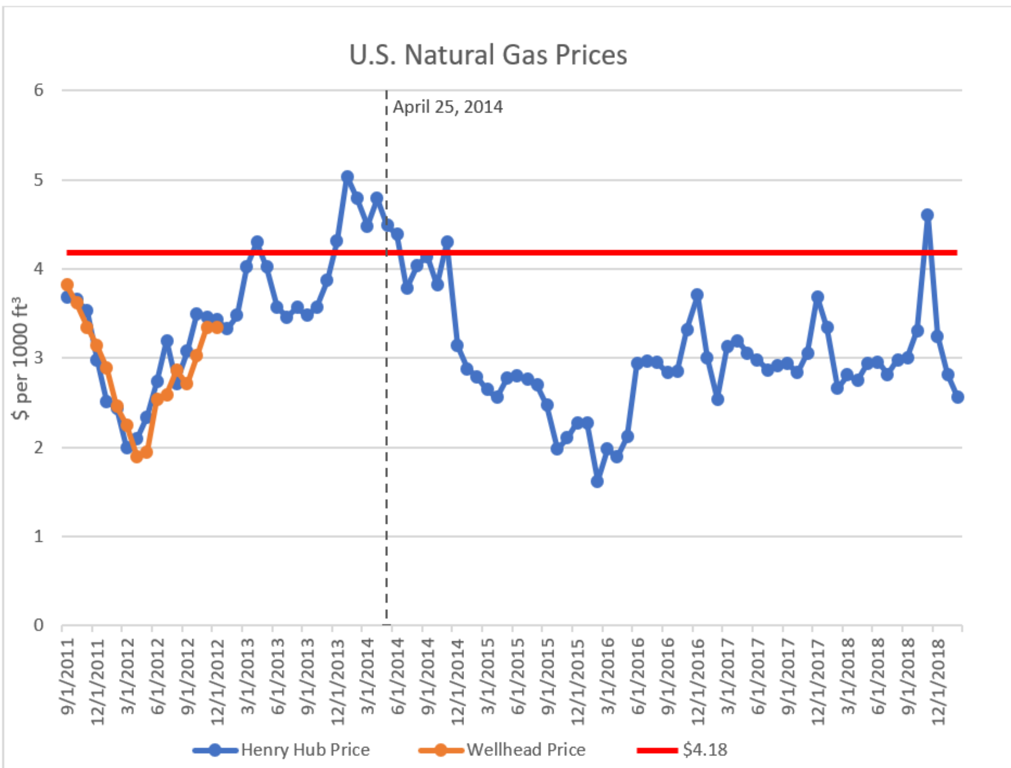

Figure 2.9

As seen in Figure 2.9, since April 25, 2014, the day the MMC Protocol was adopted, the average revenue from destroying 1000 ft^3 to generate offsets has exceeded the Henry Hub Price of methane nearly every month.[148] This means that offset generation

148 "Natural Gas Prices - Historical Chart."

could have been more financially attractive than RAU project development when an RAU project would also have been feasible.

Many site-specific factors contribute to whether an offset project is more financially attractive than an RAU project at a specific mine. These include, for example, capital costs, the quantity and market value of other gasses captured in addition to methane, transaction costs involved in verifying and selling offsets, the market price of offsets and of methane. The variance of these factors means that not every mine location producing offsets has produced non-additional offsets. It does, however, necessitate an in-depth, project specific review of past and prospective offset project finances to determine the magnitude of this additionality concern. There is currently no test built into the MMC that requires such a review, so more research is needed assess how many MMC offsets generated are non-additional. Given the risk of non-additional offsets infiltrating the CCM, all 5.8 million MMC offsets generated to date must be called into question.[149] Future iterations of the MMC protocol must include an additionality test that compares the financial feasibility of offset projects to RAU projects to remedy this current lack of transparency. Figure 2.10 summarizes the components of such a test performed on a prospective MMC offset project.[150]

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[149] This offset total includes early action offsets and was taken from CARB's offset registry March 8, 2019 (CARB, "Compliance Offset Program.").

[150] This test assumes that other additionality tests in the protocol have determined that the project is additional.

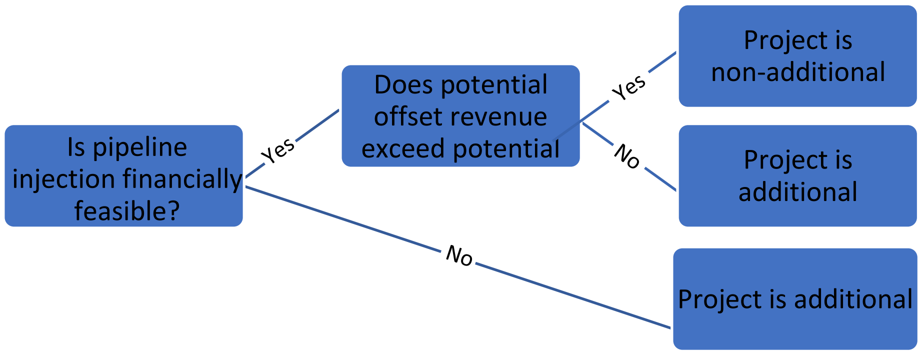

Figure 2.10

Chapter Conclusions and Summary

This chapter argues that all four offset protocols currently producing offsets for sale in the CCM have the potential to produce illegitimate offsets, compromising the integrity of California's emissions cap. In the case of the Forest Protocol, the assumption that 100-year sequestration provides equivalent climate benefits to permanent sequestration prevents any of the 115.6 million offsets generated from delivering their intended benefits. The other three protocols each also include a risk of generating non-additional or otherwise illegitimate offsets, but the scope of that risk remain unknown. Assessing the financial feasibility and opportunity of livestock and mine methane projects and integrating the effects of the leakage of replacement refrigerants into ODS offset accounting are necessary to determine the scope of that risk to California's emissions cap. This chapter's conclusions and recommendations are summarized in Figure 2.11.

Protocol	Criterion Analyzed	Conclusion	Result	Recommendation
Forest	Permanence	Since 100-year sequestration is inequivalent to permanent sequestration, the Forest Protocol cannot produce permanent offsets	All 115.6 million offsets issued are impermanent and therefore illegitimate	Invalidate all forest offsets or change from a 100-year permanence assumption, reassigning the value of issued offsets via a ton-year accounting or a carbon rental system
ODS	Quantification	The net climate benefits of the protocol depend on which gas replaces those that are destroyed, a factor that is not accounted for in the protocol's quantification methodology	All 18.9 million are called into question	1. Include the effects of future leakage of replacement gas in quantification of emissions reductions 2. Tighten mandatory leakage repair requirements, and change mandatory repair trigger rates to trigger quantities depending on which type of ODS is installed
Livestock	Additionality	Cannot disentangle the offset incentive from non-offset incentives to install anaerobic digesters	All 5.6 million offsets are called into question	Include a financial feasibility additionality test to determine whether a digester would have been installed in the absence of offset revenue
MMC	Additionality	Cannot tell if mines would have already developed a recovery and use project, destroying mine methane in the absence of an offset protocol	All 5.8 million offsets are called into question	Include a financial feasibility additionality test to determine whether a recovery and use project is also feasible at a project site and whether expected offset revenue exceeds expected recovery-and-use revenue for each project

Figure 2.11

Chapter 3: Market Trends and Case Studies in the California Compliance Market 2013-2016

Against a backdrop of questions about California Compliance Offset validity, this chapter will further investigate the scope of the threat that California's compliance offset protocols pose to the integrity of California's CAT system. This chapter will show that the most problematic type of offsets, those generated by the Forest Protocol, are also the most utilized, compromising the integrity of California's cap on GHG emissions. It will also investigate the offset submission behavior of different types of firms through four case studies (Figure 3.1). All market data in this chapter comes from CARB's publicly available Compliance Reports.[151]

Firm	Category the Firm Represents
Regents of the University of California	Firms with a deep, value-driven commitment to sustainability
City of Colton	Low emitters that submit few offsets
LA Department of Water and Power	High emitters that submit few offsets
CP Energy	Low Emitters that submit many offsets

Figure 3.1

[151] CARB, "2013-2014 Compliance Report"
CARB, "2015-2017 Compliance Report"

Market Trends in the CCM

Most firms regulated under AB 32 do not participate in compliance offsetting. In Compliance Period One (CP1), which went from 2013-2014, and Compliance Period Two (CP2), which went from 2015-2017, only 39% and 32% of firms, respectively, turned in offsets. Among those firms, more than half submitted less than 7.5%, opting not to maximize offset use.

There is no clear relationship between the quantity of a firm's emissions and the quantity of offsets that the firm submits. Figures 3.2 and 3.3 (Appendix I) show that many large emitters with significant potential for offset-derived cost savings turned in no offsets at all or opted to submit less than 8%. In CP1, twelve firms emitting more than 2.5 million tCO_2e submitted no offsets at all, seeming to pass up $200,000 or more in gross cost savings.[152] Conversely, some very small emitters maximized offset submissions, seizing sometimes negligible cost savings.

The difference in potential cost savings between the smallest emitters and the largest emitters in the CCM is enormous. Firms' emissions obligations spans nine orders of magnitude (note the logarithmic scale of the x-axis in Figures 3.2 and 3.3, Appendix I), ranging from 3 tons CO_2e (Noble Americas Energy Solutions, LLC in CP1) to nearly 162 million tons CO_2e (Tesoro Refining & Marketing Company LLC's emissions in CP2).

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[152] 8% of 2.5 million is 200,000, and offset prices lag behind allowance price by approximately 20%, delivering approximate gross cost savings of $1 each (The Climate Trust, "The Gap between the Price for Allowances and Offsets Appears to Be Closing. Is This a Long Term Trend or a Short Term Phase?")

An increase in total CCM market size expanded the total potential number of offsets utilized from CP1 to CP2. New firms entering the market and the 2015 inclusion of emissions from fossil fuel distribution under the cap more than tripled total covered emissions from one compliance period to the next—291,211,108 tCO_2e in CP1 versus 986,400,626 tCO_2e in CP2. For many of the largest emitters, three of which are shown in Figure 3.4 below, this expansion dramatically increased covered emissions in the second compliance period.

Firm	Average Annual Emissions Obligations CP1 (tCO_2e)	Average Annual Emissions Obligations CP2 (tCO_2e)
Tesoro Refining & Marketing Company LLC	8,709,951.5	53,988,150.3
Chevron U.S.A. Inc.	10,385,769.5	43,217,457.3
Phillips 66 Company	4,674,418.5	23,326,708

Figure 3.4

As a result of this expansion in CP2, offset submissions nearly quintupled, rising from 12,773,097 in CP1 to 62,717,868 in CP2.[153] Despite the expansion of the CCM in 2015 and subsequent increase in total offset submissions, the proportion of firms that utilized offsets, and the proportion of offset users that submitted the maximum number of offsets possible, changed very little. As seen in Figure 3.5 (Appendix I), most firms in

[153] It is essential to note that the total number of offsets submitted is far smaller than the number produced. This does not mean that market is flooded with unsold offsets. Rather, CARB's quarterly Compliance Instrument Report indicates that unsubmitted offsets reside in CARB's forest buffer pool and compliance entities' general accounts, waiting and ready for submission (CARB, "Compliance Instrument Report.").

both compliance periods submitted no offsets at all, and among those who did submit offsets, less than half submitted the maximum number of offsets.

Types of Offsets Submitted

The types of offsets that compliance entities have submitted vary by offset protocol, compliance period, and by the type of firm. Figure 3.6 (Appendix I) shows that offset submissions increased in every category of offset from CP1 to CP2, but that CP2 forest offsets dominated offset submissions, composing 61% of all offsets submitted in both compliance periods.

The mix of offsets submitted reflects the stream of offsets supplied to the Californian offset market. In Figure 3.7 (Appendix I), which compares total offset submissions to total offset production, the mix of offsets submitted closely resembles the mix of offsets produced, with forest offsets constituting most of supply and submissions. Offset submissions and supply are not identical, but a chi-squared test for independence shows that the differences are statistically insignificant, with three degrees of freedom and a p-value of 0.05.

Within subsets of the population of firms covered by AB 32, however, the types of offsets submitted do not always closely match supply (Figure 3.8, Appendix I). For this analysis, four groups of 10 firms were selected from all firms covered within both compliance periods. Each group contains the 10 firms that were furthest from the origin in each quadrant in Figures 3.2 and 3.3, yielding four groups of the most “extreme” firms: 10 highest emitters and highest offsetters (HEHO), 10 lowest emitters and highest offsetters (LEHO), 10 lowest emitters and lowest offsetters (LELO), and 10 highest emitters and lowest offsetters (HELO).

The offset submissions of the 10 LEHO and 10 HELO firms were found to be statistically significantly different from the mix of offsets supplied (x^2=1.75 and 0.58 respectively), while the difference between the submissions of the 10 HEHO firms and total supply were insignificant (x^2=0.017). It is essential to note that these 10 HEHO firms represent a much larger quantity of offsets submitted to the market—8,178,567—while the 20 LEHO and HELO firms sampled here only represent only 145,848 offsets submitted. These sampled firms indicate an overarching reality of the CCM: while emitters of all sizes do turn in offsets, the largest quantity of offsets submissions come from the largest emitters in the market. In addition, the offsets submitted by the largest emitters closely resembles the mix of offsets supplied to the market.

Case Studies

Figures 3.2 and 3.3 (Appendix I) indicate that many firms in the CCM do not exhibit offsetting behavior that appears, at first glance, rational. Many submit fewer offsets than the 8% maximum limit, foregoing substantial cost savings, while others maximize offset submissions even when their cost savings are minute. The remainder of this chapter will elaborate upon some of these behaviors and explain their rationale through case studies of four firms in the CCM. These case studies will show that despite apparent departures from behavioral expectations, a desire to minimize compliance costs is still the primary motivator of offsetting behavior. Nevertheless, other factors including imperfect information, social pressure, and relationships with larger companies also contribute, complicating firms' offsetting behavior.

Firm	Type of Behavior
City of Colton	Low emitters that consistently submit small numbers of offsets
CP Energy	Low Emitters that submit many offsets
Regents of the University of California	Firms buying voluntary market offsets in addition to compliance offsets
LA Department of Water and Power	High emitters that submit few offsets

Figure 3.9

Case Study: City of Colton

The City of Colton is located 57 miles east of Los Angeles and contains 53,000 citizens, about 2.5% of the population of San Bernardino County. Colton's emissions reductions fall into two categories: voluntary reductions made by Colton's local government and utilities, and compliance reductions made by the city's only stationary source covered by AB 32: The City of Colton Electric Utility (CEU). Amid significant efforts to cut its emissions, the CEU has consistently submitted offsets during both compliance periods, but in extremely small numbers, only saving approximately $200.[154]

The CEU's offsetting behavior demonstrates that pure cost savings are not the only reason why firms submit or refuse to submit offsets. Misinformation and

[154] The CEU, as will be discussed, has submitted 173 offsets according to CARB's online registry. Offset prices have lagged behind allowance prices approximately 20%, so estimated gross cost savings are about $207 (The Climate Trust, "The Gap between the Price for Allowances and Offsets Appears to Be Closing. Is This a Long Term Trend or a Short Term Phase?"). When transaction costs are taken into account, net savings are likely even smaller.

interactions with local community sustainability goals can affect how firms utilize offsets and which offsets they submit. Colton's example highlights the interplay between compliance entities' emissions goals and the goals of the communities they are nested in while also suggesting why local utilities may submit ODS offsets.

Voluntary GHG Mitigation in Colton

While AB 32 targeted a large portion of California's emissions with mandatory GHG reduction measures (e.g. cap-and-trade), it also tasked CARB with developing a Scoping Plan that defines methods for reducing non-compliance emissions. In response, CARB articulated a unique role for regional and local governments, which can influence community emissions through "planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations." While the Scoping Plan does not mandate specific community emissions goals, its call for "local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current [2008] levels by 2020."[155] By 2015, more than 50 southern California jurisdictions including the City of Colton had responded by completing a GHG Inventory and Reduction Plan, also known as a Climate Action Plan (CAP).[156]

As Colton's CAP points out, state and county-level emissions reduction measures including changes to the Renewable Portfolio Standard, Low Carbon Fuel Standard, and

[155] CARB, "Local Government Actions for Climate Change."
[156] "City of Colton Climate Action Plan."

lighting best-practices are more than sufficient for reducing Colton's GHG emissions 15% below a 2008 baseline. Even so, Colton's CAP describes additional ambition to reduce local emissions through a combination of local utility measures and city government programs, summarized below. Many of the utilities' programs were preexisting and were rolled into Colton's wider strategy when the CAP was adopted. The City of Colton Water Department, Southern California Gas Company, City of Colton Electric Utility, and Southern California Edison each offers a litany of rebates and incentive programs designed to increase efficiency and promote renewable energy use.

1. City of Colton Electricity Department (CEU)

The CEU offers 18 rebate and incentive programs, including A/C tune-up and replacement rebates, residential energy efficiency rebates, weatherization rebates, small business and commercial energy efficiency rebates, refrigeration replacement rebates, and a "treebate" for planting building-shading trees. It also provided energy efficiency audits and energy efficiency kits for a LivingWise® School Program, which empowers 6th graders to apply what they learn about energy efficiency in the classroom at home.

2. City of Colton Water and Wastewater Department (CWD)

The CWD offers rebates for installing EnergyStar-approved clothes washers, dishwashers, and for installing efficient commercial appliances.

3. Southern California Edison (SCE)

SCE provides 16 GHG-reducing rebates, incentives, and subsidy programs that promote energy efficiency, electric vehicle deployment, and solar power installation. These include a program that pays all purchase and installation costs for energy efficient appliances (for eligible customers), a refrigerator recycling program, rebates for efficient light bulbs and A/C units, and multiple programs that provide financial support or cash incentives for installing solar panels.

4. Southern California Gas Company (SCGC)

SCGC offers 29 separate company programs that promote residential and commercial gas use efficiency, which include installation rebates and financing, zero-charge efficiency tracking, project design assistance, a school program, and interactive online self-assessments.

In addition to utility-provided programs, the City of Colton has also instituted measures that promote emissions reductions, including:

- Electric vehicle and alternative fuel purchasing for the city car fleet
- City facility electric vehicle infrastructure investments
- A city facility energy efficiency retrofit initiative
- Modified work week schedule for city staff
- An administrative procurement policy to purchase recycled products
- CALGreen Building Code
- Water Efficient Landscape Ordinance

Colton's CAP estimates that, stationary sources of emissions aside, the combination of state, regional, and voluntary local measures can reduce emissions Colton's emissions from 682,418 tCO_2e (2008) to 478,344 tCO_2e by 2020, a 34.7% reduction.[157]

[157] "City of Colton Climate Action Plan."

Compliance GHG Mitigation in Colton: The Colton Electric Utility

As the City of Colton strives for voluntary emissions reductions, Colton's only compliance entity faces intense regulatory, financial, and legislative pressure to reduce GHG emissions while minimizing costs for consumers. Historically, the City of Colton Electric Utility (CEU), which owns and operates a power plant, five substations, and Colton's electrical infrastructure, "has sought to acquire new resources at the lowest possible cost (consistent with safety and reliability requirements) without considering environmental constraints." Environmental litigation and Federal and state GHG-focused legislation since 2011, however, "are reshaping" the CEU's power mix and have complicated the CEU's cost considerations.[158]

Environmental Litigation

In 2013, the San Juan Generating Station (SJGS), which supplied roughly two-thirds of the CEU's total retail power load, was involved in environmental litigation proposing nearly $1 billion in new pollution control equipment. After extensive discussion and negotiations with the US Environmental Protection Agency and between utilities in California, New Mexico, Arizona, and Colorado, two of the four generating units at the SJGS were slated for decommission by December 31, 2017. As a result, the CEU began replacing over 225,000 MWh of energy and 30 MW of capacity formerly supplied by the SJGS. At the time, it also seemed possible that the plant would be shut down earlier than anticipated, requiring the CEU to replace capacity and energy earlier at

[158] "City of Colton Electric Department 2017 Integrated Resource Plan."

additional cost. Uncertainty surrounding the SJGS plant also coincided with a host of regulatory changes with the potential to increase operating costs.

Legislative and Regulatory Pressure

According to the CEU, four environmental regulations that have the "greatest initial impact on costs" include regionalization by the California Independent System Operator (CAISO), California's AB 32, SB 350, and California's proposed movement to a centralized capacity market. Cost concerns driven by these regulations ought to increase the CEU's demand for cost-cutting policies like offsets.

CAISO regionalization would mean establishing a "west-wide grid" containing multiple western states and led by the CAISO. Although the intention behind regionalization proposals is to make it easier for Californian utilities to import renewable energy from other states, particularly wind from Montana and Wyoming, the CEU and other Californian participants are concerned about the allocation of transmission costs to western utilities, forcing utilities outside of California to comply with CAISO regulation, and about who would bear the cost of carbon emissions from out-of-state renewable resources.[159] According to the CEU, municipalities within California generally oppose CAISO expansion, while renewable energy producers outside California and California's Governor Brown continue to push for CAISO expansion.[160] As of September 1, 2018, the latest legislative attempt to expand the CAISO failed to pass in California for the third time in three years.[161] Nevertheless, the looming potential for expansion since 2012 has

[159] Roberts, "California's Huge Energy Decision."
[160] "City of Colton Electric Department 2017 Integrated Resource Plan."
[161] Sangree, "CAISO Western RTO Expansion Bill Dies in Committee."

affected the CEU's expectations of future costs and created uncertainty over the availability of additional renewable energy.

AB 32 (2006) and more recently SB 350 (2015) "potentially have the greatest impact" on the CEU. AB 32, as previously discussed, regulates emissions from electricity generation and established California's CAT system. In 2009, three years before the CAT system took effect, CARB allocated free emissions allowances to the CEU equal to its then-estimated emissions through 2020.[162] Although the exact quantity of free allowances is not publicly available, the CEU's reported emissions in CP1 and CP2 were 396,490 tCO_2e and 599,211 tCO_2e, respectively, giving a general idea of the magnitude of the CEU's free allowance allocation.[163] While the SJGS plant continued to operate, however, the freely allocated allowances proved insufficient, and freely allocated allowances may not be used to compensate for emissions from electricity purchased from CAISO. These deficiencies mean that the CEU has had to participate in quarterly allowance auctions, imposing compliance costs.[164] It has also created an opportunity for compliance offset utilization.

SB 350, also known as the Clean Energy and Pollution Reduction Act of 2015, increased existing mandatory Renewable Portfolio Standard for electric Load Serving Entities (LSEs) from 25% by 2016 and 33% by 2020, to 50% by 2030 and mandated that LSEs increase their renewable portfolio by 2% per year starting in 2021. From 2011 to

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[162] "City of Colton Electric Department 2017 Integrated Resource Plan."
[163] CARB, "2013-2014 Compliance Report"
CARB "2015-2017 Compliance Report"
[164] "City of Colton Electric Department 2017 Integrated Resource Plan."

2013, the cost for the CEU of meeting its RPS was so high that it was unable to comply, and instead claimed a cost-limitation delay allowable under SB 32.

As California has increased its Renewable Portfolio Standard and higher levels of wind and solar enter the grid, many electricity generators have claimed that they are being run out of business, creating support for a centralized capacity market. This type of market secures power delivery contracts years in the future, which advocates argue creates grid reliability and financial certainty. Detractors argue that capacity markets slow technological advancement and can result in excess generation capacity.[165] Uncertainty over the future of a Californian capacity market has created uncertainty about long-term energy procurement and costs for the CEU.[166]

CEU Response to Cost Concerns

Given the 20 to 50-year lifespan of transmission resources and the potential for long term contracts arising within a capacity market, the CEU faces conflicting desires to reduce costs today in response to current legislation and to avoid changes that may lock it into suboptimal, higher-cost circumstances in the future. So far, this tension has prompted a conservative attitude toward supply-side action. Although some changes, like procuring adequate renewable energy under RPS requirements, are necessary by law, the CEU "believes that it is better for the community and the CEU to reduce customer demand through conservation programs and rebates, rather than purchasing additional generation resources from power marketers."[167] Consequently, all the CEU's formerly voluntary

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[165] McCabe and Moore, "PJM's Capacity Market Proposal."
[166] "City of Colton Electric Department 2017 Integrated Resource Plan."
[167] Ibid.

rebate and efficiency programs have become part of its compliance strategy to increase efficiency and reduce energy use and compliance costs.

Offsetting, however, has not been a significant part of the CEU's cost-saving strategy. If the CEU had submitted 8% of its compliance obligations as offsets, it could have legally submitted 79,655 offsets across both compliance periods 2013-2017, realizing gross cost savings of nearly $80,000. This value does not account for the transaction costs associated with offset procurement, but it still represents a sum of money that could have alleviated a portion of the CEU's cost concerns. Even if the CEU's freely allocated allowances covered all the CEU's emissions, maximizing offset submission early while offsets are cheaper can allow firms to save more valuable excess allowances for later use, saving additional costs in the long term. Nevertheless, while the CEU has consistently submitted offsets, it has submitted extremely few each compliance period—88 ODS offsets in CP1, representing .022% of Colton's emissions, and 85 ODS offsets in CP2, representing .014% of Colton's emissions. The CEU's apparently foregone cost savings and simultaneous commitment to such a small number of ODS offsets suggests that values other than cost savings are driving the CEU's offsetting behavior and that ODS offsetting may reflect preferences of the CEU. To gain some insight into the CEU's offset-related values, I interviewed Dr. David Kolk, the Director of Utilities of Colton, and Jessica Sutorus, Colton's Environmental Conservation Supervisor, over the phone October 29, 2018.

Interview with Dr. Kolk and Ms. Sutorus

Speaking with Dr. Kolk and Ms. Sutorus revealed that transaction costs and concerns over offset risk have prevented the CEU from buying offsets, but that offsets awarded for pre-existing program have nevertheless contributed to the CEU's compliance obligations.

Moments into our conference call, Dr. Kolk expressed his confusion at my interest in Colton's offsetting behavior, since, he said, "I didn't claim any offsets as part of our compliance." If Ms. Sutorus received any, he went on, they would have taken them and hopefully sold them. Any offsetting in Colton, Kolk assured, "is news to me."

When I explained that CARB's publicly available compliance records indicate that Colton has engaged in offsetting, Ms. Sutorus suggested, "don't we get those from the refrigerator program?" and an explanation for Colton's offsetting behavior began to take shape. Sutorus continued that she didn't think that the program was generating offsets, but that the CEU recycles 50 to 80 refrigerators per year through its refrigerator replacement program—a potential source of ODS. Kolk and Sutorus surmised that when the CEU became a compliance entity, its preexisting refrigerator recycling program must have become part of an offset generating project that had credited the CEU with ODS offsets. It was a discovery for all of us. "Neither of us knew about it," Dr. Kolk said, "we didn't do anything with them."

Neither Kolk nor Sutorus expressed concerns over being given offsets, but Kolk made clear that purchasing offsets is not an important part of Colton's strategy. "It's not worth our time to buy an offset versus a renewable energy source," he said, adding that offsets often include too much risk. In the "early years" of offsets, he said, people were buying them from the "Amazon basin," and there was no way to know if the emissions reductions generating them were real or if they had been already sold to someone else. Verification concerns, according to Kolk, continue to negatively impact the California

Energy Commission's view of offsets, causing it to discourage their use. In addition, offsets are difficult to get—just not a "typical tool" used by the CEU.

The day after our interview, Dr. Kolk emailed me to say, "We just verified that the offsets are transferred to us through the California Tracking System Service (CTSS) from the Clime-Co. We get them for recycling the refrigeration through our refrigeration program." This confirmation officially put to rest any mystery surrounding Colton's ODS offsets, and in conjunction with Kolk's reasoning against Colton's offset use, provide insight into the offsetting behavior of local utilities like the CEU.

Discussion

Some of the CEU's reasons against offset use are unsurprising and rational, while others indicate a level of misinformation and overvaluation of the risks involved with offsetting. The claim that offsets are not worth the CEU's time, for example, is predictable. Transaction costs involved in working with an offset broker or establishing a project would have reduced the $80,000 of potential gross savings, and across 2013-2017, $80,000 is a small sum of money compared to other business-as-usual costs borne by the CEU. Even aside from operating costs, incidental costs dwarf $80,000; from just 2012 to 2013, for example, the utility lost more than $360,000 due to thieves stealing the metal plates off of damaged patches of road throughout the town, and ultimately had to pay $110,000 to settle a lawsuit with a disabled man who fell into an improperly covered electricity maintenance trench.[168] While these expenses are unrelated to the CEU's

[168] Parrilla, "Colton Pays $110,000 in Settlement with Disabled Man."

emissions, they illustrate the magnitude of business-as-usual costs that the CEU incurs. When the CEU's staff availability is also taken into account, offsetting looks even less attractive. When offset savings will yield less than $20,000 per year, an individual cannot be hired exclusively to navigate offset procurement and compliance, and offsetting would add to the workload of already busy CEU or city employees.

The CEU's concerns over offset risk are less supported. While verification is indeed difficult to guarantee as discussed in Chapter One of this thesis, the number of offsets that have been invalidated is minute. Only 88,955 offsets have been invalidated out of more than 145,000,000 produced (about .06%), and incidentally, all of the invalidated offsets were from an ODS project, the same type of offset that the CEU has exclusively submitted. The CEU would not be the first firm to interpret CARB's invalidation of these ODS offsets as an indication of wider market vulnerability—as Ecosystem Marketplace reported in 2015, the invalidation inquiry into the ultimately invalidated ODS offsets created uncertainty among market participants and "shadowed" the market long after, reducing buyer and project developer participation.[169] As time has passed however, no other invalidation events have occurred, and the scope of invalidation risk continues to be small.

Concerns that low-quality Amazonian offsets are infiltrating the CCM are also unfounded. All compliance offsets in California are generated by CARB's protocols, which only operate within the boundaries of the United States. The CEU's concerns indicate either a false understanding of Californian compliance offset production or a

[169] Gonzalez, "Invalidation Risk Still Shadows California Offsets Market."

perception of risk developed in the voluntary market (where some protocols do generate offsets in the Amazon) that is erroneously applied to the CCM. Claims that the California Energy Commission shares the CEU's disapproval of offsetting could not be verified.

Conclusions

At 599,291 tCO_2e covered in CP2, the CEU is a relatively small emitter in the CCM, so its individual offsetting behavior has little effect on the offset market at large or the environment.[170] Even so, the CEU shows that even as electricity generators face the pressures of a transition to renewable energy, offsetting does not always create cost savings that are large enough to warrant staff members' time and energy, especially when staff are limited. Having fewer staff members also means that an individual's opinion or understanding of policy can drive the offsetting behavior of an entire firm, leading it to behave according to the beliefs of an individual. This allows the behavioral idiosyncrasies inherent to individuals, such as misperceptions of risk, to influence market behavior.

Case Study: CP Energy Marketing (US), Inc.

CP Energy Marketing (US), Inc. (CPEM) is an extremely small emitter—only responsible for 1,502 tCO_2e in CP1—but it submitted 120 ODS offsets to fulfill 7.989% of its compliance obligations, the maximum quantity allowable by law. The cost savings

[170] To put the CEU's emissions in perspective, firms that emitted more than the CEU were collectively responsible for 96.76% of California's covered emissions in CP1 (CARB, "2013-2014 Compliance Report").

created by purchasing and turning in 120 offsets are miniscule, prompting the question: why utilize offsets at all?

This case study will show that in CPEM's case, compliance offsetting does not express environmental values beyond cost savings, however negligible. Although CPEM is responsible for very few emissions in the California Compliance Market, it is a subsidiary of the Capital Power Corporation, a much larger Canadian company with the staff, inclination, and experience to procure even a small number of offsets for CPEM. The phenomenon of a larger parent company assisting a subsidiary compliance entity in compliance offsetting may help explain why many small emitters maximize offset usage. It also illustrates that market experience and designated staff members can overcome transaction costs to make submitting even a small number of offsets practical.

CP Energy and Albertan Capital Power Corporation

The Capital Power Corporation is a "growth-oriented North American power producer headquartered in Edmonton, Alberta." The Corporation has indeed been growing steadily, acquiring more energy producing capacity each year since its $500 million initial public offering in 2009, when it had interests in 31 facilities in Canada and the U.S. totaling approximately 3,300 megawatts of generation capacity." By the time California's CP1 began in 2013, Capital Power owned more than 3,600 megawatts of generation capacity across 16 facilities in North America and was developing an additional 595 megawatts of owned generation capacity in Alberta and Ontario. By 2018, Capital Power owned approximately 5,100 megawatts of power generation capacity at 25 facilities, was pursuing contracted generation capacity throughout North America, and was developing an additional 1,000 MW of owned generation capacity in Alberta, North Dakota, and Illinois.[171] The Capital Power Corporation's growth trajectory and interests in multiple states and provinces in the United States and Canada have led to the development of subsidiaries, including CPEM, and has necessitated regulatory compliance across many jurisdictions.

Capital Power Corporation Greenhouse Gas Regulatory Compliance

The Capital Power Corporation has extensive experience complying with environmental regulations at the federal, state, and provincial level that address "air emissions; wastewater discharges; wildlife and habitat protection; hazardous material handling, storage, treatment, and disposal of waste and other materials; and remediation of sites and land-use responsibility."[172] It must also comply with regulations that set GHG reduction goals, which have imposed significant expenses upon Capital Power and compelled it to participate in multiple GHG markets. Alberta's GHG regulation has had the largest effect on Capital Power's operations, but British Columbia and the United States, particularly California, have also regulated Capital Power's emissions and provided opportunities to utilize compliance offsets. By 2013, when CPEM became a compliance entity in California, Capital Power was already an experienced GHG market participant and large-scale offset buyer in other markets.

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[171] "News Releases Pre-IPO to 2019."
[172] "Annual Information Form Capital Power Corporation 2014."

Alberta GHG Regulation Experience

Capital Power's native province provided years of experience in compliance offsetting prior to CPEM's involvement in the CCM. Alberta's Specified Gas Emitters Regulation (SGER), which came into force in 2007, established the first compliance offset market in North America and applied to all facilities in Alberta that produced over 100,000 tCO_2e per year. SGER mandated a 12% reduction in CO_2e intensity from the average CO_2e intensity of each facility from a 2003 to 2005 baseline period and was neither a cap-and-trade system nor a carbon tax per se, but defined three methods for achieving compliance:

1. Reduce operational emissions below 100,000 tCO_2e
2. Pay the Government of Alberta Climate Change Emission Management Fund \$15 per tCO_2e for each tCO_2e emitted in excess of the emission intensity target
3. Purchase GHG emissions offsets created from Alberta-based projects

The desire to minimize high compliance costs borne under SGER made offsetting a pillar of Capital Power's compliance strategy. Capital Power's 2014 compliance costs for its 1106 MW of owned generation capacity and 860 MW of contracted for generation capacity in Alberta totaled \$11 million, not all of which could be recovered from consumers, and as a contractually obligated power buyer, Capital Power was also on the receiving end of \$3.3 million of passed-down compliance costs. Capital Power's 2014 Annual Information Form states that by 2014, the company had been "acquiring offsets for almost a decade," and that in 2014 alone, it had "entered into more than 42 offset purchase agreements across North America," totaling approximately $15 million of offset investment (up from $9 million in 2013). Compared to the cost of paying Alberta's Climate Change and Emission Management Fund, Capital Power estimated that its investments in offsets resulted in savings of approximately $1.2 million in 2014."[173]

British Columbia GHG Regulation Experience

British Columbia (BC) enacted North America's first carbon tax in 2008, which began at $10 per tCO_2e and increased each year until it reached $30 in 2012.[174] While the tax increased the operating costs of Capital Power's single fossil-fuel-fired power plant in BC, contractual arrangements have allowed environmental costs to be passed down to BC Hydro through 2022. In 2012, Capital Power expected the BC Government to operationalize a cap-and-trade system and to harmonize it with the Western Climate Initiative, a combined market also including Ontario, Quebec and Manitoba at the time. Although Capital Power did not have enough information to determine the costs of a such a cap-and-trade program, the prospect of one replacing BC's carbon tax made emissions trading experience essential to Capital Power's compliance strategy.[175]

United States GHG Regulation Experience

In 2012 and 2013, the United States EPA, ten states involved in the Regional Greenhouse Gas Initiative (RGGI), and California each imposed separate GHG emissions

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[173] "Annual Information Form Capital Power Corporation 2014."
[174] Murray and Rivers, "British Columbia's Revenue-Neutral Carbon Tax."
[175] Ibid.

mitigation regulation and emissions trading procedures on Capital Power, increasing its GHG market and offset procurement experience. Overall, Capital Power's compliance in California has proven to be one of the most low-cost, insignificant uses of offsets in the history of Capital Power's GHG market participation.

The EPA regulates GHGs under the Clean Air Act, which at the time required "best available control technology" for new large, stationary GHG sources and for major modifications to existing sources. Since 2005, it has also required reductions in NO_x and SO_2 emissions via the Clean Air Interstate Rule, for which Capital Power's power plants in the US must buy and retire NO_x and SO_2 credits. In addition, as of March 2012 the EPA implemented a Carbon Pollution Standard, which set a national carbon emissions intensity target of 1,000 lbs. CO_2 per MWh of electricity for each new fossil-fuel-fired power plant. While the target did not affect Capital Power's existing US plants, the impact on future plants and of future regulation applying to existing sources necessitated close attention to EPA GHG mitigation plans.

When RGGI launched in 2008, it became the first market-based GHG mitigation program in the US and its earliest compliance offset market. RGGI established a regional cap on CO_2 emissions from power plants located in ten states and enabled compliance entities to utilize offsets for 3.3% of their compliance obligations. In 2012, RGGI covered three New England facilities owned by Capital Power, requiring them to possess tradeable permits or offsets for each short ton of CO_2 they emitted. Including offset-derived savings, Capital Power's compliance costs under RGGI totaled $4.2 million in 2012, demonstrating its experience complying with costly GHG regulation.

Capital Power's participation in California's compliance GHG market via CPEM was short, low-cost, and administratively non-complex compared to its other GHG market experiences. Capital Power does not own any power plants in California, but sales of electricity into California during a single year, 2013, necessitated reporting and compliance with AB 32. With years of practice participating in other GHG markets and experience handling millions of dollars of compliance costs, procuring 1,328 emissions allowances and 120 offsets for CPEM was a negligible burden—a small, yet representative example of Capital Power's general cost-saving compliance strategy.[176]

Discussion and Conclusions

Capital Power's expansion into multiple states, provinces, and countries in North America has necessitated compliance with a wide variety of regulatory regimes and developed deep offsetting experience within the Capital Power commodity portfolio management group (CPM). By 2012, the CPM lists as one of its primary function, "compliance with existing and emerging market-based environmental regulations" using "GHG offset investments" to "proactively manage potential compliance risks and costs." When Capital Power sold electricity into California via CPEM, Capital Power already had many years and tens of millions of dollars of experience in GHG markets and offset investments. It also had a sizeable staff working in the United States—by 2013, 178 out of Capital Power's total 939 employees worked in its US operations.[177] The small magnitude of Capital Power's compliance obligation in California coupled with the

[176]Ibid.
[177] "Annual Information Form Capital Power Corporation 2012."

company's experience and staff members made maximizing offsetting a simple, business-as-usual task.

Case Study: The University of California

The University of California (UC) is an organization of 10 public university campuses and five medical centers located throughout California. that employs more than 190,000 faculty and staff, making it one of the largest employers in the CCM.[178] The UC stands out in the CCM because it participates in compliance and voluntary offsetting simultaneously, demonstrating a desire to minimize compliance costs while also voluntarily spending to showcase environmental values.

The UC's commitment to sustainability predates AB 32 regulation and has motivated ambitious, self-imposed emissions reduction goals in addition to those mandated under AB 32. The UC has used carbon offsets to progress toward both goals, but the purpose and type of offsets differ between them. Compliance offsets are used exclusively to meet regulatory requirements, while voluntary offsets allow the UC to go above-an-beyond to meet carbon neutrality goals.

The UC's Sustainable History and Identity

The UC system's ties to the health of the environment date to its origins in the mid-19th century when the College of California offered its buildings and resources to the State-founded Agricultural, Mining and Mechanical Arts College. The so-called

[178] "The UC System."

"complete university" that resulted was fundamentally rooted in California's agricultural tradition and tied to the State government.[179] In 1878 as the UC continued to expand, it established the Agricultural Experiment Station, which has continued to develop knowledge that "will ensure a continuing supply of nutritious foods, useful fibers, and natural resources products in adequate amounts at low cost without adverse effects on the physical environment or consumer."[180]

Over time, the desire to ensure a high-quality physical environment for future generations has evolved into an investment strategy committed to the modern concept of sustainability, defined by the Brundtland Commission and referenced on the UC's website as "activity that meets the needs of the present without compromising future generations' ability to meet their own needs."[181]

The UC formalized that commitment in 2003 through a student initiative that led to the UC Regents adopting the Presidential Policy on Green Building Design and Clean Energy Standards. In 2004, the UC established a comprehensive Sustainable Practices Policy, which establishes goals in nine areas: green building, clean energy, transportation, climate protection, sustainable operations, waste reduction and recycling, environmentally preferable purchasing, sustainable foodservice, and sustainable water systems. Progress toward each of the nine goals is published in a comprehensive Annual Report on Sustainable Practices, which is publicly available online in a transparent expression of sustainable values.[182]

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179 University of California, "A Brief History of the University of California"
180 University of California, "Agricultural Experiment Station"
181 University of California, University of California, "Sustainable Investment."
182 University of California, "Sustainability."

Emissions reductions became a central focus of UC sustainability in November of 2013, when UC President Janet Napolitano announced the Carbon Neutrality Initiative—a commitment to emit net-zero greenhouse gasses from all UC buildings and vehicles by 2025.[183] The title "Carbon Neutrality Initiative" implies carbon offsetting—it does not promise to reduce emissions to absolute zero, but to net zero, by compensating for emissions with offsets. The Initiative was the first of its kind in the nation and has demonstrated the importance of sustainability to the UC's prestige and institutional identity. In President Napolitano's words, "if we invest in our own research and change the game on energy consumption, then UC will demonstrate to the nation, and beyond, the fundamental and unique value of a world-class public research university."[184]

In 2015, two years into the Initiative, the Office of the Chief Investment Officer of the Regents (OCIO) also committed to using its $100 billion endowment to advance sustainability by approving the Framework for Sustainable Investing. The Framework moves beyond value statements, asserting that "Sustainability is not a "checked box," but a critical component of risk management and maintaining dependable returns across multiple generations. "We do not seek merely to establish a "sustainability policy" for our holdings," wrote the OCIO, "but rather to embed sustainability analysis into our investment culture."[185] Following the Framework's approval, "the OCIO's global ranking on sustainability rose by eight spots to be ranked 17th among all worldwide investment funds and ranked first among university investment funds addressing climate change."[186]

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183 University of California, "Carbon Neutrality Initiative."
184 UC Office of the President, "President Napolitano Proposes Tuition Freeze, New Systemwide Initiatives."
185 Office of the Chief Investment Officer of the Regents of the UC, "Sustainable Investment Framework."
186 University of California, "Sustainability."

The Framework for Sustainability is another concrete example of the UC's willingness to invest in environmental goods and services not only to advance sustainability, but also to showcase its values.

Offsets, AB-32, and the UC

AB 32 has covered the UC's emissions since CP1 in 2013. In the first several allowance auctions, the UC purchased allowances. In subsequent years, CARB granted free allowances to UC to alleviate financial burdens and recognize that they "were already devoting considerable effort to directly reduce their emissions."[187] The UC's response to AB 32 has been coordinated by a cap-and-trade steering committee containing representatives from nine campuses and one medical center. While campuses individually verify and report emissions directly to CARB, the Office of the President "maintains account holdings and documentations and ensures regulatory compliance." According to the UC, "This structure allows campuses to make cap-and-trade purchase decisions independently with advice from the Office of the President and consultants. Thanks to the sequestration of funds earmarked for compliance and returns on those early investments, UC's current cap-and-trade program is now fully funded through about 2025. Thus, the program has been an effective strategy to cost-effectively administer UC's regulatory compliance obligations regarding greenhouse gas emissions." Today, nine out of 15 UC facilities are mandatorily regulated under AB 32, and one facility has opted into regulation.[188]

[187] UC Office of the President, "Carbon Neutrality at the University of California."
[188] UC Office of the President, "Carbon Neutrality at the University of California."

When interviewed over the phone, Nick Balistreri—a Renewable Energy Manager of the Regents of the UC who works with offset brokers to buy the UC's offsets—described a clear dichotomy between the UC's value-motivated offset purchases and its compliance-motivated offsetting.[189] In the compliance market, the UC has always utilized its full 8% of offsets to seize the maximum available cost savings. As Balistreri pointed out, offset prices have consistently lagged about 10% behind allowance prices, creating a constant opportunity to exploit offset-derived savings. Even in the future when offset use must drop to 4%, then 6%, Balistreri emphasized that the UC will take what cost savings it can get. Even if the savings aren't huge, the risk of offset invalidation is so small that engaging with offsets still makes sense. At the end of the day, Balistreri emphasized, procuring compliance offsets "kills two birds with one stone," since offsets trade at lower prices than allowances and help reduce the UC's carbon footprint.

Balistreri also asserted that the UC is different than most other firms, which in his view buy compliance instruments year by year to satisfy their obligations, rather than planning long in advance. Instead, the UC has always planned for the future and anticipated rising offset prices, so their strategy has been to buy early, spending and taking on risk today so that the future is less costly and risky. Part of what has enabled the UC to think long-term is that offsetting has not been "administratively complex." Balistreri works as a dedicated internal resource with the UC's offset broker, and the UC has economies of scale. Balistreri chuckled and said that offsets really only make sense

[189] Interview conducted via phone October 24, 2018

when you're buying "at least 1,000" at a time and when you have a staff member dedicated to the job.

When it comes to offset project location, the UC does value in-state projects more than out of state projects, but it has been difficult for the UC to target offsets in-state due to supply constraints.

When the opportunity arose in 2016 to buy offsets from within California, Balistreri "jumped on it." Given the new requirement mandated by AB 398 that after 2020 at least 50% of offsets must come from projects within California, the UC would love to "sit on" the offsets it already has from within California, doling them out over time to enable continued maximization of offset use. In Balistreri's view, the UC, like many other firms, would like to "load up" on California-produced offsets now. Complying with regulation today, though, is the highest priority, so the UC may use up its in-state offsets prior to 2020. "At the end of the day," Balistreri said, "the goal is to meet the regulatory objective." In general, that has made the UC "not too discerning" between offset types—its apparent preference for ODS offsets does not reflect true values or preferences.

In the voluntary market, meanwhile, the Regents of the UC plan to "ramp up" offset purchases to meet their 2025 Carbon Neutrality goal. Currently, the Regents are asking questions like "what is the UC?" and "do we want [our offsets] to reach a higher bar?" In the voluntary market, the UC's preferences for higher quality and local offsets are strong—the UC recognizes its ability to promote sustainable social norms and demonstrate leadership. The "subjectivity" of the voluntary market enables the UC to express its values with purpose and intentionality.

UC Discussion and Conclusions

The UC exemplifies the classic offsetting approach of both compliance and voluntary buyers. In the compliance market, cost containment is the UC's focus. Economies of scale are essential to offset use, both in the ability to pay a dedicated staff member to handle offsetting and in buying large quantities of offsets at once. Various types of offsets are all viewed as equally valuable—the UC will buy whatever is available in the market, and the co-benefits attached to various offsets do not factor into procurement. This behavior coincides with that of many large emitters in the CCM who utilize large quantities of offsets and whose mix of submitted offsets match the mix supplied to the market. If the mix of supplied offsets were to change, the mix of compliance offsets that the UC submits would likely change proportionately.

At the same time, the UC utilizes voluntary offsetting as a platform to demonstrate sustainable values and exercise its preferences for specific offset-generating activities and locations. Voluntary offsetting allows the UC to compensate for emissions that are not covered by California's emissions cap, allowing it to pursue "carbon neutrality," a status associated with greater commercial success. Carbon neutrality may boost employee morale, allow greater brand differentiation, and create good will and a better reputation among stakeholders. While these are attractive benefits to any business, from the perspective of long-term emissions mitigation, the benefits of carbon neutrality are unclear. Firms that achieve carbon neutrality via offsetting may hope that they inspire others to sustainable action, but voluntary offsetting may also weaken firms' ambition to lower their own operational emissions and be too expensive or complicated for inspired firms to participate in.

Case Study: The Los Angeles Department of Water and Power

The offset submission behavior of the Los Angeles Department of Water and Power (LADWP), given its potential for offset-derived cost-savings, is singular in the CCM. Although LADWP is one of the largest regulated emitters participating in the cap-and-trade system, its compliance strategy does not include the purchase and submission of compliance offsets. The LADWP is not against offsetting, but demonstrates an alternative approach to cost-effective compliance that prioritizes operational emissions reductions achieved via power providers' unique ability to change their fuel mix over time.

Background Information

LADWP was founded in 1902 to deliver water to the City of Los Angeles. When it also began supplying electricity in 1916, LADWP began a long history of growth accompanied by GHG emissions from fossil fuel combustion.[190] Today, the LADWP is the largest municipal utility in the nation and employs 9,400 people, supplying 26 million megawatt hours of electricity per year through an infrastructural footprint that stretches across 23 generation plants, 308,523 utility poles, and 15,000 miles of transmission lines.[191]

The historical fuel mix of LADWP, like most electricity generators and providers in the United States, has been dominated by coal. In recent decades, however,

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[190] LADWP, "LADWP Facts and Figures."
[191] LADWP, "Facts & Figures."

California's Renewable Power Standard has driven significant changes in LADWP's provision of renewable power. On May 23, 2005, prior to the passage of AB 32, the Board of Water and Power Commissioners of the City of Los Angeles (the Board) adopted RPS Policy that "established the goal of increasing the amount of energy LADWP generates from renewable power sources to 20 percent of its energy sales to retail customers by 2017, with an interim goal of 13 percent by 2010."[192] In 2007, the Board increased the ambition of LADWP's Renewable Power Standard, raising the 2010 goal to 20% renewable energy. LADWP met this goal through an aggressive combination of new renewable power acquisition and the phase-out of older coal facilities (Figure 3.10, Appendix I).

June 2010 marked the release of the Los Angeles City council's new sustainability plan, "Water & Power Long Term Strategy – Building a New Los Angeles," and of LADWP's completion of its Pine Tree Wind Farm, a wind power facility that now generates up to 135 MW of power, enough to serve over 63,6000 households "while reducing 215,000 tons of greenhouses gases per year—about the same as removing 41,330 cars from the road."[193] Renewable power acquisitions and expansions like this exemplify LADWP's approach to emissions mitigation: long-term, large scale changes to its power mix. Since 2010, LADWP has continued to expand its renewable generation capacity in preparation for future RPS targets (Figure 3.11,

[192] LADWP, "Renewables Portfolio Standard Policy and Enforcement Program."
[193] LADWP, "Greening the Grid."

Appendix I)[194]. By 2016, LADWP had exceeded the mandatory 25% target by 4%, and has since stayed on track for the 2020 goal of 33%.[195]

AB 32 Compliance

In CP1, LADWP was the single largest emitter in the CCM, responsible for 29,483,232 tCO_2e. The next largest emitter, Chevron USA, only reached 20,771,539 tCO_2e. In CP2, however, LADWP dropped to eighth place behind Tesoro Refining and Marketing, Chevron USA, Phillips 66, Southern California Gas Company, Pacific Gas and Electric Company, Shell, and Valero. This was due to a scheduled expansion of the cap-and-trade system in 2015 to include fossil fuel distribution and due to LADWP's efforts to change its power mix and reduce it emissions. While Chevron's average yearly covered emissions covered emissions increased from 10,385,769 tCO_2e to 43,217,457 tCO_2, LADWP's efforts decreased its average yearly emissions from 14,741,616 tCO_2e to 11,061,772 tCO_2e per year.

In both compliance periods, despite the appearance of potential cost savings, LADWP's compliance offset submissions were minute. In CP1, LADWP submitted 14,813 offsets, .05% of its emissions obligations, and in CP2, just 3,597, .01% of its emissions obligations, far fewer than the 8% maximum limit. All of LADWP's submitted offsets were generated via the ODS protocol. This submission behavior differs from essentially all compliance firms responsible for similar quantities of emissions. In Figures

194 LADWP, "LADWP 2017 Power Content Label."
LADWP, "LADWP 2016 Power Content Label."
"LADWP Power Supply Since 2003 | Los Angeles - Open Data Portal."
195 LADWP, "Briefing Book 2017-2018."

3.2 and 3.3, LADWP is represented by the bottom-right-most dot—a clear outlier given its potential for turning in offsets and seizing cost savings. Between both compliance periods, LADWP could have turned in 5,013,473 offsets, seizing more than $5 million in estimated gross compliance costs.[196] The reason why LADWP did not purchase offsets is that there is the risk that CARB could deem the offsets invalid at a later date, which could lead to future noncompliance with CARB's rules (i.e. having insufficient emissions allowances for compliance).[197]

Interview with LADWP

Speaking with members of LADWP's Environmental Affairs team revealed that LADWP has no aversion to offsetting, but that it has prioritized operational emission reductions through the transition to renewables rather than offsetting. Indeed, LADWP's lack of offset submissions does not reflect foregone cost savings, but a desire to maximize other sources of long-term cost savings.[198]

When I reached out to Maria Sison-Roces, Manager of Corporate Sustainability Programs, she set up a call that also included Mark Sedlacek, Director of Environmental affairs and Carol Tucker, Senior Public Relations Specialist. I had already sent in questions to LADWP's HR department, which asked what the LADWP's focus is in terms of sustainability, how offsets fit into LADWP's vision of sustainability, why

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[196] Transaction costs associated with offset procurement would reduce net revenue, but this upper bound on cost-savings indicates the approximate order of magnitude of LADWP's potential offset-derived cost savings.

[197] This clarification comes from an email correspondence March 11, 2018 with Carol Tucker, Senior Public Relations Specialist of LADWP.

[198] Interview conducted via phone with Maria Sison-Roces, Mark Sedlacek, and Carol Tucker (Senior Public Relations Specialist) December 13, 2018.

LADWP has not utilized the full 8% of offsets, and why the offsets it has submitted have all been generated via the ODS Protocol.

Sedlacek was extremely forthcoming—while offsets are certainly something LADWP looks at, its focus is on allowances issued by CARB and on funding projects that improve its renewable resource mix and dispatch capabilities. This approach delivers the same results—decreased emissions and compliance costs—within LADWP's system, decreasing risk while enabling greater control and long-term benefits. While offsetting may suit other business models, "We can change out our fuel resources," said Sedlacek.

Sedlacek also emphasized that RPS requirements are just a "starting point" for LADWP's focus on the shift to renewables. SB 1368, passed in 2006, also contributes by preventing long-term investment in coal-fired power plants, and other long-term infrastructural updates have decreased operational emissions. In 2016, LADWP proactively instituted a "carbon adder," which internalized the cost of GHG emissions and significantly decreased the coal power dispatched to the grid. As a municipal power provider, the desire to minimize financial risk and focus on what is within LADWP's wheelhouse has led to a strategy that does not include offset procurement. The only offsets that LADWP has submitted have been ODS offsets produced through a refrigerator recycling program that predates AB 32.

Conclusions

RPS regulation contributed to LADWP's transition to renewable prior to AB 32 and has enabled LADWP to cut operational emissions cost-effectively, making offsetting unnecessary. When cap-and-trade regulation imposed further costs on LADWP, changing its power mix remained the priority of its compliance strategy and has continued to deliver emissions reductions and cost reductions over time. Just as in Colton, discussed earlier, a pre-existing refrigerator recycling program is responsible for LADWP's offset submissions rather than a concerted effort to procure compliance offsets. Unlike in Colton, LADWP's staff emphasized that LADWP is not against offsetting. Devoting time and energy to changing its fuel mix has simply fit LADWP's long-term goals better. The offsetting behavior of LADWP ultimately demonstrates that when a firm has an opportunity to cost-effectively reduce operational emissions, a desire to minimize costs can actually incentivize low, rather than high, levels of offset utilization.

Chapter 3 Discussion and Conclusions

Departures from Expectation

The offset-related behavior of firms in the CCM defies expectations in many ways. The transaction costs, administration costs, and procurement constraints associated with offsetting ought to discourage small emitters from offsetting, while large emitters whose potential cost savings are much larger ought to maximize offset usage. Many firms behave according to these expectations, while others defy them; a number of small firms maximize offset use, while many large firms opt to submit few or no offsets and appear to miss out on cost savings. Some firms of all sizes, meanwhile, consistently submit very a small number of offsets. This behavior suggests that factors other than cost savings drive some firms' offsetting behavior.

The City of Colton Electric Utility (CEU), CP Energy and Market (CPEM), and Los Angeles Department of Water and Power (LADWP) each highlight a different explanation for unexpected behaviors. The CEU does not purchase offsets because it overestimates the risk associated with offsetting, but submits the few offsets given to it through a pre-existing recycling program. CPEM, which appears as a small emitter, is actually the subsidiary of a massive company with deep experience with offsetting, explaining its maximization of so few offsets. The LADWP, while supportive of the idea of offsetting, prioritizes changes to its fuel mix over offset procurement.

At the same time, several general rules of offsetting hold: the type of offsets that case-studied firms submitted did not indicate preferences for co-benefits, but were a product of what was most convenient for them to procure or submit. In addition, case-studied firms confirmed that larger firms are more likely to utilize offsets since they can pay a dedicated individual or team to handle offset procurement and since they can purchase many offsets at once. The exception to this rule is LADWP, which, despite its administrative capacity to offset and apparent potential for savings, devoted its personnel to other aspects of its compliance strategy.

Overall, offsets appear to be underutilized in the CCM, which means that the threats that impermanent and non-additional offsets pose to the integrity of California's emissions cap are not as large as they could be in a maximum-utilization scenario. Nevertheless, more than 75.5 million offsets that have been submitted for compliance, representing a substantial quantity of carbon and financial investment. Further, as the emissions cap declines and compliance becomes more expensive, the proportion of firms submitting offsets may increase, exacerbating issues identified in current protocols.

Implications of Offset Type

Although sub-groups of firms and some individual firms in the CCM (e.g. the CEU, CPEM, and LADWP) submit a high percentage of non-forest offsets, forest offsets—the most problematic variety of California Compliance Offset—are by far the most produced and utilized type of offset, representing 79% of offsets produced to date and 69% of all offsets submitted in CP1 and CP2. Since forest offsets are generated by impermanent emissions reductions, the majority of offsets utilized for compliance in the CCM do not compensate for firms' emissions, compromising the integrity of California's emissions cap. Preliminary analysis by CaliforniaCarbon.Info indicates that the passage of AB 398, which mandated that at least 50% of firms' compliance offsets come from California after 2025, will increase forest offset demand further, since forest offsets are the primary variety produced in California.[199]

Concerns over offset policy's ability to facilitate the trade of methane emissions for CO_2 emissions (discussed in Chapter One) are much smaller in magnitude than the threat posed by forest offsets. Although the submissions of MMC offsets increased by a greater percentage than all other protocols from CP1 to CP2, MMC and livestock offsets still represent a small proportion of the total offsets submitted for compliance. If methane-focused protocols become more productive in the future, concerns over the long-term effects of mitigating methane in lieu of CO_2 will increase.

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[199] Hamshaw, "California Carbon Info."

Implications of Types of Offsets that Different Sized Emitters Submit

Since the offset submissions of the largest emitters in the CCM match the mix of offsets supplied to the market, the largest emitters are responsible for the lion's share of forest offsets submitted for compliance. These firms, which include international oil and gas companies and other energy-intensive, trade-exposed firms, are the primary targets of emissions mitigation policy and are responsible for the largest proportion of current and historical emissions. They also possess some of the greatest capacity to innovate to develop low-carbon technologies. Inexpensive, impermanent forest offsets reduce the pressure on these firms to innovate and allow the largest, most emissive firms to emit GHGs that are not compensated for, compromising the integrity of California's emissions cap.

Smaller emitters in the CCM and large emitters that submit few offsets do not have an outsized impact on the integrity of the CCM, but the differences between the mix of offsets that are produced and the offsets they submit suggest that more study is needed to determine all the factors including cost savings that influence their utilization of offsets. The case studies presented in this chapter suggest only a few factors that motivate firms' offsetting behavior.

Conclusion: Recommendations for Policymakers and Firms Engaged in Offsetting

This thesis has argued that California's four productive carbon offset protocols each present a threat to the integrity of California's cap on greenhouse gas emissions. Although the scope of that threat varies enormously between protocols, California's US Forest Protocol alone has produced over 115.6 million illegitimate offsets—an estimated $1.38 billion worth of temporarily sequestered carbon that cannot compensate for atmospheric emissions.[200]

Faced with the flaws of California's current offset policy, policymakers in California and other carbon markets have two options: improve carbon offset policy for the future, or implement alternative policies that deliver equivalent benefits and avoid the risks of offsetting. Both of these options, as applied in California, can inform the action of policymakers engaged in current and emerging carbon markets worldwide. California's offset protocols also offer lessons for firms engaged in carbon offsetting, whether they participate in compliance markets or are also active in voluntary markets.

Flaws Identified in California's Offset Protocols

Both the Livestock and MMC Protocols present additionality questions that require further examination of projects' financial context. In livestock projects' case, non-offset incentives to install anaerobic manure digesters must be disentangled from the

[200] At $12 per tCO_2e

incentive created by offset generation to determine whether digesters would have been installed regardless of the offset protocol. In mine methane projects' case, the feasibility and potential value of a methane RAU project must be compared to the potential value of a methane-destroying offset project to determine if an RAU project could have occurred in the absence of the offset protocol. So far, 3.9 million livestock offsets have been submitted for compliance out of 5.6 million generated, while 3.8 million MMC offsets have been submitted for compliance out of 5.8 million generated. Estimating the number of these offsets that are illegitimate according to the concerns above requires further study.

The ODS Protocol is less vulnerable to additionality concerns, but does not account for the greenhouse gas emissions of refrigerants that take the place of ODS destroyed by the protocol. This means that destroying ODS may increase net emissions by accelerating the transition to ODS that are more potent GHGs, which will leak over the operational lifespan of equipment. So far, 15.7 million ODS offsets have been submitted for compliance out of 18.9 million generated. Just as with livestock and MMC offsets, determining the scope of this potential offset over crediting requires further research.

The Forest Protocol arbitrarily equates 100-year sequestration with permanent sequestration, a convention that is not supported by science. As a result, all offsets generated by the protocol are unable to compensate for real CO_2 emissions into the atmosphere by compliance entities on a climate-relevant timescale. Even if CARB were to mandate that forest project extend ad infinitem, it would be administratively and financially impossible to enforce sequestration activities long enough to fully offset today's emissions into the atmosphere. It follows that all 52,068,592 offsets submitted for compliance so far (68.9% of total submitted) and all 115,610,154 generated so far (79% of total produced) are illegitimate and undermine California's emissions reduction goals.

Implications for Global Offset Policy

The flaws in California's protocols have implications for the CCM and for current and future offsetting and carbon neutrality schemes worldwide. The United Nations Framework Convention on Climate Change (UNFCCC) has not yet adopted the rules and modalities for the international market mechanism described in Article 2.6 of the Paris Agreement, and the International Civil Aviation Organization (ICAO) has not yet confirmed which offsetting activities will be eligible in its Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). California's four productive offset protocols target activities that release substantial GHG emissions worldwide, making all four protocols, particularly the US Forest Protocol, valuable models for international offset programs. Learning from California's protocols and correcting flaws where possible will be essential to establishing international offset policies that offer meaningful climate benefits.

Of the four California compliance offset protocols examined in this thesis, the US Forest Protocol and its inherent impermanence issue has the most significant ramifications for global emissions mitigation efforts. Forest sequestration is one of the top offset-producing activity worldwide, and future estimations of forest offset supply range from 1.3 to 4.3 billion tCO_2e per year at less than \$20 per tCO_2e.[201]

This potential makes forest offsetting an attractive opportunity for the UNFCCC's international mechanism and CORSIA. Including forest offsets in both mechanisms, however, has already proven contentious. At the 24th Conference of the Parties to the Paris Agreement (COP) in 2018, Brazil's desire to maximize its forests' offsetting potential and to sell its stock of CDM offsets into the new mechanism impeded negotiations for days, preventing the Parties from reaching an agreement about the rules and modalities for a new international offset program. Ultimately, the issue was pushed to COP25, which will be held in 2019.[202] Disagreements over the potential role of forest offsets in CORSIA are well represented by the conflicting opinions of influential non-governmental organizations, including Environmental Defense Fund (supportive), Greenpeace (opposed), Our Children's Earth Foundation (opposed), and many others.[203]

If future national and international offset programs utilize forest carbon sequestration, they must not make the same mistake as California's US Forest Protocol and arbitrarily equate temporary sequestration with permanent sequestration. If they do, the production of illegitimate offsets will dramatically increase, and global emissions will not be compensated for on a climate-relevant timescale. They must also acknowledge that even if project lengths are dramatically extended, it is not possible to be sure that

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[201] Coren, Streck, and Madeira, "Estimated Supply of RED Credits 2011–2035."
[202] "COP24: Key outcomes"
[203] Cooper, "ICAO and Forest Offsets."
Timperley, "Corsia."

sequestration projects will continue long enough to compensate for atmospheric emissions. Until policymakers solve this permanence-enforcement tradeoff, forest offset production must stop.

Recommendations for Policymakers

Millions of tons of GHG emissions and millions of dollars are at stake. In California alone, forest offsets represent more than 115.6 million tons of carbon dioxide that have only temporarily been sequestered and which will allow firms to release permanent emissions into the atmosphere unless policy changes. Policymakers must take action to change offset policy to increase market efficiency, preserve the pressure to develop low-carbon technology, avoid the trade-off between co-benefits and emissions mitigation, and contribute to the political economy of emissions regulation without undermining its integrity.

Improve Market Efficiency

As long as legitimate offsets outnumber illegitimate offsets, offset policy creates net benefits for the climate. However, even while the number of legitimate offsets outnumbers illegitimate offsets, the sale of illegitimate offsets compromises the efficiency of emissions regulation, representing both wasted investment and rent-seeking on behalf of buyers and producers, respectively. Policymaker action today can reduce the number of illegitimate offsets in the market, increasing market efficiency.

In the CCM, illegitimate offsets already outnumber legitimate offsets. Forest offsets comprise a majority of offsets produced and submitted, and still represent only a lower bound on the number of illegitimate offsets in the CCM given concerns raised about the other protocols. Changing Californian offset policy is therefore essential for offset policy to deliver positive net climate benefits.

Preserve Incentives to Develop Low-Carbon Technology

Some may argue that since offset use is typically limited in a compliance market, most of the market will remain intact and will continue to incentivize emissions reductions and technological advancement even if illegitimate offsets enter the market.

The first premise of this argument—namely that offset use is always limited—does not always hold true. It is currently unknown whether there will be a cap on offset use in the UNFCCC's international offset market, and in the case of CORSIA, there is no cap at all. Offsets will be utilized to compensate for 100% of emissions growth in the aviation sector, so ensuring that all offsets are all legitimate is essential.

Even when offset use is capped within a compliance market, the threat that illegitimate offsets pose to the ultimate goal of emissions regulation—the development of new, low-carbon technologies—is too large to allow flawed offset policy to persist. In California, for example, where offset use is capped at 8% through 2020, the Union of Concerned Scientists have argued that utilizing 8% offsets will enable up to 85% of the emissions reductions from 2013 to 2020 to be achieved via offsets.[204] If many offsets are

[204] Mulkern, "Offsets Could Make Up 85% of Calif.'s Cap-And-Trade Program."

illegitimate, most of the apparent emissions ‘reductions’ achieved by the market do not exist.

Offset use in California has so far constituted only 5.9% of California’s total compliance obligations. If this trend continues through 2020 and the Union of Concerned Scientists’ calculations are correct, up to 62% of the emissions reductions mandated by California’s cap through 2020 will be fulfilled with offsets. When more than 60% of those offsets come from forestry and are known to be illegitimate, a significant portion of the emissions reductions mandated in California appear to have been accomplished with offsets that do not compensate for emissions into the atmosphere. This means that net emissions have increased as a result of offsetting and that the financial pressure to develop low-carbon technology has been delayed.

Avoid the Trade-off Between Co-benefits and Emissions Mitigation

Carbon offset policy is often seen as a policy tool that harnesses the financial resources of firms responsible for pollution to create societal co-benefits such as sustainable development. While this is certainly one of the most attractive and meaningful benefits of offsetting, offset policy that does not also ensure, as a first priority, legitimate emissions reductions, also creates costs by enabling regulated firms to pollute above the designated cap on emissions.

While populations near offset project sites may experience co-benefits from emissions-reducing activities, populations near offset buyers may experience co-costs including compromised air and water quality from increased emissions. Offset policy is not designed to evaluate whether the combination of these collateral impacts yields net-benefits for society. Offset policy quantifies benefits purely based upon CO_2e-emissions; if policymakers accept that emissions need not be legitimate but use emissions as a method for creating co-benefits outside the emissions cap, they have no way of knowing that the benefits they create will outweigh the costs that other populations incur.

If offset policy is co-opted to achieve non-emissions related goals regardless of the effect on net emissions, is also creates a tradeoff between the effectiveness of emissions mitigation policy and social goals (i.e. sustainable development). This tradeoff has not been made explicit or been agreed upon by voters or regulated firms, thereby constituting an abuse of policy. While offset projects can promote sustainable innovation and development in unregulated sectors, that should not come at the expense of sustainable innovation and development among regulated sectors, which are responsible for the majority of current emissions and have an outsized effect on future emissions trajectories.

Contribute to the Political Economy of Emissions Regulation Without Undermining its Integrity

Offsetting has historically been included in major emissions mitigation policy to increase compliance flexibility and enable decreased compliance costs, improving the political economy of emissions regulation. Offset policy is not the only flexibility mechanism embedded in emissions mitigation policy, however; the level of the emissions cap, the presence and level of price floors and ceilings for emissions allowances, the quantity and allocation of free allowances, and the scope of a cap-and-trade system's coverage, for example, can all be manipulated to change the financial pressure that firms feel in response to emissions regulation. Since offset policy is not essential, policymakers can solve the problems created by offset policy by replacing offset policy with alternatives that achieve similar benefits.

Two Ways Forward: Better Offset Policy or Alternative Policy

With three changes, California's offset protocols can provide a valuable framework for policymakers interested in designing global offset policy for the future. California's offset protocols also demonstrate, however, that upstream regulatory solutions and preexisting incentive programs can often accomplish the same emissions mitigation goals as offset protocols and decrease the need for offset incentives. Given the difficulty in ensuring reality, additionality, permanence, enforceability, and verifiability and the unintended consequences that offsets can create, alternative methods for reducing emissions outside of a CAT system may offer a lower-risk method for delivering offsets' intended emissions reductions.

Options for Offset Policy Improvement

1. Three Additionality Tests

California's Livestock and MMC Protocols already include two additionality tests: a legal requirement test and performance standard. This thesis has shown that it is also essential to investigate the financial context of projects to determine whether activities would have occurred in the absence of offset incentives. An additionality test that examines the financial feasibility of projects without offset revenue must be included in all future protocols to help ensure offset additionality.

2. Account for Impacts of Substituted Goods

As discussed in Chapter Two, the destruction of ODS for offset generation will accelerate the transition to substitute gasses, which may affect projects' net emissions. Whenever offset protocols incentivize the destruction of materials with substitutes, the emissions impact transitioning to those substitutes must be accounted for in protocols' quantification methodologies.

3. Reevaluate Quantification of Temporary Sequestration

As discussed in Chapter Two, sequestration activities must persist for an extraordinary amount of time to compensate for emissions into the atmosphere—longer than any policy today can guarantee. To overcome the tradeoff between permanence and enforceability of carbon sequestration, ton-year accounting offers one method for quantifying the climate change mitigation benefits of temporary carbon sequestration. Ton-year accounting has not been applied in policy due to uncertainty surrounding the number of ton-years that are equivalent to one permanently sequestered ton, necessitating further research. The political economy of shifting to a ton-year approach may also prove challenging since it dramatically decreases the value of sequestered carbon. Still, an alternative to the current status quo, which severely over values temporarily sequestered carbon, must be found. Until an alternative to current protocols' assumption of permanence has been researched and implemented, forest offset production must cease.

Policy Alternatives

As mentioned above, numerous policy features other than offsets can increase the flexibility of regulatory compliance, rendering offset policy non-essential to cap-and-trade systems. In the context of California's offset protocols, upstream regulatory interventions and preexisting incentive programs can, in many cases, also deliver the emissions reductions and co-benefits of offsets without their inherent risks. This section will suggest potential alternatives to the four types of offset currently generated for sale into the CCM.

Livestock Manure Emissions Management

The current inability to disentangle the incentives for anaerobic manure digestion provided by Low Carbon Fuel Standard credits, Renewable Identification Number credits, installation subsidies, and carbon offsets indicates the extent to which existing policies unrelated to offsets can successfully incentivize improved livestock manure emissions management. Indeed, SB 1383 in California indicates that anaerobic manure methane management will be mandatory within the state as early as 2024, exemplifying the momentum behind anaerobic digester installation and political economy of command-and-control manure management regulation.[205] Expanding non-offset incentive programs and financial support for installation can further increase the adoption rate of anaerobic manure digesters.

[205] SB 1383 mandates a reduction in the statewide emissions of methane by 40% below 2013 levels by 2030 utilizing regulation adopted no sooner than January 1, 2024 (Lara, Senate Bill 1383.). Since livestock manure is a significant methane source in California and anaerobic digestion is a feasible, cost-effective method for reducing livestock manure emissions, livestock owners take SB 1383's methane target as a strong hint to install anaerobic digesters by 2024 ("Implementing CA SB 1383: Dairy Methane Reduction.").

ODS

As discussed in Chapter Two, if the mandatory leakage repair rates mandated by the US EPA were more stringent, there would be no need to incentivize ODS destruction with offsets to avert leakage. Federal leakage requirements were updated in 2019 despite industry disapproval, demonstrating the potential feasibility of increased upstream regulation. Defining a timeline for future decreases in leakage requirements today can create certainty and market incentives for manufacturers of air conditioning and refrigeration equipment to develop equipment that can meet higher leakage standards in the future and reduce or eliminate the need for ODS-targeted offset policy.

Mine methane

Mine methane recovery-and-use (RAU) projects are currently researched and implemented under the US government's Coalbed Methane Outreach Program (CMOP).[206] Although the CMOP has worked voluntarily with the coal mining industry and other key stakeholders since 1994, many sites remain uninvestigated, so it is not possible to know whether more RAU project are feasible. More research is needed to address the feasibility of implementing RAU projects throughout the US without offset revenue. Once it is known how many mining operations are unable to implement an RAU project, it will also be possible to know which sites can only reduce their methane emissions with the revenue provided by offsetting.

Colorado, Indiana, Ohio, Pennsylvania, and Utah also incentivize coal mine methane RAU projects by listing coal mine methane as a renewable or alternative energy

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[206] US EPA, "Frequent Questions About Coal Mine Methane."

source. As a result, power providers can implement RAU projects to satisfy in-state Renewable Portfolio Standards.[207] This policy technique that can be expanded and adopted by other states to increase the number of RAU projects that are implemented without offset revenue.

Forest

Forest conservation and management engage more stakeholders outside of offset production than any of the three activities discussed above. At the national level, the US Forest Service manages the National Forest System, while state governments, local governments, forest industries, and private landowners govern and manage forest land in non-Federal ownership.[208]

Government owned and managed forestland provides one potential pool for improved management through the top-down establishment and enforcement of official best-practices that increase carbon storage. On private lands, numerous Federal financial incentive program promote various management practices, including but not limited to the Forest Stewardship Program, Conservation Reserve Program, Environmental Quality Incentives Program, Forest Land Enhancement Program, and many others. States offer property tax programs and incentive programs, while industry and non-governmental organizations also offer a litany of programs that affect forest land management.[209]

To list and describe every forest and forest-management program offered in the US would be outside the scope and intent of this thesis. As Jacobson et al. (2009)

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[207] US EPA, "Webinar Market Incentives for U.S. Coal Mine Methane Projects."
[208] US Forest Service, "Agency Organization."
[209] Jacobson et al., "Financial Incentive Programs' Influence in Promoting Sustainable Forestry in the Northern Region."

suggest, increased visibility, availability, funding, and streamlining can improve many of these programs.[210] Further research is needed, however, to determine the specific effects of these programs on carbon cycling, which will illuminate which programs to expand to specifically promote increased carbon storage on public and private lands.

Conclusion

These alternatives to offsetting are not an exhaustive list, but are meant to emphasize that there are alternatives to offset policy at the national and state level that can incentivize emissions reductions. Before policymakers consider revising existing offset protocols or adopting new ones, analysis of potential alternatives may reveal more instances where upstream regulation or expanding existing programs can accomplish the emissions reducing goals of offset policy while reducing administrative burdens and avoiding the uncertainties surrounding additionality, quantification, enforcement and verification that are essential to offsetting.

Recommendations for Firms that Utilize Offsets

California's compliance offset protocols also offer lessons for firms participating in compliance and voluntary offset markets. In the compliance market, this thesis recommends features that firms should look for to ensure that they purchase low-risk offsets that represent legitimate emissions reductions. In the voluntary market, the University of California's voluntary offsetting motivates a reexamination of whether achieving carbon neutrality via carbon offsetting shows climate leadership. I will argue

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[210] Ibid.

that it does not, and that firms trying to show climate leadership should reconsider buying offsets.

Seeking Quality in Compliance Markets

Firms participating in compliance markets utilize offsets that are lowest-cost and most available. At the same time, however, it is in buyers' best interest to purchase legitimate emissions reductions. Not only because submitting illegitimate offsets for compliance, if discovered, can compromise a firm's public image, but also because in some markets (e.g. California) buyers are liable for replacing any offsets that are found to be illegitimate and invalidated. Many compliance firms may take the claims of compliance offset registries at face value, assuming that their protocols deliver legitimate offsets. This thesis has argued, however, that four of today's most recent and productive compliance offset protocols have produced offsets that are illegitimate and should be invalidated. To minimize the risk of having to replace invalidated offsets and to ensure legitimate offset purchases, compliance firms seeking offsets should demand offsets produced by protocols that include the three options for policy improvement described under "Options for Policy Improvement" above.

Demonstrating Climate Leadership in the Voluntary Market

The University of California (UC), discussed in Chapter Three of this thesis, purchases voluntary offsets outside of the California Compliance Market to compensate for its unregulated emissions and achieve carbon neutrality. The overarching question that this kind of voluntary carbon offsetting prompts is whether it is better for societal emissions mitigation trajectories to offset unregulated emissions and celebrate carbon neutrality or to strive toward operational emissions reductions that lead to infrastructural change.

The UC is one of many high-profile firms that have demonstrated a belief in the value of carbon neutrality. Google has been carbon neutral since 2007, Microsoft since 2012, Salesforce since 2017, and Mckinsey and Company since 2018.[211] Carbon neutrality today is a global phenomenon—in 2015, with the support of IKEA, Marks & Spencer's, Microsoft, and numerous others, the United Nations launched "Climate Neutral Now," a scheme that encourages governments, companies, and individuals worldwide to measure their impact on the environment, reduce GHG emissions, and offset the remainder of their emissions.[212] Bank of America, Morgan Stanley, Siemens, and many others have committed to achieving carbon neutrality in the coming decades.[213]

Natural Capital Partners, a green consulting firms that has helped over 350 businesses in over 35 countries achieve carbon neutrality, asserts that carbon neutrality enables firms to:

- "Meet [their] stakeholders' demands and build [their] reputation by demonstrating climate and renewable energy leadership and standing out from [their] competitors

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[211] Dreyfuss, "How Google Keeps Its Power-Hungry Operations Carbon Neutral."
"Salesforce Achieves Net-Zero Greenhouse Gas Emissions The Company Now Provides a Carbon Neutral Cloud for All Customers."
McKinsey & Company, "Environmental Sustainability | McKinsey & Company."
[212] UNFCCC, "Go Climate Neutral Now."
[213] Bank of America, "Impact of Environmental Sustainability from Bank of America."
Morgan Stanley, "Morgan Stanley Announces New Goal of Carbon Neutrality for Global Operations by 2022."
Siemens, "Siemens Is Going Carbon Neutral by 2030."

- Anticipate and reduce climate risks and costs to the business associated with policy and energy price alterations
- Generate revenue and increase market share by differentiating products and services with a powerful statement of environmental credentials
- Drive demand for renewable energy around the world and direct carbon finance to parts of the globe where it is most needed and most effective
- Engage staff and attract new talent with an authentic and compelling climate action programme
- Encourage suppliers and customers to take responsibility for their carbon emissions by demonstrating [their] own commitment."[214]

These benefits boil down to demonstrating climate leadership—going above-and-beyond compliance obligations to showcase sustainable values, inspire others to act, and limit the impacts of climate change. While this altruistic ambition should be celebrated, many firms worldwide have made a pivotal mistake by embracing carbon offsetting as a means for achieving carbon neutrality. Achieving carbon neutrality *via carbon offsetting* does not demonstrate climate leadership. It may be voluntary, but voluntary action only matters if it inspires others to follow suit and increases the probability of political or social changes that will bring society closer to a low-carbon future. Offsetting does not pave a path for others to follow; it depends on the limited coverage of carbon regulation, channels resources away from innovation, and perpetuates a false notion that individual

[214] Natural Capital Partners, "Why Become Carbon Neutral?"

action will solve climate change—that neutralizing one's individual carbon footprint fulfills one's responsibility to the environment and society. If firms want to demonstrate climate leadership, a first step would be to stop offsetting.

Offsetting Depends on the Limited Coverage of Carbon Regulation

Offsets, by definition, must be generated by emissions reductions that occur outside the coverage of a GHG regulatory regime. For firms to achieve carbon neutrality via offsetting, therefore, GHG regulation must be limited in scope, leaving an unregulated pool of emissions that can be mitigated. Not only does this mean that the commercial benefits of achieving carbon neutrality via offseting come at the expense of greater overall emissions,[215] but it also prevents a segment of the population (offset producers) from following in the footsteps of firms that achieve carbon neutrality via offsetting.

If GHG regulation were to expand to cover currently unregulated sectors, higher offset prices would exclude more firms from achieving carbon neutrality via offsetting. Today, GHG regulation covers a very small proportion of all firms, so most potential emissions reductions are outside GHG regulatory regimes and can count as offsets. Since offsets are plentiful, they remain cheap. As GHG regulation expands, however, the pool

[215] If the emissions of a sector currently generating offsets were regulated, that sector's overall emissions would decrease because all firms would seize available emissions reductions, not just those participating in offsetting. Once offsetting begins, however, the political economy of expanding the scope of GHG regulation may decrease; Once offset buyers have picked unregulated firms' low-hanging fruit, the cost of compliance, if GHG regulation were to expand to include unregulated firms, increases for them. It is therefore only natural for unregulated firms to fight expansions to GHG regulation, preferring to sell easy, voluntary reductions as offsets rather than face the difficulty of achieving deeper, mandatory reductions.

of potential offsets will shrink, driving up their prices.[216] As more offset-producing activities become mandatory, offset production will have to shift to more difficult, expensive emissions-reducing activities, further increasing offset prices. When offsetting becomes more expensive, the cost of staying carbon neutral will also rise. Neutrality might be an attractive option at \$2.90 per ton CO_2,[217] but at \$30? or \$50? Carbon neutrality via offsetting will become unattainable for the average person or business. The status will reflect wealth, not sustainable values, and many will abandon it.

Wealthy institutions may argue that expensive expressions of sustainable values for their own sake are valuable because they raise awareness and draw attention to the issue of climate change, inspiring onlookers to behave more sustainably in their own lives. They may be right, but negative impacts are just as likely. Onlookers may feel disempowered—not only can they not afford to follow suit, but they also gain no actionable knowledge they can apply in their own lives and operations. Alternatively, onlookers may be so impressed that they think that the solutions to climate change are already in hand, or at least that climate change is in more capable hands than theirs. At best, they may take the mental license to free-ride and do nothing. At worst, they may rebound and behave less sustainably. Expensive projects are indeed necessary to reduce the impacts of climate change, but the expense is only justified if it points the way to

[216] Every newly-regulated firm will count available emissions reductions toward their personal compliance goals, and any excess reductions will sell as allowances, not offsets. For firms whose emissions are completely covered by market-based mechanisms like cap-and-trade, carbon neutrality becomes completely meaningless—they have already internalized the cost of their emissions.

[217] The average price of voluntary offsets in North America in 2016 (Hamrick and Gallant, "Unlocking Potential.").

collective action or innovation, not if its best intention is to inspire admiration and vague awareness of climate change.

Channeling Resources Away from Innovation

The cost of offsetting, however large or small, channels resources away from investment in technological innovation necessary to reach a zero-carbon future. Achieving carbon neutrality via offsetting is often assumed to buy time for technological advancement that will bring down the cost of real operational changes. Yet offsetting consumes time and financial resources, distracting from efforts to cut operational emissions from within.

Some of the most widely produced types of offsets, utilized by Google, Harvard, and numerous firms in the CCM, come from methane destruction for which the essential technology and expertise already exist. Deep, meaningful cuts to business-as-usual CO_2 emissions will require new technological solutions that are only deferred by offsetting. For institutions like universities that feel an ethical imperative and see a competitive advantage in showing climate leadership, achieving carbon neutrality via offsetting rather than striving to mitigate their own business-as-usual emissions is an easier, cheaper path to social appeal that slows progress toward an emissions-free future.

Deep changes to business-as-usual emissions can be difficult and expensive, and they may not shine as bright as fulfilled neutrality goals, but being a climate leader means acknowledging difficulty and publicly owning the rate of progress at the frontier of innovation. Carbon neutrality via offsetting may seem like an active contribution to climate change mitigation, but beneath the veneer of voluntary action, carbon neutrality achieved via offsetting expresses a deeper bias toward passivity, whereby firms take action to meet personal goals, then wait for others to develop low-cost solutions for society.

Individual Action and Collective Action

Instead of facilitating collective action, achieving carbon neutrality via offsetting perpetuates the false notion that neutralizing individual emissions satisfies one's responsibility to society and the environment. Climate change demands broad, continuous participation. When firms announce that they have achieved carbon neutrality via offsetting, they send a message that they have done their part for the environment, indeed, that they have gone above-and-beyond, but they have not. When individuals utilize the United State Postal Service's carbon-neutral shipping or offset the emissions from their transatlantic flight, they may feel that they have absolved themselves of their responsibility to the environment and one another, but they have not. As Gernot Wagner and Martin Weitzman once wrote, "Reducing your own carbon footprint to zero is a noble gesture, but it's less than a drop in the bucket. Quite literally: the standard U.S. bucket holds about 300,000 drops; but you are one in over 300,000,000 as an American, and you are one in seven billion as a human being."[218]

Neutralizing the emissions of an individual is not enough to change the emissions-intense infrastructure of society. Neither is neutralizing the emissions of an entire business, or a country. Does all of this mean that companies, universities, and individuals

[218] Wagner and Weitzman, "The Planet Won't Notice You Recycle, and Your Vote Doesn't Count."

should stop reducing their carbon footprints? Absolutely not. But climate leaders must look beyond self-important goals, judging the value of individual actions by their ability to inspire others to follow and promote changes throughout society. When carbon neutrality changes from an individual pursuit to a cascade of collective action, climate leaders will contribute more than drops in a bucket.

Appendix I

Risk Category	Risk Type	Description
Financial	Financial Failure Leading to Bankruptcy	Financial failure can lead to bankruptcy and/or alternative management decisions to generate income that result in reversals through over-harvesting or conversion
Management	Illegal Harvesting	Loss of project stocks due to timber theft
	Conversion to Non-Forest Uses	Alternative land uses are exercised at project carbon expense
	Over-Harvesting	Exercising timber value at expense of project carbon
Social	Social Risks	Changing government policies, regulations, and general economic conditions
Natural Disturbance	Wildfire	Loss of project carbon through wildfire
	Disease/Insects	Loss of project carbon through disease and/or insects
	Other Episodic Catastrophic Events	Loss of project carbon from wind, snow and ice, or flooding events

Figure 2.3

Table D.2. Financial Risk

Project Specific Circumstances	Contribution to Reversal Risk Rating
Forest project with a qualified conservation easement	1%
Forest project on public or tribal lands	1%
Forest project without a qualified conservation easement and not on public or tribal lands	5%

Figure 2.4

ODS Name	Atmospheric Residence Time (Years)	100 Year Global Warming Potential (IPCC AR4)
CFC-11	45	4,750
CFC-12	100	10,900
CFC- 13	640	16,400
CFC-113	85	6,130
CFC-114	300	8,730
HFC-23	270	14,800
HFC-32	4.9	675
HFC-125	29	3,500
HFC-134a	14	1,430
HFC-143a	52	4,470
HFC-152a	1.4	124
HFC-227ea	34.2	3,220
HFC-236fa	240	9,810
HFC-245fa	7.6	314
HFC-365mfc	8.6	241
HFC-43-10mee	15.9	1,640
HCFC-22	12	1,810
HCFC-123	1.3	77
HCFC-124	5.8	609
HCFC-141b	9.3	220
HCFC-142b	17.9	2,310
HCFC-225ca	1.9	37
HCFC-225cb	5.8	181

Figure 2.6[219]

[219] IPCC, 2013

HFCs that may replace HCFC-22	IPCC AR4 2007 GWP100
HFC-32	675
HFC-134a	1430
R-407C	1744
R-507	3985
R-404A	3922
R-410A	2088
R-422D	2729
R-407F	1824

Figure 2.7[220]

TABLE 2. Costs, revenues and net present value of a digester project producing pipeline-injectable natural gas, per participating farm

Costs	Capital cost	Annual O&M cost
Scrape conversion	$696,000	$21,000
Digester	$2,905,000	$174,000
Pipeline (low pressure)	$75,000	$4,000
Pipeline (transmission)	$104,000	$5,000
Low NOx truck purchase	$140,000	—
Manure hauling	—	$95,000
Interconnection	$849,000	$30,000
Upgrading the biogas*	—	$258,000
CNG station (small fleet)	$23,000	$2,000
Total cost	**$4,792,000**	**$588,000 ‡**
Revenue		**Annual revenue**
Fuel sales ($3.46/1,000 ft^3)	—	$149,000
RINs ($1.85/credit)	—	$1,060,000
LCFS credits ($100/credit)	—	$865,000
Total revenue	—	$2,074,000
Net present value†	—	**$6,203,000**

* Capital cost for upgrading biogas is embedded in the O&M cost.
† Present value calculations assume a 10-year life for the project, a 7% interest rate for amortizing capital cost and a 5% discount rate for future revenues.
‡ Total differs from sum of values above due to rounding.
Source: CARB (2017), Table 14 of Appendix F.

Figure 2.8

[220] IPCC, 2007 cited by Honeywell, "Guide to Alternative Refrigerants." Devotta et al., "Alternatives to HCFC-22 for Air Conditioners."

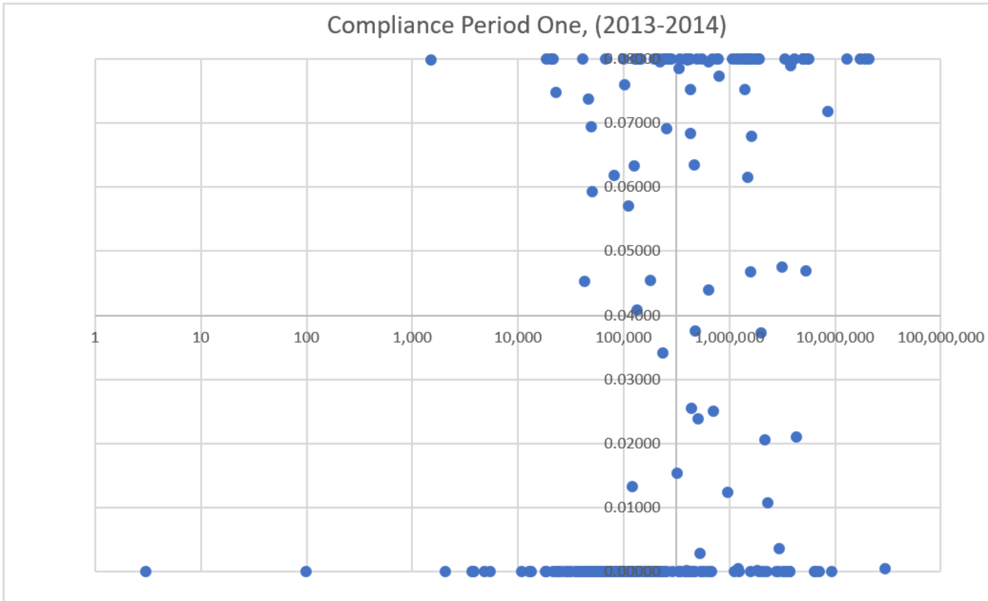
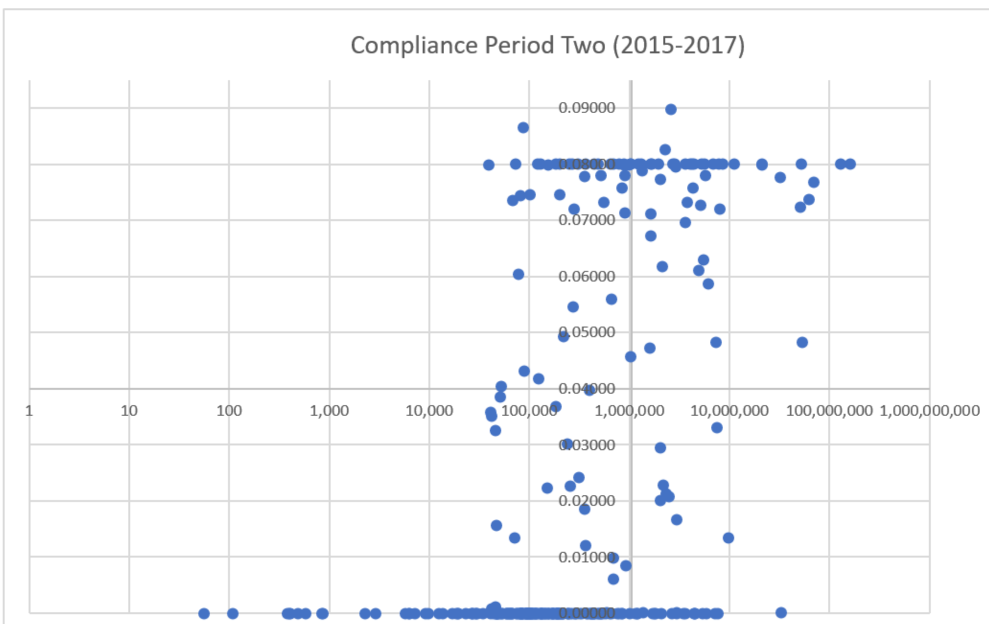


Figure 3.2



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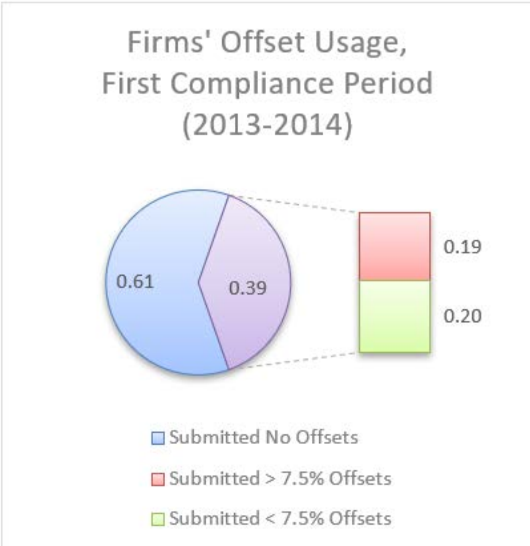

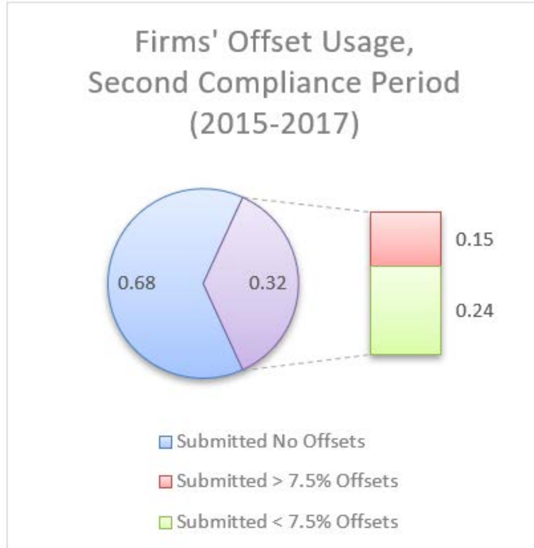

Figure 3.5

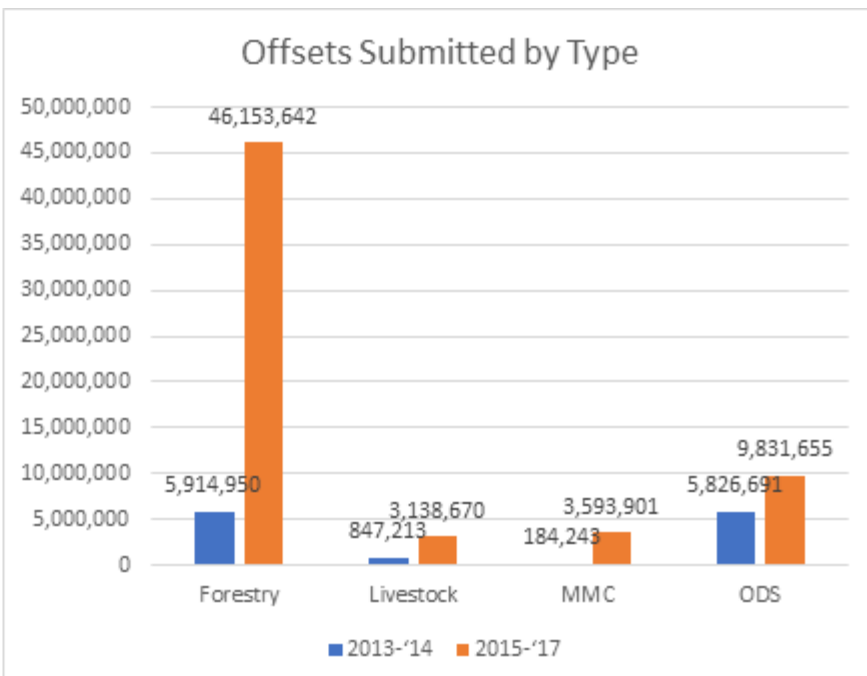

Figure 3.6

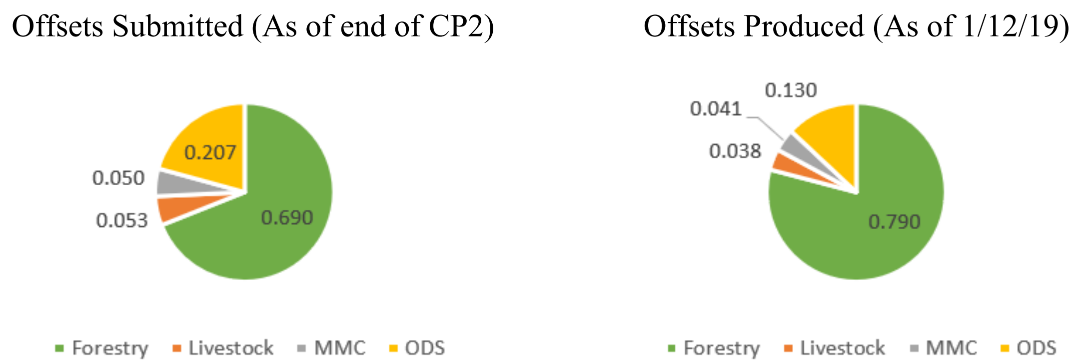

Figure 3.7

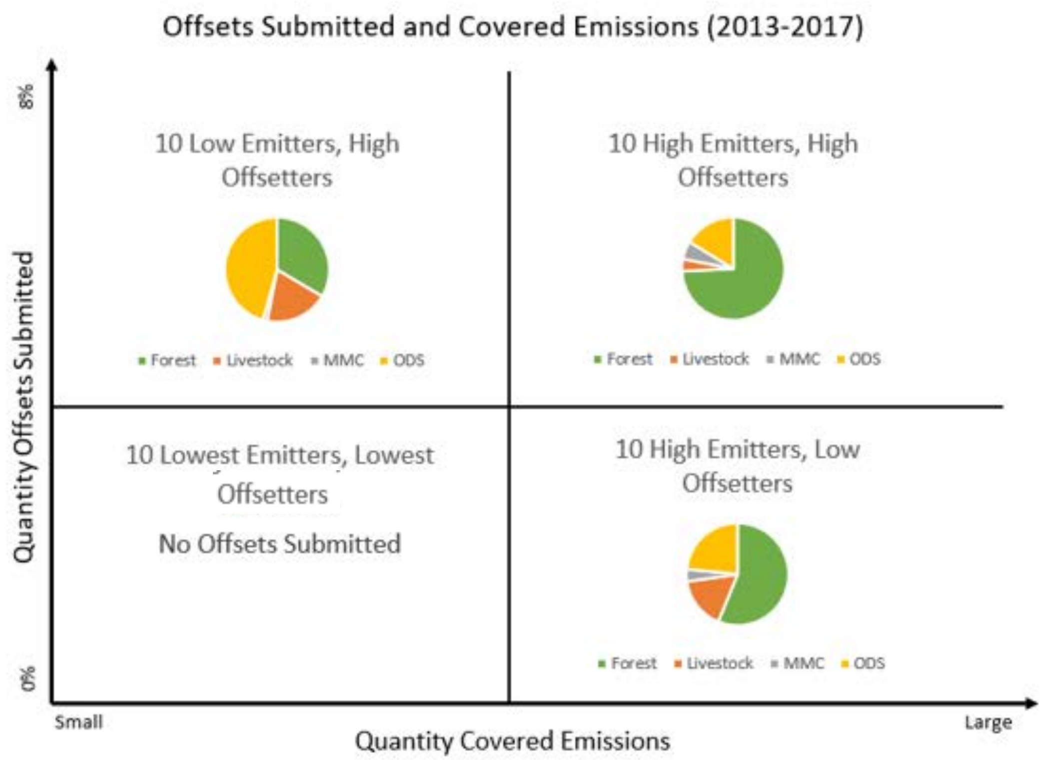

Figure 3.8[221]

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[221] HOHO Firms: Tesoro, Chevron, Phillips 66, Southern California Gas, Shell, Pacific Gas and Electric, Valero, Calpine, PBF Energy Western, British Petroleum

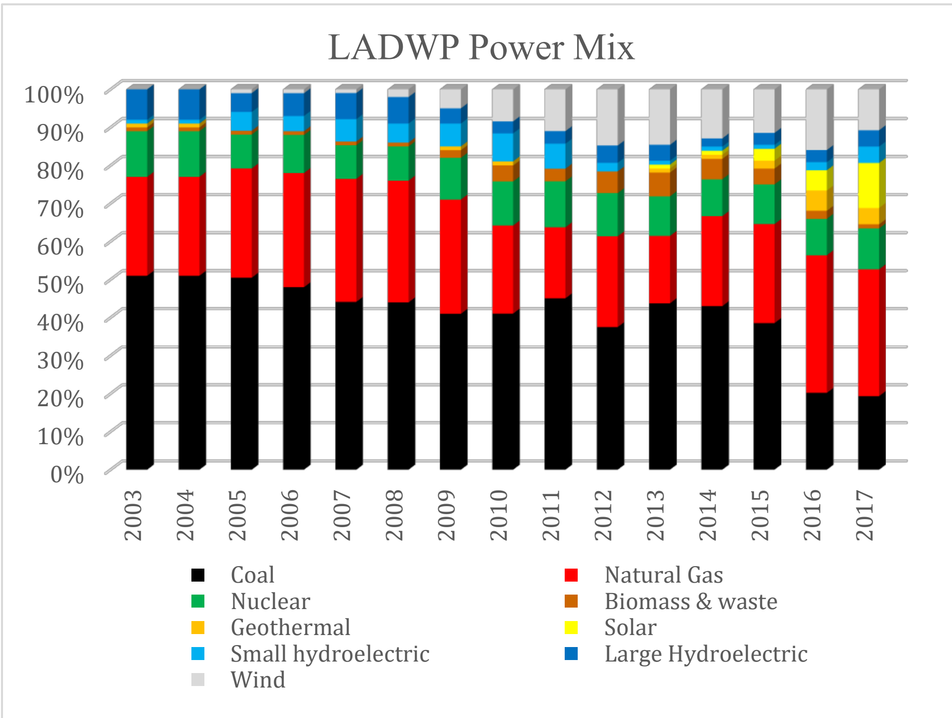

Figure 3.10

LEHO firms: CP Energy Marketing, Valley Electric, Mizkan America, Bridge Energy, Crimson Resource Management, Orange Groves, McKittrick Ltd., Chalk Cliff Limited, Ferrellgas L.P., Portland General Electric

LELO firms: precise firm choice does not matter since numerous small emitters submit zero offsets

HELO firms: LADWP, Aera Energy, Sacramento Municipal Utility District, San Diego Gas an Electric, Lehigh Southwest Cement, City of Anaheim, Kern Oil and Refining, Imperial Irrigation District, Searles Valley Minerals, Exxon Mobile

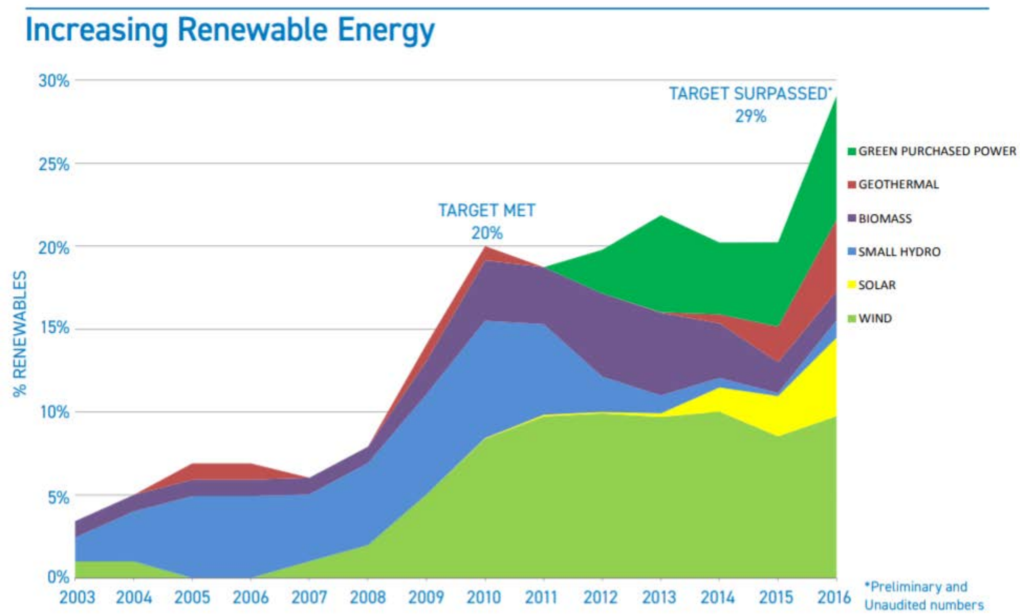
Increasing Renewable Energy
30%
25%
20%
15%
10%
5%
0%
% RENEWABLES
TARGET SURPASSED*
29%
TARGET MET
20%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
GREEN PURCHASED POWER
GEOTHERMAL
BIOMASS
SMALL HYDRO
SOLAR
WIND
*Preliminary and
Unaudited numbers

Figure 3.11

Appendix II

Potential Offset Revenue per 1000 ft^3 Methane Destroyed to Produce Offsets:

By dividing the total number offsets issued since the protocol was adopted (5,863,008) by the total number of years the 13 projects listed by CARB have been operating (47 years), the average number of offsets per year per project as found to be 124,775 offsets.[222]

Offset prices began at approximately $11 in 2013 and have risen to approximately $14, so $12 was chosen as a conservative estimate of the average offset price, while $30,000 was used as a high estimate for the verification and other transaction costs associated with developing an offset project (excluding capital costs).

This yields the expected revenue of an offset project:

(124,775 * $12) - $30,000 = $1,467,300

By dividing the expected revenue by the number of offsets, the average revenue per offset can then be found:

$1,467,300 / 124,775 = $11.76 per offset

This value can then be used to find the average value of destroying 1000 cubic feet of methane and selling the resulting emissions reductions as MMC offsets.

$$1000\ ft^3 CH4 * \frac{1085\ kJ}{1\ ft^3\ CH4} * \frac{1\ MJ}{1000\ kJ} * \frac{1\ kg\ CH4}{55\ MJ} * \frac{1000g}{1kg} * \frac{21\ g\ CO2}{1g\ CH4} * \frac{1\ tonne\ CO2}{1{,}000{,}000g\ CO2} * \frac{\$11.76}{1\ tonne\ CO2}$$

= $4.87

CO_2 created via combustion:

$$1000\ ft^3 CH4 * \frac{1085\ kJ}{1\ ft^3\ CH4} * \frac{1\ mole\ CH4}{810\ kJ} * \frac{1\ mole\ CO2}{1\ mole\ CH4} * \frac{1\ tonne\ CO2}{22{,}730\ moles\ CO2} * \frac{\$11.76}{1\ tonne\ CO2}$$

= $0.69

Estimated Average Offset Revenue per 1000 ft^3 Destroyed Methane: $4.87 – 0.69 =

$4.18

[222] CARB, "Compliance Offset Program."

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EXHIBIT D

United States Department of Agriculture
Forest Service

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Science
FINDINGS

INSIDE

Questioning the Assumptions 2
Measurement Challenges 3
The Substitution Effect 4

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"*Science affects the way we think together.*"
Lewis Thomas

DO CARBON OFFSETS WORK? THE ROLE OF FOREST MANAGEMENT IN GREENHOUSE GAS MITIGATION


Tom Iraci

Sustainably managed forests can mitigate greenhouse gases more effectively than unmanaged forests.

"*When we use the tree respectfully and economically, we have one of the greatest resources on the earth.*"
—Frank Lloyd Wright

Cap-and-trade systems were originally designed to provide incentives to businesses looking for the cheapest way to meet regulatory guidelines for greenhouse gas emissions. Forest carbon offset projects have been added to various voluntary and regional cap-and-trade systems because they were assumed to be an easily verified, low-cost method of achieving global reductions in carbon emissions. As these trading frameworks become more popular, foresters are asked to provide their professional support in the form of forest inventory data, predictive models, measurement protocols, and informed opinions.

After studying carbon trades and their implications in his role as a research forester at the Pacific Northwest Research Station, Jeremy Fried became increasingly concerned that these systems were not supported by the best available science. As a leader of the Society of American Foresters (SAF) Emerging Issues Committee, in 2010 Fried strongly recommended that SAF's membership study the issue in depth, and a multidisciplinary task force was subsequently convened. The task force's findings were compelling enough that the SAF decided to print a special supplement of the *Journal of Forestry* to share the report on their findings.

The comprehensive report, published in fall 2011, summarizes recent research on forest carbon flux, analyzes the assumptions behind carbon trading protocols, and examines the wood–fossil fuel substitution effect. The

IN SUMMARY

As forest carbon offset projects become more popular, professional foresters are providing their expertise to support them. But when several members of the Society of American Foresters questioned the science and assumptions used to design the projects, the organization decided to convene a task force to examine whether these projects can provide the intended climate benefits. The report details reasons to look for other solutions to greenhouse gas emission challenges.

After synthesizing the latest available science, the authors challenge the underlying assumptions used to establish most carbon-trading mechanisms, including the notion that lightly managed or unmanaged forests will be more effective at sequestering carbon over long periods than would a combination of managed forests and efficiently produced wood products. They take issue with the measurement systems used to determine trading parameters and find validity in the concerns that many market experts have expressed about additionality and leakage.

Energy benefits typically are ignored in forest carbon offset projects, which promotes misunderstandings about overall atmospheric carbon flux. The authors emphasize the carbon-storage benefits of using wood products in place of nonrenewable, energy-intensive materials and using wood-based energy instead of fossil fuels. They recommend sustainable production in forests where it supports primary management objectives and assert that well-managed production forests can promote the goals of reducing carbon emissions and increasing Earth's carbon-storage capacity.

assessment takes into consideration findings from the fields of forest economics, forest policy, silviculture, ecology, soil science, remote sensing, forest products, forest management, forest engineering, forest policy, and fire science. Perspectives from university researchers, federal agencies, nongovernmental organizations, and the forest products industry were represented on the task force, as was every region of the United States.

More than 200 publications and Forest Inventory Assessment statistics were cited in the report. It reviews forest carbon dynamics and enumerates the barriers to implementing trading protocols intended to reduce atmospheric carbon. Focusing on the United States market, the task force found that offset projects are highly variable and depend on numerous assumptions, most of which are susceptible to bias and “virtually insurmountable” measurement errors.

The task force also reported that carbon offsets typically use partial accounting techniques that don’t fully consider the greenhouse gas mitigation benefits occurring outside of the forest. These benefits include the long-term carbon storage available in wood products manufactured in today’s highly efficient mills, the life-cycle energy savings that accrue when structures are built with wood, and the renewable aspects of using biomass instead of fossil fuels for energy.

KEY FINDINGS

- Sustainably managed forests can provide greater greenhouse gas mitigation benefits than unmanaged forests while delivering numerous environmental and social benefits.
- Energy derived from burning fossil fuels releases carbon that has resided in Earth for millions of years, whereas energy produced from forest biomass results in no net release of carbon as long as overall forest inventories are stable or increasing.
- Using wood products instead of more energy-intensive materials such as steel, aluminum, plastic, and concrete provides substantial net emissions reductions. Unlike fossil fuel-intensive products that release new atmospheric carbon, wood products can store carbon for centuries.
- Modeled benefits of forest carbon offset projects depend on assumptions, including estimates of forest carbon flux, that are rudimentary and based on limited data. Significant investment would be needed to develop carbon equations for the 542 U.S. tree species that account for both tree size and tree form.

QUESTIONING THE ASSUMPTIONS

A carbon-offset transaction might go something like this: A manufacturer wants to show that it is achieving regulatory standards for carbon emissions, but it doesn’t want to invest in new equipment right away or change its production methods. To gain compliance, it pays a forest owner to assume the responsibility for cancelling out a certain portion of the company’s greenhouse gas emissions in the form of a carbon credit or offset. In return for a fee that has been established using calculations based on Forest Service inventory data and computer models, the landowner agrees not to cut trees on an identified parcel of forest land for, say, 100 years. Credit for 10 percent of the acreage is held back from the forest owner and goes into an insurance pool intended to cover carbon loss from catastrophic events, such as wildfire, disease, and insect epidemics, during the contract period.

Fried and the task force found several problems with the assumptions underlying this kind of trade.

First, the belief that an unmanaged forest will accumulate and retain an amount of carbon equal to or greater than that which the manufacturer is emitting over time is misguided. Although the nation’s protected, unmanaged forests sequester huge amounts of carbon, the additional annual amount is small, largely due to the increasing age of the nation’s forests coupled with the fact that insects, disease, and climate change are weakening forest systems, and massive numbers of trees are being killed in wildfires. Disturbances such as these release stored carbon into the atmosphere as the affected trees burn or decay.

Tom Iraci

Under current carbon-offset protocols, thinning to improve forest health or reduce fuel hazards is considered a “reversal,” requiring the landowner to return a portion of the carbon-offset payment.

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USDA United States Department of Agriculture

Forest Service

Tom Iraci

Wildfires release enormous amounts of carbon into the atmosphere, some at the time of the fire, and much more in the decades that follow as fire-killed trees decompose.

"Trees do die, and at a rate that eventually reaches some kind of a stasis at a landscape level," says Fried. "In some stands, up to one hundred percent of the trees will be killed by a fire or insect outbreak; other stands continue to grow, but over the entire forest you'll eventually reach a plateau, after which the net in-forest growth and carbon accumulation rates decline—eventually to zero." Many protected forests on public lands, especially those in parks and wilderness areas, are no longer increasing carbon storage, he says.

The second problem the task force found with many carbon trades is that they may overestimate the global benefits. This is because of the way additionality and leakage are calculated at the individual project scale. Additionality describes the requirement for traders to prove that a particular offset would not have happened in the absence of the trade. "Additionality," states the task force's report "is relatively easy to establish when new trees are planted and maintained, but considerably more difficult to demonstrate when based on what did not or will not happen (e.g., 'I was going to harvest in 10 years but instead will wait 30 years')."

Leakage refers to the situation in which tree harvesting is simply shifted elsewhere. A landowner selling carbon credits may agree not to cut trees, but market demands ensure that the harvest—with its attendant carbon emissions—will be moved to another parcel of forest land owned by someone else around the globe. The task force cited econometric evidence suggesting that leakage is close to 100 percent.

Third, Fried says that the structure of the insurance pool is problematic. "One problem is that the forest credits typically used as insurance against a project failure from wildfires or insects and disease are right next door, so the insurance could burn up or be killed off along with the project," explains Fried. He says that at the current rate that California forests are burning, fire can be expected in any particular stand, on average, about every 50 to 60 years. Increasingly, such fires are stand-replacing events that cover large areas. Wildfires also are becoming more frequent and destructive in the Pacific Northwest's temperate forests.

In other words, no real guarantees can be made that carbon sequestration benefits will be reaped on any particular parcel of land for some defined period of time. Meanwhile, landowners assume considerable risk in any carbon credit deal while relinquishing the right to actively manage their forests using sustainable forestry practices.

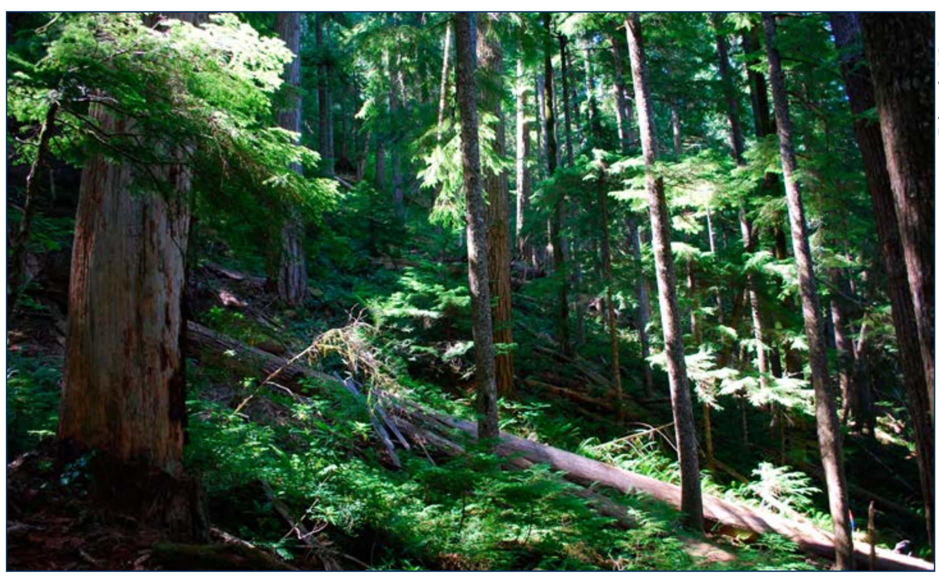
"You can't reduce your stock, even if you're just thinning to reduce your fuel hazards—that's a reduction in inventory stock, and it's considered a reversal. You'd have to pay back at least some of your carbon offset payments," says Fried. "The protocols essentially compensate only projects that reduce harvest levels. If we could make preserves and they would never grow old, blow over, or burn down, that would be great, but that's not the real world. The inescapable conclusion is that offsets really don't work."

Ultimately, the report concludes, carbon trades allow businesses to continue to pollute while providing no real benefit to the environment. "Until we have a full market that accounts for all carbon emissions, the evidence demonstrates that the current system uses biased estimates of true global benefits," says Fried.

MEASUREMENT CHALLENGES

Forest carbon occurs in many forms—in soils; standing dead trees and down logs; litter and duff; understory vegetation; and roots, branches, boles, needles, leaves, and bark of live trees. The amount of carbon in each of these "carbon pools" and the time it resides there depends on stand age, stand density, soil type, site productivity, disturbance, and management history. Climate change, fires, insects and disease, and blowdown also have considerable influence on carbon pools. Depending on the disturbance, live woody carbon is either rapidly or slowly converted to dead woody carbon and decomposition and growth rates can be dramatically influenced. All of these variables ultimately affect carbon flux—the net difference between carbon released and carbon stored in any period of time.

Tallying forest carbon with sufficient accuracy to inform carbon offset transactions would require scientifically sound estimates



Rhonda Mazza

Carbon accumulates in live and dead trees, understory vegetation, forest litter, and soil. It is released through microbial decomposition and soil respiration. Calculating carbon flux—the net difference between carbon accumulation and release—is difficult because it varies with stand age, soil type, climate, and level of management.

of woody biomass for all of the aboveground and belowground forest carbon pools. Forest stand structure, environmental conditions (e.g., topographic aspect), and stand history can profoundly influence tree form. The differences in biomass between two trees of the same species and diameter can be considerable; equations that fail to account for this will be biased (inaccurate) when applied to any particular stand.

Ponderosa pine trees growing in a sparsely stocked stand, for example, will tend to have a greater proportion of their wood in branches than in a closed-canopy stand; they will also be comparatively shorter, which will affect bole biomass. A model developed from trees sampled in closed-canopy stands and applied in an open stand would likely underpredict branch wood and overpredict height, so the landowner might not be fully compensated for the value of the carbon stored in the trees. "If you're getting paid per ton of carbon, being off by even 20 percent is a big deal," explains Fried, "and the discrepancies among the predictions of equations currently in use are often far greater."

That's not to say that today's limited carbon estimation capability isn't useful—even rudimentary estimates are helpful to those working to understand carbon dynamics and the effects of forest management on carbon pools, for example. The problem, the task force found, is that using existing carbon models to account for carbon-offset projects offers an illusion of accuracy and the potential to easily game the system through choice of models. When this occurs, the societal goal of mitigating greenhouse gases becomes secondary to extracting maximum profit from offset transactions.

"Although it is scientifically possible to build better allometric models to accurately predict carbon from tree measurements, the investment required could easily top $100,000,000. Equations would need to be developed for each tree component (bole, branches, bark, belowground) for 542 U.S. tree species, and these would need to account for not only tree size but also tree form, or its proxies: geographic variation, especially for species with large ranges, and stand density" says Fried. "That would likely require felling, drying, and weighing tens of thousands of trees."

Fried points out, however, that other policies that encourage managing forests for carbon benefits do not require such accurate accounting. Policies that encourage use of wood in place of other materials, for example, or discourage waste of wood that could be recovered for energy use, could help move toward the overarching goal of mitigating greenhouse gas emissions.

THE SUBSTITUTION EFFECT

Carbon-trading protocols miss the biggest opportunity available for mitigation because they don't factor in what happens outside the forest. The SAF task force suggests that substituting wood products for materials that require large amounts of fossil fuel to create—steel, aluminum, plastic, concrete, and other nonrenewable materials—and using biomass as a source of energy instead of gas, oil, or coal provide opportunities to reduce greenhouse gas emissions while building Earth's capacity for carbon storage.

"When the full energy benefits of harvested wood products are considered, well-managed forests typically create more total climate benefits than does any scenario intended to reduce the harvest," says Fried.

Burning fossil fuels releases carbon that has been stored in the Earth for millions of years, adding to the atmospheric load with little hope of returning it to a fossil-fuel state for millennia. In contrast, burning wood releases carbon that was stored in the relatively recent past; forests release and absorb carbon in a closed cycle that results in no net release of carbon in sustainably managed ecosystems. Many sawmills and pulp mills, for example, create their own renewable energy by burning biomass fuels—byproducts of the production process.

When trees are cut—as a result of thinning, for example—and used to produce wood products like lumber and furniture, the wood can continue to store carbon for decades or centuries. Recycling wood products increases storage longevity. Meanwhile, in a managed system, more trees can be planted or naturally regenerated to rebuild the carbon-absorption pool, and the land manager can keep the forest healthy by managing for fire, insects, disease, diversity, or other objectives.

Additionally, well-managed forests can build local and national economies, help to ensure sources of clean water, protect wildlife habitat, and provide recreational opportunities. If, on the other hand, millions of trees are killed in a wildfire, not only does the forest become a carbon emitter, the opportunity for long-term carbon storage and other social and environmental benefits is lost.

"Given the substantial carbon storage and substitution benefits that can be derived from forest products and biomass, considering only a trajectory of retaining in-forest carbon leads to inaccurate conclusions," says Fried. "An unmanaged forest is more likely to get to the point where you have catastrophic loss. As long as forests are managed sustainably, we will not be putting new carbon into the atmosphere."

Some scientists are concerned that tree harvesting for biomass production releases carbon stored in forest soils, but research cited in the SAF report found "little long-term effect" if sites are properly managed by leaving surface

Mark Nechodom

Biomass plants burn nonmerchantable harvest and mill wood residues to generate electricity. The carbon released during this process can be recaptured relatively quickly if the harvested area is replanted in trees. In contrast, returning carbon released by burning fossil fuels to its source would require millennia.

soil layers containing organic matter onsite and allowing time for regeneration.

As an active member of the Sierra Club, Fried says he understands the passion people have for forest landscapes, and he empathizes with those who never want to see trees cut. But, based on objective science, he advocates for the middle way, believing that sustainably managing forests simply makes environmental and economic sense.

"It's important to me that science be as objective as we can make it, recognizing that we all bring our own framing biases and belief systems to the table," he says. "But it's incumbent upon us to disclose them, work hard to put them aside as much as we can, and let the science tell the story as it is."

Fried and the task force are not suggesting that solely using wood-based products in place of other more energy-intensive substitutes will be enough to address greenhouse gas emissions. Rather, they suggest that serious consideration be given to the entire carbon cycle and how sustainable forestry can play a role in emissions mitigation.

Nor are they suggesting that all forests be managed.

m.o.daby design llc

Wood products store carbon indefinitely, and far less carbon is emitted during manufacturing compared to similar products made of metal, plastic, or concrete.

"There are all kinds of reasons to not manage forests and to leave them alone," says Fried. "We're recommending that where it makes sense, where objectives for forest land involve managing for products and energy, such management is compatible with carbon and climate benefits. The Europeans figured this out 10 or 15 years ago. Their carbon management is simply sustainable forestry: you grow trees, cut them, use them to make an array of products and produce energy, and grow more trees."

"Offsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened."

—Dan Welch

FOR FURTHER READING

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LAND MANAGEMENT IMPLICATIONS

- Keep forests as forests and manage appropriate forests to meet landowner objectives including carbon storage.
- Limited or "passive" management may not produce the additional in-forest carbon storage benefits desired.
- Tracking the allocation of forest carbon across live and dead trees, understory shrub and herbaceous vegetation, soils, the forest floor, forest litter, harvested wood products, and energy wood is far more difficult than conducting traditional inventories of commercially valuable wood based on bole size.
- Use objective, science-based analyses to develop climate mitigation policies and pay close attention to the assumptions and models used.
- Significant energy benefits accrue from using wood products, which commonly are underestimated or uncounted in project-based carbon offset accounting rules.
- Acknowledge the substitution effect when developing forest policy instruments; understand that it is immediate, irreversible, and cumulative.

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EXHIBIT E

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WORKING PAPER – August 2019

Managing Uncertainty in Carbon Offsets: Insights from California's Standardized Approach

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Abstract

Carbon offsets allow greenhouse gas emitters regulated under an emissions cap to comply by paying others outside of the capped sectors to reduce emissions. The first major carbon offset program, the United Nations' Clean Development Mechanism (CDM), has been criticized for generating a large number of credits from projects that do not actually reduce emissions. Following the controversial CDM experience, California pioneered a second-generation compliance offset program that shifts the focus of quality control from assessments of individual projects to the development of offset protocols, which define eligibility criteria and methods for estimating emissions reductions for categories of projects. We assess how well California's protocol-centered approach mitigates the risk of over-crediting greenhouse gas reductions. This analysis is relevant because the offset program could make up the full effect of the state's cap-and-trade program through 2020, and half of its effect through 2030. We review the development of two of California's offset protocols—Mine Methane Capture and Rice Cultivation—and examine the regulator's treatment of three sources of uncertainty in emission reduction estimates that led to large-scale over-crediting under the CDM: determining additionality, estimating the counterfactual baseline scenario, and avoiding perverse incentives that inadvertently increase emissions.

We find that while the risk of over-crediting can be reduced through careful analysis, conservative design decisions, and ongoing monitoring of protocol outcomes, even best practices result in significant uncertainty in quantifying true emission reductions. Rather than eliminate the risk of over-crediting, California's approach shifts risk from project-level to protocol-level quality assessments. To the extent that carbon pricing policies include large offset programs, as is the case in California, government priorities and methodological choices drive program outcomes, contrary to the common perception that carbon pricing policies mainly delegate decision-making to private actors. Ultimately, relying on carbon offsets to lower compliance costs risks lessening total emission reductions and increases uncertainty in whether an emissions target has been met. As a result, offsets can be understood as a way for regulated emitters to invest in an incentive program that achieves difficult-to-estimate emission reductions rather than as quantifiable and verifiable reductions equivalent to reductions under a cap. Substantial ongoing regulatory oversight is needed to contain uncertainty and avoid over-crediting.

Table of Contents

Executive Summary **4**

1. Introduction **8**

2. Background **10**

a. California's cap-and-trade program 10

b. California's offset program 10

i. Mine Methane Capture (MMC) Projects Protocol 11

ii. Rice Cultivation Projects Protocol 12

3. Challenge 1: Additionality **12**

a. Methane capture at abandoned coal mines 13

4. Challenge 2: Estimating Baseline Emissions **14**

a. Scientific uncertainty in the baseline: methane release from abandoned mines 14

b. Technological and behavioral uncertainty in the baseline: rice farmer practice 15

5. Challenge 3: Perverse Incentives **15**

a. Increasing profits: from coal mining 16

b. Increasing profits: inducing a switch from corn to rice production 16

c. Weakening or delaying climate regulation 17

d. Creating incentives for only some activities that reduce emissions 18

6. Discussion and Conclusions **18**

a. Recommendations for improvement 19

b. Implications for governance 20

Figure 1. Income from flaring methane for offset credits versus sale of natural gas **23**

References **24**

Executive Summary

Carbon offsets allow greenhouse gas emitters covered under an emissions cap to comply by paying others outside of the capped sectors to reduce emissions. By expanding the range of activities that can be counted towards compliance with an emissions cap, carbon offsets lower compliance costs. This flexibility has important downsides, however, as carbon offset programs are technically complex and their credited emission reductions inherently uncertain.

The first major carbon offset program, the United Nation's Clean Development Mechanism (CDM), is understood to have generated a large proportion of its credits from projects that did not actually reduce emissions and thereby enabled countries to claim greater emission reductions than they actually achieved. By allowing a wide range of project types to participate and focusing quality control on assessments of each proposed project individually, the CDM made it easy for project developers to game the rules and claim exaggerated quantities of credits. Importantly, project-level assessments failed to filter out "non-additional" projects—projects that would have been implemented regardless of the offset program.

Following criticism of the CDM experience, the California Air Resources Board (ARB) pioneered a second-generation compliance offset program that shifts the focus of offset quality evaluation, including additionality, from the project level to the protocol (or project-type) level. This offset program structure, commonly called a "standardized approach," defines project eligibility criteria, project baselines, and methods for estimating emissions reductions more prescriptively at the protocol level. All projects that meet the protocol's eligibility standards are considered additional and are allowed to generate offset credits pursuant to the protocol's methodologies.

Here, we examine how well ARB's standardized approach to carbon offset protocol design mitigates the risk of over-crediting. We focus on three interrelated sources of uncertainty in estimating emissions reductions: (1) determining additionality, (2) estimating emissions reduced relative to a counterfactual baseline scenario, and (3) avoiding perverse incentives that inadvertently increase emissions. This analysis has important implications for the effectiveness of California's cap-and-trade policy due to the large size of its offset program. If capped emitters use the maximum offsets allowed, offset use would exceed ARB's estimate of the total effect the cap-and-trade program is expected to have on emissions through 2020, and would equal over half of the same effect from 2021 through 2030.

Our analysis is rooted in our experiences from 2013 through 2015 as a team of researchers participating in the technical working groups established by ARB to support the development of two new offset protocols, the Mine Methane Capture and Rice Cultivation protocols. We also draw on discussions with researchers and practitioners as well as our own quantitative assessments. We use examples from these two protocols to illustrate each source of uncertainty and explore the types of analysis and protocol design decisions that could be used to reduce or avoid over-crediting under California's standardized approach.

Our work shows that ARB can reduce the risk of over-crediting with reforms to its current offset protocol design and review processes. We highlight two of these reforms here.

First, ARB should conduct an explicit and quantitative analysis of the balance of over-crediting and under-crediting expected from participating projects when developing its offset protocols; ARB should also quantify actual outcomes when updating those protocols. Protocol-level eligibility criteria enable all qualifying projects to participate and earn offset credits, including those that are non-additional but satisfy the requisite criteria. To avoid over-crediting, offset protocols should be structured so that over-crediting resulting from the participation of non-additional projects is explicitly counterbalanced by systematic under-crediting from the use of conservative methods to estimate emissions reductions and/or discount factors on the quantity of offset credits generated. Ideally, protocol development and review would involve four explicit estimates: (1) expected business-as-usual trends that lead to non-additional but eligible projects, (2) the expected influence of the protocol on truly additional project development, (3) under-crediting of truly additional projects from conservative emissions estimation methods, and (4) a discount factor designed to counterbalance any remaining over-crediting. Assumptions about business-as-usual and additional project development should be reassessed periodically, enabling regulators to dynamically modify project type exclusions, emission estimation methods, and discount factors. Consistent with current practices, regulators could use this approach to demonstrate the legal requirement of additionality by showing that the total number of credits generated by projects under a protocol is unlikely to exceed the total reduction in emissions actually achieved by the protocol across its full portfolio of projects. While these assessments involve substantial uncertainty and subjective expert judgment, performing them would explicitly improve transparency, accountability, and policy effectiveness.

Second, ARB should assess, monitor, and take precautions to avoid the creation of perverse incentives that increase emissions. For example, profits created by California's Mine Methane Capture Protocol could enable coal mine owners to keep coal mines operating longer than they otherwise would, or create incentives to flare methane that they would otherwise capture for productive use as fuel. Offsets can also increase pressure on governments not to regulate emissions because any reductions that are legally required cannot be sold as offsets. Statements made by staff of the U.S. Bureau of Land Management suggest that the Mine Methane Capture Protocol may have influenced federal decisions not to regulate methane emissions from coal mines on federally-owned lands during the Obama Administration. A "do no harm" approach would carefully assess and monitor these potential effects and exclude project types with the potential for significant perverse incentives. Fundamentally, however, perverse incentives are difficult to avoid.

While the risks of over-crediting and perverse incentives can be reduced through careful analysis, conservative design decisions, and periodic review of protocol outcomes, uncertainty and risk are inherent to carbon offsets. This is because offsets pay for reductions rather than charge for emissions. Quantifying emission *reductions* involves estimating the difference between observed emissions and those projected in an unobservable, and therefore uncertain, counterfactual scenario that describes what would have happened without the offset program, including the effect of non-additional projects that are allowed to participate under the protocol's eligibility criteria. Instead of internalizing an externality (as is done by charging polluters for their emissions), income created by *paying* for reductions can create a range of perverse incentives, including improving the profitability of high-emitting activities, inducing a shift in activity rather than a net reduction in emissions, and creating a disincentive for governments to regulate emissions.

Our work also highlights an important gap between the perception and practical function of carbon pricing policies that include large offset programs. Carbon pricing policies, such as cap-and-trade or carbon taxes, are often promoted as market-oriented solutions that allow the free market to identify the least-cost compliance portfolio with minimal direction from government. In turn, offsets are typically justified as an essential mechanism for containing compliance costs while simultaneously extending market-based incentives beyond the carbon pricing policy's borders. Due to the need to manage uncertainty in emissions reduced, however, the practical operation of offset programs rests on a complex set of protocol standards and rules developed by program regulators. The choices regulators make about what project types are allowed to participate and how emissions reductions are calculated drive outcomes in the offset market. Therefore, to the extent that offsets are used to deliver a substantial share of emissions limits, program outcomes will be heavily determined by government priorities and quality judgments, rather than primarily by decision-making that has been delegated to private actors.

Instead of describing offsets as a market-based compliance strategy like cap-and-trade, it may be more useful to think of offsets as a government-intermediated incentive program that regulated emitters pay into in lieu of directly reducing their own emissions. Like most programs that create financial incentives for technology deployment, the effect on emissions is difficult to assess because of uncertainty in how much the technology would have been deployed without the incentive, uncertainty in the emissions associated with that counterfactual scenario, and uncertainty about the effects of the incentives outside of project boundaries. Just as with any other technology support program, program outcomes are largely determined by government decisions about which types of activities receive support and the methods used to estimate program effects. As a result, we suggest that the emission reductions credited under offset protocols are fundamentally different from reductions under carbon pricing policies in terms of the ability to quantify and verify emission reductions and the role of government in decision-making.

Our observations also indicate a critical governance challenge facing carbon pricing policies that rely on offsets. In order to address uncertainty and contain the risk of over-crediting, offset program regulators must invest in substantial, ongoing, and often under-appreciated regulatory oversight. Yet to date, governance of environmental integrity concerns in the California offsets program is focused on the initial development of protocol rules, rather than their ongoing oversight and reform. Formalizing the analytical framework and processes used to manage offsets integrity could provide opportunities for evidence-based improvement.

Rather than eliminating the risk of over-crediting, California's standardized approach to offset program design shifts that risk from project-level assessments to protocol-level design decisions. Careful interdisciplinary analysis and conservative protocol design decisions are needed to contain the risk of over-crediting; to sustain this objective, policymakers must also invest sufficient resources in program oversight. Nevertheless, even the most careful and conservative program design and oversight process will result in significant uncertainty in true emission reductions. Offsets allow regulated emitters to emit more than program cap levels, in exchange for a corresponding but less certain amount of reductions outside of the cap. Thus, where carbon offsets play a significant role in the total reductions expected under a cap-and-trade program (as they do in California), they increase uncertainty in—and risk lessening—the true emission reductions achieved by a cap-and-trade program.

1. Introduction

Carbon offsets allow greenhouse gas emitters regulated under a cap-and-trade program to pay for emission reductions outside of the capped sectors in lieu of reducing their own emissions or acquiring allowances from other regulated parties. Offsets have been widely used in cap-and-trade programs to lower compliance costs and support reductions in regions and sectors outside of capped sectors (ARB 2010, Bushnell 2012). During the first commitment period of the Kyoto Protocol (2008-2012), for example, the European Union Emissions Trading Scheme used offset credits equal to 11% of covered emissions (Ellerman, Marcantonini, & Zaklan 2014, 2015). In the first eight years of California's carbon market, regulated parties can submit offsets for up to 8% of their total emissions, or about 79% of the total reductions the California Air Resources Board (ARB) expects from the state's capped sectors (Haya 2013).

Although carbon offsets are widely used in cap-and-trade programs, they have also been controversial. Empirical studies of the Kyoto Protocol's offset program, the Clean Development Mechanism (CDM), find that many CDM projects received credits far in excess of the actual reductions they achieved. These studies point to three principal sources of over-crediting. First, the CDM credited large numbers of "non-additional" projects—projects that were happening on their own, independent of the income from offset credits (Aldy & Stavins 2012, Cames et al. 2016, Haya 2009, He & Morse 2013, Wara 2008). This occurred, in part, because of difficulty evaluating project developers' individual claims that they would not have moved forward with their proposed offset projects without the offset program (Haya 2010). Second, project developers need to estimate emission reductions against an unobservable, and therefore uncertain, counterfactual scenario of what would have happened in the absence of the offset program. Project developers have a financial incentive to exaggerate emissions estimated in the counterfactual scenario in order to claim greater reductions and generate more credits (Lazarus & Chandler 2011). Third, offset programs can inadvertently create "perverse" financial incentives that increase emissions. For example, due to the extremely high global warming potential of hydrofluorocarbons (HFCs) as greenhouse gases, profits generated by offset sales from HFC destruction projects were large enough to create an incentive for refrigerant producers to increase production and reduce production efficiency in order to generate more HFC by-product that could be destroyed to generate more offset credits (Schneider & Kollmuss 2015, Wara 2008). Carbon offsets can also create an incentive for governments to delay enactment of policies requiring reductions from sectors profiting from offset credits, since reductions are no longer eligible for offset revenue once they are required by law. For example, Latin American governments considered weakening laws in the early years of the CDM to increase CDM eligibility for certain projects (Figueres 2006).

These three potential sources of over-crediting—crediting non-additional projects, uncertainty in the counterfactual baseline scenario, and perverse incentives—create significant challenges for climate regulators. Proposed solutions have included the exclusion of project types that risk generating large quantities of false credits (Cames et al. 2016, Erickson, Lazarus, & Spalding-Fecher 2014, Thamo & Pannell 2015); discount factors or conservative baselines to reduce credits awarded to offset projects to counterbalance over-crediting from non-additional projects (Bento, Kanbur, & Leard 2016); program-, policy-, or sector-scale offset crediting (Lewis 2010, van Benthem & Kerr 2013); and standardized protocol-level evaluations that define quality criteria by project-type (Government of Italy 2014, UNFCCC 2014).

Following the controversial experience with the CDM's project-level additionality evaluations, California pioneered a compliance offset program design that concentrates evaluation at the protocol-level, commonly called a "standardized approach" to carbon offset program design. This approach was first implemented by the Climate Action Reserve, a state-chartered voluntary[1] offset developer; in parallel, several CDM methodologies were modified to include a standardized approach to additionality testing (Hayashi & Michaelowa 2013). Under a standardized approach, offset protocols specify project eligibility criteria. Every project meeting these criteria is deemed to fulfill the additionality requirement and is allowed to generate credits according to the protocol's standardized methodology for calculating baseline emissions and net emission reductions. This approach differs from previous offset programs, which test additionality for each proposed project and allow more flexibility for project developers to customize baseline and emissions reduction methods. In contrast, the standardized approach manages offset credit quality for the portfolio of offset projects as a whole, rather than for every participating project individually.

The standardized approach is expected to lower costs for participating project developers (Hayashi & Michaelowa 2013, Spalding-Fecher & Michaelowa 2013) and offer greater ability to avoid non-additional crediting (Haya 2010). If protocol-level eligibility criteria are too lenient, however, a standardized approach could still lead to large-scale over-crediting (Bushnell 2011, Cames et al. 2016, Hayashi & Michaelowa 2013, Spalding-Fecher & Michaelowa 2013) while potentially prohibiting truly-additional projects from participating (Schneider et al. 2012).

In this paper, we explore how California's standardized approach to carbon offsets addresses the risk of over-crediting, focusing on the three principal sources of over-crediting observed under the CDM: (1) non-additional crediting, (2) inflated baseline emissions, and (3) perverse incentives. We use examples from the development of two California offset protocols—Mine Methane Capture (MMC) and Rice Cultivation—to illustrate each of these risks and explore strategies for mitigating them during the protocol design and implementation phases. Our analysis is rooted in our experiences during 2013 through 2015 as a team of researchers participating in the technical working groups established by California to support the development of these two protocols (see Haya, Strong, Grubert, & Cullenward 2016). We also draw on discussions with researchers and practitioners as well as our own quantitative assessments. The goals of this analysis are to examine how effectively California's standardized approach to offsets prevents the risk of over-crediting, how the protocol design and review process could be improved, and what California's experience tells us about the risks and opportunities of carbon offset programs in general. Our results have important impli-

[1] The *compliance offset market* generates offset credits that can be used towards meeting a legally enforced obligation; the *voluntary offset market* generates offset credits for any other use, such as by cities, universities, companies, and individuals wishing to lower their carbon footprint.

cations for climate policy design, especially as more jurisdictions and international bodies consider implementing offset programs.

2. Background

a. California's cap-and-trade program

California's climate laws, known as AB 32 and SB 32, require the state to reduce its greenhouse gas (GHG) emissions to 1990 levels by 2020 and to 40% below 1990 levels by 2030. ARB was tasked with developing policy to achieve the state's GHG targets and eventually adopted a suite of policies that include direct regulatory instruments and an economy-wide cap-and-trade program (Wara 2014).

The cap-and-trade program covers approximately 75% of the state's greenhouse gas emissions (ARB 2018a, 2018c)—about 450 large emitters in the state's highest emitting sectors: electricity, industrial, transportation fuels, and natural gas (ARB 2015b). Covered emitters must submit compliance instruments (allowances and offsets) equal to their reported greenhouse gas emissions. So far, ARB has relied on cap-and-trade as a "backstop" policy, while traditional regulations are doing most of the work needed to meet California's 2020 target (ARB 2014a, Bang, Victor, & Andresen 2017). Cap-and-trade has likely played only a modest role in driving emissions reductions due to the oversupply of compliance instruments on the market (Legislative Analyst's Office 2017). Going forward, however, ARB expects cap-and-trade to deliver approximately 38% of the cumulative emission reductions projected to be necessary over the period 2021 through 2030, and fully 47% of the annual reductions needed to achieve the state's 2030 climate target (ARB 2017: Figure 7).

b. California's offset program

ARB's cap-and-trade regulations limit the use of offsets to 8% of each regulated emitter's total emissions each year through 2020.[2] Thus, if all emitters fully exploit this limit, their total emissions would increase to approximately 8% above the cap, with offsets crediting reductions in sectors outside the cap in an amount that is equal to that increase. In the market's post-2020 period, the offsets limit will be reduced to 4% of capped emissions from 2021-25 and then increase back up to 6% from 2026-30. In addition, beginning in 2021, credits worth no more than half of the offsets limit may originate from projects that do not generate "direct environmental benefits" to California air or water quality.[3] Companies submitted offset credits equal to 4.4% of their emissions in the market's first compliance period (2013-14) (ARB 2015a) and 6.4% of their emissions in the second (2015-17) (ARB 2018b). Many regulated companies would prefer to increase their use of offsets because off-

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2 California Code of Regulations, title 17, § 95854.

3 California Health & Safety Code § 38562(c)(2)(E) (as modified by AB 398).

sets are expected to be less expensive than reductions under the cap (Borenstein, Bushnell, Wolak, & Zaragoza-Watkins 2018).

Although the offset limits might seem small compared to total emissions, they constitute a large share of the reductions required under cap-and-trade. ARB forecasted that cumulative reductions required in capped sectors through 2020 will be approximately 10% of those sectors' business-as-usual emissions (Haya 2013). The 8% offsets limit therefore represents approximately 80% of the mitigation required in capped sectors through 2020. From 2021 through 2030, the lower offset limits are equivalent to 20% of total mitigation required in capped sectors, and over half of the projected effect of cap-and-trade program itself (Haya 2018). As a result, the environmental effectiveness of the cap-and-trade program will likely turn on the quality of the carbon offsets program.

Each California offset protocol defines a specific set of activities eligible to generate offset credits and includes detailed methodologies for estimating the emissions reduced (and therefore credits generated) by each participating project. California's first four offset protocols were largely based on protocols developed for the voluntary market by the Climate Action Reserve (CAR): U.S. Forest, Livestock, Ozone Depleting Substances (ODS), and Urban Forest. In 2013, ARB started developing two more offset protocols: MMC and Rice Cultivation. Like the four original protocols, both were largely based on voluntary, pre-existing CAR protocols; however, the final MMC and Rice Cultivation protocols were developed through a multi-year stakeholder process that involved technical working groups in which the authors participated (Haya et al. 2016). We briefly summarize these two protocols before discussing the challenges of estimating their effect on emissions.

i. Mine Methane Capture (MMC) Projects Protocol

Many coal deposits contain methane, a potent greenhouse gas. When coal is mined, methane can be released into the atmosphere. The MMC Protocol credits the destruction of methane that would otherwise have been released into the atmosphere from coal mines. Creditable methods of methane destruction are (1) flaring from drainage wells, which tend to have high methane concentrations; (2) methane capture from drainage wells for use, including through pipeline injection, use in vehicles, and on-site electricity generation; and (3) oxidizing methane from ventilation systems, which tend to have low methane concentrations. Each method converts methane into carbon dioxide, lowering the climate impact because methane is a far more potent atmospheric greenhouse gas than carbon dioxide. Eligible mines include active underground and surface coal mines, abandoned underground coal mines, and trona mines[4] in the United States. ARB adopted the MMC Protocol in April 2014. As of July 2019, MMC projects had generated 6.1 million offset credits, each representing the equivalent of one metric ton of carbon dioxide (tCO_2e) reduced (ARB 2019).

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[4] Trona is a form of sodium carbonate (used as soda ash) that is mined in the United States.

ii. Rice Cultivation Projects Protocol

Rice cultivation is an important source of anthropogenic methane and nitrous oxide emissions. Rice is grown in flooded fields where anaerobic decomposition of organic material in saturated conditions produces methane and anaerobic denitrification produces nitrous oxide. The Rice Cultivation Protocol credits reduced methane emissions resulting from shorter flooding periods achieved by (1) seeding fields under dry, rather than wet, conditions; (2) draining fields earlier in the fall; or (3) drying fields periodically during the summer cultivation period. The protocol uses the DeNitrification-DeComposition (DNDC) process-based biogeochemical model (University of New Hampshire 2012) to estimate net carbon dioxide, nitrous oxide, and methane emissions from changing rice cultivation practices in the United States, based on field-specific crop management, fertilizer, field management, and weather parameters. ARB adopted the Rice Cultivation Protocol in June 2015. As of July 2019, no projects had earned credits under the Rice Cultivation protocol (ARB 2019).

3. Challenge 1: Additionality

Because an offset credit allows its holder to emit one extra ton above a cap-and-trade program's cap in exchange for one ton reduced or sequestered outside of the capped sectors, the offset project must cause (and not merely be coincident with) emission reductions. California's climate law, AB 32, codifies this additionality standard by requiring that reductions from market-based compliance mechanisms be "in addition to … any other greenhouse gas emission reduction that otherwise would occur."[5]

Additionality can be assessed at the project or protocol level. The CDM generally requires individual project developers to demonstrate that each proposed project is additional. In contrast, protocol-based additionality standards do not require each individual project to be additional. Under this paradigm, a regulator can address the risk of over-crediting from the participation of non-additional projects by assessing the entire pool of credits expected to be generated by a protocol. So long as the total number of credits awarded to non-additional projects is counterbalanced by conservative[6] accounting methods that reduce the estimated emission reductions and thereby reduce the overall number of credits awarded, the protocol-level additionality standard is satisfied.

ARB has chosen to operationalize its protocol-level additionality requirement with a "common practice" assessment. Under this approach, a project type is considered additional if it is not common practice, a determination that is based on "staff's best estimate of the percent of the technology or mitigation in use" for the relevant sector (ARB 2013a: 7-8). Here we analyze ARB's application of its common practice assessment to one project type—methane capture at abandoned coal mines.

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

6 " '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.

a. Methane capture at abandoned coal mines

The MMC Protocol illustrates how different interpretations of the common practice test can significantly alter the additionality determination. During the MMC Protocol development process, ARB's initial definition of common practice shifted from a broad assessment that risked generating large quantities of credits from non-additional methane capture to a more refined evaluation in the final protocol that substantially reduced the risk of non-additional crediting. As discussed below, however, an additional step is needed to avoid over-crediting.

After ceasing operation, gassy underground coal mines continue to emit methane (U.S. EPA 2008). At the time of MMC Protocol development, 38 (6%) of the approximately 645 abandoned gassy underground mines in the United States engaged in methane capture, mostly for injection into natural gas pipelines (Ruby Canyon Engineering 2013). An early draft of the protocol concluded: "from the population of … abandoned underground mines in the United States, few currently capture and destroy mine methane" and therefore "abandoned underground mine methane recovery activities are deemed additional" (ARB 2013b: 7). This initial approach to evaluating common practice risked generating a large proportion of credits from non-additional activities for three reasons.

First, ARB initially focused its common practice assessment on the number of mines, rather than the quantity of emissions. The difference matters because methane concentrations vary substantially across mines. Even though only 6% of abandoned mines captured methane in 2011, these projects captured approximately 33% of total methane released from abandoned mines in the United States (U.S. EPA 2013b).

Second, methane capture is financially or technologically infeasible at most of the 645 abandoned mines in the United States. One study found that additional methane capture is feasible at only 67 abandoned mines in the United States (Ruby Canyon Engineering 2013). Based on this study, abandoned mines already captured approximately one-half of total feasibly captured methane emissions. Thus, if ARB assessed common practice based on how much of the *feasible* methane capture was already occurring, it would have determined that abandoned mine methane capture is already common practice.

Third, an aggregated, sector-wide assessment may fail to identify sub-categories of projects that are common. For example, all mines abandoned between 1993 and 2012 that captured methane when they were active continued to capture methane after abandonment (Collings 2013, U.S. EPA 2016b). If past rates of coal mine abandonment and abandoned mine methane capture development continue—and all abandoned mines are eligible to generate credits—business-as-usual methane capture could generate credits equal to 44-54% of total feasible new methane capture potential at the current pool of abandoned mines (see Supplemental Materials, Table SM-2). Thus, the quantity of non-additional credits generated from abandoned mines would likely exceed—possibly by a large amount—the total credits generated from truly additional abandoned mine methane projects.

In its final protocol, ARB modified its common practice analysis to explicitly exclude abandoned mines that captured methane when they were active on the grounds that methane capture at this particular sub-category of mines is already common practice. ARB's decision to assess a common practice at a higher resolution avoided a significant risk of non-additional crediting. However, one more assessment is needed to contain the risk of over-crediting.

During the period 1993 to 2012, new abandoned mine methane capture systems were built at 30 abandoned coal mines that, if built today, would meet the eligibility requirements of the MMC Protocol. Half of these mines' annual reductions are from projects that participated in a voluntary carbon offset program; the other half were from projects that received no such incentive payments. The projects that were built without the voluntary offsets incentives and those that received offsets but would have been built anyway are "business-as-usual" projects. While it is not possible to know with certainty the rates of project development going forward without the protocol's financial incentive, if rates over the past twenty years continue unchanged, business-as-usual abandoned mine methane capture projects could generate a quantity of non-additional credits equal to 8 to 16% of total feasible methane capture from eligible abandoned mines (see Supplemental Materials, Table SM-2).

To contain this particular risk of over-crediting, ARB could first conduct a market analysis to assess the likely business-as-usual deployment of mine methane capture systems going forward. ARB could then reduce the number of credits expected to be generated from the total portfolio of abandoned mine methane capture systems by the amount of anticipated non-additional crediting that is eligible under its MMC Protocol. This could be done using conservative methods to estimate emissions reduced by projects participating under the protocol, or by applying an explicit discount factor to all credit generation. While these options risk weakening the effectiveness of the protocols in incentivizing emissions reductions (van Benthem & Kerr 2013), if carried out well, they should also reduce the quantity of over-crediting. If total under-crediting from the discounting of additional credits equals total over-crediting from participating non-additional projects, then the credits generated would equal the net impact of the protocol on emissions and all credits could be considered additional. This example illustrates the challenge of assessing additionality for any project type already being implemented without the added incentive from a carbon offset program.

4. Challenge 2: Estimating Baseline Emissions

Establishing additionality is one aspect of a broader challenge—estimating baseline emissions that would occur in the absence of an offset project. Project emissions can be observed and independently validated, but the baseline scenario never occurs and therefore cannot be observed. As a result, baseline emission projections are uncertain.

a. Scientific uncertainty in the baseline: methane release from abandoned mines

Estimating baseline emissions in the MMC Protocol is difficult because methane capture devices can extract more methane than would have escaped to the atmosphere in the absence of the device (ARB 2013b). Because these extra emissions would not occur in the absence of MMC projects, the total methane captured by offset projects cannot be used as a baseline. Instead, the protocol estimates baseline emissions from abandoned mines using a hyperbolic emission rate decline curve model (U.S. EPA 2016c). This model projects a rate of decline in emissions based on empirical data from U.S. coal mines reflecting characteristics such as the geologic formation, mine gassiness, and whether a mine has been sealed. Project developers can input either default coefficients or measured site-specific values.

For projects at mines that never drained methane when active and use default parameter values, ARB discounts the number of credits awarded by 20% to account for possible discrepancies between the default and the actual project-specific baseline. ARB's decision to apply a discount factor addresses a known uncertainty, but the specific discount factor—20%—reflects the agency's subjective expert judgment, based on stakeholder feedback. When methodological issues cannot be addressed empirically and instead require subjective judgment calls, uncertainty in the true emission reductions achieved under the protocol increases.

b. Technological and behavioral uncertainty in the baseline: rice farmer practice

The Rice Cultivation Protocol defines baseline cultivation practices—such as when fields are drained or how much fertilizer was applied—in two ways, depending on the location of the project. Both methods make important assumptions about farmers' cultivation choices. For projects in the Mid-South of the United States, baseline emissions are projected using the widely-used DD50 rice management model developed to aid farmers in cultivation decisions (University of Arkansas 2018). For projects in California, however, baseline emissions are defined based on what each farmer reports about past cultivation practices, rather than model projections.

Both approaches to baseline setting are uncertain and vulnerable to over-crediting. Modeled common farmer practice in the Mid-South does not necessarily predict any single farmer's practice. For example, farmers who were already draining fields earlier than the DD50 model recommends can earn credit for early drainage without changing their practices. Similarly, in California, simple averages of a specific farmer's past cultivation practice are not necessarily good predictors of future practice because cultivation decisions reflect each season's specific conditions. It is also common for farmers to experiment with new practices to reduce risk, improve yield, lower costs, respond to market prices, or achieve other goals like water conservation. Furthermore, it can be difficult for third party auditors to verify past farmer practice.

In light of these challenges, ARB decided to test alternative methods that third-party verifiers can use to verify baseline emissions at different project sites to explore their feasibility and effectiveness. As of this writing, however, no projects have been credited under this protocol and the experience with verification remains unknown.

5. Challenge 3: Perverse Incentives

Financial incentives created by an offset protocol can also inadvertently increase emissions, for example by increasing the profits of high-emitting activities, creating disincentives to enact legally binding climate regulations, and inducing business-as-usual mitigation projects to shift their activities to earn offset credits.

a. Increasing profits: from coal mining

The U.S. coal industry has been in decline in recent years (U.S. EIA 2016, 2019b). In a shrinking market for coal production, increased profits from offset credit sales might extend the lives of otherwise uncompetitive coal mines.

To assess the scale of this risk, we analyzed potential profits from implementing mine methane capture projects at the eight active underground coal mines in the United States that EPA identified as having methane drainage wells that vented the majority of drainage methane to the atmosphere and that did not already have pipeline injection systems (U.S. EPA 2016b). These coal mines are prime candidates for mine methane capture systems because of their large and high-concentration methane releases (U.S. EPA 2013a), and because capture is more economically favorable when mines are active.

We used EPA's Coal Mine Methane Project Cash Flow Model version 3.0 (U.S. EPA 2016a), 2012 data for coal production (Fiscor 2013), coal sales prices (U.S. EIA 2013), and methane releases (U.S. EPA 2016b) for each of the eight mines (see Supplemental Materials, Table SM-3).[7] Our analysis indicates that ARB's MMC Protocol could increase coal mining profits by as much as 17% if offset credits sell at \$10 per tCO_2e (lower than prevailing allowance prices in California), with a production-weighted average increase in mining profits of 3% across the eight mines analyzed. At \$50 per tCO_2e—a price for carbon credits that is not imminent but is plausible in coming years (Borenstein, Bushnell, & Wolak 2017)—mine profits could more than double at some mines, with a production-weighted average increase of 23% across the eight mines analyzed.

b. Increasing profits: inducing a switch from corn to rice production

By providing an additional source of revenue to rice farmers, the Rice Cultivation Protocol could shift the relative profitability of rice in comparison to other crops, leading to crop switching with emissions impacts. In areas of the Mid-South of the United States, farmers commonly shift between rice and corn production (Jekanowski & Vocke 2013). However, rice production is about four times more emissions-intensive than corn production in those areas (Nalley, Popp, & Fortin 2011). Corresponding changes in Arkansas crop prices and acreage since 2005 indicate that shifts between rice and corn in Arkansas are correlated with changes in relative crop prices (data from USDA 2013a, USDA 2013b). Assuming historical elasticities between prices and acreage, offset profits of \$10 per

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7 ARB assessed the impacts on coal mining revenues of two ventilation air methane (VAM) projects at underground mines and one methane capture project at a surface mine and found that the offset revenues were too small to affect coal mining decisions (ARB 2014b). ARB did not publish a similar assessment of a project that flares drainage methane at an active underground mine, the project type analyzed here.

tCO_2e could induce a shift of 1 to 2% of corn acreage to rice production. If only a fraction of this crop switching were to occur, the emissions benefits of the protocol would be weakened by 9 to 41% (see Supplemental Materials). The potential emission increases associated with such offset-induced crop switching are material enough to warrant monitoring if offset prices increase and Rice Cultivation Protocol projects start to be implemented. This example highlights the potential for carbon offsets to affect emissions by changing the relative profitability of competing products.

c. Weakening or delaying climate regulation

Carbon offsets can also exert perverse effects on the political economy of climate policy development. By definition, any emission reductions that are required by law are non-additional and therefore ineligible to earn offset credits. As a result, carbon offset revenues create an added incentive for those benefiting from offset projects to advocate against the development of legally binding regulations that apply to their activities.

These concerns have manifested in California's carbon offset regime, which may have affected federal climate policy decisions during the Obama Administration. In April 2014, the Bureau of Land Management (BLM) issued an Advance Notice of Proposed Rulemaking (ANPRM) on reducing emissions of waste methane from active underground mines on federal lands (Bureau of Land Management 2014). The ANPRM contemplated various options, including mandating or creating incentives for capture. However, mandatory regulations would preclude affected mines from earning offset credits through California's MMC Protocol. BLM issued a final rule limiting methane emissions from oil and gas operations on federal lands effective January 2017 (Bureau of Land Management 2016) without mention of methane from coal mines.

Preliminary evidence suggests, though does not conclusively establish, that incentives from California's MMC Protocol may have contributed to BLM's decision not to require methane capture at coal mines on federal lands. At the 2014 U.S. Coal Mine Methane conference held by the U.S. Environmental Protection Agency in Pittsburgh, Pennsylvania, BLM representatives stated during their presentation that BLM was taking California's MMC Protocol into account in deciding whether and how to regulate or incentivize the capture of waste methane from active underground coal mines on federal lands (Leverette & LaSage 2014). The representatives further indicated to conference participants that BLM intended to support California's offset program. It is not possible to know what BLM action (and by extension, methane mitigation activity) would have occurred in the absence of California's offset program. Nevertheless, it is notable that the BLM subsequently opted to regulate methane emissions from oil and gas operations but not from coal mines, and that the BLM representative conveyed that the California protocol was part of the federal agency's deliberations. We believe this example illustrates the potential for carbon offset programs to delay or weaken legally binding climate regulations.

d. Creating incentives for only some activities that reduce emissions

To avoid over-crediting, offset protocols generally exclude project types likely to result in non-additional crediting. While necessary, such exclusions can lead to unintended effects. For example, the MMC Protocol excludes projects at active underground mines that capture methane for injection into the natural gas pipeline network because ARB determined that projects of this type are common practice and therefore non-additional. Since pipeline injection is ineligible under California's offset program, but flaring remains eligible at qualifying drainage wells, mine operators face a choice. If they sell captured methane into the natural gas pipeline network, they receive the market value of methane's use as a fuel. Alternatively, mine operators could choose to flare the captured methane, which would be eligible for carbon offset credits.

Figure 1 illustrates the relative revenues from pipeline injection versus flaring for different combinations of carbon and natural gas prices. Since capital costs are often lower for flaring than for pipeline injection (Somers, Burklin, McClutchey, & Cote 2013) and are not taken into account in Figure 1, flaring methane instead of capturing it for beneficial use may be preferable under a wider range of conditions. Given current and likely future carbon market prices (Borenstein et al. 2017), flaring captured methane for carbon credits is likely to be much more valuable than the productive use of that methane—even under relatively high natural gas prices that occurred prior to the expansion of unconventional hydrocarbon resource production in the United States.

The MMC Protocol excludes projects that flare methane from wells that captured and injected methane into pipelines within the previous year. Because protocol eligibility criteria are determined for each drainage well, however, this restriction does not affect the incentives for operators of new wells or mines, or of wells for which pipeline injection ceased for at least one year. Operators of these wells who may have chosen to sell methane into a pipeline in the absence of the protocol may now have a financial incentive to flare this methane instead to earn carbon credits. In these cases, the protocol would not only result in non-additional crediting, but would also have the added impact of flaring methane that would otherwise have been put to productive use as a fuel.

6. Discussion and Conclusions

Drawing on examples from the development of two offset protocols, we examine how California's standardized approach to carbon offset program design addresses three interrelated challenges: assessing project additionality, estimating baseline emissions, and avoiding perverse incentives that increase emissions.

By concentrating decisions about project eligibility and emission reduction estimates in the protocol development process, California's standardized approach reduces some of the governance challenges associated with project-by-project assessments used by first generation offset programs. In particular, the standardized approach offers the ability to address additionality and avoid over-crediting for the portfolio of carbon offset projects as a whole using project type exclusions, conservative methods for estimating emissions reductions, and discount factors. Protocol-level additionality determinations and methods for estimating emissions reductions also lessen transaction costs for project developers by reducing the need for expensive and complicated project-level analysis. Finally, California's protocol-scale approach facilitates public stakeholder participation in program decisions (Haya et al. 2016).

However, California's approach does not resolve the significant uncertainty surrounding emission reductions credited to carbon offsets. Assessments of additionality, counterfactual baseline scenarios, and the effects of perverse incentives are inherently uncertain. Using detailed examples from the Mine Methane Capture and Rice Cultivation protocols, we describe a range of ways that uncertainty manifests in California's offset program. Ultimately, the risk of over-crediting can be reduced, but not eliminated, with careful analysis, conservative design decisions, and ongoing monitoring of program outcomes.

a. Recommendations for improvement

ARB could reduce the risk of over-crediting with three reforms to its offset protocol design and review processes.

First, ARB should improve the way it applies its "common practice" assessment to address additionality. As discussed in the context of the MMC protocol, non-additional crediting can be reduced by focusing the assessment on emissions, rather than projects; on feasible projects, rather than all possible projects of a certain type; and on project type sub-categories individually to filter out those with high over-crediting risks.

Second, ARB should conduct and periodically review an explicit, quantitative analysis of the expected portfolio-level balance of over-crediting and under-crediting. Protocol-level eligibility criteria enable all qualifying projects to participate and earn offset credits, including those that are non-additional but satisfy the requisite criteria. To avoid over-crediting, regulators could deliberately choose to under-credit calculated reductions from each participating project such that the credits awarded to projects under the protocol reflect the best estimate of net reductions achieved by the protocol across all projects, while being cognizant that this approach could make some truly additional projects uneconomic. Ideally, protocol development would involve four estimates: (1) expected business-as-usual trends that lead to non-additional but eligible projects (non-additional credits), (2) expected additional projects (additional credits), (3) under-crediting from conservative protocol methods, and (4) explicit discount factors designed to counterbalance any remaining over-crediting. Additionality would be preserved at the protocol level if total credits generated by a protocol do not exceed conservative estimates of the effect of the offset protocol on emissions. Assumptions about business-as-usual and additional project development should be reassessed periodically, enabling the regulator to dynamically modify project type exclusions, emission estimation methods, and discount factors. While these *ex ante* and *ex post* assessments involve substantial uncertainty and subjective expert judgment, performing these assessments would explicitly improve transparency, accountability, and policy effectiveness.

Third, ARB should assess, monitor, and take precautions to avoid the risk of creating perverse incentives that increase emissions. For example, profits created by California's Mine Methane Capture Protocol could create incentives for coal mine owners to keep mines operating longer than they otherwise would, or to flare methane that they would otherwise capture for productive use as fuel. Experience with the Mine Methane Capture Protocol suggests that it may have influenced federal decisions not to regulate methane emissions from coal mines on federally-owned lands during the Obama Administration. A "do no harm" approach would carefully assess and monitor these potential effects, excluding project types with the potential for significant perverse incentives. Fundamentally, however, perverse incentives are difficult to avoid.

b. Implications for governance

Even with best practice protocol design and updating, carbon offsets' emission reductions are inherently uncertain because offsets pay for reductions, rather than charge for emissions. Estimating emission *reductions* requires a regulator to quantify the emissions of an unknowable counterfactual scenario, as well as estimate the proportion of eligible offset projects that will be non-additional. *Paying* for reductions can create a range of perverse incentives, such as by improving the profitability of high-emitting activities, inducing a shift in activity rather than net reduction in emissions, and creating a disincentive for governments to regulate emissions.

Whether conducted explicitly or implicitly, uncertainty management in carbon offset programs illustrates a critical disconnect between the perception and practical function of cap-and-trade programs that feature large offset programs. Cap-and-trade programs are often promoted as market-oriented solutions that allow the free market to identify the least-cost compliance portfolio with minimal direction from government (e.g. Washington Post Editorial Board 2016). In turn, offsets are often seen as an essential mechanism for containing compliance costs and voluntarily extending carbon price incentives to sectors not covered by cap-and-trade. Yet the practical operation of offset programs rests on a complex set of government-determined protocol standards needed to manage uncertainty in reductions achieved. The choices regulators make about what project types to target with protocols and how to calculate reductions under those protocols drive outcomes in the market. Therefore, to the extent that offsets are used to deliver a substantial share of emission reductions (as is the case in California), program outcomes will be strongly influenced by government priorities and quality judgments, rather than primarily determined by private actors' decisions.

Instead of thinking of offset credits as equivalent to reductions under an emissions cap, it may be more useful to think of offsets as a government-intermediated incentive program in which regulated emitters invest in lieu of directly complying with emission limits. Like most programs that create financial incentives for behavior change, the effect on emissions is difficult to assess because of uncertainty in how much the change in practice would have occurred regardless of the new incentive, uncertainty in the emissions associated with the counterfactual scenario, and uncertainty about the effects of its incentives outside of project boundaries. Just as with any other government incentive program, outcomes are largely determined by government decisions about which types of activities receive support and the methods used to estimate program effects. As a result, we suggest that the emission reductions credited under offset protocols are fundamentally different from reductions measured under carbon pricing policies, both in terms of the ability to quantify and verify emission reductions and the role of government in decision-making.

Public comments at ARB offset workshops indicate that stakeholders hold profoundly different views of the offset program's purpose. Some emphasize the role offsets play in helping California meet its target for reducing emissions. Others view offsets primarily as a much-needed source of funding for activities that reduce emissions and increase co-benefits in uncapped sectors. Offsets are often portrayed as win-win, delivering both benefits at once (Anderson, Field, & Mach 2017). Our experience with protocol development, detailed here, shows that decisions about program size and stringency involve trade-offs between these goals. An offset program that prioritizes the environmental integrity of the cap-and-trade program needs to carefully target project types that are not already being implemented on their own and for which emissions reduction estimates are relatively certain. Such a program could miss many promising opportunities to reduce emissions in the sectors eligible for offset credits. For example, some of the most promising opportunities can be excluded because they have a high risk of being non-additional, such as pipeline injection at underground coal mines under the Mine Methane Capture Protocol. As another example, strict monitoring requirements for rice cultivation projects give greater confidence in credited reductions, but also diminish offsets' financial incentives, especially for smaller projects. In turn, high compliance costs may explain the lack of any participation in the Rice Cultivation Protocol so far. These tradeoffs illustrate another fundamental tension in the use of offsets as a form of climate policy.

Our observations also indicate a critical governance challenge facing carbon pricing policies that rely on offsets. In order to address uncertainty and contain the risk of over-crediting, offset program regulators must invest in substantial, ongoing, and often under-appreciated regulatory oversight. Yet to date, governance of environmental integrity concerns in the California offsets program is focused on the initial development of protocol rules, rather than their ongoing oversight and reform. Formalizing the analytical framework and processes used to manage offsets integrity could provide opportunities for evidence-based improvement.

Rather than eliminate the risk of over-crediting, California's standardized approach to offset program design shifts risk from project-level assessments to protocol-level design decisions. Careful interdisciplinary analysis and conservative protocol design decisions are needed to contain the risk of over-crediting; policymakers must also invest sufficient resources in ongoing program oversight. Nevertheless, even the most careful and conservative program design and oversight process will result in significant uncertainty in true emission reductions. Offsets allow regulated entities to emit more than the program cap levels, in exchange for a corresponding but less certain amount of reductions outside of the cap. Thus, where carbon offsets play a significant role in the total reductions expected under a cap-and-trade program—as they do in California—they risk lessening total emission reductions achieved by the cap-and-trade program and increase uncertainty in whether the emissions target has been achieved.

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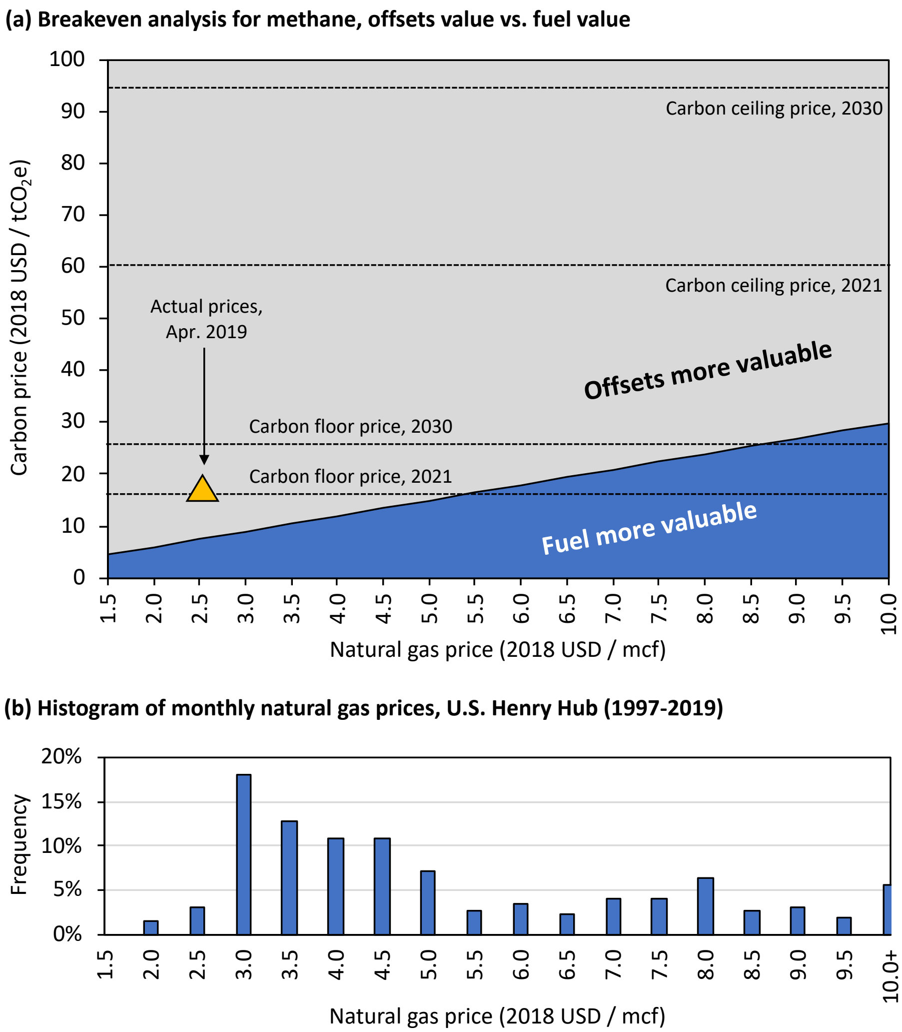
Figure 1. Income from flaring methane for offset credits versus sale of natural gas



Natural gas captured at drainage wells can be sold for fuel, or, if eligible for the MMC Protocol, flared to generate carbon offset credits. Panel (a) shows the market conditions under which flaring will be more valuable (top area) and under which fuel sales will be more valuable (bottom area). Dashed lines indicate California's minimum carbon price floor in 2021 and 2030, as well as the maximum price ceiling in 2021 and 2030. Panel (b) shows a histogram of monthly natural gas prices from 1997-2019, which have generally ranged from $3-8/thousand cubic feet (mcf), with recent prices in the $2-4/mcf range (U.S. EIA 2019a). If carbon prices remain near program minimums, then flaring methane to sell offset credits will generate higher revenues than selling methane as fuel, unless natural gas prices reach historically high levels. At carbon prices a few dollars above the minimum carbon price, drainage wells will generally profit more from offset sales, no matter the price of natural gas. This analysis indicates that mine owners face a perverse incentive: it is more profitable under a wide range of scenarios to flare methane captured from drainage wells, even if it would be economic to capture the methane for productive, private use.

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EXHIBIT F

WWF for a living planet®

Making Sense of the Voluntary Carbon Market
A Comparison of Carbon Offset Standards

Anja Kollmuss (SEI-US), Helge Zink (Tricorona), Clifford Polycarp (SEI-US)

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Table of contents

Acknowledgements . . . iii

About the Authors . . . iii

About This Report . . . iv

Executive Summary . . . v

1. **Introduction** . . . 1

2. **Market Overview** . . . 2
   2.1 Compliance Market . . . 4
   2.2 Voluntary Carbon Markets . . . 6
   2.3 Voluntary and Compliance Carbon Market Size . . . 6

3. **How Offset Projects Are Implemented** . . . 8
   3.1 The Stages of the CDM Project Cycle . . . 8
   3.2 Who Is Who in a Carbon Offset Project . . . 11

4. **The Role of the Voluntary Market** . . . 12

5. **Key Elements of Offset Standards** . . . 14
   5.1 Additionality and Baseline Methodologies . . . 15
      5.1.1 Project Based Additionality Testing . . . 15
      5.1.2 Performance Standards . . . 16
      5.1.3 ***Additionality Requirements for Each Standard*** . . . 17
      5.1.4 Baselines . . . 18
      5.1.5 ***Baseline Requirements for Each Standard*** . . . 19
      5.1.6 Project Boundaries and Leakage . . . 20
   5.2 Project Types . . . 20
      5.2.1 Biological Sequestration . . . 20
      5.2.2 Industrial Gases . . . 22
      5.2.3 Methane Capture . . . 23
      5.2.4 Energy Efficiency . . . 24
      5.2.5 Renewable Energy . . . 24
      5.2.6 ***Project Types Accepted by Each Standard*** . . . 25
   5.3 Project Location . . . 25
   5.4 Start Date & Crediting Period . . . 26
      5.4.1 ***Start Dates and Crediting Periods for Each Standard*** . . . 28
   5.5 Co-Benefits . . . 28
      5.5.1 Sustainable Development Criteria . . . 28
      5.5.2 Stakeholder Consultations . . . 31
      5.5.3 ***Co-Benefits Requirements for Each Standard*** . . . 32
   5.6 Role of Third Party Auditors . . . 33
      5.6.1 Aligned Interests Between Buyers and Sellers . . . 33
      5.6.2 Independent Validation of Project Activity . . . 33
      5.6.3 Monitoring and Independent Verification of Project Activity . . . 34

5.6.4 Project Approval: Auditors or Standard Boards 35
5.6.5 Conflicts of Interest: Auditors and Project Developers.....35
5.6.6 Quality Control of Auditors 36
5.6.7 ***Project Auditing Requirements for Each Standard*** 36
5.7 Registries 39
5.7.1 ***Registries Used by Each Standard*** 40
5.8 Double Counting.....40
5.8.1 ***Project Locations and Rules on Annex B Countries for Each Standard*** 42

6. **Offset Transactions** 42
6.1 Pricing of Offsets 42
6.1.1 Project Costs 42
6.1.2 A Common Misunderstanding: The "Project Share Pitfall" 43
6.2 Offset Market Prices 43
6.2.1 ***Pricing of Offsets for Each Standard*** 44
6.3 Choosing the Right Contract Terms 45
6.3.1 Low Transaction Risk: Prompt Delivery of Existing Offsets 46
6.3.2 Medium Transaction Risk: Forward Delivery of Future Offsets 46
6.3.3 High Transaction Risk: Forward Crediting of Ex-ante Offsets 47
6.3.4 How Providers Can Reduce Delivery Risk 47

7. **Review of Standards Used In the Voluntary Offset Market** 48
7.1 Offset Standard Types 48
7.2 Full-fledged Standards 49
Clean Development Mechanism 49
Gold Standard 54
Voluntary Carbon Standard 2007 (VCS 2007) 58
VER+ 63
Chicago Climate Exchange (CCX) 66
7.3 Offset Standard Screens 71
Voluntary Offset Standard (VOS) 71
7.4 Bio-Sequestration Standards 72
CDM Afforestation and Reforestation Standard (CDM A/R) 72
VCS AFOLU Standard 74
The Climate, Community & Biodiversity Standards (CCBS) 76
Plan Vivo System 79
7.5 Offset Accounting Protocols 79
GHG Protocol for Project Accounting 83
ISO 14064 85

8. **Governmental Action to Regulate the Voluntary Market** 87

9. **Overall Standard Ratings & Conclusions** 88

References 94

Appendix A: **Renewable Energy Certificates (RECs)** 97

Appendix B: **CDM Additionality Tool** 100

Appendix C: **Realized CDM Emissions Reductions** 102

Appendix D: **Glossary** 103

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About This Report

This report discusses the role of the voluntary carbon market and provides an overview of the most important currently available carbon offset standards. It compares the following standards side-by-side, outlining the most pertinent aspects of each:

- Clean Development Mechanism (CDM)
- Gold Standard (GS)
- Voluntary Carbon Standard (VCS)
- VER+
- The Voluntary Offset Standard (VOS)
- Chicago Climate Exchange (CCX)
- The Climate, Community & Biodiversity Standards (CCBS)
- Plan Vivo System
- ISO 14064-2
- WRI/WBCSD GHG Protocol for Project Accounting

The report is meant to be a comprehensive reference. To maximize the readability and transparency of the report, we distinguish between the following types of information:

- ***Background information*** describes principles and mechanisms of the offset market in general. This report uses the CDM as the baseline standard against which all the other standards are compared. It also includes an explanation of the CDM project cycle and the main actors involved in CDM offset projects. The information in these sections is presented as objectively as possible and with minimal editorializing. The appendices include further background information. *Background information appears in black.*
- ***Standard Comparisons and Summaries*** include specific information about each standard as well as comparison tables. The information in these sections is presented as objectively as possible and with minimal editorializing. *Standard comparisons and descriptions are titled in blue or on a blue background.*
- ***Authors' Comments*** are sections where the authors express their opinions and value judgments. Editorial comments and opinions about each standard can be found at the end of the standard description. In their brief comments, the authors focus on what they consider the main strengths and weaknesses of each standard. *Editorial comments are indicated by a vertical bar on the left.*

Many of the standards we have reviewed are young and have few implemented projects. Our assessment relies on comparing the requirements of each standard and does not include project comparisons. Judging the standards based on their performance in the real world will be impossible until at least a few projects have been implemented under each of them.

We hope that the layout and structure of this paper will allow a diverse audience of consumers, offset professionals and project developers to find the information they are looking for.

Executive Summary

In order to preserve a high probability of keeping global temperature increase below 2 degrees Centigrade, current climate science suggests that atmospheric CO_2 concentrations need to peak below 450ppm. This requires global emissions to peak in the next decade and decline to roughly 80% below 1990 levels by the year 2050 (Baer and Mastrandrea, 2006). Such dramatic emissions reductions require a sharp move away from fossil fuel, significant improvements in energy efficiency and substantial reorganisation of our current economic system. This transition can only be achieved by far-reaching national and international climate policies.

Carbon offsetting is an increasingly popular means of taking action. By paying someone else to reduce GHG emissions elsewhere, the purchaser of a carbon offset aims to compensate for – or "offset" – their own emissions. Individuals seek to offset their travel emissions and companies claim "climate neutrality" by buying large quantities of carbon offsets to "neutralize" their carbon footprint or that of their products.

Carbon offset markets exist both under **compliance schemes** and as **voluntary programs**. Compliance markets are created and regulated by mandatory regional , national, and international carbon reduction regimes, such as the Kyoto Protocol and the European Union's Emissions Trading Scheme. Voluntary offset markets function outside of the compliance markets and enable companies and individuals to purchase carbon offsets on a voluntary basis (see chapter 2.2). With more than € 20 billion* traded in 2006 (Capoor & Ambrosi, 2007), carbon markets are already a substantial economic force and will likely grow considerably over the coming years. The voluntary market, although much smaller than the compliance market, (€62.6 million in 2006; Hamilton, 2007) is also growing rapidly.

This report discusses the role of the voluntary carbon offset market and provides an overview and guide to the most important currently available voluntary carbon offset standards using the Clean Development Mechanism (CDM) as a benchmark†. The report compares the standards side-by-side and outlines the most pertinent aspects of each. The evaluated standards are:

- Clean Development Mechanism (CDM)
- Gold Standard (GS)
- Voluntary Carbon Standard 2007 (VCS 2007)
- VER+
- The Voluntary Offset Standard (VOS)
- Chicago Climate Exchange (CCX)
- The Climate, Community & Biodiversity Standards (CCBS)
- Plan Vivo System
- ISO 14064-2
- GHG Protocol for Project Accounting

Carbon offset markets have been promoted as an important part of the solution to the climate crisis because of their economic and environmental efficiency and their potential to deliver sustainability co-benefits through technology transfer and capacity building. The voluntary offset market in particular has been promoted for the following reasons:

Possibility of Broad Participation
The voluntary carbon market enables those in unregulated sectors or countries that have not ratified Kyoto, such as the US, to offset their emissions.

---

* All monetary figures were converted to euros, using the exchange rate from Feb, 5, 2008 of 1 USD = 0.67 euros. Standard fees listed in USD were left unchanged.

† The terms *GHG offset standard* and *carbon offset standard* are used as synonyms.

Preparation for Future Participation

The voluntary carbon market enables companies to gain experience with carbon inventories, emissions reductions and carbon markets. This may facilitate future participation in a regulated cap-and-trade system.

Innovation and Experimentation

Because the voluntary market is not subject to the same level of oversight, management, and regulation as the compliance market, project developers are more flexible to implement projects that might otherwise not be viable (e.g. projects that are too small or too disaggregated).

Corporate Goodwill

Corporations can benefit from the positive public relations associated with the voluntary reduction of emissions.

Most importantly, voluntary and compliance offset mechanisms have the potential to strengthen climate policies and address equity concerns:

Cost-effectiveness that allows for deeper caps or voluntary commitments.

By decreasing the costs of reductions, offsets can in principle make a compulsory mandate more politically feasible and a voluntary target more attractive, thereby accelerating the pace at which nations, companies, and individuals commit to reductions.

Higher overall reductions without compromising equity concerns.

One of the greatest challenges of climate protection is how to achieve the deep global emissions reductions required while also addressing the development needs of the poor. Historically, developed nations have been responsible for a much larger share of the increase in atmospheric GHG concentrations than developing countries. But to achieve climate stabilisation, emissions must be curbed in all countries, both rich and poor. Offsets may be one way out of the conundrum of needing to achieve steep global emissions reductions while at the same time allowing poor nations to develop. This has not been the case thus far because the emissions reductions undertaken have been too small to be significant. Small reduction targets allow participants to tinker at the margins and avoid the kind of restructuring that is needed to achieve climate stabilizations. While taking on considerable domestic emissions reductions, industrialized countries could, through offsets, help finance the transition to low-carbon economies in developing nations. In other words, offsets might allow equity to be decoupled from efficiency, and thus enable a burden-sharing arrangement that involves wealthier countries facilitating mitigation efforts in poorer countries[*].

Yet carbon offsetting is not without its critics. A recent flurry of media reports has criticised the poor quality of carbon offsets projects in both the compliance and the voluntary market (e.g. Financial Times, 2007). Recent research reports have pointed out that a significant number of offsets come from projects that would have been implemented anyway (i. e. are non-additional, see section 5.1) (Schneider, 2007; Haya, 2007) Critics have also raised concerns over equality and fairness based on the argument that carbon offsetting enables developed nations to perpetuate unsustainable lifestyles by funding carbon projects in developing countries. Some argue that these projects rarely lead to benefits for the host community, and have gone so far as to call the offset market a form of carbon colonialism (Eraker, 2000). Others assert that accounting methods for offsets are too inaccurate to justify claims of real emission reductions or to support the achievement of 'carbon neutrality.' The voluntary offset market in particular has been criticised for its lack of transparency, quality assurance and third-party standards.

To address these shortcomings, over a dozen voluntary offset standards have been developed in the last few years. Each standard has a slightly different focus and none has so far managed to establish itself as *the* industry standard. Some closely mirror compliance market standards, while others take

* For an in-depth analysis of such a potential climate and equity framework, see the *Greenhouse Development Rights Framework* (Baer et al 2007)

a more lenient approach in order to lessen the administrative burden and enable as many credits as possible to enter the market. Certain standards are limited to particular project types (e.g. forestry) while others exclude some project types in order to focus on the social benefits of carbon projects. It is important to note that the vast majority of voluntary offsets are currently not certified by any third-party standard. This is likely to change over the coming years.

General Standard Information

The summary table provides broad comparisons and summaries of the standards. Each of the criteria is briefly put in context and explained below.

Main Supporters
'Main Supporters' lists the type of stakeholder associated with each standard. Each of the reviewed standards has been developed and is supported by different groups of stakeholders. The types of stakeholders reflect to some extent the goal of the standard.

Market Share
Not all standards are equally influential. 'Market Share' indicates the size of each of the standards, and thus to some extent reflects the standard's importance.

Price of Offsets
'Price of Offsets' indicates the cost of one offset representing the reduction of 1 tonne of CO_2e. Offset prices depend on many different parameters, such as the type of project, the location, market demand, stringency of the standard requirements, etc. The pricing given in this column indicates average prices for different projects as of early 2008 (see chapter 7.)

Authors' Comments
The Authors' comments state the perceived goal of each standard and any relevant information about the standard. More in-depth commentary and information about each standard can be found in chapter 7.

Additionality

Additionality tests attempt to establish whether an offset project would have happened anyway. A major limitation of offset systems based on project-based mitigation is that emission reductions have to be measured against a counterfactual reality. The emissions that would have occurred if the market for offsets did not exist need to be estimated in order to calculate the quantity of emissions reductions that the project achieved. This hypothetical reality cannot be proven; instead, it must be inferred and its definition is always to some extent subjective (see chapter 5.1).

Additionality Tests (relative to CDM)
The CDM additionality tool (see appendix B) most commonly used for testing the additionality of CDM projects was developed carefully over several years. In this column it is used as a reference against which the other standards' project-based additionality testing procedures are compared:

+ Requirements go beyond and are more stringent than CDM rules
− Requirements are less stringent than CDM
= Requirements are the same or very similar to CDM
N/A Not Applicable

Although the CDM additionality tool is well respected, it does not guarantee that only additional projects are approved. Recent reports have shown that despite the fact that the additionality tool is required for all CDM projects, it is likely that a significant number of non-additional projects are registered (Schneider, 2007; Haya, 2007). Similar studies have not yet been carried out for VER projects. It is therefore impossible to know if VER standards likely have a higher or lower percentage of additional projects. It remains to be seen how well these standards will succeed in implementing their additionality requirements.

Some of the standards, such as the VCS and the VER+, plan to develop performance-based additionality tools (also called benchmark tools). By shifting the tasks of establishing a baseline from the project developer to the standard-setting organisation, benchmark tools could potentially increase transparency and decrease administrative burden for project developers. Yet such approaches also harbour the danger of certifying too many free riders. Benchmark rules will have to be closely examined to ensure that they minimize or mitigate the effects of non-additional offsets (see chapter 5.1).

Approval Process

Although offset markets are relatively straightforward in principle, they have been anything but straightforward to implement in practice. In part, this may be attributed to the inevitable birthing pains associated with creating institutions and stabilizing new markets. But problems also arise from inherent structural problems inherent in the conception of offset markets. Offset markets lack a critical competitive check found in well functioning markets, in which the interests of buyer and seller are naturally balanced against each other. In offset markets, both the seller *and* the buyer benefit from maximizing the number of offsets a project generates. This issue can partially be mitigated by imposing stringent requirements for auditors and an additional approval process though the standard organisation (see chapter 5.6).

Another conflict of interest arises from the fact that auditors are currently chosen and paid by a project's developer. There is thus pressure on auditors to approve projects in order to preserve their business relationships with the developers. This compromises the auditors' independence and neutrality. To account for this dynamic, offset markets need an administrative infrastructure to ensure that auditors' estimates of project reductions are reasonable.

Third-party Verification Required
To minimize the number of "free riders," most standards require third-part auditors to verify the emissions reductions.

Separation of Verification and Approval Process
Fundamental differences exist among standards as to how projects are reviewed and approved. Under the CDM, projects are verified by third-party auditors and then reviewed, approved or rejected by the CDM Executive Board. Most voluntary offset standards do not have such a body to review and approve the projects after the auditors have verified them. Projects are simply approved by the auditors themselves. The lack of a standard body which approves projects exacerbates conflicts of interest, particularly where auditors are selected and paid for by the project developer. None of the voluntary standards have specific procedures in place to review the approved auditors nor to allow for sanctions against or the discrediting of an under-performing auditor (see chapter 5.6).

Registry
Carbon offset registries keep track of offsets and are vital in minimizing the risk of double-counting, that is, having multiple stakeholders take credit for the same offset. Registries also clarify ownership of offsets (see chapter 5.7).

Offset Project Information

Each standard accepts different types of offset projects. The CDM, for example accepts all projects that reduce the six GHGs listed in the Kyoto Protocol, with the exception of the protection of existing forests (REDD), nuclear energy, and HFC destruction from new facilities (see chapter 5.2).

Project Types
REDD = Reduced Emissions from Degradation and Deforestation
EE = Energy Efficiency
RE = Renewable Energy
LULUCF = Land Use, Land-Use Change and Forestry = Bio-Sequestration

Excludes Project Types with High Chance of Adverse Impacts
Some project types are more likely to have adverse social and environmental impacts. Some standards therefore exclude these projects types, such as tree plantations and monocultures which are detrimental to biodiversity and can negatively impact watersheds or large hydro projects, which can displace large numbers of people.

Sustainable Development

Co-benefits are social and environmental benefits that go beyond the GHG reduction benefits of offset projects. Such benefits include job creation, improved local air quality, protected and enhanced biodiversity, etc. The Clean Development Mechanism (CDM) was approved by developing nations specifically because offset projects were not only to provide cost-effective reductions for Annex 1 countries but also development benefits for the host countries. In other words, to qualify as a CDM project, the original intention was that a CDM project would have to deliver development benefits. In practice, the CDM has failed to consistently deliver such development and sustainability benefits (Holm Olsen, 2007; Sutter and Parreño, 2007; see chapter 5.5.)

Co-Benefits (relative to CDM)
Voluntary standards vary in their requirements for co-benefits. This column highlights the co-benefit requirements of each standard, comparing them to the requirements of the CDM.

Many of the voluntary carbon offset standards that have been developed in the last few years represent a step in the right direction. They help address some of the weaknesses in the current offsetting process and foster climate mitigation projects. The voluntary market in particular has helped to shape climate actions in countries that have thus far been reluctant to enact strong policies. Even with far reaching cap-and-trade policies expected to be enacted in the medium term, there will likely always be room for a voluntary market. The demand for voluntary offsets will come from private and corporate actors who wish to go beyond regulatory requirements and will be supplied by mitigation projects in sectors that are not capped. Well-designed standards will help the voluntary market mature and grow.

Main Supporters	Market Share	Additionality Tests (relative to CDM)	Third-party Verification Required	Separation of Verification and Approval Process	Registry	Project Types	Excludes Project Types with high chance of adverse impacts	Co-Benefits (relative to CDM)	Price of Offsets
Clean Development Mechanism									
UNFCCC Parties	large	=	yes	yes	yes	All minus REDD, new HFC, nuclear	no	=	€14–30
Authors' Comments:	The CDM is part of the Kyoto protocol and aims to create economic efficiency while also delivering development co-benefits for poorer nations. It has been successfull in generating large numbers of offsets. Whether it also has delivered the promised development co-benefits is questionable.								
Gold Standard									
Environmental NGOs (e.g. WWF)	small but growing	=/+[1]	yes	yes	Planned	EE, RE only	yes	+	VERs: €10–20 CERs: up to €10 premium
Authors' Comments:	The GS aims to enhance the quality of carbon offsets and increase their co-benefits by improving and expanding on the CDM processes. [1] For large scale projects the GS requirements are the same as for CDM. Yet unlike CDM, the GS also requires the CDM additionality tool also for small-scale projects.								
Voluntary Carbon Standard 2007 (VCS 2007)									
Carbon Market Actors (e.g. IETA)	new; likely to be large	=[2]	yes	no	Planned	All minus new HFC	no	-	€5–15[3]
Authors' Comments:	The VCS aims to be a universal, base-quality standard with reduced administrative burden and costs. [2] The VCS plans to develop performance based additionality tests. These tools have not yet been developed and are thus not included in this rating. [3] Prices are for projects implemented under VCS ver. 1.								
VER+									
Carbon Market Actors (e.g. TÜV SÜD)	small but growing	=	yes	no	yes	CDM minus large hydro	yes	-	€5–15
Authors' Comments:	VER+ offers a similar approach to CDM for project developers already familiar with CDM procedures for projects types that fall outside of the scope of CDM.								
Chicago Climate Exchange (CCX)									
CCX Members and Carbon Market Actors	large in the US	-	yes	yes	yes	All	no	-	€1.2–3.1[4]
Authors' Comments:	CCX was a pioneer in establishing a US carbon market. Its offset standard is part of its cap-and-trade programme. [4] Sales in USD: $1.8-4.5 per metric tonne (October 07-February 08)								
Voluntary Offset Standard (VOS)									
Financial Industry and Carbon Market Actors	N/A	=	yes	no	Planned	CDM minus large hydro	yes	=	N/A
Authors' Comments:	VOS closely follows CDM requirements and aims to decrease risks for offset buyers in the voluntary market.								
Climate, Community and Biodiversity Standards (CCBS)									
Environmental NGOs (e.g. Nature Conservancy) and large corporations	large for LULUCF	=	yes[5]	no	N/A	LULUCF	yes	+	€5–10
Authors' Comments:	The CCBS aims to support sustainable development and conserve biodiversity. [5] The CCBS is a Project Design Standard only and does not verify quantified emissions reductions.								
Plan Vivo									
Environmental and social NGOs	very small	=	no	no	yes[6]	LULUCF	yes	+	€2.5–9.5
Authors' Comments:	Plan Vivo aims to provide sustainable rural livelihoods through carbon finance. [6] It verifies and sells ex-ante credits only. Third party verification is not required but recommended.								

1. Introduction

"Carbon, the currency of a new world order" (Paul Kelly, *The Australian*, 21 March 2007)

Public awareness of the threat of climate change has risen sharply in the last couple of years and an increasing number of businesses, organizations and individuals are looking to minimize their impact on the climate.

To effectively address the threat of climate change, we need comprehensive and stringent policies to reduce greenhouse gas (GHG) emissions at national and international levels. At the same time, voluntary individual and corporate climate action can be essential for creating the public awareness and constituency needed for policy change.

Individuals and organizations can most effectively lower their own carbon footprints by improving energy efficiency (e.g. in their homes, offices, or factories), relying on lower-emission products (e.g. buying locally grown food), and changing consumption patterns (e.g. home size, travel choices). Beyond this, carbon offsets[*] are gaining prominence as a tool to compensate for emissions. By paying someone else to absorb or avoid the release of a tonne of CO_2 elsewhere, the purchaser of a carbon offset can aim to compensate for or, in principle, "offset" their own emissions. This is possible because climate change is a non-localized problem; greenhouse gases spread evenly throughout the atmosphere, so reducing them anywhere contributes to overall climate protection.

Yet carbon offsetting is not without its critics. A recent flurry of media reports has criticized the poor quality of carbon offsets projects in both the compliance and the voluntary market (e.g. Financial Times, 2007). Recent research reports have pointed out that a significant number of offsest come from projects that would have been implemented anyway (i. e. are non-additional, see chapter 5.1) (Schneider, 2007; Haya 2007) Many have also raised issues of equality and fairness based on the argument that carbon offsetting enables developed nations to perpetuate unsustainable lifestyles by funding carbon projects in developing countries. Some critics have pointed out that these offset projects rarely lead to benefits for the host community and have gone as far as calling the offset market as a form of carbon colonialism (Eraker, 2000.) Others assert that accounting methods for the offsets are too inaccurate to justify claims of real emission reductions or to support the achievement of 'carbon neutrality.'

Despite these critiques, the carbon markets are growing rapidly. With more than € 20 billion[†] traded in 2006 (Capoor & Ambrosi, 2007), carbon markets are already a substantial economic force and will likely grow considerably over the coming years. It is therefore important to focus the discussion on how to use these markets most effectively to:

- Contribute to climate protection through real and additional, permanent, and verifiable greenhouse gas (GHG) reductions, while limiting unintended negative consequences.
- Reduce GHG emissions in an economically efficient way.
- Enhance the social and environmental benefits to project hosts.
- Stimulate social and technological innovation and participation by new actors sectors and groups.
- Create and build constituencies for more effective and comprehensive national and international solutions.
- Avoid perverse incentives that could stymie broader climate protection actions and policies.
- Synergistically work with other climate protection measures.

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* *Carbon offset* and *carbon credit* are synonymous terms, yet the term *carbon credit* is more often used when referring to the compliance markets, such as CDM. The term *carbon offset* is more often used when referring to the voluntary market.

† All monetary figures were converted to euros, using the exchange rate from Feb, 5, 2008 of 1 USD = 0.67 euros. Standard fees listed in USD were left unchanged.

The voluntary offset industry has recognized the need for quality assurance in order to restore the credibility of the offset market. Over a dozen voluntary offset standards have been developed in the last few years. Yet no single standard has so far managed to establish itself as *the* industry standard. Each standard has a slightly different focus. Some closely mirror compliance market standards, while others take a more lenient approach in order to lessen the administrative burden and enable as many credits as possible to enter the market. Certain standards are limited to particular project types (e.g. forestry), while others exclude some project types in order to focus on the social benefits of carbon projects. It is important to note that the vast majority of voluntary offsets are currently not certified by a third-party standard. This is likely to change over the coming years.The next chapters provide an overview of the carbon markets in general and the compliance and voluntary offset markets.

2. **Market Overview**

In order to understand the carbon markets, it is important to recognize the differences between two fundamentally different types of carbon commodities, allowances and offsets, and the systems that create them. The first, allowances, are created by cap-and-trade systems. The second, offsets or carbon credits, are created by baseline-and-credit systems (also sometimes called a project-based system).

Under a **cap-and-trade system**, an overall cap is set to achieve emissions reductions. Each of the participants within a cap-and-trade system (usually countries, regions or industries) is allocated a certain number of allowances based on an emissions reduction target. In a cap-and-trade system the cap constitutes a finite supply of allowances, set by regulation and political negotiation. These allowances are then neither created nor removed, but merely traded among participants. This finite supply creates a scarcity and drives the demand and price for allowances.

A cap-and-trade system aims to internalize (some of) the costs of emissions, and thus drives actors to seek cost-effective means to reduce their emissions. The challenge in a cap-and-trade programme is to determine the appropriate level at which to set the cap, which should be stringent enough to induce the desired level and rate of change, while minimizing overall economic costs.

A **baseline-and-credit system** in contrast, does not entail a finite supply of allowances. It does not involve projects that are implemented under the umbrella of a cap-and-trade system. Rather, more credits are generated with each new project implemented. These credits can then be used by buyers to comply with a regulatory emission target, to "offset" an emitting activity (such as an airline flight), or to be a "carbon neutral" organisation with zero "net" emissions.

In a baseline-and-credit system a carbon offset buyer can only legitimately claim to offset his emissions if the emissions reductions come from a project that would not have happened anyway. This concept is called **additionality** in the carbon markets, and refers to the requirement that "[…] reductions in emissions […] are additional to any that would occur in the absence of the certified project activity" (Kyoto Protocol in Article 12.5). Under a cap-and-trade system it is the cap and the allocations rules that drives demand, and determines the level of emissions reduction. Activities that are undertaken in response to the pressure of the cap therefore do not need to prove that they are additional. Additionality is discussed in detail in chapter 5.1.

Cap-and-trade systems often allow for a certain number of offsets to come from emissions reductions that are generated by projects that are not covered under the cap (i.e. from baseline-and-credit systems)*. Under a cap-and-trade system the covered sources (for example power producers) have an obligation to reduce their emissions. If these covered sources cannot buy offsets, they will have to reduce their emissions in some other way (e.g. by buying allowances or by increasing efficiency in their plants). If they can buy offsets and these come from projects that are fully additional, then the offsets replace reductions that the cap-and-trade participant would have had to otherwise achieve himself. In other words, under a cap-and-trade system, offsets do not lead to emissions reductions beyond the target set by the cap but only cause a geographical shift in where the emissions reduction occurs. Therefore, non-additional offsets sold into a cap-and-trade system will actually lead to an *increase* in emissions since the buyer will not have reduced his emissions and the seller will not have offset this increase in emissions.

In a voluntary system, on the other hand, individuals and companies are not required to reduce their emissions. We can therefore assume that they would only do so to a limited extent. The availability of offsets enables them to go beyond what they would have done anyway to reduce their own emissions. The availability of offsets in the voluntary market may therefore lead to additional emissions reduction that would not have happened without the availability of offsets. Buyers in the voluntary market can only claim a unique, incremental "offset" reduction if the reduction is additional. Yet even without additionality tests, the offset market might induce reductions that would not have happened otherwise, because the market will bring investment to some projects at the margin. But without clearly established additionality, there is no one-to-one correspondence between each credit sold and an additional tonne of reductions.

TABLE 1: ***Distinguishing Features of Cap-and-Trade and Baseline-and-Credit Systems***

Features	Cap-and-trade	Baseline-and-credit
Exchanged commodity	Allowances	Carbon Credits
Quantity available	Determined by overall cap	Generated by each new project
Market dynamic	Buyers and sellers have competing and mutually balanced interests in allowances trades.	Buyers and sellers both have an interest in maximizing the offsets generated by a project.
Sources Covered	Usually high emitters such as the energy sector and energy intensive industries	As defined by each standard. Not limited to just high emitting sectors.
Independent third party	Minor role in verifying emissions inventories.	Fundamental role in verifying the credibility of the counterfactual baseline and thus the authenticity ("additionality") of the claimed emission reductions.
Emissions impact of trade	Neutral, as is ensured by zero-sum nature of allowance trades.	Neutral, providing projects are additional. Otherwise, net increase in emissions. Possible decrease in emissions in the voluntary market.

Cap-and-trade systems exist almost exclusively in the compliance market†. Baseline-and-credit systems exist both in the compliance and in the voluntary market. All currently established cap-and-trade programs allow for a limited use of offsets and have an associated offset programme:

* For example, the EU-ETS allows for CDM credits (CERs) to be used interchangeably with their allowances (EUAs). In the case of the EU-ETS, it is the countries themselves who set the limit on what percentage of CERs are allowed into their system. Allowing CERs will de-facto increase the number of available allowances and therefore raises the cap. On the other hand, it makes achieving reductions potentially more cost effective.

† An exception to this is the Chicago Climate Exchange which is a voluntary but legally binding cap-and-trade regime.

TABLE 2: ***Types of Carbon Trading Programs***

Type of Programme	Cap-and-Trade	Associated Baseline-and-Credit (Offset) Programme
Compliance Market	Emissions Trading under Kyoto Protocol	CDM & JI
	EU-ETS	CDM & JI
	RGGI	RGGI Offset Programme
	Western Climate Initiative	under development
Voluntary Market	Chicago Climate Exchange (CCX)	CCX Offset Programme

Except for the CCX Offset Programme, voluntary offset standards are independent of and function outside of a cap-and-trade system*. The following sections provide a brief overview of the compliance and the voluntary markets.

2.1 Compliance Market

Carbon markets exist both under compliance schemes and as voluntary programs. Compliance markets are created and regulated by mandatory national, regional or international carbon reduction regimes.

Cap-and-Trade Systems

Emissions Trading Under the Kyoto Protocol

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) established a cap-and-trade system that imposes national caps on the greenhouse gas emissions of developed countries that have ratified the Protocol (called Annex B countries†). Each participating country is assigned an emissions target and the corresponding number of allowances – called Assigned Amount Units, or AAUs. On average, this cap requires participating countries to reduce their emissions 5.2% below their 1990 baseline between 2008 and 2012. Countries must meet their targets within a designated period of time by:

- reducing their own emissions; and/or
- trading emissions allowances with countries that have a surplus of allowances. This ensures that the overall costs of reducing emissions are kept as low as possible; and/or
- meeting their targets by purchasing carbon credits: to further increase cost-effectiveness of emissions reductions, the Kyoto Protocol also established so-called *Flexible Mechanisms*: the Clean Development Mechanism (CDM) and Joint Implementation (JI).

European Union Emissions Trading Scheme

The Kyoto Protocol enables a group of several Annex I countries to join together and form a so-called 'bubble' that is given an overall emissions cap and is treated as a single entity for compliance purposes. The 15 original member states of the EU formed such a 'bubble' and created the EU Emissions Trading Scheme (EU-ETS). The EU-ETS is a company-based cap-and trade system which came into force in 2005. Under this cap-and-trade scheme, emissions are capped and allowances may be traded among countries. The EU-ETS is the largest mandatory

* Although the Gold Standard also certifies CDM credits, it is a voluntary standard.

† ***Annex 1 or Annex B?***
In practice, Annex 1 of the UNFCCC **Convention** and Annex B of the **Kyoto Protocol** are used almost interchangeably. However, strictly speaking, it is the **Annex 1** countries that can invest in **JI** / **CDM** projects as well as host JI projects, and **non-Annex 1** countries that can host CDM projects, even though it is the Annex B countries that have the emission reduction obligations under the Protocol. Note that Belorus and Turkey are listed in Annex 1 but not Annex B; and that Croatia, Liechtenstein, Monaco and Slovenia are listed in Annex B but not Annex 1.
(source: ***www.cdmcapacity.org/glossary.html***)

cap-and-trade scheme to date. In 2006, it traded 1.1 billion metric tonnes of CO_2e, valued at over €16 billion. There are currently several cap-and-trade compliance schemes that operate independently of the Kyoto Protocol. All of these also incorporate a baseline-and-credit component to their programme. Three examples are:

New South Wales GHG Abatement Scheme (NSW GHGAS)

The NSW GHGAS in Australia aims to reduce greenhouse gas emissions from the power sector. It achieves this by using project-based activities to offset the production of greenhouse gas emissions. The programme was established in 2003.

Regional Greenhouse Gas Initiative (RGGI)

RGGI is a multi-state regional cap-and-trade programme for the power sector in the Northeast United States. The RGGI cap-and-trade programme is proposed to start in 2009 and lead to a stabilisation of emissions at current levels (an average of 2002-2004 levels) by 2015, followed by a 10% reduction in emissions between 2015 and 2020. Some of the programme reductions will be achieved outside the electricity sector through emissions offset projects. Offsets serve as the primary cost containment mechanism in RGGI; if allowance prices rise above trigger prices, the ability for regulated sources to use offsets increases.

Western Climate Initiative (WCI)

The WCI is a collaboration of 5 Western US stated and British Columbia launched in early 2007. The initiative set a goal of reducing greenhouse gas emissions by 15% from 2005 levels by 2020 and requires partners to develop a market-based, multi-sector mechanism to help achieve that goal, and participate in a cross-border greenhouse gas (GHG) registry.

Baseline-and-Credit Systems Used within Cap-and-Trade

The Clean Development Mechanism (CDM)

The CDM allows Annex I countries to partly meet their Kyoto targets by financing carbon emission reductions projects in developing countries. Such projects are arguably more cost-effective than projects implemented in richer nations because developing countries have on average lower energy efficiencies, lower labor costs, weaker regulatory requirements, and less advanced technologies. The CDM is also meant to deliver sustainable development benefits to the host country. CDM projects generate emissions credits called Certified Emissions Reductions or CERs – one CER is equal to one tonne of carbon dioxide equivalent – which are then bought and traded (see chapter 7.1 for more details on the CDM).

Joint Implementation (JI)

Joint Implementation works similarly to CDM, with the exception that the host country is not a developing nation but another Annex I country. The tradable units from JI projects are called Emissions Reductions Units (ERUs). It is not strictly a baseline-and-credit system since it also has aspects of a cap-and-trade system, and, notably, both participants have an overall reduction target.

The value of both JI and CDM projects has more than doubled in recent years, reaching a combined total of USD 5 billion (EUR 3.9 billion) in 2006 (Capoor & Ambrosi, 2007). Since JI officially starts in 2008, it is not surprising that over 90% of the credits transacted in these markets were produced by CDM projects.

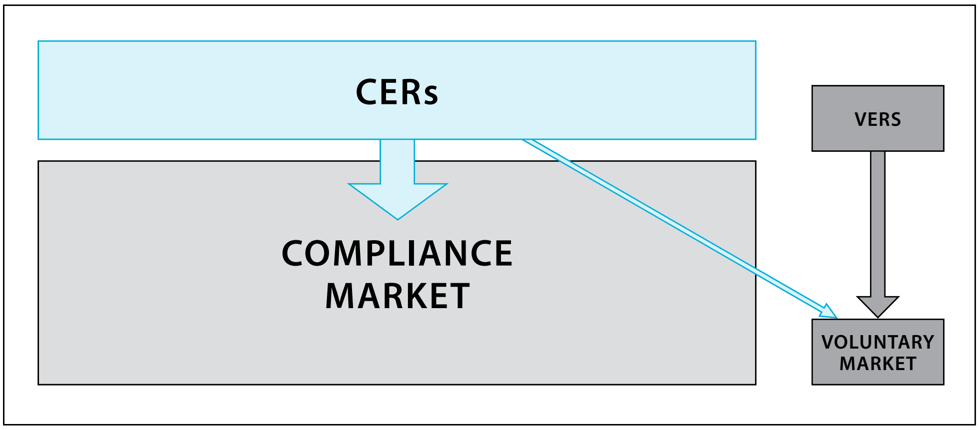
The EU-ETS Linking Directive

The EU Linking Directive, which was passed in 2004, allows operators in phase 2 of the ETS to use credits from Joint Implementation (JI) and the Clean Development Mechanism (CDM) to meet their targets in place of emission cuts within the EU. Member States specify a limit up to which individual installations will be able to use external credits to comply with the ETS. These limits vary between 0% (Estonia) and 22% (Germany) of allowances. There are also restrictions on use of CERs from forestry projects and from certain types of large hydro projects.

2.2 **Voluntary Carbon Markets**

The voluntary carbon markets function outside of the compliance market. They enable businesses, governments, NGOs, and individuals to offset their emissions by purchasing offsets that were created either through CDM or in the voluntary market*. The latter are called VERs (Verified or Voluntary Emissions Reductions). It is noteworthy that about 17% of the offsets sold in the voluntary market in 2006 were sourced from CDM projects (Hamilton, 2007)

CHART 1: ***Carbon Offsets in the Compliance and in the Voluntary Market***



Unlike under CDM, there are no established rules and regulations for the voluntary carbon market. On the positive side, voluntary markets can serve as a testing field for new procedures, methodologies and technologies that may later be included in regulatory schemes. Voluntary markets allow for experimentation and innovation because projects can be implemented with fewer transaction costs than CDM or other compliance market projects. Voluntary markets also serve as a niche for micro projects that are too small to warrant the administrative burden of CDM† or for projects currently not covered under compliance schemes. On the negative side, the lack of quality control has led to the production of some low quality VERs, such as those generated from projects that appear likely to have happened anyway (see chapter 5.1 on additionality.)

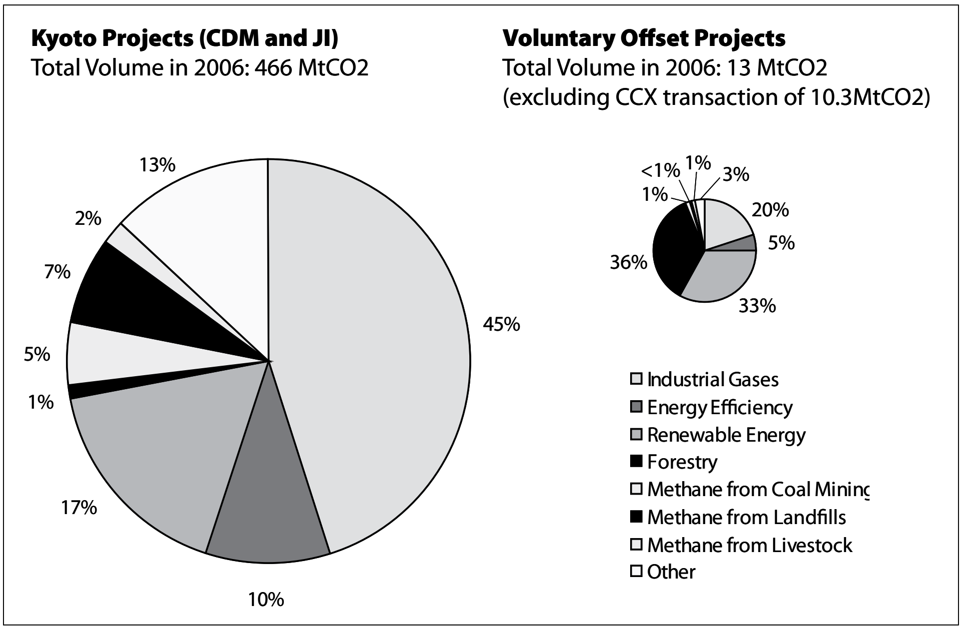
2.3 **Voluntary and Compliance Carbon Market Size**

Compared to the compliance market, trading volumes in the voluntary market are much smaller because demand is created only by voluntary wish to buy offsets whereas in a compliance market, demand is created by a regulatory instrument. Because there is much lower demand, because quality standards are not widely established, and because they are not fungible in compliance markets, carbon offsets sold in the voluntary market tend to be cheaper than those sold in the compliance market.

* When compliance market credits are used for voluntary offsetting, they are retired, thus do not go towards assisting or meeting any legally-binding reduction targets.

† According to project developers, carbon offset project must reduce at least 5,000 metric tonnes of CO_2 per year in order justify the CDM transaction costs. (myclimate, personal communication.)

CHART 2: ***Offset Trading Volumes in the Kyoto and in the Voluntary Markets***



(Source: Capoor, 2007; Hamilton 2007)

In 2006, 23 million tonnes of CO_2e were traded at a value of €62.6 million (Hamilton, 2007) in the voluntary market – the trading value of the compliance market, including allowances and credits was €23 billion in 2006. The value of CDM and JI credits was €3.8 billion in 2006. (Capoor and & Ambrosi, 2007.) Nevertheless, the voluntary carbon market has grown dramatically over the last couple of years. According to a recent report, the voluntary offset market grew 200% between 2005 and 2006 (Hamilton, 2007).

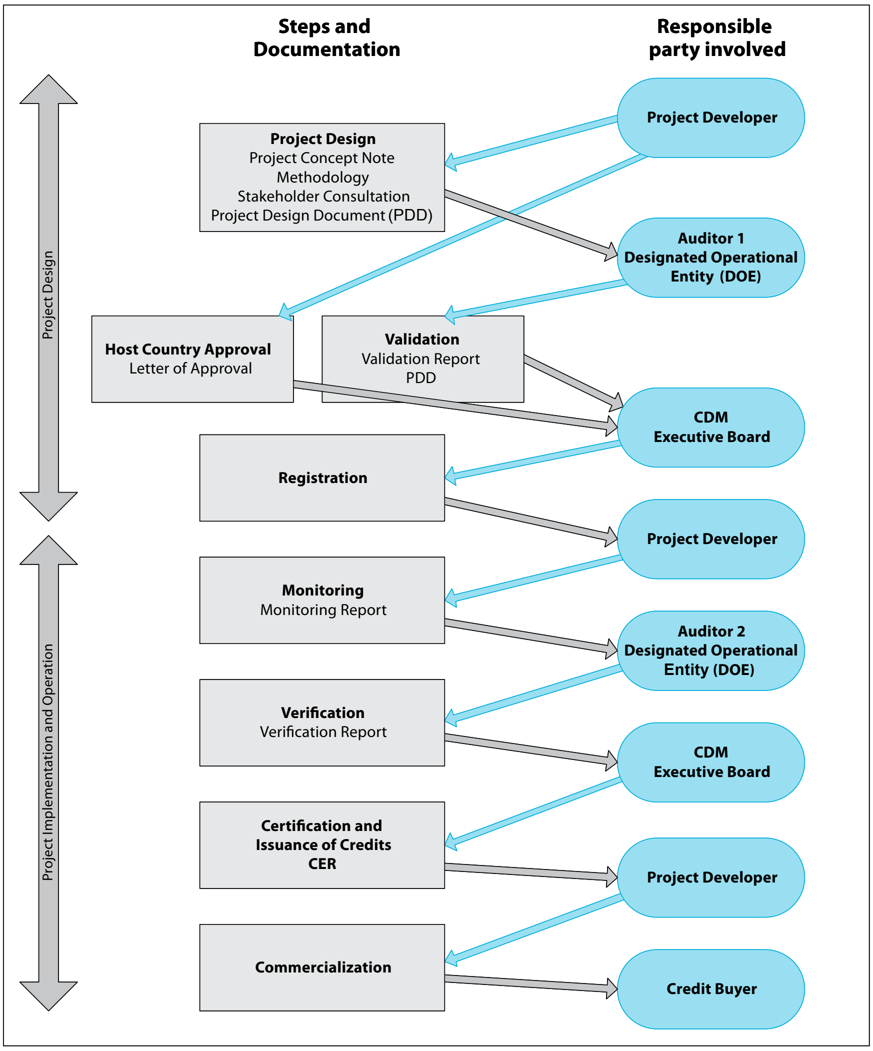
3. How Offset Projects Are Implemented

3.1 The Stages of the CDM Project Cycle

This chapter provides a brief overview of how offset projects are developed under the CDM. The CDM has established detailed guidelines and procedures for project developers. Although the project development process for projects implemented under a voluntary offset standard are somewhat different from CDM procedures, the CDM project cycle can serve as a frame of reference to analyze the different standards.

The CDM Executive Board (CDM EB) requires that all CDM projects follow a set of project development steps that are referred to as the project cycle. CDM project activities can only deliver Certified Emission Reductions (CERs) if the project itself and its successful operation have been approved by the CDM EB. Each stage of the project cycle is outlined below.

CHART 3: ***The CDM Project Cycle***



Project Design

The Project Design stage includes developing a project concept, choosing or developing a baseline and monitoring methodology, and stakeholder consultations. All of these elements are documented in the project design document (PDD).

Project Concept

A feasibility study of a potential CDM project is conducted to assess the technical feasibility, investment requirements, development and operational costs, expected returns, administrative and legal hurdles, and project risks and pitfalls. Based on the results of the feasibility study, the project owner will decide whether or not to continue development of the potential CDM project.

Methodology

A CDM methodology defines the rules that a project developer needs to follow to establish a project baseline and to determine project additionality (see chapter 5.1), to calculate emission reductions and to monitor the parameters (e.g. electricity produced by the project) used to estimate actual emission reductions. It is a generic recipe that can be applied to different projects within a given project type (e.g. renewable power production) and applicability conditions (e.g. grid-connected). If no approved methodology exists for a specific project type, a project developer can submit a new methodology for approval to the CDM Methodology Panel*.

236 methodologies have been submitted for approval, 110 have been rejected, 28 are pending and 98 methodologies have been approved so far†.

Project Design Document (PDD)

The Project Design Document (PDD) describes the CDM project activity in detail and forms the basis for all future planning and administrative procedures. It contains a description of the chosen technology and explains the methodology used to define the baseline scenario, to confirm additionality and to calculate emission reductions. It also contains information on the monitoring of all relevant technical parameters (e.g. temperature, gas flow rates, electricity productions, operation hours, etc.) including, how monitoring procedures will be established, measurements will be made, quality will be controlled, and records will be stored and accessed. It contains an estimate of the volume of emission reductions achieved by the project. Finally, it documents how the project contributes to sustainable development.

The PDD plays a central role in project development. It serves as the basis for evaluating all carbon credit transactions and contract proposals for a CDM project. The PDD is used throughout the implementation phase to ensure that the project performs according to the parameters outlined in the document.

Stakeholder Consultation(s)

CDM projects are required to provide evidence that the project's activities will not adversely impact local populations and other relevant stakeholders. To ensure that all relevant stakeholders have been provided an opportunity to comment on the proposed CDM project, the project developer must inform them about the project through appropriate forms of media. The project developer must respond to all stakeholder comments, and describe a course of action to minimize negative impacts. The outcomes of the stakeholder consultations must be documented in the Project Design Document (PDD).

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* The Methodologies Panel (Meth Panel) was established to develop recommendations to the Executive Board on guidelines for methodologies for baselines and monitoring plans, and to prepare recommendations on submitted proposals for new baseline and monitoring methodologies.

† UNEP, November 2007

Project Validation

After the project developer has written the PDD, an independent UN-approved third-party auditor conducts the project validation. Under CDM auditors are called ***Designated Operational Entities*** or DOEs. The process of CDM project validation normally consists of four phases:

- a desk review of the PDD,
- on-site visits and follow-up interviews with project stakeholders,
- a 30 day public comment period after the PDD has been made available through the internet
- resolution of outstanding issues, and
- the issuance of the final validation report and written by the DOE.

After completion, the validation report and the PDD are submitted to the CDM Executive Board for review and registration.

Host Country Approval

Final acceptance of a CDM project by the CDM EB is not possible without the approval of the project's host country. The project documentation must be submitted to the relevant authority which checks the project activity against national rules and regulations and confirms the project's compliance with the host country's sustainability criteria. This screening process and host country requirements vary from country to country.

Project Registration

The registration of a project by the CDM EB as a CDM project is a major step in the CDM project cycle. The CDM EB's decision to register a project is based on the review of the PDD and the validation report and public feedback. Once the CDM EB approves a project it is officially registered as a CDM project.

Project Implementation

The project can begin implementation anytime during the project cycle. However, if the project is implemented before it is registered by the CDM Executive Board, then the project developer has to supply documentary evidence proving that they considered CDM revenues at the time of planning the project. The documentary evidence must be supplied at the time of seeking CDM registration. If documentary evidence is not supplied, then the project is likely to be rejected on the grounds that it is not additional.

Project Monitoring

Project developers are required to maintain records measuring the emission reduction achieved during the operation phase. These records, maintained in a monitoring report, must be in accordance with the parameters and procedures laid out in the original PDD that was validated by the DOE and registered by the CDM EB. Emission reductions are issued based on the monitoring report. Therefore, a project developer will make the trade-off between having continuous CER income (many short monitoring periods) and lower administrative costs (long monitoring periods). There are no requirements as to how long or short a monitoring period must be as they ranges from a few weeks to several years.

Project Verification

The monitoring that the project developer has done is then evaluated and approved by a DOE. To minimize conflict of interest, the validating DOE cannot also conduct project verification. A different auditor must be chosen for this task.This is called Project Verification. The project developer has to submit the monitoring report to the DOE along with relevant supporting documents. The DOE undertakes a desk review of the report to ensure that the monitoring has been carried out in accordance with the procedures laid out in the original PDD. The DOE may also undertake a site visit, if necessary. Following the desk review and site visit, the DOE prepares a draft verification report highlighting any issues in the process. Once the project developer resolves these issues, the

DOE prepares the final verification and certification report, which also quantifies the actual emission reductions achieved by the project.

Verification is done at time intervals freely chosen by the project developer or project owner and is usually a consideration between having low costs (long intervals) and frequent sales revenues (short intervals).

Project Certification

The verification report is submitted to the CDM EB for certification and issuance of CERs. The issued CERs are then transferred to the CDM registry account of the relevant project participant after the mandatory fees are paid to the UNFCCC secretariat.

Commercialization

At the commercialization stage, a project developer sells the carbon credits from a project to a prospective buyer. The credits can either be sold directly to a company that requires it to meet its legally binding or voluntary emission reduction obligations or it can be sold to a trading company that facilitates the transaction between the seller and the end user of the credits.

A contract to sell the carbon credits from a project can be signed at any stage during the project development cycle. Depending on the project developer's risk appetite, some will sign contracts as early as the planning stage (i.e. forward contracts), lock in the price and other terms, and insulate themselves from the risks of price volatility while others will wait until the credits are generated, certified and issued before selling them (i.e. spot market sales). The project developer usually receives payment for the credits only after they have been delivered. However, in a few cases, a project developer may receive an advance payment. This is usually done if the project developer wants to bridge an investment gap or needs to meet cash flow requirements during the project's implementation (see chapter 6.3).

3.2 Who Is Who in a Carbon Offset Project

Designing, implementing and operating a carbon offset project requires the involvement of a large number of parties, stakeholders and authorities. Even though the parties involved differ from project to project some general categories and types of stakeholders can be defined as follows.

Project Owner
The operator and owner of the physical installation where the emission reduction project takes place can be any private person, company or other organisation.

Project Developers
A person or organisation with the intention to develop an emission reduction project could be the project owner, a consultant or specialized services provider.

Project Funders
Banks, private equity firms, private investors, non-profit organizations and other organizations may lend or invest equity to fund a project. Some of the standards have rules to what kind of funding, aside from the offset revenue, are acceptable for an offset project.

Stakeholders
Stakeholders are individuals and organizations that are directly or indirectly affected by the emission reduction project. Stakeholders include the parties interested in developing a specific project (e.g. owner, developer, funder, local population, host community), parties affected by the project (e.g. local population, host community environmental and human rights advocates) and national and international authorities.

Third Party Auditors Validators and Verifiers
The CDM and many of the voluntary offset standards require a third-party auditor to validate and verify a project's climate saving potential and achieved emission reductions. Under CDM the auditors are called Designated Operational Entities (DOEs). To minimize conflict of interest, the validating DOE cannot also conduct project verification.

Standards Organisation
In the absence of national and international legislation, standard organizations define a set of rules and criteria for voluntary emission reduction credits.

Brokers and Exchanges
In the wholesale market, emission offset buyers and sellers can have a transaction facilitated by brokers or exchanges. Exchanges are usually preferred for frequent trades or large volumes of products with standardized contracts or products, while brokers typically arrange transactions for non-standardized products, occasionally traded and often in small volumes.

Trader
Professional emission reduction traders purchase and sell emission reductions by taking advantage of market price distortions and arbitrage possibilities.

Offset Providers
Offset providers act as aggregators and retailers between project developers and buyers. They provide a convenient way for consumers and businesses to access a portfolio of project offsets.

Final buyers
Individuals and organizations purchase carbon offsets for counterbalancing GHG emissions. Therefore, the final buyer has no interest in reselling the offset but will prompt the retirement of the underlying carbon offset.

4. **The Role of the Voluntary Market**

After giving a brief overview about how offset projects are developed, we now examine how the voluntary markets differ from CDM and how the standards that have been developed for the voluntary market approach carbon project management.

Key differences exist between the mandatory and voluntary markets. Unlike the former, voluntary markets do not implement any particular policy mandates. The mandatory and voluntary markets occupy different but overlapping niches. As chart 1 shows, the voluntary offset market is currently fed by two distinct offset streams: offsets that originate in the compliance market (e.g. CERs from CDM projects) and offsets that are created in the voluntary market (Verified Emissions Reductions – VERs). In other words, voluntary offset buyers can choose if they want to buy offsets that come from CDM or JI projects or offsets that come from projects implemented exclusively for the voluntary offset market.

In order to better understand the voluntary market, it is helpful to ask what role it should play in protecting the climate and contributing to sustainable development. Compared to the compliance market, trading volumes are minimal in the voluntary market (see chart 2). The voluntary market does currently not make significant contribution to reducing GHGs. Furthermore, effective future climate policy will necessarily involve a gradual transition from voluntary to mandatory action, and eventual regulation (through allowance markets or other policies) of many of the actors currently involved in the voluntary market. While there will likely always be a voluntary offset market to serve those individuals or companies who want to push the envelope beyond what is possible through internal reductions and evolving regulation, a key role of the voluntary market is to shape the rules and procedures for offsets in future compliance markets*. In other words, the voluntary market can be used as a testing ground for procedures, methodologies and technologies. The voluntary market can help achieve emissions reductions with projects that are too small for CDM, projects set in countries without a Kyoto target, or reductions that are ineligible for CDM for formal reasons other than quality (e.g. China CDM requires major Chinese ownership in project).

The opinions on how the voluntary market can best do this, vary significantly. To clarify this ongoing discussion, we distinguish below between three main points of view. The distinction between these viewpoints is somewhat theoretical since most market participants have views that synthesize aspects of all three approaches. Yet juxtaposing these three views helps explaining the differences in how the voluntary market is perceived.

A. Voluntary Market Should Closely Follow, or Build Upon CDM

There are those, among them the governments of the UK and Norway (see chapter 8), who argue that under the current market situation voluntary buyers can minimize their risk by buying compliance credits because the legal and procedural requirements for CERs are already well established. The current voluntary offset market is seen as potentially undercutting the compliance market with cheaper offsets that are not clearly additional and sending the wrong price signals. Since the public and the media often do not distinguish between the compliance and the voluntary market, there is also a risk of damaging the reputation of compliance markets. To secure quality and transparency in the voluntary market, it is argued that voluntary offset standards should closely follow CDM procedures and apply them to VERs (e.g. the CDM approach to additionality, the documentation of reductions, and the monitoring and verification processes).

Standards that share this viewpoint include VER+ and the Voluntary Offset Standard (VOS).

B. Voluntary Market Should Be More Stringent than CDM

Some have taken this argument even further and have created standards with the explicit goal of enhancing the quality of offsets from both markets by requiring explicit social and environmental benefits as well as strict accounting standards (see chapter 5.5 on Co-Benefits.)

Standards that espouse this viewpoint include the Gold Standard and the Climate Community & Biodiversity (CCB) Standard.

C. Voluntary Market Should Complement and Be Different From CDM

On the other end of the spectrum are those who argue that voluntary offset standards should be less stringent and bureaucratic than the standards in the mandatory markets. They agree that the voluntary market can serve as a testing ground for future policy but they argue that in order to preserve the voluntary market's creativity and innovation it must be protected from too many bureaucratic requirements. They distinguish between the compliance market, where regulatory obligations must met, and the voluntary market, were no such obligations exist and where the emphasis is on creating a market for innovative projects with as little administrative burden as possible.

Most carbon offset providers who do not use a third party standard but follow their own procedures fall under this category. The Voluntary Carbon Standard (VCS) also adheres more closely to this viewpoint. Although VCS incorporates many of the CDM procedures and guidelines, it is in principal a standard that looks to loosen the requirements for VER projects to allow for more flexibility and innovation.

The tension between these different viewpoints on the proper function of the voluntary market has shaped the market's recent development. As with any complex issue, the devil lies in the details.

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* This implies that if the voluntary market is successful, it will become obsolete in its current form in the medium term as more comprehensive and effective mandatory policies are put in place. Yet there may always be a need for voluntary markets to serve sectors that are not included in compliance schemes.

All sides have contributed to the discussion on the role the voluntary carbon market can play to further climate protection. Numerous new standards and registries have been introduced over the last couple of years and the competition among carbon offset standards has increased dramatically since large financial institutions, businesses, and industries have gotten involved in the carbon trade. In the next section we will discuss the elements that are necessary to create an effective carbon offset standard.

5. Key Elements of Offset Standards

> ***"Carbon offsets are an intangible good, and as such their value and integrity depend entirely on how they are defined, represented, and guaranteed. What the market lacks are common standards for how such representations and guarantees are made and enforced "*** (Broekhoff, 2007)

Clearly, no standard can ever be perfect, and as pointed out in the discussion above each of the currently available standards is based on a particular view of the voluntary offset market. Yet it is safe to say that notwithstanding these differences, the best and most successful standards will be those that are simple yet rigorous and have very wide support from carbon project developers, offset traders and buyers, environmental NGOs and the financial industry. A complete and full-fledged carbon offset standard must include the following three components*:

- Accounting Standards
- Monitoring, Verification and Certification Standards
- Registration and Enforcement Systems

Accounting standards ensure that offsets are "real, additional, and permanent." They include definitions and rules for the elements that are essential during the design and early implementation phase of a project. These include additionality and baseline methodologies, definitions about accepted project types and methodologies, validation of project activity etc (chapter 5.1-5.6).

Monitoring, Verification and Certification Standards ensure that offset projects perform as was predicted during the project design. Certification rules are used to quantify the actual carbon savings that can enter the market once the project is up and running. There is sometimes a lag time between the start of a project and when it starts producing carbon offsets. This is especially true for forestry projects – the trees have to grow for a few years before they have absorbed enough carbon that can be quantified and sold. Monitoring, verification and certification happen after validation and implementation of the project. Yet procedures and protocols for monitoring and verification have to be included very early on in the project design phase (chapter 5.6).

Verification and certification are *ex-post* assessments of what has actually been produced, as opposed to validation which is the *ex-ante* assessment of whether a project qualifies against a standard, provided it is going to do what it promises in the project design documentation.

3. Registration and Enforcement Systems ensure that carbon offsets are only sold once and clarify ownership and enable trading of offsets. They must include a registry with publicly available information to uniquely identify offset projects and a system to transparently track ownership of offsets (chapter 5.7).

In the following sections we discuss each of these elements in more detail and compare the voluntary offset standards to the CDM rules and regulations. A table at the end of each section, summarizes how each standard handles that particular issue.

* Much of the content in this section is based on the analysis of Derik Broekhoff's (World Resources Institute) Testimony before The House Select Committee on Energy Independence and Global Warming, U.S. House Of Representatives, July 18, 2007; ***http://pdf.wri.org/20070718_broekhoff_testimony.pdf***

5.1 **Additionality and Baseline Methodologies**

> ***"Offsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened."*** (Dan Welch quoted in *The Guardian*, June 16 2007)

The topic of 'additionality' is the most fundamental – and contentious – issue in the carbon offset market. In theory, additionality answers a very simple question: Would the activity have occurred, holding all else constant, if the activity were not implemented as an offset project? Or more simply: Would the project have happened anyway? If the answer to that question is yes, the project is not additional.

Additionality makes intuitive sense: If I buy carbon offsets, I make the implicit claim that I forgo reducing my own emissions (i.e. I still drive my car) in exchange for paying someone to reduce their emissions in my stead. If I "neutralize" the emissions I caused while driving my car by buying offsets from someone who would have reduced their emissions anyway, regardless of my payment, I, in effect, have not neutralized my emissions but merely subsidized an activity that would have happened anyway.

Additionality is thus an essential element needed to ensure the integrity of any baseline-and-credit scheme. Yet additionality is very difficult to determine in practice. Many different tools have been developed to maximize the accuracy of additionality testing and to minimize the administrative burden for the project developer. There are two distinct approaches to additionality testing: Project based additionality testing and performance standards.

5.1.1 **Project Based Additionality Testing**

Project based additionality testing evaluates each individual project on a case by case basis. The following is a short selection of additionality tests that are commonly used:

Legal and Regulatory Additionality Test (Regulatory Surplus)
If the project is implemented to fulfil official policies, regulations, or industry standards, it cannot be considered additional. If the project goes beyond compliance ("regulatory surplus"), it may be additional, but more tests are required to confirm this. For example, an energy efficiency project might be implemented because of its cost savings and would in this case not be additional.

Investment Test
This test assumes that an offset project is additional if it would have a lower than acceptable rate of return without revenue from the sale of carbon offsets. In other words, the revenue from the carbon offsets must be a decisive reason for implementing a project. The investment test is consistent with a microeconomic view of behaviours, and in theory would be a perfect additionality test. But in reality there may be projects whose finances make them look non-additional that are still "additional" because of existing non-monetary barriers.

Barriers Test
This test looks at implementation barriers, such as local resistance, lack of know-how, institutional barriers, etc. If the project succeeds in overcoming significant non-financial barriers that the business-as-usual alternative would not have had to face, the project is considered additional.

Common Practice Test
If the project employs technologies that are very commonly used, it might not be additional because it is likely that the carbon offset benefits do not play a decisive role in making the project viable.

Which test is best suited to validate additionality depends on the type of project. An additionality test appropriate for one type of project (e.g., a simple regulatory test for methane flaring, where there is no reason to do the project if not required by law) might not be sufficient for other kinds of projects (e.g., energy efficiency, where there could be plenty of reasons for doing a project besides complying with regulations).

The main issue with project-based additionality testing is that the determination of whether a project is additional can be quite subjective. A developer can claim that their project's IRR was too low without a carbon revenue stream, and that the carbon revenues therefore made the project viable. But who can really determine what level of IRR is acceptable to a given company, and thus whether the additionality demonstration is valid? Such additionality claims can only be tested with access to internal company information relating to the financing of the project, yet this information is in most cases confidential.

5.1.2 **Performance Standards**

Performance Standards try to address some of the weaknesses of project-based additionality tests in that they do not rely on examining each individual project but establish a threshold for technologies or processes to determine additionality. This approach is associated with simpler procedures and lower transaction costs for project developers. Performance standards are developed and/or approved by standard organizations and therefore shift much of the project developer's administrative burden to the standard organisation. Drafting performance standards requires comprehensive data collection and verification, as well as regular updates. The political process to approve such performance standards may take a long time and may only be feasible for certain industries (e.g., small renewable heat and power, biomass, or small energy efficiency).

Performance Standards typically use aggregated data on project or technology characteristics to establish a threshold (e.g., a performance indicator such as an emissions rate or a market indicator such as a penetration rate) that must be met or exceeded in order for a project to be deemed additional. Performance Standards include among others positive technology lists and benchmark approaches.

Benchmark Approaches

The most widely discussed of performance standards is the emissions-based (benchmark) additionality test. This test establishes a generic baseline scenario – referred to as a benchmark – against which all projects of a given type are assessed. Employing such an assessment as an additionality test presumes that technologies with emissions lower than a given emission rate standard would not be deployed in the absence of the offset programme incentive.

This method works best in sectors or applications where business-as-usual technologies and fuels do not vary widely in emissions rates. In sectors like electricity generation, where emissions rates can be as low as near zero for some hydroelectric plants or relatively high for coal-based plants – both of which are conventional technologies – benchmarking emissions rates can be problematic. For example, any threshold above zero would deem all new hydroelectric or wind development additional.

Several CDM baseline methodologies include benchmark approaches for calculating baselines and emission rates, but additionality must still to be established by using project-based additionality tests (see chapter 5.1.3).

Positive Technology Lists

Positive technology lists simply define which technologies are automatically considered additional if installed in a certain geographic region. The project developer must still use a baseline methodology to determine the numbers of offsets a project will create. Again, such lists are transparent and enable faster and simpler processing of offsets. They also shift much of the administrative burden from individual project hosts to a centralized standard-setting entity.

The main problem with performance standards is that they may be too simple and broad. All activities whose emissions fall below the benchmark emissions are awarded credits, regardless of whether they would have taken place anyway. Projects that are non-additional are referred to as **free-riders**. One proposed solution to the problem of free-riders would be to discount offsets by the number of expected free riders. For example, if a benchmark is set at the 20th percentile, we can expect 20% of projects to be free-riders. If all offsets were then discounted by 20%, the overall environmental integrity would be preserved. Yet discounting is not a perfect solution either since it may skew the results and favor non-additional projects, which by definition rely less on offset revenue.

To summarize, any additionality test, no matter how quantitative and seemingly objective, will always create some number of false positives (projects that appear additional although they are not) and some number of false negatives (projects that appear not to be additional although they are). The design of the test determines if it will err on the side of false positives or false negative. The judgment as to which is more acceptable is determined by a political process. It is important to understand that while false positives and false negatives both impair economic efficiency, only false positives undermine the environmental integrity of offsets. In other words, it is the false positives – offsets from non-additional projects – that lead to increases in emissions and therefore hamper climate protection goals. The most practical and viable option for additionality testing may mix elements of project based and benchmark approaches.

5.1.3 TABLE 3: *Additionality Requirements for Each Standard*

Standard	Project-Specific Additionality or Performance Standards?	How is additionality determined?
CDM	Project-specific	Specified by individual methodologies or Additionality Tool version 4: Step 1: Regulatory Surplus Step 2: Investment analysis or Step 3: Barrier analysis. Step 4: Common Practice Step 5: Impact of CDM Registration
GS	Project-specific, same as CDM	Gold Standard CER and VER CDM Additionality Tool version 4 In addition for both CERs and VERs: Previous announcement checks required for all project types.
VCS	Project-specific or performance-based Currently approved additionality tests are all project-specific.	Project based test: Step 1: Regulatory Surplus Step 2: Implementation Barriers: Investment barrier or technological barrier or institutional barrier Step 3: Common Practice
VER+	Project-specific, same as CDM	Specific additionality requirements of CDM approved methodologies or Most recent version of CDM Additionality Tool Performance tests have not yet been developed
CCX	Primarily performance-based. No formal definition of additionality. Determinations are based on eligibility criteria, which are examined by the CCX Offsets Committee.	Additionality testing not as a distinct step. However, CCX rules explicitly define project eligibility requirements on the basis of these indicators: • beyond/before regulatory requirements • new projects • highly unusual practices
VOS	Project-specific, same as CDM	Same as CDM or Gold Standard VER
CCBS	Project-specific	Specified by individual methodologies. Step 1: Regulatory Surplus Step 2: Barriers: Financial, Lack of Capacity, Institutional or Market Barriers or Common Practice
Plan Vivo	Project-specific	Project based test: Step 1: Regulatory Surplus Step 2: Financial and Step 3: Barriers test (e.g. lack of technical expertise or prohibitive social, traditional, political or cultural environments. Commercial forestry projects are excluded from participation).

Standard	Project-Specific Additionality or Performance Standards?	How is additionality determined?
GHG Protocol	No formal requirements for additionality determination. Discusses additionality conceptually with respect to baseline determination.	Generic criteria on how to establish additionality either through project-specific or performance-based approaches.
ISO 14064-2	No formal requirements for additionality determination. ISO doesn't specify how additionality must be demonstrated.	Generic criteria on how to establish additionality either through project-specific or performance-based approaches.

5.1.4 **Baselines**

In order to calculate an offset project's GHG benefits, a baseline must be established. This baseline expresses the business-as-usual scenario. In other words, it represents the counterfactual scenario of what would have happened if the project had not been implemented. The number of credits generated by the project is equal to the difference between emissions in the baseline scenario and emissions resulting from the project. The key difficulty is that the baseline scenario is a *hypothetical* scenario; by definition it describes another reality, one in which the activity is *not* implemented as an offset project. As that scenario will never occur, there is no fail-safe way to divine with certainty what the results of that scenario would have been.

The baseline must be explicit and concrete enough to allow an estimation of the corresponding GHG emissions, so that the benefits of the offset project may be calculated. Baselines should be calculated conservatively so as not to overestimate the achieved emissions reductions.

The baseline must be based on verifiable information sources and documented in a confirmable manner.

As with additionality, baselines can be established using project based or performance based approaches. These may either be the same as the approach used to determine additionality or different. Performance based tools may increase transparency and decrease costs; however, they must be well designed to avoid inaccuracies and to ensure environmental integrity. If the baseline is defined by a performance standard, it provides a credible estimate of reductions in aggregate. Each standard usually chooses one approach or the other, although some use a combination.

Some standards prescribe upfront the methods that project developers must use to estimate baseline emissions for each type of allowable project activity (top-down). Others allow project developers to propose appropriate methods for new types of projects, following general programme guidelines (bottom-up). A purely bottom-up standard (like the CDM) is one in which project developers must propose, and win approval for, appropriate methods for every project category. Some programs may be a mix of top-down and bottom-up.

Baselines can be static or dynamic. A static baseline does not change over time, whereas a dynamic one is updated periodically based on ex-post observations, and emission reductions are calculated based on the most current baseline.

Many standards have different levels of requirements for different classes of projects. For example, some might have simplified baseline methodologies for small scale projects.

5.1.5 TABLE 4: *Baseline Requirements for Each Standard*

Standard	How are baselines determined?	How are methodologies determined and approved?
CDM	Most are project-specific, though some methodologies use Performance standards as well (e.g. recently approved high-efficiency coal plant methodology)	New methodologies are submitted to the CDM Methodology Panel, which reviews methodologies and submits its recommendations to the CDM EB, which makes the final decision.
GS	Gold Standard CER: CDM approved methodologies Gold Standard VER: CDM methodologies or Small Scale Working Group (SSC WG) or United Nations Development Programme (UNDP) MDG Carbon Facility or proposed new methodology approved by Gold Standard Technical Advisory Committee.	Gold Standard CER: CDM approved methodologies Gold Standard VER: New methodologies must be reviewed by two independent experts and are then approved by the Gold Standard Technical Advisory Committee.
VCS	Projects will use one of the VCS Programme approved methodologies. At present CDM methodologies have been approved under the VCS. Currently CCAR is going through the approval process. If approved, the CCAR methodologies will also be approved under the VCS Programme. New methodology must be approved through a double approval process. Performance standards or best practice approaches are allowed but have not yet been developed.	Any new methodologies approved under a GHG Programme (e.g. CDM) that has been approved under the VCS are automatically recognised. Other individual new methodologies must be reviewed and approved by two VCS accredited independent verifiers and are then accepted by the VCS Board (though the Board retains the right to examine each methodology).
VER+	CDM approved baseline and monitoring methodologies Baselines that conform with JI rules and are approved by auditor.	CDM approved methodologies in their most current version. If no CDM methodology is available, the project specific approach as defined for JI may be used. The proposed methodology is assessed and approved by the auditor in charge.
CCX	Baselines and methodologies are pre-defined for each specific project type. Some are project based, some are performance based.	New methodologies are reviewed and approved by the CCX Committee on Offsets.
VOS	Same as CDM or Gold Standard VER	Same as CDM or GS VER. INCIS may decide to recognise other standards, or the application of specific methodologies contained within those other standards, in the future.
CCBS	Baselines as defined by CDM LULUCF methodologies or IPCC's Good Practice Guidance (IPCC GPG)	CDM LULUCF methodologies or IPCC's Good Practice Guidance (IPCC GPG) New methodologies are reviewed and approved by CCBS-approved auditors.
Plan Vivo	Project-specific baselines are reviewed and approved by the Plan Vivo Foundation	Projects and new methodologies are reviewed and approved by the Plan Vivo Foundation using standard criteria.
GHG Protocol	Generic guidelines for determining project-specific and performance standard baselines for any type of project.	N/A*
ISO 14064-2	Generic guidelines for determining project-specific and performance standard baselines for any type of project.	N/A

* N/A Not applicable

5.1.6 **Project Boundaries and Leakage**

Each project must define its boundaries, including physical, legal and organizational boundaries. This is necessary in order to calculate the emissions reductions accurately: all emissions reductions and increases within the project boundaries must be taken into account. Some standards require specifying a boundary encompassing all the effects a project has on GHG emissions. Others do not explicitly spell out rules and guidelines on determining boundaries.

Leakage is a project's unintended effects on GHG emissions outside the project's boundaries. For example, a project may reduce GHG emissions in one place, but cause an unintended increase in emissions elsewhere. Under some standards, leakage is explicitly accounted for by examining emissions outside the project's boundaries. In many cases, it can be burdensome or impossible to trace every possible effect an individual project may have on GHG emissions. Standards therefore sometimes explicitly exclude certain types of leakage from project accounting. It is important to address leakage in bio-sequestration projects; this issue is further discussed for the bio-sequestration standards in chapter 5.2.1.

5.2 **Project Types**

Carbon offset projects can be grouped by type of project. Most projects may be broadly categorized into bio-sequestration, industrial gases, methane, energy-efficiency, and renewable energy projects. The following chapter discusses each project category.

Not all project types are equally effective at delivering the emissions reductions that they initially set out to deliver. The CDM keeps statistics on what percentage of projected emissions are realized in each project category (see Appendix C). No such statistics currently exist for the voluntary market.

5.2.1 **Biological Sequestration**

Forestry mitigation projects can make a "very significant contribution to a low-cost global mitigation portfolio that provides synergies with adaptation and sustainable development" (IPCC 2007, WGIII). Historic data indicate that cumulative emissions from land use changes, predominantly deforestation, have contributed about a quarter of all GHG emissions (IPCC Special Report on Land Use, Land-Use Change And Forestry).

Projects that aim to reduce GHG emissions from land use practices are collectively called *Land Use, Land-Use Change, and Forestry* (LULUCF) activities. There are three broad types of LULUCF projects:

- Those that avoid emissions via conservation of existing carbon stocks (i.e. avoided deforestation), called Reduced Deforestation and Degradation (REDD).
- Those that increase carbon storage by sequestration (afforestation and reforestation).
- Those that increase carbon storage by soil management techniques (e.g. no-till agriculture).

"Tree projects" have a natural appeal, since they conjure up images of pristine and healthy ecosystems. Yet the reality of LULUCF projects is far more complex. The amount of carbon sequestered by forests depends upon a number of factors including tree age, growth rate, local climate, and soil quality. Climate change impacts on forest health and the trees' ability to store carbon, as a result of increased temperatures, altered precipitation patterns, and changes in disturbance regimes (fire, insects, disease), are still largely unknown across the globe. Over time these uncertainties are expected to make the accurate measurement and calculation of LULUCF carbon sequestration projects more challenging and complex.

Leakage is of particular concern in LULUCF projects. Leakage is the unanticipated loss of carbon reductions outside the project boundary. For example, the reforestation of pastureland may drive local farmers to clear forests elsewhere for new pastures. Leakage can best be addressed through careful project design (e.g., incorporating project activities that reduce pressure on other lands), and any resulting leakage must be accounted for and subtracted if project calculations are to be considered credible and accurate.

Permanence is another issue that LULUCF projects must contend with. Permanence refers to the length of time that carbon will remain stored after being sequestered in vegetation. Forests can easily be destroyed by natural events such as fire, pests, or disease, or by illegal logging or burning. LULUCF projects can therefore only temporarily sequester carbon from the atmosphere.

Several trade offs exist in the design of effective forest management strategies which balance carbon storage along with a wide range of ecosystem services. Despite the fact that young forests have the greatest gross rate of carbon uptake, if an old growth forest is cut down and replaced with young fast-growing trees, it will take years to decades before the new forest will constitute a net carbon sink. This is because two-thirds of the carbon in terrestrial ecosystems is stored below ground. Clear cutting leads to large emissions of carbon from disturbed soils and debris decomposition. Projects that protect existing old growth forests are expected to provide the greatest carbon mitigation benefits (IPCC 2007, WGIII). Currently, emissions from deforestation are so great that stopping this emission source would have the greatest net impact on forest-related emissions.

Despite the importance of REDD (Reducing Emissions from Deforestation and Degradation), very few such projects have been implemented in the voluntary market, and CDM does not currently allow for REDD projects. The science to account for carbon storage in existing forests is very complicated. It can also be difficult to prove that the forest would have been cleared if it were not for the offset project, i.e. it may be difficult to prove the additionality of certain REDD projects.

Furthermore, it can be argued that deforestation is a demand-side problem, and that as long as the demand for biomass (fuel and timber) and land cannot be shifted and decreased, forestry offset projects in one area will only cause a change in the supply source rather than lower demand on the whole. In other words, none of the forestry standards are able to account for international leakage and market shifting. This argument holds true for certain sectors (e.g. timber demand) but may not do so for others, where good project design is able to affect supply and demand (e.g. by providing local livelihoods through sustainable harvesting, more sustainable and productive agriculture, increasing energy-efficiency and providing alternatives to wood fuel).

Over the long term, sustainable forest management strategies which aim to maintain or increase forest carbon stocks while providing ecosystem services and offering income for local communities will generate the largest sustained mitigation benefits (IPPC 2007, WGIII). Strategies that maximize both carbon storage and carbon uptake include protecting carbon rich old growth forests but allowing selective, well managed harvesting to increase carbon uptake of young trees, to create local economic opportunities, and to protect biodiversity.

Without doubt, exemplary LULUCF projects can address several global problems: they can sequester and store carbon, protect watersheds, offer economic opportunities for the local population, and conserve or restore biodiversity[*]. Conversely, poor-quality projects may result in a loss of biodiversity and the displacement of the local population. Although major international agreements call for integrated approaches to global problems (see section XX), there is little concrete guidance as to how to develop such holistic projects.

The currently available offset standards deal with the challenges of LULUCF projects in the following ways:

- Either excluding or strictly limiting LULUCF projects (Gold Standard, CDM)
- Imposing rules for LULUCF projects that specifically focus on maximizing biodiversity and social benefits (CCBS, Plan Vivo).

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* Stephen Pacala and Robert Socolow calculate that over the next 50 years, we need to stop all clear-cutting in primary tropical forests, reforest or afforest 250 million hectares in the tropics or 400 million hectares in temperate zones. and plant 300 million hectares of new tree plantations. (S. Pacala and R. Socolow, "Stabilisation Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," Science, 13 August 2004, Vol. 305, No. 5686, pp. 968–972.)

- Addressing issues of permanence by either issuing temporary offset credits (LULUCF CDM) or establishing carbon buffer zones which retain a portion of the project carbon credits and sales in case of forest loss and provide funding for reestablishment (VCS, Plan Vivo).

LULUCF projects have only reluctantly been included into the CDM and are currently excluded from the EU-ETS. As of early 2007, seven different afforestation/reforestation methodologies had been accepted by the CDM board. Yet of the total 827 projects registered in the CDM as of September 2007, only 1 is an afforestation/reforestation project (***www.cdmpipeline.org/cdm-projects-type.htm***).

Forestry and other land use projects play a much larger role in the voluntary offset market.

In 2006, forestry accounted for 36% of the transaction volume in the voluntary market (Hamilton, 2007). Yet there is a noticeable difference between forestry's role in the American and European markets. Forestry credits in the European market have decreased considerably due to concerns about additionality and a focus on clean technology investments. But forestry projects still play an important role in the American market. Two-thirds of the offsets that entered the voluntary market in the US in 2006 came from sequestration projects (Hamilton, 2007).

5.2.2 **Industrial Gases**

Some industrial gases have very high Global Warming Potentials[*] (GWP). The destruction of these gases is therefore a very effective way to reduce GHGs. Yet industrial gas offset projects are controversial because although they are the cheapest to conduct and generate large numbers of offsets, they do not contribute to the path to a low-carbon economy and deliver few additional environmental and social benefits.

Few disagree that these industrial gases should either be destroyed or not produced in the first place, but the offset market does not appear to be the best way to reduce these emissions[†]. Some reports have indicated that the creation of an offset market for HFC-23 gases has created perverse incentives in China and India to start building new HCFC-22 facilities[‡] to increase revenue from offsets[§]. Many balk at the idea that heavily polluting industries such as these should be rewarded for the destruction of gases that should not have been produced in the first place (Financial Times, Jan 18, 2007). Furthermore, some research has shown that establishing an international fund to finance the capture and phasing out of HCFCs (via the World Bank, for example) would be much less expensive than reducing these emissions through the offset market (Wara, 2007[¶]).

Furthermore, although industrial gas projects can generate large emission reductions, these projects are high-tech end-of-the-pipe applications with limited employment and local environmental benefits.

To counteract some of this criticism and to support sustainable development initiatives, some project developers have chosen to invest a portion of their gains into local schools, health care systems, etc. For example, 65% of the revenue from CER sales in China is collected as tax revenue by the government and is supposed to be used to support sustainable development initiatives.

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* Nitrouse Oxide (N_2O, e.g. from fertilizer production) is 296 times, Hydrofluorocarbons (HFCs, used as non-ozone depleting refrigerants) thousands of times, and Sulphur Hexafluoride (SF_6, used in the electrical industry) more than 22,000 times more potent than CO_2.

† At a Montreal Protocol conference in the September 2007, 191 nations agreed to a faster phaseout of ozone-depleting chemicals than had originally been negotiated in 1987. Developed countries have agreed to reduce production and consumption by 75 percent by 2010 and by 90 percent by 2015 with final phase out in 2020 – 10 years sooner than the earlier agreement. Developing countries have agreed to cut production and consumption by 10 per cent in 2015; by 35 percent by 2020 and by 67.5 percent by 2025 with a final phase-out in 2030.

‡ HFC-23 is created as a by-product during HCFC-22 production.

§ E.g. Oeko Institute (2005) Implications of the CDM on other Conventions. The case of HFC-23 destruction, discussion paper. See also Warra, 2007.

¶ The cost to the developed world for installing technology to capture and destroy HFC-23 at the 17 production facilities in the developing world would be €100 million, compared to €4.7 billion in value for CERs generated under CDM through 2012, based on €10/tonne price of carbon at time of author's calculations, and neglecting taxes.

Current CDM rules prohibit new capacity at HCFC-22 plants from earning carbon credits, but the issue will be reconsidered at the next meeting of the UN Subsidiary Body for Scientific and Technological Advice in June 2008. A range of different solutions have been proposed. These include, among others, continuing the ban on including HFC-23 from new HCFC-22 plants, and a tax on carbon credits generated by newer refrigerant plants, the proceeds of which would be channelled into a clean technology fund to invest in renewable technologies.

The exclusion of new HFC facilities from the CDM market might have the unanticipated effect of creating a large supply of these offsets in the voluntary market. New HFC producing facilities, which are no longer eligible under CDM, could potentially flood the VER market with a large supply of cheap offsets.

Nevertheless, because of these controversies, some standards exclude industrial gas projects altogether. The Gold Standard does not accept any industrial gas projects. Of those standards that accept all projects types, VER+ excludes all HFC projects, while the VCS and the VOS exclude HFC-23 destruction credits from new HCFC-22 plants.

In the CDM market, 34% of all CERs transacted in 2006 came from HFC destruction projects, down from 67% in 2005. N_2O destruction projects accounted for 13% of offsets transacted in 2006 (Capoor & Ambrosi, 2007). Yet despite this trend, N_2O and HFC projects are projected to account for 50%* of all cumulative offsets sales under CDM by 2012. Industrial gas destruction accounted for 20% of VERs sold in the voluntary market in 2006 (Hamilton, 2007).

5.2.3 **Methane Capture**

Methane's global warming potential is about 21 times greater than that of CO_2. Methane is produced and emitted by landfills, during wastewater treatment, in natural gas and petroleum systems, by agriculture (livestock and rice cultivation), and during coal mining. Methane is natural gas and can therefore be captured and used as a source of energy.

There are two types of methane projects. The first type captures and flares methane. Through combustion, methane gas is turned into less potent CO_2 and H_2O. Examples of such projects include the capture and flaring of landfill gas and of coal mining gas. The second type of project captures methane and uses it to produce either hot water or electricity. Such projects include those that capture and purify methane in wastewater treatment plants or landfills and use it for electricity production or the production of another form of energy.

Biofuel plants that use agricultural or forestry waste to produce electricity also use methane – organic matter is anaerobically digested and the resulting methane is used to produce electricity – but such biofuel projects are considered renewable energy projects rather than methane capture.

It is usually quite easy to establish additionality for methane projects because there is generally no other source of revenue from the activity aside from the sale of offsets. Yet methane offset projects could create disincentives to regulate landfills and agricultural emissions (e.g. from manure lagoons). Once methane capture and destruction becomes profitable, there is little incentive for project owners to support legislation that would mandate capture and destruction from all such sources. Yet such regulation would likely cover more sources, and thus would decrease emissions directly without generating offsets that would allow buyers to increase their emissions. In other words, the climate benefits of such regulation could be greater overall. This issue of perverse incentives that could stifle more effective general regulation holds true for all offset types (see chapter 9).

In 2006, methane projects accounted for approximately 3% of VERs sold in the voluntary market (Hamilton, 2007). In the regulatory market, 8% of all CDM projects are methane projects. These projects accounted for 11% of CERs in 2006 (Capoor & Ambrosi, 2007.)

* ***http://cdmpipeline.org***, accessed October 2007

5.2.4 **Energy Efficiency**

Energy efficient products or systems use less energy than conventional technology to perform the same task, such as a new car fleet that replaces old, less fuel-efficient vehicles. There is clearly great potential for energy efficiency projects (Weizsäcker & Lovins, 1997). Such projects are often quite cost effective because they save money over the long term through avoided fuel costs. In other words, such projects have a "payback". Additionality tests for energy efficient projects must show that the revenue from the carbon offsets played a decisive role in making the projects viable.

Demand-side-management energy efficiency projects are held back by methodological challenges, such as additionality requirements for activities that are considered economically rational. Such demand-side energy efficiency projects are often small and disaggregated (e.g. distributing compact fluorescent bulbs or installing more efficient cooking stoves). Establishing a baseline, monitoring and evaluating energy efficiency projects can be challenging and labour-intensive. Consequently, such projects often have higher transition costs than large centralized offset projects*.

In 2006, energy efficiency projects made up 5% of offsets sold in the voluntary market (Hamilton, 2007). 9% of the CERs in 2006 came from energy efficiency and fuel switching projects. This is a large increase from 2005, when only 1% of the CERs originated from energy efficiency projects (Capoor & Ambrosi, 2007). Most CDM energy efficiency projects are implemented at large industrial facilities.

5.2.5 **Renewable Energy**

Renewable Energy (RE) projects include hydro, wind, and photovoltaic solar power, solar hot water and biomass power and heat production. Renewable energy projects are crucial for the long-term protection of the global climate because they help us move away from fossil fuel-based electricity and heat production to more benign forms of energy production. Although in theory this makes renewable energy projects ideal for the carbon offset market, it is sometimes difficult to establish the additionality of such projects.

Many renewable energy projects have high up-front capital costs. Legislative hurdles and local opposition can further complicate the implementation of such projects. Yet because most renewable energy projects have very low (biofuel) or no fuel costs (wind, solar, hydro), their operating costs are minimal once built.

As with all offset projects, additionality tests for renewable energy projects must determine that the projected revenue from the sale of offsets played a decisive factor in making the project viable. A lack of adequate additionality testing may be an issue when Renewable Energy Certificates (RECs) are converted to carbon offsets. Because RECs were created for a regulatory market with a cap, they are not designed to be tested for additionality (see Appendix A for a discussion on RECs).

Not all renewable power projects are benign. Hydro power projects in particular are controversial because they can have large negative environmental and social impacts. Several of the standards therefore require that hydro projects above a certain size comply with The World Commission on Dams (WCD) Framework. The WCD was an independent, international, multi-stakeholder process which addressed the controversial issues associated with large dams. Its final report, *Dams and Development: A New Framework for Decision-Making*, was released in November 2000. The report outlines a framework for decision-making based on five core values: equity, sustainability, efficiency, participatory decision-making, and accountability.

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* To address this issue, the CDM has approved to use of a programmatic approach for certain projects: A programmatic CDM project activity is one in which the emission reductions are achieved by multiple actions executed over time as a result of a government measure or a private sector initiative. Examples include grant or soft loan programs to promote energy efficiency, fuel switching activities, and the use of renewable energies by private households, in the transportation sector or by small enterprises, as well as voluntary or mandatory efficiency standards for equipment or facilities.

In 2006, renewable energy projects made up approximately 33% of offsets sold in the voluntary market. Over half of those originated as RECs (Hamilton, 2007). In the regulatory market, 11% of all CDM projects are renewable energy projects, but only 4% of the CERs in 2006 came from RE projects (Capoor & Ambrosi, 2007).

5.2.6 TABLE 5: *Project Types Accepted By Each Standard*

Standard	Accepted Project Types
CDM	Any* except nuclear energy, new HCFC-22 facilities and avoided deforestation (REDD)
GS	Renewable energy (including methane-to-energy projects) and end-use energy efficiency. No large hydro above 15 MW
VCS	Any except projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction (e.g. new HCFC-22 facilities)
VER+	Any except any HFC projects, nuclear power projects and hydro power projects exceeding 80MW Hydro projects exceeding 20MW with World Commission on Dams compliance only
CCX	Renewable energy, energy efficiency, HFC-23 destruction except from new HCFC-22 facilities, methane capture and destruction, forestry (including REDD) and agricultural practices
VOS	GS VERs: see above or CDM plus large hydro above 20 MW have to comply with WCD guidelines; no new HCFC-22 facilities.
CCBS	LULUCF
Plan Vivo	LULUCF except commercial forestry
GHG Protocol	Any
ISO 14064-2	Any

5.3 Project Location

Under CDM, offset projects can only be implemented in non-Annex 1 countries – countries that have no Kyoto obligation to reduce their emissions. There is high demand for projects implemented in the consumer's home country. If these countries are signatories to the Kyoto Protocol and have emissions reductions requirements, then it is currently not possible to implement such projects without running into issues of double counting (see chapter 5.7.)

Carbon offset projects are implemented on all continents, yet there are some striking trends. China has been the single largest seller of CDM credits, accounting for 60% of the cumulative total. In 2006, 61% of all CERs came from projects in China, 12% from India, 10% from Latin America, and 3% from Africa† (Capoor & Ambrosi, 2007; see chart 4).

In the voluntary market, 43% of VERs came from projects in North America, 22% from Asia, 20% from Latin America, 6% from Europe and Russia, 6% from Africa, and 3% from Australia (Hamilton, 2007; see chart 5).

* Any project that reduced the emissions of one of the GHGs covered under the Kyoto Protocol: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6

† Four UN agencies, the African Development Bank and the Worldbank have been implementing the Nairobi Framework since 2006 to help sub-Saharan Africa, to increase the number of CDM projects complementary to bilateral support of different donors. See ***http://cdm.unfccc.int/Nairobi_Framework/index.html***

CHART 4: ***CERs Issues By Host Country and Region, 2006***

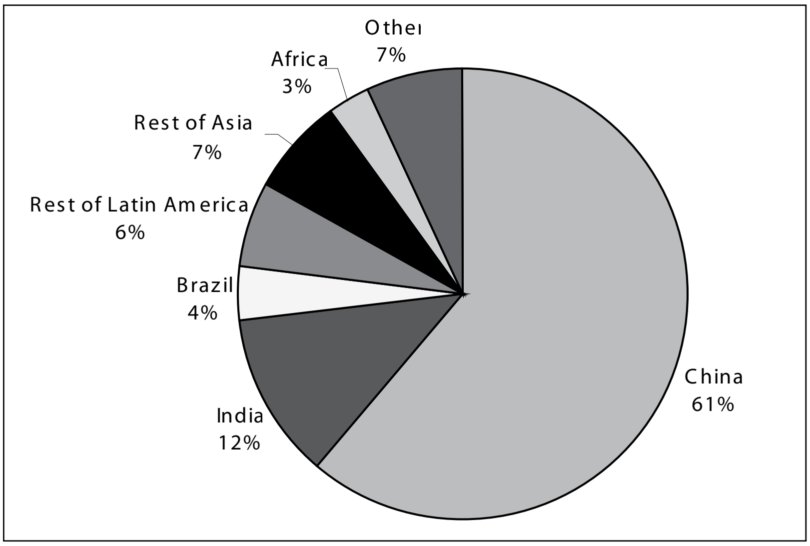
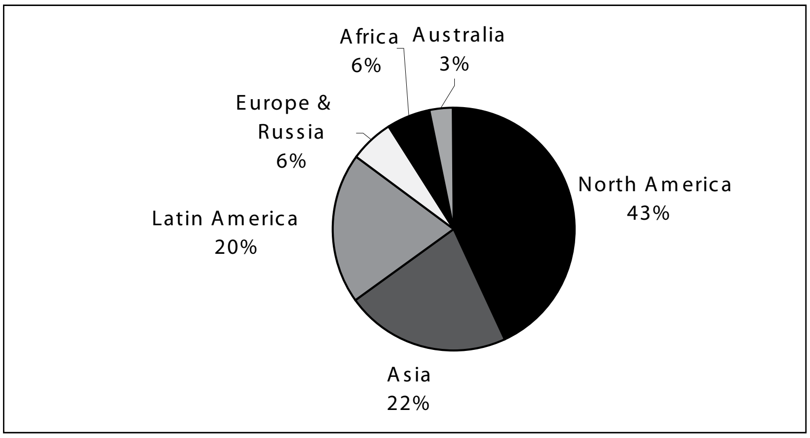


CHART 5: ***VERs Issues By Host Country and Region, 2006***



5.4 **Start Date & Crediting Period**

The 'start date' in the context of a carbon offset project refers to either the start date of the project activity itself or the start date of the crediting period. The 'crediting period' is the period during which a carbon offset project can generate verifiable and/or certifiable emissions reductions credits. The project start date is one of the parameters used by all carbon offset programs to determine the eligibility of a project for consideration. For example, if a project started before 2000, it is considered non-additional under CDM. More significantly, the start date of the crediting period is used to determine the starting point for calculating the emission reductions achieved by a project.

Project Start Dates

Under CDM, the project start date is defined as "the date on which the implementation or construction or real action of a project activity begins" resulting in actual GHG reductions or net GHG removals in the case of forestry carbon sequestration projects. The Gold Standard uses the same definition as CDM. The VCS 2007 defines the project start date somewhat differently as "the date on which the project reached financial closure." While other schemes do not explicitly define project start date, they do specify earliest possible start dates for projects. For the purposes of accounting emissions reductions, the relevant start date of a carbon offset project is the date when the project starts to reduce or remove GHG emissions.

Standards specify the earliest possible start date of a project to limit the number of already implemented projects entering the pipeline. Such projects may be additional, but proof of additionality is more difficult to establish with projects that were fully implemented years ago. The rules on start date vary somewhat across standards (see table 6).

Crediting Period

Start and end dates

The start date of the crediting period can be any date after the project start date provided the project starts after it has been registered. If the project start date is earlier than the registration date, then each programme has somewhat different rules that govern the determination of the earliest start date of the crediting period (see *retroactive and CDM pre-registration crediting*). The end date of the crediting period is either the maximum permissible duration of the crediting period (see *duration and renewals*) or the end of the project itself. The end of Kyoto Protocol crediting period, 2012, acts as the *de facto* end date for the CDM programme, and the VER+ programme links the end date to the Kyoto expiry date until a post-Kyoto regime has been established, at which point the crediting period for projects can be extended.

Retroactive and CDM pre-registration crediting

CDM no longer allows retroactive crediting*, but most of the voluntary schemes do allow it. For example, the earliest start date for retroactive crediting under the Gold Standard is 1 January 2006 and 28 March 2006 for the VCS. VER+ allows retroactive crediting up to 2 years before the registration of the project. Thus, CDM project developers can sell their CDM pre-registration credits in the voluntary market as VERs, in effect extending the total crediting period (see discussion below). The prices of VERs are usually much lower than the prices of CERs, but, they do remain an additional revenue source for project developers. Notwithstanding the benefits to project developers, the sale of CDM pre-registration credits does call into question the additionality of these CDM pre-registration credits, since the project was deemed additional yet profitable without the revenue of the CDM pre-registration credits.

Duration and renewals

The duration of the crediting period varies based on either project types or whether they are renewable or not. Most programs only distinguish between LULUCF projects and all other project types in specifying the eligible crediting periods. The CCX is the only exception in that it specifies different crediting periods for different project types. The permissible crediting periods across schemes range from 4 to 25 years for standard projects and from 20 to 100 years for LULUCF projects (see table 6). The justification for generally longer crediting periods for sequestration projects is to enhance their viability.

There is a trade-off between limiting crediting periods to the minimum to allow more projects to enter the market and extending it to the maximum to make more projects viable. Longer crediting periods will result in fewer projects being implemented: For example, if we assume that three identical offset projects under a 10 year crediting period meet the demand for all offsets in this hypothetical example, a 15 year crediting period will deliver the same number of offsets with just two of the three projects. In other words, longer crediting periods increase supply without increasing emissions reductions.

Further, having longer crediting periods under some standards enables a project developer to potentially register the project first under one standard (e.g. with a 10 year limit), and after the end of its crediting period, switch to another standard (e.g. with a 15 year limit) for the remaining time (in this example, 5 years). This raises potential additionality issues.

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* Projects that started between 1 January 2000 and 18 November 2004 (the date of registration of the first CDM project) could claim retroactive credits provided they submitted the projects for CDM registration by 30 April 2007 and provided that the project was validated before 31 December 2005.

5.4.1 TABLE 6: *Start Dates and Crediting Periods for Each Standard*

Standard	Project Start Date Rules	Crediting Periods Fixed/ Renewable	CDM Pre-registration Credits
CDM	Originally: 1/1/00, This rule has elapsed Currently: date of registration	10 yrs/ 3x7 yrs LULUCF: 30 yrs/ 3x20 yrs	Not allowed
GS	For Gold Standard CERs: as CDM For Gold Standard VERs: Maximum 2 years back from the date of GS registration; with earliest start date being 1 January 2006	10 yrs/ 3x7 yrs	Allowed for up to 1 year before CDM registration if the project is submitted for validation before January 31st 2008 and meets certain criteria
VCS	1/1/02; after 19/11/08: start date must be within 2 years of present date	3x10 yrs AFOLU: 20-100 yrs	Allowed. No further additionality proof required.
VER+	1/1/00; issues credits up to 2 years back from date of registration. This rule expires in 2009.	Extension possible up to 25 yrs for standard projects and 50 yrs for LULUCF projects	Allowed for the period between PDD publication in the Global Stakeholder Process and UNFCCC registration. No further additionality proof required.
CCX	Landfill methane & renewable energy: 1/1/99 Forestation & forest enrichment: 1/1/90 Destruction of HFC: 1/1/07	Renewable Energy: 6 years Soil Carbon: 5 years HFC: 4years All other projects: 8 years	Allowed. No further additionality proof required.
VOS	Same as CDM	As CDM or as GS VERs	Allowed. No further additionality proof required.
CCBS	No Start Date	N/A	N/A
Plan Vivo	No Start Date	Varies project-by-project; 5-15 years.	N/A
GHG Protocol	N/A	N/A	N/A
ISO 14064-2	N/A	N/A	N/A

5.5 Co-Benefits

5.5.1 Sustainable Development Criteria

In the offset industry, people like to talk about 'gourmet offsets' versus 'minimum standard offsets.' A minimum standard makes sure that offsets are real, not double counted and additional. Gourmet offsets are those that are sourced from projects that adhere to strict additionality standards and have strong social and environmental benefits (so called *co-benefits* or *secondary benefits*. Such offsets often fetch a considerably higher price in the voluntary carbon market.

The distinction between 'minimum standard' and 'gourmet' offsets is to some extent a useful shorthand, yet it also reveals that sustainability and development benefits are no longer seen as an integral requirement for a carbon offset. This holds true for the compliance market as well as the voluntary market. Yet the carbon offset mechanism was originally conceived as a mechanism that would not only yield climate benefits but also include co-benefits.

As the word 'Development' in the Clean Development Mechanism indicates, when CDM was approved by developing nations, it was specifically because offset projects were not only to provide cost-effective reductions for Annex 1 countries but also development benefits for the host countries. In other words, to qualify as a CDM project, the original intention was that a CDM project must not only have carbon benefits but also development benefits. This two-fold goal is still included in the CDM guidelines (Article 12 of the Kyoto Protocol).

In practice, however, the CDM has failed to consistently deliver such development and sustainability benefits. What anecdotal evidence has indicated for a while is corroborated by recent scientific analyses: A literature review (Holm Olsen, 2007) concludes that there is a trade-off between the CDM target of supplying cheap emission credits and the promotion of sustainable development, and that the former goal has taken precedence. Another study (Sutter and Parreño, 2007) evaluated registered CDM projects and concluded that none of the 16 analyzed projects score high on sustainability and "likelihood of real emissions reduction" simultaneously. They find that the large projects in their sample have a low sustainability score and that over 95% of reductions come from projects with a low score.

Authors' Comments

We would argue that removing the development goals from the requirements of a voluntary offset standard undermines the original goal of carbon offsetting as defined by CDM, and gives credence to the critics who claim that carbon offsetting enables rich countries to take advantage of cheap business opportunities in developing nations that lead to no improvements for the local population.

Persistent criticism of the market could seriously hamper the growth of the voluntary offset market. Removing the development requirement could communicate to the consumers and to the public at large that the development benefits are a 'gourmet' attribute, a luxury add-on that is only for those offset purchasers who can afford to pay a premium.

Yet in reality, these development benefits are not just charitable contributions from the North to the South, but are essential in achieving climate protection. Responding to the world's main development challenges, 192 United Nations member states agreed in 2000 to actively support the Millennium Development Goals (MDG) – which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015. The MDGs include an eight-goal action plan.* Two of the action items target energy and resource planning and collaboration between developed and developing countries and therefore directly relate to climate mitigation and adaptation. Many governments have recognized that the success of the MDGs will depend less on direct foreign aid, than on integrating the goals into all trade and investment policies and agreements.

Carbon offset standards that solely promote cost effective climate mitigation projects and do not deliver other sustainability benefits such as employment creation and reduction in air pollution do not support the MDGs. To truly impact the carbon market and to support projects that are sustainable on many levels, a standard must include additional sustainability and development goals.

* The eight action items are as follows:
1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria, and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development, see: ***http://www.un.org/millenniumgoals/***

It is important to recognize that there is often a trade-off between maximising emissions reductions and increasing sustainability benefits. Projects that work on the grass-roots level and involve local populations are often small-scale and require much continuous support, capacity building and follow-up. Such projects are not primarily about maximizing emissions reductions but about providing financial alternatives to projects with high sustainability benefits.

Several initiatives are underway to support the growths of CDM projects with true development and sustainability benefits. Two UN initiatives focus specifically on linking development goals with carbon offset and energy projects:

MDG Carbon Facility
The UN Development Programm, recently established its *MDG Carbon Facility* with the goal of:

> *Broadening access to carbon finance by enabling a wider range of developing countries to participate, particularly those countries which are presently under-represented. Promoting emission reduction projects which contribute to the Millennium Development Goals ("MDGs"), yielding additional sustainable development and poverty reduction benefits.*
>
> ***http://www.undp.org/mdgcarbonfacility/***

The MDG Carbon Facility is a joint project between UNDP and Fortis Bank. UNDP offers project development services, including performing due diligence, providing technical assistance for CDM or JI project approval, and establishing the monitoring system for the project's emission offsets. Each prospective project is assessed against criteria in five main areas: carbon potential, technical feasibility, finance and legal issues, MDGs and the environment, and country risk.

UNDP charges a flat-rate cost-recovery fee for these services. Fortis provides carbon banking services, comprised of purchasing and marketing the emission offsets generated by the projects.

CD4CDM
The *Capacity Development for the Clean Development Mechanism* (CD4CDM) project was developed by the United Nations Environment Programme (UNEP) with financial support from the Dutch government. CD4CDM was established to promote GHG emission reduction projects that are consistent with national sustainable development goals, particularly projects in the energy sector. CD4CDM gives guidance to participating developing countries about the opportunities offered by CDM projects, and helps these countries develop the necessary institutional and human capabilities to plan and implement projects under the CDM (see ***http://cd4cdm.org***).

Several of the voluntary standards also focus on strengthening the cobenefits of carbon projects.

The Gold Standard (GS) was developed by a group of environmental and social non-profit organizations to strengthen the social and environmental benefits of carbon offset projects. The Gold Standard can be used for voluntary as well as CDM projects. It has a very well developed stakeholder process and stresses environmental and socio-economic co-benefits for the host communities.

The ***Climate, Community & Biodiversity Standards*** (CCBS) focuses exclusively on bio-sequestration projects and emphasizes the social and environmental benefits of such projects. CCBS is a project design standard and offers rules and guidance for project design and development. It has a very well developed stakeholder process and stresses environmental co-benefits.

Plan Vivo is a standard for community-based agro forestry projects and focuses on promoting sustainable livelihoods in rural communities.

5.5.2 **Stakeholder Consultations**

Stakeholders are individuals or organizations that are in some way affected by the project. In the case of a wind farm, for example, stakeholders include the project owner, the wind turbine supplier, the employees, the municipality, nearby inhabitants, and banks.

Stakeholder consultations are an important tool to minimize possible negative impacts of carbon offset projects. Because many offset projects are being carried out in countries where regulations are routinely poorly enforced, stakeholder consultations also function as a risk management tool. When regulations are poorly enforced, an investor is unable to tell whether appropriate due diligence has been carried out with respect to local environmental impacts, land rights or labour issues. Embedding stakeholder consultation in the project approval process is therefore a way for investors to gain more assurance that violations of either their investment principles or of local legislation are not taking place. In China, for example, stakeholder consultation is being prioritised by the government as a tool to improve enforcement of environmental legislation at the local level.

The evaluated offset standards require stakeholder involvement to varying degrees and also differ in terms of how specific the stakeholder involvement rules are spelled out. The CDM rules are quite general and require relevant local stakeholders to be consulted via "appropriate media." The validator (DOE) needs to confirm that relevant stakeholders have indeed been consulted with appropriate media and that comments from local stakeholders have been appropriately taken into account during the validation. It is ultimately up to the DOE to judge whether local stakeholders have been consulted appropriately. Some countries require certain local stakeholders to be consulted as part of their regulation to obtain a construction license or the approval of the environmental impact assessment. Some countries, such as Brazil, have clearly defined rules as to which stakeholders have to be consulted.

Of the reviewed standards, the Gold Standard most proactively spells out stakeholder rules. The Gold Standard tries to ensure transparency and participation with clear rules at to what media is to be used, what type of information is to be presented, and what questions are to be asked of local stakeholders. For example, the GS details the documentation that needs to be made available to local stakeholders along with a questionnaire for the stakeholders to fill out. It also requires an additional local stakeholder consultation for CDM projects (i.e., once the PDD is finalized and the comments from the initial stakeholder consultation have been taken into account).

5.5.3 TABLE 7: *Co-Benefit Requirements for Each Standard*

Standard	Environmental Requirements	Social Requirements	Comments
CDM	Negative environmental impacts must be stated in the PDD and minimized.	The Kyoto Protocol requires that CDM projects enable developing countries to achieve sustainable development. Stakeholder consultation is required at initial project planning stage.	The sustainability criteria for CDM projects are developed by each individual host country and therefore vary. If required by the host country, an Environmental Impact Assessment (EIA) has to be done and findings included in the PDD.
GS	Must demonstrate environmental benefits. Major negative impacts that cannot be mitigated lead to project disqualification.	The project must demonstrate social, economic or technical development benefits. Major negative impacts that cannot be mitigated lead to project disqualification. Stakeholder consultation required at initial project planning stage. There are specific requirements as to which stakeholders have to actively be invited. Two public consultation rounds are required before validation is completed. There is a 60 day commenting period for stakeholders in parallel to validation process. For Gold Standard VER, no public international stakeholder consultation such as for CDM is required. NGO supporters of the Gold Standard must be included in all consultation rounds.	The Gold Standard provides a set of sustainable development indicators to support project developers' efforts to define and assess co-benefits. EIA requirements are the same for CER and VER. The Gold Standard provides detailed documentation on how a stakeholder consultation has to be conducted and which requirements apply. The Gold Standard rules are more specific than under CDM. Micro-scale projects need only one stakeholder consultation round. The claimed co-benefits and impact mitigation measures must be monitored.
VCS	Must comply with local and national environmental laws.	The project document must include "relevant outcomes from stakeholder consultations and mechanisms for ongoing communication." (VCS 2007, p. 14)	If required by the host country, an Environmental Impact Assessment (EIA) has to be done.
VER+	Negative environment impacts must be stated in the PDD and minimized.	Local stakeholder consultation required only - if required by national law of host country or - if project proponent cannot demonstrate that the project does not impact the vicinity.	If required by the host country, an Environmental Impact Assessment (EIA) has to be done.
CCX	Must comply with local and national environmental laws.	Must comply with local and national laws.	If required by the host country, an Environmental Impact Assessment (EIA) has to be done. For agriculture, land-use and forestry projects the proponent must identify potential negative environmental and/or socio- economic impacts and take steps to mitigate them.
VOS	Same as CDM or GS	Same as CDM or GS	Same as CDM or GS
CCBS	Must demonstrate environmental benefits. Major negative impacts that cannot be mitigated lead to project disqualification.	Must generate positive social and economic impacts. Stakeholder involvement is required and must be documented. 21-day public commenting period.	Extra points are given for positive environmental impacts such as use of native species and biodiversity protection. Extra points are given for capacity building and use of best practices in community involvement. The CCBS is intended to be applied early on during the project design phase, which is when the environmental and social outcomes are often "locked in".

Standard	Environmental Requirements	Social Requirements	Comments
Plan Vivo	Must demonstrate environmental benefits.	Must demonstrate social benefits. Projects are required to increase capacity over time and promote extra activities contributing to well-being (e.g. micro-enterprises, fuel-efficient stoves etc.)	The Standard Manual includes explicit requirements for ecosystem and livelihood benefits and is reviewed periodically
GHG Protocol	N/A	N/A	
ISO 14064-2	N/A	N/A	

5.6 Role of Third Party Auditors

5.6.1 Aligned Interests Between Buyers and Sellers

In a typical market, the competing interests of buyer and seller create checks and balances: Producers try to maximize both price and the number of items sold or services rendered, whilst buyers try to lower the price and minimize the number of products they must purchase to satisfy their need. This system of checks and balances does not function in offset trading – there is an inherent conflict of interest in the current market design. Although there is competition on pricing – the supplier (project developer/funder) wants high prices, the offset buyer wants low – since both the supplier and buyer of carbon offsets aim to maximize the number of offsets produced, there is a strong financial incentive for both supplier and buyer to overestimate the baseline scenario and thus artificially inflate emission credits to increase profitability[*]. The purpose of a free market is to enable dynamic innovation and entrepreneurship. Free markets are not designed to protect public goods. Neither suppliers nor buyers of carbon offsets can therefore be reasonably expected to act altruistically and conservatively estimate a project's reductions, as this would directly translate into decreased profits. In a "normal" market, the seller faces this same incentive, but it is balanced by the buyer's incentive to ensure that the offsets are not overestimated.

This inherent alignment of interests is a profound design flaw of project-based carbon trading systems, which can only to partly be mitigated by rigorous monitoring and third-party validation and verification of offset projects. Most standards do require third-party auditors. The following sections detail validation and verification as well as the role of third-party auditors.

5.6.2 Independent Validation of Project Activity

The validation process is initiated during the planning and early implementation phase of a project. It confirms the sound planning of a project developer and the compliance with the chosen offset standard's rules and regulations. The project has usually not been implemented at this stage and the validation neither comments on the actual performance of a project nor certifies any emissions reductions.

Validation Process

An independent auditor reviews and validates the project design documents (PDD) and other project-related documentation such as construction licenses, environmental impact assessments and records from the stakeholder consultation meetings with local stakeholders. For CDM projects, the information in these documents is reviewed against CDM rules and regulations. In the voluntary market, the validation entails the comparison of the proposed project to the rules of the standard under which the project is implemented.

* This dynamic is to some extent mitigated by the buyers' potential risk of damaging his reputation if he buys offsets from a project that might later be criticised for overestimating its credit reductions.

It is important to point out that a validation can only be as good as the standard which it follows. If the requirements of a standard are weak, e.g. if the baseline requirements are not rigorous and conservative, the validation will not rectify that but will simply confirm that the proposed project conforms to the requirements of the standard.

A validation process under CDM typically consists of the following three phases:

- *A desk review of the project design document:* The auditor reviews the PDD and other relevant documents and critically checks the assumptions and calculations given by the project developer.
- *Follow-up interviews with project stakeholders*: The auditor confirms elements from the project documentation during interviews with local regulatory bodies (e.g. that the project has complied with all local regulations) and the project owner (e.g. that sufficient training has been administered to the staff to run the project equipment professionally). The auditor also consults a selection of local stakeholders i.e. organizations or individuals other than the project participants that are affected by the project so as to confirm that their concerns have been taken into account.
- *The resolution of outstanding issues and the issuance of the final validation report:* Inconsistencies in the documentation or missing evidential documents are pointed out by the auditor and corrections requested. Only after all open issues are resolved will the final validation report be issued and the project recommended for registration.

Validation is an ex-ante confirmation that the project, if implemented according to design, will generate the expected amount of emission reductions and comply with rules and regulations. The final validation report does not confirm the amount of carbon reductions that will be generated. It is the later verification and certification process which confirms and certifies the actual emissions reductions.

Table 8 lists the validation requirement and the review process for each of the evaluated standards.

5.6.3 **Monitoring and Independent Verification of Project Activity**

Verification is an ex-post confirmation that the project was implemented and is performing according to design. Verification confirms and quantifies the amount of emission reductions.

Monitoring and verification standards are required to ensure that offset projects perform as expected.

Under CDM procedures, an accredited third-party auditor (Designated Operational Entity - DOE) must confirm that the claimed emissions reductions have actually occurred. To reduce conflict of interest, DOEs are not allowed to do validation and verification on the same project.

Verification is only as good as the accounting standards it verifies against.

Verification by itself cannot ensure high quality of the project because it only confirms that the methodologies and monitoring standards have been implemented according to what was specified in the validation documents. If these methodologies and monitoring standards are weak, the verification process will not rectify this. For example, in a land-fill gas project, a verification report will confirm if the emissions reductions were actually achieved to the extent they were estimated in the PDD. The verification report will not evaluate or reconsider the additionality requirements.

Verification In the Voluntary Market

The lack of third-party project verification by a certified and independent auditor is one of the biggest gaps in the current voluntary carbon offset market. Many project developers in the VER market do not use third-party verification at all but do the verification in-house. One of the reasons for this is that historically, project developers were the ones that knew most about the technologies they implemented and the circumstances of their projects. Early on, there simply were not enough third-party verifiers with the necessary technical expertise available to allow for external verification. Self-verification does not necessary indicate that such projects are of low quality, but there is clearly a strong incentive for the project developer to evaluate his projects in as positive a light as possible. Third-party evaluation therefore not only adds to the transparency of projects but also decreases the inherent conflict of interest in self-evaluated projects. Many of the voluntary offset standards have recognized the need for independent verification and require third-party auditors. Table 8 outlines the requirements for each standard.

5.6.4 **Project Approval: Auditors or Standard Boards**

Under the CDM, upon completion of the validation or the verification process, the DOE submits the documents to the CDM Executive Board who will then approve or reject the project. Many of the voluntary offset standards also require the use of third-party auditors for project validation and verification. In other words, it is the auditors themselves that approve the projects. This is problematic for the reasons explained in the next two sections.

5.6.5 **Conflicts of Interest: Auditors and Project Developers**

Under both the CDM and voluntary offset standards, auditors are generally hired and paid by project developers. This creates a conflict of interest because the auditor will need to be impartial, yet may want to generously overlook issues and overestimate emission reductions in order to keep the customer. The CDM has tried to address this conflict of interest by stipulating that auditors are not allowed to provide any consulting services to project participants:

> *The DOE [Designated Operational Entity – CDM approved auditor] shall work in a credible, independent, non-discriminatory and transparent manner. The structure of the DOE shall safeguard impartiality of its operations. If the DOE is part of a larger operation, the DOE shall clearly define the links with other parts to demonstrate that no conflicts of interest exists. The DOE shall demonstrate that it is not involved in any commercial, financial or other processes which might influence its judgment or endanger trust in its independence and integrity. (CDM modalities & procedures, Appendix A, paragraph 2)*

In the CDM, the additional approval process through the CDM Executive Board adds a layer of quality control because it is not solely up to auditors to approve or reject a project.

Except for the Gold Standard and the CCX, the evaluated voluntary offset standards do not employ an additional approval process. Auditors themselves approve the projects. This lack of an additional approval process potentially exacerbates the conflict of interest for the project auditor.

In addition, the subjectivity that is inherent in any offset project validation process weakens the quality control function of the auditor. In every project review, there is a significant degree of subjective judgment involved. Auditors are paid by project developers and are given the power to make judgments about issues such as whether assumptions are "conservative", whether a given barrier is substantial in a given country, whether a baseline and an additionality argument make sense, and whether data sources are legitimate.

To counterbalance these design flaws, many of the standards, including CDM, require a short public commenting period – for example, for review of the baseline documents and background information. It is nevertheless questionable whether these public commenting periods are sufficient to properly review the social and environmental consequences of projects.

5.6.6 **Quality Control of Auditors**

Under CDM's accreditation standard,* DOEs have to provide proof that they have the necessary competences to conduct project validation (e.g. experience and technical expertise with validating biomass plants). To ensure auditors' quality, the CDM Executive Board has set up a regular

* Procedure for Accrediting Operational Entities by the Executive Board of the Clean Development Mechanism (***http://cdm.unfccc.int/DOE/cdm_accr_01.pdf***)

surveillance system for DOEs, including on-site assessment of every DOE at least every three years. Furthermore, the CDM Executive Board is authorized to conduct "spot-check" activities (i.e. unscheduled surveillance) of DOEs at any time. Depending on the results of the spot check, the CDM EB can issue a warning to the DOE or in the most severe cases suspend its accreditation.

In 2006 the CDM EB conducted three spot checks, yet it did not suspend any DOEs or publish their names despite "several non-conformities of the DOE regarding both procedural and operational requirements". Given the negative findings of all three spot-checks, the EB set up a regular surveillance system for DOEs, including on-site assessment of every DOE at least every three years.*

The voluntary standards evaluated in this report currently have no formal structures in place to assess and ensure the quality of the auditors' work.

5.6.1 TABLE 8: *Validation, Verification and Third-Party Auditor Requirements*

Standard	Requirements for Validation	Validation Approval Process	Requirements for Verification	Verification Approval Process	Third-party Requirements
CDM	Project Design Document (PDD) containing: Description of the project activity; Information on baseline methodology; Crediting period; Monitoring methodology and plan; Estimation of GHG emissions by sources; Environmental impacts; Stakeholders' comments; Host nation approval.	Validation documents need to be approved by the CDM Executive Board. After approval, the project is officially registered.	Monitoring report (by project developer) including estimate of CERs generated. Verification report (by DOE) and certification report (by DOE) confirming the emissions reductions.	Project developers monitor project according to monitoring plans as given in the PDD. Monitoring reports are submitted to third-party auditor (DOE). DOE writes verification reports which are then submitted for approval to the CDM Executive Board.	Validation and verification have to be done by third-party auditors (Designated Operational Entities, DOEs). To avoid conflict of interest, validation and verification cannot be done by the same DOE.

* Details can be found: Executive Board of the Clean Development Mechanism Twenty-ninth Meeting (*http://cdm.unfccc.int/EB/029/eb29rep.pdf)*

Standard	Requirements for Validation	Validation Approval Process	Requirements for Verification	Verification Approval Process	Third-party Requirements
GS	All CDM requirements plus additional GS requirements must be met (e.g. GS eligibility, previous announcement, scoring of sustainable development indicators, monitoring plan for sustainable indicators, detailed outcomes of both stakeholder consultations) .	Validation documents need to be approved by the Gold Standard Technical Advisory Committee (TAC). Gold Standard TAC and Gold Standard supporter NGOs have six weeks to seek clarification and can request an in-depth audit of a project. After approval, the project is officially registered. Micro-scale projects can be submitted for an internal validation. Some are externally validated on a targeted random basis.	Monitoring report (by project developer) including estimate of CERs or VERs generated. Verification report including the GS-specific annex (including monitored sustain. dev. indicators) and statement (by DOE) confirming the emissions reductions and compliance of sustainable development indicators. Verification report including the GS-specific annex to be submitted to Gold Standard by CDM-accredited DOE. Gold Standard verification periods have to correspond to CDM verification periods.	Project developers monitor project according to monitoring plans as given in the PDD. Monitoring reports are submitted to third-party auditor (DOE). DOE writes verification reports. Gold Standard CER: submitted for approval to the CDM Executive Board and the Gold Standard TAC. Gold Standard VER: submitted for approval to the Gold Standard TAC. Micro-scale projects are selected to be verified on a targeted random basis. Both Gold Standard CER and VER: a 2-week review period precedes issuance during which the Gold Standard TAC and Gold Standard NGO supporters can ask for clarifications and corrective actions.	Registered DOEs DOEs conducting a first time validation of a Gold Standard PDD trigger a more in-depth audit of the project by the Gold Standard TAC, which also serves as accreditation procedure of the DOE to the Gold Standard. Validation and verification can only be done by the same DOE for small-scale and VER micro-scale projects.
VCS	The VCS Project Description (VCS PD), monitoring plan, environmental impacts, comments by stakeholders etc. are validated according to ISO 14064-3 requirements and VCS Programme requirements.	Validation documents are approved by the auditors. Validations are mandatory, and can be completed up front or at the time of the first verification.	Monitoring report (by project developer) including estimate of VCUs generated. ISO 14064-3 requirements using the VCS Verification Report template confirming the emissions reductions.	Project developers monitor project according to VCS PD. Monitoring reports are verified by third-party auditor. Auditor writes verification reports and also approves them and the emissions reductions. These are automatically approved by the VCS once authenticity and completeness of documents have been confirmed.	Registered CDM DOEs Certified auditors under ISO 140065 Auditors registered under JI Other auditors need to be certified by the VCS board.
VER+	JI or CDM PDD plus formal statement of compliance with VER+ criteria	Validation documents are approved by the auditors.	Monitoring report (by project developer) including estimate of VERs generated Verification report (by auditor) confirming the emissions reductions	Project developers monitor project according to PDD. Monitoring reports are submitted to third-party auditor who writes verification reports and also approves them and the emissions reductions*.	Validation and verification have to be done by third-party auditors (DOEs). Validation and verification can be done by the same DOE

* DOEs have a "certification body" which reviews and approves the validation and verification reports. For CDM projects, the DOE certification body is the DOE's quality control before the documentation is submitted to the CDM EB. For VER project, it is that certification body that gives the final approval for a project.

Standard	Requirements for Validation	Validation Approval Process	Requirements for Verification	Verification Approval Process	Third-party Requirements
CCX	CCX does not distinguish between validation and verification.	See verification.	Project proposal Independent verification report confirming the emissions reductions.	Verification documents are submitted for approval to the CCX Committee on Offsets.	Third-party auditors are approved by CCX for each project type.
VOS	Same as CDM or GS	Same as CDM or GS	Same as CDM or GS	For GS VERs: see above. For other VERs: project developers monitor project according to PDD. Monitoring reports are submitted to third-party auditor (DOE). DOE writes verification reports and also approves them and the emissions reductions.	Same as CDM or GS
CCBS	Fifteen required criteria and eight optional "point-scoring" criteria. Project ratings: Approved, Silver, Gold.	The CCB Alliance works closely with auditors, but it is ultimately the auditor who makes the decision to approve or reject a project.	Project documents and monitoring results reviewed by auditors.	Each project must be verified at least every five years. Because CCBS is only a project design standard, it does not verify quantified emissions reductions.	Registered DOEs for 'Afforestation and Reforestation' and accredited FSC auditors. Validation and verification can be done by the same auditor.
Plan Vivo	Report including: Project description Communication with national regulatory authorities. Monitoring protocol Technical specifications Size of risk buffer Financial records	Validation carried out by expert reviewers. All documentation reviewed and approved by the Plan Vivo Foundation. Projects are reviewed on a yearly basis through annual reporting.	Verification is currently not required for Plan Vivo projects but recommended.	Because Plan Vivo sells ex-ante credits it does not verify quantified ex-post emissions reductions.	Approved validators with extensive experience in forestry and carbon management projects.
GHG Protocol	Requires monitoring plan but does not cover validation and verification	N/A	N/A	N/A	N/A
ISO 14064-2	Does not distinguish between, and does not require, validation and verification	N/A	N/A	N/A	No third-party auditor requirements; ISO certifies auditors under ISO 14065 and ISO 14066 (not yet released)

5.7 **Registries**

Carbon offset registries* keep track of offsets and are vital in minimizing the risk of double-counting (that is, to have multiple stakeholders take credit for the same offset.) Registries also clarify ownership of offsets†. A serial number is assigned to each verified offset. When an offset is sold, the serial number and "credit" for the reduction is transferred from the account of the seller to an account for the buyer. If the buyer "uses" the credit by claiming it as an offset against their own emissions, the registry retires the serial number so that the credit cannot be resold.

Registration and Enforcement Systems must include:

- A registry with publicly available information to uniquely identify offset projects.
- Serial numbers for each offset credit generated by each project.
- A system to transparently track ownership of offsets which makes it possible to track each offset to the project from which it originated.
- A system to easily check on the status of an offset (i.e., whether an offset has been retired).
- Contractual or legal standards that clearly identify the original "owner" of emission reductions.
- Contractual or legal standards that spell out who bears the risk in case of project failure or partial project failure (e.g. who is responsible for replacing the offsets that should have been produced by the failed project).

(Broekhoff, 2007)

Obtaining offsets directly through a registry simplifies the delivery process significantly, as buyers simply establish an account into which the registry transfers the purchased offsets. In so doing, the buyer is assured of both the quality of the purchased offsets (as only offsets that meet the registry's standards are transacted) and their ownership of the offsets, since they are deposited directly into the purchaser's account.

Under CDM, the certification process is the phase of a CDM or JI project during which permits are issued on the basis of calculated emissions reductions and verification. In the VER market, credits are not certified but solely verified -- thus the difference between CERs (Certified ERs) and VERs (Verified ERs.) The CDM registry is used to issue CERs from registered CDM project activities into the Pending Account. Up to date information on all registered projects can be found at: ***http://cdm.unfccc.int/Issuance/cers_iss.html.*** Entities authorized to participate in a CDM project activity by a Non-Annex I Party may apply for a permanent holding account in the CDM registry at the time of the first issuance of CERs for their CDM project activity. Entities authorized to participate in a CDM project activity by an Annex I Party may apply for a temporary holding account in the CDM registry.Registry-administered offsets transactions have the advantage of transaction credibility, protection against fraud and errors, and simplified facilitation of transactions based on established standards and procedures.

There is no one single registry for the voluntary market. Registries for the voluntary market have been developed by governments, non-profits, and the private sector. Some of the registries are tied to certain standards whereas others function independently. Most voluntary standard registries are still in the planning stage and not yet operational. Table 9 summarizes the registries and the approval process for each of the standards.

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* The term 'registry' is somewhat loosely defined. It sometimes also refers to accounting systems that track greenhouse gas emissions and/or emissions reductions. In this section we focus solely on registries that are carbon credit accounting systems.

† The issue of ownership is not a trivial one: "For example, both the manufacturer and the installer of energy efficient light bulbs might want to claim the emission reductions caused by the light bulbs – as might the owners of the power plants where the reductions actually occur. Right now, establishing the right to an offset reduction largely consists of making public marketing claims and trying to exclude others from doing the same." (Broekhoff, 2007)

When transactions occur without registry administration, providers and buyers must find other ways to ensure the integrity of the delivery process. Since offsets have no physical form, buyers must be given proof that the stated emission reductions have truly taken place. A verification report from an independent thirdparty can serve this purpose. Furthermore, buyers must obtain all rights and titles to the emission reductions and assurance that the provider did not and will not double-sell the offsets. This confirmation usually takes the form of a "transfer of title and ownership" document signed by the provider. However, unless the provider engages an independent third party to verify its internal processes, the buyer cannot be sure that the provider has truly retired the stated amount of offsets. This form of delivery is often time-consuming, may require extensive negotiations, and demands a great deal of know-how on the part of the buyer. It is therefore only suitable for deliveries of large quantities of offsets.

5.7.1 TABLE 9: *Registries Used by Each Standard*

Standard	Accepted Registries	Approval Process
CDM	CDM Registry	Verification documents need to be approved by the CDM Executive board
GS	Gold Standard Registry (currently under construction, predicted start date early 2008) For CERs: CDM Registry; GS-labeled CDM serial numbers will be tracked in the Gold Standard registry For VERs: Gold Standard Registry	Verification documentation for CER and VER projects are approved by the Gold Standard Technical Advisory Committee CERs are issued by the UNFCCC and the Gold Standard label is delivered by the Gold Standard VERs are issued by the Gold Standard
VCS	In the process of accrediting multiple VCS registries that are electronically connected and transfer data between each other in real time. All registries will be connected to a central VCS project database which is under development and aiming to launch in March 2008.	Verification documents are approved by the third party auditor.
VER+	Blue Registry of TÜV SÜD	Verification documents are approved by the third party auditor and then forwarded to BlueRegistry administration. All VER+ projects must be registered in the BlueRegistry.
VOS	Is planning to establish their own registry	For GS VERs: see above. For other VOS VERs: verification documents are approved by the third party auditor (DOE)
CCX	CCX Registry	Offset projects need to be approved by the CCX Committee on Offsets
CCBS	N/A	N/A
Plan Vivo	Plan Vivo Registry	Plan Vivo sells ex-ante credits (Plan Vivo Certificates) which are recorded in their own registry
GHG Protocol	N/A	N/A
ISO 14064-2	N/A	N/A

5.8 Double Counting

Some double-counting issues can be addressed through the use of a registry. A universal mandatory registry for all types of offsets could ensure that each offset is sold only once. Such a registry could also ensure that offsets are not also sold as other commodities, such as Renewable

Energy Certificates (RECs). But because multiple registries operate independently in the VER market, a project developer could potentially sell his credits through two different registries. Such fraudulent activity would not be possible if the market used a single registry, or several linked registries, but the differences between the current standards have made efforts to coordinate them so far unsuccessful.

Other double-counting issues are more difficult to address. For example, many customers want to buy offsets that come from projects implemented in their own country. Whereas the average European produces 11 tonnes of CO_2, and the average American produces 20 tonnes, the average Chinese or Indian produces just 4 or 2 tonnes respectively, so clearly there is a moral imperative for rich nations to reduce their emissions first. But while this seems logical, such a system turns out to be problematic because of double-counting issues.

Under Kyoto, 39 developed countries (called "Annex B countries") adopted legally binding emissions reduction targets. If the offsets for a carbon project implemented in an Annex B country are sold in the voluntary market, the reductions will automatically be double-counted: the purchasing individual or organisation will claim them, but they will also be counted toward the host country's greenhouse gas inventory. If a company funds an offset project in an Annex B country, the resulting carbon offsets would need to be retired from that country's national greenhouse gas inventory in order to avoid double-counting. This matters because every Annex B country has to implement policies and projects to achieve their Kyoto goals, but to date no Annex B country has a regulatory system in place that would prevent this kind of double-counting. This means that voluntary offset projects in Annex B countries effectively replace another set of emissions reduction measures that the country would have had to take in order to meet its Kyoto requirements had the reductions not been double-counted[*]. This problem could be addressed if Annex B countries with emissions reduction obligations retired AAU credits for all VERs created through the voluntary market. Yet countries are unlikely to approve such a mechanism because it would mean that governments would indirectly endorse VERs. Once accepted as AAU equivalents, they would in effect be equivalent to CERs.

Paradoxically, in high-emitting countries that have not ratified Kyoto, such as the United States and Australia, these double-counting issues don't exist at the national level. They do exist on a more local level, however: if a region, state, county, or city has enacted an emissions reduction target (even just a voluntary one), any emissions reductions that are created in that area but then sold as offsets in the voluntary market should not also be counted in that jurisdiction's emissions inventory[†].

* This is only true if the country has a serious commitment to meeting its emissions targets. Give the failure of many nations to stay on target with their goals, it could be argued that any emissions reductions are welcome and that voluntary actions do not replace mandatory action.

† Another type of double counting can occur with company-based trading schemes such as the EU ETS. In this case cancellation of AAU would be insufficient; cancellation of EUA would be required as well.

5.8.1 TABLE 10: *Project Locations and Rules on Annex B Countries for Each Standard*

Standard	Project Location	Rules to avoid double counting for projects in Annex B countries.
CDM	Non-Annex I countries	N/A
GS	Gold Standard CERs: Non-Annex 1 countries Gold Standard VERs: Any country	Retirement of corresponding amount of AAUs VERs: Retirement of corresponding allowances in caped countries
VCS	Any country	Retirement of corresponding amount of AAUs
VER+	Any country	Retirement of corresponding amount of AAUs (for projects carried out during commitment period) or if applicable: statement of country that AAU shortage exists not allowing International Emissions Trading; or statement of project participant, that VER+ will not be transferred out of the country.
CCX	Any country but member states of the EU-ETS	CCX does not allow for the registration of projects in Annex 1 countries during the Kyoto period that might be counted under the country level inventory (AAU).
VOS	Any country	Retirement of corresponding amount of AAUs
CCBS	Any country	Rules to be developed for CCBS (2008)
Plan Vivo	Developing countries	N/A
GHG Protocol	N/A	N/A
ISO 14064-2	N/A	N/A

6. Offset Transactions

In the absence of predominant market standards, the variety of offset prices, qualities, delivery conditions and contract terms makes it difficult to get a clear overview of the voluntary offset market. The following clarifies pricing, costs, risks and delivery terms within the market mechanisms.

6.1 Pricing of Offsets

A complete and correct assessment of the production costs of an offset requires extensive knowledge of investment costs, operational costs, past, present and future project performance, corporate finance, and risk management, among other factors, and is extremely time-consuming. Few consumers have the time and know-how to conduct such extensive analyses. Even those that do may find it extremely difficult to factor all cost components correctly.

6.1.1 Project Costs

Offset providers must cover costs incurred at many different stages of project implementation before the emission reduction can be sold as an offset. The main cost factors can be divided into:

- Project cycle-related costs: investment for technological implementation, financing of investment capital, costs for technical project operation, maintenance, administration, etc., and

- Delivery process-related costs: costs for the management of project failure risk, quality control, administration, legal, printing costs, etc.

These costs have an indirect influence on the market price of offsets: in a functioning market where rigorous and transparent standards are available, prices are set by supply and demand. Offset providers whose efficient projects and internal processes enable them to generate offsets below market prices will be most successful. Providers whose generation costs exceed market prices, on the other hand, will need to increase their prices, which may result in decreased sales.

The cost of each aspect of production varies from project to project, so no rule of thumb exists for predicting the generation cost of an offset. The cost can be as low as two Euros per offset (typically in projects at large chemical plants), but has no upper limit. Some projects incur costs of € 20 per offset and more, not including delivery process-related costs. The generation costs for some offsets exceed resale prices as early as in the planning stage. Other projects reach equivalent cost levels due to technical failure or generation shortfall.

Since no for-profit organisation can sell offsets below production costs over the long term, less cost-efficient projects are typically implemented with funds donated to non-profit organizations. Such projects may in turn have high co-benefits which have no assigned monetary value in the current carbon markets, in which the traded commodity is a CO_2e reduction.

6.1.2 **A Common Misunderstanding: The "Project Share Pitfall"**

Buyers of offsets are inclined to pay the lowest possible price for offsets of a given quality, and are not willing to pay for a provider's unreasonable profit or other unwanted expenditures (e.g. project administration or taxes). In comparing different offset purchase offers, buyers often try to invest in projects with high project share – that is, the proportion of the investment that goes toward direct implementation costs as opposed to overhead and organizational costs. Many buyers prefer offsets with a high project share because they believe this indicates a more significant contribution to climate protection.

But the project share measure can be manipulated, and is subject to individual assumptions and definitions:

a) There is no agreed-upon method for calculating project share, so different providers may include various costs in their calculations. Internal administration costs to the provider, for example. may or may not be included in the administration costs for a specific project.
b) Purchasing offsets with a high project share that are significantly more expensive than other offsets may not be the most effective use of available funds, since the same funds could be used to achieve more emissions reductions at a lower price.
c) Even if two projects have the same project share in the planning stage, the projects' generation success (and, therefore, climate impact) may differ significantly. The overall project share may be known only after successful long-term project operation.
d) Some projects are easily constructed but difficult to administer, while the opposite is true for others.

Most buyers aim to maximize the emissions reductions they are funding. But project share is often an unreliable measure for evaluating and comparing the quality and effectiveness of offset projects.

6.2 **Offset Market Prices**

It is nearly impossible to give a precise overview of current offset market prices, as the market is considerably fragmented due to the variety of available standards, project types and locations, offset qualities, delivery guarantees, contract terms and conditions, etc. That said, the main price drivers are an offset's standard and origin (i.e. project type).

In a competitive market, offset prices are a function of supply and demand. The attractiveness of a project depends on the buyer's objectives. These are different for a compliance buyer than for a voluntary buyer:

- Compliance buyers are interested in obtaining credits reliably and cheaply in order to fulfil their regulatory requirements.
- Most institutions that voluntarily use offsets for their climate neutralization efforts want to communicate that effort to the public and choose projects that are well-received by the target group.
- In Europe, voluntary buyers are especially interested in biomass, renewable energy and end-user energy efficiency projects from less developed countries. Other emissions reduction projects such as industrial gas projects at chemical plants are less attractive to these buyers because, despite their emission reducing capability, such projects deliver very limited co-benefits such as job creation and protection of local ecosystems.
- In the US, voluntary buyers prefer offsets generated by domestic projects, and are less focused on project type or sustainable development components.

Carbon markets are still in their infancy. As public opinion and understanding of the markets increase, different project attributes may become more attractive to buyers. The following market prices* are only approximations, and do not reflect the full variety of the purchase and sale preferences of all market participants.

6.2.1 TABLE 11: *Pricing of Offsets for Each Standard*

Standard	Pricing
CDM	The wholesale market price for CERs is at around € 18.† A seller therefore has the possibility to sell the CER to a compliance customer at that price using a standardized and cost efficient process and will sell to other buyers only, if any additional administration costs are covered by additional revenues. Additional costs apply for marketing expenses, certificate management, administration, value added tax etc. Therefore, CERs are sold in the area of € 14 to € 30.
GS	GS CER or GS VERs are sold on average at a premium to regular CERs or comparable VERs of 5-25% of the market price. The premium varies depending on a number of factors: the project itself (its attractiveness for communication for example), project location (projects in so called least-developed-countries for example, are much sought after), whether a trade happens in the wholesale or in the retail market, vintage etc.
VCS	VCU prices depend to a large extend on the project type. VCS version 1 VCUs are traded at € 5 to € 15.
VER+	VER+ offset prices depend to a large extend on the project type and are traded at € 5 to € 15.
VOS	GS VER: see above Other VOS VERs: prices depend to a large extent on the project type. They trade at a premium compared to other VERs, but at a lower level than GS VER levels.
CCX	CCX offsets are traded at €1.2–3.1.‡ Additional costs apply for exchange fees, marketing expenses, certificate management, administration, providers profit, value added tax etc. and resale prices will usually be higher than the price listed on the exchange.
CCBS	Offsets from CCB projects are traded at €5 - €10.
Plan Vivo	The price of Plan Vivo Certificates depends on the volume of the purchase and the project. Plan Vivo certificates are traded at €2.30 - €9.50 / tCO_2
GHG Protocol	N/A
ISO 14064-2	N/A

* "State of the Voluntary Carbon Market 2007 – Picking Up Steam", Ecosystem Marketplace & New Carbon Finance, 17th July 2007 and Tricorona, November 2007

† Nordpool price, 14th November 2007: € 17.70

‡ Pricing data from October 07-February 08; http://www.chicagoclimateexchange.com/market/data/summary.jsf

6.3 **Choosing the Right Contract Terms**

In the offset market, as in most other markets, participants compete to secure market shares. In order to do so, providers of a certain offset quality (e.g. Gold Standard CERs) must set prices at competitive levels. This requires efficient project operation on the part of the provider, as well as limited profit margins. A provider of offsets with profitability expectations substantially above the competition will set their prices too high and as a consequence lose market share. On the other hand, a provider pricing offsets too low without looking at all of the applicable risk and cost components runs the risk of bankruptcy – especially in case of project shortfall or failure.

Yet the market can only function successfully if reliable information is available about the quality of offsets. Otherwise, the markets will fail to ensure quality and efficiency. For example, if non-additional offsets enter the market and are indistinguishable from additional offsets, a market driven race-to-the-bottom will occur, since the non-additional offsets will by definition be cheaper than the additional ones. Standards must fulfill the role of ensuring quality and providing transparent information to buyers and sellers. If reliable standards are available to distinguish the different types and qualities of offsets, buyers can take advantage of the competition in the offset market by comparing prices for products of a desired quality.

Comparing offsets is no simple task. Buyers must take into consideration project type, offset standard, delivery guarantee, and other factors. Ideally, by choosing offsets offering the best value among those of similar type and quality, the consumer fuels market competition, which in turn results in more efficient emission reduction activities.

Among the most important contract parameters are the delivery provisions, which are specified in the contract between buyer and seller. In order to choose the product that best fits their needs, it is crucial that buyers understand the terms of the contract and the delivery terms and risks involved.

The cost of purchasing *guaranteed* offsets, for example, may be more than that of buying *intended* emission reductions, even if the offered offsets are of the same quality. Guaranteed reductions have either already occurred (**prompt delivery**) or will occur in the near future and are guaranteed to be delivered (**forward delivery)**. In the latter case, the provider is held liable for contract default if they fail to deliver the agreed-upon number of emissions reductions. In cases where buyers donate toward *intended* emission reductions, project shortfall or failure has no consequences for the offset provider. Such *intended* emission reductions are referred to as **forward crediting** or **ex-ante credits.**

Some buyers may prefer to make a donation toward intended reductions based on personal preferences, especially if a project delivers high co-benefits. Others may prefer the certainty of achieved emission reductions associated with purchasing guaranteed offsets.

All but one of the reviewed full-fledged standards verify exclusively ex-post emissions. For such offsets, it is up to the buyer and seller to choose between prompt delivery and forward delivery. Plan Vivo is the only standard that verifies ex-ante credits. But not all providers clearly distinguish between non-guaranteed ex-ante credits and guaranteed offset purchases. For example, a provider could advertise to sell Gold Standard offsets from projects that have not yet produced verified emissions reductions. If this is not clearly communicated to the buyers, they might be unaware of the risk they are taking. It is therefore vital that the buyer reads the general terms and conditions of the contract and identifies if the purchased amount of offsets is backed by real emission reductions or not. The following sections describe the three levels of delivery risk in broad terms. Though single contracts may deviate from this scheme, the underlying principles generally hold true.

6.3.1 **Low Transaction Risk: Prompt Delivery of Existing Offsets**

Prompt delivery in the carbon markets typically means delivery within a few days of contract signature. This delay allows for administration of the actual transaction, but not for the generation of offsets, which would be impossible in such a short time.

In such cases, the provider assumes all project and price risks and generates the carbon offsets prior to selling them. The provider invests in the necessary technology, oversees project implementation, covers the operational project expenses, and pays the costs for the validation, registration and verification of the project activity. The provider does so without knowing for certain how large a volume of offsets the project will ultimately generate, nor at what price these offsets may be sold. However, after successful project operation, having the carbon offsets in stock enables the provider to offer risk-free deliveries, and to achieve a higher nominal sales price than could be set for high-risk (non-guaranteed) offsets.

Since providers of promptly delivered offsets can specify and easily guarantee the exact amount, quality and parameters of their products, buyers of such offsets carry no project-related risks. Thus, this type of contract is suitable for buyers that wish to receive risk-free emission reductions quickly.

6.3.2 **Medium Transaction Risk: Forward Delivery of Future Offsets**

A forward contract constitutes a binding agreement between the offset provider and the buyer to deliver emission reductions at a pre-defined time and price. The provider may have access to future emission reductions from a certain project or portfolio of projects or may have existing emission reductions available in stock.

For both the provider and the buyer, a forward contract is a way to eliminate market price risks and secure a desired transaction price, even though delivery may not occur for months or years. Such an arrangement protects the provider from falling market prices, and the buyer from rising market prices.

Forward contracts may specify a fixed or proportional amount of offsets to be delivered. A fixed delivery quantity specifies the exact amount of offsets to be delivered, while a relative number typically refers to the project's overall success (e.g. buyer agrees to buy 50% of all generated offsets each year for 3 years).

In fixed volume transactions, the seller carries the risk if the project produces fewer offsets than expected. In case of an offset shortfall, the seller must make up the missing offsets by delivering offsets from other projects at the same price.

A forward contract can be executed only if both parties still exist at the time of delivery (i.e. have not suffered bankruptcy). If the seller is unable to meet their contractual obligation, the buyer faces the risk of having to pay the current market price for offsets, which may be more than they had originally settled on with the forward contract. The risk of a party not being able to fulfill its contractual commitment is referred to as credit risk. Before signing a forward contract, each party typically assesses the credit risk of the other party.

While organizations applying professional risk management strategies may prefer forward deliveries to eliminate market price risks, such arrangements are less suitable for consumers who do not know how to assess credit risk. Forward contracts are most suitable for buyers who want to secure a price ahead of actual delivery and payment date (e.g. buyers who expect market prices to increase in the future).

6.3.3 High Transaction Risk: Forward Crediting of Ex-ante Offsets

Forward crediting – the sale of ex-ante credits – is the most complicated type of transaction for the buyer to understand. Typically, at contract closure, the buyer pays the purchase price for a certain number of offsets that have yet to be produced, and the provider delivers a certificate confirming the purchase. However, these offsets do not yet exist, and the successful generation of the agreed number of emission reductions is uncertain.

Unless the contract contains an ex-post adjustment of the purchase price corresponding to any shortfall in offset generation, the customer carries the risk that some or all of the purchase price may be lost, given that offsets might not be delivered. Transparency in such transactions is likely to be limited because providers are unlikely to inform buyers of any shortfall in the number of emissions ultimately achieved. This is especially true for projects that are not expected to deliver the emissions reductions for several decades, as is the case with certain forestry projects. Because buyers must pay upfront with no guarantee of the fulfillment of delivery, such transactions carry the highest risk for the buyer.

Forward crediting is similar to forward purchasing (see above) and the same principles of price-risk hedging and credit risk assessment apply. But there is a substantial difference in risk associated with the two types of transactions: In forward crediting contracts, the purchase price is paid upfront and is not repaid in case of delivery shortfalls. The seller is not obligated to replace delivery shortfalls with offsets from other projects. Because of this, forward crediting might be more suitable for donors who do not depend on exact emissions reductions than for buyers who are looking to offset a precise amount.

6.3.4 How Providers Can Reduce Delivery Risk

Risk management techniques can substantially reduce the risk of project under-performance and consequent delivery failure. One key technique is the portfolio approach: by contracting / developing not just one or a few projects but a large number (e.g. with differing technologies or locations), the provider can diffuse the risk of catastrophic project failure. Restricting sales to the expected delivered volume based on the probability of project failure can significantly reduce the risk of over-selling. Providers with a substantial portfolio of projects are thus able to guarantee the amount, quality, and parameters of the carbon offset delivery to the buyer at contract signature, prior to generation and delivery.

Active risk management can also be applied on a technical and operational level. By hiring technical experts to oversee the job site and perform quality control, and by consulting with local representatives, providers ensure that they will react in a timely manner to technical failure, shortfalls and errors in project documentation, changes in laws and regulations, etc. Although such measures raise project costs for the provider, they also ensure a lower project failure rate.

A third way for the provider to avoid delivery default is to compensate for generation shortfalls with emission reductions purchased from other providers.

Since all forms of risk management require an investment of resources, not all providers are able to offer an optimal delivery guarantee when contracting to generate offsets.

7. Review of Standards Used In the Voluntary Offset Market

7.1 Offset Standard Types

In order to better understand the different standards and their goals we distinguish between the following types of offset standards:

Full-fledged carbon offset standards offer all three components:

1. Accounting Standards
2. Monitoring, Verification and Certification Standards
3. Registration and Enforcement Systems

Project Design Standards (PDS) include accounting standards and some monitoring standards or guidelines, but do not offer certification of offsets or a registry. These PDS are useful for project developers in the initial phase of project development and may help secure upfront funding. But the project developers must use the PDS in conjunction with a full-fledged standard in order to get certification and access to a registry once the project starts producing credits.

Offset Standard Screens are not full-fledged standards by themselves but accept projects that were implemented under other standards and that adhere to their screening standards (e.g an offset screen that accepts all CDM credits, except those from large hydro and industrial gas projects.)

Offset Accounting Protocols provide definitions and procedures to account for GHG reductions from offset projects but have no associated regulatory or administrative bodies. They have programme-specific rules and procedures for reviewing, validating, and registering GHG projects, as well as verifying and certifying GHG reductions. Yet protocols do not define eligibility criteria or have procedural requirements. Many of the full-fledged standards are based on such protocols (for example, the VCS uses ISO-14064 methodologies).

Other Standards Types. Some standards don't quite fit any of the above mentioned categories. These are usually less widely used standards that have been developed for very specific project types. Some of these standards, such as Plan Vivo, sell ex-ante credits. In other words, they sell carbon offsets that are projected to be produced in the future. The standards discussed in this paper fit into the following categories:

TABLE 12: ***Offset Standard Types***

Full-Fledged Carbon Offset Standards	Project Design Standards	Offset Standard Screens	Offset Protocols	Other Standard Types
CDM **VER+** **CCX** Once they have established their registries: **Gold Standard (GS)** **Voluntary Carbon Standard (VCS)**	**Climate, Community & Biodiversity Standards (CCBS)**	**Voluntary Offset Standard (VOS)**	**ISO 14064-2** **WRI/WBCSD's GHG Project Protocol**	**Plan Vivo**

The following sections describe each standard in more detail. To facilitate cross comparisons, we have followed the same order of topics and the same layout for all standards. The only exceptions to this are the bio-sequestration rules for CDM and VCS, which are discussed in more detail in chapter 7.4 on forestry standards. In these sections, the numbering system is slightly different.

The standards are summarized as objectively as possible. Editorial comments and opinions about the standards can be found in the Authors' Comments at the end of each standard description. Their brief comments focus on what they consider the main strengths and weaknesses of each standard.

7.2 Full-fledged Standards

Full-fledged carbon offset standards offer all three components:

1. Accounting Standards; 2. Monitoring, Verification and Certification Standards and; 3. Registration and Enforcement Systems. In the following sections we describe these full-fledged standards: CDM, Gold Standard, Voluntary Carbon Standard, VER+, and CCX.

CLEAN DEVELOPMENT MECHANISM

http://cdm.unfccc.int/index.html

1. Overview

Type of Standard

The Clean Development Mechanism (CDM) is a full-fledged offset standard and is a part of the international legally binding Kyoto Protocol and its related accords. It is administered by the United Nations Framework Convention on Climate Change (UNFCCC). CDM enables industrialized countries to achieve emissions reductions by paying developing countries for certified emission reductions (CERs).

History of Standard

Recognizing the need for stronger action to combat climate change, the parties of the UNFCCC negotiated and adopted the Kyoto Protocol in 1997. At the time of its adoption, the treaty only sketched out the basic features of the GHG trading mechanisms like the CDM. The rulebook detailing how the mechanisms would operate was fleshed out over the next four years, culminating in the Marrakech Accords. The treaty came into force on 16 February 2005, making the trading mechanisms operational.

Administrative Bodies

Conference of Parties serves as the *Meeting of Parties to the Kyoto Protocol (COP/MOP)*: The COP/MOP is the ultimate decision-making body of the UNFCCC. It is comprised of representatives from each member state that has ratified the Kyoto Protocol. The COP/MOP reviews and approves the CDM EB's recommendations, thereby providing guidance and direction to the EB in administering the CDM.

CDM Executive Board (CDM EB) supervises the CDM under the authority and guidance of the COP/MOP, and is fully accountable to the COP/MOP. The EB has 10 members from parties to the Kyoto Protocol including one representative each from the five UN regions, two each from the list of industrializing countries with emission reduction targets and those without targets, and one from the Small Island Developing States.

The responsibilities of the CDM EB include:

- Developing and amending the rules of procedure for CDM
- Accrediting DOEs
- Registering CDM projects
- Approving new baseline and monitoring methodologies or amendments to existing ones
- Authorizing the issuance of CERs

Accreditation Panel reviews applications from prospective DOEs, reports conclusions and prepares recommendations to the EB for accrediting and designating operational entities.

Methodologies (Meth) Panel reviews proposed new or amendments to existing baseline and monitoring methodologies, and makes recommendations to the EB regarding their approval or amendments. The Meth Panel also makes recommendations to the EB regarding changes to the guidelines for methodologies for baselines and monitoring plans. The Meth Panel is co-chaired by two members of the EB and is composed of an additional 15 members who serve as technical experts on the panel.

Afforestation and Reforestation (A&R) Working Group prepares recommendations to the EB on submitted proposals for new baseline and monitoring methodologies for CDM A&R project activities in cooperation with the Meth Panel.

Small-Scale (SSC) Working Group prepares recommendations to the EB on submitted proposals for new baseline and monitoring methodologies for CDM small scale project activities.

CDM Registration and Issuance Team (RIT) assists the CDM EB by appraising requests for registration of project activities and requests for issuance of CERs. It is chaired by a member of the EB on a rotational basis. The RIT was established in 2006 (before that, in 2004-5, projects were assessed by individual Board members).

Designated National Authorities are agencies designated by each party to the Kyoto Protocol to act as a nodal agency for administering CDM involving parties within its jurisdiction.

Designated Operational Entities (DOEs) are the accredited auditors who validate and verify CDM projects. There are currently 19 registered DOEs, of which 18 are authorized to validate projects and 7 of the 18 are also authorized to verify projects. Only one of 19 is designated solely as a verifier. DOEs are not allowed to do the validation and the verification for the same project, and the sectors that each of them can cover also varies.

Financing of the Standard Organisation

The CDM is financed through the CER issuance fees and through start-up donations from Annex I countries.

Recognition of Other Standards

The CDM does not recognize any other standards. However, many of the regulated and voluntary carbon offset schemes recognize CDM and accept CERs as eligible offsets under their respective schemes. These schemes include the EU ETS, the VOS, VER+, CCX, and the VCS.

Number of Projects

As of September 2007, there are 827 registered projects with a further 154 in the registration process, 2,647 projects in the CDM Pipeline, 46 projects have been rejected and 8 withdrawn. 85,9 million CERs have been issued to date.*

2. Eligibility of Projects

Project Type

CDM accepts projects that reduce the emissions of, avoid the release of or sequester any one of the six gases covered by the Kyoto Protocol with the exception of nuclear energy projects, and sequestration projects other than afforestation and reforestation projects (REDD).

* UNEP RISOE Center ***http://www.cdmpipeline.org/***, accessed on 15 November 2007

Project Location

CDM only accepts projects in non-Annex I countries.

Project Size

There are no restrictions on the size of projects.

Projects may be classified as small-scale CDM projects.† Small-scale projects use simpler documents and are subject to a simpler approval process than other projects.

Start Date

Originally: 1 January 2000

This rule has lapsed. Currently, the start date is the date of registration.

Crediting Period

The crediting period options for CDM projects are the same for all project types, except afforestation and reforestation projects. In the case of the former, project developers can choose between: (i) a seven-year crediting period with the option of up to two seven-year renewals, , provided the project baseline is still valid or has been updated to take new data into account or (ii) a maximum period of 10 years with no renewal option. For afforestation and reforestation projects, the choice is between: (i) a 20-year period with up to two 20-year renewals or (ii) a maximum of 30 years with no renewal.

CDM Pre-Registration Credits

N/A

Project Funding Restrictions

CDM projects cannot accept any Official Development Assistance (ODA).

Environmental & Social Impacts

While there are no explicit guidelines laid out for the environmental or social impacts of CDM projects, the Kyoto Protocol requires that CDM projects enable developing countries to achieve sustainable development. Each country sets the policies for the sustainable development criteria by which it can assess CDM projects. Social criteria may include improvements in the quality of life, alleviation of poverty, and greater equity, while environmental criteria may include the conservation of local resources, removing pressure on local environments, health benefits, and compliance with domestic environmental policies.

An analysis of the environmental impacts of the project, including trans-boundary impacts, must be provided in the PDD. If an Environmental Impact Assessment (EIA) is required by the host country, the project developer

† Projects can qualify as *small scale* if they fulfill the following two criteria:
1. the energy output does not exceed 15 MW,
2. the reduction in energy consumption is less than 15 gigawatt hours per year or the reduction in emissions is less than 15 kilotons of CO_2-equivalent per year.

must also include conclusions of the EIA in the PDD. Similarly, the project developer must also describe the process of inviting comments from local stakeholders likely to be affected by the project, summarize their comments and document the action taken to address their concerns.

The PDD is published for commenting for 30 days on the CDM website.

3. Additionality and Baselines

Additionality Requirements

CDM uses project-specific tools to assess additionality. However, some of the baseline tools are based on performance standards.

The process of determining whether a project is additional involves three or four steps as laid out in the UNFCCC additionality tool version 4 (for details, see Appendix B).

Step 1: Identifying realistic and credible alternatives to the proposed project activity that are compliant with current laws and regulations

Step 2: Investment analysis to determine that the proposed project activity is not the most economically or financially attractive, or step 3

Step 3: Analysis of barriers that prevent the implementation of the proposed project activity or do not prevent the implementation of one of the other alternatives

Step 4: Analysis as to whether the proposed project activity is 'commonly practiced' by assessing the extent of diffusion of the proposed project activity

Baseline & Monitoring Methodologies

CDM follows a bottom-up, project-specific approach to determine baseline and monitoring methodologies. However, once a baseline and monitoring methodology is developed and approved by the CDM EB, the same framework can be used to develop other projects, provided they meet the other eligibility requirements. Existing methodologies have been amended and refined over time as new projects have been proposed and approved with amendments to the previously existing methodologies. Further, similar methodologies for certain types of projects have been consolidated into single methodologies so that they are applicable to a broad range of projects.

Project developers or consultants acting on behalf of the project developers may propose new methodologies. The proposal for a new methodology must be submitted to the UNFCCC secretariat through a DOE. The DOE or a member of the Meth Panel may undertake a pre-assessment of the proposed methodology. Upon receipt of the complete documentation and a fee of USD 1,000, the secretariat makes the methodology publicly available for comment for a period of 15 days. The Meth Panel reviews and assesses the proposed methodology with the help of the secretariat and based on the independent assessments of four members of the Meth Panel (who are selected on a rotational basis), two independent experts, and comments from the public. Based on the recommendations of the Meth Panel, the CDM EB approves or rejects the proposed methodology. If the proposed methodology is approved or incorporated into a consolidated methodology, then the USD 1,000 fee is adjusted in the registration fees.*

4. Validation & Registration

Process

The project developer or a consultant acting on behalf of the project developer must prepare a Project Design Document (PDD) describing the project activity, the baseline methodology to be used to calculate the emissions reductions under the project and the methodology that will be used to monitor the emission reductions achieved. The PDD is then reviewed by a DOE to confirm the veracity of the information and arguments provided. Simultaneously, the PDD is posted on the DOE's website and opened to public comments for a period of 30 days. The DOE and project developer need to consider the comments received and take action (if deemed necessary) before the DOE finalizes the Validation Report. The DOE review process also involves visits to the project site and consultations with local stakeholders. The DOE's assessment and conclusions, including a summary of the stakeholder consultations, are synthesized into a Validation Report.

The PDD and the Validation Report are submitted to the project host nation's DNA for approval. If the project meets the sustainable development criteria, complies with the country's laws and regulations, and fulfills any other requirement specified by the DNA, the DNA issues a letter confirming the host nation's approval. The PDD, the Validation Report and the Host Nation Approval are then submitted to the CDM EB for registration.

Within 8 weeks (or 4 weeks for small projects) of receipt of the *Request for Registration*, the EB is required to register the project. The RIT supports the EB in this process by reviewing the reports submitted along with the Request for Registration. If a party to the project or at least three members of the EU request a review of the project, then registration can be delayed until the next EB meeting.

* *http://cdm.unfccc.int/Reference/Procedures/Pnm_proced_ver12.pdf*

Key Requirements

- Completed PDD with the baseline and monitoring methodology
- Validation Report including the stakeholder consultation
- Host Nation Approval

5. Monitoring, Verification & Certification, and Issuance

Process

Once the project is operational, the project implementer or a consultant acting on behalf of the project implementer is required to prepare a Monitoring Report on a periodical basis in accordance with the monitoring protocol in the PDD. The report must also include an estimate of the CERs generated during the reference period. A DOE verifies the Monitoring Report and also carries out a site visit, if deemed necessary. The DOE prepares a Verification Report documenting its assessment of the monitoring report and verifying the emissions reductions. The same DOE that validated a project cannot also verify it except in the case of small-scale projects.

The Monitoring, Verification and Certification Reports are submitted to the CDM EB with a request to issue the requisite amount of CERs. Within 15 days of receipt of this request, the EB must authorize the issuance of the CERs unless a project participant or three EB members request a review. The RIT supports the EB in this process by reviewing the reports submitted along with the Request for Issuance.

Key Requirements

- Monitoring Report estimating the emissions reduction achieved
- Verification and Certification Reports from the DOE confirming the emissions reductions.

6. Evaluation of Auditors

The CDM Accreditation Panel (CDM-AP), which reports to the CDM EB, is required to undertake regular surveillance of the DOE's management responsibilities, resource and organizational management, and technical and analytical review processes, with a view to assessing the DOE's ability to deliver the intended quality of its service. The CDM-AP carries out this surveillance at least every three years with the help of the CDM Assessment Team (CDM-AT).

In addition to the regular surveillance, the CDM EB, with the help of the CDM-AP and the CDM-AT, can conduct an unscheduled assessment of a DOE, a 'spot check' to ascertain whether the DOE still meets the accreditation requirements.

For both the regular surveillance and the spot checks, the DOE that is being assessed pays for the expenses to be incurred by the CDM-AP and CDM-AT in carrying out the assessment in advance.

7. Registries

The CDM Registry is administered by the UNFCCC secretariat. Upon authorization from the EB to issue CERs for a project activity, the secretariat forwards the issued CERs into a Pending Account until it receives instructions to forward CERs into the relevant Holding Account. Project participants may have a Holding Account either in the CDM Registry or in the National Registry of an Annex I country.*

For CERs to be transferred from an account in the CDM Registry to a National Registry account, they must pass through the International Transaction Log (ITL). The ITL, which is still under development, will record transactions of CERs from the CDM registries to the Annex I National Registries. These transactions include issuance, cancellation, replacement, retirement and the transfer of CERs.† Once the CERs are received in a National Registry account they may be traded or used for complying with national or regional targets. At present, CERs cannot be transferred between National Registries but internal transfers within a National Registry are possible.

8. Fees

New methodology submission fee: USD 1,000 (adjustable in the registration fee if the methodology is approved or consolidated)

Registration fee: USD 0.10 per CER issued for the 15,000 CERs issued in a given calendar year and USD 0.20 per CER for every CER issued over and above the 15,000 CERs. The upper limit set for the fee is USD 350,000. No registration fee is charged if the average annual emissions over the crediting period are less than 15,000 tCO_2e. If the project is not registered, then any amount above USD 30,000 is reimbursed to the project developer.

Issuance fee: 2% of the CERs from each issuance is charged to cover administrative expenses and adaptation costs.

* *http://cdm.unfccc.int/Issuance/IssuanceCERs.html*

† *http://regserver.unfccc.int/seors/file_storage/ak11nelszgfgrda.pdf*

Authors' Comments on CDM

Quality of EB Decisions

The fraction of projects that are being reviewed and rejected by the CDM Executive Board has increased notably over time. This is especially true since the Registration and Issuance Team (RIT) was established in 2006. Nevertheless, the EB still has a large backlog of CDM projects awaiting registration. Some project developers have expressed dissatisfaction with the fact that project assessment varies quite considerably among RIT members. A major cause for this is the lack of institutional memory and insufficient training of staff. Despite the addition of the RITs, the EB is still not very efficient and is at times quite bureaucratic.

Quality of DOEs

Currently project developers choose and pay DOEs. This causes a conflict of interest which potentially undermines the environmental integrity of CDM projects. As discussed earlier, DOEs are under pressure to do validation and verification services at low prices and in as little time as possible. Also, CDM does not provide detailed instructions on auditing procedures. Despite the DOE review and spot check procedures, there currently does not seem to be a strong threat of sanctions against DOEs that under-perform (Schneider, 2007).

Additionality

The CDM *additionality tool* was developed over several years and is seen as a benchmark against which to compare other additionality testing procedures (it is used by a number of other standards described in this report). Yet recent reports have shown the current additionality tests are to a large extent subjective and can easily be misrepresented (Schneider, 2007; Haya 2007). No approach for determining additionality is perfect. Yet given the importance of ensuring environmental integrity of CDM projects, great care and effort should be put in place to minimize free riders. The CDM Executive Board is in the process of creating a set of validation and verification guidelines. Through creating better definitions for terms such as "common practice" and guidelines for evaluating arguments about project barriers, some non-additional projects could be less likely to be registered

Co-Benefits

There are trade-offs between generating large quantities of offsets and benefits for sustainable development: Project activities with large emission reductions often have few benefits for sustainable development (e.g. industrial gas projects), whereas emissions reductions are often small for projects which have high benefits for sustainable development (e.g. many types of small scale projects). The CDM has so far not been very successful in fostering projects that contribute to sustainable development. This is partly due to the fact that each country can establish their own sustainability criteria. Some host countries may be hesitant to develop stringent sustainability criteria because of the perceived risk of having project developers turn away if their criteria are too stringent. On the other hand, it is also worthwhile pointing out that some co-benefits are indirect such as improvement of infrastructure, additional tax income for the host country, improved power supply and grid stability.

GOLD STANDARD

http://www.cdmgoldstandard.org

1. Overview

Type of Standard

The Gold Standard (GS) is a full-fledged carbon offset standard. The Gold Standard (GS) requires social and environmental benefits of its carbon offset projects and has a very well developed stakeholder process. The GS can be applied to voluntary offset projects as well as to CDM projects.

History of Standard

The GS was developed under the leadership of the WWF in order to ensure that emission reduction projects are real and provide social, economic and environmental benefits. The GS CDM was launched in 2003 after a two year period of consultation with stakeholders, governments, NGOs and the private sector from over 40 countries. GS VER was launched in 2006. The GS is endorsed by 56 NGOs.

Administrative Bodies

The Gold Standard Foundation is a non-profit organisation under Swiss Law, funded by public and private donors. The operational activities of the GS are managed by the Gold Standard secretariat based in Basel, Switzerland, including capacity building, marketing and communications, certification, registration and issuance as well as maintenance of the GS rules and procedures. The secretariat has currently a staff of 5.

The Foundation Board oversees the strategic and organizational development of the Gold Standard. The Board has currently 8 members. At least 50% of its members must be recruited from the Gold Standard NGO supporter community, and one member is at the same time the Chair of the Gold Standard Technical Advisory Committee (GS-TAC, see below). In case of significant changes to the Gold Standard rules and procedures, the Board decides whether or not a Gold Standard NGO supporter majority is necessary to implement the change.

Technical Advisory Committee (GS-TAC) evaluates and approves projects, new methodologies for VER projects and is in charge of updating the GS rules and procedures. It is the equivalent of the CDM EB / Meth Panel for VER projects. The GS-TAC has currently 7 members, all acting in their personal capacities. The GS-TAC members are from the NGO community, multilateral organizations, aid agencies and the private sector.

Gold Standard NGO Supporters decide on major rule changes (e.g. eligibility of project types). Gold Standard Supporter NGOs must be consulted as part of the Gold Standard stakeholder consultation in case they have operations in the relevant host country. Supporter NGOs are also invited to take part in the project reviewing process and can request an in-depth audit of GS projects both at the registration as well as issuance stage.

GS Auditors are UNFCCC accredited DOEs who carry out validation and verification of GS projects. DOEs are not allowed to do the validation and the verification for the same project, except for micro and small scale projects.

Financing of the Standard Organisation

The standard is financed through donors and income from issuance fees and franchising fees.

Recognition of Other Standards

The GS does not recognize any other voluntary standards. Yet the GS it is recognized by the VOS and is likely to be recognized in the near future by several other standards (VER+, VCS.)

Number of Projects

In total, 10 projects have been registered under the Gold Standard. About 35 projects are official Gold Standard Applicants, representing about 4 million CERs and 500,000 VERs. Another 65+ projects are in the pipeline.

2. Eligibility of Projects

Project Type

The GS accepts renewable energy (including methane-to-energy projects) and energy efficiency projects. It excludes large hydro projects above 15 MW capacity.

Project Location

Gold Standard VER projects cannot be implemented in countries with an emissions cap, except if Gold Standard VERs are backed by AAUs being permanently retired.

Project Size

The Gold Standard does not have any project size minimum. Project sizes for Gold Standard VERs are: micro-scale (<5,000 tonnes CO_2 per year), small-scale (5,000-60,000 tonnes CO_2 per year) or large-scale (>60,000 tonnes CO_2 per year).

For Gold Standard CERs, the same size limits as for the CDM apply.

Start Date

The earliest start date for retroactive crediting of Gold Standard VERs is January 1st 2006, and retroactive crediting is only permitted for a maximum of 2 years prior to the registration date.

Retroactive crediting for CDM projects submitting documentation (Gold Standard Validation report) is limited to two years prior to the date of registration for the Gold Standard. For years with compliant verification reports that lie only partly within that period, a proportional volume of credits is issued.

Crediting Period

Crediting periods are either one 10 years period, or a 7 year period renewable three times, except for validated pre-CDM Gold Standard VERs (see below).

Projects can opt-in for Gold Standard crediting during the overall crediting period by submitting a Gold Standard-compliance verification report to the Gold Standard. Projects can opt-out of Gold Standard crediting during the overall crediting period, but opt-out is final and the project cannot be communicated as Gold Standard any more.

Prior to opt-in and after opt-out it is permissible to seek issuance of credits from other standards. It is however not permitted to apply for issuance of credits under different standards if this extends the overall crediting period of the project beyond what is possible under the Gold Standard VER rules.

CDM Pre-registration Credits

The Gold Standard does certify CDM pre-registration credits for a maximum of a year prior to the project's CDM registration date under certain conditions:

- The project developer can provide proof that the final version of the PDD has been submitted for validation to the DOE prior to 31st of January 2008.
- The DOE must provide a verification report covering the Gold Standard VER period either with the first verification of Gold Standard CERs or separately.
- The reasons for the delay between the start of project operation and CDM registration have to be explained by the DOE as part of the verification report covering the Gold Standard VER period.

Gold Standard VERs will only be issued after the project has been successfully registered as a Gold Standard CDM project. Once the project has been registered as a Gold Standard CDM project the normal Gold Standard rules apply.

Project Funding Restrictions

Official Development Assistance (ODA) funding is not allowed for Gold Standard CER projects, except from the development of the PDD or of a new methodology, but is acceptable for Gold Standard VER projects if additionality of the project can be clearly established.

Environmental & Social Impacts

Both Gold Standard CER and Gold Standard VER projects must show clear sustainable development benefits, including local and global environmental, social, and economic as well as technological sustainability. The GS provides a sustainability matrix to help project developers develop their sustainability criteria. The GS requires that critical and sensitive sustainable development indicators and mitigation or compensation measures are monitored over the entire crediting period and information on the status of the indicators is included in the verification reports.

Both the project developer and the stakeholders consulted assign scores between -2 (major impact that cannot be mitigated) and +2 (major positive impact) to a broad set of pre-defined indicators covering all aspects of sustainable development. Scoring depends on specific circumstances, and the framework chosen for the scoring process is tailored to each project and must be clearly explained and justified.

Environmental Impact Assessment (EIA) requirements are the same for both VER and CER stream for small- and large-scale projects. For micro-scale voluntary offset projects, an EIA is required if the relevant local or national law prescribes an EIA or potentially if stakeholders have concerns about environmental impacts for which mitigation measures cannot be identified – in such a case, the project must be treated as a small- or large-scale project. If no EIA is required by the legislation, the project developer still has to provide a statement confirming that the project complies with local environmental regulation.

Gold Standard requires two public consultation rounds for all projects (except micro-scale projects, which require one initial consultation only). VER offset projects require a letter to the Designated National Authority (DNA or, if not present, other relevant authority) to communicate the development of the project as a GS voluntary offset project. For micro-scale projects, only one consultation round is needed during the design phase.

During a 60-day period prior to finalizing the validation process, stakeholders must have the opportunity to make comments on the GS-PDDs. For VER projects, no international stakeholder consultation is required, in contrast to CDM projects. National Gold Standard NGO supporters and international GS NGO supporters with offices in the host country must be involved in stakeholder consultations in all cases.

3. Additionality

Additionality Requirements

The additionality tools for both GS CERs and VERs are project based. In addition, previous announcement checks are required for both CER and VER projects.

The GS requires the application of the latest UNFCCC additionality tool (see Appendix B).

Baselines & Methodologies

GS CDM projects can only use CDM EB approved methodologies. Gold Standard VER projects can choose to use the baseline methodologies approved by the Methodology Panel of the CDM Executive Board, the Small Scale Working Group (SSC WG) or the United Nations Development Programme (UNDP) MDG Carbon Facility. If no suitable methodology exists, Gold Standard VER projects can propose a new one to Gold Standard, to be approved by the Gold Standard Technical Advisory Committee at a fixed cost paid by the project developer. The fees are USD 2,500 for small & large projects and USD 1,000 for micro-scale projects. A methodology for the deployment of a fleet of small-scale biodigesters has been approved so far and others are under review.

4. Validation & Registration

Process

In general, the requirements for Gold Standard VER and Gold Standard CER projects are identical, but for VERs, some requirements of the CDM have been simplified or removed:

- Simplified guidelines for micro-scale projects (< 5000 t of emission reductions annually)
- Broader eligibility of host countries
- Lower requirements on the use of official development assistance (ODA)
- Broader scope of eligible baseline methodologies
- No need for formal host country approval

All Gold Standard projects must be validated and verified by a DOE. The Gold Standard supports DOEs with a validation manual for each VER and CDM stream.

Micro Projects

Validation and verification procedures are often unreasonably costly for micro-scale projects. Hence, micro-scale projects pay a standard fee to a validation fund (USD 5,000) and to a verification fund (USD 2,500). After submitting all documentation, Gold Standard TAC uses a 'targeted random' selection method to select projects for validation and verification. Actual validations and verifications performed by DOEs are paid for via the Gold Standard validation and verification funds. Projects not selected for DOE validation/verification in this approach are validated/verified by the Gold Standard in-house but may be required to undergo DOE verification in later years.

Key Requirements

- Stakeholder consultation report
- Completed PDD with the baseline and monitoring methodology, and the sustainable development matrix
- Validation Report
- Acceptance of the Gold Standard Terms and Conditions.

GS CDM projects use CDM PDD and validation forms, with the additional Gold Standard specific information on project type, stakeholder consultation and contribution to sustainable development provided as an appendix. The GS provides templates and instructions for GS VER project verification documents.

5. Monitoring, Verification & Certification

Process

Project developers monitor projects according to monitoring plans as given in the PDD. Monitoring reports are submitted to a third-party auditor (DOE). Gold Standard-specific verification is conducted by DOEs. It includes emission reduction data and monitoring of sustainable development indicators. Monitoring reports have to be submitted yearly. Normally, the same DOE cannot validate and verify the same project, except for micro-scale and small-scale projects.

The Technical Advisory Committee, the GS secretariat and GS NGO supporters can request clarifications or corrective actions within a 2-week period after submission of the verification report to the GS before credit issuance (GS VERs) or certification of CERs is initiated.

Until the Gold Standard VER Registry has been approved, GS VERs are issued with unique provisional serial numbers. Currently, VERs are issued directly by the Gold Standard.

Key Requirements

The verification report showing compliance with GS reporting criteria (especially Sustainable Development Indicators.) Indicators must be monitored if:

- they are crucial for the overall positive impact on sustainable development
- they are particularly sensitive to changes
- stakeholder concerns have been raised.

Appropriate success indicators for mitigation or compensation measures must also be monitored.

6. Evaluation of Auditors

The GS only accredits DOEs and relies on the quality control procedures of the UNFCCC (e.g. CDM spot check procedure).

7. Registries

The Gold Standard Foundation announced in November 2007 that APX, Inc. has been selected to create and manage the Gold Standard's Registry for Verified Emissions Reductions (VERs) in the voluntary carbon market. CERs are registered in the CDM registry and will be tracked in the Gold Standard registry as well. VERs will be registered in the Gold Standard registry which will be launched in early 2008.

The Gold Standard does not engage in project or credit transactions. In the upcoming Gold Standard VER registry, it will be possible to track the number of retired Gold Standard VERs and to review the number of issued Gold Standard VERs. However, buyers and intermediaries between the point of issuance and the point of retirement remain unknown to the Gold Standard. The ownership of retired credits can be made public if desired.

8. Fees

The Gold Standard charges an issuance fee of currently 0.01 USD for CERs and 0.10 USD for VERs. No registration fee is charged. Separate fees are charged by the Gold Standard VER registry operators: 0.05 USD at issuance and 250 USD per year for all accounts except project owners. The 250 USD include trading transactions for 25,000 credits p.a., after which every trade is charged with 0.01 USD/credit. No fees are charged to transfer the credits out of the project owner account.

Already operational projects can earn retroactive Gold Standard status. For this, they need to go through a feasibility pre-assessment process for which the Gold Standard charges a fee of USD 0.01 per VER for an amount of VERs equivalent to the expected annual volume of reductions (with a minimum fee of 250 USD).

If the project developer submits a new baseline methodology, the methodology must be approved by the Gold Standard TAC. A fixed fee is charged for this process (1,000 USD for micro-scale and 2,500 USD for small and large-scale projects).

Authors' Comments on the Gold Standard

The Gold Standard is generally accepted as the standard with the most stringent quality criteria. Many buyers turn to Gold Standard as the only full-fledged standard endorsed by leading environmental NGOs. It is furthermore the only voluntary standard that has the following three elements: clearly defined additionality rules, required third-party auditing and an approval body similar to the CDM EB.

Co-Benefits

The supplemental criteria of the GS are all validated by a DOE. According to project developers, this often makes the validation process more intensive. In their experience, DOEs take this additional GS validation seriously and ask tough questions about the project's background data for filling in the Gold Standard SD matrix.

The CDM has a rather poorly defined process for how to involve stakeholders. The GS improves this process by having clear and detailed definitions of the stakeholder consultation process. However, the projects eligible for GS generally do not face serious concerns from stakeholders. It would actually be much more important to improve stakeholder consultation of other CDM projects, for example, large hydro projects.

Additionality

Similar to the stakeholder process mentioned above, the UN regulations on additionality for small-scale projects are not very well defined. The GS addresses this issue by requiring that the additionality tool is also applied to small-scale projects.

Complex Documentation
The Gold Standard sets demanding requirements and documentation thereof. This makes the validation and verification process more complicated, time-consuming and expensive. Some project developers might decide that the higher income from Gold Standard CERs (over regular CERs) does not justify the extra work.

Limitation of Project Categories
Gold Standard only recognizes offset reductions from renewable energy and energy efficiency projects. This is potentially limiting, since the energy sectors are the most likely to be covered by mandatory reduction targets. If the United States, for example, were to implement a cap-and-trade programme covering the electricity generation sector, offsets from these types of projects would no longer be possible. Also, given the large contribution of deforestation to climate change, it would seem important to add bio-sequestration projects, especially since the Gold Standard, with its focus on high quality offsets with co-benefits could play an important role in ensuring quality in this sector.

Future of Gold Standard
Currently, the Gold Standard is in the process of improving its rules and procedures. Gold Standard version 2 is expected to go live in May 2008 and will provide further clarification and guidance for project types, additionality, sustainable development assessment, stakeholder consultation, and for the validation and verification process. It remains to be seen if the GS, currently a very small organisation, will be able to certify large quantities of emission reductions.

At the moment, with only a few projects using Gold Standard, it is a challenge to balance strengthening the standards with the need to attract project developers, most of whom are currently not willing to invest in much additional work to ensure environmental integrity and co-benefits.

It seems likely that the Gold Standard will only be successful on a larger scale if it succeeds in creating enough incentives to motivate more project developers to follow the strict guidelines. This could possibly be accomplished thought creating a large and sustained demand for Gold Standard offsets and through streamlining the Gold Standard process as much as possible without compromising the integrity of the standard.

VOLUNTARY CARBON STANDARD 2007 (VCS 2007)

http://www.v-c-s.org

1. Overview

Type of Standard
The Voluntary Carbon Standard is a full-fledged carbon offset standard. It focuses on GHG reduction attributes only and does not require projects to have additional environmental or social benefits. The VCS 2007 is broadly supported by the carbon offset industry (project developers, large offset buyers, verifiers, projects consultants). VCS approved carbon offsets are registered and traded as Voluntary Carbon Units (VCUs) and represent emissions reductions of 1 metric tonne of CO_2.

History of Standard
The Voluntary Carbon Standard (VCS) version 1 was published jointly in March 2006 by *The Climate Group* (TCG), the *International Emissions Trading Association* (IETA) and the *World Economic Forum Global Greenhouse Register* (WEF). The VCS 2007 was launched in November 2007 following a 19-member Steering Committee review of comments received on earlier draft versions. The Steering Committee was made up of members from NGOs, DOEs, industry associations, project developers and large offset buyers. The *World Business Council for Sustainable Development* joined in 2007 as a founding partner of the VCS 2007. The VCS will be updated yearly for the first two years and every two years after that.

Administrative Bodies

VCS Association manages the VCS. The VCS Association is an independent, non-profit association registered under Swiss law that represents the VCS Secretariat and the VCS Board.

VCS Secretariat is responsible for responding to stakeholder queries, managing relationships with registry operators and accreditation bodies, and managing the VCS website and projects database.

VCS Board is responsible for approving any substantial changes to the VCS 2007. It also evaluates and approves other GHG Standards (whether in full or elements of them) project methodologies and additionality performance standards. It also has the authority to suspend an approved programme temporarily or indefinitely if changes are made to it that affect its compatibility with the VCS Programme. Further, it can sanction validators and verifiers, project proponents and registry operators for improper procedure. Finally, it decides on appeals made by project developers against a validator or verifier.

Technical Advisory Groups (TAGs) support the Board by providing detailed technical recommendations on issues related to the programme and its requirements (e.g. the Agriculture, Forestry and Other Land Use TAG for bio-sequestration projects).

Accredited Third-Party Auditors have the authority to validate and verify GHG emission reduction projects, validate new baseline and monitoring methodologies, validate additionality performance standards, and perform gap analyses of other GHG programs. They can only do so for project scopes and geographies for which they are accredited. To receive accreditation, they must either be accredited under an approved GHG Programme or under the ISO 14065:2007 with an accreditation scope specifically for the VCS Programme. Unlike under CDM, accredited third-party auditors can validate and verify the same project.

Financing of the Standard Organisation

Start-up funding for the VCS Standard Organisation comes from TCG, IETA and WBCSD with additional fundraising currently underway. Donations from commercial organisations are capped at €20,000 per annum. In the medium term costs will be covered by a per-tonne levy charged at the point of VCU issuance.

Recognition of Other Standards

At present, the VCS Programme recognizes the CDM and JI, and is in the processing of evaluating the California Climate Action Registry. VCS will evaluate and adopt other offset standards either fully or elements of them. The approval process will be based on the principle of full compatibility with the VCS Programme. If another offset standard is fully adopted by the VCS, all their auditors and methodologies are automatically accepted by the VCS. All credits certified by that standard will then be fungible with VCS credits, the Voluntary Carbon Unit (VCU).

Number of Projects

VCS 2007 was launched in November of 2007. It is not possible to determine how many projects have been certified under VCS 2007 to date because the VCS registries and central project database are still under development. Several projects were validated and verified against VCS version 1. The VCS Association expects that between 50–150 projects creating between 10–20 million tonnes of CO_2e will have been approved under the VCS Programme by the end of 2008.

2. Eligibility of Projects

Project Type

All project types are allowed under the VCS Programme provided they are supported by an approved VCS methodology or if they are a part of an approved GHG programme. Exceptions are: projects that are "reasonably assumed" to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction (e.g. new HCFC facilities) and projects that have created another form of environmental credit (e.g. Renewable Energy Certificate). RECs are fungible with VCUs if the GHG Programme certifying the RECs has been approved under the VCS. In addition, projects that have created another form of environmental credit must provide a letter from the programme operator that the credit has not been used under the relevant programme and has now been cancelled (so it can not be used in the future).

Project Location

No restrictions. Retirement of corresponding AAUs required for projects in Annex-1 countries.

Project Size

There is no upper or lower limit on project size. VCS does however classify projects into 3 categories based on their size:

- Micro projects: under 5,000 tCO_2e per year
- Projects: 5,000–1,000,000 tCO_2e per year
- Mega projects: greater than 1,000,000 tCO_2e per year

The rules on validation and verification vary to some degree for projects that fall in the 'micro' or 'mega' categories.

Start Date

The earliest project start date permissible under the VCS is 1 January 2002. For the 1st year of the VCS 2007's operation, projects that started anytime after January 1st 2002 will be accepted provided they complete the validation process within a year from 19 November 2007. After the first year, only those projects that started within 2 years before the validation date will be accepted. In other words, retroactive crediting is allowed for up to two years from the validation date.

Crediting Period

The earliest permissible start date for the crediting period is 28 March 2006. The duration of the crediting period can be a maximum of 10 years and it can be renewed up to three times.

CDM Pre-registration Credits

CDM pre-registration credits are allowed in accordance with the start date and crediting period rules above. No further additionality proof required.

Project Funding Restrictions

The VCS imposes no exclusion of ODA funds.

Environmental & Social Impacts

The VCS does not focus on environmental and social benefits. It is sufficient for VCS projects to show that they are compliant with local and national environmental laws.

The requirements for stakeholder involvement are based on ISO 14064-2 requirements and are stated in general terms: Independent stakeholders are provided with access to all documents that are not commercially sensitive and given sufficient opportunity to offer comments and other inputs.

3. Additionality and Baselines

Additionality Requirements

The VCS uses project-based, performance-based and positive technology list-based additionality tests. The **project-based test** closely follows CDM procedures:

Step 1: Regulatory surplus: The project must not be mandated by any enforced law, statute or other regulatory framework. This criterion also applies to projects using the performance or positive list tests.

Step 2: Implementation barrier: The project must demonstrate that it faces capital or investment return constraints *or* an institutional barrier that can be overcome by additional revenues from VCU sales, *or* that it faces technology-related barriers to implementation of the project.

Step 3: Common practice: The project must demonstrate that it is not common practice in the sector or region when compared with other projects that received no carbon finance, and if it is found to be common practice, then the project proponent must identify barriers it faces that were not faced by the other projects. In demonstrating this criteria, the VCS advocates the use of guidance provided by the GHG Project Protocol for Project Accounting (see GHG Protocol).

A **performance test** can be used as an alternative to the project-based additionality test. With a performance test, a project can demonstrate that it is not business as usual if the emissions generated per unit of output it generates are below a benchmark level approved by the VCS Programme for the product, service, sector or industry. At the time of its launch, no performance standards had been approved. New performance tests will be approved through the double approval process and by the VCS Board.

A **positive list of approved technologies** can be used as an alternative to the project-based additionality test. The project developer still has to use a baseline methodology to determine the number of offsets a project will create. At the time of its launch, no technology was included in the positive list. The list is currently under development.

Baselines & Methodologies

The VCS accepts projects using existing methodologies either approved under the VCS Programme or another approved GHG Programme, and also approves new ones. At the time of the VCS 2007 launch, all CDM baselines and monitoring methodologies had been approved for use under VCS and methodologies from the California Climate Action Registry were under consideration.

For the most part, VCS draws on guidelines provided in ISO 14064-2:2006 to guide the development of a VCS Programme Methodology (see section on ISO 14064). The VCS Board will approve new methodologies using a double approval process which entails seeking an approval from two independent accredited auditors, one appointed by the project developer and the other appointed by the VCS Secretariat. The Board automatically approves the standard if there is unanimity amongst the two auditors and rejects it if there is a disagreement between them. The project developer can appeal the decision. If it does so, then the VCS Secretariat appoints an independent consultant to review the project proponent's claim. Based on the review, the VCS Board then makes a final decision. The expenses for each review are borne by the project proponent.

4. Validation & Registration

Process

Under the VCS, validation is required but can be done at the same time as verification. The VCS provides a template for both the validation and the verification report.

Projects may choose to be validated either as an individual project or as part of a grouped project including two or more subgroups each retaining their distinctive characteristics. Group projects are only sampled by the project auditor.

A project proponent contracts an accredited auditor of the VCS Programme or of a VCS-approved GHG Programme to validate the project. The auditor evaluates the project against the VCS' validation requirements (see below) and prepares its report as per the VCS Validation Report template.

The project is automatically approved if it is successfully validated by the auditor. A formal registration process with the VCS Association takes place only at the time of issuance of VCUs. However, upon successful validation, a VCS project may volunteer to be recorded on the VCS Project Database. In order to do so, its documents are checked for authenticity by the registry operator and the verifier completes a GPS search on the project database that checks if the project has been registered under the VCS before.

Key Requirements

The validation of a project is to be carried out in conformance with the requirements of ISO 14064-3:2006 and the report prepared as per the VCS Validation Report template including:

- Project Design
- Baseline
- Monitoring Plan
- Calculation of GHG Emissions
- Environmental Impact
- Comments by Stakeholders

5. Monitoring, Verification & Certification

Process

The emission reductions achieved by VCS projects can be verified by the same entity that validated the project. The VCS Board does not approve or reject projects; it is the auditors themselves who verify the projects and approve the claimed emissions reductions.

The third-party auditor verifies the emissions reductions and the accuracy of emission reduction calculations as per the requirements of ISO 14064-3:2006. After a project has been validated and verified, the VCS Project Document and proof of title are submitted to the registry operator. Electronic copies of these documents are then put on the VCS project database and are publicly available.

Key Requirements

Verification report prepared as per the VCS Validation Report template.

6. Evaluation of Auditors

One year after the launch of the VCS 2007, the VCS will conduct an external review of all the projects that will have been certified. This work will likely be carried out by a commissioned NGO. VCS will then evaluate the results and decide if any of the rules have to be modified to improve the standard or close any unforeseen loopholes.

There is currently no plan to have a systematic evaluation of the third-party auditors. Yet the VCS board has the authority to sanction auditors, project developers or registry operators "based on evidence of an improper behavior." (VCS Programme Guidelines, p.7).

7. Registries

The VCS will accredit different registries. To avoid double counting and to ensure that VCUs are only registered in a single registry, the VCS will also maintain a project database on its website which will assign a serial number to each project. The database will be publicly available and enable anyone to look up the vintage of the offsets, the project proponent, the registry in which they are kept, and other project information.

To minimize the risks of double counting, the project owner must further submit the following to the VCS:

a) A letter confirming that the VCUs being registered have not been registered, transferred or retired prior to the said registration;

b) Where emissions reductions have occurred in an Annex-1 country, a certificate from the national registry of the host country stating that an equal number of Assigned Amount Units have been cancelled from that registry;

c) Proof that emission reductions (from renewable energy projects) have not arisen from an activity used to meet a regulatory renewable energy commitment or to generate Renewable Energy Certificates or that the latter have been cancelled.

8. Fees

The registration fee for each VCU issued is 0.04 Euros (November 2007). Account fees will be set by each of the VCS approved registries.

Authors' Comments on the VCS

The VCS is a base-level-quality standard that aims to keep costs for validation and verification low while still ensuring basic quality requirements. The VCS has outsourced a number of tasks that under CDM are done by the Executive Board and the Methodology Panel (e.g. project and methodology approval). The advantage of this is that the organisation can be kept very lean. Also, outsourcing tasks to professionals in the respective fields can potentially increase the quality of work (e.g. having a proposed methodology evaluated by an external advisory group of experts in that particular technology). The downside of this approach is that more decision making power is given to outside entities.

No Separation of Verification and Approval of Projects
Under the VCS, it is the auditors themselves who approve the projects. Given the pressures on auditors and given the conflict of interest discussed earlier, we see the lack of an accrediting board to review projects and give final project approval as a potential weakness of the VCS. A double approval process for projects similar to the one VCS uses for methodology approval could be a potential solution to this.

Approval of Methodologies
There is pressure on auditors to approve their clients' methodologies in order to maintain a good relationship and not compromise future work opportunities. As has been shown in the CDM (Schneider, 2007), this design flaw in carbon markets is difficult to address as long as the project developer pays for and can choose the auditor. VCS is mitigating the fact that project developers and auditors have aligned interests by having two auditors approve a new methodology (the second of which is chosen by the VCS and reports directly to the board). It will be interesting to see how well this system works in practice.

Additionality
The VCS plans to add benchmark tools and technology lists to its additionality tests. Since these tools have not been developed yet, we cannot comment on their quality or stringency. However, the VCS 2007 states that benchmark and technology list tools must demonstrate that projects approved under them would also be approved under the project-based tests. Nevertheless, current VCS documents do not indicate that these tools will have embedded measures to account for free riders, for example through discounting of offsets that are accredited through benchmark tools. We hope that a conservative approach will be taken to ensure the integrity of these additionality tools.

Crediting Period
The VCS crediting period for offset projects is 10 years with the option to renew three times. This is considerably longer than under the CDM or the Gold Standard (3 times 7 years). Extending the crediting period means that fewer emissions reduction projects are necessary to create the same number of emissions reductions. In other words, there is a trade-off between limiting crediting periods to the minimum to allow more projects to enter the market and extending it to the maximum to make more projects viable. Longer crediting periods will result in fewer projects being implemented. Also, having longer crediting periods than other standards might allow project developers to jump to the VCS once the crediting period of the originally chosen standard has expired. This raises potential additionality issues.

* Commercially sensitive information is defined as:
Trade secrets, financial, commercial, scientific, technical or other information whose disclosure could reasonably be expected to result in a material financial loss or gain, prejudice the outcome of contractual or other negotiations or otherwise damage or enrich the person or entity to which the information relates. (VCS 2007, p.6)

Co-Benefits

The VCS requirements for stakeholder involvement are based on ISO 14064-2, which states these only in very general terms. Definitions of stakeholders, confidential information* and 'sufficient opportunity' for comments appear to be left to the project developer to decide. There are also no specified procedures and rules on how stakeholder concerns are to be taken into consideration. For buyers who place value on these co-benefits, VCS would not be a sufficient standard.

Future of VCS

Given that the VCS 2007 is broadly supported by the carbon offset industry, it will likely become one of the more important standards in the voluntary offset market and might very well establish itself as the main standard for voluntary offsets. The VCS version 1 was criticized by many as too weak and vague. The VCS 2007 was developed after a 2-year stakeholder consultation and has taken into account many of these criticisms and is clearly an improvement over version 1.

Since VCS 2007 was just released, it is too early to judge if the standard will be able to realize its goal of ensuring "that carbon offsets that businesses and consumers buy can be trusted and have real environmental benefits." We are hoping that the VCS will use its market position to improve the quality of offsets and will address some of the potential weaknesses in the standard.

VER+

www.tuev-sued.de/climatechange
www.netinform.de

1. Overview

Type of Standard

The VER+ is a full-fledged carbon offset standard and closely follows the Kyoto Protocol's project-based mechanisms (CDM and JI). It does not focus on co-benefits.

History of Standard

The VER+ standard was developed by TÜV SÜD, a Designated Operational Entity (DOE) for the validation and verification of CDM projects. It was designed for project developers who have projects that cannot be implemented under CDM yet who want to use very similar procedures as the CDM. The VER+ was launched in mid 2007.

Administrative Bodies

TÜV SÜD certification body "climate and energy" has four members who supervise and administer the VER+ standard's criteria. The same body also reviews all the CDM projects that TÜV SÜD audits as a DOE before the documents are submitted to the CDM EB.

Third Party Auditors are CDM and JI accredited auditors. They are approved to validate and verify projects. In the validation and verification process, the auditing company is obliged to follow the requirements as defined by the Validation and Verification Manual (initially published by Worldbank / IETA), in its most recent version. Unlike under CDM, accredited third-party auditors can validate and verify the same project.

Financing of the Standard Organisation

The VER+ is financed by funds from TÜV SÜD and by issuance fees for use of the registry.

Recognition of Other Standards

If a project that has been initially implemented under another standard seeks VER+ certification, a so called "equivalence check" is carried out. Based on validation and verification reports, the auditor in charge confirms that the already audited project also complies with VER+ requirements.

Number of Projects

At the end of 2007 there were approximately 25 validated projects and several verifications were taking place. The demand for VER+ is growing, especially among project developers in China and for CDM pre-registration credits.

2. Eligibility of Projects

Project Type

VER+ accepts all project types except HFC projects, nuclear energy projects, large and hydropower projects over 80MW. Hydro projects exceeding 20MW have to conform with World Commission on Dams rules. LULUCF projects, including REDD, are accepted if implemented with a buffer approach to address the risk of potential non-permanence.

Project Location

VER+ follows the same project criteria as JI but without limitation to the status of the host country. Hence, the host country can be an Annex I, non-Annex I or non-ratification country.

VER+ credits generated in an Annex I country need to demonstrate the retirement of AAUs in order to be fully interchangeable with VER+ credits from a non-Annex 1 country. Furthermore VER+ credits can be issued if it is demonstrated that the host nation does not participate in International Emissions Trading (Kyoto Protocol Art 17) or if it is confirmed that VER+ credits will not be transferred out of the host country.

Project Size

No restrictions apply.

Start Date

Applications for retroactive VER+ accreditation can be submitted for start dates as early as January 1st, 2000. Retroactive crediting has been limited such that credits are issued for 2 years back from the registration date (at the certification body of the auditor in charge) and will be phased out by the end of 2009.

Crediting Period

The crediting period of VER+ activities ends at the end of the latest agreed commitment period under the UNFCCC scheme. At the end of 2012 a brief check up on the "Kyoto status" of the host country will be carried out to avoid double counting with UNFCCC regimes. Once this review is carried out, the crediting period is extended up to the end of the next commitment period (as defined by UNFCCC). At the end of this next commitment period (e.g. 2020), a revalidation is required. The maximum crediting periods are limited to 25 years for standard projects and 50 years for LULUCF activities.

CDM Pre-Registration Credits

The generation of VER+ credits is possible ahead of the registration of a CDM project without any further additionality testing. A registered CDM project has to have started to operate and reduced emissions prior to UNFCCC registration. The earliest starting date for this pre-CDM/JI crediting is the date of publication of the PDD on the UNFCCC website (Global Stakeholder Process). VER+ crediting may occur until CDM/JI registration. No separate PDD is needed for CDM or JI activities applying for VER+ credits for a crediting period prior to the one under UNFCCC.

Project Funding Source

As under CDM rules, VER+ projects are not allowed to use Official Development Assistance (ODA).

Environmental & Social Impacts

If the project activity requires an Environmental Impact Assessment (EIA) due to national legislation, it needs to be submitted for project approval.

If required by national law, a local stakeholder process has to be carried out. Otherwise, the project developer can choose between:

- performing a voluntary stakeholder process and include documentation to the VER+ Project Design Document (PDD), or
- justifying in the VER+ PDD that the project does not impact the vicinity.

Just like in CDM the PDD is published for 30 days on the DOE's website and comments can be made via the website, which will then be considered in the audit process.
(***www.netinform.de***; look for climate and energy).

3. Additionality and Baselines

Additionality Requirements

Additionality tests for VER+ are project-based.

Baselines & Methodologies

All CDM approved baselines and methodologies are allowed. The latest versions of the CDM methodologies have to be used. If there is no existing CDM methodology that matches the project conditions, a project specific methodology can be developed. This new methodology is reviewed on a project by project basis. The project methodology has to be based on "guidance on criteria for baseline setting and monitoring" as defined for JI activities.

Additionality Criteria

VER+ projects are required to:

- follow specific additionality rules of an approved CDM methodology or
- in all other cases, apply the most recent version of the CDM Additionality Tool.

4. Validation & Registration Process

Process

A UNFCCC-accredited auditor reviews the validation process and approves the project. The project is then registered with the auditor in charge. The results of the validation (as well as verification at a later stage) are forwarded to the BlueRegistry, where relevant information of VER+ projects is held and publicly available.

Key Requirements

The requirements are similar to those of CDM but they do not require approval from the host country:

1. Completed PDD

2. Validation Report

A project specific approach as defined for JI can be used for those project settings where a CDM approved methodology is not available or fully applicable.

5. Monitoring, Verification & Certification

Process

Verification is based on monitoring reports from the project developers and conducted by an auditor. The auditor also approves the verification report. All VER+ project documentation is submitted to the BlueRegistry. Unlike under CDM rules, an auditor is allowed to do validation and verification of the same project.

The first verification is required at latest one year after registration of the starting date of the crediting period. For LULUCF projects, a first verification is required within 5 years from validation.

For any VER+ activity, the frequency of the proceeding verifications can be chosen by the project participants. Based on a positive verification statement, VER+ credits are issued by the auditor.

Key Requirements

1. Monitoring Report

2. Verification Report

6. Evaluation of Auditors

Since the VER+ relies exclusively on DOEs, the standard relies on the review procedures of the CDM.

7. Registries

In June 2007, TÜV SÜD launched its own BlueRegistry for VER+ credits. An account is opened for each verified VER+ project at TÜV SÜD's BlueRegistry. In an effort to prevent project developers from registering their credits with multiple registries, VER+ includes in its contract a clause that stipulates that the credit holder shall refrain from double selling / registering. The BlueRegistry intends to accept GS-VER and VCS certified credits and already registers green energy certificates. Agreements on the standardized interchange between registries are currently pending.

8. Fees

Total costs for validation, registration and VER+ issuance charged by the auditing company vary depending on project size, technology, location etc. and is estimated to be in the range of 5,000 to 15,000 Euros.

If verification has been carried out by TÜV SÜD then all VER+ credits are automatically registered in the BlueRegistry without additional costs.

For projects and credits not verified by TÜV SÜD, there is a registration fee which covers incorporation into the BlueRegistry. TÜV SÜD charges a one time subscription fee (550-1100 Euros) and a registration fee (1500-3000 Euros p.a.) for opening and maintaining accounts. In addition the transaction fee for registered credits ranges from 120 Euros for 200 tonnes or less to 700 Euros for 10,000 tonnes or more.

Authors' Comments on the VER+

No Separation of Verification and Approval of Projects

TÜV SÜD has a good reputation as a DOE and is a well-know auditor. We are nevertheless concerned about potential conflicts of interest. Currently, most VER+ projects are validated and verified in house, since both the certification body and the auditor are in this case TÜV SÜD, it is difficult to know if project approval will always be strictly independent.

Projects are validated, verified and approved by the same DOE. Even with TÜV SÜD's best intentions, given the pressures DOEs are currently facing to do very fast and low cost evaluations, the possible conflict of interest is real.* Yet, since the standard is very new and few projects have been implemented it remains to be seen if these concerns prove to be valid.

* TÜV SÜD responded to this criticism:
The well established internal quality control processes and the general relevance of transparent procedures within a company for which auditing is a core business activity, create the safeguards, which ensure that standard definition does not constitute a conflict of interest with validation and verification. (e-mail communication, Markus Knödlseder, 14/11/07)

Double Counting in Annex 1 Countries

The VER+ standard allows projects in any country. For Annex 1 countries they stipulate that the corresponding amount of AAUs are retired or that the generated VER+ credits are not to be transferred out of the country. We agree that the first provision avoids double counting but do not see how VERs used within the country avoids double counting. We therefore see the second alternative as insufficient to avoid double counting.

Co-Benefits

VER+ does not require a local stakeholder process and does not focus on enhancing co-benefits. For buyers who place value on these co-benefits, VER+ would not be a sufficient standard.

Future of VER+

There are several reasons why project developers might choose VER+ over CDM. In comparison to CDM, VER+ provides more flexibility on methodologies, which speeds up validation and verification. A project specific approach as defined for JI can be used for those project settings where a CDM approved methodology is not available or fully applicable. The fees for the incorporation of VER+ credits to the BlueRegistry are usually lower than those covered by UNFCCC for registration and issuance of CDM projects.

Given the proliferation of standards, it remains to be seen how well the VER+ will be able to establish itself. Although TÜV SÜD is well respected in the industry, the VER+ was developed by a single DOE and does not have the wide NGO or industry-based support that the Gold Standard and the VCS have. It is therefore unclear how widely the VER+ will be used.

CHICAGO CLIMATE EXCHANGE (CCX)

http://www.chicagoclimatex.com

1. Overview

Type of Standard

The Chicago Climate Exchange (CCX) is a voluntary GHG emissions cap-and-trade scheme based in North America. Although participation is voluntary, compliance with emission reduction objectives is legally binding once a member joins. CCX has as part of its cap-and-trade scheme an offset programme with a full-fledged carbon offset standard. CCX members commit to reduce their emissions by a fixed amount below the established baseline level.* Members who cannot achieve the reduction target through cutting their emissions internally can meet their compliance commitment by purchasing emission allowances (called Carbon Financial Instruments; CFI) through CCX's electronic trading platform from other CCX Members that reduce their emissions beyond the reduction target. Offsets from projects implemented through the CCX offset programme can also be used to comply with reduction targets. Total use of offsets for compliance is limited to no more that one half of the required reductions.

* In the first phase of the scheme, from 2003 to 2006, members agreed to cut their emissions by 1 per cent each year below their annual average emissions for the period 1998 to 2001, thereby by achieving a reduction of 4 per cent by the end of the fourth year. For the second phase from 2007 to 2010, the original members have to further cut their annual emissions to achieve the target of six per cent by 2010. The new members who did not participate in the first phase have to achieve the same target by 2010 by reducing their emissions by 1.5 per cent each year.

History of Standard

In 2000, a group of researchers led by Richard Sandor at Northwestern University carried out a feasibility study on the viability of a cap-and-trade market to reduce greenhouse gas (GHG) emissions in the US. Through 2002, they developed the rules and protocols required to establish the scheme and, by 2003, they launched trading operations with 13 members that made voluntary but legally binding commitments to reduce six GHGs. Total membership has grown to almost 400 entities.

Administrative Bodies

CCX Committee on Offsets is responsible for reviewing and approving proposed offset projects. The offset committee has currently approximately 12 members. Each member is appointed by the CCX Executive Committee for a 1 year appointment with the possibility of renewal.

External Advisory Board provides external strategic input to the CCX team and includes experts from the environmental, business, academic and policy-making communities.

Technical Advisory Committees are established by request of each CCX standing committee or on an ad-hoc basis. These technical committees are usually comprised of outside experts. Currently CCX has technical advisory committees on agricultural methane capture, landfill methane capture, soil carbon sequestration for conservation tillage and rangeland soils, forestry and ozone depleting substances.

CCX Committee on Forestry is responsible, among other things, for reviewing proposed forestry offset projects.

CCX Regulatory Services Provider is the *Financial Industry Regulatory Authority (FINRA*), the largest non-governmental regulator for all securities firms doing business in the United States, which provides external verification of the baseline and annual emissions report of each member, monitors CCX trading activity and reviews verifiers' reports for offset projects.

Third-party Offset Project Auditors are called 'verifiers' and are approved by CCX for each project type to verify an offset project's annual GHG sequestration or destruction. There are currently 29 approved auditors (12/07).

Financing of the Standard Organisation

Climate Exchange PLC is a publicly listed company on the AIM division of the London Stock Exchange. Financials of Climate Exchange, including CCX, are available to the public. The operations and management of the exchange is financed primarily through trading and offset registration fees as well as through enrolment and annual fees generated from its members.

Recognition of Other Standards

The CCX allows trading of credits generated in some projects registered under the CDM. Such projects must be approved by the CCX Offsets Committee and must retire their CERs in exchange for receiving CCX credits.

Number of Projects registered and offsets issued

44 offset projects have been issued 20.82 million metric tonnes of CO_2e offsets since the scheme's inception in 2003 as of 28 November 2007. (***http://www.chicagoclimatex.com/offsets/projectReport.jsf***, accessed Nov 28, 2007)

2. Eligibility of Projects

Project Types

CCX accepts the following project types:

- ***Energy efficiency and fuel switching***
- ***Renewable energy***
- ***Coal mine and landfill methane***
- ***Agricultural methane*** such as anaerobic digesters.
- ***Agricultural soil carbon:*** Project owners must make a minimum 5 year contractual commitment to continuous no-till, strip till or ridge till on enrolled acres.
- ***Rangeland soil carbon:*** Projects must take place within designated land resource regions. Further, non-degraded rangeland projects in specific locations that are managed to increase carbon sequestration through grazing land management that employs sustainable stocking rates, rotational grazing and seasonal use are eligible.
- ***Forestry carbon:*** a) Forestation and forest enrichment projects must be on deforested or degraded lands b) forest conservation projects in specified locations may be eligible if they are undertaken in conjunction with forestation on a contiguous site. CCX rules address permanence issues of forestry projects by requiring a carbon reserve pool equal to 20 percent of all offset credits issued for the project and the cancellation of reserve pool offsets in case of sequestration reversal.
- ***Ozone depleting substance*** **(ODS)** destruction is accepted only for chemicals that can no longer be produced and where there is no legal requirement to destroy remaining stocks.

Project Location

Most CCX offset projects to date are located in the US. In order to avoid double counting, CCX accepts projects in any country except in member states of the EU-ETS. Furthermore, CCX does not allow for the registration of projects in Annex 1 countries during the Kyoto period that might be counted under the country level inventory (AAU).

Project Size

There is no limit on the project size. However, projects with less than 10,000 metric tonnes of CO_2e cannot trade on the exchange directly but can do so through an offset aggregator.

Start Date

Projects selling offsets on the CCX should not have started earlier than January 1, 1999 for most project types. However, the earliest start date for forestry projects is January 1, 1990 and for HFC destruction projects is January 1, 2007.

Crediting Period

Most of the eligible project types can earn offsets for the period 2003 to 2010 (8 years). The exceptions include renewable energy projects, which can earn offsets from 2005 to 2010 (6 years), HFC destruction projects, which can earn offsets from 2007 to 2010 (4 years), and rangeland soil carbon projects, which can earn offset from 2006 to 2010 (5 years).

CDM Pre-registration Credits

CCX generally approves CDM pre-registration credits if all the CDM documentation is in place. CCX does not require any further additionality proof for such pre-registration VERs.

Project Funding Restriction

No funding restrictions.

Environmental & Social Impacts

Offset projects must comply with the rules and regulations of the host country. Beyond this legal prerequisite, CCX does not have any requirements for stakeholder involvement and other co-benefits. The vast majority of CCX offsets are implemented in developed countries where legal and regulatory frameworks already require assessment of environmental and social impacts. In cases where projects originate from a non-Annex I country, environmental and social impacts are considered by the offset committee on a case by case basis depending on the project type.

3. Additionality and Baselines

Additionality Requirements

Additionality requirements are primarily performance-based. Additionality criteria are incorporated into the eligibility criteria of the project types. The CCX requires that projects are new, beyond regulation and involved in highly unusual "best in class" practices. There is no formal project-specific assessment of additionality. Additionality of each project is reviewed by the CCX Offsets Committee.

Baselines & Methodologies

The baselines and methodologies for calculating emission reductions are defined for each project type through the use of specified crediting rates for eligible project activities. Some baselines are project-specific (e.g., large reforestation projects are credited relative to measured site-specific carbon levels prior to the start of the project). Other baselines are based on performance standards (e.g. avoided deforestation projects in Brazil are credited using predetermined annual deforestation rates for specific states within Brazil).

4. Validation and Registration (Initial Verification and Enrolment)

CCX does not distinguish between validation and verification. Both steps are usually done at the same time by the same auditor and are called "project verification and enrollment." In other words, an initial validation of projects is optional. Credits are generated after verification.

Process

The following steps are involved in verifying or enrolling an offset project on the CCX:

1. An offset project owner submits a project proposal or questionnaire for an eligible project to the CCX.
2. The proposal is reviewed by the CCX Committee on Offsets and they provide a preliminary approval if the project is eligible (the project may be referred to scientific technical advisory committees, if required).
3. Once approved by the Committee, the project owner or aggregator must obtain an independent verification by a CCX-approved verifier (the verification may include site visits) to accurately assess a project's annual GHG sequestration or destruction potential.
4. The verification reports are then reviewed by CCX staff as well as the CCX provider of regulatory services, FINRA, for completeness and accuracy.
5. The offset provider can then join the CCX and enroll the project (if the offset provider is already a member or offset aggregator, then the new project is enrolled independently or aggregated together with other projects).

Key Requirements

1. Eligible project proposal
2. Verification Statement by the third-part auditor

5. Monitoring, Verification and Certification (Annual Verification and Issuance)

Process

The steps involved include:

1. The CCX-approved auditors verify the project's actual annual GHG sequestration or destruction.
2. The CCX then issues the offset provider or aggregator Carbon Financial Instrument® (CFI™) contracts equivalent to the quantity of emission sequestered or destroyed (one CFI is equivalent to 100 metric tonnes of CO_2e).

Key Requirements

Verification Statement by the third-part auditor are required.

6. Evaluation of Auditors

Auditors are approved for each project type. Once approved the CCX does not have a formal process in place to evaluate and sanction auditors in case of underperformance.

7. Registries

Offset project developers can participate in CCX by registering offsets either as Offset Providers or Offset Aggregators. An Offset Provider is an owner of an offset project that registers and sells offsets directly on the Exchange. An Offset Aggregator is an entity that serves as the administrative representative for multiple offset-generating projects on behalf of multiple project owners. The CCX Trading System has three components:

1. The CCX Registry

The CCX Registry is the electronic database that serves as the official record holder and transfer mechanism for Carbon Financial Instrument® (CFI™) contracts. All CCX Members have CCX Registry Accounts.

2. The CCX Trading Platform

The CCX Trading Platform is an internet-accessible marketplace in order to execute trades among CCX Registry Account holders and to complete and post trades that are established through private bilateral negotiations.

3. The Clearing and Settlement Platform

The Clearing and Settlement Platform processes daily information from the CCX Trading Platform on all trade activity.

8. Fees

Fees for CCX membership areUSD1,000-35,000 per year depending on the size and type of member. Offset registration fees are USD 0.12 per metric tonne from non-Annex I countries and USD 0.15 per metric tonne from Annex I countries. The trading fee is USD 0.05 per metric tonne. Trading and offset registration fees are posted on the CCX website and are subject to change.

Authors' Comments on CCX

CCX has been a pioneer in establishing a cap-and-trade system. It was the first such system established in North America and it has given companies the opportunity to learn and gain experience with emissions reduction commitments and carbon trading. Despite these very positive aspects of CCX, there have been several points of criticism of CCX in general (as a cap-and-trade system) and of CCX's offset programme. We first discuss the offset programme:

Co-Benefits

CCX does not require a local stakeholder consultation process and does not focus on enhancing co-benefits. For buyers who place value on these co-benefits, CCX would not be a sufficient standard.

Additionality

There has been significant criticism of the lack of additionality of some CCX offsets, in particular those involving no-till agriculture. There were several documented instances where farmers received carbon offset revenue for practicing no-till agriculture despite the fact that these farmers had been practicing no till for many years already.*

* J. Goodell, "Capital Pollution Solution?" New York Times Magazine (July 30, 2006).

CCX argues that it would be unfair if the proactive farmer who has been practicing no-till cannot sell his carbon credits, whereas a farmer who just started doing so in order to get revenue can earn credit. This argumentation in favour of 'rewarding early action' with carbon credits conflates two separate issues:

Environmental integrity: 'Rewarding early action' with carbon credits undermines the environmental integrity of offsets: If non-additional credits enter a cap-and-trade system, emissions are actually increasing because the buyer of the non-additional offsets will continue to emit whilst no further emissions reductions are achieved through the offset projects.

Fairness to early actors: it is true that additionality raises an equity issue: Individuals who have acted as pioneers and have already been engaged in non-traditional low-carbon practices such as no-till agriculture will not be able to sell their carbon credits because their actions are by definition non-additional (they happened for other reasons than the carbon offset market).

In order to preserve the environmental integrity of the broader offsets market, the fairness concern would need to be addressed via measures other than handing out non-additional carbon credits (e.g. early action provisions, tax/subsidy treatment, discounting of credits, etc).*

The following points apply to CCX in general:

Transparency of CCX
Several groups have in the past criticized CCX for its general lack of transparency.† CCX has responded to this criticism by making its rule book and many of the methodologies available on its website. We welcome this increase in transparency which will enable a more independent evaluation of project methodologies.

Accomplishments of CCX and additionality of CFIs
Companies who voluntarily signed on to CCX are a self-selecting subset of corporations who are likely to be confident that they can comply or even over comply with the commitments. It is therefore difficult to assess the achievements of the CCX per se. The very low prices of CFIs indicate that many of the member companies of CCX have over-complied with their commitments and, conversely, that the CCX targets are not stringent enough to exert any pressure above and beyond the companies' expected emission levels. If the cap in a cap-and-trade system is low and there is over-compliance, the cap may not be leading to any reductions beyond business-as-usual. There is a risk that carbon offsets from unspecified CFIs do not actually lead to emissions reductions beyond business-as-usual.

Future of CCX
CCX was the first cap-and-trade system that was established in the US and as such has played a innovative and valuable role in bringing carbon trading to the US. It is unclear how CCX will function if the US adopts a mandatory cap-and-trade programme. It is possible that CCX could become largely a trading platform and exchange, deferring to government authorities to define rules and procedures and to certify reductions.

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* CCX responded to this criticism by claiming that tillage can only be ensured through a contract and a verification process, which CCX provides. "There is no guarantee it would go on without a contract with CCX." No-till has been practiced for decades. Where it can rightfully be assumed that more farmers will change to no-till now that revenue from offsets are available, the argument that without the offsets the amount of no-till agriculture would actually decrease below the current level is not supported. CCX further states:

The primary concern was that we not encourage perverse actions that would encourage people to game the system to qualify as "new no-tillers" by virtue of the fact that they have tilled up fields that formerly had been subject to conservation tillage that removes CO_2 from the air. We did not want to see reversals of stored carbon dioxide with the resulting release to the atmosphere. (Michael Walsh, e-mail communication 12/21/08)

Although a valid argument, it is unclear how many farmers would choose to start to till again, since they had enough incentive to switch their tilling practice before offsets were available. Even more importantly, the argument ignores the issue that non-additional offsets will lead to a de facto increase in emissions under a cap-and-trade system (see chapter 5.1.)

† Dale S. Bryk. (2006). 'States and Cities Should Not Join the Chicago Climate Exchange.' Natural Resources Defense Council

7.3 **Offset Standard Screens**

Offset Standard Screens are not full-fledged standards by themselves but accept projects that were implemented under other standards and adhere to their screening standards.

VOLUNTARY OFFSET STANDARD (VOS)

http://www.carboninvestors.org/

1. Overview

Type of Standard

The Voluntary Offset Standard (VOS) is a carbon offset screen that accepts other standards and methodologies using certain screening criteria. It currently accepts Gold Standards VER projects and projects that employ CDM procedures but which are implemented in countries that have not ratified the Kyoto Protocol and are therefore not eligible for CDM.

History of Standard

The International Carbon Investors and Services (INCIS) launched the VOS in June 2007. INCIS is a not-for-profit association of large investment companies that provide carbon-related investments and services. INCIS has 26 members (as of November 2007).

Administrative Bodies

Since the VOS is a new standard, many of its administrative structures are not yet in place.

Members: INCIS was initially set up as the "European Carbon Investors and Services" but has since its launch expanded to represent the interests of 26 members based both within and outside of Europe. These include, among others, ABN AMRO, Baker & McKenzie, Barclays Capital, Climate Change Capital, Credit Suisse, Deutsche Bank, Fortis, ING, MGM International, Morgan Stanley, and Standard Bank.

Auditors: UNFCCC approved DOEs verify and approve projects.

Financing of the Standard Organisation

The VOS is financed through INCIS membership fees and will further be financed through the issuance fees once its registry is established.

Recognition of Other Standards

The VOS accepts credits from CDM, JI, and Gold Standard CER and VER projects. Other VER standards (or specific methodologies approved under these additional standards) may be recognised under the VOS in the future by INCIS.

Number of Projects

No information is available: the VOS relies upon DOE certification so there will be no central entity to collect VOS project numbers until a registry is established.

2. Eligibility of Projects

Project Type

VOS accepts project types covered under the CDM/JI mechanism, with the exception of new HFC projects and 20 MW-plus hydroelectric dams unless they meet the criteria and guidelines of the World Commission on Dams.

Project Location

Projects are allowed in any country except those based in countries covered by a scheme for greenhouse gas emission allowance trading, such as the EU-ETS, if there is no mechanism in place to retire the equivalent numbers of allowances in that country (e.g. retiring of AAUs).

Project Size

The limitations specified under CDM/JI mechanisms apply.

Start Date

The limitations specified under CDM/JI mechanisms apply.

Crediting Period

The same as CDM/JI and CDM Gold Standard

CDM Pre-registration Credits

Pre-registration VERs are generally accepted by the VOS. Such VERs can be issued from the project start date if the project has been successfully validated by a DOE as meeting the CDM standard, including additionality, and the number of VERs has been verified by a different DOE.

Project Funding Restriction

The limitations specified under CDM/JI mechanisms apply.

Environmental & Social Impacts

The limitations specified under CDM/JI mechanisms apply. If the credits are GS, then Gold Standard rules apply.

3. Additionality and Baselines

The rules and guidelines specified under the CDM/JI mechanisms and the Gold Standard apply.

4. Validation & Registration

For GS VERs: validation is done through the Gold Standard. For CDM standard VERs: validation is done through DOE certification.

5. Monitoring, Verification & Certification

For GS VERs: verification is done through the Gold Standard. For CDM standard VERs: verification is done through DOE certification.

6. Evaluation of Auditors

The VOS relies on the review processes of the CDM and does not have its own review process for auditors.

7. Registries

The VOS is planning to establish its own registry.

8. Fees

For GS VERs: see the Gold Standard section. For CDM standard VERs: the DOE validation and verification costs. Registry costs are yet to be determined.

Authors' Comments on VOS

The VOS standard screen is supported by many of the heavy weights in the financial industry. This is an indication that these financial players are concerned about the risk they are taking by trading VERs from an unregulated market. Because of the support by these powerful financial players, the VOS could potentially play an important role.

Yet currently the VOS seems somewhat vague. It is difficult to get any specific information about the VOS. There is little information available on the website or in printed materials.

Currently the VOS only accepts VERs from projects implemented using CDM methodologies and Gold Standard offsets. In terms of VER projects implemented using CDM methodologies, the VOS is similar to the VER+, yet has fewer defined organisational structures and procedures. It is still unclear how the decision making structures for approval of methodologies or other standards will look. For these reasons, it is unclear how important a role the VOS will play in the voluntary offset market.

7.4 Bio-Sequestration Standards

CDM AFFORESTATION AND REFORESTATION STANDARD (CDM A/R)

1. Overview

This section focuses on CDM's bio-sequestration rules only. For a complete description of the CDM, see chapter 7.1.

Number of Projects

As of September 2007, only 10 afforestation/reforestation projects are registered with CDM. (Source: ***http://www.cdmpipeline.org/cdm-projects-type.htm***)

2. Eligibility of Projects

Project Type

CDM accepts afforestation* or reforestation† projects. CDM forestry projects can only be implemented on land (a) that is not forested at the start of the project activity; (b) which was not recently harvested; and (c) which is not likely to become forested in the near future without human intervention. All other forms of biological sequestration or land-based emissions reduction activities, including avoided deforestation, are currently not allowed.

The requirements for registering, validating, and certifying forestry projects are the same as for other project types. However, the following requirements are specifically for CDM forestry projects.

Leakage

Specific methods to account for leakage are developed under each baseline methodology. Methodologies must identify the sources of leakage and explain which sources of leakage are to be calculated, and which can be neglected. They must also specify any relevant calculations, parameters, and coefficients; indicate how values will be obtained; and describe uncertainties associated with key parameters. Specific methodologies may identify circumstances in which a particular source of leakage can be "neglected" or ignored. Such exclusions must be justified.

CDM does not account for international leakage and market shifting.

Permanence

To address the risk that carbon might be re-released in the atmosphere due to forest destruction, CERs from forestry CDM projects produce ***temporary emissions credits***. Specifically, these are either termed "temporary CERs" (tCERs) or "long-term CERs" (lCERs). Both types of CERs have expiration dates, after which they must be replaced by another tradable emissions unit under the Kyoto Protocol (e.g., standard CERs, AAUs, ERUs, or RMUs).

If an Annex 1 country uses a tCER for compliance it must replace it with a permanent Kyoto unit or an unexpired tCER in the next commitment period. If the project is still performing as expected, the new tCERs will just replace the expired ones. If the project fails during the first year of the commitment period, the tCERs will not have to be replaced until the end of that commitment period. This reduces the risk for the buyer who can plan for the whole commitment period.

lCERs expire at the end of the final crediting period for the project activity. lCERs may be cancelled if the verification reveals that the stored carbon for which they were issued got released back into the atmosphere. Upon cancellation, they must be replaced by another Kyoto Protocol emissions trading unit.

Crediting Periods

CDM forestry projects have either a single 30-year crediting period, or 20-year crediting periods that are renewable up to two times.

Other Rules

During the first commitment period, Annex 1 countries are limited to using forestry credits for no more than 1% of their baseline emissions.

Authors' Comments on the CDM A/R

There have been very few implemented CDM A/R projects. The methodology requirements are complicated and require sophisticated measurements of carbon stocks.

CDM currently does not allow for REDD projects, yet deforestation remains a serious problem and contributes significantly to climate change. Many developing countries and NGOs have been advocating for the inclusion of REDD into CDM. Yet it is unclear how well suited CDM is for addressing deforestation. Even with carefully designed methodologies, (international) leakage is difficult to address in REDD projects. For authors' comments on the CDM, see chapter 7.1

* Afforestation: The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources (Kyoto Definition).

† Reforestation: The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to those lands that did not contain forest on 31 December 1989.

VCS AFOLU STANDARD

http://www.v-c-s.org/afl.html

This section focuses on bio-sequestration rules only. For a complete description of the VCS, see chapter 7.1

1. Overview

Voluntary Carbon Standard (VCS) includes bio-sequestration and land-based emissions reductions projects and has developed a specific set of rules to address the particular issues and risks associated with these project types. The VSC uses the acronym AFOLU (Agriculture, Forestry and Other Land Use) for its bio-sequestration projects.

Number of Projects

The VCS AFOLU standards were launched on November 19th, 2007, and new methodologies and projects have yet to be approved.

2. Eligibility of Projects

Project Type

The following types of projects are acceptable under the VCS AFOLU:

- Afforestation, Reforestation and Revegetation (ARR)
- Agricultural Land Management (ALM)
  - Improved cropland management
  - Improved grassland management
  - Cropland to grassland conversions
- Improved Forest Management (IFM)
  - Conventional to Reduced Impact Logging
  - Convert logged to protected forest
  - Extend rotation age
  - Conversion of low-productive forests to productive forests
- Reducing Emissions from Deforestation (RED)
- Further activities can be added in the future

Leakage

The geographical area subject to potential leakage must be identified ex-ante, and any potential leakage subtracted from the net carbon benefits generated. Each project activity type has specific rules governing how leakage must be addressed.

Given the potential for regional markets to shift leakage from improved forest management projects (if they reduce overall timber supply), the VCS provides default leakage factors to ensure that potential leakage impacts are captured and subtracted. These default values can range from 10% to 70%.

In the case of RED projects, an analysis of agents and drivers of deforestation must be presented to the verifier, as well as a description of the measures that will be implemented to address them (e.g., building in sustainable agricultural intensification practices when shifting agriculture is a deforestation driver, or incorporating fast-growing wood lots to address local fuel wood or timber needs). The identified factors must subsequently be monitored on a regular basis. Depending on the extent of possible leakage, the area subject to leakage monitoring could encompass the entire host-country. If significant leakage that is directly attributable to the project is likely to occur beyond this area (such that it cannot be monitored), the activity is not eligible.

In line with the CDM, VCS AFOLU does not account for international leakage or international market shifting.

Permanence

Unlike CDM, the VCS does not issue temporary credits. VCS AFOLU projects produce permanent VCUs that are fully fungible regardless of the project type generating them. VCS AFOLU projects set aside a portion of all their credits generated into a buffer reserve to mitigate non-permanence risk. The buffer credits from all projects are held in a single pooled VCS buffer account to act as insurance against unanticipated project failure.

The buffers are sized depending on the risk level of a project. Projects with higher risk of (partial) failure must include a larger buffer than projects with smaller risks.

Risk Class	RED Buffer	ARR Buffer
High	20–30%	40–60%
Medium	10–20%	20–40%
Low	5–10%	5–20%

This risk assessment and subsequent buffer determination is conducted by two separate independent verifiers to ensure that a conservative number of credits are set aside.

The buffer solution to permanence issues in bio-sequestration projects reduces the risk to the buyer and seller of the offsets because the buffer acts as a guarantee. Credits in the buffer are cancelled when carbon is lost from the project compared to a previous issuance event, or should the project not be re-verified in the future. The buffer approach is meant to encourage developers to design projects for longer time-horizons and adopt strong risk mitigation strategies, since long-term projects with a low risk profile will be subject to a lower buffer withholding requirement.

Buffers can be drawn upon over time as project's longevity is established and risks shown to be effectively mitigated. 15% of project's buffer is released every 5 years at re-verification. For example, a medium-risk project starting out with a 30% buffer would have 15% of this (or 4.5% of total credits) released at its next verification event five years later. This 15% release would continue (e.g., at next verification would release 15% of 25.5% of credits from buffer), so that by 50 years after the first verification (or 55+ years since project start), assuming that the project's risks have been shown to be effectively managed, the project would be subject to a ~6% buffer withholding.

Verification of the project is in theory optional, but it is in interest of project proponents to regularly submit verification reports to the VCS because if a project fails to submit a verification report to the VCS within five years from latest verification, 50% of the buffer credits are cancelled. After another five years, all remaining buffer credits are cancelled. Projects may claim cancelled credits in the future by submitting a new verification before the end of the crediting period.

To ensure the environmental integrity of the buffer approach the VCS will conduct "truing up" of the overall VCS buffer pool every few years. A review of existing VCS verification reports for all AFOLU projects under the VCS would flag the projects that have failed or underperformed and then identify their common characteristics. The buffer values and/or risk criteria for VCS projects going forward would then be adjusted accordingly.

Crediting Periods

VCS crediting period for AFOLU projects are the same as the life of the project, with a minimum of 20 years and a maximum of 100 years.

Socio-Economic and Environmental Impacts

VCS requires all AFOLU projects to "identify potential negative environmental and/or socio-economic impacts they might have, and effectively mitigate them prior to generating VCUs." However, VCS does not monitor social and environmental impacts; project developers simply have to demonstrate to verifiers that there are no negative social and environmental impacts.

Authors' Comments on VCS AFOLU

The VCS AFOLU rules are thorough and innovative and they address many permanence and additionality concerns. It is also the first carbon standard to cover all the major land use activities, whether forestry or agricultur related, under a single verification framework. Only once projects have been implemented will it be possible to fully evaluate the quality of the standard.

Co-Benefits

VCS AFOLU does not require a local stakeholder process beyond what is required by law and does not focus on enhancing co-benefits. For buyers who place value on these co-benefits, VCS AFOLU alone would not be a sufficient standard but could be combined with a standard such as the CCBS. For authors' comments on the VCS, see chapter 7.1.

THE CLIMATE, COMMUNITY & BIODIVERSITY STANDARDS

http://www.climate-standards.org/

Introduction

Type of Standard

The Climate, Community & Biodiversity Standards (CCBS) is a project design standard and offers rules and guidance for project design and development. It is intended to be applied early on during a project's design phase to ensure robust project design and local community and biodiversity benefits. It does not verify quantified carbon offsets nor does it provide a registry. The CCBS focus exclusively on land-based bio-sequestration and mitigation projects and require social and environmental benefits from such projects.

History of Standard

The CCBS was developed by the Climate, Community and Biodiversity Alliance (CCBA) with feedback and suggestions from independent experts. CCBA is a partnership of non-governmental organizations, corporations and research institutes, such as Conservation International, The Nature Conservancy, CARE, Sustainable Forestry Management, BP and CATIE. The first edition was released in May 2005.

Administrative Bodies

CCB Alliance is formed by representatives from each member organisation. The alliance currently has 13 members and makes decisions about changes to the standards. It also works closely with the auditors, advising them on interpretation and application of the standards.

Working groups are comprised of alliance members and external advisors and are appointed when needed to address specific issues. Working groups proposals for changes must be approved by the Alliance.

Third-party auditors are certified DOEs under the CDM for afforestation and reforestation – organizations that are approved to evaluate CDM projects – or evaluators who are certified under the Forest Stewardship Council*. Validation and verification can be done by the same auditor.

* The Forest Stewardship Council (FSC, ***www.fsc.org/en/***) is a non-profit organisation with a mission "to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests". It certifies sustainably managed forestry operations, and tracks their timber through the supply chain to the end product, which can then carry the FSC ecolabel.

Financing of the Standard Organisation

The CCBS are managed by the CCBA which is supported by contributions from alliance member organizations and by foundation grants.

Recognition of Other Standards

Because CCBS is a project design standard only, and not a full fledged carbon offset standard, project developers who want to sell certified or verified emissions have to apply another standard to get certification and registration of their offsets. About 30% of the projects are developed as CDM projects that will generate CERs. 70% of the projects are looking to sell their offsets in the voluntary market.

Projects may combine the use of several different standards (e.g. CCBS to ensure validity of design to generate carbon credits with social and environmental benefits, FSC for certification of timber products, and the VCS for verification and registration of carbon credits). Using different standards might potentially help projects attract different funders and product buyers at different stages in the project cycle.

Number of Projects

As of September 2007, two projects have been validated against CCBS, a further five projects are undergoing validation and at least 20 more projects plan for CCBS validation in the coming few months. Over 70 projects are under development using the CCB Standards. The pool is growing by a few projects every month.

Ex-Ante Sale of Carbon Offsets

Some CCBS projects are selling ex-ante credits. Some are planning to sell a mixture of ex-ante and ex-post credits. Ex-ante credits enable projects to raise funds for project implementation. Because of the risk that is associated with purchasing ex-ante credits, buyers are often offered preferential rates for such up-front credits. In cases where the buyer requires carbon verification, the projects can, once real carbon benefits have been generated (5-12 years for most reforestation projects and shorter for avoided deforestation and degradation), apply a carbon verification standard such as the CDM or VCS.

As a design standard, CCBS does not verify emissions reductions. The offsets must be verified through another standard (e.g., VCS or CDM). When the carbon credits are verified, they are tracked by the registry associated with the carbon accounting standard used. It is the responsibility of the project proponent to register and cancel any ex-ante carbon credits that might be sold in advance of verification, in order to prevent double selling.

2. Eligibility of Projects

Project Type

CCBS focuses on land-based climate change mitigation projects, and accepts the following project types:

- primary or secondary forest conservation;
- reforestation or re-vegetation;
- agro-forestry plantations;
- densification and enrichment planting;
- introduction of new cultivation practices;
- introduction of new timber harvesting and/or processing practices (e.g., reduced impact logging);
- reduced tillage on cropland;
- improved livestock management; etc.

Project Location

Projects can be located in industrialized and developing countries. The revised version of the Standards – CCBS (2008) – will include rules to prevent potential double counting of Annex 1 based projects.

Project Size

There is no restriction on project size.

Start Date

There is no restriction on project start date but projects must have credible documentation for baselines from the start of the accounting period for carbon, community and biodiversity benefits.

Crediting Period

The CCBS has no rules on crediting periods because it is solely a project design standard.

CDM Pre-registration Credits

N/A

Project Funding Restriction

No restrictions on funding sources. On the contrary, since offset revenue alone is usually not enough to ensure project viability, many projects rely on co-funding through other means.

Environmental & Social Impacts

CCBS projects must generate net positive impacts on biodiversity. The standard employs a screen to rule out negative impacts and a point system to reward additional environmental benefits. The screen stipulates that projects cannot have negative effects on species included in the IUCN Red List of threatened species or species on nationally recognized lists. Invasive species or genetically modified organisms cannot be used in a project. CCBS rewards projects with an additional point each for the use of native species and water and soil resource enhancement.

Projects must generate net positive impacts on the social and economic wellbeing of communities and must mitigate potential negative effects caused by the project on-site and offsite.

Stakeholder involvement is required and must be documented during all phases of project development. Stakeholders must have an opportunity before the project design is finalized, to raise concerns about potential negative impacts, express desired outcomes and provide input on the project design. The project design must include a process for hearing, responding to and resolving community grievances within a reasonable time period. The overall net social and economic effect of the project has to be positive. Additional credit is given for capacity building activities and best practices in community involvement.

Leakage

Decreased carbon stocks or increased emissions of non-CO_2 GHGs outside the project boundary resulting from project activities need to be quantified and mitigated. The project proponents must:

1) Estimate potential offsite decreases in carbon stocks (increases in emissions or decreases in sequestration) due to project activities.

2) Document how negative offsite impacts resulting from project activities will be mitigated, and estimate the extent to which such impacts will be reduced.

3) Subtract any likely project-related unmitigated negative offsite climate impacts from the climate benefits being claimed by the project. The total net effect, equal to the net increase in onsite carbon minus negative offsite climate impacts, must be positive. (Climate, Community and Biodiversity Project Design Standards, First Edition, p. 17)

Permanence

Permanence is addressed by requiring that projects identify potential risks up front and design in measures to mitigate potential reversals of carbon, community and biodiversity gains, including establishing buffer zones. Yet because CCBS is a project design standard, it does not have specific permanence requirements such as the issuance of temporary offsets.

3. Additionality and Baselines

Additionality Requirements

The additionality tests for CCBS are project based and specified by individual methodologies.

The CCBS require:

Step 1: Regulatory Surplus: Project developers must prove that existing laws or regulations would not have required that project activities be undertaken anyway. The standard also allows for project developers to make claims when a law is in existence but is not enforced e.g.

if heavy logging happens in an area that is pro forma under protection.

Step 2: Barriers: Financial, Lack of Capacity, Institutional or Market Barriers or Common Practice: Several additionality tests are required. The project proponents must provide analyses (poverty assessments, farming knowledge assessments, remote sensing analysis, etc) showing that without the project, improved land-use practices would be unlikely to materialize.

Baselines & Methodologies

CCBS relies on methods and tools developed by other organizations and standards for their baseline calculations. For example, to estimate net change in carbon stocks they accept the methodologies of the IPCC's Good Practice Guidance (IPCC GPG) and any methodology approved by the CDM.

The baseline calculations must be based on clearly defined and defendable assumptions about how project activities will alter carbon stocks and non-CO_2 GHG emissions over the duration of the project or the project accounting period.

4. Validation & Registration

Process

Once a project has been designed, a third-party auditor validates the project. After reviewing relevant project documents, a site visit, and taking account of the comments received during a 21-day public comment period, the auditor approves or rejects the project. The CCB Alliance works very closely with the auditors, commenting on and reviewing project documentation. Yet is it is ultimately the auditor who makes the decision to approve or reject a project.

Key Requirements

The CCBS include fifteen required criteria and eight optional "point-scoring" criteria. Silver or Gold status is awarded to exceptionally designed projects that go beyond the basic requirements. Such Gold and Silver projects use primarily native species, enhance water and soil resources, build community capacity, and adapt to climate change and climate variability.

5. Monitoring, Verification & Certification

Process

To keep its CCB validation, each project must be verified every 5 years. Verification includes a project document review by the auditor and a site visit to check on project implementation and monitoring results in addition to any changes in project design.

The validation and the verification can be done by the same auditor. Currently all of the CCB projects are less than 5 years old and have therefore not yet been verified. CCBA intends to develop and publish further rules and guidance on project verification.

Key Requirements

The CCB verification does not include a quantitative certification of the carbon benefits but is a qualitative evaluation that confirms carbon benefits as well as the environmental and social benefits of the project.

6. Evaluation of Auditors

The accreditation of auditors lies with the CCB Alliance currently limited to DOE's accredited by CDM EB for Afforestation and Reforestation auditors accredited by the Forestry Stewardship Council (FSC). There is no formal procedure in place to "spot check" auditors but the CCB Alliance could potentially decide to ban or restrict certain auditors that under-perform.

7. Registries

Because CCBS is a Project Design Standard it does not have a registry accredited for its offsets.

8. Fees

Cost for validation of a project rages from €3,500 to €10,000. If the validation is being done in conjunction with CDM, validation costs are lower for CCBS than for stand alone projects, because many of the requirements for CCBS will already have been fulfilled through the CDM requirements (e.g. baseline calculations).

Authors' Comments on CCBS

Project Design Standard

The CCBS is intended to be used as a design tool to ensure robust multiple-benefits will be delivered. Project design standards for forestry projects are especially valuable and important, since carbon verification standards typically do not come into play until many years after the project has been designed and after upfront investment has been secured.

Co-Benefits
CCBS emphasizes the social and environmental benefits of projects and has developed a set of useful tools and guidelines to ensure and measure these co-benefits. Some of their criteria are quite specific (e.g. biodiversity rules) while others are defined in very general terms (e.g. stakeholder and capacity building rules). Using general language to define requirements gives the project developer the flexibility to address the issue in a way that fits the project best yet it also places more onus on the auditor's judgment when making the assessment. Quality of projects can therefore only be assured if auditors are truly independent and adhere to high standards in their work.

No Separation of Verification and Approval of Projects
Under the CCBS it is the auditors themselves that approve the projects. Given the pressures on auditors and conflict of interest discussed earlier, we see the lack of an accrediting board as a potential weakness of the CCBS.

The CCBA is currently working fairly actively with auditors, because the validation procedures have only recently been defined and some initial guidance was needed. Also, the CCBA has been soliciting auditor feedback to help inform the development of the 2nd edition of the CCBS (to be developed in 2008). However, CCBA expects less and less engagement with projects and auditors. This separation of CCBA, auditors and project developers is needed since it helps minimize a potential conflict of interest between the project developer and the CCBS.

PLAN VIVO SYSTEM

www.planvivo.org

1. Introduction

Type of Standard
Plan Vivo is an Offset Project Method for small scale LULUCF projects with a focus on promoting sustainable development and improving rural livelihoods and ecosystems. Plan Vivo works very closely with rural communities, emphasizes participatory design, ongoing stakeholder consultation, and the use of native species. The Plan Vivo Foundation certifies and issues only ex-ante credits, called *Plan Vivo Certificates,* and therefore does not verify ex-post offsets.

History of Standard
The Plan Vivo System was initiated in 1994 for a research project in southern Mexico. The system was developed by the Edinburgh Centre for Carbon Management (ECCM, ***http://www.eccm.uk.com/***), a consulting company that focuses on climate change mitigation strategies and policies, in partnership with El Colegio de la Frontera Sur (ECOSUR), the University of Edinburgh and other local organisations with funding from the UK Department for International Development (DFID).

Administrative Bodies
Plan Vivo is currently managed by the Plan Vivo Foundation (formerly BioClimate Research and Development), a non-profit focused on promoting actions to reconcile human development and environmental change. The Foundation reviews and registers projects according to the Plan Vivo System, issues Plan Vivo Certificates annually following the submission and approval of each project's annual report, and acts as overall 'keeper' of the Plan Vivo System which is periodically reviewed in consultation with projects and other stakeholders. It also approves third-party verifiers and registers resellers of Plan Vivo Certificates.

Consultants are hired by Plan Vivo to review certain aspects of their projects. Because of the small number of projects, there is no established procedure for this. The Plan Vivo Foundation also conducts frequent field visits to projects in order to monitor their progress and see that evaluations are done as needed.

Project Developers: Plan Vivo works with local NGOs who function as project developers ('project coordinators'). They coordinate sales with the offset purchasers and administer payments to local farmers based on the achievement of 'monitoring targets'.

Financing of the Standard Organisation
The financing of the Plan Vivo Foundation is sourced primarily from a levy imposed on the issuance of Plan Vivo Certificates. They currently take USD 0.30 per tonne of carbon dioxide sold. Other sources of income come from project and resellers' registration fees.

Recognition of Other Standards
Plan Vivo does not currently work in conjunction with other standards.

Number of Projects

Plan Vivo currently has three projects (in Mexico, Uganda and Mozambique) and a few more are currently being reviewed.

Ex-Ante Sale of Carbon Offsets

Plan Vivo exclusively certifies ex-ante credits.

2. Eligibility of Projects

Project Type

Plan Vivo accepts the following project types: forest restoration; agroforestry/small plantations; forest protection and management; soil conservation and agricultural improvement.

Project Location

Plan Vivo projects are located in developing countries.

Project Size

There is no minimum or maximum size limitation for Plan Vivo projects. Projects generally expand in size over a number of years as more farmers hear about the project, learn more about the notion of selling carbon as a commodity and see it working in practice. The current Plan Vivo projects range in size from a carbon offset potential of 10,000 tCO_2/ yr to 100,000 tCO_2/yr.

Start Date

In order to sell Plan Vivo Certificates, projects must first be registered as Plan Vivo projects. There is no time restriction on this.

Crediting Period

The crediting period varies from project to project. Farmers are reimbursed for sequestration activities for 5-15 years, yet carbon benefits are calculated over much longer time periods of up to 150 years.

CDM Pre-Registration Credits

N/A

Project Funding Restriction

No restrictions are imposed on funding sources. On the contrary, since carbon finance only becomes available once a project has gone through the process of feasibility studies, detailed project design, extensive training and registration, many projects rely on co-funding through other means during the initial stages. Projects are designed so that carbon payments will sustain the projects once they are fully functional..

Environmental & Social Impacts

Plan Vivo requires that all its projects provide additional benefits to the local environment and community through the development of sustainable land-use systems, planting of native species, and promotion of sustainable and improved livelihoods through the diversification of income sources. Metrics for quantifying environmental and social benefits of Plan Vivo projects have recently been revised and standardized and can now be found in the Plan Vivo Standards.

Leakage

Leakage at individual plot level

To minimize leakage, each producer must show that they are not reducing their agricultural output below sustainable levels. In other words, a Plan Vivo project will not be registered unless the producer can live sustainably from their land under the plan , and has identified management objectives beyond receiving carbon payments (e.g. sustainable timber production, fruits or other non-timber products, agro-forestry).

Leakage at project level

Leakage is assessed for each land-use activity in the technical specifications, considering the local and regional trends, identifying potential leakage risks and mechanisms for controlling them. Some examples are given in the following table:

Land use activity	Potential leakage	Mitigation
Afforestation	Planting trees on agricultural land leads to further deforestation as farmers clear new areas of forest to plant crops	Ensure that farmers have sufficient land for agriculture and tree-planting
Forest Conservation	Leads to increased harvesting in other areas in order to meet demand for timber	Ensure that Plan Vivo management plan includes actions to improve sustainable timber production

Permanence

The Plan Vivo System contains a number of mechanisms that ensure permanence:

- Projects are initially assessed for their long-term viability, taking into account issues such as the organisational capacity and experience of all partners involved and the stability of the area.
- Producers selling carbon through the Plan Vivo System must enter into long-term sale agreements (contracts) with the in-country project coordinator which ensures that payments are made following monitoring against measurable and realistic goals.
- Producers must hold land tenure agreements (or community concession or similar usufruct rights) to demonstrate long-term ownership of land.

- All producers are under obligations to re-plant where trees die, for example from disease or extreme weather events, or if harvested for timber.
- Projects are internally monitored by Plan Vivo through the approval of annual reports and site visits.
- Each project maintains an unsold reserve of carbon credits called a risk buffer. The level of the risk buffer is set by the Plan Vivo Foundation according to its risk assessment of the project (normally 10-20%). The aim of the risk buffer is to cover any unexpected shortfall in carbon credits supplied to purchasers, for example due to extreme weather events, inaccuracies in baseline assumptions or producers defaulting on sale agreements.

3. Additionality and Baselines

Additionality Requirements

The additionality tools for Plan Vivo are project based. Additionality may be demonstrated through an analysis of the barriers to implementing activities in the absence of the project. These could include, for example, lack of finances, lack of technical expertise or prohibitive political or cultural environments. Only native species, which are unlikely to be planted without financial incentives in many countries where seedlings are difficult to find, may be planted. Commercial forestry projects are excluded from participation.

Baselines & Methodologies

Baselines are calculated at the project level and also modelled at the regional scale. Carbon sequestration potential, for the sale of ex-ante credits, is calculated on a per hectare basis for a specified length of time using information on the management regime, growing conditions, proposed species, growth rates, and proposed planting densities.

Technical specifications which describe the methodologies for and carbon potential of each land-use system (e.g. boundary planting, mixed species woodlot etc.) are commissioned by the Plan Vivo Foundation. All existing technical specifications can be viewed in the project pages of the Plan Vivo website (***www.planvivo.org***).

All Plan Vivo Technical Specifications are currently being externally reviewed by independent organisations including the University of Edinburgh and TerraCarbon. When this process is concluded the Plan Vivo Technical Advisory Board will discuss the results and the Plan Vivo Foundation will commission revisions and new Technical Specifications as necessary.

4. Validation & Registration

Process

Projects must register as Plan Vivo Concepts, which involves a desk review of the project's long-term viability. The project developer must describe the proposed project area and proposed activities and identify its sustainable development aims in consultation with the communities.

Key Requirements

Projects can be registered as Plan Vivo projects once they have:

1. A Plan Vivo Foundation approved set of technical specifications (used for describing land-use activities, carbon accounting, prescribing risk and other management activities and monitoring indicators and containing analyses of leakage, additionality and permanence)
2. A Plan Vivo Foundation approved operational manual (for describing project governance, systems for evaluating and monitoring Plan Vivos, administering payments and community-led planning)
3. Been validated by an expert reviewer chosen by BR&D.

5. Monitoring, Verification & Certification

Process

Monitoring is conducted throughout the crediting period by local technicians based on the protocol and indicators identified in the technical specifications of the Plan Vivo project approved by the Plan Vivo Foundation during project validation**.**

All operational projects must conduct and submit annual reports to the Plan Vivo Foundation using the standard Plan Vivo Annual Reporting Template. This report contains a full update of the project's status and development, including what sales and payments have been made, the results of monitoring and outcomes of consultations. The Plan Vivo Foundation reviews each annual report and issues Plan Vivo Certificates after approval of the report. Approval of annual reports may be qualified by imposing corrective actions, if the report shows the project fails to act in full compliance with the Plan Vivo System or Plan Vivo principles.

The Foundation may choose to follow up corrective actions with site visits where it is deemed necessary.

The local project coordinators monitor the work of each individual farmer and pay them when they are found to have reached their targets. The exact payment schedule varies with each project, but normally involves periodic monitoring and payments over periods of 10–15 years.

The Plan Vivo System currently does not require third-party verification, but has procedures for assisting projects in preparing for and choosing a verifier which must verify the project according to the Plan Vivo System (terms of reference are provided by the Plan Vivo Foundation). In the future as there are more Plan Vivo projects, it is likely that more specific verification requirement rules will be instituted.

Key Requirements

Each project must develop its own internal Monitoring Protocol based on the monitoring of indicators prescribed in the project's technical specifications. Any change to the Monitoring Protocol must be reported to the Plan Vivo Foundation in the project's annual report.

Specific requirements for each producer are set out in their individual sale agreement with the project coordinator. For example, a producer may receive 20% of the total payment after completing 50% of planting, and a further 10% after one year provided they have completed 100% of the planting.

6. Evaluation of Auditors

Plan Vivo has no formalized process to evaluate and sanction auditors in case of underperformance.

7. Registries

The Plan Vivo Foundation maintains a registry of carbon credits sold from Plan Vivo projects and issues Plan Vivo Certificates to purchasers accordingly. All carbon credits are sold as ex-ante payments. Each Certificate has a unique serial number which can be traced back to the project and exact producer, which ensures there is no double-counting of carbon credits.

8. Fees

Costs vary from project to project. Example operational costs can be found in project annual reports which can be viewed on the Plan Vivo website (***www.planvivo.org***).

The Plan Vivo Foundation currently charges no validation fee but takes a levy of USD 0.30 per Certificate issued. The Plan Vivo Foundation plans to implement registration fees for both projects and resellers, which are expected to be nominal amounts to cover administrative costs.

Authors' Comments on Plan Vivo

Grass-Roots Approach

Plan Vivo is a small standard organisation that works closely with rural communities. Because of the grass-roots approach of Plan Vivo, conservation and community benefits are very high, yet standards of this type usually remain small because they are very costly compared to cheap carbon options available on a globally traded carbon market. It is likely that Plan Vivo will stay small and not grow its portfolio beyond a handful of projects.

Ex-Ante Offsets

Farmers who participate in Plan Vivo are paid in regular installments over 10-15 years, yet they are expected to keep their trees standing for many decades. Plan Vivo's offset calculations are based on the trees remaining standing for decades after payments have ceased. Once all payments have been made to the farmers, there are no repercussions for farmers who decide to cut their trees down. Plan Vivo argues that the threat of non-compliance is largely mitigated through their project design: all Plan Vivo projects strive to improve the livelihoods of farmers and it is therefore in their own (economic) interest to keep the trees standing even after offset payments have ceased.

The authors welcome Plan Vivo's multi-benefit, grassroots approach that aims to help the very poorest, something that many larger offset projects and the CDM as a whole have so far failed to do (Schneider, 2007). Yet ex-ante credits cannot guarantee that actual emissions reductions will be realized. This should be clearly communicated to prospective buyers: Plan Vivo projects have high co-benefits but the carbon offsets are less secure than with ex-post credits.

7.5 Offset Accounting Protocols

Offset Accounting Protocols provide definitions and procedures to account for GHG reductions from offset projects yet they have no associated regulatory or administrative bodies and do not define eligibility criteria, or procedural requirements. Many of the full-fledged standards are based on such protocols, for example the VCS uses ISO-14064 methodologies. Below we describe the GHG Project Protocol and ISO 14064.

GHG PROTOCOL FOR PROJECT ACCOUNTING

www.ghgprotocol.org

1. Introduction

Type of Standard

The GHG Protocol Initiative has developed two separate protocols. The *Corporate Accounting and Reporting Standard* covers accounting for corporate GHG emissions inventories. The *GHG Protocol for Project Accounting* is an offset accounting protocol. It is a tool for quantifying and reporting GHG emissions reductions from GHG mitigation projects. It does not focus on verification, enforcement or co-benefits. We discuss only the latter and refer to it as the *GHG Protocol*.

History of Standard

The GHG Project Protocol was jointly developed by the *World Business Council for Sustainable Development (WBCSD)* and the *World Resources Institute (WRI)* in partnership with a coalition of businesses, NGOs, governmental and inter-governmental organizations. The initiative was launched in 1998 with the aim of developing internationally accepted GHG accounting and reporting standards. The Corporate Accounting and Reporting Standard (revised edition) was published in 2004. The GHG Protocol for Project Accounting was finalized and published in December 2005.

Administrative Bodies

The GHG Protocol is developed by the WRI and the WBCSD:

The World Resources Institute (WRI) is an environmental think tank "that goes beyond research to create practical ways to protect the Earth and improve people's lives. [WRI's] mission is to move human society to live in ways that protect Earth's environment for current and future generations. [WRI's] programme meets global challenges by using knowledge to catalyze public and private action." (GHG Protocol, p. 145)

The World Business Council for Sustainable Development (WBCSD) is a coalition of 175 international companies "united by a shared commitment to sustainable development via the three pillars of economic growth, ecological balance and social progress. [WBCSD's] members are drawn from more than 30 countries and 20 major industrial sectors." (GHG Protocol, p. 145)

Financing of the Standard Organisation

The development of the GHG Project Protocol for Project Accounting was supported by numerous companies, organisations, and governmental sponsors, including Energy Foundation, US AID, US EPA, BP, Chevron Corporation, Ford, International Paper, SC Johnson, Dow, and Environment Canada.

Recognition of Other Standards

The GHG Project Protocol is programme neutral and is often used in conjunction with other standards or programs.

Number of Projects

N/A

2. Eligibility of Projects

Project Type

The GHG Project Protocol can be used to develop any project type. The protocol is supplemented with more specific guidelines for accounting for GHG emissions reductions in grid-connected electricity and LULUCF projects.

Project Location

Not defined under the GHG Protocol

Project Size

Not defined under the GHG Project Protocol

Start Date

Not defined under the GHG Project Protocol

Crediting Period

The protocol does not specify the duration of the crediting period and advises the project developer to err on the side of conservativeness.

The protocol recommends that the following aspects be taken into account when determining a crediting period:

- The pace at which economic conditions, technologies or practices are changing.
- The point at which the underlying assumptions, the barriers or the net benefits are likely to change significantly.

- Whether the baseline emissions are static or dynamic.

CDM Pre-Registration Credits
N/A

Project Funding Restriction
Not defined under the GHG Project Protocol

Environmental & Social Impacts
GHG Project Protocol does not address environmental and social impacts as they are not directly related to GHG reduction accounting and quantification per se. It acknowledges the importance of these issues but leaves it to the users of the protocol to determine policies in this regard and incorporate them in their programme's or standard's requirements.

3. Additionality and Baselines

Additionality Requirements
The GHG Protocol contains no formal requirements for additionality determination. It discusses additionality conceptually with respect to baseline determination (see below), but doesn't require specific additionality tests.

Baselines & Methodologies
The GHG Project Protocol offers guidance on the use of both project-specific and performance-based methods for estimating the baseline in a project. The protocol recommends the use of the performance standard procedure when:

- a number of similar projects are implemented
- obtaining verifiable data on alternatives to the project activity is difficult
- the project developer intends to keep confidential data that would need to be revealed if a project-specific standard were used
- the number of baseline candidates is limited or the GHG emission rate data for baseline candidates are difficult to obtain.

4. Validation & Registration

Process
The GHG Project Protocol is only an accounting guidance document, and therefore does not provide guidance on validation or registration.

Key Requirements
N/A

5. Monitoring, Verification & Certification

Process
The GHG Project Protocol requires a plan for monitoring GHG emissions related to the primary and relevant significant secondary GHG effects of a project within the scope of the assessment boundary. The GHG Project Protocol does not cover verification or certification.

Key Requirements
The monitoring plan must describe the quality assurance and quality control measures that will be employed for data collection, processing and storage. It also requires the monitoring of data related to baseline parameters and assumptions to ensure their continuing validity.

6. Evaluation of Auditors
N/A

7. Registries
N/A

8. Fees
The GHG Project Protocol is free and publicly available for any GHG programme or project developer to use.

Author's Comments on GHG Protocol

The GHG Project Protocol can be used as a building block for a full-fledged offset standard. As such, it is a useful tool and has been used by many regulatory and voluntary schemes.

In this paper we evaluate the overall quality of offset standards rather than protocols. It would therefore go beyond the scope of this paper to comment on the specifics of the GHG Protocol.

ISO 14064

http://www.iso.org

1. Overview

Type of Standard

ISO 14064 is an offset protocol. It is an independent, voluntary GHG project accounting standard, and is deliberately policy neutral. The ISO 14064 standard consists of three parts. The first part (14064-1) specifies requirements for designing and developing organisation or entity-level GHG inventories. The second part (14064-2) details requirements for quantifying, monitoring and reporting emission reductions and removal enhancements from GHG projects. The third part (14064-3) provides requirements and guidance for the conducting of GHG information validation and verification.

Unlike the GHG Project Protocol, which has specific guidelines on what tools and accounting methods to use, ISO 14064 gives guidance on what to do but does not spell out the exact requirements. The requirements are usually spelled out only in general terms. For example, ISO points out that additionality needs to be taken into account but does not require a specific tool or additionality test to be used. These would be defined by the GHG programme or regulation under which ISO 14064 is used. ISO 14064 does not focus on co-benefits.

History of Standard

ISO 14064 was developed over several years by the International Organisation for Standardization (ISO). It was launched in the spring 2006.

Administrative Bodies

ISO (International Organisation for Standardization) is the world's largest developer and publisher of International Standards. ISO is a non-governmental organisation that forms a bridge between the public and private sectors. It is a network of the national standards institutes of 157 countries.

Financing of the Standard Organisation

ISO's national members pay subscriptions to cover the operational cost of ISO's Central Secretariat. The subscription paid by each member is in proportion to the country's Gross National Income and trade figures. Another source of revenue is the sale of standards. The cost for ISO 14064 is around € 85 for each of the three standards.

Recognition of Other Standards

Because ISO 14064 is an Offset Standard Protocols and not a full fledged offset standard it provides definitions and procedures to account for GHG reductions yet does not define eligibility criteria. ISO 14064 is therefore intended to be used in conjunction with other regulations or standards. For example, the procedures for the VSC are based on ISO 14064.

ISO 14064 is intended by be programme-neutral and the requirements of the programme under which ISO is used take precedence to the ISO rules.

Number of Projects

N/A

2. Eligibility of Projects

Project Type

Not defined under ISO 14064.

Project Location

Not defined under ISO 14064.

Project Size

Not defined under ISO 14064.

Start Date

Not defined under ISO 14064.

Crediting Period

Not defined under ISO 14064.

Project Funding Source

Not defined under ISO 14064.

Project Funding Restriction

Not defined under ISO 14064

Environmental & Social Impacts

The requirements are listed in only general terms: an Environmental Impact Assessment (EIA) is required if the host country or region requires the completion of such an assessment.

ISO also specifies that relevant outcomes of stakeholder participation have to be presented.

3. Additionality and Baselines

Additionality Requirements

ISO 14064-2 contains no formal requirements for additionality determination but offers general guidelines. The guidelines for additionality tools generally assume a project-specific approach. However, since the requirements of a GHG programme take precedence over specific ISO 14064-2 requirements ISO 14064-2 allows performance standards to be used where this is prescribed by a GHG programme.

Baselines & Methodologies

ISO 14064-2 does not prescribe baseline procedures, but rather offers general requirements and guidance on how to determine a project baseline.

4. Validation & Registration

Process

ISO 14064-2 strongly recommends the use of third-party auditors but it is a requirement to do so only if the party wants to make its GHG claims public.

ISO 14064-3 defines the validation and verification process. "It specifies requirements for selecting GHG validators/verifiers, establishing the level of assurance, objectives, criteria and scope, determining the validation/verification approach, assessing GHG data, information, information systems and controls, evaluating GHG assertions and preparing validation/verification statements," (ISO-14064-3) Validation and verification requirements are stated together with few distinctions between the two.

Key Requirements

ISO 14064 does not require validation or verification. Such requirements are usually elements of a GHG programme. If a GHG project has not been linked to a specific GHG programme, the project proponent has to decide on the type of validation and/or verification (1st, 2nd or 3rd party verification) and the level of assurance (e.g. high or moderate) required against the GHG assertion. The GHG assertion is a statement on the performance of the GHG project usually made by the project proponent. ISO 14064-3 specifies principles and requirements for the validation and verification of GHG assertions. (ISO 14064-2)

5. Monitoring, Verification & Certification

Process

ISO defines criteria in general terms: Project proponents must establish the criteria and procedures for project monitoring, including selecting or establishing "criteria and procedures for selecting relevant GHG sources, sinks and reservoirs for either regular monitoring or estimation."

Key Requirements

Project only have to be verified if they are reported publicly. Project proponents must identify and justify which GHG sources, sinks, and reservoirs will be monitored.

Monitoring procedures should include the following:

a) *purpose of monitoring;*
b) *types of data and information to be reported, including units of measurement;*
c) *origin of the data;*
d) *monitoring methodologies, including estimation, modelling, measurement or calculation approaches;*
e) *monitoring times and periods, considering the needs of intended users;*
f) *monitoring roles and responsibilities;*
g) *GHG information management systems, including the location and retention of stored data.*

6. Evaluation of Auditors

ISO 14065 was released in 2007 and spells out the requirements for greenhouse gas validation and verification bodies for project accreditation and emissions reductions verifications.

ISO is currently developing ISO 14066 which will outline how individuals can get accredited auditors and how auditors will be reviewed.

It is not yet clear how ISO will supervise the work of its GHG project auditors.

7. Registries

Not applicable

8. Fees

The purchase cost of each of the three ISO standard manuals is around € 85.

Author's Comments on ISO 14064

ISO 14064 can be used as a building block for a full-fledged offset standard. As such it is a useful tool and has been used by many regulatory and voluntary schemes.

In this paper we evaluate the overall quality of offset standards rather than protocols. It would therefore go beyond the scope of this paper to comment on the specifics of the ISO 14064.

8. Governmental Action to Regulate the Voluntary Market

Several governments have expressed concern about the lack of quality control in the voluntary market and are starting to explore possibilities to regulate the voluntary market.

United Kingdom

In early 2007, the UK's Department for Environment, Food and Rural Affairs (DEFRA) launched their consultation process for establishing a code of best practice for voluntary carbon offsetting. The code is meant to:

1. educate consumers about offsetting and its role in addressing climate change
2. enable consumers to make choices about offsetting
3. increase consumer confidence
4. show offset providers the quality and verification standards to which they should aspire

In February 2008 DEFRA released its code of best parctice, initially limiting it to credits that have been certified and issued by the UN, such as CERs and ERUs. Although the code of practice currently excludes VERs, these might be included at a later point. Such VERs would have to prove that they are additional and permanent, avoid leakage, are verified, transparent and not double counted[*].

Norway

In mid 2007, the government of Norway announced that it will set up a web-based system for consumers for purchasing and cancelling CER offsets. Starting in April 2008, Norway will allow private consumers, businesses and organizations to purchase and cancel UN-backed carbon credits from a government website, in an effort to ease concerns over the quality of offset credits.

In July 2007, The US House of Representatives Select Committee on Energy Independence and Global Warming hosted a hearing on voluntary carbon offsets "to explore the issues of transparency, effectiveness and other necessary questions to ensure carbon offsets can be a responsible way to address global warming on a consumer-based level."[†]

France

The ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie; ***www.ademe.fr***), a public agency under the joint supervision of the Ministries for Environment and Education and Research, is currently developing a *Charter of Good Practice* for offset providers in France. The charter will standardize definitions and methodologies, and provide transparent and homogeneously rated information on offset projects in terms of their environmental and social impacts. Offset providers can sign on to the charter and agree to having their projects evaluated. ADEME will make its information available to the public via a website.[‡]

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* ***http://www.defra.gov.uk/environment/climatechange/uk/carbonoffset/codeofpractice.htm***, accessed on Fed 22, 2008

† ***http://www.house.gov/apps/list/press/global_warming/July18CarbonOffsets.shtml***, accessed Nov 16, 2007

‡ Charte de bonnes pratiques des opérateurs de compensation volontaire, ***http://ademe.fr***, accessed Nov 16 2007

9. **Overall Standard Ratings & Conclusions**

*"For every complex problem, there is a solution that is simple, elegant, and wrong." (*Henry Louis Mencken 1880–1956)

In order to preserve a high probability of keeping global temperature increase below 2 degrees Centigrade, current climate science suggests that atmospheric CO_2 concentrations need to peak below 450ppm. This requires global emissions to peak in the next decade and decline to roughly 80% below 1990 levels by the year 2050 (Baer and Mastrandrea, 2006). Such dramatic emissions reductions require a sharp move away from fossil fuel, significant improvements in energy efficiency and substantial reorganisation of our current economic system. This transition can only be achieved by far-reaching national and international climate policies.

Carbon offset markets have been promoted as an important part of the solution to the climate crisis because of their economic and environmental efficiency and their potential to deliver sustainability co-benefits through technology transfer and capacity building. The voluntary offset market in particular has been promoted for the following reasons:

Possibility of Broad Participation
The voluntary carbon market enables those in unregulated sectors or countries that have not ratified Kyoto, such as the US, to offset their emissions.

Preparation for Future Participation
The voluntary carbon market enables companies to gain experience with carbon inventories, emissions reductions and carbon markets. This may facilitate future participation in a regulated cap-and-trade system.

Innovation and Experimentation
Because the voluntary market is not subject to the same level of oversight, management, and regulation as the compliance market, project developers have greater flexiblility to implement projects that might otherwise not be viable (e.g. projects that are too small or too disaggregated).

Corporate Goodwill
Corporations can benefit from the positive public relations associated with the voluntary reduction of emissions.

Most importantly, voluntary and compliance offset mechanisms have the potential to strengthen climate policies and addres equity concerns:

Cost-effectiveness that allows for deeper caps or voluntary commitments.
By decreasing the costs of reductions, offsets can in principle make a compulsory mandate more politically feasible and a voluntary target more attractive, thereby accelerating the pace at which nations, companies, and individuals commit to reductions.

Higher overall reductions without compromising equity concerns.
One of the greatest challenges of climate protection is how to achieve the deep global emissions reductions required while also addressing the development needs of the poor. Historically, developed nations have been responsible for a much larger share of the increase in atmospheric GHG concentrations than developing countries. But to achieve climate stabilisation, emissions must be curbed in all countries, both rich and poor. Offsets may be one way out of the conundrum of needing to achieve steep global emissions reductions while at the same time allowing poor nations to develop. This has not been the case thus far because the emissions reductions undertaken have been too small to be significant. Small reduction targets allow participants to tinker at the margins and avoid the kind of restructuring that is needed to achieve climate stabilizations. While taking on considerable domestic emissions reductions, industrialized countries could, through offsets, help finance the transition to low-carbon economies in

developing nations. In other words, offsets might allow equity to be decoupled from efficiency, and thus enable a burden-sharing arrangement that involves wealthier countries facilitating mitigation efforts in poorer countries*.

Yet as experience with offset markets grows, their shortcomings have become more widely understood. The main points of criticism against carbon offsetting include:

Carbon Offsets May Stifle Action At Home
Carbon offsetting enables industrialized nations to avoid taking action domestically, corporations to continue inefficient and unsustainable production methods, and individuals to perpetuate unsustainable lifestyles. While the cost-effectiveness arguments for offset markets should not be dismissed, it is important to note that they are based on somewhat oversimplified interpretations of the required transition to a low-GHG economy.

It is true a tonne of carbon has the same impact on atmospheric GHG concentrations regardless of its source, and therefore "cheap" reductions are equivalent to "costly" reductions. However, different reductions have varying *long-term* impacts in terms of technological innovation, market transformation, and infrastructural transition. For example, a reduction that comes from fuel switching from oil to gas may be cheaper than a comparatively costly investment in a public transit system, but is much less effective at facilitating change in the long-term. The former may be based on entirely conventional technology and undone as soon as relative fuel price incentives reverse. By contrast, the latter may help to advance a relatively novel practice (e.g., hybrid bus rapid transit), curb sprawl by making a denser urban core more attractive, and demonstrate appealing alternatives to automobile dependence. For this reason, market mechanisms alone are not sufficient to address climate change, and complementary policies that prioritise a long-term transition to a low carbon economy are needed.

Unintended Negative Impact on Policies
Carbon markets can create barriers to future regulation of emissions sources. Those who benefit from the sale of carbon offsets may oppose regulation that would deny them that stream of revenue.

Additionality Difficult to Test
Additionality tests attempt to establish that an offset project would not have happened in a business-as-usual scenario. The major weakness of offset systems centered on project-based mitigation is that emission reductions have to be measured against a counterfactual reality. The emissions that would have occurred if the market for offsets did not exist must be estimated in order to calculate the quantity of emissions reductions that the project achieves. This hypothetical reality cannot be proven; instead, it must be inferred and thus its definition is always to some extent subjective. Unless the issue of additionality is addressed effectively, it is unclear to what extent offsets can make a useful contribution to climate protection.

Unbalanced Market Dynamics and Free Riders
Although offset markets are relatively straightforward in principle, they have been anything but straightforward to implement in practice. In part, this may be attributed to the inevitable birthing pains associated with creating institutions and stabilizing new markets. But problems also arise from inherent structural problems inherent in the conception of offset markets. Offset markets lack a critical competitive check found in well functioning markets, in which the interests of buyer and seller are naturally balanced against each other. In offset markets, both the seller *and* the buyer benefit from maximizing the number of offsets a project generates. This issue can partially be mitigated by imposing stringent requirements for auditors and an additional approval process though the standard organisation (see chapter 5.6).

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* For an in-depth analysis of such a potential climate and equity framework, see the *Greenhouse Development Rights Framework* (Baer et al 2007)

Inherent Conflicts of Interest
To minimize the number of "free riders" most standards require third-part auditors to verify the emissions reductions. Yet auditors are chosen and paid by a project's developer. There is thus pressure on the auditors to approve projects in order to preserve their business relationships with the project developers. This compromises the auditors' independence and neutrality. To account for this dynamic, offset markets need an administrative infrastructure to ensure that auditors' estimates of project reductions are reasonable. This has proven to be a much greater challenge than anticipated (Schneider, 2007 & Haya, 2007).

Lack of Development Benefits
Although carbon markets – and specifically the CDM – are intended to deliver development co-benefits for their host countries, these have not been widely realized. In practice, offset projects often rely on relatively conventional technologies, and rarely benefit poor communities with insufficient access to energy services.

Carbon offsetting is a complex and multifaceted process. No offset standard will ever be able to simultaneously maximize quality, minimize cost, and ensure large co-benefits for all its projects, because the design of offset systems inherently involves tradeoffs between these factors. The relative wieght given to each of these considerations depends on the overall goals of each standard. Many standards for the voluntary offset market have only recently been developed. A full evaluation of how these standards perform in practice is thus not yet feasible. Yet, it is possible at this time to compare each standard's approach to minimizing the weaknesses and maximizing the strengths of offset schemes. The following sections and table summarize the most relevant aspects of each standard.

General Standard Information

Main Supporters
'Main Supporters' lists the type of stakeholder associated with each standard. Each of the reviewed standards has been developed and is supported by different groups of stakeholders. The types of stakeholders reflect to some extent the goal of the standard. For example, environmental NGOs tend to be more concerned about credit quality and co-benefits, whereas private actors in the carbon markets tend to put more emphasis on simplifying procedures to minimize costs.

Market Share
Not all standards are equally influential. 'Market Share' indicates the size of each of the standards, and thus to some extent reflects the standard's importance. With most standards, it is very difficult or impossible to get actual figures for the numbers of offsets sold. Some standards, such as the VCS 2007, were only recently released and do not yet have a history of transactions, so their market share is difficult to predict. This column therefore gives only a broad indication of the current and predicted market share of each standard.

Price of Offsets
'Price of Offsets' indicates the cost of one offset, representing the reduction of 1 tonne of CO_2e. Offset prices depend on many different parameters, such as the type of project, the location, market demand, stringency of the standard requirements, etc. The pricing given in this column indicates average prices for different projects (as of January 2008; see chapter 7). While it would be wrong to assume that low prices are necessarily an indication of lower quality offsets, it is true that very low priced carbon offsets are more likely to originate from projects that are non-additional. Since the revenue they produce is small, it is on average less likely that the offsets are vital to the project's feasibility. Industrial gas projects, which are low-cost mitigation options, are an exception to this general rule. These projects point to a second aspect of very low priced offsets: they usually do not have high co-benefits.

Authors' Comments

The Author's comments state the perceived goal of each standard and any relevant information about the standard. More in-depth commentary and information about each standard can be found in chapter 7.

Offset Quality Control

Additionality Tests (relative to CDM)

The CDM additionality tool (see appendix B) most commonly used for testing the additionality of CDM projects was developed carefully over several years. In this column it is used as a reference against which the other standards' project-based additionality testing procedures are compared:

+ Requirements go beyond and are more stringent than CDM rules
– Requirements are less stringent than CDM
= Requirements are the same or very similar to CDM
N/A Not Applicable

Although the CDM additionality tool is well respected, it does not guarantee that only additional projects are approved. Recent reports have shown that despite the fact that the additionality tool is required for all CDM projects; it is likely that a significant number of non-additional projects are registered (Schneider, 2007; Haya 2007). Similar studies have not yet been carried out for VER projects. It is therefore impossible to know if VER standards likely have a higher or lower percentage of additional projects. It remains to be seen how well these standards will succeed in implementing their additionality requirements.

Some of the standards, such as the VCS and the VER+, plan to develop performance-based additionality tools (also called benchmark tools). By shifting the tasks of establishing a baseline from the project developer to the standard-setting organisation, benchmark tools could potentially increase transparency and decrease administrative burden for project developers. Yet such approaches also harbour the danger of certifying too many free riders. Benchmark rules will have to be closely examined to ensure that they minimize or mitigate the effects of non-additional offsets (see chapter 5.1)*.

Third-party Verification Required

To minimize the number of "free riders" most standards require third-part auditors to verify the emissions reductions.

Separation of Verification and Approval Process

Fundamental differences exist among standards as to how projects are reviewed and approved. Under the CDM, projects are verified by third-party auditors and then reviewed, approved or rejected by the CDM Executive Board. Most voluntary offset standards do not have such a body to review and approve the projects after the auditors have verified them. Projects are simply approved by the auditors themselves. The lack of a standard body which approves projects exacerbates conflicts of interest, particularly where auditors are selected and paid for by the project developer. None of the voluntary standards have specific procedures in place to review the approved auditors nor to allow for sanctions against or the discrediting of an under-performing auditor (see chapter 5.6).

Registry

Carbon offset registries keep track of offsets and are vital in minimizing the risk of double-counting, that is, having multiple stakeholders take credit for the same offset. Registries also clarify ownership of offsets (see chapter 5.7).

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* Related to additionality are baseline calculations. The requirements for baselines methodologies are not included in this summary table but can be found in chapter 5.1.

Offset Project Information

Each standard accepts different types of offset projects. The CDM, for example accepts all projects that reduce the six GHGs listed in the Kyoto Protocol, with the exception of the protection of existing forests (REDD), nuclear energy, and HFC destruction from new facilities (see chapter 5.2).

Project Types
REDD = Reduced Emissions from Degradation and Deforestation
EE = Energy Efficiency
RE = Renewable Energy
LULUCF = Land Use, Land-Use Change and Forestry = Bio-Sequestration

Excludes Project Types with High Chance of Adverse Impacts
Some project types are more likely to have adverse social and environmental impacts. Some standards therefore exclude these projects types, such as tree plantations and monocultures which are detrimental to biodiversity and can negatively impact watersheds or large hydro projects, which can displace large numbers of people.

Sustainable Development

Co-benefits are social and environmental benefits that go beyond the GHG reduction benefits of offset projects. Such benefits include job creation, improved local air quality, protected and enhanced biodiversity, etc. The Clean Development Mechanism (CDM) was approved by developing nations specifically because offset projects were not only to provide cost-effective reductions for Annex 1 countries but also development benefits for the host countries. In other words, to qualify as a CDM project, the original intention was that a CDM project would have to deliver development benefits. In practice, the CDM has failed to consistently deliver such development and sustainability benefits (Holm Olsen, 2007; Sutter and Parreño, 2007; see chapter 5.5.)

Co-Benefits (relative to CDM)
Voluntary standards vary in their requirements for co-benefits. This column highlights the co-benefit requirements of each standard, comparing them to the requirements of the CDM.

Many of the voluntary carbon offset standards that have been developed in the last few years represent a step in the right direction. They help address some of the weaknesses in the current offsetting process and foster climate mitigation projects. The voluntary market in particular has helped to shape climate actions in countries that have thus far been reluctant to enact strong policies. Even with far reaching cap-and-trade policies expected to be enacted in the medium term, there will likely always be room for a voluntary market. The demand for voluntary offsets will come from private and corporate actors who wish to go beyond regulatory requirements and will be supplied by mitigation projects in sectors that are not capped. Well-designed standards will help the voluntary market mature and grow.

Main Supporters	Market Share	Additionality Tests (relative to CDM)	Third-party Verification Required	Separation of Verification and Approval Process	Registry	Project Types	Excludes Project Types with high chance of adverse impacts	Co-Benefits (relative to CDM)	Price of Offsets
Clean Development Mechanism									
UNFCCC Parties	large	=	yes	yes	yes	All minus REDD, new HFC, nuclear	no	=	€14–30
Authors' Comments:	The CDM is part of the Kyoto protocol and aims to create economic efficiency while also delivering development co-benefits for poorer nations. It has been successfull in generating large numbers of offsets. Whether it also has delivered the promised development co-benefits is questionable.								
Gold Standard									
Environmental NGOs (e.g. WWF)	small but growing	=/+[1]	yes	yes	Planned	EE, RE only	yes	+	VERs: €10–20 CERs: up to €10 premium
Authors' Comments:	The GS aims to enhance the quality of carbon offsets and increase their co-benefits by improving and expanding on the CDM processes. [1] For large scale projects the GS requirements are the same as for CDM. Yet unlike CDM, the GS also requires the CDM additionality tool also for small-scale projects.								
Voluntary Carbon Standard 2007 (VCS 2007)									
Carbon Market Actors (e.g. IETA)	new; likely to be large	=[2]	yes	no	Planned	All minus new HFC	no	-	€5–15 [3]
Authors' Comments:	The VCS aims to be a universal, base-quality standard with reduced administrative burden and costs. [2] The VCS plans to develop performance based additionality tests. These tools have not yet been developed and are thus not included in this rating. [3] Prices are for projects implemented under VCS ver. 1.								
VER+									
Carbon Market Actors (e.g. TÜV SÜD)	small but growing	=	yes	no	yes	CDM minus large hydro	yes	-	€5–15
Authors' Comments:	VER+ offers a similar approach to CDM for project developers already familiar with CDM procedures for projects types that fall outside of the scope of CDM.								
Chicago Climate Exchange (CCX)									
CCX Members and Carbon Market Actors	large in the US	-	yes	yes	yes	All	no	-	€1.2–3.1 [4]
Authors' Comments:	CCX was a pioneer in establishing a US carbon market. Its offset standard is part of its cap-and-trade programme. [4] Sales in USD: $1.8-4.5 per metric tonne (October 07-February 08)								
Voluntary Offset Standard (VOS)									
Financial Industry and Carbon Market Actors	N/A	=	yes	no	Planned	CDM minus large hydro	yes	=	N/A
Authors' Comments:	VOS closely follows CDM requirements and aims to decrease risks for offset buyers in the voluntary market.								
Climate, Community and Biodiversity Standards (CCBS)									
Environmental NGOs (e.g. Nature Conservancy) and large corporations	large for LULUCF	=	yes[5]	no	N/A	LULUCF	yes	+	€5–10
Authors' Comments:	The CCBS aims to support sustainable development and conserve biodiversity. [5] The CCBS is a Project Design Standard only and does not verify quantified emissions reductions.								
Plan Vivo									
Environmental and social NGOs	very small	=	no	no	yes [6]	LULUCF	yes	+	€2.5–9.5
Authors' Comments:	Plan Vivo aims to provide sustainable rural livelihoods through carbon finance. [6] It verifies and sells ex-ante credits only. Third party verification is not required but recommended.								

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Appendix A: **Renewable Energy Certificates (RECs)**

Are RECs equivalent to or fungible with emission offsets?*

Renewable Energy Certificates (RECs) are an environmental commodity created to provide economic incentive for electricity generation from renewable energy sources. Commonly, a REC is referred to as representing the environmental benefits attributed to one megawatt hour of electricity generated from a renewable energy resource. Yet the definitions of RECs as an environmental commodity are vague at best†. It might therefore be more correct to define a REC as "Representing the exclusive proof that one MWh of electricity was generated from an eligible renewable energy resource." (Gillenwater, 2007) Typically, RECs are sold separately from the electricity that is generated.

Regulated and voluntary REC markets exist in the United States, Europe and Australia. Both of these markets are growing rapidly. Voluntary markets are driven by large buyers such as corporations and institutional customers. In the US, renewable energy sales in voluntary markets have grown at rates ranging from 40% to 60% annually for the past several years. Collectively, the compliance and voluntary renewable energy markets made up an estimated 1.7% of total U.S. electric power sales in 2006. (Bird, 2007)

In the voluntary carbon offset market, RECs are increasingly being converted to and sold as carbon-offset equivalents. RECs and other renewable energy projects accounted for 33% of the voluntary carbon market and over half of those originated as RECs (Ecosystem Marketplace). Converted RECs, while often considerably cheaper than other offsets are highly controversial. To understand why, it is especially important to examine ***additionality*** and ***ownership*** issues.

Additionality

RECs are designed primarily to track renewable energy production. In the United States, for example, many states have established Renewable Portfolio Standards (RPSs) ‡. These standards require utilities to produce a certain percentage of their electricity with renewables. Utility companies can either choose to build new renewable facilities or buy RECs from other utilities who have more than met their requirement. Under an RPS, RECs function the same way allowances function in an emissions Cap-and-trade system. The lower the emissions cap, the more emissions reductions will be needed; the higher the RPS requirement is, the more renewable energy will have to be produced. In other words, In a quota system, additionality is not necessary for environmental integrity. Because of that RECs that are used in a quota system do not have to be tested for additionality. In the voluntary markets, RECs do not function under a quota and therefore have to be additional in order to fulfill their purpose of compensating for other emissions (see section on Additionality XXX)

Some certified RECs are tested for additionality. Yet these additionality tests are usually quite minimal: The *regulatory test* typically states that the same renewable generation must not be counted toward RPS compliance. The *technology test confirms* that electricity is generated from an eligible renewable energy technology (e.g. wind, solar, or geothermal). The *start date test* sets the earliest acceptable start date of a project (e.g. 1996). Projects that were built before the set start date are not eligible to produce RECs. To define RECs that have passed these three tests as additional, implies that all renewable energy generation capacity outside an RPS and built after 1996 were built because of the revenue they are generating from REC sales into the voluntary market.

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* Much of this section was informed by Gillenwater, 2007. His two papers offer an in-depth analysis of how RECs function in emissions markets.

† Many US states have not fully defined a REC or specified which environmental attributes must remain with renewable energy transactions for those transactions to count towards RPS compliance. For more information see Holt, 2007

‡ "As of the end of 2006, twenty-one [US] states and the District of Columbia had mandated RPSs in the United States. However, only eighteen of these states allowed the use of tradable RECs". (Gillenwater, 2007, p.4)

If RECs are converted to carbon offsets without any strict additionality testing, RECs will tend to come from cheaper business-as-usual (BAU) projects (which by definition are economic without additional REC incentives). These BAU projects will thus tend to dominate the market. Truly additional projects will not be able to compete because they face additional costs or barriers. In conclusion, the sale of non-additional RECs in voluntary market can potentially hamper truly additional projects and lead to increases in emissions.

However, these tests may not provide a complete picture of the whether a renewable project would have otherwise occurred, and in particular, the role that offset revenue might play in making a renewable energy project happen. To do this, the REC and RPS markets alone do not tell the full story. Many national and sub-national programs offer financial incentives for renewable energy projects (e.g. production tax credits, state/local tax incentives, and/or guaranteed feed-in or net metering tariffs) that may play a even more important role in funding renewable projects than REC (or offset) revenue. In other words, if the presumption is that a retired REC should count as an offset, the threshold question is whether REC revenue was sufficient to make a project "happen". The very fact that RECs trade for as little as 0.1c/kWh in some parts of the US (equivalent to perhaps USD 1-2/ tCO_2), and that production tax credits are worth about 1.8c/kWh in the US, casts some doubt [*]. Also, renewable electricity plants operate with very low variable operating costs because unlike fossil fuel plans, they do not incur fuel costs. Therefore, the additionality of RECs must be determined during the project design phase, not the operation phase. Projects shown to have been started with the expectation and need for REC revenues are likely to be additional.

Ownership

Offsets in general and RECs in particular face challenges about who has the right to claim ownership of a particular emission reduction. Establishing ownership of offset reductions from renewable energy projects is especially difficult. For example, if a wind farm is built, the emissions reductions could potentially be claimed by: the utility, the state the wind farm is located in, or the end-user of the electricity. Few policies are in place to prevent two parties from selling the same reduction or to prevent a single party from selling a reduction to multiple buyers. (see section on double counting XXX) This lack of clear ownership is exacerbated with RECs, the attributes of which are often defined in general and ambiguous terms, which makes assigning ownership more difficult. The lack of a consistent REC definition in the voluntary and the compliance REC markets prevents RECs from functioning as a homogeneous environmental commodity (Gillenwater, 2007).

RECs as Carbon Offsets

Because of the issues discussed above, the retirement of RECs does not automatically provide a solid basis for a GHG offsets. To do so, the following conditions should be met:

- The RECs originate from an RPS compliance market, with adequately ambitious RPS targets and the likelihood of strict enforcement (i.e. they create true scarcity)
- The attributes of RECs are clearly and unambiguously defined,
- Ownership issues have been resolved (e.g. through a registry)

If these conditions are met, then voluntarily buying and retiring RECs from a RPS compliance market could be an effective tactic to ensure genuine emissions reductions. Buying such RECs reduces their supply, leading to the implementation of more renewable energy projects to meet RPS targets.

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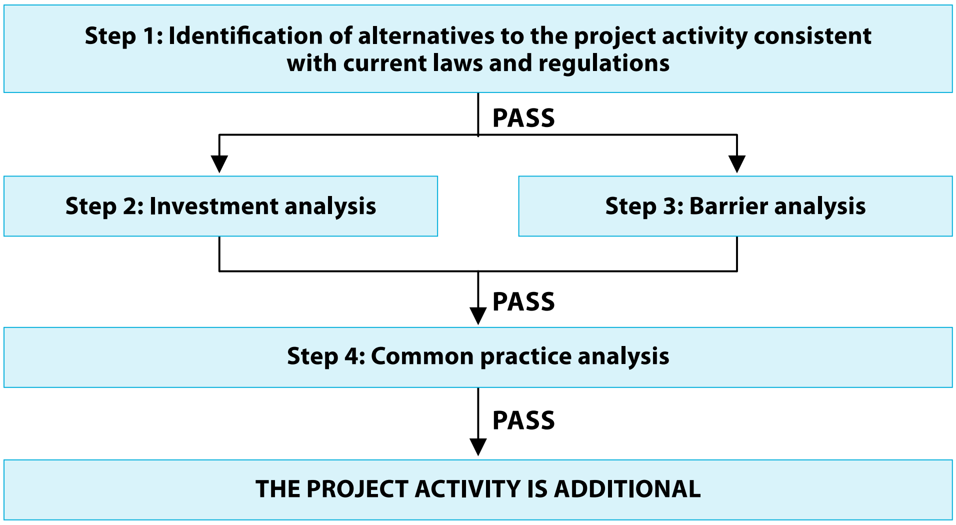
* The following is an excerpt from a BusinessWeek article:
The trouble stems from the basic economics of RECs. Credits purchased at $2 a megawatt hour, the price Aspen Skiing and many other corporations pay, logically can't have much effect. Wind developers receive about $51 per megawatt hour for the electricity they sell to utilities. They get another $20 in federal tax breaks, and the equivalent of up to $20 more in accelerated depreciation of their capital equipment. Even many wind-power developers that stand to profit from RECs concede that producers making $91 a megawatt hour aren't going to expand production for another $2. "At this price, they're not very meaningful for the developer," says John Calaway, chief development officer for U.S. wind power at Babcock & Brown, an investment bank that funds new wind projects. "It doesn't support building something that wouldn't otherwise be built." (Ben Elgin, Little Green Lies, October 29, 2007, BusinessWeek)

Yet a more fundamental issue remains: If a sector that currently generates voluntary RECs and VERs becomes part of a regulated market with its own emissions cap, voluntary offsets based on RECs may no longer be valid*. For example, a region's electric sector is capped, with allowances distributed to generators or retail electricity providers. If renewable energy projects in this region are reducing emissions from these capped sources, allowances are freed up. If these projects (e.g. via their RECs) claim offsets as well, this would lead to double counting for the same emission reductions. It is possible to avoid these double counting issues by designing a cap-and-trade system that enables offsets within capped sectors (by setting aside a fixed amount of allowances for up to that amount of offsets), but that has yet to occur in the GHG cap-and-trade systems implemented to date (EU ETS and RGGI).

* The voluntary market could also potentially create barriers to future regulation of sources. If a sector that currently generates voluntary RECs and VERs becomes part of a regulated market, that sector can no longer sell those voluntary RECs and VERs. Those who benefit from the current sales might therefore oppose regulation that would remove that stream of revenue from them.

Appendix B: **CDM Additionality Tool**

Flowchart of the CDM Additionality Tool Version 4



Source: UNFCCC (2004), EB-36 Report, Annex 13

Step 1: Identifying realistic and credible alternatives to the proposed project activity that are compliant with current laws and regulations
Compliance with existing laws and regulations is mandatory even if they are unrelated to GHG emissions. If the proposed project activity is not compliant with existing laws and regulations, then the project developer must demonstrate that the applicable laws and regulations are not systematically enforced, and that widespread non-compliance is prevalent. If this step is satisfied, then project developers need to satisfy either the investment analysis test (step 2) or the barrier analysis test (step 3), or both, before moving to demonstrate that the proposed project is not commonly practiced (step 4).

Step 2: Investment analysis to determine that the proposed project activity is not the most economically or financially attractive
If the proposed project produces no economic benefits other than CDM revenues, a simple cost method can be used to demonstrate that the project is not financially attractive without the CDM revenues. However, if the project does generate revenues other than CDM revenues, then an investment comparison analysis or a benchmark analysis using appropriate financial indicators should be applied. The financial analysis must also include a sensitivity analysis to show that the conclusion the financial attractiveness of the project is robust to reasonable variations in the critical assumptions.

If the analysis results in at least one of the alternatives being more financially attractive than the proposed project activity, then it would have satisfied the investment analysis test and the project developer can move directly to satisfy step 4 (common practice analysis). But if the project does not satisfy step 2, then the project developer needs to first fulfil step 3 before moving to step 4.

Step 3: Analysis of barriers that prevent the implementation of the proposed project activity or do not prevent the implementation of one of the other alternatives
In undertaking the barrier analysis test, project developers must assess barriers other than the financial barriers discussed in step 2. Such barriers may include investment barriers like the non-availability of private capital or technological barriers like the non-availability of skilled labour or higher technological risks under local conditions. To satisfy the barrier analysis test the project developer must demonstrate that the barrier identified prevents the implementation of the proposed project and does not prevent the implementation of the one of the identified alternatives. If this condition is satisfied, then the project developer can move directly to satisfy step 4. But if it is not satisfied, then the project developer must satisfy step 2 before moving to step 4.

Step 4: Analyze whether the proposed project activity is 'commonly practiced' by assessing the extent of diffusion of the proposed project activity
After demonstrating step 1 and either step 2, 3 or both, the project developer must demonstrated that the proposed project activity is not commonly practiced in the specified region. This is done by discussing other similar activities to the proposed project either to prove that no similar activities can be observed. If they are observed, then the essential distinctions between the proposed project and the observed similar projects must be explained. This step reinforces and complements claims made under the investment and/or barrier analyses. The satisfaction of this step means that the project is additional.

Appendix C: **Realized CDM Emissions Reductions**

Realized CDM Emissions Reductions By Project Category

CDM project with CERs issued (November 2007)

Type	Number of Projects	Issued kCERs	Issuance success
Agriculture	29	2019	49%
Biogas	3	274	87%
Biomass Energy	76	7328	90%
Energy Efficiency	26	6969	63–103%
HFCs	11	41570	93%
Hydro	44	3175	88%
Landfill gas	12	2301	35%
N_2O	4	17504	119%
Transport	1	59	51%
Wind	37	2257	74%
Total	259	85850	90%

For current and complete statistics, please see UNEP RISOE:
http://cdmpipeline.org/publications/CDMpipeline.xls

Appendix D: **Glossary**

Additionality: The principle that only those projects that would not have happened anyway should be counted for carbon credits.

Afforestation: The process of establishing and growing forests on bare or cultivated land, which has not been forested in recent history.

Annex 1 Countries: The 36 industrialized countries and economies in transition listed in Annex 1 of the UNFCCC. Their responsibilities under the Convention are various, and include a non-binding commitment to reducing their GHG emissions to 1990 levels by the year 2000.

Annex B Countries: The 39 emissions-capped industrialised countries and economies in transition listed in Annex B of the Kyoto Protocol. Legally-binding emission reduction obligations for Annex B countries range from an 8% decrease to a 10% increase on 1990 levels by the first commitment period of the Protocol, 2008–2012.

Assigned Amount Unit (AAU): A tradable unit, equivalent to one metric tonne of CO_2 emissions, based on an Annex 1 country's assigned carbon emissions goal under the Kyoto Protocol. AAUs are used to quantify emissions reductions for the purpose of buying and selling credits between Annex 1 countries.

Baseline scenario: A scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases (GHG) that would occur in the absence of the proposed project activity.

Baseline-and-credit system: More credits are generated with each new project implemented. Projects that are implemented outside of a cap-and-trade system.

Cancellation see Retirement

Cap-and-Trade: A Cap and Trade system involves trading of emission allowances, where the total allowance is strictly limited or 'capped'. Trading occurs when an entity has excess allowances, either through actions taken or improvements made, and sells them to an entity requiring allowances because of growth in emissions or an inability to make cost-effective reductions

Carbon Dioxide (CO_2): This greenhouse gas is the largest contributor to man-made climate change. Emitted from fossil fuel burning and deforestation

Carbon Dioxide Equivalent (CO_2e): A measure of the global warming potential of a particular greenhouse gas compared to that of carbon dioxide. One unit of a gas with a CO_2e rating of 21, for example, would have the warming effect of 21 units of carbon dioxide emissions (over a time frame of 100 years).

Certification: Certification is the written assurance by a third party that, during a specified time period, a project activity achieved the reductions in anthropogenic emissions by sources of greenhouse gases (GHG) as verified.

Certified Emissions Reductions (CERs): Tradable units issued by the UN through the Clean Development Mechanism for emission reduction projects in developing countries. Each CER represents one metric tonne of carbon emissions reduction. CERs can be used by Annex 1 countries to meet their emissions goals under the Kyoto Protocol.

Clean Development Mechanism (CDM): A provision of the Kyoto Protocol that allows developed countries (Annex 1) to offset their emissions by funding emissions-reduction projects in developing countries (non-Annex 1).

Compliance Market: The market for carbon credits (specifically CERs, EUAs, AAUs, and ERUs) used to reach emissions targets under the Kyoto Protocol or the EU ETS. Also called the Regulated Market.

Conference of Parties (COP): The meeting of parties to the United Nations Framework Convention on Climate Change.

Crediting Period: The period a mitigation project can generate offsets.

Designated Operational Entity (DOE): An independent entity, accredited by the CDM Executive Board, which validates CDM project activities, and verifies and certifies emission reductions generated by such projects.

Double-Counting: Double counting occurs when a carbon emissions reduction is counted toward multiple offsetting goals or targets (voluntary or regulated). An example would be if an energy efficiency project sold voluntarily credits to business owners, and the same project was counted toward meeting a national emissions reduction target.

Emission Reductions (ERs): The measurable reduction of release of greenhouse gases into the atmosphere from a specified activity or over a specified area, and a specified period of time.

Emission Reduction Units (ERUs): A tradable unit, equivalent to one metric tonne of CO_2 emissions, generated by a Joint Implementation project and used to quantify emissions reductions for the purpose of buying and selling credits between Annex 1 countries under the Kyoto Protocol.

Emissions Trading: A provision of the Kyoto Protocol that allows Annex 1 countries to trade emissions reduction credits in order to comply with their Kyoto-assigned targets. This system allows countries to pay and take credit for emissions reduction projects in developing countries where the cost of these projects may be lower, thus ensuring that overall emissions are lessened in the most cost-effective manner.

Environmental Integrity: Is used to express the fact that offsets need to be real, not double counted and additional in order to deliver the desired GHG benefits. The term should not be confused with "secondary environmental benefits" which is used for the added benefits an offset projects can have (e.g. air pollution reduction and protection of biodiversity.)

European Union Allowance (EUA): Tradable emission credits from the European Union Emissions Trading Scheme. Each allowance carries the right to emit one tonne of carbon dioxide.

European Union Emissions Trading Scheme (EU ETS): The EU ETS is a greenhouse gas emissions trading scheme which aims to limit emissions by imposing progressively lower limits on power plants and other sources of greenhouse gases. The scheme consists of two phases: Phase I (2005-07) and Phase II (2008-12).

Ex-ante: In terms of carbon offsets, ex-ante refers to reductions that are planned or forecasted but have not yet been achieved. The exact quantities of the reductions are therefore uncertain.

Ex-post: As opposed to ex-ante offsets, ex-post reductions have already occurred and their quantities are certain.

Forward Crediting: Sale of ex-ante credits. At contract closure the buyer pays for and receives a certain number of offsets for emissions reductions or sequestration that will occur in the future.

Forward Delivery: At contract closure the buyer pays the purchase price for a certain number of offsets that have yet to be produced. The offsets will be delivered to the buyer once they have been realized and verified.

Greenhouse Gases (GHGs): Gases that cause climate change. The GHGs covered under the Kyoto Protocol are: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6

Host Country: The country where an emission reduction project is physically located.

Internal rate of return (IRR): The annual return that would make the present value of future cash flows from an investment (including its residual market value) equal the current market price of the investment. In other words, the discount rate at which an investment has zero net present value.

Issuance: Issuing a specified quantity of CERs for a project activity into the pending account of the CDM EB into the CDM registry.

Joint Implementation (JI): A provision of the Kyoto Protocol that allows those in Annex 1 (developed) countries to undertake projects in other Annex 1 (developed or transitional) countries (as opposed to those undertaken in non-Annex 1 countries through the CDM).

Kyoto Mechanisms: The three flexibility mechanisms that may be used by Annex I Parties to the Kyoto Protocol to fulfil their commitments through emissions trading (Art. 17). Those are the Joint Implementation (JI, Art. 6), Clean Development Mechanism (CDM, Art. 12) and trading of Assigned Amount Units (AAUs).

Kyoto Protocol: An international treaty that requires participating countries to reduce their emissions by 5 percent below 1990 levels by 2012. The Protocol, developed in 1997, is administered by the Secretariat of the UN Framework Convention on Climate Change.

Leakage: Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the project activity.

LULUCF: Land use, land use change and forestry. The term given to tree-planting projects, reforestation and afforestation, designed to remove carbon from the atmosphere.

Millennium Development Goals (MDGs): The MDGs commit the international community to an expanded vision of development, one that vigorously promotes human development as the key to sustaining social and economic progress in all countries, and recognises the importance of creating a global partnership for development. The goals have been commonly accepted as a framework for measuring development progress.

Non-Annex 1 Countries: A group of mostly developing countries which have not been assigned emissions targets under the Kyoto Protocol and which are recognised by the UNFCCC as being especially vulnerable to the effects of climate change.

Offset Company: A company whose primary purpose is to create or sell offsets, either directly to consumers or through another organisation that wish to offer offsets to their clients.

Offset Provider: Offset providers include both offset companies and other businesses that utilize the services of offset companies to provide offsets to their clients.

Pre-registered Emission Reductions (pre-CERs): A unit of greenhouse gas emission reductions that has been verified by an independent auditor but that has not yet undergone the procedures and may not yet have met the requirements for registration, verification, certification and issuance of CERs (in the case of the CDM) or ERUs (in the case of JI) under the Kyoto Protocol. Buyers of VERs assume all carbon-specific policy and regulatory risks (i.e. the risk that the VERs are not ultimately registered as CERs or ERUs). Buyers therefore tend to pay a discounted price for VERs, which takes the inherent regulatory risks into account.

Primary market: The exchange of emission reductions, offsets, or allowances between buyer and seller where the seller is the originator of the supply and where the product has not been traded more than once.

Project-based system see Baseline-and-credit system

Project boundary: The project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases (GHG) under the control of the project participants that are significant and reasonably attributable to the project activity.

Project Design Document (PDD): A project specific document required under the CDM rules which will enable the Operational Entity to determine whether the project (i) has been approved by the parties involved in a project, (ii) would result in reductions of greenhouse gas emissions that are additional, (iii) has an appropriate baseline and monitoring plan.

Prompt Delivery: At contract closure the buyer pays the purchase price for a certain number of offsets which have already been realized and are delivered to the buyer promptly.

Renewable Energy Certificates (RECs): A Renewable Energy Certificate represents a unit of electricity generated from renewable energy with low net greenhouse gas emissions. One REC represents 1 megawatt-hour.

Reforestation: This process increases the capacity of the land to sequester carbon by replanting forest biomass in areas where forests have been previously harvested.

Registration: The formal acceptance by the CDM Executive Board of a validated project as a CDM project activity.

Retirement: Retirement is a way of reducing overall emissions by purchasing carbon offsets and retiring them so that they may not be used to offset others' emissions. Retired credits can no longer be traded.

Secondary Market: The exchange of emission reductions, offsets, or allowances between buyer and seller where the seller is not the originator of the supply and represents a secondary trade in the particular product.

Stakeholders: Stakeholders mean the public, including individuals, groups or communities affected, or likely to be affected, by the proposed project activity or actions leading to the implementation of such an activity.

Temporary certified emission reductions (tCERs): A temporary certified emission reduction or tCER is a unit issued pursuant to Article 12 of the Kyoto Protocol for an Aforestation/Reforestation CDM project activity under the CDM, which expires at the end of the commitment period following the one during which it was issued. It is equal to one metric tonne of carbon dioxide equivalent.

United Nations Framework Convention on Climate Change (UNFCCC): An international treaty, developed at the 1992 UN Conference on Environment and Development, which aims to combat climate change by reducing global greenhouse gas emissions. The original treaty was considered legally non-binding, but made provisions for future protocols, such as the Kyoto Protocol, to set mandatory emissions limits.

Validation: The assessment of a project's Project Design Document, which describes its design, including its baseline and monitoring plan, by an independent third party, before the implementation of the project against the requirements of a specific standard.

Verification: Provides an independent third party assessment of the expected or actual emission reductions of a particular abatement project

Verified or Voluntary Emissions Reductions (VERs): Reductions that, unlike CERs, are sold on the voluntary market. VERs are linked neither to the Kyoto Protocol nor to the EU ETS. VERs are sometimes referred to as Voluntary Emissions Reductions.

Voluntary Market: The non-regulated market for carbon credits (especially VERs) that operates independently from Kyoto and the EU ETS. Also called the Non-Regulated Market.

Voluntary Offsetting: Offsetting purchases made by individuals, businesses, and institutions that are not legally mandated.

EXHIBIT G

Carbon Offsets in San Diego County

An Analysis of Carbon Offset Policy Effectiveness, Best Practices, and Local Viability in the San Diego County Region

Sara Wanous
June 2019

UC San Diego | SCRIPPS INSTITUTION OF OCEANOGRAPHY

Table of Contents

Capstone Advisory Committee 2

Acknowledgements 3

Executive Summary 4

Introduction 5

Policy Analysis 5

- Brief History of Carbon Offset Policies 5
  - Who Uses Carbon Offsets? 5
  - International 6
  - California State 6
  - San Diego County 7
    - San Diego County Climate Action Plan 7
    - Legal Challenges 8
- Policy Design 8
  - Common Critiques of Carbon Offsets 8
    - Additionality 9
    - Accountability 9
    - Verifiability 10
    - Incentive for Slow Growth in Carbon Reduction Technology 11
  - Effective Policy Design for Carbon Offsets 11
    - Local Projects 11
    - Trade Ratios 12

Local Carbon Offset Opportunities in San Diego Region 13

- Analysis 13
- Results and Discussion 16

Recommendations 17

- Incorporate Trade Ratios into Offset Policies 17
- Include Local Requirements in San Diego County Offset Policies 17
- Develop Local Options with Offset Registries 18

References 19

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Executive Summary

Carbon offsets are features of emissions reduction policies where a carbon emitting entity can pay for atmospheric carbon to be sequestered or emissions to be avoided elsewhere to subtract this amount of carbon from their total emissions. Where emissions reductions are required by law, carbon offsets give carbon emitting entities flexibility in how they meet emissions reductions. In addition, some carbon emitting entities choose to voluntarily invest in offsets to meet their own zero net emissions goals.

While carbon offset policies theoretically work to meet climate goals and provide more flexible ways for carbon emitters to reduce their net reductions, they often meet criticisms for not working as well in reality. Carbon offsets are criticized for not truly meeting net neutrality goals because it is nearly impossible to tell if a carbon offset project is additional, i.e., would not have happened without the influence of the offset incentive. Non-additional projects would not meet offset goals but are difficult to identify. Carbon offsets are also criticized for being prohibitively difficult to measure and verify and for slowing progress on emissions reductions strategies.

The shortcomings of carbon offsets can be addressed with strategic design. Where offsets are required by law, policies can incorporate a trade ratio that discounts offsets relative to directly reduced emissions. For example, a trade ratio of 1.25:1 would require the purchase of offsets for 125 tons of carbon to count for 100 tons of carbon emissions reductions. Both required and voluntary offsets can benefit from investing in local projects where they are easiest to verify and the co-benefits (such as green space or clean energy production) are kept local to the carbon emissions they are offsetting and the negative externalities of those operations.

The San Diego region many opportunities for potential offsets. San Diego County incorporated carbon offsets as an addition to their climate action plan but faces legal challenge from the Sierra Club over the integrity of the policy they designed, specifically about the unbounded geographic distance allowed between offset projects and emissions sources. In 2021, the State of California will increase stringency on carbon offsets by cutting the percent of emissions reductions that can be accounted for by offsets in half and requiring half of them to be local. Simultaneously, voluntary offsets are becoming more and more popular.

With carbon offsets being such a timely opportunity in San Diego, the region has options to maximize carbon offsets. In particular, I recommend the following policy options:

Incorporate trade ratios. The State of California, the County of San Diego, and voluntary offset registries do not currently utilize trade ratios that could account for unmeasurable additionality.

Include local requirements. Requiring a portion of offset projects to be developed locally improves ability to measure and verify projects. Local projects keep co-benefits of the projects local to the communities that may experience negative externalities of emissions being offset.

Invest in local offset projects. Currently, there are no carbon offset projects in the San Diego Region. A preliminary analysis of wetland restoration opportunities suggests that wetland restorations will not be enough to meet local offset demand and other project types should be investigated further.

Introduction

Carbon offsets are a part of a carbon emission reduction policy that allows carbon emitting entities added flexibility in meeting carbon emission reductions. Because carbon is well mixed in the atmosphere[1] carbon emissions from a factory on one side of the world theoretically have the same effect on our climate in terms of radiative forcing as a factory on the other side of the world. Extending this theory, limiting emissions or removing carbon from the atmosphere would have the same net climatological regardless of where these activities occur. Carbon offsets allow entities to pay for carbon reductions or carbon sequestration projects elsewhere to count toward their own business emissions reductions. Such policies have become popular facets of carbon emissions reduction policies and are incorporated in international policy under the Kyoto Protocol; California state policy under AB 398, which established the cap-and-trade program; and in San Diego County's Climate Action Plan.

Carbon offsets are a popular way to balance economic and climate goals; however, they come with a set of risks and trade-offs. Carbon offset policies have been critiqued for not truly creating a carbon neutral standard, being difficult to verify, and slowing progress on direct emissions reductions. However, because they the gap between emissions reductions goals and low carbon technologies, they are widely used in climate policy and will likely remain widely used in the future. Because carbon offsets are now built into our climate policy landscape, it's important to know how we can most efficiently use carbon offset policies. Using data and policy design elements, carbon offset policies can meet goals in a more efficient way.

This report explores the current use of carbon offset policies pertaining to the San Diego region, what the best practices for carbon offset policy design are, and how the San Diego region can best implement effective carbon offsets.

Policy Analysis

Brief History of Carbon Offset Policies

Who Uses Carbon Offsets?

Carbon offsets provide more flexibility for carbon emitting entities to reduce their net carbon emissions. They can be used voluntarily for businesses seeking to reduce their emissions by their own motivation or as a feature of a law that requires emissions reductions. However, offsets are highly complex and as such have become highly regulated. Carbon offsets are often incorporated into carbon emission reduction laws. Where emissions reductions are required by law, carbon offsets help provide carbon emitting entities with options to meet the required reductions in the most cost-effective way. Carbon emitting entities can meet some reductions onsite with low cost methods and readily available technology and the rest of the reductions with offsets while working on developing technology for further on-site reductions. The offset projects they invest in can be any project that sequesters atmospheric carbon or avoids emissions elsewhere. Examples of offset projects include renewable energy development, energy efficiency upgrades, methane capture, biosequestration, carbon farming, and carbon capture and storage.

Some companies may decide to purchase offsets even when they are not required by law to reduce emissions. If companies purchase offsets equivalent to amount of emissions they produce, they can claim that their business is 'net carbon neutral' and qualify for carbon neutral certifications. Carbon emitting entities participate in these voluntary carbon neutrality programs to differentiate themselves as 'green' options in the market place. Carbon offset registries, such as American Carbon Registry (ACR), Climate Action Reserve (CAR), Verra, and Gold Standard, support voluntary carbon offsets by developing and verifying projects for carbon emitting entities looking to purchase offsets. Carbon offset registries often work closely with government agencies and government regulations to verify voluntary offsets. Given the close ties between voluntary and legally required offsets, this report will focus primarily on legally required offsets.

International

Carbon offsets first entered the international policy sphere in the Kyoto Protocol in 1997. Article 3 of this agreement legally bound developed, industrialized countries (known as Annex I countries) to emissions reductions by a minimum of 5% below their 1990 emissions levels by 2012[2]. Article 12 laid out the possibility for offset projects by allowing Annex I countries to invest in emissions reducing activities in countries not included in Annex I to claim 'Certified Emissions Reductions' (CER) that can count toward the emissions reductions required in Article 3[2]. Furthermore, Article 12 indicated that CERs will be certified under the Clean Development Mechanism (CDM) by rules agreed upon by the United Nations Framework Convention on Climate Change (UNFCCC)[2]. At the first UNFCCC Conference of Parties (COP), parties decided on specific modalities and procedures for each type of potential offset project to ensure uniform standards and reliability of projects[2].

California State

The State of California utilized carbon offsets as a piece of the cap-and-trade program established under Assembly Bill 32 (A.B. 32), the state's ambitious and overarching emissions reduction legislation. Chapter 3 of A.B. 32 included stipulations for offsets referred to as 'Alternative Compliance Mechanisms.'[3] Alternative Compliance Mechanisms are defined as "an action undertaken by a greenhouse gas emission source that achieves the equivalent reduction of greenhouse gas emissions over the same time period as direct emission reduction and that is approved by the state board"[3]. Entities covered under the cap-and-trade program may use carbon offsets to meet up to 8% of their emissions reductions during the current period of 2013-2020[3,4].

California's cap-and-trade program was then expanded under AB 398 which delegated the management of these projects to the California Air Resources Board (CARB)[5] which verifies offset projects and issues credits in accordance to carbon emissions avoided or atmospheric carbon captured by a project[4]. CARB accepts projects that are established using a 'Compliance Offset Protocol' which is a set of project guidelines that establish standards for projects and capitalize on best practices. Compliance Offset Protocols are highly specific to project size and scope to maintain consistency of permits across a wide variety of offset project possibilities and include detailed instructions and guidelines for the specific project. They are developed collaboratively between CARB and other state agencies or independent carbon offset registries that submit protocols to be reviewed by CARB. Examples include the US Forest Projects Protocol, Urban Forestry Protocol, Livestock Digester Protocol, and Rice Cultivation Protocol[4]. In developing Compliance Offset Protocols, CARB considers factors including the potential for projects to be done in California rather than elsewhere, the potential offset supply, the cost-effectiveness, and co-benefits of project types[4].

CARB has also established standards that are used across all Compliance Offset Protocols in establishing and approving Compliance Offset Protocols. Offset projects will only be approved if the emissions reductions come from sources outside of the scope of California's cap-and-trade programs to avoid double counting[4]. Projects outside of the state that would be covered if they were inside the state are also not eligible for offset credits. Only Scope 1* emissions reductions, meaning reductions occurring immediately from the actions of the projects are counted[4]. While projects not directly related to emissions, such as reducing electricity use, may reduce emissions from the reduction of energy used (Scope 2 emissions*), these emissions would not be counted in a compliance offset protocol to maintain a higher confidence in emissions reduction calculations and to avoid double counting in a growing carbon offset market. Carbon offset projects must also ensure the permanent avoidance of emissions[6]. For example, methane flaring would permanently destroy methane, while methane storage would not. Restoration based projects have a standard of permanence of 100 years[6]. This means that a restoration project must ensure it will be preserved for at least 100 years to qualify as a carbon offset project. Lastly, any project seeking to qualify as a carbon offset must be quantified using the most conservative estimates and must be verifiable[4,6]. 'Additionality,' meaning the verification that carbon offset credits represent carbon that would not be sequestered or avoided without the investment of a carbon offset project, is a common concern for the integrity of offset projects. To account for these concerns, CARB outlines plans for verifying that a carbon offset is truly an additional avoidance or sequestration of carbon above what would have occurred without the intervention of an offset program. Primarily, CARB conducts an assessment of standard practices in an area where a project is suggested. If a carbon reducing or sequestering practice is already commonplace in a community, those projects cannot apply toward carbon offsets in said community as they likely would have occurred without the intervention of a carbon offset program[4,6]. CARB addresses the possibility that projects with sizeable co-benefits may qualify for other types of environmental credits such as wetland or stream mitigation credits[4]. However, receiving other types of environmental credits will not disqualify a project from receiving offset credit so long as the other credits they receive are not carbon emissions credits. CARB recognizes the benefit of keeping projects and their co-benefits local but does not require qualifying projects to occur in the state. Because the cap-and-trade program covers a significant portion of the California economy, CARB believes limiting offset projects to the state would significantly limit the offset supply such that there would not be enough available[4].

San Diego County

San Diego County Climate Action Plan

In February of 2018 San Diego County adopted their current Climate Action Plan (CAP) that outlined the county's emissions goals and strategies to reach them[7]. Among their strategies, San Diego County included a plan (Strategy T-4) to invest in local projects to offset carbon emissions resulting from the county's activity[7] . Strategy T-4 leans on the pre-established compliance offset protocols and verification methods established by CARB, the California Air Pollution Control Officers Association (CAPCOA), and the San Diego County Air Pollution Control District (SDAPCD) to confirm emissions reductions[7]. Emissions reductions, avoidance of emissions, and sequestration of carbon under Strategy T-4 will be verified by a third party under these standards, then maintained in a registry designed by the SDAPCD that may become an independent registry or may be built into an existing one. These offsets will be paid for by the county, verified, and

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* Scope 1 emissions are emissions that are a direct result of the entity's activities. For example, emissions resulting from fossil fuels burned on site or used in their own shipping fleets would be counted under Scope 1. Scope 2 are emissions that are indirectly caused by the entity's activities. For example, the emissions associated with the electricity used to power the lights in the entity's offices are not scope one as the electricity generation is not occurring on site, but are scope 2 because they are an indirect result of the activities occurring on site.

immediately retired rather that sold on as offset credits. Through this program, San Diego County hopes to retire 176,614 tons of carbon by 2030[7].

Strategy A-2 focuses on increasing carbon sequestration under its agriculture and conservation goals. Plans under Strategy A-2 focus on tree planting both in residential areas and on unincorporated lands. In residential areas the County will plant and maintain two new trees per additional dwelling unit on county-owned lands in residential areas to maximize co-benefits[7]. Furthermore, the County plans to plant 3,500 trees in more rural unincorporated areas each year[7]. The county anticipates sequestering 1,244 tons of CO_2 from residential projects and 1,735 tons of CO_2 from projects in unincorporated areas for a total of almost 3,000 tons of CO_2 sequestered[7].

Legal Challenges

In 2011 San Diego County did a comprehensive update to its general plan for the first time since 1978[8]. This plan acknowledges the existence of climate change, lays out the County's strategies to meet state goals under AB32 and other environmental policies, and establishes the County's own sustainability and environmental goals[8]. As a part of this plan, San Diego County acknowledged that sustainable housing development methods would play a role in how the County meets its climate goals[8]. The 2011 General Plan outlined goals for environmentally sustainable development and approved a level of development that would fit within their climate goals[8]. The rules for environmentally sustainable development were then altered under the Climate Action Plan[9].

CAP Mitigation Measure M-GHG-1 stated any housing developments not already approved under the 2011 General Plan would be required to purchase carbon offsets to offset emissions from further development[9]. M-GHG-1 specified that all sustainability measures to reduce on-site emissions should be taken, then any remaining emissions must be offset by purchasing carbon credits from a reputable registry[9].

This carbon offset policy for housing development has become a point of contention for environmental groups that believe the offset regulations are not sufficiently thought out and will result in net environmental degradation of the San Diego region. On September 14, 2018, the Sierra Club challenged San Diego County arguing that CAP Mitigation Measure M-GHG-1's allowance the purchase of offsets from projects anywhere in the world to offset further development was not consistent with the County's previously stated climate action goals in the 2011 General Plan[10,11,12]. The Sierra Club argued that allowing development under the rules in CAP Mitigation Measure M-GHG-1 would be substantially harmful to environment in the San Diego Region and undermine the County's climate goals[10,11]. San Diego County argued that offsets from projects anywhere in the world should be allowed because greenhouse gases are well mixed in the atmosphere so geography of offsets relative to the housing development does not affect adherence to climate goals[10,11]. The judge has preliminarily sided with the Sierra Club by issuing a stay and preliminary injunction preventing the County from applying CAP Mitigation Measure M-GHG-1 to approve development[11,12,12].

Policy Design

Common Critiques of Carbon Offsets

Carbon offsets can provide useful flexibility for carbon emitting entities to work toward emissions reductions goals before significant emissions reductions technologies are available for their direct emissions. However, anecdotal, economic, and scientific evidence suggest that carbon offsets may not be a perfect substitute to bridge this gap as the basic theory of offsets suggests. Common critiques of carbon offsets can be grouped into three categories: additionality, accountability, and verifiability. The following section breaks down each of these critiques.

Additionality

The Waxman-Markey Bill (H.R. 2454), a comprehensive environmental bill introduced in 2009 which never passed, defines the term 'additional' in reference to carbon offsets as follows:

> "The term additional, when used with respect to reductions or avoidance, or to sequestration of greenhouse gases, means reductions, avoidance, or sequestration that result in a lower level of net greenhouse gas emissions or atmospheric concentration than would occur in the absence of an offset project."[13]

Proving the 'additionality' of carbon offset projects is challenging and as such, problems of additionality are a common critique of carbon offset policies. For an offset project to function as the policy intends, it must be a project that would not have occurred without the influence of a carbon offset policy. Proving whether a project would occur without a carbon offset policy, in a 'business-as-usual' world, is exceedingly difficult because it cannot be observed and is estimations are rough due to the many competing factors involved and the asymmetry of information between the buyer, seller, and regulator. As a demonstration of how difficult establishing a baseline is, leading institutions like the Intergovernmental Panel on Climate Change (IPCC) rarely reference a single estimate for aggregated emissions projections, but rather provide a variety of scenarios or a range of confidence. Without a known baseline of business-as-usual emissions for every individual firm which adds only more uncertainty, it is impossible to tell exactly which projects would occur without a carbon offset policy and which are truly additional as a result of the policy[14]. The US General Accountability Office (GAO) attempted to determine the effect of the CDM on greenhouse gas emissions but determined that it was nearly impossible due to the uncertainties of additionality[15].

Without addressing the additionality problems, carbon offset policies encounter adverse selection problems that will undermine the no-net-impact goals of offsets[16]. Adverse selection describes a situation where poor incentives and asymmetric information lead to the selection of the lowest quality options[16,17]. Because there is not an accurate business-as usual baseline, one cannot rule out all projects that would occur in the absence of a carbon offset policy. Furthermore, there is an asymmetry of information and incentives between potential offset sellers and regulators. Potential offset sellers know their project well and know whether their project would occur without an offset policy but have an incentive to keep this information secret to seek the added benefits from the offset policy[18]. When a carbon offset policy is introduced to this pool of potential projects, the ones that would have occurred in a business-as-usual scenario are the ones most likely to be developed and take advantage of the carbon offset policy[16,17].

A common policy response to the imperfection of carbon offsets is to limit the number of offsets that can be used[17]. Limiting the number of offsets being purchased on the market exacerbates the adverse selection problem. The lowest quality offsets will be the least expensive and therefore the first to be purchased and developed[16,17].

Accountability

There is a geographic trend in offset projects where most projects are purchased to offset emissions in developed countries with projects occurring in developing countries[19,20,21]. Many view this as mutually beneficial wherein businesses in developed countries gain access to economically viable offset projects and developing countries receive help with conservation, restoration, and sustainable development. Offsets across great geographic distances work theoretically as climate policy because greenhouse gases are well mixed in the atmosphere, meaning that carbon sequestered, or emissions avoided in one part of the world generally have the same positive effects on reducing anthropogenic global warming as they would elsewhere[1]. However, this theoretical framing fails to account for co-benefits of carbon offset projects and other negative externalities associated carbon emitting practices such as local pollution. Moving offset projects geographically distant from emission sources limits any potential benefits wherein those harmed by the negative externalities of carbon emitting activities receive the co-benefits of the offset projects.

Added geographic distance and crossing political borders between those purchasing CERs and the CDM projects they are funding can also decrease the accountability to ensure the projects are beneficial or at least neutral to the surrounding community[17]. Many offset projects make clear efforts at carbon sequestration or emission avoidance and are beneficial or benign to the surrounding communities. However anecdotal evidence shows cases in which particularly poor incentives lead to projects that harm surrounding communities. For example, one Scottish company purchased offsets from a eucalyptus tree planting project in Brazil that drained local water resources and displaced native communities[15]. In another case, Forests Absorbing CO_2 Emissions (FACE), a non-profit that restores forests as carbon offset projects, evicted 6,000 villagers with 9 days' notice from their desired restoration site. The evicted villagers were left homeless with nowhere to graze their cattle. The land they were evicted from was never fully restored15. Projects that cause significant negative externalities less likely to exist when geographically closer to the region demanding carbon offsets as there are more opportunities for whistle blowers in the community to call attention to the effects of the project [22,23].

Verifiability

Carbon offset projects rely on the ability to accurately measure carbon emissions avoided or atmospheric carbon sequestered. Emissions avoided from energy-related projects (such as building solar farms or investing in energy efficiency projects) can be closely calculated using the energy data. However, it is significantly more difficult to calculate the carbon offset by biomass and ecosystem-based projects. Biomass sequestration projects require more time to develop and have more uncertain factors that make them more difficult to estimate than energy-based projects[24,25]. These projects are also most accurately measured using long-term methods to determine the amount of carbon sequestered[24,25]. The variability involved in estimating carbon sequestration rates of natural systems makes determining the number of credits to issue for a project difficult and less accurate.

Misaligned incentives between governments and between developers and regulators add to the difficulty of verifying offset projects. The majority of carbon offset projects are established in developing countries and the even larger majority of the CERs from these projects are purchased in developed countries[20,21,21]. Developing countries that desire the foreign investment in offset project to boost their sustainable infrastructure or aid in conservation or restoration efforts have an incentive to underreport[17]. Underreporting the level of development, restoration, or conservation that would happen without the intervention of an offset project would qualify their country for more investment in CDMs17. Developed countries purchasing CERs from CDMs in developing countries have a complimentary incentive not to question whether developing countries are underreporting the business-as-usual estimates. The underreported numbers provide more supply of cheaper offsets[17]. Similar perverse incentives exist between all offset project developers and carbon credit purchasers[26]. Developers will always have an incentive to overestimate the amount of atmospheric carbon that will be sequestered or emissions that will be avoided by a project to qualify more projects and receive more credits[26]. Purchasers do not have the incentive to check estimates more closely to preserve the supply of cheap offset credits[26]. In both exchanges between governments and between developers and purchasers, regulators have little ability to sort out which projects are truly additional due to the asymmetry of information and the same limited science as offset developers[17,26].

Incentive for Slow Growth in Carbon Reduction Technology

Carbon pricing and offset policies aim to transition economies away from carbon intensive practices by providing carbon emitting entities with alternative venues for meeting emissions reductions in the most economically viable way possible[17]. While offsets do add options for carbon emitting entities, they may also create potentially perverse incentives that limit environmental gains by commodifying emissions reduction of certain types[17]. Allowing for alternatives to direct emissions reductions slows the incentive for switching systems to lower carbon alternatives. Without the option of offsets, carbon emitting entities would have a stronger incentive to change their practices to avoid paying fines or carbon taxes[15].

Economic incentives for specific offset projects may also interfere with projects that may be net better for the environment in the long run[17]. For example, oil drilling often results in leaked methane. With proper infrastructure established, leaked methane can be captured and used as natural gas to fuel activities. However, oil companies like Shell and Chevron have found it more profitable to flare the methane under CDM project guidelines for offset credits[15]. The use of methane as energy would be more sustainable and would be more economically efficient under a direct carbon pricing policy, but carbon offsets has made flaring more profitable.

Effective Policy Design for Carbon Offsets

Despite critiques, carbon offsets are often used as a bridge that provides alternatives to carbon emitting entities that cannot yet reduce their onsite emissions without reducing their activities while they work on direct reduction technologies. As such, carbon offsets are a still a popular policy feature and a reality of our current policy landscape. A thorough understanding of the critiques of carbon offset policies can help inform more effective policy design for policies moving forward. Two options to address the various critiques of carbon offset policies are developing offset projects locally and incorporating trade ratios.

Local Projects

Keeping offset projects local to the activities that they are offsetting helps bridge the gap between the co-benefits of offset projects and the added negative externalities of carbon emitting practices. The theoretical basis of carbon offset policies is that atmospheric carbon is well mixed, so the geography of the projects relative to the emissions source should not matter. However, carbon emitting processes often have other externalities that are not accounted for in the greenhouse gas emissions pricing scheme like particulate matter that stay local[26]. Conversely, carbon offset projects often have co-benefits such as additional energy production, creation of greenspace, or habitat restoration[22,26]. These tradeoffs are not lost on members of communities where carbon offsets or considered nor on the carbon emitting entities considering them. A 2015 study in Mexico showed that both citizens of areas affected by a carbon offset policy and the purchasers of offsets exhibited a preference for the projects to be local at a marginally higher cost when given the option[22]. When asked why, citizens quoted specific co-benefits that they were interested in seeing developed in their community that would make up for negative environmental effects they had experienced[22]. Offset purchasers similarly sited an interest in developing projects co-benefits in their community[22]. For example, a community that had experienced wildfires that caused dangerous air quality in the past volunteered a strong preference for afforestation and other projects they believed would improve air quality[22]. The co-benefits of offset projects do not necessarily offset the specific local externalities that a carbon emitting entity contributes to in the way that the carbon offsets equally counteract their carbon emissions. These projects may still contribute to the advancement of other environmental goals and net improvement of local environment.

The State of California is taking steps toward including local offsets in their carbon pricing policies. Under A.B. 398, the bill that established California's cap-and-trade system, carbon emitting entities covered under the law may use offsets to account for 8% of their emissions reductions from 2013-2020[27]. These offsets must be certified by CARB but have no geographic limitations. California did not include geographic restrictions in this phase of the policy because they believed that the carbon price would cover a significant portion of the economy and limiting the geographic scope of offsets would create a shortage of supply[4]. However, beginning in 2021, carbon emitting entities will only be allowed to use offsets to account for 4% of their emissions reductions and at least half of the offset projects they invest in must take place in the state[27]. This phase of the policy is a significant step toward onsite emissions reductions in the state and keeping co-benefits of offsets local.

Trade Ratios

Policies can be designed to account for 'non-additional' offsets that cannot be easily excluded. One policy design to address this problem is including a trade ratio. A trade ratio discounts offsets to account for additionality and 'low quality' offsets by requiring more units of offsets to account for a single unit of emissions[16]. The CDM under the Kyoto Protocol includes a 95% discount rate meaning a trade ratio of 1.05:1[16]. Research suggests that more than 5% of offsets are likely non-additional meaning that the CDM trade ratio moves carbon offsets under the Kyoto Protocol closer to being truly neutral offsets but is not a completely neutral policy[16]. Offsets in the EU and California programs have a 1:1 trade ratio but limit the percentage of emissions reductions that offsets can account for[18]. The proposed Waxman Markey legislation would have included a more aggressive 1.25:1 trade ratio for offsets[18].

A trade ratio works theoretically by requiring a higher reported sequestration and/or more emissions avoided than an emitting entity will receive in credits. If the trade ratio is calculated appropriately, the ratio matches the proportion of carbon offsets on the market that are not additional, and the additional carbon sequestered and emissions avoided match the amount of emissions the purchasing entity is accounting for exactly[16]. A perfect trade ratio is difficult to calculate as it meets many of the same obstacles to estimating additionality in general. Trade ratios are particularly susceptible to adverse selection problems[16,18]. Because purchasers are required to invest in more projects, the incentive for cheaper, lower quality increase which makes the fraction of low-quality offsets to high quality ones greater[16,18]. Trade ratios should not be a substitute for strong vetting of the quality of offsets but should be an additional method of valuation included regulations. Vetting regulations for their quality and additionality is important to ensure that the supply of offsets is more inelastic and limits adverse selection[16].

Local Carbon Offset Opportunities in San Diego Region

I was unable to find any carbon offset projects in the San Diego region. Furthermore, CARB has not yet approved a Compliance Offset Protocol for wetland restorations to be counted as carbon offsets in California's cap-and-trade program.

Carbon offset projects based in the San Diego region are a valuable opportunity because of the co-benefits generated from local projects and available resources for more thorough monitoring. Local projects are particularly timely given the legal challenges to San Diego County's offset program on the basis that non-local projects are not sufficient and the upcoming addition to the State of California's offset regulations that will require entities investing in carbon offsets to have half of their offset projects be in the state.

Carbon offset projects can take many forms from energy efficiency upgrades, to energy generation, to restoration projects. My analysis focuses specifically on opportunities for wetland restoration in San Diego County. Wetland restorations are outstanding opportunities for carbon offset projects because wetlands are one of the most carbon dense ecosystems[28,29,30,31,32], provide many local co-benefits[†] and there are many opportunities for restoration wetlands are lost at a higher rate than almost any other ecosystem at up to 3% of total wetlands lost per year[28]. Wetlands are lost at such high rates because wetlands can be repurposed as highly productive agricultural lands and are often on coastlines that are highly valued for development[28]. It is more likely for wetland restorations to be truly additional offset projects because wetlands often have more profitable alternative uses. Wetland restorations also have risks of being non-additional due to other incentives to restore wetlands such as California's wetland mitigation banking credits[33]. However, records of these credits may improve ability to assess additionality and wetland restoration projects are more likely to be additional than many other projects due to the abundance of other uses for wetlands such as beachfront property or productive agricultural land [28,34,35].

Analysis

Using data from the National Oceanic and Atmospheric Association (NOAA)[36] and the San Diego Association of Governments (SANDAG)[37], I identified wetlands that were already in areas zoned to qualify for restoration and wetlands within a quarter mile of those that were not already zoned to qualify for restoration. Wetlands that were already zoned to qualify for restoration are defined as the portion of wetlands that are within zoning areas S80, defined as "Open Space – intended for recreation areas or areas with severe environmental constraints"[38]. For the purpose of this analysis, I excluded all sites zoned as open space regardless of restoration status as a measure to increase the confidence in additionally of all identified sites. I found wetlands within a quarter mile of those already zoned for restoration using a buffer analysis. Wetlands within a quarter mile of wetlands already zoned for restoration should be the lowest hanging fruit for new restoration projects as they are either connected to wetlands already eligible for restoration resources or extremely geographically close. After finding wetlands zoned for restoration and those within .25 miles of the wetlands zoned for restoration, I overlaid NOAA data for coast line changes with 1.83 meters (6 feet) of sea level rise. It is important to incorporate a scenario of 6 feet of sea level rise as a conservative estimate of sea level rise within

[†] Wetlands provide benefits to local communities including flood protection, streambank and shoreline protection, water quality improvements for surrounding bodies of water, stormwater management, greenspace, and tourism and recreation[43,44].

the next 100 years as estimated by the Center for the Blue Economy[39] because CARB's definition for permanence of carbon sequestration is that carbon must be stored for at least 100 years. Figure 1 shows an example of a wetland in Encinitas that is vulnerable to sea level rise. I eliminated this site and all wetlands vulnerable to sea water intrusion from this analysis as sea water intrusion into a freshwater wetland will change the dynamics and carbon sequestration of a wetland.

The remaining wetlands were all freshwater emergent wetlands or freshwater forested/shrub wetlands‡. Figures 2 and 3 show the five largest potential restoration sites for freshwater emergent wetlands and freshwater forested/shrub wetlands by acreage. Because all ten potential restoration sites are freshwater wetlands, it is important to note that freshwater wetlands are known to emit significant amounts of methane[46]. Methane has a significantly stronger global warming potential than carbon dioxide[47]. Carbon sequestration by a wetland should be discounted by the amount of methane and other greenhouse gases released by a wetland project. This analysis does not include an assessment of greenhouse gases released by the sites identified and only estimates carbon sequestration.

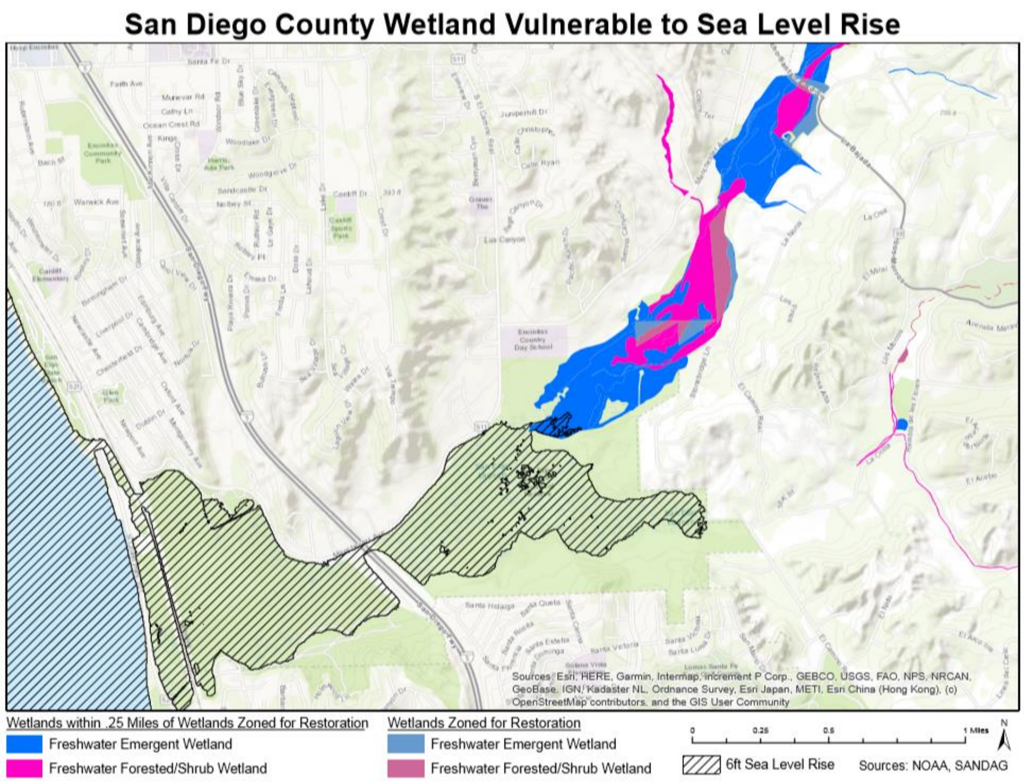

Figure 1: San Diego County Wetland Vulnerable to Sea Level Rise. Based on a Center for the Blue Economy estimate of sea level rise in the San Diego region and NOAA sea level rise data, this Encinitas wetland is vulnerable to the effects of sea level rise in the next 100 years. This wetland was excluded from further analyses.

‡ Freshwater emergent wetlands are areas that are flooded with freshwater for the majority of the year and are characterized by emergent, herbaceous plants. Freshwater emergent wetlands are sometimes also called riverines, lacustrine, or cattail-sedges[45]. Freshwater forested/shrub wetlands are similarly flooded by freshwater for the majority of the year but are characterized by larger trees and woody plants.

Freshwater Forested/Shrub Wetland Restoration Options

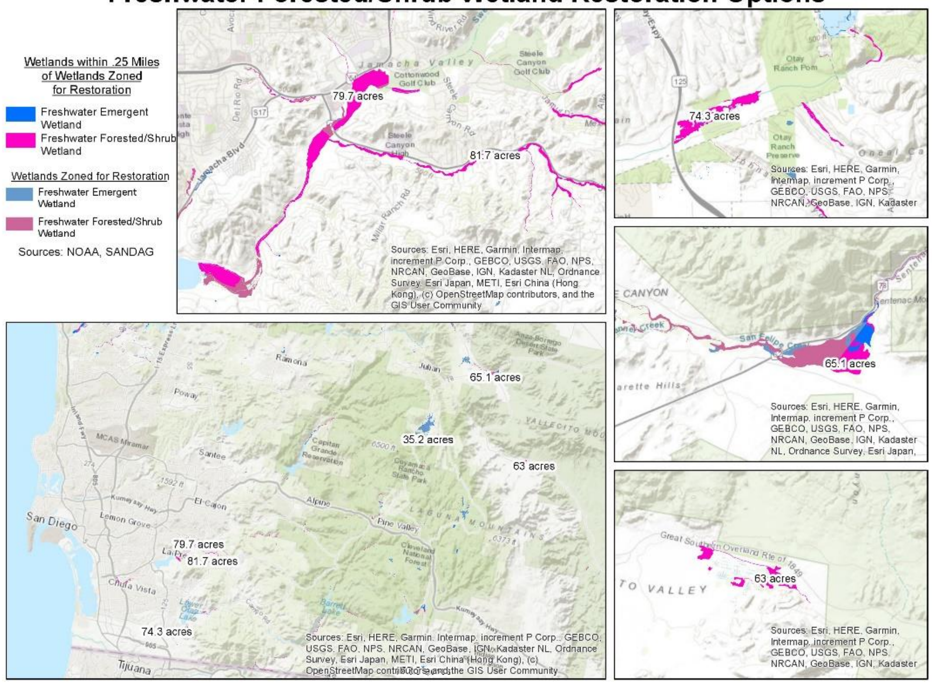

Figure 2: Freshwater Forested/Shrub Wetland Restoration Options. This map displays the locations of the 5 largest potential freshwater forested/shrub wetland restoration sites by acreage. The map in the bottom left shows the locations in the county and the surrounding maps detail specific sites.

Freshwater Emergent Wetland Restoration Options

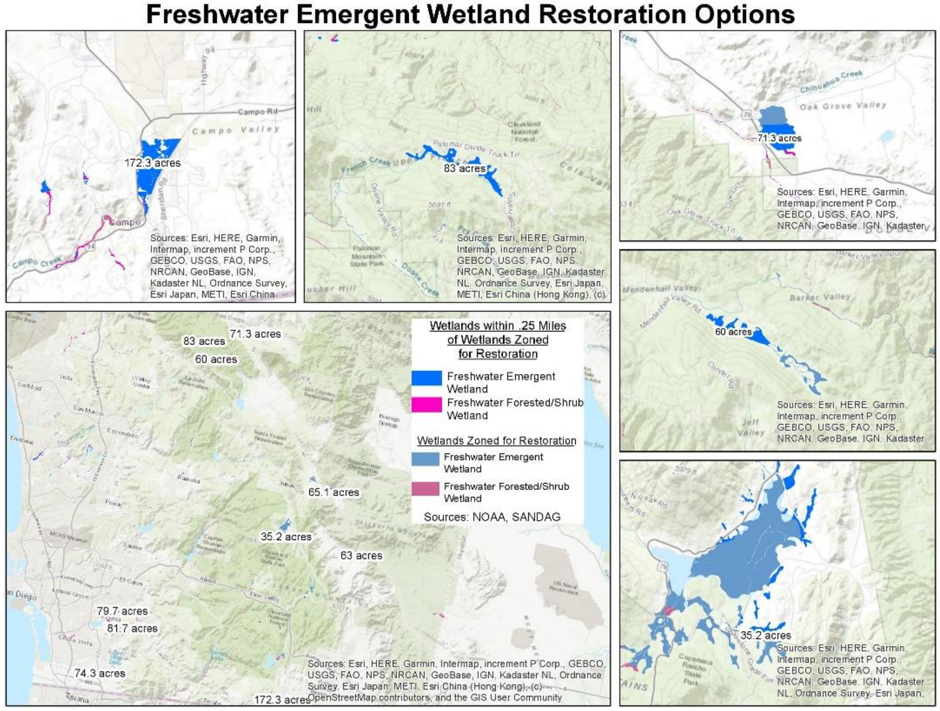

Figure 3: Freshwater Emergent Wetland Restoration Options. This map displays the locations of the 5 largest potential freshwater emergent wetland restoration sites by acreage. The map in the bottom left shows the locations in the county and the surrounding maps detail specific sites.

Carbon sequestration by wetlands is best measured over long time periods and is affected by factors including dominant vegetation, tidal dynamics, and climate[25,40,41]. These measurements do not currently exist for the particular wetlands identified. Additionally, there is no CARB Compliance Offset Protocol defining how wetlands can be restored and their sequestration rates calculated to meet CARB standards. To estimate the carbon that could be sequestered by implementing these projects I reviewed papers that used long term measurements to observe sequestration rates for wetlands from with similar vegetation, tidal dynamics, and from similar climates and used the most conservative measurements. Based on a measurement from an emergent wetland in California with dominant vegetation that is also commonly found in the San Diego region[42], I estimate that freshwater emergent wetlands will accumulate carbon at a rate of 105g C/m^2/year[31]. Data on forested/shrub wetland in similar climates with similar dominant vegetation is lacking. Based on average observations from Ohio forested and shrub wetlands[30] and observations that carbon density in freshwater wetlands in the Midwestern and Western regions are similar[29] that freshwater forested/shrub wetlands will accumulate carbon at a rate of 337.5 g C/m^2/year[30]. These carbon accumulation rates were used only to estimate potential carbon accumulation rates of the wetlands identified. Onsite observations should be gathered before issuing carbon credits.

Results and Discussion

Table 1 combines the data from the analysis of the wetlands most eligible for restoration and literature review to estimate the opportunities for carbon offset projects in the San Diego Region. If the top five largest wetlands in close radius to those already zoned for restoration were restored, they could sequester an estimated 744 tons of carbon each year providing as many permits for carbon offsets. These figures are rough estimates that should be updated with actual observations from the region before administering permits, but show the order of magnitude of opportunity for local wetland restoration carbon offset projects in San Diego County. These figures also do not account for methane and other greenhouse gases that would be released by these sites that would reduce their eligibility for carbon credits. 744 tons of carbon offsets is a low number compared to the demand for offsets in the San Diego Region. For example, the San Diego International Airport, which is interested in offsetting emissions, claims approximately 19,000 tons of direct carbon emissions. The UC System is currently looking to develop local carbon offset projects to account for its 250,000-500,000 tons of carbon emissions.

Wetland Type	Acres in SD Region Near Wetlands Eligible for Restoration	Estimated Carbon Accumulation Rate	Offset Opportunities
Freshwater Emergent Wetland	421.8 acres	105 g C/m^2/year	197 tons C/year
Freshwater Forested/Shrub Wetland	363.8 acres	337.5 g C/m^2/year	547 tons C/year
Totals	785.6 acres		744 tons C/year

Table 1: This table shows the combined results of an analysis of low hanging fruit for wetland restoration sites and their estimated carbon accumulation rates to determine the offset opportunities from wetland restoration in the San Diego region.

Recommendations

Incorporate Trade Ratios into Offset Policies

Trade ratios help to account for low quality offsets that cannot be filtered out through other vetting processes. The Clean Development Mechanism under the Kyoto Protocol incorporates a small trade ratio of 1.05:1, however California's cap-and-trade program and the County of San Diego's proposed offset policy in their Climate Action Plan do not. Incorporating a conservative trade ratio on non-local can help increase the integrity of the State of California and County of San Diego's offset policies. Because offsets taking place far from the activities that they are offsetting are the most difficult to monitor, introducing a trade ratio on non-local offsets first may help increase their veracity. Introducing a trade ratio first on non-local offsets or a more aggressive trade ratio on non-local offsets will also increase their price. Local offsets are often not considered because they are more expensive than non-local projects. Such a policy could even the playing field and help aid investment in local offsets which are more easily verifiable and keep co-benefits close to the emissions sources.

Calculating an adequate discount rate for an offset trade ratio is difficult because it requires estimating the proportion of non-additional offsets which cannot be observed. More accurate estimates can be made for specific types of offsets than for offsets as a whole. California State offset policy is already broken down by project type by the requirement to use CERs for offset projects to qualify for offset credits. The State of California has the opportunity to incorporate more specific trade ratios defined with each CER. However, multiple trade ratios for different offset policies may also make policy more complex where requirements are not already specified by project type. San Diego County and voluntary offset registries may incorporate a trade ratio that reflects an average of the additionality risk in all offsets. Research suggests that this average would be greater than the 1.05:1 ratio in the Kyoto Protocol, however the inclusion of any trade ratio will be an improvement.

Include Local Requirements in San Diego County Offset Policies

San Diego County is currently facing a legal challenge from the Sierra Club to a policy in their Climate Action Plan that allows for carbon offset projects from anywhere in the world to offset local development. The judge issued a preliminary injunction and stay on the policy until it can be heard in court on the basis that the offsets would be unverifiable. San Diego County can update the policy to require all or a portion of the offsets to take place in the San Diego region. The county might also enforce a hierarchical approach where those looking to purchase offsets must document attempts to establish offsets in the region first before looking elsewhere. Keeping offset projects in the San Diego region will make monitoring projects easier and more reliable.

While wetland restorations may not be an adequate match for the demand for offsets in the San Diego Region, there are many other local offset projects that can be explored. Exploring other options for local projects is important because keeping offsets local will also keep the co-benefits of the offset projects local. The Sierra Club was motivated to sue the county by a concern that relaxed offset regulations would lead to low quality offsets and sprawl that would harm natural, undeveloped areas. Requiring carbon offset projects to be local would limit the available supply of offset credits which would limit the amount of sprawl. Keeping carbon offset projects local would also provide an influx of funds for valuable environmental projects that could restore local lands and help make any further development more sustainable.

Develop Local Options with Offset Registries

Entities that are not required to offset emissions under neither California's cap-and-trade program nor San Diego County's offset regulations can participate in voluntary offset programs. Emitters that participate in voluntary offset programs are motivated by their own desire to make their business activities more sustainable rather than regulation and as such have a greater vested interest in verifying that they are investing in the best option they can. Research has shown that both citizens and emitters understand that investing in local projects keeps the valuable co-benefits of these projects local and further that when given the choice, they prefer to invest in local projects. Working with carbon offset providers like the Good Traveler Program which works with the San Diego International Airport to provide offset options for individual flights and common voluntary offset registries like American Carbon Registry, Climate Action Reserve, Verra, and Gold Standard to provide local options in the San Diego region at a premium rate can help increase investment in local projects. Building interest in carbon offset projects in the San Diego Region is also timely as demand for offsets in California will increase in 2021 when entities covered under the cap-and-trade program will be required to have half of their offsets come from projects in the state.

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