

Whistleblower Disclosure

Request for Investigation by U.S. Congress

**Problem: Disclosure of Unfixable Flaws of Greenhouse Gas Offsets
in Proposed U.S. Climate Legislation**

**Impact: Misleading the Public; Implications for Proposed Climate
Legislation; Waste, Fraud and Abuse of Public Funds and Public
Trust**

July 22, 2010

By Laurie Williams and Allan Zabel¹

Oakland, CA

www.carbonfees.org

williams.zabel@gmail.com

¹ We are speaking out as parents, citizens and a married couple. The opinions expressed in this Disclosure are our personal opinions only and are not intended to present the views of the U.S. Environmental Protection Agency or the Obama Administration.

TABLE OF CONTENTS

I. Who We Are.....3

II. Introduction.....3

III. What Are Greenhouse Gas Offsets?.....5

IV. The Role of Greenhouse Gas Offsets in Proposed U.S. Climate Legislation.....7

V. Additionality: What It Is and Why It Is Critical.....7

VI. The Unfixable Flaws that Make Additionality Unachievable for GHS Offsets.....8

 A. Summary of the Unfixable Flaws..... 8

 B. Discussion of the Unfixable Flaws.....9

 1. Business-as-Usual is not Distinguishable.....9

 a. Role of Incentives in Additionality.....9

 b. Two Approaches to Determining “Beyond Business-as-Usual”10

 i. Performance Standards.....10

 ii. Profitability Analysis.....12

 (a) Market Volatility in the Price of Offsets and Other Relevant Parameters.....13

 (b) Avoiding Hidden Liabilities.....14

 (c) Subjectivity in Profitability Determinations.....15

 2. Activity Shifting (also called “Leakage”) Cannot Be Tracked.....15

 3. Perverse Incentives to Keep Polluting Activities Legal.....17

 4. Subjectivity, Complexity and Uncertainty.....19

VII. Third-Party Certifiers and Regulatory Oversight Cannot Solve the Problem.....20

 A. Third-Party Certification.....20

 B. Regulatory Oversight.....21

VIII. Conclusion.....21

IX. Reference Materials and Additional Resources by Subject Category.....23

I. Who We Are

We provide this whistleblower disclosure in our personal capacities as citizens, parents and a married couple. While we are both current employees of the United States Environmental Protection Agency (“EPA”), this disclosure presents our personal opinions only and is not intended to represent the views of EPA or the Obama Administration.

The personal views we express in this disclosure draw on our long experience - more than 20 years for each of us - working as attorneys at EPA’s San Francisco Regional Office. Allan has worked primarily on air pollution issues under the Clean Air Act and has counseled Region 9’s air program on offset issues and California’s cap-and-trade program for the Los Angeles area. Laurie has worked in hazardous waste, solid waste and oil pollution enforcement programs at Region 9. Both of us have experience with Supplemental Environmental Projects, an offsets-type approach to reducing penalties for environmental violations. This disclosure is based on our combined experience with offsets, cap-and-trade and environmental enforcement issues.

The recent resolution of EPA’s objections to our October 31, 2009 Washington Post Op-ed, (“Cap-and-Trade Mirage,” <http://www.washingtonpost.com/wp-dyn/content/article/2009/>) and September 2009 YouTube Video (The Huge Mistake – Climate Change Solutions 2009, http://www.carbonfees.org/home/?page_id=35), has allowed us to provide this disclosure with increased confidence that we are within our protected First Amendment rights in doing so. See http://www.usoge.gov/ethics_guidance/opinions/advop_files/2010/10x1.txt.

II. Introduction

This disclosure requests an investigation of the use of greenhouse-gas (“GHG”) offsets in proposed federal climate legislation.² We argue that the concept of GHG offsets is fundamentally flawed and cannot be fixed. As a result, including GHG offsets in U.S. climate legislation would result in waste, fraud and abuse of public funds and public trust.³ It would also undermine the legislation’s stated goal of reducing GHG emissions to the atmosphere. Three of the major climate legislation proposals before Congress rely on a cap-and-trade-with-offsets approach and would allow all required reductions for almost 20 years to be met with GHG offsets.⁴ These offsets are similar to those described in the EPA’s voluntary program, “Climate

² Greenhouse gas offsets are also commonly known as “carbon offsets.”

³ EPA FY2010 Budget in Brief: <http://www.epa.gov/budget/2010/2010bib.pdf> (Cap & Trade Offsets Methodology (FY 2010 PB: \$5.0M, FY 2009 Enacted: \$0.0M, FY 2010 Increase: +\$5.0M) (Requests \$5.0 million to provide analytical support for proposed greenhouse gas cap and trade programs, including offset verification).

⁴ Waxman-Markey, American Clean Energy & Security Act <http://www.govtrack.us/congress/bill.xpd?bill=h111-2454>, , Kerry Boxer, Clean Energy Jobs and American Power Act,

Leaders,”⁵ and in the whitepaper recently issued by three sub-national GHG programs (“Regional GHG Programs”) entitled “Ensuring Offset Quality: Design and Implementation Criteria for a High Quality Offset Program” (“Three-Regions Whitepaper”).⁶ Our disclosure raises an urgent question because Senators Reid, Kerry and Lieberman have indicated their intention to bring an electricity-sector-only version of these cap-and-trade-with-offsets proposals to a vote in the Senate in a matter of days.

Our disclosure is drafted in the context of warnings by NASA scientists that levels of GHGs in the atmosphere have reached unsafe levels.⁷ In May 2009, MIT researchers concluded that “without rapid and massive action” to reduce GHG emissions, dangerous increases in global temperatures are inevitable.⁸ The National Science Foundation announced in March 2010 that the East Siberian Arctic Shelf, long thought to be an impermeable barrier, is perforated and beginning to leak large amounts of methane, a powerful GHG, into the atmosphere from melting permafrost below. The announcement states, “[r]elease of even a fraction of the methane stored in the shelf could trigger abrupt climate warming.”⁹

While the United States cannot successfully address climate change alone, a continuing U.S. failure to adopt effective domestic climate strategies weakens the chances of effective international action. Our country’s ability to help forge an effective international effort is dependent on showing that the U.S. can adopt a sustainable path at home. Our request for a careful, unbiased investigation of the flaws of GHG offsets is rooted in the reality that enacting ineffective programs to address climate change is likely to have extremely serious consequences for public health and the environment, as well as the economy and national security.

<http://kerry.senate.gov/cleanenergyjobsandamericanpower/pdf/bill.pdf>, Kerry Lieberman, American Power Act at <http://kerry.senate.gov/imo/media/doc/APAbill3.pdf>

⁵ EPA Climate Leaders offset protocols at <http://www.epa.gov/stateply/documents/resources/OffsetProgramOverview.pdf>

⁶ Release of Joint Offset Quality White Paper, May 19, 2010 http://www.rggi.org/docs/3_Regions_Offsets_Announcement_05_17_10.pdf

⁷ Target Atmospheric CO2: Where Should Humanity Aim: http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf

⁸ MIT Research Report May 2009: <http://web.mit.edu/newsoffice/2009/roulette-0519.html>

⁹ National Science Foundation Press Release, “Methane Releases from Arctic Shelf May Be Much Larger and Faster than Anticipated” http://www.nsf.gov/news/news_summ.jsp?cntn_id=116532

III. What Are Greenhouse Gas Offsets?

Offsets were not part of early cap-and-trade programs such as the EPA Acid Rain program. Nevertheless, GHG offsets have been an integral part of Europe’s implementation of the European Union Emissions Trading Scheme, a GHG cap-and-trade program under the Kyoto Protocol. GHG offsets are also a key element of cap-and-trade legislation proposed by the U.S. Congressional leadership to address climate change.

Cap-and-trade is a program that aims to limit or “cap” total pollutant emissions from particular sectors of the economy by setting a total acceptable level of emissions, which is gradually ratcheted down each year, until the environmental goal is achieved. Facilities are allowed to “trade” allowances by buying them from or selling them to other facilities.

Offsets are emission reductions in sectors other than the capped sectors that take the place of reductions within the capped sectors. The World Resources Institute has developed the following charts to show how offsets are supposed to work in a GHG cap-and-trade program:¹⁰

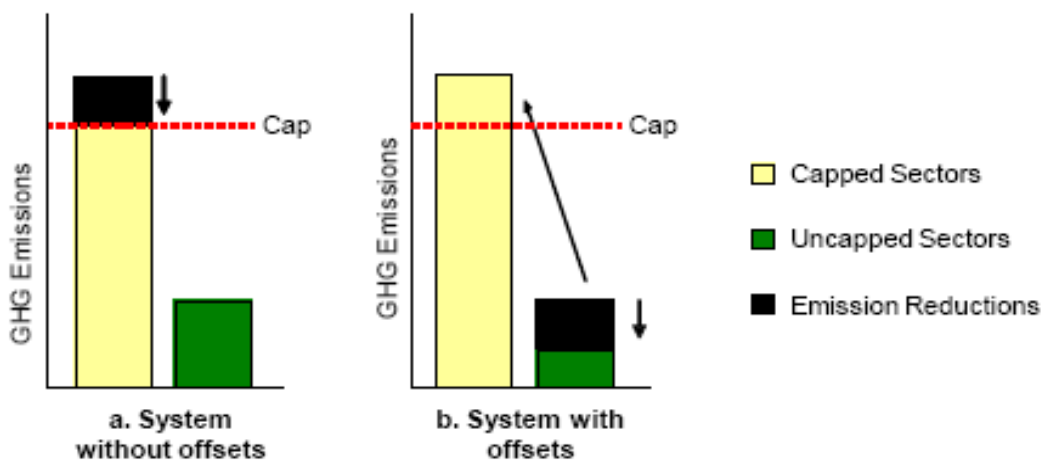


Figure 1 – Role of Offsets in Cap-and-Trade Programs

Offsets are intended to be reductions (1) beyond what is legally required and (2) beyond what would have happened anyway (also called “business-as-usual”) in the non-capped sector. When GHG offsets that do not meet these criteria are counted as reductions, they allow emissions in the capped sector to exceed the cap, without the intended compensating reductions in the uncapped sectors. As shown in another World Resources diagram, Figure 2, example “c.” below, when they are spurious, GHG offsets are a form of counterfeit accounting and corrupt the integrity of the GHG cap-and-trade program.

¹⁰ Three-Regions Whitepaper at pp. 7 and 9.

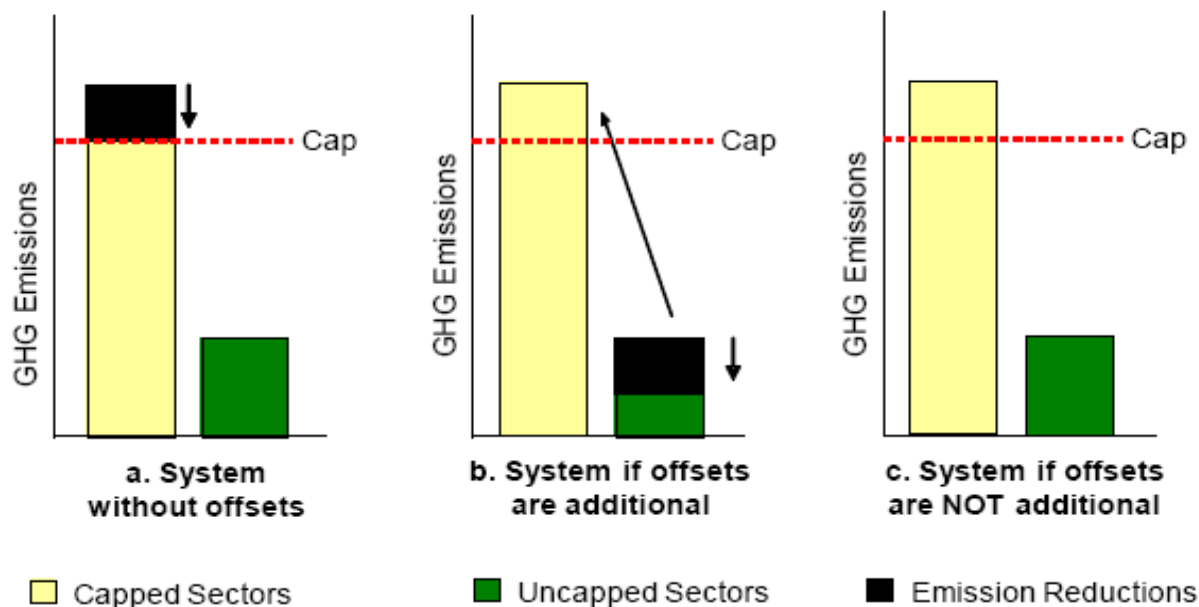


Figure 2 – Impacts of Additional and Non-Additional Offsets

Virtually all proposals to use cap-and-trade to address climate change include substantial levels of GHG offsets as a means of lowering the costs of compliance. Clearly, a cap that would reduce U.S. emissions of carbon dioxide by limiting emissions will raise the prices of permits allowing emissions — and, hence, fuel and energy prices — by a lesser amount if a significant percentage of the emission reductions can be “off-loaded” to other sectors or other countries via an offset provision. Including offset mechanisms in cap-and-trade legislation has also been seen as a means of winning political support from firms and individuals who stand to profit from participating in the offset markets. Not surprisingly, a leading proponent of the cap-and-trade approach to addressing climate change, the Pew Center on Global Climate Change has stated, “Establishing confidence in the environmental integrity of offsets is critical for the successful launch and acceptance of future cap and trade regulatory systems.”¹¹ Unfortunately, GHG offsets cannot actually be verified as net additional reductions, as we explain in detail below.

GHG offsets are considered a “non-traditional” type of offset. Traditional offsets under the Clean Air Act are limited to specific air basins and permitted facilities whose emissions are verified using long-established protocols. Traditional offsets for a specific air basin involve reductions in emissions from facilities that either lower their emissions below existing legal requirements or shut down entirely. In contrast, non-traditional offsets are putative reductions from unpermitted facilities and are therefore more difficult to track, verify and distinguish from

¹¹ <http://www.pewclimate.org/press-center/press-releases/offset-quality-initiative-releases-white-paper>, July 28, 2008.

the hypothetical trajectory of “business-as-usual.” All GHG offsets in the proposed climate legislation before Congress are non-traditional offsets.

IV. The Role of Greenhouse Gas Offsets in Proposed U.S. Climate Legislation

Greenhouse-gas offsets play a central role in all three of the major pieces of proposed climate legislation introduced in the 111th Congress: Waxman/Markey (“American Clean Energy and Security Act”) bill, which passed the House in 2009, Kerry/ Boxer (“Clean Energy Jobs and American Power Act”) introduced in the Senate in 2009, and Kerry/Lieberman (“American Power Act”) introduced in the Senate in 2010. All three bills would authorize two billion tons of GHG offsets each year, allowing *all required greenhouse gas reductions* for almost 20 years to consist of offsets. This makes the question of GHG-offset integrity a central issue for evaluating whether these legislative proposals can accomplish their stated goal of significantly reducing GHG emissions.

The current climate program in Europe today is similar to the approach contemplated in proposed U.S. climate legislation. Companies are allowed to purchase GHG offsets to meet a substantial portion of their emission reduction requirements under the European Trading Scheme. The U.N. regulatory mechanism established to determine the eligibility of offsets to participate in the European Trading Scheme is called the Clean Development Mechanism (“CDM”). Much has been written about the flaws of this system, and many critics have assumed that these flaws could be corrected in future iterations of the program.¹² This disclosure explains why the flaws that have plagued that early experience reflect intrinsic properties of GHG offsets and make them an inappropriate tool for U.S. climate legislation.

V. Additionality: What It Is and Why It Is Critical

The concept of “additionality” is fundamental to GHG offset integrity. “Additionality” means that greenhouse gas emission reductions that result from the offset project must be greater than those required by law or what would have happened in the course of “business-as-usual.”¹³ The concept of additionality is recognized in the proposed U.S. climate legislation, the EPA Climate Leaders program¹⁴ and the Regional GHG Programs.¹⁵

¹² A Dangerous Distraction: Why Offsets are A Mistake the U.S. Cannot Afford to Make, by Friends of the Earth, September 2009, <http://www.foe.org/dangerous-distraction>; International Climate Change Programs: Lessons Learned from the European Union’s Emissions Trading Scheme and the Kyoto Protocol’s Clean Development Mechanism, U.S. Government Accountability Office, November 2008, <http://www.gao.gov/new.items/d09151.pdf>

¹³ This discussion also applies to activities which result in GHG sequestration, such as certain types of forestry and agricultural practices. For simplicity, the discussion will only make reference to GHG reductions rather than both reductions and sequestration, except for the discussion concerning reforestation/afforestation.

¹⁴ The EPA Climate Leaders Program is an EPA industry-government partnership. Participating companies commit to reduce their impact on the global environment in order to receive EPA recognition as corporate environmental

Additionality is critical because it is the basis for any claim that goals set by the program are actually being achieved. As noted above, where non-additional GHG offsets are approved, they will be used to justify emissions above the climate program’s limits in the capped sectors.

VI. The Unfixable Flaws that Make Additionality Unachievable for GHG Offsets

Four unfixable flaws make it impossible for GHG offsets to meet the critical elements of additionality. These flaws apply to the offset protocols in Climate Leaders and in Regional GHG Programs (both planned and currently operating) as well as to the offset provisions in proposed cap-and-trade legislation. Contrary to the claims made by many advocates of offsets, these flaws cannot be fixed by certification or regulatory oversight.

A. Summary of the Unfixable Flaws:

1. Business-as-Usual is Not Distinguishable – It is impossible to determine whether a particular project would not have happened “but for” the additional incentive provided by the offset payments (i.e., would not have “happened anyway”).

2. Activity Shifting (also called “Leakage”) –Emissions allegedly reduced by the project may simply be shifted elsewhere and there is no feasible way to track this.

3. Perverse Incentives to Keep Polluting Activities Legal – The dual pressures to maintain offset profits and to keep the price of GHG offsets low will increase political pressure against the development of new regulations to limit polluting activities.

4. Subjectivity/Complexity/Uncertainty – Subjective factors, along with complex and uncertain emissions calculations, are used to determine the baseline emissions and the allegedly additional reductions from GHG offsets. Along with the other unfixable flaws, subjectivity, complexity and uncertainty make enforcing additionality impossible.

leaders. The program has created seven GHG offset protocols for use by corporate partners in meeting their GHG reduction goals.

¹⁵Three-Regions Whitepaper: http://www.midwesternaccord.org/News%20Page/Three-Regions_Offsets_Whitepaper%2005_17_10.pdf

B. Discussion of the Unfixable Flaws

1. Business-as-usual cannot be distinguished

a. Role of Incentives in Additionality

A fundamental issue with generating GHG offsets is determining whether claimed emission reductions would not have occurred “but for” the GHG offset project funding. In other words, do the reductions go beyond what would have otherwise occurred in the course of “business-as-usual”? With any activity that might reduce GHG emissions, the potential offset generators can be divided into three categories: business-as-usual reductions, no reductions without incentives, and no reductions.

Naturally, the composition of these groups is constantly changing depending on the costs of making reductions in GHG emissions and the size of the incentive for making the reductions.

GROUP 1 – Business-as-Usual Reductions - Those who would make reductions even without the GHG offset incentive (they get a bonus)
Group 2 – No Reductions Without Incentives - Those who would not make reductions “but for” the incentive provided by the GHG offsets
Group 3 – No Reductions - Those who would not make reductions even with the incentive of GHG offsets

Group 1 – Business-as-Usual Reductions - The first group of entities are those that would make the reductions anyway, even without the incentive of GHG offset payments. This group defines the notion of business-as-usual. The reasons that no additional incentive from GHG offset payments is needed to motivate this group to lower emissions may include:

- Increasing profits by lowering energy or other costs (e.g., buying more efficient machines which require less energy to run, or switching to a cheaper fuel which happens to have lower GHG emissions).
- Reducing liabilities, such as controlling explosive hazards or avoiding lawsuits from

neighbors over the nuisance of smells from landfills or run-off from manure lagoons.

If we pay this first group for offsets, we are giving them a bonus for doing what they would have done anyway. This bonus is environmentally counterproductive because it allows those who purchase these illegitimate offsets to increase GHG emissions above the cap.

Group 2 – No Reductions Without Incentives — The second group of entities — those that would not make GHG emission reductions but for the incentive of offset payments — are the target group that offset incentive programs allegedly seek to identify; however, this group cannot reliably be distinguished from Group 1.

Group 3 – No Reductions - The third group of entities — those that would not make the reductions even with the incentive of GHG offsets — are not relevant because they are unable or unwilling, generally for economic reasons, to lower their GHG emissions.

b. Two Approaches to Determining “Beyond Business-as-Usual”

Currently, there are two approaches which are used in the attempt to distinguish between Group 1 and Group 2. These approaches are:

- Establishing a performance standard methodology which allegedly limits the generation of GHG offsets to those projects which would not have occurred in the course of business-as-usual, or
- Performing a profitability analysis to determine which GHG reduction projects would not have occurred but for the incentive of the GHG offsets.

i. Performance Standard Methodology

A performance standard methodology attempts to determine additionality by comparing the relative performance levels and market shares of various technologies. The use of a performance standard methodology to determine additionality, and the failings of this approach, are well-illustrated in EPA’s Climate Leaders Program.

Additionality is defined in the Climate Leaders Program materials as follows: “The GHG reductions must be surplus to regulation and beyond what would have happened in the absence of the project or in a business-as-usual scenario based on a performance standard methodology.” While this definition pays lip service to the “beyond business-as-usual” standard, all seven of the protocols in the Climate Leaders Program use a performance standard methodology that blatantly

allows the generation of GHG offsets for activities which are actually business-as-usual.¹⁶

For example, the Climate Leaders program's GHG offset project methodology for "Commercial Boilers Efficiency," dated August 2008, allows offsets to be generated for the retrofit or replacement of existing boilers. The retrofit technology or replacement boiler must be in the top 20th percentile of performance when compared with commercial boilers in use between 1990 and 2003.¹⁷ This means that GHG offsets can be granted for the installation of readily-available technology that is currently being installed without the incentive of a GHG offset payment, i.e., in the course of business-as-usual. While the existence of a GHG offset incentive may induce some entities to install cleaner, more efficient, advanced technology than they otherwise might have used, the Climate Leaders protocol for commercial boilers makes no attempt to limit the generation of GHG offsets to these entities.

The contradiction between paying lip service to the "beyond business-as-usual" standard and what is actually allowed under the Commercial Boiler protocol is clearly stated in the performance standard methodology for this sector:

"The additionality determination represents a level of performance that, with respect to emission reductions or removals, or technologies or practices, is significantly better than average compared with recently undertaken practices or activities in a relevant geographic area. Any project that meets or exceeds the performance threshold is considered "additional" or beyond that which would be expected under a "business-as-usual" scenario."¹⁸

This statement, which is repeated in all seven protocols in the Climate Leaders Program, eviscerates the "beyond business-as-usual" standard by equating it with "significantly better than average." For instance, the Climate Leaders Captured Methane End Use protocol reveals that, by the time of the protocol's issuance, 435 landfills utilized methane end use as part of business-as-usual.¹⁹ This protocol does not attempt to distinguish those landfills that can provide a reasonable return on investment from their new or upgraded methane capture by using or selling the resulting methane for energy, even without the incentive of offset payments. Similarly the Climate Leaders protocols for Commercial Boilers, Industrial Boilers and Transit Buses make no

¹⁶ Climate Leaders carbon offset methodologies: <http://epa.gov/climateleaders/resources/optional-module.html>

¹⁷ Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Commercial Boiler Efficiency ("CB Protocol"): http://epa.gov/climateleaders/documents/resources/comm_boiler_proto.pdf

¹⁸ Id. at p. 7.

¹⁹ Captured Methane End Use protocol (<http://www.epa.gov/climateleaders/documents/resources/EndUseOffsetProtocol.pdf>) at p.4.

attempt to determine whether the efficiency savings from these projects may provide a sufficient return to justify the investment without offset payments.²⁰

Innovation is a constant feature of a market economy. The inherent incentives to innovate as a method to compete and increase profits means that “significantly better than average” performance levels are almost always being achieved by the newest and most efficient technologies. Without these advances in technology, the combination of economic growth and population growth would push GHG emission increases even higher than they are already under business-as-usual. By allowing GHG offsets to be generated from the business-as-usual activities inherent in a market economy, the Climate Leaders protocols allow business-as-usual to be claimed as a net decrease in emissions.

ii. Profitability Analysis

Some GHG offset programs acknowledge that some businesses will undertake GHG reduction projects similar to the projects which are allowed to generate GHG offsets even without the incentive of the offset payment. However, proponents of these programs claim they can distinguish between the Group 1 and Group 2 projects through use of a profitability analysis. The Regional GHG Programs include the Regional Greenhouse Gas Initiative (Northeast and Mid-Atlantic States of the U.S.), the Midwestern Greenhouse Gas Reduction Accord, and the Western Climate Initiative. While each has developed its own structure and governance, the three programs have entered into a collaborative process in order to develop a consensus on key offset policy design and implementation components. As a result of this effort, the three regions have jointly produced the Three-Regions Whitepaper.

The Three-Regions Whitepaper claims it is possible to clearly distinguish the profitability of a GHG-offset project, with and without the incentive of the offset payment (see Three Regions Whitepaper, Chart on p. 12). However, there are several reasons this cannot be objectively determined:

- (a) Market volatility of relevant parameters such as GHG offset price and fuel prices.
- (b) Hidden liabilities that may be addressed by the project.
- (c) The inherent subjectivity of a determination concerning whether a project will be sufficiently profitable to justify the risks.

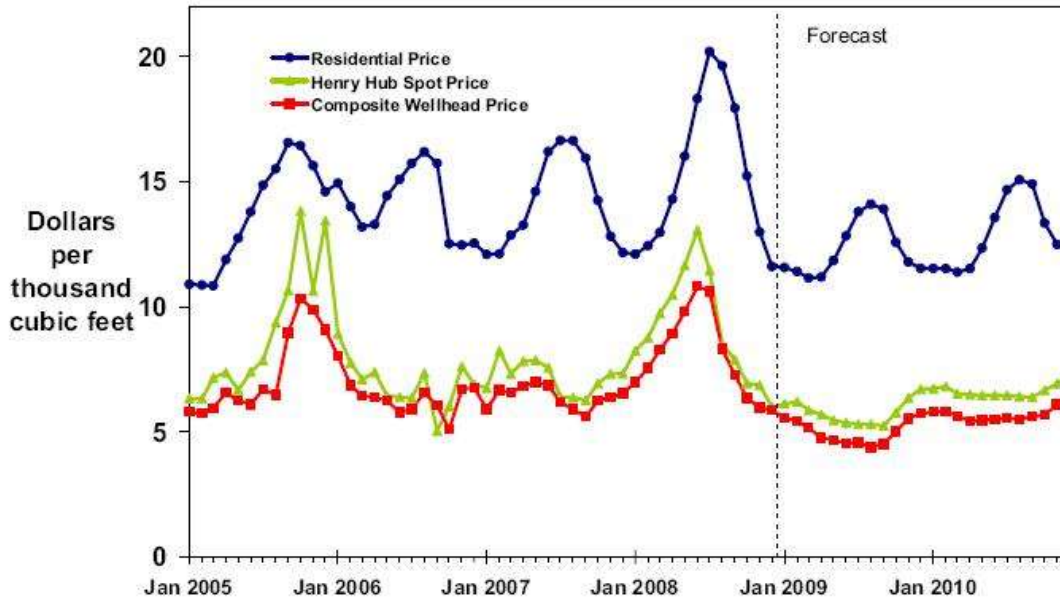
²⁰ Commercial Boiler Efficiency protocol (http://www.epa.gov/climateleaders/documents/resources/comm_boiler_proto.pdf) at p. 6; Industrial Boiler Efficiency protocol (http://www.epa.gov/climateleaders/documents/resources/industrial_boiler_protocol.pdf) at p.4; Transit Bus Efficiency protocol (http://www.epa.gov/climateleaders/documents/resources/transit_protocol.pdf)

(a) Market Volatility in the Price of Offsets and other Relevant Parameters

The following two charts are provided as examples of market volatility in the price of offsets payments and other relevant parameters such as fuels (here natural gas prices). These forms of volatility, as well as the variability of many other factors that affect profitability, prevent any effort to reliably establish whether a project will be profitable with or without an offset payment.



Natural Gas Prices



As is widely understood by the general public and shown in the charts above, the multiple prices that determine profitability are not static; they are constantly fluctuating, making profitability predictions an art not a science.

(b) Avoiding Hidden Liabilities

A second factor that makes it impossible to determine whether an activity is business-as-usual is hidden liabilities. For instance, it may appear that there is no profit incentive to capture and flare landfill gas. However, there are several possible cost incentives. These include avoiding lawsuits for causing a nuisance with noxious odors and preventing explosive concentrations of gas from accumulating.

The Landfill Methane Capture and Control (“LMCC”) protocol does not attempt to distinguish those landfills that can provide a reasonable return on investment from their new or upgraded methane capture by using or selling the resulting methane for energy. The protocol excludes landfills that are required to have gas collection under federal, state or local law, but indicates that substantial emissions from many landfills are not regulated. The protocol cannot distinguish, however, those landfills that add capture and collection because of a combination of nuisance complaints, safety and liability concerns and/or the motive to profit from methane end use. As a result, the protocol allows non-additional, business-as-usual projects to receive GHG offsets. Like many others, this protocol indicates that a practice that is not legally required — and is “significantly better than average” compared with the practices in the relevant geographic area — meets the performance standard. The protocol states, “A minority of the unregulated landfills have landfill gas collection and combustion systems. Therefore installing collection and combustion systems at unregulated landfills is considered ‘beyond business-as-usual’ and, therefore, additional.”²¹

The United States Agency for Toxic Substances and Disease Registry has documented the reasons why even landfills that are not required to have gas collection may choose to implement such a system as part of business-as-usual: “odor complaints or potential safety and health concerns may also prompt landfill gas collection. Sulfide emissions are a common source of landfill odor complaints. At older landfills or at smaller landfills exempt from federal and state regulations, uncontrolled releases of landfill gases can pose potential safety and health concerns (e.g., explosion hazards). In such cases, the landfill might implement landfill gas control measures, even if they are not required by federal or state regulations. Some landfills have also

²¹ Landfill Methane protocol: http://epa.gov/climateleaders/documents/resources/draft_landfill_offset_protocol.pdf.

implemented voluntary gas collection and control or treatment systems to recover landfill gas for energy production.”²²

Similar consideration may affect the decision as to whether to invest in “Managing Manure with Biogas Recovery Systems,” another one of the EPA Climate Leaders offset protocols.²³

(c) Subjectivity in Profitability Determinations

Given that all projections of profitability rely on a best guess of many unknowable factors, the decision as to whether to make an investment, such as an offset project is always somewhat subjective. As a result, distinguishing whether the offset payment was a deciding (“but for”) factor in the investment would require knowledge of the mindset of the offset project investor at the moment that the decision was made (i.e., did they act because of the offset payment incentive or not?) When asked whether the offset payment was the deciding factor, of course, the motivation of any investor and his or her representative is to portray their decision as dependent on receiving the offset payment; otherwise they stand to lose that extra bonus payment.

Both the performance standard methodology and profitability analysis approach suffer from an unfixable flaw: they cannot reliably distinguish between those projects that would not have been profitable without the extra incentive of the GHG offset payment and those projects that would have occurred in the course of business-as-usual.²⁴

2. Activity Shifting (also called “Leakage”) Cannot Be Tracked

Even if it were possible to distinguish business-as-usual projects, when GHG offsets are generated through activities that can be shifted to other locations, it is not feasible to track these shifts in emissions. Generating GHG offsets through changes in forest preservation presents a clear example of this problem. Claimed sequestration of GHGs from preserving a forest will be illusory if the continued demand for forest products results a shift in logging operations to another location. In that case, the result is no net gain in GHGs sequestered by forests.

The Reforestation/Afforestation GHG offset protocol in the Climate Leaders program states that GHG offsets should be allowed only where a net gain in forest land can be demonstrated.

²² U.S. Agency for Toxic Substances and Disease Registry, Landfill Gas Primer – An Overview for Environmental Health Professionals, Chapter 5, Nov. 2001, available at: <http://www.atsdr.cdc.gov/hac/landfill/html/ch5.html>

²³ EPA Climate Leaders GHG Offset Protocol, Managing Manure with Biogas Recovery Systems (August 2008) at http://www.epa.gov/climateleaders/documents/resources/ClimateLeaders_DraftManureOffsetProtocol.pdf

²⁴ Additional evidence, some of it anecdotal, of the difficulty in distinguishing business-as-usual in India, where many GHG offsets were generated for the CDM, is found a paper by Barbara Haya, of the UC Berkeley Energy and Resources Group, “Measuring Emissions Against an Alternative Future: Fundamental Flaws in the Structure of the Kyoto Protocol’s Clean Development Mechanism.” http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1562065

However, the protocol only makes an extremely narrow and ineffective attempt to limit the impact of activity shifting. The protocol states that activity shifting by an individual landowner can be addressed by including all of that landowner's holdings inside the "project boundary." If new land under the same ownership is shifted from forest land to pasture land or crop land, this is designated as "leakage" and a corresponding reforestation/afforestation project by the same landowner cannot get GHG offsets for a new increase in GHG sequestration. This narrow limitation will be extremely difficult or impossible to track and quantify, especially where lands held by overlapping owners use different corporate entities and business names. The protocol provides no mechanism nor suggests any approach to accomplish this tracking.

Finally, there is no serious attempt to deal with activity shifting due to continued demand for forest products. The protocol states:

Although there are other forms of leakage, for this performance standard, leakage is limited to activity shifting – the displacement of GHG activities outside of the project boundary. If it is determined that significant emissions that are reasonably attributable to the project occur outside the project boundary, these emissions must be quantified and included in the calculation of reductions; however, no specific methodology is required. All associated activities determined to contribute to leakage should be monitored.

As a limitation on activity shifting, especially for commodities like forest products which are traded worldwide, this standard is meaningless and unenforceable. Among the unanswered questions are:

- Who makes any determination regarding leakage?
- What are "significant emissions?"
- What is "reasonably attributable?"
- How are the emissions to be quantified?
- How are activities associated with leakage to be monitored?

Unless each of these questions could be answered in an objective and enforceable manner, this so-called limitation is completely ineffective. The Three-Regions Whitepaper makes an equally ineffective attempt to address leakage. On page 10, it merely states that protocols "must appropriately account for . . . identified project leakage." No standard, methodology, or process for addressing the problems associated with leakage is set forth, or even suggested.

To know whether any reforestation/afforestation project resulted in a net gain in forest land, it would be necessary to have complete knowledge of the associated markets and harvesting

activities on a worldwide basis. This is not feasible and the protocol ignores the reality of activity shifting.²⁵

3. Perverse Incentives to Keep Polluting Activities Legal

Once an activity is approved to generate GHG offsets, parties who are benefiting from such GHG offsets payments will oppose regulating that activity in any way that would reduce or eliminate its ability to generate these offsets. As a result, these profits will interfere with the passage of new regulations to limit polluting activities. New regulations are a normal part of our society's response to improved scientific understanding, the development of new control technologies, and evolving social and environmental conditions. There are at least five groups of parties who develop an interest in continuing the ability of projects to generate GHG offsets.

- a. **Offset developers/investors:** The most obvious parties who develop an interest in keeping the polluting activity legal (such as the release of methane from landfills) are those profiting from developing the GHG offset project. If the activity generating the GHG offset becomes a regulatory requirement, the developer/investor will no longer be able to profit from selling this category of GHG offsets and the cost of the project is transformed into a cost of compliance.
- b. **Offset Purchasers:** The second party benefiting from the generation of the GHG offset is the one using the GHG offset to satisfy its GHG reduction obligations. Presumably, the party using the GHG offset is doing so because it is cheaper for the GHG user to purchase the GHG offset than it is to control GHG emissions at the purchaser's own facility within the capped sector. Elimination of a cheaper compliance option will entail either securing a different, and possibly more costly, source of GHG offsets or more costly GHG emissions controls at the purchaser's facility.
- c. **Political Appointees:** The third group benefiting from the generations of GHG offsets is the politically-appointed leaders of the regulatory agencies overseeing GHG offset generation and use. As advocates of proposed programs involving cap-and-trade-with-offsets have often stated, the main purpose of GHG offsets is to keep the costs of those programs low. Eliminating sources of GHG offsets will raise the costs of those programs and be politically unpopular.
- d. **Brokers, Traders and Certifiers:** The fourth group benefiting from the generation of GHG offsets is comprised of the brokers, traders, certifiers, lawyers and others who make the deals and "push the paper" necessary to create GHG offsets. Almost any limitation

²⁵ We agree that it is important for the U.S. and other countries to develop global incentives for preservation and increases in total verifiable forests cover. However, we believe this effort should be decoupled from the effort to achieve fossil fuel emission reductions in any U.S. climate program because of the flaws described herein.

on the generation of GHG offsets will have a negative financial impact on this group, and they will be vigorously opposed to such limits.

- e. **Others with Uncontrolled Emissions:** Finally, there is a fifth group which benefits from the lack of regulatory requirements which allows the generation of GHG offsets – those who are engaging in the same polluting activity as the GHG offset generators, but have not yet controlled their GHG emissions. For this group, a new regulatory requirement eliminates the potential future benefits of generating GHG offsets.

The potential for perverse incentives is evident both in the EPA Climate Leaders program and the proposed legislation before Congress. Two of the GHG offset protocols in the Climate Leaders program involve the capture and control of methane. One protocol applies to methane from landfills and the other from manure digesters. In the normal development of environmental and energy efficiency regulations, these are activities that would likely become targets for new regulatory requirements.

Individual methane control projects in a GHG-offset program would produce environmental benefits. However, programs and/or legislation that provide for the generation of GHG offsets from these methane control activities would increase pressure to delay or completely avoid industry-wide rules applicable to all sources in this category. These rules, applied across the board, would achieve much greater environmental benefits than the individual GHG offset projects. As a result, authorizing GHG offsets makes controlling the entire sector's emissions more difficult. Delays in passing sector-wide controls result in a net increase in emissions compared with more timely regulation.

A well-known example of this perverse incentive to keep polluting activities legal is found in the GHG offsets provided for the destruction of HFC-23 under the CDM. HFC-23 is an extremely powerful greenhouse that is created as a by-product during the manufacture of the refrigerant HCFC-22. GHG offsets, consisting of flaring of HFC-23, primarily in China, have provided the majority of reductions for the European Trading Scheme (59% in 2009).²⁶ Despite the vast sums of money paid for HFC-23 projects to date, HFC-23 emissions are still increasing, due to emissions from facilities not participating in the offset program. Efforts to address these ongoing emissions through regulation have been blocked by those who are profiting and those who would like to profit from the offset payments the CDM offset program provides.²⁷ While the HFC-23

²⁶ Carbon Watch Policy Briefing - HFC-23 In The context of the EU Emissions Trading Scheme, July 14, 2010 at https://docs.google.com/viewer?a=v&pid=gmail&attid=0.9&thid=129f3171181722dc&mt=application/pdf&url=https://mail.google.com/mail/?ui%3D2%26ik%3D1e0eb42e49%26view%3Datt%26th%3D129f3171181722dc%26attid%3D0.9%26disp%3Datt%26realattid%3D2c6a278b0af739a8_0.9%26zw&sig=AHIEtbQV7LZg56oCdbWg2hhdYbusefzRw&pli=1

²⁷ Id.

example is so egregious and well-known that it is specifically prohibited in the current U.S. climate legislative proposals, the offsets that are allowed under these bills would create a similar dynamic.

Specifically, the perverse incentive to allow the generation of GHG offsets rather than regulate the emissions sources is seen in the evolution of the legislative proposals before Congress. In the 2009 Waxman-Markey legislation, methane emissions from coal mines, landfills, and oil and natural gas distribution facilities were part of the capped sectors. In the subsequent Kerry-Boxer bill in the Senate, these same emissions were removed from the capped sources and made eligible as a source of GHG offsets.²⁸

4. Subjectivity, Complexity and Uncertainty

In addition to the other flaws noted above, the subjectivity, complexity and uncertainty of many factors identified as crucial to offset protocols undermine the reliability and enforceability of this mechanism. Each of the seven GHG protocols in the Climate Leaders program includes multiple examples of these confounding factors, which affect calculation of both the baseline GHG emissions which allegedly would have occurred without the project, as well as the claimed GHG reductions from the project. In many cases, critical elements needed for calculating emissions are left open ended and subject to gross manipulation. These elements are “addressed” with such phrases as “should be accounted for” and “should be considered.” No standard methodology is supplied for these elements and no mention is made of who should determine the appropriateness of any particular methodology.

A number of examples of subjectivity, complexity and uncertainty can be found in the Climate Leaders protocols. One example, found in the Commercial Boiler, Industrial Boiler and Transit Bus Efficiency protocols, is the subjective determination of whether a boiler or a bus is being “retired [or replaced] early.”²⁹ Since there is no objective standard for whether a boiler or bus is being retired early, offset project proponents will be tempted to claim many years of additional life. Every year that a boiler or bus can be claimed to have had remaining life can produce additional offsets. Further, the protocols involve vague instructions like, “No specific quantification methodology is required. All associated activities determined to contribute to leakage should be monitored.” Complex formulas that use emission factors are used to estimate both baseline emissions and after-project emissions. (CB protocol at p. 9-10.) Another vague

²⁸ Jessie Jenkins, “Anatomy of a Bill: Kerry Boxer” <http://theenergycollective.com/TheEnergyCollective/48931>

²⁹Commercial Boiler Efficiency protocol (http://www.epa.gov/climateleaders/documents/resources/comm_boiler_proto.pdf) at p. 6; Industrial Boiler Efficiency protocol (http://www.epa.gov/climateleaders/documents/resources/industrial_boiler_protocol.pdf) at p.4; Transit Bus Efficiency protocol (http://www.epa.gov/climateleaders/documents/resources/transit_protocol.pdf) at p.4.

instruction provides: “All commercial boiler greenhouse gas offset projects must also monitor any regulatory requirements (or changes in regulatory requirements) or substantive changes in the project that might affect the continued eligibility of the project as a greenhouse gas offset project.” (CB protocol at p. 11).

The legislation before Congress does nothing to address these issues of subjectivity, complexity and uncertainty, or any of the unfixable flaws inherent in the creation of GHG offsets. Most often these issues are “punted” to regulatory agencies such as EPA with no real standards or guidance. For example, section 734 of the American Clean Energy and Security Act of 2009 (“ACES”) leaves to EPA the tasks of creating standardized methodologies for determining additionality, creating baseline activity levels, creating quantification protocols for GHG offsets, and assuring that the issue of leakage is addressed. The language in ACES regarding leakage is typical of the “hold back the tides” charge given to EPA while providing no instructions for addressing this critical and complex issue. Section 734(a)(4) of ACES requires that EPA establish for each type of listed offset project “A standardized methodology for accounting for and mitigating potential leakage, if any, from an offset project of that type, taking into account uncertainty.”

The EPA Climate Leaders protocols appear to provide a preview of what EPA’s effort to fulfill this charge might look like. However, neither the Climate Leaders protocols nor the Three-Region Whitepaper can overcome the unfixable flaws described in this disclosure.

Lack of Enforceability: The result of all of the flaws discussed above is a complete lack of objective criteria or standards for additionality and an inability to enforce the alleged additionality of offsets. Courts generally refuse to punish companies for violations of standards which are subjective and vague. The legal principle is that potential defendants must be given “fair notice” that certain conduct or actions would violate the law and any regulations promulgated pursuant to that law. See, e.g., General Electric Company v. EPA, F.3rd 1324, (D.C. Circuit 1995). For all of these reasons, GHG offsets, including those in the proposed legislation before Congress, would create an enormous unfixable loophole in any climate program of which they were a part.

VII. Third Party Certification and Regulatory Oversight Cannot Fix the Problems

Based on the nature of the flaws we have described above, we do not believe it is possible to construct a system of either independent third-party certification or regulatory oversight that can overcome the flaws of GHG offsets.

A. “Third-Party” Certification

The CDM, EPA Climate Leaders Program and the Regional GHG Programs all provide for a system of “independent” certifiers (also called validators and verifiers) to assure that all criteria

for the additionality of GHG Offsets have been met.³⁰ For instance, the Three-Region Whitepaper states: “Verification should be conducted by an independent party that does not have any financial interest or other interest in an offset project, or a relationship with an offset project developer or other party involved in an offset project that could cause a conflict of interest, which would undermine the objectivity of the verifier.”³¹ Even if certifier does not have a financial interest in a particular project, the certifier’s profession as a whole relies on finding that GHG offsets have the potential to be additional. As a result, certifiers’ financial interest in continued employment is at odds with acknowledging the flaws we have described in this disclosure.

In addition, regardless of whether certifiers are independent and fair, the lack of objective enforceable standards makes their role a sham and puts a meaningless gloss on the process. Certification is only as good as the underlying process and cannot make up for a fundamentally failed system.

B. Relying on Regulatory Oversight

As noted above, the nature of GHG offsets makes it impossible to provide fair notice and objective standards for any regulatory oversight program. The combination of vague, subjective and unknowable factors would make efforts at regulatory oversight or enforcement fruitless.

VIII. Conclusion

Like the creative financial instruments that helped bring us the current recession, GHG offsets lack integrity. The consequences of enacting climate legislation that relies on this flawed mechanism are likely to be even more serious than the recent financial crisis. We therefore request that Congress fully investigate our allegation that adopting a cap-and-trade-with-offsets approach to climate legislation would be a waste of government resources, mislead the public and defeat the legislation’s stated purpose of significantly reducing GHG emissions.

Our disclosure is supported by the March 5, 2009 finding by the U.S. Government Accountability Office (“GAO”), regarding the CDM offset program in Europe under the Kyoto Protocol. The GAO found, “Because additionality is based on projections of what would have occurred in the absence of the CDM [Clean Development Mechanism], which are necessarily hypothetical, it is impossible to know with certainty whether any given project is additional.” (“Observations on the Potential Role of Carbon Offsets in Climate Change Legislation” at p. 12, GAO-09-456T.)³² The report concludes that “the use of [GHG] offsets in a cap-and-trade

³⁰ Clean Development Mechanism PowerPoint on Independent Verification
<http://www.firstenvironment.com/assets/pdf/VVCDM.pdf> at p.2.

³¹ Three-Region Whitepaper at p.16.

³² U.S. Government Accountability Office, March 2009 “Observations on the Potential Role of Carbon Offsets in Climate Change Legislation” at p. 12, GAO-09-456T (<http://www.gao.gov/new.items/d09456t.pdf>)

system can undermine the system's integrity, given that it is not possible to ensure that every credit represents a real, measurable, and long-term reduction in emissions." Id. at p.17-18.

We would go one step further and conclude that, because of the unfixable flaws we describe, it will be impossible to demonstrate that any GHG offsets meet the standards for additionality. Using a cap-and-trade-with-offsets approach to U.S. climate legislation would result in a deeply-flawed system of accounting for GHG reductions and seriously undermine our ability to effectively address the unprecedented climate challenge facing our generation.

IX. Reference Materials and Additional Resources by Subject Category:

A. Our Personal Website

1. CarbonFees.org: <http://www.carbonfees.org/home/>

B. The Proposed U.S. Climate Legislation

2. Waxman-Markey, American Clean Energy & Security Act
<http://www.govtrack.us/congress/bill.xpd?bill=h111-2454>,
3. Kerry Boxer, Clean Energy Jobs and American Power Act,
<http://kerry.senate.gov/cleanenergyjobsandamericanpower/pdf/bill.pdf>,
4. Kerry Lieberman, American Power Act at
<http://kerry.senate.gov/imo/media/doc/APAbill3.pdf>

C. EPA Budget Materials FY2010 – Spending on Offset Program Development

5. EPA FY2010 Budget in Brief: <http://www.epa.gov/budget/2010/2010bib.pdf> (**Cap & Trade Offsets Methodology (FY 2010 PB: \$5.0M, FY 2009 Enacted: \$0.0M, FY 2010 Increase: +\$5.0M)**) (Requests \$5.0 million to provide analytical support for proposed greenhouse gas cap and trade programs, including offset verification. These funds address basic analytical needs to assess a potential GHG cap and trade program. EPA, in cooperation with other agencies, will develop protocols to measure the effectiveness of offset projects, develop options to include early action GHG offsets and international offsets and provide advice on effective, environmentally sound approaches to offsets.) Noted: This summary of the EPA budget provisions assume that there is “an environmentally sound approach to offsets.”

D. The Urgency of Addressing Climate Change

6. Target Atmospheric CO2: Where Should Humanity Aim:
http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf
7. MIT Research Report May 2009: <http://web.mit.edu/newsoffice/2009/roulette-0519.html>
8. National Science Foundation Press Release, “Methane Releases from Arctic Shelf May Be Much Larger and Faster than Anticipated”
http://www.nsf.gov/news/news_summ.jsp?cntn_id=116532
9. Lisa Jackson Memorandum to All EPA Employees – January 12, 2010 -
<http://yosemite.epa.gov/opa/admpress.nsf/0/bb39e443097b5df5852576a9006a5a86?OpenDocument>

D. The EPA Climate Leaders Program

10. Climate Leaders Program Website: <http://epa.gov/climateleaders/>
11. Climate Leaders Carbon Offset Methodologies:
<http://epa.gov/climateleaders/resources/optional-module.html>
12. EPA News Release, July 21, 2009: “EPA’s Climate Leaders Program Recognizes Partners for Reducing Greenhouse Gas Emissions” (Exelon Corp., Public Service Enterprise Corp (PSEG) and Raytheon Co.)
<http://yosemite.epa.gov/opa/admpress.nsf/6fa790d452bcd7f58525750100565efa/c710abfd65fb066d852575fa00627ea1!OpenDocument>
13. Captured Methane End Use:
<http://epa.gov/climateleaders/documents/resources/EndUseOffsetProtocol.pdf>
14. Commercial Boilers:
http://epa.gov/climateleaders/documents/resources/comm_boiler_proto.pdf
15. Industrial Boilers:
http://epa.gov/climateleaders/documents/resources/industrial_boiler_protocol.pdf
16. Landfill Methane:
http://epa.gov/climateleaders/documents/resources/draft_landfill_offset_protocol.pdf
17. Managing Manure with Biogas Recovery Systems:
http://epa.gov/climateleaders/documents/resources/ClimateLeaders_DraftManureOffsetProtocol.pdf
18. Reforestation/Afforestation:
http://epa.gov/climateleaders/documents/resources/draft_reforestation_offset_protocol.pdf;
<http://ecoserver.env.duke.edu/RAPCOEv1/>
19. Transit Bus Efficiency:
http://epa.gov/climateleaders/documents/resources/transit_protocol.pdf
20. P.3 of the January 19, 2006 Climate Leaders’ Partners “overview of the performance standards approach for offsets.”
http://www.epa.gov/climateleaders/documents/events/jan2006/overview_lefranc.pdf
21. Clinton County Landfill Methane Project: Landfill Methane Offsets for Sale:
http://www.carbonfund.org/site/pages/our_projects/ - Sold at \$10 per ton of offset, this project claims to be “the first-ever carbon offset project approved by the US EPA’s Climate Leaders

Program. Located in Clinton County, NY, this project involves collecting and destroying the greenhouse gas methane.

22. EPA Climate Leaders: Partner and Small Business Network Member Use of Carbon Offsets Using EPA-Approved Methodologies, see

<http://www.epa.gov/stateply/resources/partneruse.html>.

23. EPA Offsets Analysis, March 6, 2009, Bill Irving, Climate Change Division,

http://www.pewclimate.org/docUploads/bill-irving-03-06-09_0.pdf

E. Three-Regions Whitepaper and Related Materials

24. Midwestern Greenhouse Gas Reduction Accord, Release of Joint Offset Quality White Paper, <http://www.midwesternaccord.org/news.html>

25. Ensuring Offset Quality – May 2010 (White Paper):

[http://www.midwesternaccord.org/News%20Page/Three-Regions Offsets Whitepaper%2005 17 10.pdf](http://www.midwesternaccord.org/News%20Page/Three-Regions%20Offsets%20Whitepaper%202005%2017%2010.pdf) (see page 11).

F. Project Types Selected For Offset Payments May Be Profitable Without Such Payments

26. Methane Digesters to Help Cut Dairy Emissions 25% by 2020:

http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=15685 – “Currently, only about 2% of U.S. dairies that are candidates for a profitable digester are using the technology, even though dairy operations with anaerobic digesters routinely generate enough electricity to power 200 homes.”

27. U.S. Agency for Toxic Substances and Disease Registry, Landfill Gas Primer – An Overview for Environmental Health Professionals, Chapter 5, Nov. 2001, available at:

<http://www.atsdr.cdc.gov/hac/landfill/html/ch5.html>

28. EPA Landfill Methane Outreach Program PowerPoint,

http://www.epa.gov/statelocalclimate/documents/pdf/lmop_overview_victoria_ludwig.pdf.

29. EPA “Turning an Asset Into a Liability - A Landfill Gas-To-Energy Project Development Handbook” EPA 430-B-96-0004 - September 1996 (see p. 16).

30. SF Muni Bus Purchase 2007 - <http://www.sfmta.com/cms/mfleet/hybrids.htm>.

G. Other Critiques of Offsets

31. U.S. Government Accountability Office, March 2009 “Observations on the Potential Role of Carbon Offsets in Climate Change Legislation” at p. 12, GAO-09-456T

<http://www.gao.gov/new.items/d09456t.pdf>.

32. International Climate Change Programs: Lessons Learned from the European Union's Emissions Trading Scheme and the Kyoto Protocol's Clean Development Mechanism, U.S. Government Accountability Office, November 2008, <http://www.gao.gov/new.items/d09151.pdf>.
33. A Dangerous Distraction: Why Offsets are A Mistake the U.S. Cannot Afford to Make, by Friends of the Earth, September 2009, <http://www.foe.org/dangerous-distraction>
34. Trading in Fake Carbon Credits: Problems with the Clean Development Mechanism, by Friends of the Earth and International Rivers, presents additional evidence of the flaws of offsets http://www.foe.org/pdf/FOE_IR_CDM_FS.pdf.
35. Jessie Jenkins, "Anatomy of a Bill: Kerry Boxer" <http://theenergycollective.com/TheEnergyCollective/48931>.
36. Carbon Watch Policy Briefing - HFC-23 In The context of the EU Emissions Trading Scheme, July 14, 2010 at https://docs.google.com/viewer?a=v&pid=gmail&attid=0.9&thid=129f3171181722dc&mt=application/pdf&url=https://mail.google.com/mail/?ui%3D2%26ik%3D1e0eb42e49%26view%3Datt%26th%3D129f3171181722dc%26attid%3D0.9%26disp%3Dattd%26realattid%3D2c6a278b0af739a8_0.9%26zw&sig=AHIEtbQV7LZg56oCdbWg2hhndybusefzRw&pli=1.
37. Barbara Haya, Measuring Emissions Against an Alternative Future: Fundamental Flaws in the Structure of the Kyoto Protocol's Clean Development Mechanism http://erg.berkeley.edu/working_paper/2009/ERG09-001.pdf.