WRITTEN TESTIMONY
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TO THE

U.S. SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
CONCERNING METHODS OF COST CONTAINMENT
IN A GREENHOUSE GAS EMISSIONS TRADING PROGRAM

1. Introduction and Summary

Mr. Chairman and members of the committee, I am honored to appear before you to testify on the potential role of carbon offsets as a cost containment mechanism for a US greenhouse gas emissions trading market. Overall, I believe that offsets hold limited promise, both as a cost control mechanism and as a method for reducing emissions beyond the sectors covered by a cap-and-trade scheme. Alternative cost-containment measures, such as a symmetric safety valve with revenues dedicated to a climate trust fund, are more likely to supply many of the hoped for benefits of with fewer of the risks associated with their use. This is especially likely to be the case for the cap and trade system proposed in Title III of the American Clean Energy and Security Act of 2009 (ACES)[1]. The ACES's cap and trade system depends very heavily on the provision of unprecedented numbers of offsets from both domestic and international programs for cost containment ,while at the same time requiring that these systems meet exacting environmental standards. My research focuses on the implementation and function of the only existing compliance grade carbon offset market, the Kyoto Protocol's Clean Development Mechanism (CDM). Detailed analysis of this large and growing carbon offset market suggests that these twin objectives for an ACES offset market, of copious offset supply and high environmental integrity, are likely to be fundamentally incompatible.

In this testimony, I will address several key lessons learned from the international experience with carbon offsets under the Kyoto Protocol so far. I will then describe the relevance of these lessons to the offsets program contemplated by ACES. Finally, I will describe an alternative cost-containment mechanism, a symmetric safety valve or price collar, combined with a climate trust fund. Based on experience with carbon offsets so far, a price-collar is likely to provide far more reliable cost-containment than carbon offsets. I conclude the following:

[1] The American Clean Energy and Security Act, H.R. 2454, 111th Cong. (2009).

(1) **There has been and will continue to be substantial crediting of business-as-usual behavior within the CDM.** This is particularly true for sectors such as electricity generation that are highly regulated by developing country governments. This crediting of counterfeit emissions reductions is likely to be a hallmark of any real offset program. The crux of the problem is the inability in practice to tell which of the many applicants for carbon offsets are telling a genuine story regarding emissions reductions and which would have installed cleaner technology even in the absence of the carbon market.

(2) **The CDM has yet to perform as a reliable cost-containment strategy.** Actual issuance of offsets has been far lower than predicted because of concerns about environmental integrity. These concerns have led of necessity to an elaborate and time consuming regulatory process. The impact of this failure to produce offsets has been largely hidden by the reduction in demand for permits due to the global recession.

(3) **Real-world implementation of an offset market of the scale contemplated by ACES could not avoid the CDM's pitfalls.** ACES as passed requires an offset market and regulatory structure of between 10 and 50 times the size of the current CDM. While there are process efficiencies that a US system could realize, the potential for crediting business-as-usual behavior, for uncertain offset supply, or both, is substantial. In practice as opposed to theory, both effective cost control and certainty as to emissions levels are impossible to achieve under such a system.

(4) **A symmetric safety valve or price collar that includes both a price floor and a price ceiling for emissions allowances is preferable to offsets as a cost-control option.** A price collar would be simple to administer, would not require an elaborate regulatory system to administer, and would produce certainty ex-post as to the actual level of emissions under the cap. Offsets will deliver none of these. A price-collar would keep costs within the ACES emissions trading market commensurate with expectations. By doing so it would help to ensure the ongoing support of constituencies essential for an enduring and stable climate policy. Finally and most importantly, a price collar would provide a guaranteed minimum return for clean-tech innovators seeking to displace older fossil generation. This guaranteed return ould increase the provision of new and innovative technologies to the US economy. By doing so, it would also increase the number of green jobs created by a US climate program, and help to position the US as a leader in the global energy revolution.

(5) **A price collar would produce substantial revenues via the sale of extra permits. These funds could be used to produce many of the environmental benefits promised by offsets.** While use of the safety valve would increase the level of emissions under the cap, the revenue could be directed into a Climate Trust Fund. This fund could accomplish many of the

emission reduction objectives of an offset program and do so more cost-effectively. By allowing for increased flexibility and by reducing the rents captured by offset producers a Climate Trust Fund would quite possibly produce greater reductions from uncapped sources than would be possible under a carbon offset system.

2. Crediting of Business-as-Usual Activities in the Clean Development Mechanism

The environmental integrity and cost-effectiveness of a carbon offset system depend on the ability to rapidly, reliably, and cheaply determine how entities seeking carbon offsets would have behaved in the absence of the financial incentives created by emissions trading. The "business-as-usual" or baseline scenario can then be compared to what actually happens. Any reduction in emissions from the baseline to reality can then be credited with offsets. Offsets must, if they are to be effective, result in changed behavior. If not, then the result is that emissions do not fall either under the cap (where the offset is used as an alternative compliance tool) or outside the cap (where emissions remain unchanged relative to the baseline scenario). If an offset system performs perfectly, total uncapped and capped emissions remain unchanged. For every ton reduced outside the cap, one ton is emitted by a covered entity inside the cap. Of course, no offsets market is likely to work perfectly; in practice, a balance must be struck between the over-crediting of business-as-usual behavior and the under-crediting of real reductions. But even evaluating this type-1 versus type-2 error requires some ability to objectively determine the counterfactual baseline scenario. In too many contexts, this has proven impossible to do in real offset systems.

The Clean Development Mechanism of the Kyoto Protocol (CDM) is the largest carbon offset market in the world, both in terms of volume of credits and value transacted. The CDM is also the world's first compliance grade carbon offset market. Firms covered by cap-and-trade regimes, most notably the European Union's Emissions Trading Scheme (EU ETS), can use CDM offsets in lieu of allowances for compliance. The CDM was conceived with the twin goals of lowering compliance costs for parties to the Kyoto Protocol and assisting in the financing of sustainable development. The performance of the CDM holds important lessons for an analogous compliance grade carbon offset system proposed for the US.

The CDM has evolved through time as it has both grown in size, from just a few emission reduction projects to more than four thousand, and in complexity, from just a few project types to over one hundred. During this growth process, the regulators of the CDM have learned by doing and have improved practices. These improvements have been made mainly with the intention of insuring greater environmental integrity. **Both anecdotal and systematic evidence suggests that substantial crediting of business-as-usual projects continues to occur. The root cause of the problem appears to be an inability to reliably determine the baseline scenario for a particular project or class of projects.**

The problems in the CDM have been greatest in sectors and countries where government regulation plays an important role in economic activity. In China where more than half of all CDM credits originate, this is most evident in the energy sector. The Chinese energy sector, because of its strategic importance, remains largely state controlled and in many cases, state owned. The basic problem for the CDM is that state mandates and subsidy programs, along with a complicated and non-transparent interaction between state owned banks, state owned utilities, and financial and energy regulators, already strongly favor the construction of renewable and natural-gas fired energy production. Some small fraction of the new capacity added is no doubt caused by the additional finance provided by CDM. However, in practice, almost all new plants in the wind, hydro, and natural gas sectors apply for and receive credit under the CDM for emissions reductions (see Figure 1)[2].

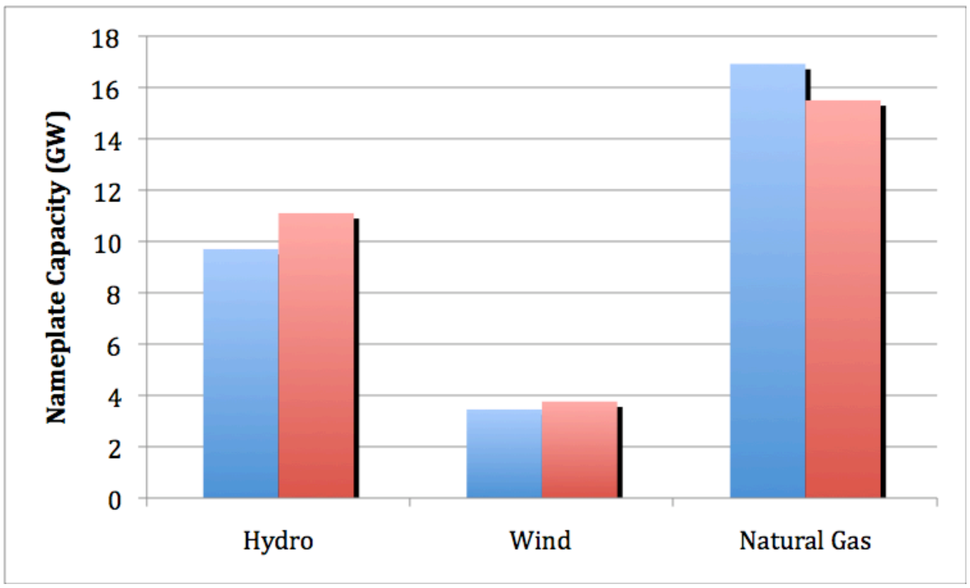

Figure 1: Hydro, wind, and natural gas fired power plants built or under construction in China compared to applications for CDM crediting for these projects. Essentially all new capacity (blue bars) is applying for CDM offset credit (red bars). Issued credits are based on the difference between these new energy sources and the Chinese grid GHG emission intensity. Shown are new capacity and CDM applications for Chinese hydro and wind power in 2007, and for natural gas-fired power in 2005-2008.[3]

The problem for the CDM has been that in practice, there is no straightforward way to determine whose behavior has been altered because of offsets and therefore who should receive them. CDM regulators have been forced to add layers of bureaucracy

[2] *See*, Michael Wara and David Victor, A Realistic Policy on International Carbon Offsets, Stanford Program on Energy and Sustainable Development Working Paper #74 (2008), *at* http://pesd.stanford.edu/people/michaelwara

[3] Hydro and wind CDM applications exceed new capacity additions in part because some plants applying for credit in 2007 were built earlier and in part because some plants that applying for credit experienced construction delays. Data Sources: National Development and Reform Council; International Gas Union; International Energy Agency; Jørgen Fenhann, UNEP-Risø Centre, CDM-JI Pipeline Database.

in an ultimately futile effort to determine which of the many applicants are telling a genuine story regarding emissions reductions and which would have installed cleaner technology even in the absence of the carbon market. As a result, there are lingering uncertainties as to the quality of credits that have been and are being issued by the CDM.

CDM offsets are ultimately bought for use as alternative compliance in a cap-and-trade system. The impact of their uncertainty quality creates uncertainty as to the quantity of emission reductions produced by the overall program of cap, trade, and offset. In the EU ETS, this uncertainty has turned out to be less than anticipated because of the global recession causing a fall in demand for electric power and hence for allowances and offsets. The fall in demand, combined with free allocation of allowances to emitters has resulted in relatively little use of offsets.[4] Even so, approximately one third of the reduction between the cap in 2007 and the cap in 2008 was covered by CDM offsets. To the extent that these offsets are of doubtful quality, we will never know whether a third of the reductions within covered sectors for the first year of the Kyoto Protocol were real or mere paper reductions. Unless ACES can somehow resolve the lingering uncertainty and criticism that has surrounded determination of baselines and consequent emissions reductions in offset programs, it will suffer the same fate. And ACES if enacted, would rely on offsets to a far greater extent than does the current EU ETS.

3. The Clean Development Mechanism Struggles to Produce a Large Offset Supply

Another surprise of the first 5 years of CDM operation has been the difficulty the system has had in producing large numbers of issued credits. Reliable supply of large volumes of offsets is a necessity for a cost-containment mechanism. The problem for CDM offsets has been that in order to maintain environmental integrity, a relatively complex regulatory system has been required. The CDM system works by first requiring that a project apply for registration, after which it operates, producing emission reductions. Reductions claimed by a project are then audited by an accredited third-party verifier. Only after this verification can an offset project owner apply for issuance of credits that can be used for compliance purposes. The ACES offset program is designed to operate in a similar fashion.[5]

In practice in the CDM, this process has proven fraught with delay such that the number of issued credits is far lower than had been expected or has been promised in offset project application documents. Estimates vary depending on methodologies used to assess project and country risk, but expected deliveries of CDM credits were on the order of billions of tons. To the end of date, in 5 years, the

[4] In 2008, the first year during which covered entities could use CDM offsets as alternative compliance in the EU ETS, just 82 million offsets were surrendered, compared to a maximum allowed usage of 8% of the cap or approximately 150 million offsets. Data obtained from the European Commission Community Independent Transaction Log.

[5] ACES *supra* note 1, §§ 735, 736.

program has produced just over 300 million offsets (See Figure 2). Further, the rate of issuance, which increased through the early phases of the program, has recently stabilized at about 12 million offsets per month (See Figure 3). At this rate, the CDM will issue just 800 million tons of offsets by the end of the Kyoto Protocol compliance period in 2012. This slow rate of issuance has been caused largely by the need to carefully check issuance requests prior to issuance because of concerns about environmental integrity. Because each request and audit trail must be checked individually before approval, this is not an area where significant economies of scale have been found. Instead, issuance has emerged as perhaps the most significant bottleneck in the CDM process.

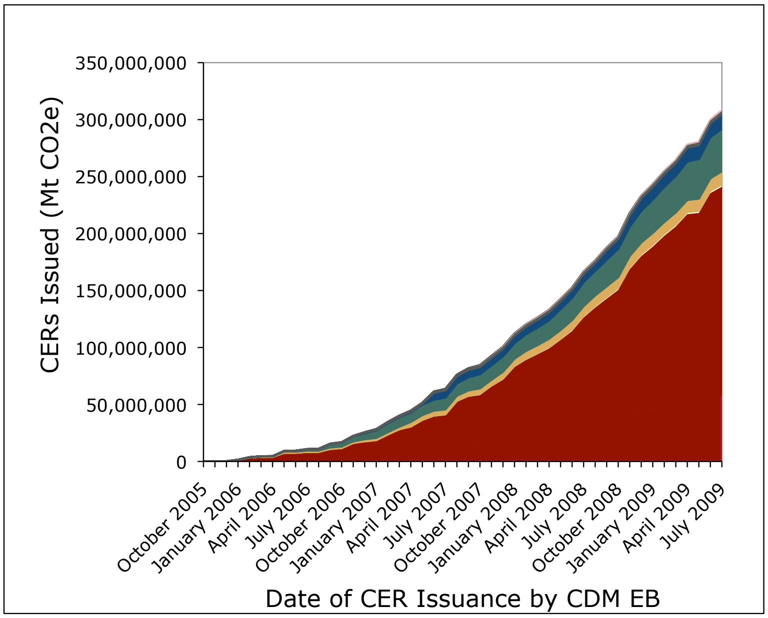

Figure 2: Cumulative issuance of carbon offsets, known in the CDM as Certified Emission Reductions (CERs) by the CDM to July 31, 2009. Total issuance is just over 300 million CERs over almost 5 years. 70% of issued CERs come from large industrial gas projects (Red). The remainder come from a mix of methane capture (Tan), renewable energy (Green), industrial energy efficiency (Blue) and natural gas power plants (Grey).[6]

Furthermore, the composition of the projects generating credits is strongly biased towards those that generate large numbers of credits. This reduces the number of requests for issuance that must be reviewed by the CDM. Thus the current rate of issuance is probably unrealistically fast relative to the entire universe of offset projects. Shown in red in Figure 2 are the industrial gas capture projects, which have generated more than 70% of the issued credits to date. These offset projects capture high global warming potential gases at industrial facilities. Because each ton of high GWP gas is worth between 310 and 11,700 times a ton of carbon dioxide, these projects generate enormous volumes of credits. Industrial gas projects greatly

[6] Data compiled by the author from the CDM issuance database, *at* http://cdm.unfccc.int/issuance/index.html.

simplify the workload for the CDM, since a few large issuances from these projects make up most of the issuance request throughput. Unfortunately, these are unlikely to be representative of either the future of the CDM or of any other large offset system. Because these projects are highly profitable, there is essentially complete global participation on the part of the eligible industries.[7] The remainder of projects in the CDM portfolio or in any other potential offset portfolio will be significantly smaller in scale and so require proportionately more work on the part of regulators to process.

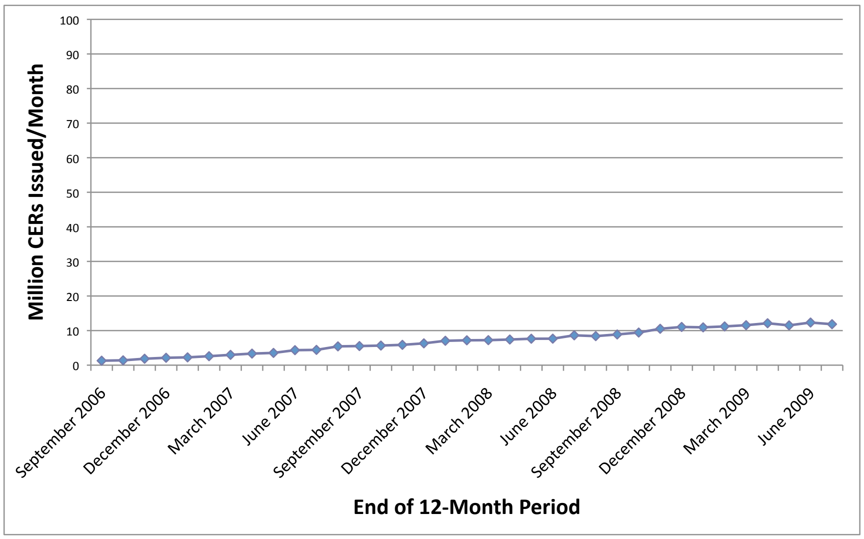

Figure 3: The 12-month running average of CDM offset issuance scaled to reflect the approximate monthly requirement to meet ACES demand for international offsets, 100 million tons per month. CDM issuance rates appear to have stabilized at 12 million CERs per month.[8]

Whatever the ultimate issuance rate achieved by the CDM, one thing the system has made clear is that actually producing compliance grade offsets is a complex and time consuming regulatory undertaking. Building the regulatory apparatus for the CDM has proven quite challenging, especially as concerns about quality have caused greater scrutiny to be applied to each project registration and request for issuance. This scrutiny takes time and leads to delays and hence a slower than anticipated production rate of offsets. Luckily for those nations and firms otherwise dependent on the CDM for cost containment of their Kyoto Protocol compliance obligation, the global recession, by reducing economic activity, substantially lowered emissions.[9] This in turn has greatly reduced the need for

[7] Indeed, these projects are so profitable that the carbon offsets produced by them are worth substantially more than the underlying products – most notably refrigerant gases for mobile air conditioners – being produced by the polluting industries. *See*, Michael Wara, The Performance and Potential of the Clean Development Mechanism, 55 UCLA Law Review 1759 (2008), *available at* http://pesd.stanford.edu/people/michaelwara.

[8] Ibid.

[9] The United States is a useful point of reference in this regard since it did not ratify the Kyoto Protocol and so is not trying to reduce emissions in order to comply. During 2008 and 2009, the EIA estimates that

offsets and the costs of not having them, averting what could have been a compliance crisis.

4. Implications of the CDM example for ACES

The CDM is the carbon offset system about which we know the most. But how relevant is experience gained under the Kyoto Protocol to the ACES offset program? I believe that the lessons presented above, of difficulty telling good from bad credits, and of the challenges of producing adequate supplies of credits, are likely to be highly relevant to an offset program of the scale contemplated by ACES.

No offsets system, including the CDM or ACES, can avoid the problem of establishing emissions baselines against which actual emissions are judged. The CDM has illustrated the difficulty of this task. By 2020, the ACES offset program would likely be approximately 20 times the size of the current CDM, if measured in terms of issuance rate (See figure 3).[10] Extrapolating from the relatively small size of the CDM to the much larger ACES program is necessarily uncertain. This is especially the case because ACES contains provisions for both a large international forestry offsets program[11] as well as a large domestic agricultural and forestry offsets program.[12] Also, ACES incorporates numerous provisions aimed at improving the quality of its offsets program compared to the CDM.[13] Nevertheless, the fundamental conceptual and administrative challenges that have confronted the CDM are unlikely to be absent from an ACES or ACES-like offset program. Such a program will struggle to create offsets of undisputed high quality because of difficult baseline determination problems, both in domestic agricultural and forestry settings and in the international regime. Finally, it will have to confront the reality that its rulemakings are potentially subject to challenge in court. The CDM Executive Board faces no such scrutiny of its decisions, or potential source of delay, in its implementation.

In addition, the ACES cap-and-trade program is, far more than the EU ETS, dependent on offsets both for cost-control and for environmental effectiveness. Most analyses of the bill indicate that allowance prices will approximately double in the absence of a ready supply of offsets.[14] In its analyses of the bill, EPA estimates that less than 50% of emission reductions that occur due to its enactment will be in capped sectors prior to 2030 (See Figure 4). That is, the majority of the bill's environmental impact hinges on the offsets program having

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US emissions have fallen by between 8 and 9 percent.

[10] *See,* Environmental Protection Agency, EPA Analysis of the American Clean Energy and Security Act of 2009: HR 2454 in the 111th Congress (Jun 23, 2009);

[11] ACES *supra* note 1, §§751-756.

[12] ACES *supra* note 1, §§501-511.

[13] ACES *supra* note 1, §§731, 739, 509, 531.

[14] EPA *supra* note 9; Congressional Budget Office, Economic and Budget Issue Brief: The Use of Offsets to Reduce Greenhouse Gases (August 3, 2009); Energy Information Administration, Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009 (Aug. 4, 2009).

superb environmental quality. If not, then emissions will occur under the cap and be covered by offset credits that due not represent real world reductions. In order to accomplish this objective, the ACES offset program, both international and domestic, will have to accomplish a far higher level of environmental oversight than has proven possible, even with the best intentions, within the CDM.

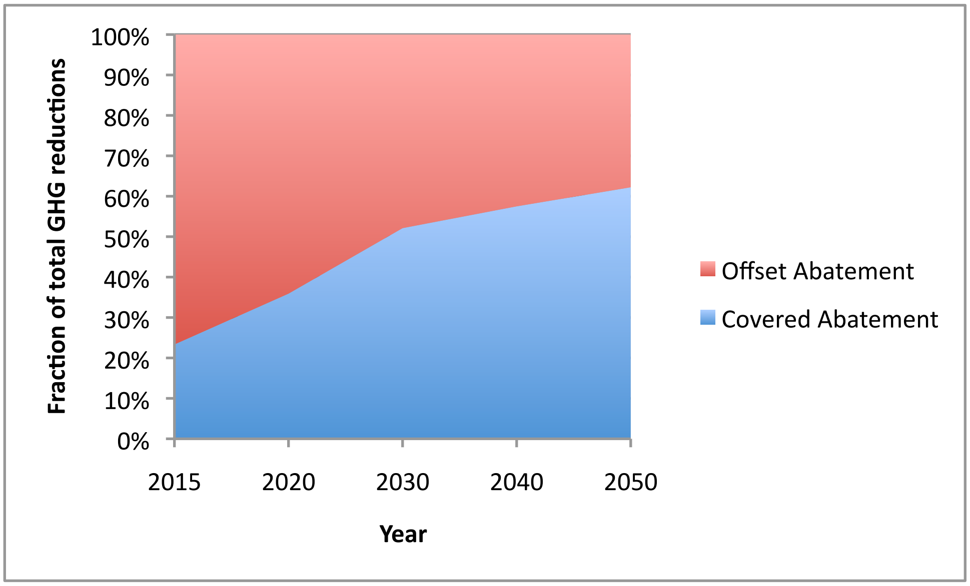

Figure 3. An EPA projection of the relative proportion of emissions reductions that occur at sources covered by the ACESA cap and at offset projects occurring at sources that are not covered by the cap.

In order to avoid chronic shortages of credits, and consequently very high allowance prices for covered entities, USDA and EPA will have to accomplish more stringent environmental review of offsets at a much faster rate than the CDM – at least 20 times the speed of the current CDM. All economic analyses of the bill suggest that its' costs will nearly double if offset supply is significantly constrained or delayed.[15] Failure to accomplish this issuance rate might both cause undue harm to the US economy and undermine long-term support for the ACES program. In the event that offset supply proves lower than expected under ACES, the EPA and USDA will come under tremendous pressure to lower standards in order to increase the rate of supply of new offsets into the US emissions trading market. The dependence of ACES on offsets thus exposes it to significant risks. Either that insufficient offset supply will drive a reduction in standards or, if the regulator is unwilling to increase supply in this way (or cannot on the timescale the health of the US economy demands) the undermining of political support for continued implementation.

[15] Ibid.

5. The Advantages of a Price Collar over Offsets for Cost-Control

A price collar or symmetric safety valve sets a reliable and simple upper and lower bound on allowance prices in a cap and trade system. A price collar places a hard and certain limit beyond which US permit prices would not fluctuate. These trigger points would increase each year at a predetermined rate in excess of inflation over the life of the program. Operating such a system would be relatively straightforward compared to the complexity of a high quality offsets system. If allowance prices exceeded the price ceiling, the government would sell allowances into the market until the price fell below the ceiling. All allowance auctions would be held with a reserve price such that no allowances would enter the market at a price below the floor. If an exogenous shock caused prices in the secondary market for allowances to fall below the floor, the government could respond by reducing the number of allowances released for auction at regularly scheduled intervals until the price stabilized at the desired level.

The history of emissions trading schemes indicates that ex ante predictions of permit prices are generally inaccurate and biased toward overestimation of cost. Experience with cap-and-trade programs to date indicates that a lower bound on prices is as important as an upper bound. The US Acid Rain Trading Program (ARTP), the Regional Clean Air Incentives Market (RECLAIM), and the EU ETS have, more often than not, exhibited prices far below marginal abatement costs predicted prior to their enactment. In the ARTP case, this was because abatement costs were in fact far lower than predicted. For RECLAIM, the problem was early over-allocation of allowances. In the EU ETS case, this was because of over-allocation in the first phase of trading (2005-2007) and due to recession in the second (2008-present). All three emissions trading markets have also experienced relatively brief periods of very high prices. The truth is that because we don't know with much certainty what marginal abatement costs will be under cap and trade, what fuel prices will be, and the future trajectory of GDP, it is impossible to predict with any accuracy or precision what allowance prices will be. Pretending otherwise is a misuse of the models used to estimate differences between policy outcomes.[16]

A symmetric safety valve provides reliable cost-containment for covered entities planning for compliance with a cap-and-trade system. In theory, offsets provide a solution for firms worried about the costs of compliance with cap-and-trade. In practice as described above, the biggest carbon offset market has been unable to provide either cost-containment or the environmental integrity required to ensure quantity certainty. Further, there is little reason to believe that the causes of this failure can be avoided under ACES. In contrast, a safety valve, because it responds directly to the price of allowances, provides far greater certainty that costs

[16] The computed general equilibrium and energy system models used to estimate future allowance price and program costs are likely far more reliable at estimating differences between policies than absolute costs. For example, estimates of the difference between a case with offsets and without offsets is likely more informative than an estimate of the absolute cost of either.

will not exceed a particular level during any given compliance period. Especially under a program like ACES that provides emissions targets until the mid-twenty-first century, such cost certainty allows for sound long-term investment planning on the part of vertically integrated utilities and merchant generators. In Europe under the EU ETS, it has proven very difficult for utilities to plan for new generation when there is tremendous uncertainty as to the carbon price. Such planning certainty is an important policy objective of any US climate program and a key prerequisite to charting a secure, clean, and low-carbon US energy future.

A symmetric safety valve will also provide a reliable minimum price for allowances that will enable firms to confidently make investments in new pollution reduction technologies. The history of cap-and-trade programs is as much a story of prices that fell below expectation as above. This result has led the clean-tech start-ups that create and venture capital firms that fund new energy technologies to ignore carbon prices when planning and investing. A price collar that provides long-term certainty as to the minimum price of allowances in a US cap-and-trade would allow the innovative firms to count on a certain level of advantage relative to traditional fossil generation technologies. Providing this minimum certainty would allow startups to more fully capitalize on the societal benefits that their new low-carbon technologies will provide. As a consequence, a price floor would increase the provision of these technologies to the US economy, increase the number of green jobs created by a US climate program, and help to position the US as a leader in the global energy revolution.

While a price collar does not provide absolute certainty of emissions limits, neither would a real-world carbon offset system. It's important to emphasize what is not given up in the choice of cost-containment strategy. The main criticism of symmetric safety-valve proposals is that they do not provide quantity certainty for climate policy. [17] That is, they do not pretend to provide certainty as to the level of pollution that will be allowed in any given year. As has been shown above, offset systems promise to provide this certainty, but in practice fail to do so. Thus the choice between quantity certainty under a cap, trade, and offset system like ACES and quantity uncertainty under cap-and-trade with a price collar is in reality, a false choice – neither approach can provide both cost containment and certainty as to the maximum pollution level. In fact, given the low allowance price history of emissions trading programs, it is at least likely that a price collar would provide superior environmental results due to its ability to reduce the supply of allowances when prices fall too far.

6. Revenues from a Price Collar Could Fund Additional Cost-Effective Reductions

In the event that prices within a US cap-and-trade program exceed expectations and so trigger the safety valve, revenues raised from the auction of extra allowances could be used to accomplish many of the benefits

[17] A lack of quantity certainty is also the major criticism of carbon taxes.

promised by offsets. One of the key benefits of offsets is that they extend incentives to reduce emissions beyond the scope of sectors covered by the cap. Offsets create a potential financial benefit for reductions in uncapped sectors, such as agriculture, or uncapped jurisdictions, such as Brazil, to reduce GHG pollution even though they are not required to do so. This benefit need not be sacrificed just because offsets are not relied upon for cost-containment. The simple solution is to dedicate revenues raised by the price collar to reductions outside of the cap.

Any revenues generated by a safety valve should be deposited into a Climate Trust Fund (CTF) dedicated to reducing emissions outside of the cap. Such a trust fund could be utilized as a source of funding to assist the agricultural and forestry sectors in reducing their emissions or to assist developing countries in doing the same. These goals might be accomplished via payment for the cost of particular activities that are known to result in lowered emissions or via open requests for proposal for emission reduction activities.

Administration of an agricultural and forestry emissions reduction program by a CTF would be far simpler than via offsets. The two great challenges of administering an agricultural offset program are measurement and permanence. A CTF administered system, because it is not linked to an emissions trading market greatly simplifies both. Measurement of carbon emissions of similar accuracy and precision to covered sources is difficult and costly to accomplish on farms and in forests. At the same time, permanence looms large for sequestration based offsets because reversals threaten the integrity of the cap. In contrast, a CTF could handle both issues more flexibly and could more realistically shape an emissions reduction program to fit the needs and capabilities of both US farms and forests. A CTF would enable society to capture greater benefits from the contributions that farms and forests have to make towards reducing emissions while also simplifying the process of farmers and foresters gaining credit for their actions.

Administration of a CTF would allow for far greater cost-effectiveness in an international emissions reduction program. One of the major criticisms leveled at the CDM has been that most of the reductions in GHG emissions it has produced could have been had at far lower prices.[18] Careful study of the emission reduction opportunities available at lowest cost in developing countries shows that these are accessible via good regulatory design and effective implementation in areas like building standards, industrial efficiency, and appliance energy efficiency.[19] These are areas that are typically inaccessible to carbon offsets because regulations are part of the emissions baseline, because results are nearly impossible to quantify with sufficient certainty for offset creation, and because there is unclear title to the emissions reductions. A CTF could more easily realize these key emission reduction strategies, available at a cost far below the likely price of emissions in the US cap-and-trade market, without concern for what was or was not a part of the regulatory

[18] *See*, Michael Wara, Is the Global Carbon Market Working?, 445 *Nature* 559 (Feb. 8, 2007).
[19] *See*, McKinsey & Company, Pathways to a Low Carbon Economy (Jan. 2009).

baseline. Indeed, the goal of a CTF would be to shape this baseline in ways that drive large-scale change. Further, a CTF, because not tied to an emissions trading market, would be free to grasp such low-cost solutions without the need for strict quantification and clarity of ownership. In sum, a CTF, freed from the strictures of an offset market, could produce greater reductions at lower cost.

7. Conclusions

A price collar will provide superior cost-containment for a US cap-and-trade system compared to offsets along a wide variety of dimensions.

Experience with the CDM has shown that large compliance grade offset markets fail to provide either adequate environmental integrity or a sufficient supply of offsets. The former results in substantial doubt as to the reality of reductions promised by the cap on emissions; the latter in significant cost uncertainty for the program.

A symmetric safety valve, by creating certainty as to the range of possible allowance prices allows firms to plan for a worst case compliance situation while allowing new technologies to fully capitalize on a minimum guaranteed return from the carbon market. It also insures that if estimates of program costs turn out to be lower than expected, extra emissions reductions can be wrung from the capped sectors. This insures that the political calculus of costs and benefits central to the enactment of the program is in fact realized in practice.

Revenues raised from the safety valve, assuming that it is employed, invested via a Climate Trust Fund, could be used to create a domestic agricultural and forest GHG pollution reduction program that better matches the needs and capabilities of these sectors. These funds could also be used to access the very low-cost emission reduction opportunities available from energy efficiency of buildings, appliances, and industry in the developing world.