CLIMATE CHANGE LEGISLATION DESIGN
WHITE PAPER

Getting the Most Greenhouse Gas Reductions for Our Money

The Committee on Energy and Commerce and its Subcommittee on Energy and Air Quality are issuing a series of Climate Change Legislation Design White Papers as the next step in the legislative process leading to enactment of a mandatory, economy-wide climate change program. While the hearings held last year were designed to give the Committee an understanding of the status and projected path of climate change and potential ways to address it, these White Papers and the hearings on them will focus the Committee's attention on crafting climate change legislation. The White Papers and related hearings will lay out basic design and key principles of a program, and also identify issues about which further information and discussion is needed.[1]

This White Paper addresses different potential mechanisms for limiting the cost and maximizing the efficiency of a mandatory, comprehensive climate change program to reduce greenhouse gas emissions by 60 to 80 percent by 2050.

Executive Summary

One of the Committee's goals in designing a comprehensive climate change program is to achieve the necessary greenhouse gas reductions for the least cost and with the least economic disruption. Reducing greenhouse gas emissions will be an expensive proposition, but scientists tell us that *not* reducing emissions will leave future generations with serious problems that will cost even more to address. This White Paper discusses ways to keep costs as low as feasible while still achieving our environmental goals.

The most important way to keep costs down is to establish a system that will achieve lowest-cost reductions. The climate change debate often focuses on the need for expensive measures. If the program is structured properly, however, significant reductions can be achieved by economically beneficial measures (i.e. measures with savings that exceed costs). In large part, these measures are improvements in energy efficiency and productivity.

The decision to have a cap-and-trade regulatory program as the cornerstone of a mandatory climate change program is driven in large part by the ability of such a program to reduce greenhouse gas emissions to a specified level at the lowest possible overall cost to society and to lower the cost for regulated entities. As compared to more traditional forms of regulation, a well-designed cap-and-trade program generally should achieve the same environmental results at a lower cost because it provides flexibility to emitters, creates incentives for sources to use low-cost compliance strategies, and provides incentives for technological advances.

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[1]The White Papers are available at http://energycommerce.house.gov/Climate_Change/index.shtml

While Congress can always pass new legislation modifying the cap-and-trade program if costs are excessive, it may be desirable to provide methods in the initial legislation to respond to cost problems that do not require Congressional intervention. One approach is to establish mechanisms that operate automatically, such as the ability to purchase offset credits and engage in "banking" of emission allowances. Similarly, Congress could authorize, pursuant to predetermined price triggers, a limited amount of system-wide borrowing of allowances. Alternatively, Congress could assign power to a board or agency to determine when system-wide borrowing or other cost containment measures should be initiated.

The cap-and-trade program will include two important features to help reduce costs:

- Regulated entities and other market participants will be able to **bank allowances** for later use. Allowance banking can help reduce costs by encouraging the use of cost-effective, long-term compliance strategies and by providing a "cushion" to help minimize price fluctuations in the allowance market.

- Regulated entities will also be able to use **offsets**, provided they are real, verifiable, additional, and permanent. Offsets are measures that reduce greenhouse gas concentrations (such as a forest that sequesters carbon biologically) in a way that would otherwise not be reflected in the cap-and-trade program. Offsets can be less expensive than the marginal cost of reducing emissions covered by the cap and can, therefore, reduce costs and provide flexibility for regulated entities.

The Committee should consider a number of optional features of cap-and-trade programs to help reduce costs.

- The Committee should consider whether to allow each regulated entity to borrow allowances from the future to apply to a current year obligation (**firm-level borrowing**). It is unclear whether this approach would provide firms with flexibility they would not otherwise have from the allowance market, and it poses some difficult administrative issues (such as how one would determine whether a firm was sufficiently credit-worthy to permit it to borrow allowances).

- The Committee should consider whether to have a **compliance period longer than a year**. Some believe a longer compliance period could help individual firms reduce costs by allowing them to average out business cycles and unexpected circumstances over a longer time period.

- The Committee should consider whether to provide for a **special cost containment mechanism** to release additional allowances into the market (i.e., raising the cap for a year) when allowance prices are high for a sustained period. It should also consider whether to make the release self-executing based on a statutory or regulatory formula established at the outset of the program and revised periodically thereafter, or to vest an entity with discretion to release allowances based on certain criteria. Releasing

allowances into the market should decrease allowance prices, but could also reduce or delay the environmental benefit of the program, depending on how it is done. This White Paper discusses the following four methods of releasing additional allowances, which could be combined or modified in numerous ways:

  - The bill could set a safety valve price and allow the Government to sell an unlimited number of allowances at that price.

  - The cap could be held constant when allowance prices are high and continue to decline when allowance prices drop.

  - A new, independent board could have the authority to borrow allowances from the future and release them in the current year as necessary to prevent significant economic harm.

  - A strategic allowance reserve could be set aside and tapped when allowance prices rise above a certain level.

- The Committee should consider setting a **floor for allowance prices** as a means for providing minimum price certainty for technology developers.

A number of matters beyond the scope of this White Paper will also affect the cost of a comprehensive, mandatory climate change program. They include:

- Additional, complementary measures (beyond the cap-and-trade program) must be reviewed to determine whether they reduce or raise the total cost of achieving the necessary greenhouse gas reductions. Measures such as appliance efficiency standards and local or State energy efficiency programs might achieve economically beneficial or low-cost greenhouse gas reductions that would not be achieved solely through the cap-and-trade program. Other measures might increase the total cost of reductions by requiring expensive reductions or by adding transaction costs to achieve reductions the cap-and-trade program would achieve on its own.

- The distribution of allowances could affect the cost of the program or the distribution of the cost among regulated entities and other affected parties.

- The interim timetables and targets for greenhouse gas reductions (leading up to the goal of reducing greenhouse gas emissions by 60 to 80 percent by 2050) will also affect the cost of the program.

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Background

There are two types of costs associated with greenhouse gas reduction programs: the costs of acting and the costs of not acting. This White Paper will focus on the costs of acting because one of the Committee's goals is to achieve the necessary greenhouse gas reductions (60 to 80 percent by 2050) for the least cost and while avoiding economic disruption.

In reviewing projected costs of climate change programs, however, it is important to remember that they tell only part of the story; they fail to account for the cost of not acting. For example, an estimate that a climate change program will reduce U.S. Gross Domestic Product (GDP) by 3 percent in 2050 is based on comparing GDP in a world with a climate change program to GDP in a fictional world where there are no controls on greenhouse gases, no climate change, and no measures necessary to adapt to climate change.

To provide context for the discussion of how to contain costs, this section discusses different types of costs associated with reducing greenhouse gas emissions. It first discusses different costs of a comprehensive climate change program. It then briefly describes the costs of failing to reduce greenhouse gases.

Program Costs

When people talk about limiting the cost of the program, they often have different "costs" in mind. In evaluating various methods of limiting cost, it is helpful to be specific about the type of cost one is trying to limit. The "costs" people are trying to affect include:

- the overall, long-term cost to society of reducing greenhouse gases;
- the cost to individual participants of complying with the greenhouse gas reduction program;
- volatility in the price of allowances;
- the average price of allowances over a long (multi-month) time period; and
- the distribution of costs among all entities and people affected by the greenhouse gas reduction program.

Costs can be measured and estimated in a variety of ways, but nearly all approaches involve economic modeling. The Environmental Protection Agency (EPA), the Energy Information Administration, and others use various economic models to analyze and project the effects of different proposed legislative climate change policies, but their results must be reviewed with some degree of caution. The outputs of such models are only projections, based on current knowledge and significantly affected by model assumptions. As such, modeling results are limited in their ability to project future economic effects accurately, especially those

costs that will be incurred decades from now. The models are best used to compare differences in policies to see how those differences produce different effects, as well as to identify basic trends and directions.

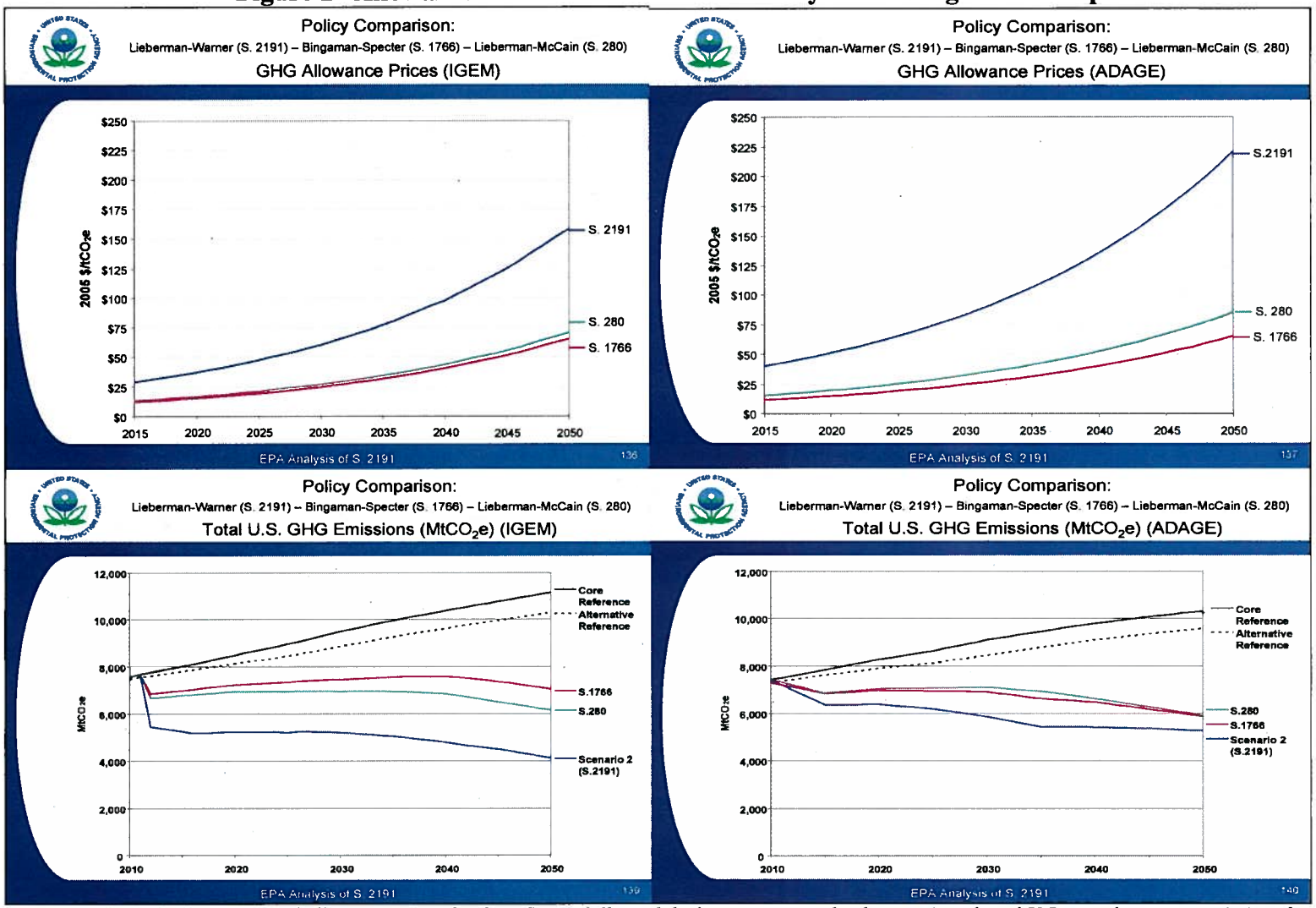
One commonly used measure of cost for cap-and-trade programs is the allowance price. The allowance price is the *marginal* cost of reducing an additional ton of carbon dioxide or its equivalent (CO_2e), not the *average* cost of reducing CO_2e. If allowance prices are projected to be $20 per ton, theoretically regulated entities should have made all reductions that cost less than $20 per ton. The average cost of reducing emissions to that level would be significantly less than $20 per ton, but the cost of reducing the next ton should be $20. Figure 1 contains EPA's estimates of allowance prices for three different climate change bills, using two different models: S. 280 (McCain-Lieberman), S. 1766 (Bingaman-Specter), and S. 2191 (Lieberman-Warner). The allowance prices are projected to start in 2015 in the $12 to $15 range for S. 280 and S. 1766, and in the $29 to $40 range for S. 2191. The allowance price for each bill are projected to approximately double by 2030. The higher allowance prices for S. 2191 are driven in large part by the larger required reductions in greenhouse gas emissions, also shown in Figure 1.

Another commonly used measure of cost for a cap-and-trade program is the total cost of abatement. Abatement costs are the net cost of the actions taken to reduce greenhouse gas emissions (e.g., to install and operate carbon capture and storage technology or to improve energy efficiency).[2] EPA's projected total annual costs of abatement for S. 2191, S. 1766, and S. 280, using two different models, are provided in Figure 2 (although EPA notes these are over-estimates).

The cost to an individual regulated entity is also an important measure and is often miscalculated. An individual regulated entity's cost is sometimes assumed to be the allowance price multiplied by the number of tons of CO_2 that the entity would have emitted if there were no regulation of greenhouse gas emissions. This is likely to be an overestimate of the cost to a regulated entity. First, the regulated entity's cost would be lowered by the number of allowances it receives for free. Second, the regulated entity's cost would be lower if it were to reduce its emissions at a cost less than the allowance price (such as through energy efficiency measures). Third, costs would also be lowered if the entity were able to pass abatement costs on to its customers. In fact, a regulated entity might make money if it were given allowances for free and made sufficient reductions that cost less than the allowance price and/or passed on the cost of allowances to its customers.

[2]Note that abatement costs should be significantly less than the required reductions multiplied by the allowance price.

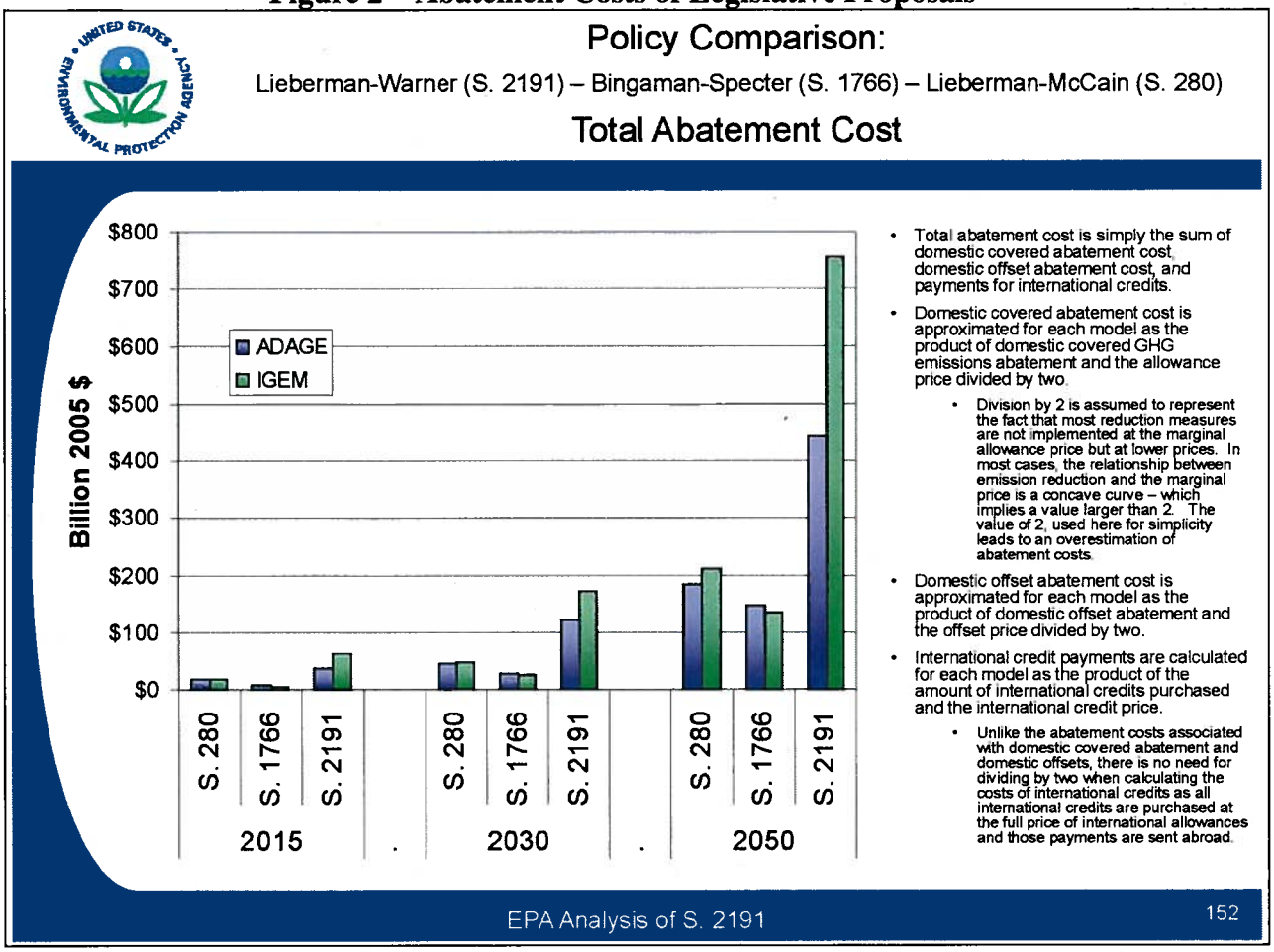
Figure 1 –Allowance Prices and Emission Pathways under Legislative Proposals



The top two graphs each show projected allowance prices for three Senate bills, and the bottom two graphs show projected total U.S. greenhouse gas emissions for the same bills. The legislated policies modeled in the left-hand graphs are the same as those in the right-hand graphs. The differences between the right- and left-hand projections are due to the use of two different general equilibrium models (IGEM and ADAGE).

Source: Environmental Protection Agency, "EPA Analysis of the Lieberman-Warner Climate Security Act of 2008," at pp. 136-137, 139-140.

Figure 2 – Abatement Costs of Legislative Proposals



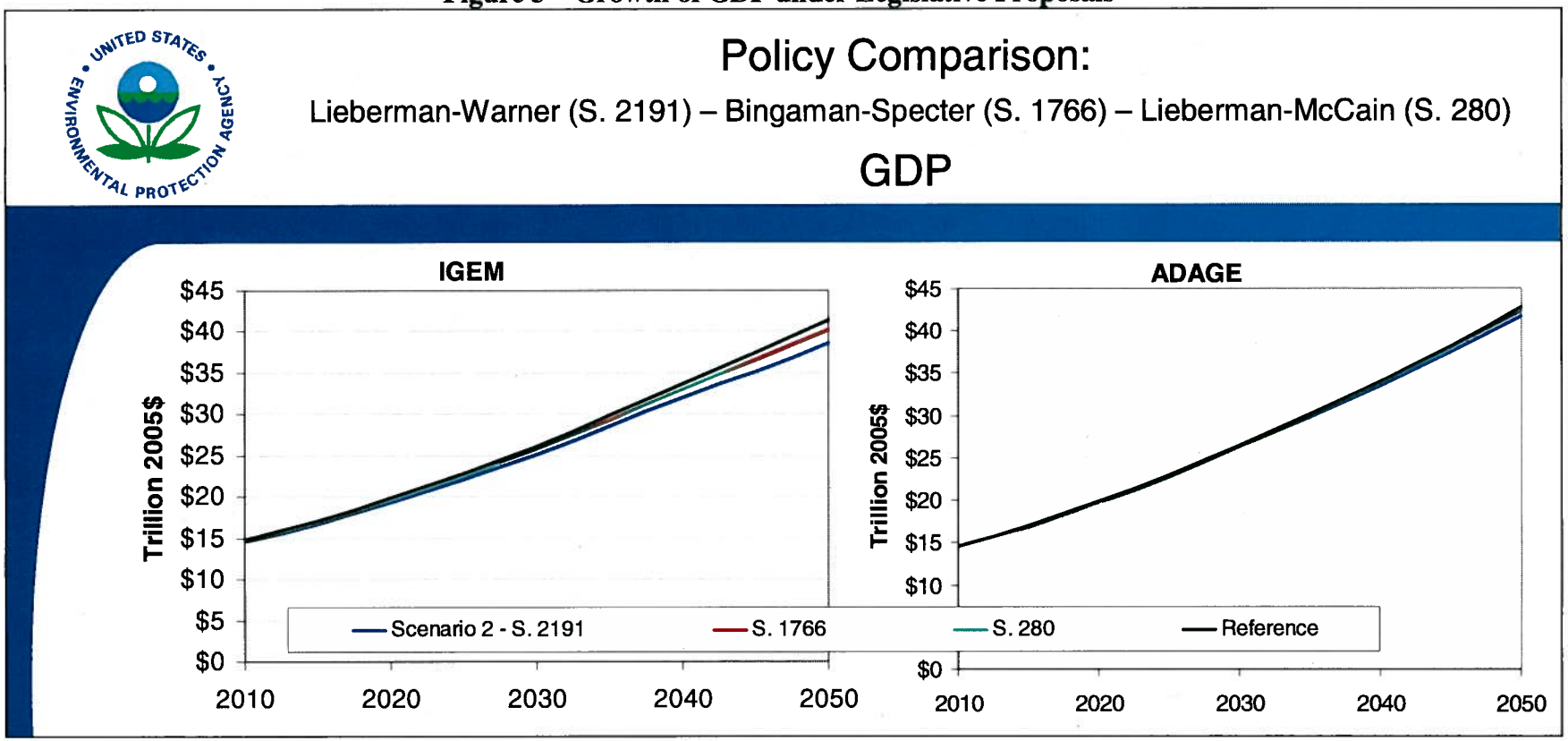
This figure represents estimates from two different models of annual abatement costs in each given year (not cumulative costs) for three different Senate bills. Due to a lack of information, EPA approximated the cost of actions that would be taken to reduce emissions, but did so in a manner that overestimates total abatement costs (as explained in the right-hand column of this slide).

Source: Environmental Protection Agency, "EPA Analysis of the Lieberman-Warner Climate Security Act of 2008," at p. 152.

Changes in GDP are another measure of the cost to the U.S. of reducing greenhouse gas emissions. EPA's projected changes in GDP for S. 2191, S. 1766, and S. 280, using two different models, are provided in Figure 3.

Other measures of cost include: changes in energy prices (electricity, natural gas, oil, and gasoline), effects on the cost to consumers, effects on different industrial sectors, and the effect on U.S. jobs. This White Paper primarily discusses ways to control total costs to society and allowance prices. Measures that control these costs should also help control other types of costs. The distribution of costs among regulated entities and affected parties is generally beyond the scope of this White Paper.

Figure 3 – Growth of GDP under Legislative Proposals



This figure shows projections from two different models of the effect on GDP from three different Senate bills.

Source: Environmental Protection Agency, "EPA Analysis of the Lieberman-Warner Climate Security Act of 2008," at p. 150.

Costs of Inaction

A serious commitment of societal resources to combat climate change is warranted by the damage that is projected to occur if we fail to do our part in global efforts to reduce greenhouse gas emissions. Last year the Intergovernmental Panel on Climate Change projected the following future impacts for the range of climate changes projected over the 21st century:[3]

- Changed ecosystems, including increased risk of extinction for 20-30 percent of the plant and animal species.
- Decreased crop productivity in lower latitudes and, for temperature changes above 5.4 degrees Fahrenheit, decreased crop productivity globally.
- Increased risk to coasts, including coastal erosion, due to climate change and sea level rise.
- Millions more people subject to annual flooding due to sea level rise (by 2080's).
- Potential changes in health status for millions of people due to malnutrition, severe weather events, increased burden of diarrheal disease, changes in infectious disease patterns, and so forth.
- Reduced water availability, reduced hydropower potential, and changing seasonality of meltwater flows from major mountain ranges (where more than one-sixth of the world population lives).
- Decreased water resources in semi-arid areas (including the Western United States).
- Increased flood risk from heavy rainfall events, even in some areas where the mean rainfall is projected to decrease.
- Increased salinisation of groundwater supplies in coastal areas due to sea level rise.

The U.S. will experience some of these climate change effects within our borders, but even those occurring outside our borders could affect us significantly. A report by a Military Advisory Board warned that:

> Projected climate change poses a serious threat to America's national security. . . . On the simplest level, [climate change] has the potential to create sustained natural and humanitarian disasters on a scale far beyond those we see

[3]Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)] (2007) at pp. 48-49.

today. The consequences will likely foster political instability where societal demands exceed the capacity of governments to cope.[4]

Unfortunately, none of the cost projections of U.S. climate change bills account for the cost we will incur if we do not reduce greenhouse gas emissions. There is a high level of scientific certainty that failing to reduce emissions will cause significant problems, but the methodologies for monetizing the costs of such failure are still in their infancy, owing to the complexity of the subject.

One critical question in attempting to characterize the cost of inaction on climate change is the manner in which a cost estimate should account for the fact that actions taken today will prevent harm that would otherwise occur decades from now.[5] *The Stern Review*, a comprehensive and controversial review of the economics of climate change done for the British Government, took the view that today's generation should not be able to treat costs it would impose on future generations as less significant than the same costs incurred today. This is the key reason some other economists view as inflated *The Review's* estimate of the "social cost of carbon" as $85 per ton of CO_2e under a business-as-usual scenario (where the world's greenhouse gas emissions remain on their current trajectory).[6] *The Review* went on to note that this cost of continuing to emit carbon was much higher than the marginal cost of reducing greenhouse gas emissions in many sectors. The same criticism regarding the failure to discount future costs applies to the *Review's* estimate of net benefits, which are set forth here:

> Comparing the social costs of carbon on a BAU [business as usual] trajectory and on a path towards stabilisation at 550 ppm CO_2e, we estimate the excess of benefits over costs, in net present value terms, from implementing strong mitigation policies this year, shifting the world onto the better path [towards stabilization at 550 ppm]: the net benefits would be of the order of $2.5 trillion. This figure will increase over time. This is not an estimate of net benefits occurring in this year, but a measure of the benefits that could flow from actions taken this year; many of the costs and benefits would be in the medium to long term.[7]

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[4]The CNA Corporation, *National Security and the Threat of Climate Change*, (April 2007) at p. 6. The Military Board was comprised of "a dozen of the nation's most respected retired admirals and generals." The report also states that "Climate change acts as a threat multiplier for instability in some of the most volatile regions of the world....Economic and environmental conditions in already fragile areas will further erode as food production declines, diseases increase, clean water becomes increasingly scarce, and large populations move in search of resources. Weakened and failing governments, with an already thin margin for survival, foster the conditions for internal conflicts, extremism, and movement toward increased authoritarianism and radical ideologies."

[5]Sir Nicholas Stern, *The Economics of Climate Change: The Stern Review* (January 2007) at pp. 31-32. Usually economic analyses use a discount rate that values goods today more highly than the same type of goods years from now (basically for the same reasons that many of us would prefer to have $100 today rather than $1,000 several decades from now). It is unclear, however, that discounting is appropriate when a later generation will bear the cost for actions taken (or not taken) by our generation.

[6]*Ibid* at pp. xvi-xvii.

[7]*Ibid* at p. xvii.

In reviewing estimates of the cost of reducing greenhouse gas emissions, it is important to remember that they look at only half of the story – how much we will spend to reduce emissions. Although we lack agreed-upon analytical methodologies to provide reasonable estimates of the cost of failing to act, those costs should be part of the consideration of what actions to take.

Capturing Economically Beneficial and Low-Cost Reductions

To limit the overall, long-term cost of reducing greenhouse gas emissions by 60 to 80 percent by 2050, the Committee should establish a system that results in society making the lowest cost reductions (to the extent consistent with other social goals). The measures that a climate change program requires or encourages can have a dramatic effect on the cost of the program. A number of measures create a net economic benefit (e.g., the measure's additional capital cost is more than offset by its lifetime savings). For example, a consumer's electricity bill savings from more efficient lighting can be greater than the extra initial cost of that lighting. Other measures, however, will have a net economic cost. For example, capturing carbon dioxide (CO_2) from electricity generation and sequestering it underground in geologic formations generally does not save money and would not be done absent the need to reduce greenhouse gas emissions (except perhaps in limited circumstances, such as enhancing oil recovery).

It appears that substantial reductions in greenhouse gases could come from measures that would pay for themselves. A recent analysis evaluated hundreds of measures using a bottom-up approach to try to identify the lowest cost greenhouse gas reductions. The resulting report, *The McKinsey Report,*[8] focused on 250 measures that it determined had a marginal cost of less than $50 per ton and that, when combined, could produce greenhouse gas reductions in 2030 at two different levels of greenhouse gas reductions – one slightly below and one in the range of reductions contemplated by current climate change legislative proposals. *The McKinsey Report* represents an interesting and useful construct for evaluating and analyzing the costs of different climate policies, although its cost estimates should not be taken as definitive.

As illustrated in Figure 4, the report found that a significant volume of greenhouse gas reductions can occur in a manner which provides a net economic benefit to the United States.[9] For a 3.0 gigaton CO_2e reduction in 2030 (from projected annual emissions of 9.7 gigatons), the report concluded that "Almost 40 percent of abatement could be achieved at 'negative' marginal costs, meaning that investing in these options would generate positive economic returns over their lifecycle."[10]

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[8]McKinsey & Company, *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* (Dec. 2007). The analysis assumes that the price of oil varies between $50 and $69 per barrel from 2005 to 2030. *Ibid* at p. 78. Higher oil prices should reduce the cost of some options and/or make more options available at a cost less than $50 per ton CO_2e.

[9]The report concluded that "The United States could reduce greenhouse gas emissions in 2030 by 3.0 to 4.5 gigatons of CO_2e using tested approaches and high-potential emerging technologies. These reductions would involve pursuing a wide array of abatement options available at marginal costs less than $50 per ton, with the average net cost to the economy being far lower if the nation can capture sizable gains in energy efficiency." *Ibid* at p. ix (footnote omitted). The report notes that annual U.S. greenhouse gas emissions "are projected to rise from 7.2 gigatons CO2e in 2005 to 9.7 gigatons in 2030." *Ibid* at p. x.

[10]*Ibid* at p. xii. The report gave 3.5 to 5.2 gigatons as the abatement implied by proposed legislation and concluded

A few notes about this analysis are warranted. First, the "net" cost estimates do not account for the economic benefit of reducing greenhouse gas emissions or other air pollutants. These measures are projected to be economically beneficial on their own. Second, the analysis was largely concluded before enactment of the Energy Independence and Security Act of 2007 (EISA). Therefore, some of the opportunities for efficiency improvements may overlap with requirements in EISA. For example, the significant strengthening of the vehicle fuel efficiency standards in EISA is not reflected in *The McKinsey Report's* baseline. Finally, there is no universal agreement on the cost estimates presented in *The McKinsey Report.*[11] The Committee should use those cost estimates as illustrative, rather than definitive.

Economically beneficial reductions may seem too good to be true. One would think that people and companies would already be implementing measures that have a net economic benefit. Some early movers are doing so. For example, a rural Indiana school district reduced its energy usage by 38 percent and saved $1.77 million in energy costs over 43 months (meeting its 7-year rate of return goal in 3 ½ years).[12] The country's biggest private consumer of electricity, Wal-Mart, recently recognized substantial improvements in its bottom line by reducing CO_2 emissions through wide-ranging energy efficiency improvements. The company's accounting of its carbon dioxide emissions revealed cost-saving energy efficiency opportunities such as retrofitting refrigerator cases (reducing more than 15,000 metric tons CO_2 and saving $2.6 million annually) and installing auxiliary power units in trucks (reducing 100,000 metric tons CO_2 and saving $25 million annually).[13]

There are many reasons why companies, governments, and consumers have not taken advantage of economically beneficial measures to reduce greenhouse gas emissions. For example, the person who purchases a good may not be the one who pays for its electricity use, so the extra cost would be borne by one person and the savings reaped by another. This would be the case where a landlord buys the refrigerator and the tenant pays the electricity bill. Also, people may not have sufficient information to make the economically rational choice.

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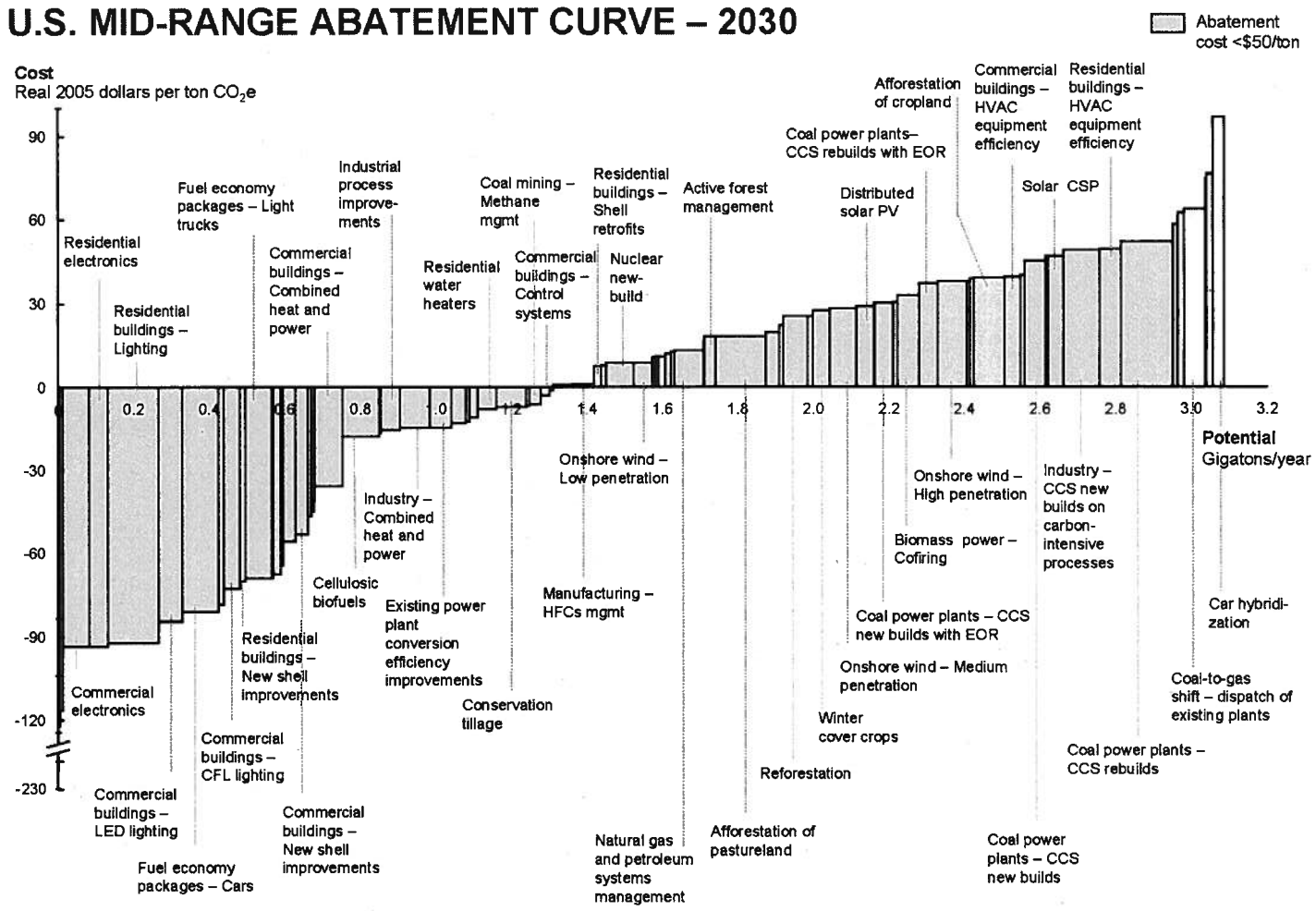
that 4.5 gigatons could be achieved at a marginal cost less than $50 per ton CO2e, but did not state an estimate of how much of the 4.5 gigatons could be achieved with options that have a net economic benefit. *Ibid* at p. x.

[11]For example, many in the auto industry do not believe that there are fuel economy packages for cars and light trucks at the cost estimated by *The McKinsey Report* that do not change the consumer's utilization of the vehicle.

[12]*The Evening Star*, "DeKalb Central Saves $2 Million: District Conserves Energy to Save Programs, Staff, Library Funding" (Jan. 16, 2005); *The Evening Star*, "DeKalb Central Cuts Its Energy Use by 38 Percent" (April 21, 2008).

[13]Wal-Mart Stores, Inc. "Sustainability Progress to Date 2007-2008," (November 15, 2007) at p. 42, http://walmartfacts.com/reports/2006/sustainability/documents/SustainabilityProgressToDate2007-2008.pdf (accessed 3/25/08).

Figure 4 – Abatement Measures with Estimated Costs and Contributions



This figure shows projected cost per ton of CO_2e (vertical axis) and greenhouse gas reduction potential (horizontal axis) for a variety of measures.

Source: McKinsey and Company, "Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?" (Dec. 2007) at p. xiii.

Consumers may underestimate the annual and lifetime costs from inefficient appliances such as refrigerators. They retain old ones when energy cost savings would justify replacement with a new one, and they choose less costly but less efficient models when energy cost savings would justify buying more expensive, efficient models.

It is not just individual consumers that fail to take advantage of economically beneficial greenhouse gas reduction opportunities. Companies that have voluntarily reduced emissions have found that the mere requirement to track and monitor their CO_2 emissions (or energy usage) has led to ways of reducing those emissions (or energy usage) that save money.[14]

We cannot meet our greenhouse gas reduction goals solely by reliance on measures with a net economic benefit. Maximizing the use of such measures to the extent consistent with other goals, however, will help offset the cost of other measures, thereby reducing the net cost of a greenhouse gas program. We need to design a comprehensive climate change program that will encourage or require greenhouse gas reduction measures with a net economic benefit or low economic cost.

Cap-and-Trade Regulatory Program – Cornerstone of a Low Cost Program

The decision to have a cap-and-trade regulatory program as the cornerstone of a mandatory climate change program is driven in large part by the ability of cap-and-trade to reduce greenhouse gas emissions to a specified level at a lower overall cost, and with greater flexibility for regulated entities, as compared with traditional command-and-control regulation.[15] Relative to more traditional forms of regulation, a well-designed cap-and-trade program should achieve the same environmental results at a lower cost because it provides flexibility to emitters, creates incentives for sources to use low-cost compliance strategies, and rewards technological advances.

In a cap-and-trade regulatory program, the Government establishes the maximum level of emissions allowed in each year (i.e., it caps emissions), and distributes allowances (by allocation formula or auction) equal to that level. (This White Paper will assume that one allowance authorizes the emission of one ton of CO_2 (or its equivalent).) Regulated entities (and others) can then buy and sell allowances. At the end of the compliance period, the regulated entities must turn in to the government allowances in an amount equal to the emissions for which they have responsibility under the program.

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[14]Companies that have voluntarily joined EPA's Climate Leaders program with greenhouse gas emissions reduction goals have subsequently recognized considerable financial improvements related to emissions control. For example, SC Johnson calculated a 20 percent rate of return on one strategy adopted to meet its Climate Leaders goal, which the company then expanded further to obtain additional cost savings. EPA, *A Program Guide for Climate Leaders; Setting the Standard for Greenhouse Gas Management* (March 2007) at p. 5, accessed 5/5/08 at http://www.epa.gov/stateply/documents/cl_programguide_508.pdf.

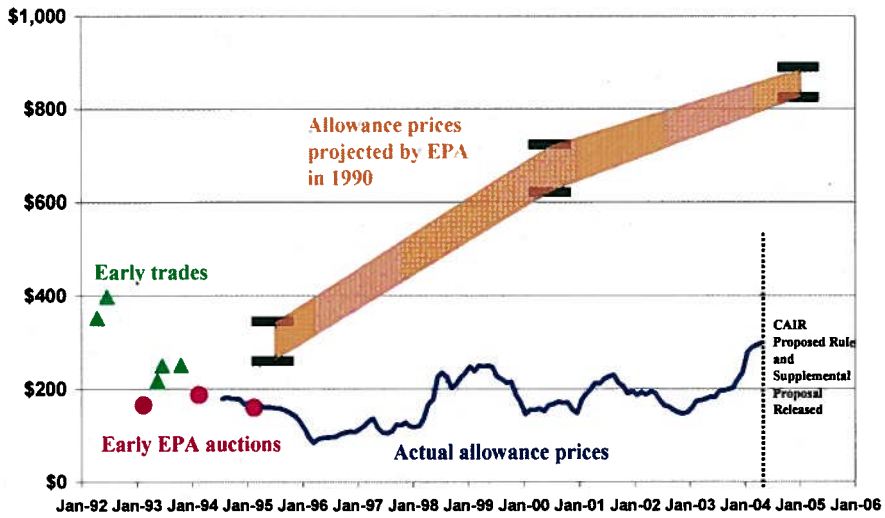
[15]A cap-and-trade program is an appropriate regulatory tool to accomplish the environmental goals of addressing climate change because the geographic location of greenhouse gas emissions does not affect the environmental consequences. In contrast, under traditional air pollution, people closest to the source are often affected more than people farther away from the source.

A cap-and-trade program with broad coverage can also help make the climate change program fairer. It would help ensure that all sectors in the economy do their fair share in addressing climate change. By incorporating the price of carbon into the price of goods and services, the cap-and-trade program helps ensure that people who are causing carbon emissions bear more of the cost of those emissions. Currently, the price of goods with large carbon footprints does not reflect the true cost of the good to society because the price does not reflect the damage from climate change.

The Acid Rain cap-and-trade program, established in the Clean Air Act Amendments of 1990, is generally regarded as both an environmentally and economically successful program. It has significantly reduced sulfur dioxide emissions and the resulting damage caused by acid rain at a cost far less than was estimated when it was adopted in 1990. *See* Figure 5. The cost of the reductions has also been estimated to be less than the cost of achieving the same reductions through traditional source-specific performance standards. *See* Figure 6. The flexibility as to when, how, and where reductions occurred played a significant role in the lower costs. A greenhouse gas cap-and-trade regulatory program will be far more complicated than the Acid Rain Trading Program, but the same basic principles leading to low-cost reductions should apply.

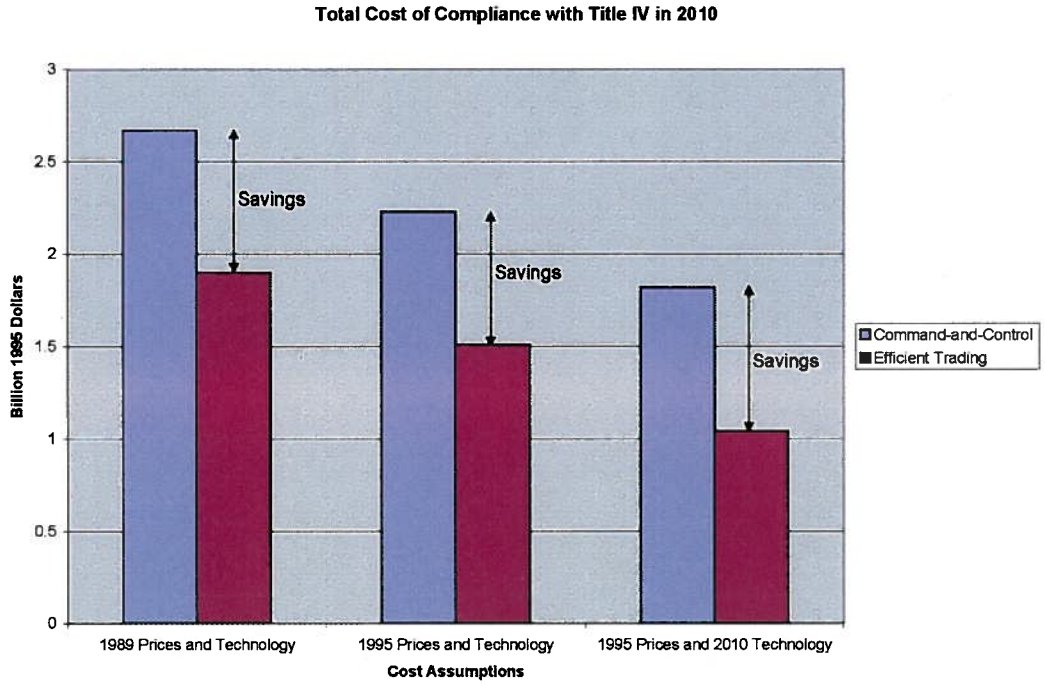
Figure 5 – Actual Costs of Acid Rain Program Lower than Projected Costs

SO_2 Allowance Prices (2005$/ton)



Source: Graph provided by Dallas Burtraw, Resources for the Future. SO2 price projections taken from the Environmental Protection Agency, Comparison of the Economic Impacts of the Acid Rain Provisions of the Senate Bill (S.1630) and the House Bill (S.1630), (July 1990). Actual price trajectory and early market data taken from Ellerman et al., Markets for Clean Air: The U.S. Acid Rain Program, (2000). CAIR is the Clean Air Interstate Rule, which revised the use of Acid Rain SO2 Allowances and thus disrupted the displayed trend line.

Figure 6 – Estimated Savings from Acid Rain Trading Program Compared to Traditional Command-and-Control Approach



Source: Figure generated with data from Carlson et al., "Sulfur Dioxide Control by Electric Utilities: What are the Gains from Trade?" Journal of Political Economy, (2000), Table 2, at p. 1313.

Flexibility

A cap-and-trade regulatory program puts the choice of compliance strategies in the hands of the private sector, rather than the Government. It is based on the assumption that the private sector is better than the Government at selecting low-cost compliance options. Different entities facing different circumstances can tailor compliance programs on an on-going basis in a way that the Government would never have the resources, flexibility, or information to allow in a traditional regulatory program. Entities can react to changing information and circumstances by adjusting compliance strategies without obtaining approval from the Government.

In contrast, using traditional regulatory approaches as the cornerstone of a comprehensive climate change program could pose a number of downsides and is less likely to result in the lowest cost reductions.[16] Under a traditional regulatory approach, the Government would set performance standards, emission rates and/or technology requirements to determine what actions all regulated entities must take. It would be very difficult for the Government to take into account the different circumstances faced by each of the regulated entities. Providing flexibility to industry by tailoring decisions to each entity (as would happen in a permitting or waiver

[16]As discussed in a later section in this White Paper, traditional regulatory approaches for some types of reductions may, however, be necessary to complement a cap-and-trade program. For example, appliance efficiency standards may be appropriate to overcome market barriers that would otherwise limit the ability to achieve economically beneficial reductions.

process) would be quite resource-intensive for both the Government and the regulated entity. On the other hand, selecting a standard applicable to many entities could disproportionately burden some sources and/or not achieve all the cost-effective reductions. In addition, the Government is unlikely to have all the accurate information necessary to require the lowest cost reductions, especially given that costs will change over time.

The Acid Rain Trading Program provides a good example of how this flexibility could be used. Regulated power plants were given allowances. Each plant could then do any of the following:

- Reduce its emissions to equal the allowances it had been given.
- Over-control its emissions and sell the extra allowances to another plant or save them for later use.
- Or under-control its emissions and buy extra allowances from another plant (or use allowances that it banked in a year that it over-controlled).

Electricity generators were allowed to select their own emission reduction strategies. They could increase the efficiency of their plants, switch to low sulfur coal, install pollution control equipment (scrubbers), encourage their consumers to use electricity more efficiently so that the power plant did not need to burn as much coal, switch to a fuel source (e.g., renewable, natural gas, or nuclear) that does not emit sulfur dioxide, or any combination of those actions. Companies could also pick different compliance strategies for different plants, allowing them to phase in pollution control installations over a number of years as it made economic sense for them to do so.

Incentives for Low-Cost Reductions

Under a cap-and-trade regulatory approach, the reductions that are cheapest should be made first. For example, if Company A can reduce emissions for $5 per ton and allowances are selling for $20 per ton, it will have an incentive to reduce emissions even if it were given enough free allowances to cover all of its emissions. This is because Company A can sell its allowances to others for more than the cost of reducing its own emissions. If it costs Company B $100 per ton to make reductions when allowances are selling for $20 per ton, it will have an incentive to continue emitting and acquire enough allowances to cover its emissions. Under this scenario, Company B could cover its emissions by buying 1,000 allowances from Company A. Company B would save $80,000 by buying allowances instead of reducing its emissions, and Company A would have a net profit on the sale of $15,000.

One difference between the Acid Rain Trading Program and the climate change cap-and-trade regulatory program is that the point of regulation (i.e., the entity that has to turn in allowances to the Government) in the climate change program will not always be the entity that

actually emits the greenhouse gases.[17] Despite this difference, the program should still provide incentives for emitters to select low-cost methods of reducing emissions. For example, in the transportation sector, fuel providers, rather than emitters (vehicle owners), may be the point of regulation. Fuel providers presumably would incorporate the price of allowances into the cost of fuel. The higher fuel price should provide vehicle owners/emitters with the same economic incentive to reduce their emissions as if they were required to turn in allowances themselves. For example, a delivery company with a large fleet of vehicles would presumably have the same incentive to reduce CO_2 emissions (by using more efficient vehicles or improving driving patterns) whether it paid for its emissions through a fuel surcharge or had to turn in allowances directly.

Theoretically, a cap-and-trade regulatory program (regardless of point of regulation) will generally incorporate the price of carbon into goods and then allow the people in the stream of commerce to select compliance strategies by reacting to that price.[18] There are instances, however, when the allowance cost will not be fully passed along. For instance, if a company has significant competition from companies or products not subject to the same regulation, it may not pass along the full cost of the allowances.

Incentives for Technology Advances

Cap-and-trade also rewards and, thereby, encourages technology development and innovation, which should help lower the cost of the program compared to a more traditional regulatory program with the same level of environmental protection. Caps that become more stringent over time provide a financial incentive to develop technology that will achieve greater emission reductions at a lower cost. Because a cap allows technology to be phased in over time (instead of requiring all sources to install a new technology within a short time period), it facilitates continuous improvement of the technology; later users can make adaptations based on the experience of early movers.

A cap-and-trade program also reduces the risk associated with using new technology to reduce emissions. Using a new control technology to meet traditional regulatory programs carries some risk that it will not work as well as expected (possibly resulting in a source being out of compliance with the law), and no chance of reward if it works better than expected. In contrast, in a cap-and-trade program, if new technology underperforms, a source can cover the deficit by purchasing more allowances. If a new technology overperforms, it directly benefits the source's bottom line by reducing the number of allowances a source needs.

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[17]See the first White Paper (Oct. 3, 2007) for a discussion of point of regulation in a cap-and-trade program.
[18]Pizer, Billy "Scope and Point of Regulation for Pricing Policies to Reduce Fossil-Fuel CO_2 Emissions," *Assessing U.S. Climate Policy Options* (Nov. 2007) at p. 73.

Principles for Smart Program Design and Implementation

In designing a cap-and-trade program, the Committee will keep in mind the following principles, which can help keep costs down:

- *Certainty*: Certainty in program rules helps regulated entities and other affected parties make efficient compliance decisions. Long-term certainty is important because compliance requires long-term capital investment.

- *Sufficient Lead Time*: Regulated entities and other affected parties need sufficient lead time before the program starts to assess compliance options and construct necessary capital equipment. Sufficient lead time also helps avoid early run-ups in allowance prices.

- *Market Liquidity*: The Government's failure to release allowances to the market in a timely manner will increase prices. Whatever allowance distribution methodologies the Government uses, allowances should be distributed and available to the market prior to the end of the compliance period.[19]

- *Good Information*: The market needs to know actual emissions, both before the program starts and periodically during the compliance year.[20] Participants need to understand what is happening in the market. Under the Acid Rain Trading Program, allowance ownership is public information. In addition, trade magazines and brokers provide price information.

- *Simplicity*: Simple, clear rules help regulated entities understand their compliance obligations and can help reduce the cost of a program in the long run. Although a special rule for a unique circumstance may seem reasonable on its own, a multitude of special rules taken together can make a program so complicated that it takes experts and lawsuits to determine the rules. As one witness told the Subcommittee, "If...the devil is in the details, then the more details there are, the more places there are for the devil to hide."[21]

Market Mechanisms to Manage Risk

Under a cap-and-trade regulatory program, the private sector will be able to develop a range of methods to help individual firms manage and control their own compliance costs. In a

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[19]For example, if allowances are provided to States, the allowances for 2012 should not be distributed at the end of 2012.

[20]The lack of knowledge of actual emissions was one of the major causes of several problems in the EU ETS, including the over allocation of allowances initially and the large drop in prices when the actual emissions data was released after the program started. Ellerman, Denny and Buchner, Barbara, "Over-Allocation or Abatement? A Preliminary Analysis of the EU-ETS Based on 2005 Emissions Data," MIT Center for Energy and Environmental Policy Research, (November 2006), p. 5, accessed 5/5/08 at http://web.mit.edu/ceepr/www/publications/workingpapers/2006-016.pdf.

[21]Written Testimony of Dallas Burtraw, March 29, 2007, Hearing, Subcommittee on Energy and Air Quality, Committee on Energy and Commerce.

healthy market for carbon allowances, the allowance price will go up and down in response to underlying changes in market fundamentals. Although this volatility is one sign of a healthy market, it raises the concern that fluctuating allowance prices will unnecessarily increase costs for regulated entities. That concern has led some to question how the Government could design the program to protect regulated entities from excessive allowance price fluctuations. Although the Government can include certain design elements in the program (e.g., allowing unlimited banking), a cap-and-trade regulatory program does not need to rely solely on the Government to manage all contingencies. The private sector will also play an important role in helping businesses manage risk and minimize the cost effects from price fluctuations.[22]

In existing cap-and-trade regulatory programs for sulfur dioxide and nitrogen oxide, the private sector currently uses financial instruments to enable companies to manage the cost of complying with these programs. In particular, futures, forwards, and options allow a company to lock in a *future supply* of allowances at a price that is known *today* – smoothing costs over time. Undoubtedly, these and similar tools will be developed and used for the carbon market to help cushion businesses from unexpected changes in allowance prices and to provide some certainty about future compliance costs.

Optional Cap-and-Trade Program Features to Control Costs

There are a number of program features that can be added to a basic cap-and-trade program to enhance the program's ability to avoid unnecessarily high costs. Two of these, banking and the use of offsets, will be included in the cap-and-trade program. The Committee should also consider using additional cost containment measures.

Banking

The cap-and-trade program will allow unlimited banking of allowances.[23] Banking allowances should help reduce the overall, long-term cost of making necessary emission reductions, lessen cost to regulated entities, and reduce volatility in the allowance market. A basic cap-and-trade program provides flexibility as to *who* emits *where*. Banking enhances the advantages of a cap-and-trade program by providing flexibility as to *when* emissions occur, and does so without undermining the environmental goals of the program. While the same overall emission reductions are obtained with or without banking, banking encourages firms to make some reductions earlier than they normally would; in essence trading their lower-cost early reductions for higher-cost later reductions. Reducing greenhouse gas emissions earlier than required by the cap will not decrease the environmental benefit of the program.

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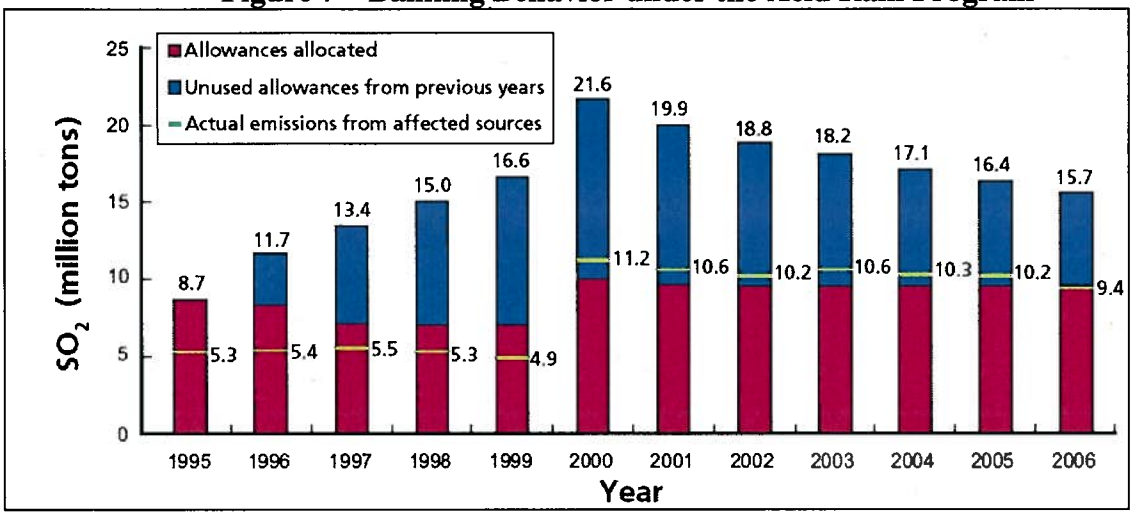
[22]Although the private sector can help manage risk, there are also concerns that the private sector can unnecessarily increase risk or cost. Some have expressed concern, for example, about market manipulation or that speculation in allowance markets by non-regulated firms will make it difficult for regulated entities to obtain sufficient allowances at reasonable prices to cover their obligations. The Committee is interested in suggestions for methods of reducing the risk of speculation and manipulation in the allowance market.

[23]To verify and authenticate allowances, the implementing agency may need to limit the time period for which an allowance can be banked.

In some cap-and-trade programs, allowances can be used for the specific compliance period for which they are issued or for any later compliance period (although each allowance may only be used once). For example, in the Acid Rain Trading Program, companies could use allowances issued for 1995 in that year, or they could save or "bank" them to cover emissions in 1996 or any later year. In this Program, companies over-controlled in the early years and banked a significant number of allowances. *See* Figure 7.

Figure 7 – Banking Behavior under the Acid Rain Program



Source: Environmental Protection Agency, "Acid Rain and Related Programs 2006 Progress Report," (2007), at p. 9, accessed 5/5/08 at http://www.epa.gov/airmarkets/progress/docs/2006-ARP-Report.pdf.

In contrast, in some cap-and-trade programs, allowances from one compliance period cannot be used in a later compliance period. For example, in Phase 1 of the EU ETS, allowances could only be used during the first phase of the program (2005-07), and could not be used for later years.

Banking can help reduce costs by encouraging companies to adopt compliance strategies that are more cost-effective over the long-term, instead of focusing solely on short-term compliance. Sources that over-control in the early years by installing control technology before it is needed can offset part of the cost by saving extra allowances for later sale or use. In contrast, the lack of banking in Southern California's Regional Clean Air Incentives Market (RECLAIM) program is believed to have discouraged firms from adopting long-term compliance strategies.[24]

Banking can help protect against short-term volatility (ups and downs) in allowance prices by providing a "cushion" both on a firm-level and a system-wide basis. On a firm-level basis, for example, an industrial plant might want to over-control in the early years (by making the plant more efficient) and "bank" its extra allowances so that it can use them in case of an unexpected increase in its emissions (due perhaps to equipment malfunction or a sudden upswing in business). If a large number of market participants bank allowances, a similar cushion is

[24]Environmental Protection Agency, *Tools of the Trade: A Guide to Designing and Operating a Cap-and-Trade Program for Pollution Control* (June 2003) at p. 3-20.

created to protect against systemic circumstances which cause higher emissions than expected. For example, when economic growth is slow, emissions might decrease, which should result in banking of allowances. Those banked allowances will then be available for sale or use when economic growth picks up.

Offsets and International Trading

A full discussion of offsets and international trading, including their advantages and disadvantages, is beyond the scope of this White Paper and will be addressed in a subsequent White Paper. Nonetheless, it is important to note that they provide an opportunity for reducing the cost of the cap-and-trade program and for reducing allowance prices.

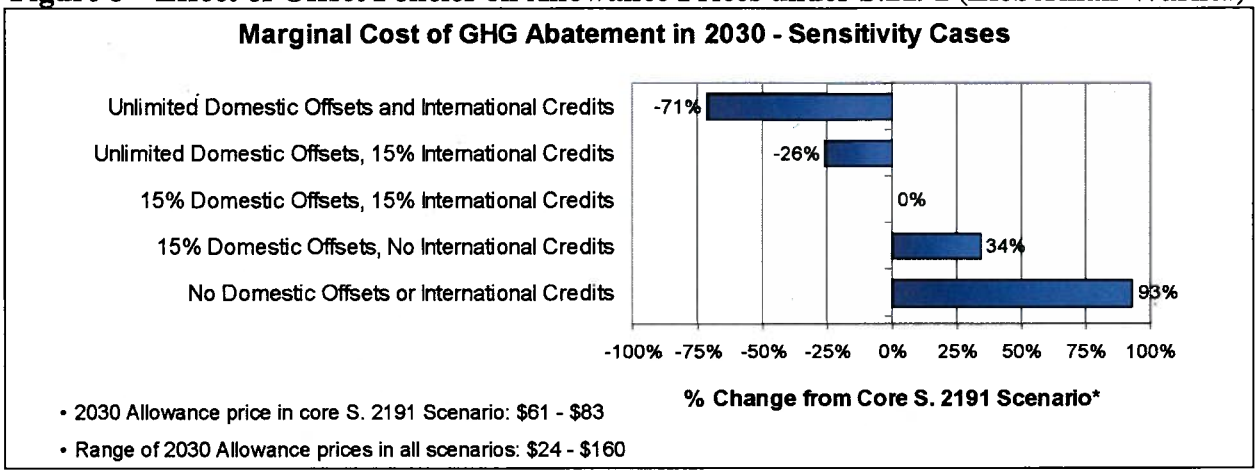
The cap-and-trade program will allow the use of offsets, although the extent to which they can be used is beyond the scope of this White Paper. To ensure the environmental integrity of the cap, offsets must be real, additional, verifiable and permanent. There are people seeking to limit offsets, but any limit on offsets could effectively limit the incentives to develop technologies that would produce offsets.

Offsets allow regulated entities to meet their obligation to turn in allowances by using credits generated by reducing or sequestering greenhouse gas emissions outside of the cap. For example, sources of greenhouse gas emissions cannot be covered by the cap if they are not measurable. Methane leaking from landfills, for example, cannot be measured easily, and largely for that reason, landfills emitting methane will not be regulated entities under the cap-and-trade program. If, however, methane from landfills is captured and converted into energy, the decrease in greenhouse gas emissions can be measured. A landfill owner could install equipment to capture methane and convert it into energy and create "offsets" that could be sold to a regulated entity and used like an allowance to cover the regulated entity's emissions (provided that the owner's actions were not otherwise required by law).

The Committee will also need to address whether to link the U.S. cap-and-trade program to international trading programs, and the extent to which the program should allow the use of international credits or offsets. Factors to consider include the effect on cost and on developing countries' incentives to limit greenhouse gas emissions.

Allowing regulated entities to use offsets can reduce the cost of allowances and the cost of a cap-and-trade program because many offset opportunities are projected to cost less than the marginal cost of reducing emissions from covered sources. For example, EPA compared the projected allowance prices for S. 2191 using several different assumptions about the ability to use domestic and international offsets. *See* Figure 8. S. 2191 limits both the use of domestic offsets and the use of international credits to 15 percent each of the total allowances that must be turned in each year. EPA projected that, if instead the bill were to allow *unlimited* use of domestic offsets and international credits, it would reduce allowance prices by about 70 percent. In contrast, EPA projected that, if S. 2191 were changed to *preclude* the use of any domestic offsets or international credits, it would increase allowance prices by more than 90 percent.

Figure 8 – Effect of Offset Policies on Allowance Prices under S.2191 (Lieberman-Warner)



In general, the tighter the limit on the amount of domestic or international offsets that can be used, the higher the projected price path of allowances.

Source: Environmental Protection Agency, "Offsets and Climate Policy: EPA Perspectives," (March 26, 2008) at p. 7. Accessed 05/12/08 at http://carbonoffsetproviders.org/7.html.

Firm-Level Borrowing from the Future

The Committee should consider whether an individual firm should be able to borrow allowances from the future.[25] This would permit a regulated entity to meet a current-year compliance obligation with future-year allowances. For example, an entity would be able to turn in 2018 vintage allowances to cover its 2015 emissions.

Firm-level borrowing is often mentioned as a way of reducing the cost to individual regulated entities. A firm might want to borrow from the future for several years until it installs new control technology that will dramatically reduce its emissions; installing the technology sooner might not be economically or technologically feasible. A firm might also want to borrow from the future if it were to miscalculate and have insufficient current allowances to cover its current emissions.

Firm-level borrowing from the future on a small-scale or a short timeframe is unlikely to change the environmental outcomes of a cap-and-trade program. Nonetheless, firm-level borrowing from the future does pose environmental or economic risks and potentially significant administrative issues.

Perhaps the biggest concern expressed about firm-level borrowing from the future is that firms will borrow a significant number of future allowances and then default. Depending on how the borrowing is structured, a default could cause environmental harm by resulting in more

[25]Borrowing from the future must be distinguished from borrowing currently-issued allowances from other private entities, which would be allowed by the program. For example, in 2015, Party A could loan 2015 vintage allowances to Party B under whatever terms were amenable to the two parties.

emissions than allowed by the program (because the borrowed allowances are never paid back). Another scenario that has been raised is that companies would engage in excessive borrowing, creating such significant liabilities that Congress would feel compelled to step in and bail the companies out by relieving them of their obligation to reduce emissions. This would have adverse environmental consequences, penalize companies that had met their obligations, and might even create a degree of uncertainty sufficient to cause significant instability in the allowance market. Alternatively, defaulting firms could increase the cost of the program for others by decreasing the number (and thus increasing the price) of allowances that should have been available in the years from which they were borrowed.

Firm-level borrowing from the future could also pose administrative issues. For example, consider a firm that borrows future-year allowances from a Government "bank." Presumably, the firm would have to pass some type of credit-worthiness test, put up some type of collateral for the borrowed allowances, and then agree to pay back the allowances over time with interest. Firm-level borrowing might be simpler if a firm could take future-year allowances that it owns and use them for current year compliance.[26] In either type of borrowing, though, the system would have to be carefully designed to prevent profiteering on borrowed allowances, to guard against defaults, and to minimize the economic and environmental consequences of defaults.

Given the administrative burdens and potential for defaults, it is important to focus on the problem that firm-level borrowing from the future is meant to address and determine whether it is really desirable or whether there is a better way to address the problem. If the allowance market is functioning well, a firm that needs extra allowances for a few years until it installs new technology or because it miscalculated its allowance needs should be able to purchase current-year allowances in the market, use allowances that it has banked, or trade future-year allowances that it owns for current-year allowances. If those options were not available (or economical) because the market is not functioning well (i.e., if allowances prices were unexpectedly high for a sustained time period), then regulated entities might find firm-level borrowing particularly useful. If there is a systemic problem, however, system-wide, rather than firm-level, borrowing might be a more efficient solution. In system-wide borrowing, future allowances are made widely available to regulated entities to cover current emissions. One way to accomplish system-wide borrowing would be to have the Government take allowances from a future year and release them into the market for current use.

Questions:

If the allowance market is functioning well, what problems would firm-level borrowing from the future solve?

If the allowance market is not functioning well, would system-wide borrowing be a better solution than firm-level borrowing?

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[26]A firm could own future-year allowances either because the Government has allocated the allowances to the firm or because the firm bought them.

If firm-level borrowing from the future were allowed:

- *What mechanisms should be used to protect against defaults?*
- *Should borrowers have to pay interest? In dollars or allowances? How should the interest be set?*
- *Should a borrower have to prove credit-worthiness? How?*
- *What type of collateral (if any) should be required to borrow allowances?*
- *How far into the future could allowances be borrowed?*
- *How quickly should allowances have to be paid back?*
- *What limit, if any, should there be on how many allowances a firm could borrow?*
- *What system-wide limit, if any, should there be on the total amount of allowances that could be borrowed from or in a specific year? If there should be a limit, should borrowed allowances be available on a first-come first-served basis? Should there be another means of apportioning them?*
- *Should anyone be allowed to borrow from the future? Or only regulated entities?*
- *Would firm-level borrowing create opportunities for market manipulation? If so, would there be ways to protect against that?*

Multi-Year Compliance Periods

The Committee should consider the appropriate length of the compliance periods (i.e., how frequently allowances must be turned in to cover emissions). Different trading programs have different compliance periods.[27] The minimum length of the compliance period should be one year, but it might be appropriate to have a longer compliance period, which might reduce the cost to regulated entities and reduce volatility in the market.

A two- or three-year compliance period would provide regulated entities more flexibility than a one-year compliance period. Instead of issuing allowances for a specific year, allowances could be issued for the full compliance period and used to cover any emissions during that compliance period. This method might help contain the cost of a climate change program by reducing volatility in the allowance market and allowing regulated entities to average their

[27]The Acid Rain Trading Program requires all regulated entities to turn in allowances once a year to cover the last year's emissions. The Regional Greenhouse Gas Initiative (RGGI) in the Northeast generally uses a 3-year compliance period that would be extended to 4 years under certain circumstances.

emissions over a longer time period. Effectively, it is a way of allowing a limited amount of system-wide borrowing with minimal administrative burden.

A multi-year compliance period might raise concerns that regulated entities might not pay sufficient attention to their allowance needs and face a shortage at the end of the period. A longer compliance period would not, therefore, change the requirement that regulated entities report actual emissions periodically during the year. Annual, interim obligations to turn in allowances might also be appropriate.

A variation on a multi-year compliance period would be to permit regulated entities to use allowances one year in advance of the year for which they are issued. For example, to cover emissions in 2012, regulated entities could turn in allowances from 2012 or 2013; to cover emissions in 2013, regulated entities could turn in allowances from 2012, 2013, or 2014. To decrease the potential for abuse or default, regulated entities could be limited to meeting no more than a specified percent of their obligation in any given year with allowances from the following year. Effectively, this would allow regulated entities to "borrow" some allowances one year in advance with minimal administrative burden.

Questions:

- *How long should the compliance period be?*
- *What are the potential downsides of a multi-year compliance period and how could they be minimized?*
- *Would a multi-year compliance period help reduce cost either system-wide or for individual regulated entities?*
- *If a multi-year compliance period were adopted, should regulated entities be required to turn in allowances annually?*
- *Alternatively, should regulated entities be permitted to use allowances one year in advance of the year for which the allowance is issued? If so, should there be a limit on how many future allowances a regulated entity can use at a time?*

Special Cost Containment Mechanisms: Safety Valve, Circuit Breaker, Independent Agency, and Strategic Reserve

The Committee should consider the use of one of a variety of special cost containment mechanisms that would release additional allowances into the market to reduce costs. Releasing additional allowances into the market essentially raises the cap for that year (allowing more emissions), which should have the effect of lowering allowance prices, and thus lowering the cost of complying with the program.

In determining the viability of each of these mechanisms, a critical question is how it would affect the environmental integrity of the cap-and-trade program. The answer would depend in part on whether the additional allowances would increase cumulative emissions through 2050. Cumulative emissions should not increase if allowances were to be taken from one year and moved into a different year (such as would happen if allowances were borrowed from the future).[28] In contrast, if new allowances were created, then cumulative emissions might increase. The effect on the environmental integrity of the program would also depend on how many allowances could be added in a given year.

The best way to design a mechanism to release additional allowances will depend, to a certain extent, on the cost "problem" the Committee is trying to address. The following are the two primary competing potential goals of mechanisms for releasing additional allowances:

- To lower the cost of the program (by lowering allowance prices) in the event that unexpected or unusual circumstances lead to unexpectedly high allowance prices over a sustained period (such as six months or longer); or

- To cap costs instead of emissions by providing certainty about the maximum cost per allowance.[29]

The first goal would guard against a dramatic rise in allowance prices due to unusual and unexpected circumstances. Rather than relying on creative legal interpretations by regulatory agencies in the event of unexpectedly high allowance prices, it might be better to design flexibility into the program to handle unusual circumstances. In effect, Congress would be deciding that, if costs were in the range of what is projected, emission reductions must be achieved on the timetable set out in the statute. Only if something unexpected were to happen should the timetable and reduction targets be adjusted.

The second goal represents a very different approach. In effect, Congress would be deciding the maximum amount to spend on reducing greenhouse gas emissions regardless of the level of reductions it would achieve.

If the first goal were adopted (to protect against unexpectedly high allowance prices), and allowance prices were projected to range from $25 to $35 per ton, then Congress might direct that the cap be raised slightly (or temporarily) when allowance prices hit $60 or more per ton. If the second goal were adopted (to provide certainty about the maximum cost), Congress might direct that the cap be loosened when allowance prices hit $20. That would reflect a decision by Congress that, no matter what the scientists tell us about the dangers of climate change, Congress is only willing to require reductions that cost $20 or less per ton.

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[28]If a significant number of allowances are moved from the future to cover current emissions, it could create unachievable caps in the later years. If this were to happen, Congress might be compelled to increase the cap in the later years.

[29]Releasing additional allowances into the market generally is not considered to be a good way of addressing short-term fluctuations in the market, even if prices are unexpectedly high for a short time period.

Another potential goal deserves special discussion. One motivation for mechanisms to release additional allowances into the market is the desire to ensure that someone (other than Congress) will have the authority to "fix" a long-term problem with the program for fear that Congress will not intervene even if the program is creating significant harm to the U.S. economy over many years. While it is certainly wise to design a system that has some ability to adapt to changing or unforeseen circumstances, it is unrealistic to believe that Congress will not address climate change again for 40 years, especially if there are major problems with the program.

Special cost containment mechanisms for climate change cap-and-trade programs have evolved over the last few years. There are more potential mechanisms to release additional allowances into the market than can be discussed in this White Paper, and each mechanism has numerous potential modifications. The trigger price for releasing allowances is key to all of these approaches. Rather than providing an exhaustive discussion of all the options, this White Paper will provide a flavor of the options being discussed by focusing on four different mechanisms:

- a safety valve and unlimited allowances;
- a circuit breaker that holds the cap constant when allowance prices are unexpectedly high;
- an independent agency with the broad discretion to release additional allowances; and
- a strategic allowance reserve and an agency with limited discretion to release additional allowances.

For each of these, the description below is a broad overview of how that type of mechanism might work. The methods could be combined or modified in a number of ways.

Safety Valve and Unlimited Allowances

In 2005, Senator Bingaman issued a discussion draft of a climate change cap-and-trade program that included a "safety valve" as a way of containing costs.[30] Under that legislative draft, regulated entities could meet their compliance obligation either by turning in allowances or by making a "safety valve" payment of $7 per ton of CO_2e emitted in 2012 (with the payment increasing at a rate of 5 percent each year).[31] In S. 1766, Senators Bingaman and Specter modified this concept, increasing the payment to $12 per ton of CO_2e emitted in 2012. The payment would increase at a rate of 5 percent each year above inflation, bringing it to $25 per ton CO_2e in 2030.[32] They also renamed the safety valve payment a "Technology Accelerator Payment" (TAP). Essentially, the safety valve or TAP releases an unlimited number of additional allowances into the market at the price specified in the legislation.

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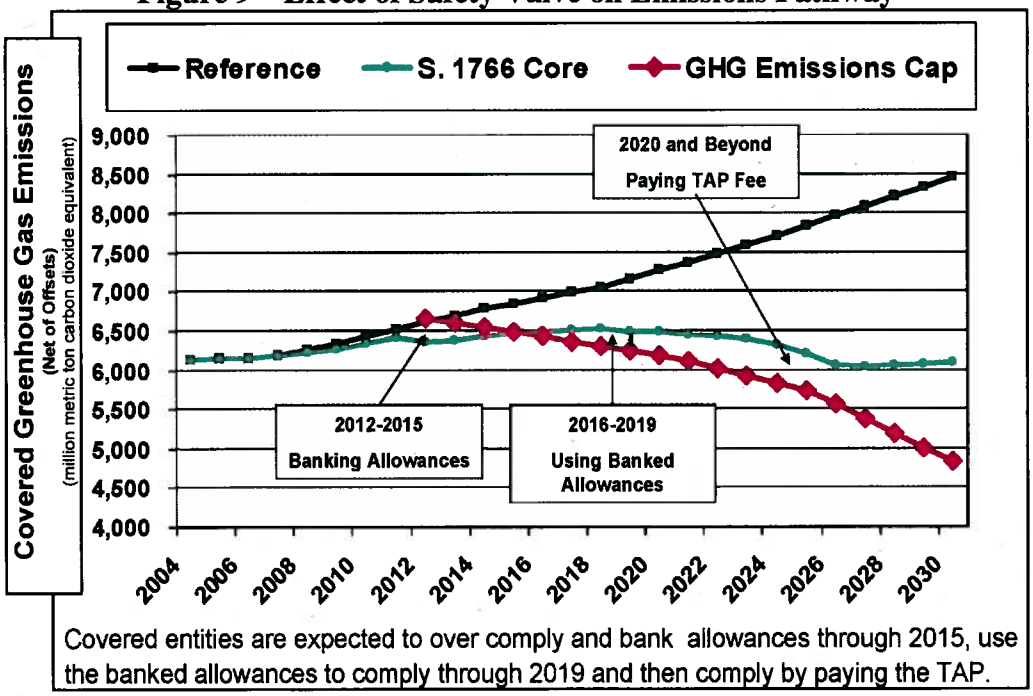
[30]The draft bill was named the "Climate and Economy Insurance Act of 2005," but was not formally introduced.
[31]Sections 1512(13) and 1516 of the Climate and Economy Insurance Act of 2005.
[32]Environmental Protection Agency, *EPA Analysis of the Low Carbon Economy Act of* 2007 (January 15, 2008) at p. 33. Dollar amounts given in 2005 dollars.

The result of this safety valve or TAP would be that, instead of capping the *amount* of emissions each year, the program would cap the *cost* of emissions per ton. Figure 9 shows that, starting in 2020, the projected cumulative emissions with a TAP (area under the green line) would exceed the cumulative emissions allowed by the cap operating without a TAP (area under the red line).[33] This is because the safety valve price (red dotted line in Figure 10) was set lower than the projected price of allowances in the same program without a TAP (green and blue lines). Instead of reducing emissions to a level at or below the cap, regulated entities were projected to comply with these requirements through a combination of reducing some emissions and making safety valve payments.

The Bingaman-Specter safety valve would help contain costs by creating certainty about the maximum cost per ton of CO_2e. It would also be relatively easy to implement because Congress, as part of the final legislation, would make the hard decisions about what allowance price would trigger the safety valve and how many allowances would be released.

The primary concern that has been raised with the Bingaman-Specter safety valve is that it is projected to prevent the program from achieving the necessary greenhouse gas reductions and environmental goals. This is because the safety valve price was set lower than the projected allowance price. Another major problem that has been raised is that the safety valve price would likely decrease the incentive to develop and deploy new technology. Pollution control

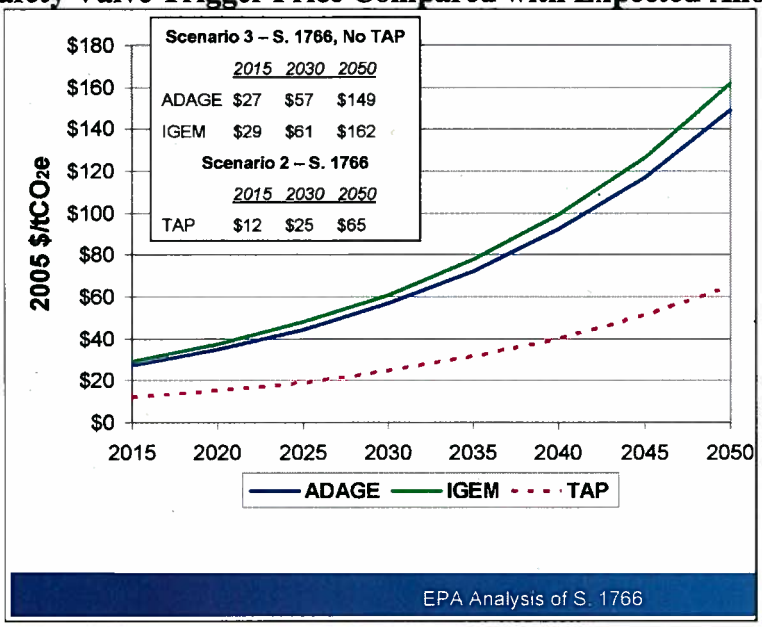
Figure 9 – Effect of Safety Valve on Emissions Pathway



Source: Energy Information Administration, "Energy Market and Economic Impacts of S.1766, the Low Carbon Economy Act of 2007," (January 2008), at p. 8, accessed 5/5/08 at http://www.eia.doe.gov/oiaf/servicerpt/lcea/pdf/sroiaf(2007)06.pdf.

[33]This effect was more pronounced when the safety valve was set at $7 per ton.

Figure 10 – Safety Valve Trigger Price Compared with Expected Allowance Prices



This figure compares estimated allowance prices of S.1766 without a TAP (safety valve) to allowance prices of S.1766 with a TAP (using two different models).

Source: Environmental Protection Agency, "EPA Analysis of the Low Carbon Economy Act of 2007; S.1766 in the 110th Congress," (January 15, 2008), at p. 31, accessed 5/5/08 at http://www.epa.gov/climatechange/economics/pdfs/S1766_EPA_Analysis.pdf.

technology may be less expensive than initially expected. With a safety valve near or below the projected allowance price, potential technology may be dropped due to a mistaken early estimate that the cost will exceed the safety valve price. Also, some firms might prefer the certainty of safety valve payments and fail to invest in technology that might cost less in the long run, but is riskier. Finally, it would be difficult for Congress to decide now on the right safety valve price each year for the next 40 years.

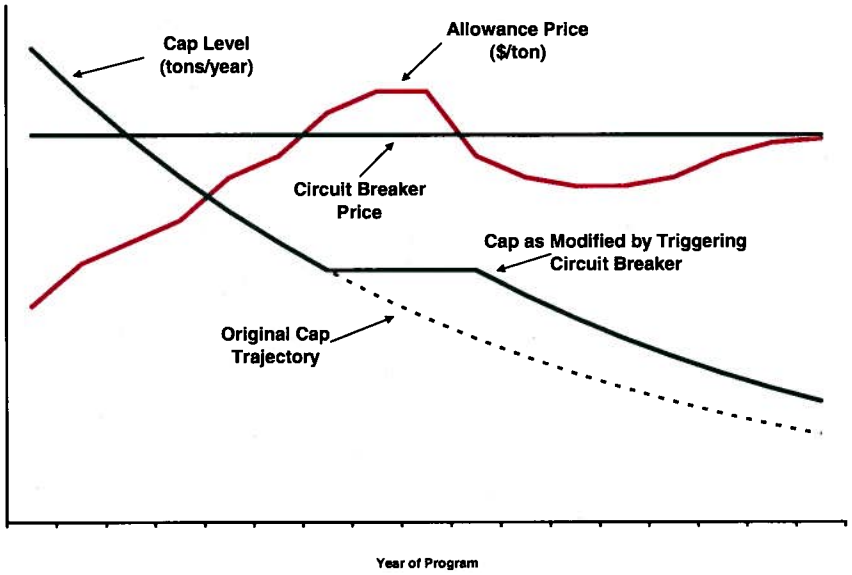
An important consideration in using a safety valve is the level at which it is set. A safety valve set below the expected marginal cost (or allowance price) would be much more likely to be triggered, which would result in emissions above the cap. If the safety valve were set significantly higher than the marginal price, it would be less likely to be triggered. A high safety valve would be less likely to result in emissions above the cap, but would do less to ensure that the cost of the program is not greater than anticipated.

A safety valve coupled with making unlimited allowances available at the safety valve price is particularly well-suited to achieving the second goal discussed above – providing absolute price certainty regardless of the level of reductions achieved. If one wanted only to protect against unexpectedly high allowance prices, the safety valve price could be set well above the projected range of allowance prices.

Circuit Breaker – Holding the Cap Constant While Allowance Prices Are High

A "circuit breaker" approach is an alternative method of releasing additional allowances into the market. During time periods when the average annual allowance price exceeded a pre-determined "circuit breaker" price, the cap would be held constant, rather than continuing to decline. If the average allowance price for a year were to drop below the circuit breaker price, then the cap would continue declining at its initial rate. Figure 11 illustrates a situation where the circuit breaker is in effect for a few years and then, when allowances prices decline, the cap continues its previous rate of descent. S. 309 (Sanders-Boxer) includes a circuit breaker, which it calls a "technology-indexed stop price."[34]

Figure 11 – Theoretical Operation of a Circuit Breaker Mechanism



Source: Figure provided by Energy and Environment Associates.

Inclusion of a circuit breaker would help address one of the difficulties with establishing a cap for greenhouse gas emissions – uncertainties about when technology will be developed and deployed. For example, when EPA projects allowance prices for particular cap-and-trade programs, it makes assumptions about the pace at which new nuclear capacity could be deployed. If those assumptions turn out to be too optimistic, the cost of meeting a declining cap could be much higher than anticipated. A circuit breaker would hold the cap constant until new nuclear capacity (or some other technology) comes on line and brings the allowance price down. While the cap is being held constant, there would continue to be an incentive to develop and deploy new technology because allowance prices would be above the circuit breaker price.

This approach provides less certainty about price than a safety valve with unlimited allowances because the allowance price may still rise after the circuit breaker is triggered. It

[34] *See* Section 2 of S. 309, adding Section 704(f)(2)(D)(ii) to the Clean Air Act.

provides more certainty about environmental benefits because there is still a cap (although it may be larger than the cap initially set in the statute). If, however, the circuit breaker were triggered, cumulative emissions over the length of the program would be greater than without the circuit breaker.

This approach would help meet the first goal, protecting against unexpectedly high prices due to unforeseen circumstances. It would not meet the second goal of providing price certainty because prices could rise above the price that would trip the circuit breaker.

This approach would require Congress or an agency to make difficult decisions about the price at which to set the circuit breaker and whether (and how) the price trigger should change over time.

Independent Agency with Broad Discretion to Release Allowances

The debate on special cost containment mechanisms was changed dramatically with the introduction of S. 1874, which was later modified and incorporated into S. 2191 as reported out of the U.S. Senate Committee on Environment and Public Works on December 5, 2007 (Sections 2601-05). Rather than the statute setting a safety valve price and allowing essentially an unlimited number of additional allowances into the market, the bill would establish a new, independent government board (the Carbon Market Efficiency Board or Board), modeled after the Federal Reserve Board of Governors. The bill would delegate to the Board the authority to decide the timing and number of any additional allowances to be released into the market by borrowing them from the future, based on a determination of what was necessary to prevent significant harm to the U.S. economy.[35]

The Board would have authority to implement different sets of "cost relief measures" as necessary to prevent significant economic harm. Most importantly, the Board would be able to borrow allowances from future years (by reducing the caps in those years) and release those allowances to the market. The Board would also be able to increase the number of allowances that regulated entities could borrow from their future allowances, lengthen the payback period of loans to regulated entities, or lower the interest rate on loans. (This group of measures would only be useful in a system that allows firm-level borrowing.) In addition, under S. 2191, the Board would be able to increase the quantity of offsets or foreign allowances that could be used.[36]

The bill would provide the Board very broad discretion regarding the use of these cost relief measures.[37] The Board *may* carry out measures "to ensure a functioning, stable, and efficient market," but "only as needed to avoid significant economic harm" and only for one year

[35]The Board would also be responsible for collecting and analyzing allowance market information.

[36]The intent is that the Board would consider the use of the other cost relief measures before borrowing allowances from the future.

[37]For simplicity, this paper only discusses the Board's authority after the first two years. Sec. 4(d)(2) and 5(a)(3) of S. 1874, which provide authority for cost control measures in the first two years of the program, are far more prescriptive.

at a time.[38] The Board would have to ensure that borrowed allowances would be paid back in 15 years. Otherwise, the Board would have broad discretion. The amount of allowances that could be released, when they could be released, and the year from which the allowances could be borrowed are among the decisions that would be left to the discretion of the Board and its determination of what is needed to avoid significant economic harm. The bill would not require the Board to issue rules to establish guidelines for how it would exercise its discretion or to provide an opportunity for public comment or participation. Nor does the bill provide for judicial review of the Board's decisions. [39]

The Board was designed to operate independently of political influence. It would be comprised of 7 members with staggered 14-year terms.[40] The members would be Presidential appointees requiring Senate confirmation, and could not hold other employment during their terms of service. The members could be removed by the President for cause.

Several benefits of this approach have been noted. It could protect against significant unexpected economic harm, and do so in a way that does not increase cumulative greenhouse gas emissions over the life of the program.[41] It also would avoid the difficulty of having Congress decide on a specific safety valve price or how many allowances could be released each year for the next 40 years.

A number of concerns have been raised about this approach. For one, it would add uncertainty to the cap-and-trade program. Regulated entities would not know when the Board would make additional allowances available, which would make it difficult to predict future allowance prices. This uncertainty could hinder investment in the development of new technologies. The Federal Reserve, for example, took many years to evolve to the point of relative predictability that it exhibits now. Also, starting a new agency from scratch poses logistical and practical problems that may seem mundane, but that would take considerable energy and time to solve.

More importantly, though, this approach raises a fundamental question about what decisions should be made by elected, politically accountable representatives of the American

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[38]Although Sec. 3(a) of S. 1874 states that one purpose of the Board is to "promote the achievement of the environmental objectives of the United States," the language governing the use of cost relief measures does not specifically require the Board to take environmental considerations into account. It is somewhat unclear how Sec. 4(d), which says that the Board "shall carry out such cost relief measures" if the Board determines that the allowance market "poses a significant harm to the economy of the United States," interacts with Sec. 5(a)(1), which *allows* the Board to carry out cost relief measures "to ensure functioning, stable, and efficient [allowance] markets," but only to the extent "needed to prevent significant economic harm during the applicable allocation year."

[39] Sec. 5(a)(2) of S. 1874 would require the Board to "specify the terms of the [cost] relief to be achieved" and to submit to Congress "a report describing the actions carried out by the Board and recommendations for the terms under which the cost relief measure should be authorized by Congress and carried out by Federal entities."

[40]Terms of initial members would be shorter than 14 years to the extent necessary to have one member's term expire every 2 years.

[41]Although the bill would not allow the Board to increase cumulative emissions, excessive borrowing from future years could cause such unrealistically low caps in future years that Congress would be forced to increase those caps (and thus increase cumulative emissions). Shifting a significant amount of emissions from future to current years could also have detrimental environmental effects by delaying greenhouse gas reductions.

people, and what decisions should be delegated to expert agencies with little accountability. The question arises from both the nature of the decisions left to the Board and the limited checks on its actions.

The decisions delegated to the Board are significant from both environmental and economical perspectives. (For example, the Board could decide to double the level of emissions allowed in any given year, or it might decide that an average allowance price of $150 a ton in 2015 is acceptable.) Essentially, the Board would have the ability to weaken the timetables and targets adopted by Congress. The bill would give the Board significant discretion – with the main limit being the Board's determination of what is necessary to prevent significant economic harm.

Broad grants of discretion on significant environmental and economic decisions are not uncommon, but the decisions are usually subject to a greater level of political and judicial accountability than this approach would provide. The Board is designed to operate free of political influence, which may have advantages, but also means that neither the President nor the Congress would have much control over it.[42] Some perceive this political independence as beneficial because they fear that a politically accountable Board might interfere in the market or decrease the environmental benefits of the program to meet short-term political needs. (For example, a Board that served at the pleasure of the President might be pressured into releasing additional allowances into the market to reduce allowance prices (and therefore gasoline prices) right before an election, or might refuse to release allowances even if the allowance price were very high.) This approach relies on substantial faith in the ability of the President and the Senate to ensure that the right people are selected as Board Members. In addition, it seems unlikely that the Board could be held to account in the Courts if it deviated from Congressional intent. The need for the Board's actions to be quickly implemented to react to the allowance market would seem to make judicial review impractical (even if the bill provided for it).

Ironically, Congress would create this new Board with almost unfettered discretion in the hope that, were the cap-and-trade program to work as Congress intends, this Board would have nothing to do other than to collect information and prepare reports,[43] because the Board's main function would be to intervene if the program were not working. This could make it difficult to attract and retain members with the appropriate skills, wisdom, and experience to make the decisions entrusted to it. Alternatively, if the Board were to attract highly qualified members, they might try to enlarge its mission to make the Board relevant and interesting.

It is unclear whether this Board would better meet the first goal (protecting against unexpectedly high allowance prices) or the second goal (limiting the price of allowances regardless of the environmental consequences). It would depend, at least in part, on how the Board interpreted its charge to "prevent significant harm to the U.S. economy." It does appear,

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[42]Although the President can remove a Board Member, he can do so only for cause. Congress could also enact new legislation overriding the Board or changing its mandate.

[43]It is unclear why a new Board would need to collect information, analyze the program, and prepare reports. Presumably these functions could be served by the agency running the program and/or by agencies charged with market oversight.

however, that the Board is designed to meet the goal of ensuring that someone can "fix" the program if something goes wrong and Congress does not meet its responsibility to step in.

Strategic Allowance Reserve and an Agency with Limited Discretion to Intervene in the Market

An alternative cost containment mechanism would be to create a strategic allowance reserve by setting aside a fixed percentage of each year's allowances from the start of the program through 2050.[44] If allowance prices were too high for a sustained period, the implementing agency would auction some of the reserve allowances. No more than a fixed percentage (perhaps 5 or 10 percent) of the initial reserve could be released in any calendar year. If prices were within expected bounds in the early years, the reserve would serve as system-wide banking of allowances for use in later years. If prices were higher than expected in the early years, releasing the allowances would function as system-wide borrowing of allowances from the future.[45]

Under this alternative, the climate change legislation would provide the implementing agency with limited discretion in using the reserve. For the first part of the program (perhaps the first 10 years), Congress would provide specifics such as: the average allowance price that would trigger the release of allowances; the time period over which the average allowance price would be measured (perhaps six months); the number of allowances that would be released; and the timing and method of release. For example, the legislation might require that, if average allowance prices were too high for two quarters in a row, then in the next quarter the implementing agency would be required to sell one-fourth of the reserve allowances that could be released in that year.

Although the rules governing release of reserve allowances for the first part of the program would be set in legislation, Congress could require the implementing agency to issue rules (subject to judicial review) governing release of reserve allowances for subsequent periods of time (perhaps every 10 years).[46] At a minimum, these rules would have to set the allowance price that would trigger the release of allowances. The bill might also give the agency limited discretion to change other factors (such as when and how the allowances are released) as necessary to improve the efficient functioning of the market.

This approach would require Congress to make some very hard decisions in the climate bill, such as how high is too high for an allowance price. If the purpose of the strategic reserve is to protect against unexpected high prices to prevent significant economic harm, then the dollar value that would trigger a release of reserve allowances would need to be set significantly above

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[44]If there were a price floor for allowances, allowances obtained by the implementing agency could be added to the reserve.

[45]If the implementing agency were to obtain allowances due to a price floor, they could be added to the strategic reserve. This would increase the amount of banking from years in which allowance prices are much lower than expected.

[46]In case the agency rule were delayed or overturned in court, the statute would need to have a back-up provision to protect against market disruptions.

projected allowance prices for each year and be adjusted for inflation. Setting it too close to the projected allowance price would be likely to interfere with the market and decrease the incentives for industry to develop and deploy breakthrough technologies. Congress would also have to set forth criteria that would sufficiently limit the implementing agency's discretion for the rules to be issued governing the later periods of the program. Setting these criteria in a way that provides meaningful direction to the implementing agency and reviewing courts might not be easy.

Agency decisions made by rulemaking could be challenged in court. Because the rules for releasing allowances would either be set by Congress or through rulemaking by the implementing agency, political interference with the actual release of the allowances would be difficult. The head of the agency would be appointed by the President and confirmed by the Senate, and would serve at the pleasure of the President.

This approach is designed to meet the first goal. It is based on the assumption that the cap-and-trade market needs some built-in flexibility to protect against significant economic harm if the market does not quite work as projected in the short or medium run (e.g., unusual circumstances lead to high allowance prices for a year, or deployment of carbon capture and storage technology takes a couple of years longer than expected). It also recognizes that, if there is a serious, long-term flaw (e.g., carbon storage technology does not work), Congress has the responsibility to step in. Congress would have ample warning and time to craft solutions before it would need to act; by limiting the allowances that could be released in any given year, it would take a decade or longer of sustained high prices before the reserve would run dry.

Variations

The discussion in this section provides just a flavor of the range of special cost containment mechanisms available to release additional allowances into the market if the Committee were to decide that was an appropriate tool to help contain costs. The options discussed above could be modified or combined in many different ways.[47]

The mechanisms outlined above could also be used to introduce additional flexibility into the market in other ways. Before additional allowances are released into the market, a lower trigger price might raise the limit (if there is one) on the number of offsets that could be used or might change the terms of firm-level borrowing from the future (if that were allowed).

Questions:

- *Should a cap-and-trade program have a mechanism for releasing additional allowances into the market to protect against sustained, unexpectedly high allowances prices?*
    - *Are there reasons other than sustained, unexpectedly high allowance prices for releasing additional allowances into the market?*

[47]The special cost containment mechanisms being discussed in the Senate include variations on the mechanisms discussed above.

- *What factors should be used to set the average allowance price that would trigger the release of additional allowances into the market?*
    - *How should the trigger price compare to the projected allowance price?*
    - *How long do allowance prices need to be high?*
- *Should the trigger price be set by the Congress in statute or by an agency or board?*
- *Should the allowances be extra ones that add to cumulative emissions? Or should they come from another year (either borrowed from future years or banked from past years), and thus not increase cumulative emissions?*
- *Should there be a limit on the number of allowances that could be released in any given year?*
    - *If so, should that limit be set by Congress or by an agency or board?*
    - *If Congress should set it, what should the limit be? What factors should Congress consider in setting it?*
    - *If an agency or board should set it, what, if any, constraints should there be on the discretion of the agency or board?*
- *Should there be a limit on the total number of allowances that could be released during the life of the program (such as by setting up a reserve)?*
    - *If so, should that limit be set by Congress or by an agency or board?*
    - *If Congress should set it, what should the limit be? What factors should Congress consider in setting it?*
    - *If an agency or board should set it, what, if any, constraints should there be on the discretion of the agency or board?*
- *How should the allowances be released?*
    - *According to that year's allocations? Auctioned? First-come first-serve? Fixed price?*
    - *To whom should they be released? Regulated entities only? Everyone?*
- *How do the different allowance release mechanisms affect the incentives to invest and innovate?*

- *Should other types of flexibility be allowed when lower allowance price triggers are hit, such as allowing greater use of offsets?*
    - *If so, what flexibility should be allowed and at what trigger price?*
    - *Should it be set in statute? Or left to an implementing agency?*
- *Should authority to release additional allowances be delegated to an existing agency or agencies? Which one (s)? Or should a new agency be created?*
- *Does the implementing agency need to be independent? If so, to whom should it be accountable and in what way?*
- *To what extent should the implementing agency's decisions be judicially reviewable?*
- *To what extent do any of these potential mechanisms introduce opportunities for players in the market to manipulate it? Are there methods to limit the potential for manipulation?*

A Price Floor for Allowances

Although concern centers on excessively high allowance prices, allowance prices that are too low could also be problematic. Low allowance prices (or the potential for them) may fail to encourage investment in new, low-carbon technologies that will be necessary for large-scale emission reductions in later years. Low allowance prices might also be an indication that we can afford to lower the emissions cap.

The Committee should consider whether a floor for allowance prices should be set, and determine whether it should be done via legislation or delegated to a board or agency. One approach would be to give authority to the implementing agency to buy allowances in the market when prices are low. Allowances obtained by the implementing agency could be placed into a reserve for later release during a period of excessively high allowance prices.

Questions:

- *Should there be a price floor for allowances?*
- *Should the implementing agency be authorized to buy allowances in the market when prices drop below the price floor?*
- *What should the price floor be?*
    - *Who should set it?*
    - *What factors should be considered in setting it?*

- *What should happen to the allowances obtained or kept as a result of the price floor? Should they be retired? Or saved for later release in the event that prices are too high?*

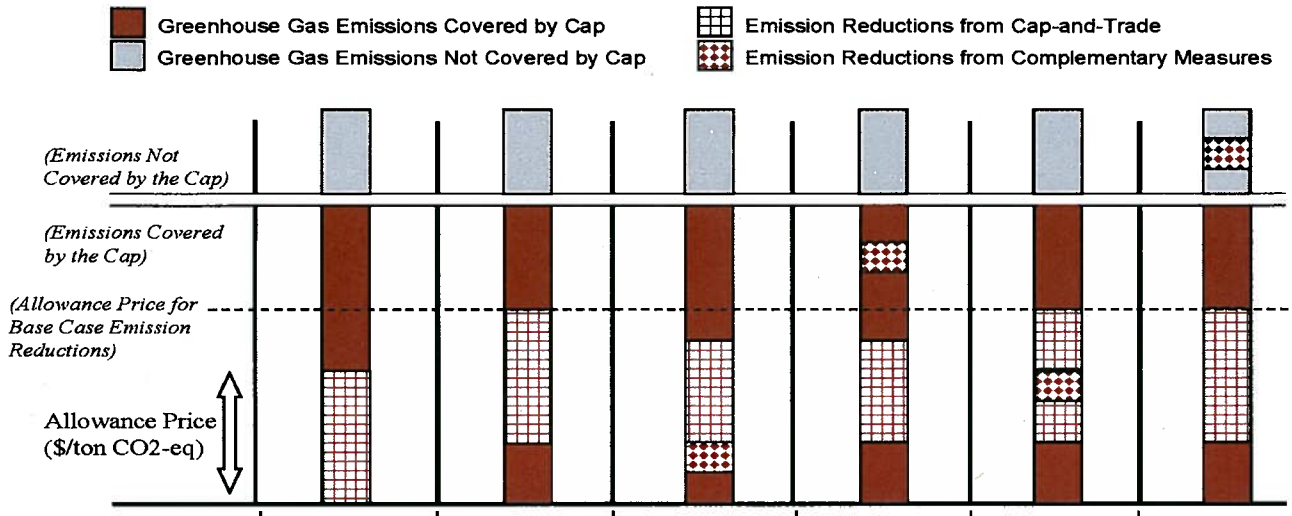
Complementary Measures

Although generally beyond the scope of this White Paper, complementary measures can affect the cost of a comprehensive climate change program. As other measures are proposed, the Committee should carefully review whether they are likely to increase or decrease the total cost of reducing greenhouse gas emissions. Figure 12 illustrates how complementary measures can affect allowance prices and the total cost of reducing greenhouse gases. Congress adopted a number of complementary measures when it passed EISA last year, including more stringent fuel efficiency standards for motor vehicles and a number of measures to improve efficiency of buildings, industry, appliances, and lighting. Complementary measures might include regulations establishing greater energy efficiency in appliances, funding for research and development of new technologies, and performance standards for certain industrial facilities.

Some measures may help reduce cost by requiring economically beneficial or low-cost reductions that the market is likely to miss. In a perfect market, a cap-and-trade program that puts a price on carbon should result in the greatest reductions at the lowest costs (represented by Column A in Figure 12). The market, however, is not perfect, and people do not always respond in the most economically rational way. For example, even though lower operational costs would more than offset the higher initial cost of a more efficient water heater, a consumer might not have enough information to determine that the more expensive water heater would be cheaper in the long run, might not be planning to stay in the house long enough to recoup the higher initial costs, or might not have sufficient resources to cover the higher initial cost at the time of purchase. As a result of these imperfections in the market, a cap-and-trade program is likely to miss some of the low-cost reductions, as represented by Column B in Figure 12.

Some measures may help reduce long-term costs by requiring or encouraging technology development that a cap-and-trade program might not encourage on its own early on, particularly with respect to long-lasting equipment. For example, costs tend to decline as new technologies are commercialized and used on a wide scale. For some technologies, it may be appropriate to subsidize or otherwise encourage their development and deployment though the pilot- and early-commercial phases, in order to accelerate their introduction into widespread commercial use. Doing so might entail designing regulations or incentives to achieve reductions that cost more than the then-current allowance prices (as represented by Column D in Figure 12). (For example, Sections 3601-3605 of S. 2191 (as passed out of Committee) award "bonus" allowances for early deployment of carbon capture and storage at electricity generation plants.) The total cost of reductions could temporarily increase as a result, but benefits would accrue once large-scale, cost-effective reductions from that technology became feasible.

Figure 12 – Effects of Complementary Policies on Cap-and-Trade Abatement Costs



Scenario	A Federal Cap-and-Trade Program (Perfectly Efficient)	B Base Case: Federal Cap-and-Trade Program (Some Inefficiencies)	C Base Case Plus Complementary Measures Requiring Low-Cost Reductions	D Base Case Plus Complementary Measures Requiring High-Cost Reductions	E Base Case Plus Complementary Measures Requiring Same Reductions as Federal Program	F Base Case Plus Complementary Measures Requiring Reduction of Emissions Not Covered by Cap
Emissions Reduced	Same as Base Case	Base Case	Same as Base Case	Same as Base Case	Same as Base Case	Greater than Base Case
Cost of Reductions	Lower than Base Case	Base Case	Lower than Base Case	Higher than Base Case†	Same as Base Case	Higher or Lower than Base Case‡
Costs to Administer	Same as Base Case	Base Case	Higher than Base Case	Higher than Base Case	Higher than Base Case	Higher than Base Case

† Although total cost of meeting the cap has increased, the price of traded allowances has decreased.
‡ Unchanged cap-and-trade compliance cost; Cost of uncapped emission reduction could be negative or positive.

Abatement cost impacts of the complementary policies are independent of the implementing authority (i.e. whether at the local, state, or federal level).

Some measures may, however, *increase* the cost of reducing emissions. For example, a regulation might require specific types of control technology to be installed at industrial facilities that would have likely been installed anyway to meet the cap. If this were to happen, there would be no environmental benefit and there would be additional transaction costs in setting, meeting, and enforcing the control technology regulation. (See Column E in Figure 12.) Similarly, a regulation of facilities whose emissions are covered by the cap might require specific types of control technology that have a cost per ton greater than the allowance price. In this case, the high -cost reductions would be made instead of lower cost reductions (as represented by Column D in Figure 12). The allowance price would go down, but the total cost of reducing greenhouse gas emissions would go up.

Distribution of Allowances or Proceeds from the Sale of Allowances

The distribution of allowances (or proceeds from the sale of allowances) can affect the total cost of the program, as well as the distribution of costs among regulated entities and other persons affected by the cap-and-trade program. Although an in-depth discussion of this issue is beyond the scope of this White Paper, the following are some ways in which the distribution of allowances could affect cost:

- Allowances targeted to accelerate research, development, or deployment of new technologies could reduce the overall cost of the program.

- Allowances targeted to speed deployment of carbon capture and storage from coal-fired power plants could help deter fuel switching to natural gas, which could help address potential economic disruption from high or volatile natural gas prices.

- Allowance revenues distributed to consumers in a way that prevents them from feeling the price of carbon could make the program more costly overall by not giving individuals incentives to reduce energy consumption. (If, on the other hand, consumers still "felt" the price of carbon in energy prices, but were compensated with allowance revenues in a way that did not mask that price, the incentive to reduce energy consumption would be retained.)

- Allowances dedicated to programs designed to overcome market barriers to the low (or no) cost carbon reductions (such as energy efficiency improvements) could reduce the overall cost of the program.

Big and Small Players in the Same Market

The cost to individual firms is affected by their ability to develop and implement a cost-effective compliance strategy. An economy-wide cap-and-trade program will require both small and large regulated entities to participate in an allowance market that will also be open to sophisticated financial institutions. Different regulated entities will have different levels of sophistication and trading experience. For example, the electricity sector has a great deal of experience with pollution allowances due to the Acid Rain Trading Program and should have the

skills to adapt to a carbon trading program with relative ease. For other sectors, however, a trading program will require rethinking their methods of complying with environmental regulation and the acquisition of trading skills they may not have now. A smaller industrial company run by engineers, which currently does not employ traders, might not have a large enough financial stake in the carbon market to justify paying close attention to a carbon allowance market. Undoubtedly private firms will develop services to help smaller firms manage their emissions and allowances. The Committee is interested in whether there are ways to design the cap-and-trade program that would assist smaller, less sophisticated firms in complying in a cost-effective manner.

Questions:

- *What types of regulated entities are likely to be smaller players in the allowance market?*
- *Will private sector firms develop services to assist smaller firms develop and implement cost-effective strategies to comply with the cap-and-trade program?*
- *Are there ways to design the cap-and-trade program to help smaller firms develop and implement cost-effective strategies to comply with the cap-and-trade program?*

Conclusion

The Committee has a number of options for designing a comprehensive climate change program to achieve the goal of reducing greenhouse gas emissions by 60 to 80 percent by 2050 while keeping costs as low as is feasible.