Question 3. International Linkage
Submitter's Name/Affiliation: (Chris Dodwell, Head of EU Emissions Trading Sceme/ Department for Environment, Food and Rural Affairs, UK

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

Please begin your response HERE. (no page limit)

1. Through linking, the size of the market increases. This in turn leads to more trades and improved market liquidity. The larger and more liquid a market, the more efficiently it will allocate resources towards the least cost abatement options. Shared abatement and compliance costs leads to a net welfare gain. In contrast, poor liquidity results in poor pricing and poor participation.

2. Though markets will link 'naturally' to some extent as arbitrage, swap and hedging opportunities are explored, direct linkages are likely to be more efficient and better able to reduce overall compliance costs.

3. Greater liquidity in turn leads to increased stability, reduced price volatility, and reduced risk. It enables the scheme to better cope with unpredictable variables, such as weather, as by spreading the geographical area and increasing the market size these variables have less impact.

4. In an addition to marked improvements in economic efficiency, linking is consistent with a multi-lateral approach to dealing with climate change, and it is a powerful sign of coordinated international action to tackle an international issue.

5. International linkages are part of global response to a global issue. It expands international business relations and opens up access to low cost reductions that are available across the world.

Question 3. International Linkage
Submitter's Name/Affiliation: (Chris Dodwell, Head of EU Emissions Trading Sceme/ Department for Environment, Food and Rural Affairs, UK

Clarifying Question 3a:

- Do the potential benefits of leaving the door open to linkage outweigh the potential difficulties?

Please begin your response HERE. (no page limit)

1. Yes. First of all, by closing off the opportunity to link trading schemes, the significant economic and environmental benefits of linking, as detailed in the previous question, are lost.

2. Secondly, though certain issues will need to be resolved, linking itself does not inherently have to be difficult. The EU Emissions Trading Scheme itself demonstrates the feasibility and the benefits of linking trading scheme as, in many respects, it is itself a linked network of 25 schemes. Links into international mechanisms such as Clean Development Mechanisms (CDM) and Joint Implementation (JI) also demonstrate both successful linking and substantial cost reductions. For example, the European Commission estimate that costs of compliance within the EU have reduced by 20% through linking the trading scheme by linking project credits to the EU ETS. In addition, linking to the international market via CDM/JI would require no special legal arrangements as it could be arranged at a technical level through use of the available registry systems- including the GRETA software developed by the UK.

3. Thirdly, a number of the potential barriers to linking can be addressed by considering them at an early stage in the design of a scheme. Alternatively if it is decided that design elements which might prevent linking (e.g. price caps) are required for other reasons, these could be expressed as being temporary or subject to review after a certain period.

4. In order to create an effective link, certain design issues in each scheme need to be resolved at early stage. Design issues that are potentially relevant to the Committee's proposal are provided below alongside possible solutions to issues that may arise:

    - The Definition and Recognition of Trading Units: there must be co-ordination of the tradable commodities that are recognized in the schemes. The nature/definition of the units must be compatible. Though fundamental, this may not in practice be a significant issue as it is likely that the majority of trading schemes will use the standard unit measure of 1 ton of CO_2 equivalent.

    - Systems to Track Allowances: the registries in the trading schemes must be sufficiently compatible to enable transfers between the two schemes to be reliably recorded. Again there are common standards for data exchange and adherence to these could help minimize potential issues.

Question 3. International Linkage
Submitter's Name/Affiliation: (Chris Dodwell, Head of EU Emissions Trading Sceme/ Department for Environment, Food and Rural Affairs, UK

- Monitoring, Reporting, Verification (MRV): these three processes do not prevent linking from taking place but they can significantly impact on the success of the link. The setting, reporting and monitoring of standards is fundamentally important to the confidence in the units that are being traded (and consequently in the value of those units). In additions, robust MRV ensures an even playing field for all participants. Though procedures need not be identical, they must be compatible to the extent that equity is maintained and confidence in the scheme is not undermined. The UK met with Canadian officials last November to discuss requirements for effective MRV procedure; they are:

  – Ensure monitoring requirements are clear and unambiguous, but with some flexibility to deal with smaller installations and unusual situations;
  – Engage with industry early to develop robust and consistent monitoring requirements without excessive cost;
  – Provide sufficient detail in monitoring and reporting plans for the industry to know what is expected; and,
  – 3rd party verification reduces regulator costs but requires good education of verifiers, sound accreditation, and very clear and comprehensive verification requirements. Regular contact between regulators, verifiers, the accreditation agency and industry is important to ensure quality and consistency in verifications.

- Price Cap: the need to find ways to reduce compliance costs is widely recognized and shared by the UK. Furthermore, the existence of a price cap in one trading scheme though problematic is not prohibitive to linking two trading schemes so long as the price cap is sufficiently high and/or the design sufficiently rigorous to ensure that the price cap is not regularly triggered. A price cap should also be subject to an early review of its usefulness, following familiarization of participants to the trading scheme.

5. There is no price cap in the EU ETS. In part, this is because a market functions with optimum efficiency when free from government intervention, and also because Industry is incentivised to abate only up to the level of the price cap. This potentially encourages smaller scale, less efficient investments and, in particular, fails to encourage those who could do more at the least cost. There is also considerable uncertainty regarding how to implement a price cap, and possibilities can include the payment of a tax at the price of a cap, the buying of units at the cap price in an special fund that invests in carbon reduction technologies, issuing additional credits at the level of the price cap; or providing a rebate on verified costs above the level of price cap. There are a number of economic, environmental and practical problems with each one of these possible methods and in each example the actual 'price certainty' effectiveness of the cap in any case reduces over time as it becomes due for readjustment. This creates more uncertainty and more expensive bureaucracy.

Question 3. International Linkage

Submitter's Name/Affiliation: (Chris Dodwell, Head of EU Emissions Trading Sceme/ Department for Environment, Food and Rural Affairs, UK

6. Instead, in the EU ETS, flexibility is provided by links into the JI/CDM market. Provision of access to cheap project credits from developing countries is preferable to a price cap as it not only assists linking of developed country schemes (as use of CDM and JI will equalise the price at global credit levels and smooth the way for linking of trading schemes directly), but it also engages developing countries in mitigation action. Considerable progress has recently been made on resolving those issues that up until now have restrained the CDM market. Substantial growth in the market is expected and official estimates now predict that the number of Certified Emission Reductions (CERs) from registered CDM projects until the end of 2012 will be greater than 340 million.

7. Finally, there are costs involved in ignoring worldwide market momentum and being cut off from a linked network of trading schemes. Not only is access denied to cheaper sources of carbon but opportunities for global financial leadership in carbon markets are much reduced. In short, the costs of not being involved will, over time, outweigh the costs of being involved in international trading.

Question 3. International Linkage

Submitter's Name/Affiliation: (Chris Dodwell, Head of EU Emissions Trading Sceme/ Department for Environment, Food and Rural Affairs, UK

Clarifying Question 3b:

- If linkage is desirable, what would be the process for deciding whether and how to link to systems in other countries?

Please begin your response HERE. (no page limit)

1. Once a bilateral decision to link in principle has been taken, certain legislative and technical issues will need to be considered to ensure that the link, once put in place, is successful in delivering its environmental and economic objectives.

2. First, the legal framework must envisage and permit a link to take place. For example, article 25 of the EU ETS directive recognizes the possibility of a link, specifies the basic criteria for a link to take place, and formally delegates responsibility for drawing up provisions relating to the mutual recognition of allowances to a European Commission Committee. At present, article 25 prohibits a link between the EU ETS and countries that have not ratified Kyoto. However, the European Commission have stressed the importance they attach to seeing a global carbon market develop and a review of the current limitations in Article 25 is likely to be carried out either as part of their larger review of the EU ETS for phase III (post 2012) or sooner.

3. Secondly, 'Minimum Compatible Design Criteria' must be considered. What these criteria are, and the level at which they are set, is to be discussed by the two parties. However, it is likely that those issues examined in question 3a (definition and recognition of trading units, systems to track allowances, MRV and enforcement rules, and price caps) will arise in discussions on the minimum compatible design. In addition, the criteria could cover areas such as type of target, level of effort, and scope of scheme, including offsets.

4. The above considers the process for establishing a two-way link between trading scheme. Should a one way 'unilateral' link only be envisaged then besides having the legal grounds to do so, the majority of the design issues need not apply as no mutual recognition of allowances is required. A unilateral link occurs when one scheme recognizes the cancellation of another scheme's allowances for compliance in its own scheme. When deciding to make a unilateral link the principal are the price of allowances in the other trading scheme, the impact on the allowance price by setting up the link, and the environmental integrity of the underlying units.

Question 3. International Linkage

Submitter's Name/Affiliation: (Chris Dodwell, Head of EU Emissions Trading Sceme/ Department for Environment, Food and Rural Affairs, UK

5.

Clarifying Question 3c:

- What sort of institutions or coordination would be required between linked systems?

Please begin your response HERE. (no page limit)

Information coordination is critical for linked trading systems. On one hand, compatible IT data management systems must be in place in order to reliably reconcile transfers between the two systems. On the other hand, having fixed an operational framework from the start, exchange of information on a policy level must also take place on a regular, agreed basis. This is to ensure that experiences can be shared and future changes can be flagged and discussed in advance. However, the process for sharing information should not be confined to linked trading schemes. It is critical from inception through to implementation, whether linked or not, and lessons learnt from the EU ETS, for example on monitoring and reporting, are already regularly being shared with those working on the Canadian, Japanese, and Australian trading schemes.

The other issue for linking trading schemes relates to ongoing management. At the start of the link, all major design features may have been agreed, and the link may have been put smoothly into place. However, as circumstances change, it is likely that regulators in one scheme will want to make changes to their own scheme. Not all these changes will necessarily be problematic. However, should the change be substantial (for example, the introduction of relative not absolute targets), then the other linked scheme would feel the effect of this change. Again, the best way of dealing with the difficulties that arise in this situation, is by agreeing at a very early stage guidelines for taking decisions. This could include, for example, notification procedures that would vary depending on the extent of the change being considered. It could also stipulate the agreed course of action should a change be implemented. For example, while an insubstantial technical change may not result in any amendment to the link, a larger change may result in the suspension of the link or the allowance of only a one way link. Careful definition of activities and actions at an early stage could therefore help solve ongoing management difficulties and review points could be built in to re-consider detail of the guidance.

The International Emissions Trading Association (IETA) is a good example of business inspired work to ensure coordinated development of an active, global greenhouse gas market, consistent across national boundaries and involving all flexibility mechanisms (CDM, JI and emissions trading), and the creation of systems and instruments that will ensure effective business participation in this market.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Chris Dodwell/ Department for Environment, Food and Rural Affairs, UK

If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

Please begin your response HERE. (no page limit)

- Leadership in developing a mandatory market-based program is likely to encourage countries to consider similar approaches.

- The development of emissions trading and, in time of links between trading schemes, will act as clear and persuasive message to others of the economic effectiveness of tackling internationally with market mechanisms a global environmental issue.

- A review of the effectiveness of the NCEP would provide the opportunity to take on board experiences and to factor in changes to domestic and international circumstances. However, in order to balance flexibility with long term certainty, the timing and scope of the review should be clearly defined from the start of the trading scheme. In the same way that the European Commission is currently carrying out its own review of the EU Emissions Trading Scheme (EU ETS), a review must clearly be about improvements to the scheme and not about the actual existence of the scheme. Long term certainty with regards to the existence and role of the trading scheme is crucial to business and crucial to the successful deployment of the low carbon technologies that lead to the desired and necessary reductions in emissions.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Chris Dodwell/ Department for Environment, Food and Rural Affairs, UK

Clarifying Question 4a:

- What metrics are most valuable for comparison of developed and developing country mitigation efforts to U.S. efforts?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Chris Dodwell/ Department for Environment, Food and Rural Affairs, UK

Clarifying Question 4b:

- What process should be used to evaluate the efforts of other nations and how frequently should such an evaluation take place?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Chris Dodwell/ Department for Environment, Food and Rural Affairs, UK

Clarifying Question 4c:

- Are there additional incentives that can be adopted to encourage developing country emission reductions?

Please begin your response HERE. (no page limit)

- Developing countries need to undergo wide-scale economic development, and this will require significant increases in energy production and consumption.

- Developing countries view climate change within the context of sustainable development and are pursuing low carbon energy technology for energy security reasons (to reduce dependency on oil and gas imports) as an enabler of economic growth and social development.

- Actions to encourage development and deployment of low carbon energy technology from developed to developing countries, including ways of covering additional costs of associated with carbon emissions reductions would provide incentive developing countries to adopt these technologies.

- Developed countries should also work with developing countries on establishing policy, regulatory and financing mechanisms that favor investment in low carbon technology and longer-term sustainable development.

- Such actions are consistent with developed country commitments under the international obligations and reinforce agreements relating to technology transfer within this.

Submitter's Name/Affiliation: Dominion
Contact: Lenny Dupuis
Email: leonard_dupuis@dom.com
Phone: (804)273-3022

Dominion submits these comments in response to the Senate Energy and Natural Resources Committee white paper released on February 2, 2006 entitled "Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System".

We believe a voluntary, technology-based approach that focuses on reducing greenhouse gas emission intensity over time to allow for the development and deployment of zero- and lower-emitting technologies will effect significant reductions and continued economic growth. While we do not endorse a mandatory program, we raise a number of relevant factors that should be considered in the development of programs to address greenhouse gases in the Additional Topics section, including the need for compliance flexibility through a robust use of offsets, a price control mechanism to protect consumers and operators, and credit for early action.

Point of Regulation: Dominion believes that any regulatory approach should encompass all sectors of the economy, and we strongly support an intensity-based approach over absolute reductions. Should the approach focus on certain sectors, it is imperative that offset mechanisms be implemented that would minimize compliance costs by allowing, facilitating and incentivizing emission reductions from non-regulated sources and encompass all greenhouse gases. We do not endorse any particular regulation approach, but emphasize that sectors/entities with regulated rates and tariffs, such as pipelines, that are captured under a mandated program must be allowed to recover full compliance costs.

Allocation: Allowances should be distributed to entities regulated under the program to cover 100% of their compliance requirement. To the extent set-asides are established, allowances should be made available to the market immediately, with priority given to those industries/entities who incur cost to operate within the mandates of the program. We would support a safety valve and that revenues raised be directed toward incentives for development of zero- and lower-emitting technologies and programs to enhance the exploration and production of natural gas.

International Linkage: Although we generally would support linkage with other systems, we raise several issues that should be considered in linking a domestic program with international programs, including the fact that linkage does not provide cost certainty and should not compromise the institution of a safety valve mechanism. We also express concern with the ability of linkage to lower costs if allowance costs in other systems are significantly higher.

Developing Country Participation: We believe that comparable action by other nations, in particular developing countries, is critical to reducing global greenhouse gas emissions and to ensure that the U.S. is not disadvantaged economically. Commitments from other countries must also be binding and enforceable in the same way that regulated entities would be held accountable in the U.S. (presumably via financial penalties for noncompliance).

Question 1. Point of Regulation
Submitter's Name/Affiliation: Dominion

Who is regulated and where?

As noted in our General Comments, Dominion supports voluntary actions to addressing greenhouse gas emissions.

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

To the extent a mandatory cap-and-trade system is imposed, Dominion would suggest an economy-wide approach to regulating greenhouse gas emissions. All sectors of the economy, including energy, industrial, commercial, residential, transportation and agriculture, emit greenhouse gases. Therefore, any regulatory approach should encompass all sectors of the economy. Efforts focused exclusively on a single or certain sectors would economically disadvantage those sectors.

We would strongly support an intensity-based approach over absolute emission reductions.

Should for whatever reason regulation be limited to certain sectors, we believe it imperative that offset mechanisms be implemented that would (1) reduce the compliance costs to entities subject to reduction requirements and (2) allow, facilitate and incentivize emission reductions from non-regulated sectors and encompass all greenhouse gases.

We also would urge that any regulatory approach taken be flexible enough to allow an evaluation of the effectiveness and economic impacts of the program, and to allow for future modifications to address adverse impacts. The implementation of a safety valve in the form of a price cap could address this issue up-front.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Dominion

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

This issue focuses on whether the point of regulation should be at the point of energy production and supply (upstream), at the point of energy end-use or emissions (downstream) or distribution (midstream). The paper does not appear to address possible "hybrid" approaches that were the focus of some discussion during the National Center for Energy Policy (NCEP) Workshops last year.

Dominion is a fully integrated energy company that would be directly impacted in some way by any of these regulatory implementation approaches in terms of what segment of our business may bear the burden of regulatory requirements. At this time, we do not endorse any particular approach. However, we do wish to emphasize the following points:

- There are advantages and disadvantages that one could cite with respect to any implementation approach, whether upstream or downstream. The White Paper appears to favor an upstream to midstream approach, and although these programs have the potential to address economy-wide emissions, the lack of actual experience with such an approach warrants extensive caution and thorough evaluation before widespread application across the U.S. economy.
- Although the administrative simplicity of downstream approaches has been demonstrated through the Acid Rain and NOx trading programs for electric generating units, we note that these programs were implemented with the necessary technologies already developed to allow affected entities to actually reduce emissions in a way to volatize the market (and for that reason have been highly successful). There are currently no such back-end technologies to effectively reduce greenhouse gases from stationary sources and not likely to be for some time. Therefore, to assume that a downstream approach would be an effective means of reducing emissions cost-effectively is premature.
- Any mandated program that includes sectors with regulated rates and tariffs must be allowed to recover full compliance costs. In particular, the white paper references potentially regulating pipelines as the point of regulation for the natural gas sector. Pipelines cannot simply pass along the cost of greenhouse gas regulation (allowance purchase costs and administrative costs) by increasing fuel costs. Pipelines do not own the gas they transport and do not purchase and sell the gas they transport. Pipelines transport natural gas for customers who own the gas.
- Pipeline revenue is determined by regulated tariffs set by the Federal Energy Regulatory Commission (FERC) and no costs can be added to these tariffs without FERC approval. Thus, under current regulation, pipelines would not be able to add to the cost of the fuel, increase the transportation cost or otherwise pass through the cost of purchasing allowances without specific authorization from the regulator.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Dominion

- Regardless of which approach is implemented, a system should include all greenhouse gases, and must ensure that allowances are fully tradable across all sectors subject to reduction requirements.
- Furthermore, we urge caution that whatever approach is adopted ensure that no entity is subject to more than one program of regulatory requirements. This may be of more concern with "hybrid" approaches that attempt to regulate certain sectors with a downstream approach and regulate other sectors upstream.

Question 2. Allocation
Submitter's Name/Affiliation: Dominion

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

As noted in our General Comments, Dominion supports voluntary actions to addressing greenhouse gas emissions.

However, to the extent an allowance program is utilized, Dominion does not support the use of auctions. Requiring entities to purchase a significant number of allowances will raise the cost of the program. Allowances should be distributed to entities regulated under the program to cover 100% of their compliance requirement.

Regarding set-asides and carve-outs, we wish to emphasize the following concepts:

- It should be recognized that set asides increase compliance costs for entities subject to the requirements of the program.
- To the extent set asides are established, allowances should be made available to the market immediately and priority should be given to those industries/entities who incur the costs to operate within the mandated emission reduction requirements.

Dominion would support that the revenues raised by a safety valve be dedicated toward technology research, development and deployment that helps and is needed to effectively reduce ghg emissions, and programs to incentivize investments in zero- and lower-emitting technologies including nuclear, clean coal and renewables as well as programs to enhance exploration and production of natural gas.

Question 3. International Linkage
Submitter's Name/Affiliation: Dominion

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

As noted in our General Comments, Dominion supports voluntary actions to addressing greenhouse gas emissions.

To the extent a national U.S. program is adopted, we generally would support the concept of linkage with other market-based regulatory programs as a means of providing additional compliance flexibility. However, Dominion raises the following issues for consideration in linking a domestic regulatory program with systems in other countries:

- Linkage by itself does not provide cost certainty. It may not offer relief from rising compliance costs of a domestic system, particularly if the compliance costs in other systems, such as the European Trading System (ETS) or the Canadian Large Final Emitter System are considerably higher.
- In such instances, regulated sources in higher cost systems will likely pursue lower cost allowances from a U.S. system, eventually driving up the cost of allowances in a domestic program.
- Linkage with other systems must not compromise the imposition of a safety valve in a domestic program.
- A safety valve should be instituted in a mandatory program, even at the cost of linkage with other systems.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Dominion

If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

As noted in our General Comments, Dominion supports voluntary actions to addressing greenhouse gas emissions.

To the extent a national U.S. program is adopted, Dominion believes that comparable action by other nations, especially developing countries, is critical to the success of any global strategy to reduce ghg emissions. An important component of any domestic program must not only encourage major trading partners and large emitters of ghg's take similar actions but ensure that such actions are comparable in order to ensure that the U.S. is not economically disadvantaged. Commitments from other countries must be binding and enforceable, with entities that fail to meet targets held accountable in the same way that regulated sources in the U.S. are subject to financial penalties for failure to meet reduction requirements and targets.

Dominion supports incentives and mechanisms for international partnerships focused on technology advancement. One of the best ways to ensure actions by other nations, and in particular, developing nations with growing economies, is to develop zero- and less-emitting technologies needed to meet growing energy demands and to allow the markets to disseminate those technologies. The U.S. EPAct of 2005 contains a number of provisions to foster the development of these technologies domestically and internationally, and these provisions should be funded and implemented.

Additional Topics
Submitter's Name/Affiliation: Dominion

If there is an additional topic related to the design of a mandatory market based program that you would like to address, please submit comments on this form.

Dominion submits these comments in response to the Senate Energy and Natural Resources Committee white paper released on February 2, 2006 entitled "Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System".

Dominion is one of the nation's largest producers of energy and one of the largest independent oil and natural gas exploration and production companies in North America, with an energy portfolio of about 28,100 megawatts of generation, about 6 trillion cubic feet equivalent of proved natural gas and oil reserves and 7,900 miles of natural gas transmission pipeline. Dominion operates the nation's largest underground natural gas storage system with more than 965 billion cubic feet of storage capacity and produces nearly 1.2 billion cubic feet equivalent gas and oil daily from more than 26,000 offshore and onshore wells. The Company also serves retail energy customers in nine states.

The White Paper contemplates a mandatory cap-and-trade approach to address greenhouse gases. While we commend the paper's recognition of a market-based regime, and fully support the use of market-based approaches in efforts to reduce emissions, we support voluntary actions to addressing greenhouse gas emissions and do not endorse mandatory requirements to reduce greenhouse gases.

We believe approaches to achieve greenhouse gas emission reductions should be addressed and designed within an energy as well as environmental context. According to a recent EIA report[1], fossil fuels currently account for 86 percent of U.S. energy consumption. To reduce greenhouse gases will require a shift to less carbon intensive energy technologies, which will require the development of policies and programs to effectively accomplish a turn-over in the country's generation fleet in a way that does not compromise our energy security and our nation's economy. We believe a voluntary, technology-based approach that focuses on reducing greenhouse gas emission intensity gradually over time to allow for the development and deployment of zero- and lower-emitting technologies will effect significant reductions and continued economic growth. Policies and programs that provide incentives for long-term financial investments in nuclear energy, clean coal technologies, renewables (including hydro-power) as well as incentives to enhance exploration and production of natural gas supplies, are needed to effectively transition to a less-carbon intensive energy fleet while maintaining a broad portfolio of diversified generation sources and energy supplies needed to ensure energy security and a healthy, growing economy. The U.S. EPAct of 2005 contains a number of provisions to foster the development of these technologies, and these provisions should be fully funded and implemented.

[1] "Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals", Energy Information Administration, Office of Integrated Analysis and Forecasting (March 2006).

Additional Topics
Submitter's Name/Affiliation: Dominion

To the extent any type of mandatory program is pursued to reduce greenhouse gas emissions, Dominion urges the Committee to consider the following relevant factors:

- Climate change is a global issue that requires global participation to address. Any approach undertaken domestically should be, at a minimum, national in scope. It must assure that U.S. actions are not more stringent than those of other countries to ensure that the U.S. is not disadvantaged economically. State-specific and/or regional approaches are likely to result in a patchwork of inconsistent implementation as well as regional economic disparities, and should be avoided.
- Any mandatory program should be comprehensive in nature, and should not single out any single or certain sectors.
- It must recognize that there currently are no economically feasible technologies to reduce greenhouse gases from fossil fuel-fired power plants. Although the U.S. has demonstrated the cost-effectiveness of market-based cap-and-trade programs for power plants for SO2 and NOx, mandatory programs to address these pollutants were not imposed in advance of available and economically feasible technologies with which to achieve reductions and advance the market. A program aimed at reducing CO2 and other greenhouse gases should not subject entities to requirements that cannot be met economically.
- For these reasons, the stringency and timing of the required reductions (or the emission cap) are crucial. The nature of the cap is also important. We believe that any program pursued should be intensity-based in lieu of absolute reductions, and should establish limits at existing levels in the near term with a gradual decline that allows the time needed to address the technology advancements that will be needed to address ghg reductions without compromising the nation's economic and energy security.
- It must recognize that nuclear energy, natural gas and coal are all part of the solution. Support for R&D and incentives for zero- and lower-emitting technology advancements are the most effective means of reducing ghg's. Fuel diversity is the key to energy security, affordable electricity and a healthy economy.
- Compliance flexibility is crucial for sources that will be required to reduce emissions. In programs that do not cover all sources of ghg's, offsets are critically important to minimize compliance costs. Any mandatory program must allow a robust use of offsets, and should be designed to incentivize reductions from sources outside of the system. Since the climate issue is global in scope, there should be no geographic limitations with respect to offset applicability. Artificial constraints on offsets are economically unsound, raise the compliance and overall costs of the program and do not make sense from a global climate perspective.
- Any mandated program must recognize early action and should provide credit for early reductions.
- An allowance and offset price control mechanism, which acts as a "safety valve", is critical to any mandated reduction program in order to protect consumers, operators and the reliability of the market.

Submitter's Name/Affiliation: NEW ENERGY ECONOMY
Contact: John Fogarty MD MPH
Email: john@newenergyeconomy.org
Phone: 505.982.9002

We are an alliance of New Mexico organizations that is committed to reducing global warming through innovation and better practices. Our members are developing alternative fuels, solar and wind energy projects, improving building practices, and taking other concrete steps to reduce emissions of carbon dioxide. In addition, we have worked with the Governor and the State Legislature to address this issue. We are proud that New Mexico has an executive order pledging reductions in carbon dioxide emissions, a task force to determine how to realize these reductions, an executive order on energy standards for new state buildings, and new legislation to spur solar technologies.

Reducing carbon emissions requires the cooperation of the entire world- nothing we can do in New Mexico will protect us from carbon emissions released elsewhere. We applaud the U.S. Senate for recognizing the need for a mandatory program to control emissions and your work on moving us towards legislation.

New Mexico is at extreme peril from global warming

New Mexico is an arid state, subject to periodic extreme drought. Global warming will adversely affect every aspect of its economy and ecology. Tourism is a mainstay of the economy, yet ski areas will have decreased snowpack, due to terrestial warming. Fishing is another major contributor to the state's way of life and economy, but one that will diminish due to increased temperatures in streams and reduced summer flows. Terrestial warming leads to stress in trees, which are consequently more likely to be infested by insects and more vulnerable to forest fires. Agriculture is part of the state's culture, but reduced snowpacks will affect all sectors of that economy, especially the acequias that lack water storage. Without hyperbole, this state, which is united by a love of the outdoors, and with much of its economy built on the outdoor experience, will be a hotter and drier place, lacking many of the amenities that we now value.

Set CO2 target of 450 PPM and begin reductions immediately

Binding emissions limits are required to actually reduce the levels of greenhouse gases, so that we "slow, stop, and reverse" global warming. We support a long term CO2 target that results in reductions of global warming to no greater than 450 ppm and believe that it is critical that the US immediately begin to reduce its emissions so that the transition is as smooth as possible. The discussion over the U.S. target levels and a timetable for compliance should be a part of any discussion of binding limitations.

Auction off allocations, using the proceeds for research and development and addressing social justice

An auction should be used to allocate credits; the global atmosphere belongs to the public as a public trust and private rights to pollute it should recognize the public's interest. The proceeds from the auction should be used to protect low income consumers, to fund research and development in alternative technologies, to subsidize public transportation, and to assist developing nations with reducing their emissions, among other needed purposes.

The Congress should embrace a multitude of approaches to reducing emissions

Our experience in New Mexico is that there are many low cost public investments that will provide large returns in energy efficiency. A cap and trade program should make these investments more attractive, however direct federal investment in these approaches will provide surer and earlier use of these technologies.

In addition Congress should take actions directed at the sectors that affect global warming, such as strengthening the CAFÉ standards and imposing an oil tax that can be used for funding of new energy strategies.

The Congress should not preempt state initiatives

Innovation among the states is gaining steam and is providing valuable information on approaches to the wide array of activities that affect global warming. There should be no preemption of state standards.

Question 1. Point of Regulation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Consider implementing an array of measures to reduce CO2 emissions

The white paper asks which of two approaches should be taken for greenhouse emissions. There is no necessary reason that a single approach must be taken. It would be sensible to set a national economy wide cap, and also to utilize incentives and regulations for different sectors of the economy. For example, CAFÉ standards are an effective way of bringing about fuel economy, which serves multiple goals of decreasing oil dependence, lessening air pollution, and also reducing greenhouse gases. Our experience in New Mexico is that there are great energy savings possible in the building sector, but there are difficulties in sending the correct economic signal about the benefits of long term energy savings to consumers. Regulation, in the form of building codes, is as important as the types of economic signals that may be sent through a cap and trade system.

Question 1. Point of Regulation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Who is regulated and where?

Please submit your response HERE. (no page limit)

Question 1. Point of Regulation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

Please begin your response HERE. (no page limit)

Question 1. Point of Regulation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Build Flexibility into the Regulatory Program to allow for responses to new information

The discussion might benefit from a consideration of the initial foray into cap and trade programs, the acid rain program. In retrospect, the Congress had an incomplete understanding of the costs of SO2 removal, in a situation in which the regulated industry had no incentive to be forthcoming about its costs strategies. The costs provided by the energy industry were significantly greater than the actual costs to that sector. In the present situation, there are a host of unknowns, such as costs of reduction for each sector, the ability to pass costs on, and the economic winners and losers under the new energy economy. Most importantly, there are uncertainties about the efficacy of this approach in reducing CO2 emissions, and the possibility of further scientific developments concerning the magnitude and timing of necessary reductions. Given this, it would seem prudent to hold back allowances for new entrants, to limit the time period of this approach, and to explicitly provide for a reconsideration of whether faster progress is achievable.

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

Please submit your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2c:

Consumer Protections

- What portion of the overall allocation pool should be reserved to assist consumers?
- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2e:

Special considerations for fossil-fuel producers?

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2f:

Allocations for downstream electric generators?

- Should electricity generators be included in the allocation if they are not regulated? (Clarification: We mean to ask if an electric generator should be included in the allocation if the greenhouse gas regulation occurs at a point of regulation that is upstream or downstream from the generator, but not the generator itself.)
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2g:

Allocations for energy-intensive industries?

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Questions 2h:

Allocations to other industries/entities?

- What other industries/entities (e.g. agriculture, small businesses, etc.) should be considered in the allocation pool?
- What should be the basis for their share of the total allocation as well as for the distribution among such industries/entities?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

The goal of providing incentives to all nations to participate in greenhouse gasses reductions is an important one. However, it is not good policy, nor good ethical practice, for the U.S. to condition its actions on those of other nations. The U.S. has been an outlier with respect to global warming and it would seem impolitic to begin our regulatory efforts with this sort of message. Second, every nation has a responsibility to address this problem. Our responsibility is not dependent on the actions of other nations. It would be preferable to utilize diplomacy, to understand the barriers to participation by other nations, and to participate in international efforts to bring resources to nations that require them.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Question 4a:

- What metrics are most valuable for comparison of developed and developing country mitigation efforts to U.S. efforts?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Question 4b:

- What process should be used to evaluate the efforts of other nations and how frequently should such an evaluation take place?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: John Fogarty / NEW ENERGY ECONOMY

Clarifying Question 4c:

- Are there additional incentives that can be adopted to encourage developing country emission reductions?

Please begin your response HERE. (no page limit)

Mary Luevano
Global Green USA
Submitter's Name/Affiliation: **Mary Luevano / Global Green USA**
Contact: **Mary Luevano**
Email: **mluevano@globalgreen.org**
Phone: **(310) 581-2700 ext. 101**

Global Green USA applauds the efforts of the Senate Energy & Natural Resources Committee in engaging the critical issue of climate change. The entire Committee is showing great leadership on the issue and we hope that the focused attention continues beyond the upcoming Climate Conference. At Global Green USA our climate change workstream is based on the following principle: that the mechanisms implemented to mitigate and adapt to climate change must be designed to enable direct benefits to inure to our at risk low-income communities.

To advance this principle Global Green USA has developed a Climate Solutions *for* Communities (CSC) program to explore model designs and verification protocols for community-level distributed generation and energy efficiency project reductions to access carbon markets. Low-income communities are often the most at risk, not only from the effects of climate change, but also from local air pollution and a lack of economic flexibility to adapt to the potential price impacts of national carbon constraints. We hope that the Committee looks to the CSC program's environmental justice and carbon market design workstream as a resource.

Our comments to the Committee follow the focus of the CSC program and mainly address question two concerning allowance allocations for low-income community assistance via set-aside / offset programs. Global Green's key points in response to question two are as follows: (1) An offset program should be adopted that explicitly supports the inclusion of renewable energy (RE) and energy efficiency (EE) project reductions generated by low-income communities, in particular those programs that fit the substantiation / verification models under development by Global Green USA; (2) Electric utilities, whose generator emissions are reduced indirectly or displaced by these community-level RE and EE projects, as the non-acting entity, should be required to relinquish any potential ownership of the resulting emission reduction credits; and (3) Allowances should be allocated to a low-income community adaptation and mitigation fund to help our at risk communities. The revenue generated by auctions/sales from this set-aside fund should be directed to finance RE and EE projects in low-income communities. This mechanism will hedge against carbon cost pass-through pressures from the electricity sector by lowering electricity costs for low-income communities. It will also help improve local air quality and provide badly needed services to our impoverished communities while at the same time generating more emissions reductions.

Global Green USA's final comments fall under the additional topics question. The potential formation of pollution "hotspots" resulting from a national carbon market is a real concern for low-income communities located adjacent to fossil fuel generators that contribute to these communities' non-attainment of air quality standards. Global Green USA is developing models for "Hotspot Gate-keeping" in which areas identified as at risk for hotspot formation (with carbon emissions demonstrated as linked to emissions of local air pollutants) would be required to adopt restrictions to discourage the import of emissions allowances / credits above a certain threshold to covered entities. These restrictions, in the form of a tariff (with revenues recycling to the community) on imported emissions allowances / credits or a reduction in their compliance values, would ensure air quality in our most at risk communities is not negatively impacted by a new national carbon market.

Thank you again for your leadership and the opportunity to participant in this important effort.

Mary Luevano
Global Green USA

Question 2. Allocation
Mary Luevano/Global Green USA

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

The focus of Global Green USA's comments is that mechanisms implemented to mitigate and adapt to climate change must be designed to enable direct benefits to inure to our at risk low-income communities. Regardless of the system put in place, Global Green USA feels that it is critical that the system integrates measures that improve the lives and livelihood of the low-income segments of our communities.

Global Green USA believes that an auctions-only approach to allowance distribution is philosophically optimal as the best means by which to honor the public trust doctrine as well as the polluter-pays principle. However, given the political reality and the need for consensus, Global Green USA recommends a hybrid approach of free allocations to regulated/covered entities, set-asides / offset programs, with 35 percent of the overall allowance pool distributed by auction. From those 35 percent dedicated for auction, a set-aside of at least 25 percent should be directed to a low-income community mitigation and adaptation fund.

There are additional reasons, other than the practicalities of politics, which support a hybrid approach to distribution. The uncertainty that an auctions-only approach would bring to the carbon market, even with future vintages on the block, could reduce the overall effectiveness of a carbon trading program. Instead of being spread out over a period of time with speculator involvement, market activity would likely concentrate around the auction time period and the true-up/compliance deadline (potentially resulting in similar negative market effects, such as massive price swings, of not allowing for the banking of allowances between compliance periods). For the success of any market-based climate policy, care must be taken to ensure that barriers to a deep, liquid, and continuous carbon market are avoided. A vibrant carbon market is the best way to fix real, long-term asset value to emissions allowances and credits. By adopting an auctions-only approach the market-period fracturing that could occur represents a risk to the future carbon market. Further, it is arguable that by simply auctioning all allowances the federal government's important capacity to promote specific policies and technologies is reduced. Thus, Global Green believes that a hybrid approach is the most practical.

Allowances should be allocated freely to the regulated/covered sectors and set-aside / offset programs, with 35 percent of the overall allowance pool auctioned. Of this 35 percent, at least 25 percent should be allocated to a low-income community mitigation and adaptation fund. This fund would then auction those allowances with proceeds flowing to renewable energy and energy efficiency projects in our most at risk low-income communities. This mechanism will hedge against carbon cost pass-through pressures from the electricity sector by lowering electricity costs for low-income communities. It will also help improve local air quality and provide badly needed services to our impoverished communities while at the same time generating more emissions reductions. Further, by having an allocation / auction hybrid approach the public trust doctrine is honored without the negative reduction on the federal

government's ability to specifically promote policy objectives and without running the risk of market-period fracturing.

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

Global Green USA believes that at least 25 percent of the auctions allowance pool (which is recommended at 35 percent of the overall allowance pool) should be allocated to a low-income community mitigation and adaptation fund. This federally administered fund would then publicly auction the allowances. The revenue generated would then remain in the fund and be distributed to state energy offices after a RFP for projects and best-practices selection. The RFP would specify that the project must be located in low-income community that is at risk from climate change (heat waves, flooding, etc.) and must deploy renewable energy and energy efficiency technologies.

The low-income community mitigation and adaptation fund combines the concepts of adapting and mitigating climate change through the same mechanism: allowing our at risk communities to mitigate warming and adapt to climate change all through the same project.

For example, revenues from the fund go to finance an energy efficiency project in an inter-city school. The project – installing new high efficiency air conditioners – would help the school adapt to the heat waves resulting from climate change as well as cope with electricity cost increases resulting from new carbon regulation by reducing the school's electricity demand. Additionally, the reduced electricity use would result in indirect carbon emissions reductions by regional power generators as well as a resulting improvement in local air quality.

Under a model, similar to those that Global Green USA is developing, these indirect emissions reductions would be verified and transferred as credits to the "action-entity" who provided the up-front capital for the project (following the Principal of Additionality), in this case the low-income community mitigation and adaptation fund, to finance similar projects or to retire the credits. The multiplier effect and resource parity evidenced by this approach enables mitigation, adaptation, and low-income consumer protections all via the same project to the benefit of our most at risk communities.

Question 2. Allocation
Mary Luevano/Global Green USA

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

Global Green USA recommends that an early reduction credit program be granted a limited set-aside to be accessed only by entities that reduce their net emissions at their own facilities or via offset project reductions and substantially evidence those reductions. As to the offset pilot program, Global Green USA strongly recommends such a program be adopted with at least ten to fifteen percent of the overall allowance pool.

Specifically, we call for an offset program that explicitly supports the inclusion of renewable energy and energy efficiency project reductions generated by low-income communities, in particular those programs that fit the substantiation / verification models under development by Global Green USA. We recommend that out of the entire offset pilot program set-aside that low-income community renewable energy and energy efficiency projects (such as those that deploy in inner city schools as well as in public and affordable housing) be granted at least 15-25% of the overall offset program set-aside.

These programs are critical to helping our communities most at risk from climate change to mitigate and adapt. The low-income community project offsets should stand with the low-income community mitigation and adaptation fund, both as distinct mechanisms. However, when the low-income community mitigation and adaptation fund provides front-end finance to a low-income community project offset the appropriate amount of resulting emission reductions credits should be transferred on a pro-rata basis back to the fund for auction or sale.

In other cases, where the "action entity" financing a low-income community project offset is a corporation or charitable organization, the ownership of the resulting indirect emissions reductions should be placed firmly in the hands of those entities. This follows the climate-critical principle of additionality. As the utility's and/or its generator's business-activities-as-usual baseline would include the indirect emissions reductions in question (i.e. they did not do anything in addition to their normal business practices to create the reductions), the ownership of those reductions should sit with those who are actually acting (and spending) to achieve them. Even though it is the equipment of the utility and/or its generators that experience the reductions in emissions, it is not the utility or generator, rather those funding and implementing the community-level project reductions, whose actions actually created the emissions reductions. If the utility becomes one of the acting entities, for instance by funding a demand side management rebate program or a renewable energy direct grant program, then the utility as an action entity should receive ownership of its pro-rata share of the resulting emissions reduction credits.

Question 2. Allocation
Mary Luevano/Global Green USA

This clarification of ownership is critical to enable community-level and local project reductions (renewable energy and energy efficiency) to be recognized in aggregate by carbon markets. Without such clarification the entire community-level for emissions reductions – reductions that carry with them unmatched co-benefits – could potentially be demeaned and unrecognized by the carbon market.

Global Green USA is working on developing models for verification and substantiation of indirect emissions reductions stemming from low income and minority community renewable energy and energy efficiency projects. Similar to how the World Bank Prototype Carbon Fund test drove methodologies and modalities for project reductions in the international carbon market prior to the commencement of formal trading, Global Green USA seeks to organize and implement low-income community renewable energy and energy efficiency pilot projects to push the U.S. experience curve prior to the opening of a formal national carbon market. We hope that the Committee looks to our experiences as a resource.

Global Green USA looks forward to continued dialogue with the Committee concerning the efficacy and design of a low-income community project offset system as well as a low-income community mitigation and adaptation fund.

Question 2. Allocation
Mary Luevano/Global Green USA

Additional Topics
Mary Luevano / Global Green USA

If there is an additional topic related to the design of a mandatory market based program that you would like to address, please submit comments on this form.

The potential formation of pollution "hotspots" resulting from a national carbon market is a real concern for low-income communities located adjacent to fossil fuel generators that contribute to these communities' non-attainment of air quality standards.

Often the carbon emissions of a fossil generator track with its efficiency and thus if carbon emissions are high, in the absence of scrubbing technology, so to are the emissions of ozone precursors and particulates per unit of output. Therefore, in many cases, notwithstanding other emissions markets for NOx, if fossil fuel generators have the allowances or credits to cover their carbon emissions it is a good bet that their emissions of particulates and ozone precursors will also remain steady. This link between carbon and local air pollutants is often strongly evidenced by peaking fossil generators, generators that are frequently located in or near the low-income communities of load centers.

Global Green USA is developing models for "Hotspot Gate-keeping" (HSG) in which geographic areas identified as at risk for hotspot formation (of local air pollutants that are demonstrated as linked with carbon emissions) would be required to adopt restrictions to discourage the import of carbon emissions allowances / credits above a certain threshold to covered entities. These restrictions, in the form of a tariff (with revenues recycling to the community) on imported carbon emissions allowances / credits or a reduction in their compliance values, would ensure air quality in our most at risk communities is not negatively impacted by a new national carbon market.

It is important to note that the restrictions created by the inclusion of an HSG system in the Committee's legislation would not dampen the health of a future national carbon market. If included in the bill's market design, a HSG system would only engage the electricity sector. Within that sector, only the dirtiest plants that are located in the communities with the worst air quality would see import restrictions. Further, the HSG model seeks to "restrict" the import of emissions allowances and credits not "ban" them. This is a critical mechanism to make sure that the flexibility created via a market-based climate policy would not enable increased degradation of the already dangerous air quality in our low-income communities. Global Green USA looks forward to exploring hotspot gate-keeping model designs with the Committee.

Cut and Trade
A Better Model for Addressing Climate Change[1]
- Executive Summary -

Cap and Trade is an important but imperfect model for combating climate change. This paper suggests a new approach that borrows significantly from the Cap and Trade structure, but also addresses some of the significant shortcomings – particularly emissions goal attainment and transitional costs – inherent in that approach. This new way of addressing climate change: "Cut and Trade," integrates Cap and Trade's mandatory, market-based trading mechanisms, but offers a significant structural adjustment that could achieve more substantial environmental benefits while minimizing economic impacts.

Due to the restrictiveness of emissions ceilings and the potentially high costs of compliance, the emissions-reduction goals of Cap and Trade will almost certainly suffer compromise – either through necessarily soft or under-aggressive caps (possibly weakened further by a low safety valve number) or less-than-rigorous enforcement. Cut and Trade addresses these challenges by creating flexible emissions goals that are responsive to economic swings.

Instead of imposing emissions caps, Cut and Trade aims to reduce greenhouse gas (GHG) emissions by an agreed percentage – the "action target." For example, an action target of 20% would reduce emissions by one-fifth (20%) of a ton for each ton of GHGs emitted. The actual quantity of reductions to be achieved would be determined over the course of the commitment period on a pay-as-you-go basis. Each ton emitted would create an obligation to achieve or acquire one-fifth of a ton of reduction.

To the regulated entity this translates as a requirement to hold one permit for every five tons of GHGs emitted, as opposed to the Cap and Trade requirement to hold five permits to cover five tons of emissions (one per ton). Thus, with a 20% action target, the compliance cost under Cut and Trade is one-fifth what it would be under Cap and Trade. Alternatively, assuming a comparable cost to emitters and consumers, Cut and Trade could achieve substantially greater environmental benefits than would Cap and Trade.

As is the case with Cap and Trade, Cut and Trade permits emitters to buy and sell emissions permits (or credits) on the open market in order to achieve their reduction goals. Because Cut and Trade provides the same incentive as Cap and Trade to capture the lowest cost emissions reductions, it is efficient in the same way that Cap and Trade is efficient.

All reductions would be verified and certified through a national registration program similar to the one created in § 1605(b) of the Energy Policy Act of 1992. An effective Cut and Trade verification program would require improvements, however, such as the replacement of the current broad definition of "entity" in 1605(b) with a strict definition that requires entity reporting at the highest meaningful level of aggregation. Accounting standards might incorporate performance benchmarks or rate-based emission baselines (e.g., CO_2 per unit of output), possibly on a sector or sub-sector level. The cost of verification and certification could offset somewhat the cost reduction associated with Cut and Trade, an issue that requires further study.

The point of regulation is important. Upstream regulation simplifies administration, but it is downstream emitters (or, for that matter, consumers) who are best placed to determine the quantity and price of permits needed. If regulation is upstream, Cap and Trade relies on cost pass-through and price signals to transmit information about price and quantity between regulated entities and downstream emitters and consumers. Time-lags and other factors tend to distort this information, introducing inefficiency. Cut and Trade solves this problem by requiring regulated upstream entities to acquire permits directly from downstream emitters and consumers, who create permits by achieving actual reductions (unlike the government, which creates only pieces of paper), making information flow direct and immediate.

---

[1] This proposal is being submitted by Donald M. Goldberg, Senior Attorney at the Center for International Environmental Law, with assistance from Danielle Rosengarten and Taylor Ferrell, in response to the white paper "Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System" released by Senators Pete Domenici and Jeff Bingaman in February 2006.

Because the cost of complying with Cut and Trade is considerably lower than the cost of Cap and Trade, a safety valve is not really needed. Nevertheless, it may be desirable to give emitters the option of paying money into a fund in lieu of reducing emissions. If the fund is to be used solely for the purpose of obtaining additional reductions, the amount paid could be based on the same ratio that underpins Cut and Trade. Assuming a 20% action target, for each ton they "emit," regulated entities would pay an amount that is estimated to be sufficient to purchase one-fifth ton of reduction. This money could be used to purchase additional reductions or to finance activities that would result in additional reductions (e.g., transformative investments in the auto industry).

A "safety valve" used only for this purpose would require a lower fee, per ton of emission, than has typically been proposed for such a mechanism. For example, if a 20% action target was anticipated to drive reduction prices to $50 per ton, the safety valve price would be $10. To obtain $50 reductions under Cap and Trade would require a safety valve set no lower than $50. If the Cut and Trade safety valve was set higher than $10, say at $15 per ton, some proceeds could be used for other activities, such as adaptation, research and development of new technologies, and low-income energy assistance.

Cut and Trade would provide an additional layer of information and transparency. Typically, emissions inventories reflect increases or decreases in emissions, but they do not provide much information about the causes of those changes. A country's emissions may vary for reasons unrelated to its emissions control policies (e.g., weather or population change), making it difficult to assess the effectiveness of policies. Cut and Trade would require emitters and others to identify and assess their abatement actions, adding an important dimension to emissions data.

Another significant benefit to Cut and Trade is that it will retain jobs by substantially reducing the risk of polluter flight. This is because compliance costs – the main driver of such migration – would be much lower under Cut and Trade than under Cap and Trade. Thus, companies would have less incentive to move their operations overseas. Moreover, in the event of some migration, it can be shown that, unlike Cap and Trade, Cut and Trade will retain most of its environmental benefits.

Cut and Trade addresses many of Cap and Trade's shortcomings – in particular, its potential economic impacts and political impracticality – while generating a useful set of collateral benefits: increased predictability, improved data and reduced loss of environmental benefit resulting from industry flight. By devising a set of rules that emitters can play by, Cut and Trade can achieve aggressive environmental goals while avoiding the risk of unacceptable compliance costs that make climate policy particularly difficult for governments to embrace and economies to endure.

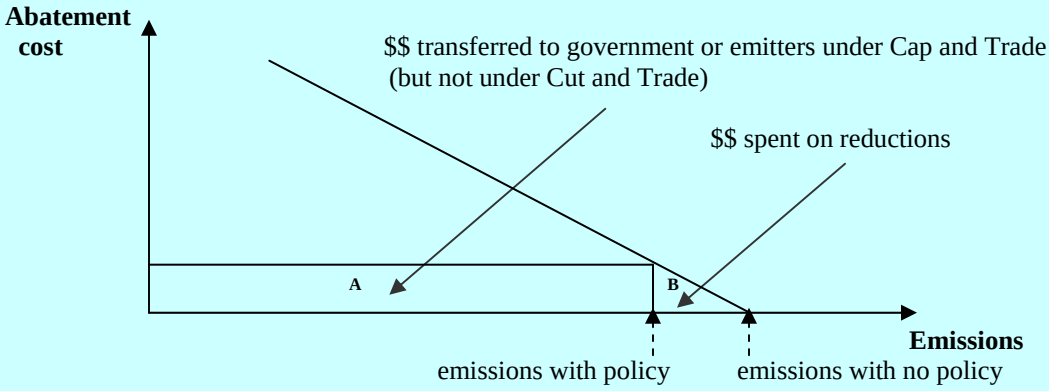


Figure 1. Cut and Trade can deliver reductions at a much lower cost because it avoids the enormous resource transfer that occurs with Cap and Trade – from the emitter to the government, if allowances are auctioned, or from the government to the emitter if allowances are allocated. Regardless of the direction, the consumer sees this transfer as an increase in prices. Relative to the cost of abatement, the transfer cost is quite high, as can be seen in figure one, where rectangle **A** is the transfer cost and triangle **B** is the abatement cost.

Answers to Questions Submitted by Donald Goldberg, Senior Attorney, Center for International Law, In Response to:

Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System

Sen. Pete V. Domenici and Sen. Jeff Bingaman
February 2006

Key Elements of Proposals for a National Program

1. Who is regulated and where?

Key questions:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

An economy-wide approach is fair; it can be simple, albeit probably more complex than an approach limited to certain large sectors; and, if designed right, it can be rational.

An additional benefit of such an approach is that, because it captures more reduction opportunities, it should be more efficient and, hence, cheaper. This benefit could be offset, however, by transaction costs in a poorly designed system.

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

Regulating upstream has the advantage of simplicity and greater coverage of the economy. Its main drawback is that most reduction decisions (e.g., fuel switching, efficiency improvements, conservation) are made farther downstream, creating a mismatch between the decision points; quantity and price of permits is decided upstream, decisions whether to emit or reduce are made downstream. Information is passed back and forth by means of a price "signal"; that is, some or all of the upstream cost of acquiring permits is passed on to the downstream emitter (or reducer), and information about the cost and quantity of reductions is passed back upstream as a fluctuation in demand.

It seems obvious that this is not an optimal way to provide the market, or markets, with the information needed to operate efficiently. Upstream permit holders will lack complete information as to the number and price of reductions that can be obtained in each sector and firm; hence, they may not know how many permits to buy or what price to pay. Over time, the market may adjust, but there will always be some potential for disruptions

caused by unanticipated fluctuations in demand for fuels or availability and price of reductions.

A safety valve can mitigate this problem, but the more the system relies on the safety valve to smooth bumps in the system, as opposed to providing its intended function of price protection, the less efficient the system will be and the fewer reductions it will achieve.

Cut and trade resolves this unpalatable choice (simplicity versus efficiency) in two ways. First, it requires upstream permit holders to obtain those permits directly from downstream emitters and consumers (permits – often referred to as credits – are created when emitters reduce emissions or consumers reduce consumption). In other words, all permits are generated by those who must reduce, hence have direct knowledge about quantity and cost of available reductions, as opposed to being generated by the government, which may have little accurate information about quantity and cost of reductions.

Second, a spike in price or unexpected drop in availability of reductions will roil a cut and trade market far less than a cap and trade market. This is because cap and trade requires the regulated entity to hold one permit for each ton of emission, whereas cut and trade requires the regulated entity to hold a far smaller amount of permits per ton of emission, the amount being determined by the action target (e.g., a 20% action target requires the regulated entity to hold one permit for every five tons of emissions). By substantially lowering compliance costs, cut and trade flattens dips and spikes that potentially could disrupt the market.

2. Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

Key questions:

- What level of resources should be devoted to stimulating technology innovation and early deployment?

Because cut and trade does not create allowances, it provides no opportunity to auction allowances in order to raise revenue for stimulating technology or other worthwhile goals. (Cut and trade, as proposed, would include a mechanism similar to a safety valve, allowing regulated entities to pay a specified amount into a fund in lieu of obtaining permits, but this fund would be used exclusively to obtain additional reductions through a reverse auction.) But the low cost of compliance under cut and trade leaves room for a small carbon tax to generate revenue for complementary actions (adaptation, technology innovation, etc.) For example, a five dollar carbon tax (over and above the requirement to obtain permits or pay the "safety valve" fee), could generate $9-10 billion per year for such activities.

- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?

As noted above, cut and trade does not involve creation or sale by the government of permits or allowances. We propose a small carbon tax to provide revenue to spur technological development and achieve other related objectives. We take no position on the question whether this money would best be spent by the government or a research consortium.

- What criteria should be used to determine how such funds are spent and which projects are chosen?

We have no position on this question.

- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

As noted, we propose a small (i.e. ~$5) carbon tax or emissions fee.

a. Adaptation Assistance

Key Questions:

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

We take no position on these questions, other than to note that the more the U.S. spends on domestic adaptation, the more we can expect blameless, vulnerable developing countries to expect us to pay towards their adaptation.

b. Consumer Protections

Key Questions:

- What portion of the overall allocation pool should be reserved to assist consumers?

As already mentioned, as our proposal does not involve allowances or allocations, we recommend a separate carbon tax/emissions fee of about $5 to provide such assistance.

- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

To be fair, assistance should be allocated in proportion to need, all other things being equal. Poor households use 7-10 times more of their disposable income than average households for heat, gasoline, and other forms of energy. It may be necessary to fix the amount of assistance each family will receive at the beginning of the commitment period to avoid a moral hazard.

c. Set-Aside Programs

Key Questions:

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

As noted in our paper, cut and trade is based entirely on accounting for reductions. We believe that in most instances such accounting will be straightforward, e.g., where measurable efficiency improvements are made in production processes. We understand that in other instances, however, reduction accounting may introduce uncertainty. Because for a given level of compliance cost, much more reduction can be obtained through cut and trade than through cap and trade, we feel the tradeoff is more than justified. Nevertheless, where a class of projects or activities poses a particular problem for accounting purposes, a pilot project may be appropriate. Perhaps a combination of partial credit and partial financing from the carbon fund would be an appropriate way to provide incentives.

d. Special considerations for fossil-fuel producers?

Key Questions:

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

Because compliance costs (costs of permits or allowances) would be much lower under cut and trade than under cap and trade, there would be little if any need to reimburse or subsidize fossil fuel producers.

e. Allocations for downstream electric generators?

Key Questions:

- Should electricity generators be included in the allocation if they are not regulated?
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

Just as cut and trade minimizes compliance costs for regulated entities, it minimizes the possibility of additional costs being borne by downstream emitters and consumers. In fact, to the extent they are able to provide quantifiable reductions, emitters and consumers could reap financial rewards.

f. Allocations for energy-intensive industries?

Key Questions:

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

As noted above, such industries are unlikely to bear any significant additional costs due to cut and trade, but could find very significant opportunities for reductions, hence financial rewards. While we have not attempted to analyze effects on competitiveness, we assume there is a possibility that US firms could be made more competitive by cut and trade, rather than less so.

g. Allocations to other industries/entities?

Key Questions:

- What other industries/entities (e.g. agriculture, small businesses, etc.) should be considered in the allocation pool?

- What should be the basis for their share of the total allocation as well as for the distribution among such industries/entities?

Agriculture, small business, and other similarly situated industries/entities should be able to participate in the cut and trade market by creating and selling reductions, much the way CDM projects generate CERs (certified emissions reductions). If verification shows that they achieved real reductions, they do not need to be covered by allowance set-asides. The real, quantifiable and additional reductions they supply can be safely sold as offsets, presumably at a profit.

3. Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

Key Questions:

- Do the potential benefits of leaving the door open to linkage outweigh the potential difficulties?

- If linkage is desirable, what would be the process for deciding whether and how to link to systems in other countries?

- What sort of institutions or coordination would be required between linked systems?

While we believe cut and trade is compatible with other trading systems, further analysis is required to identify possible difficulties or inconsistencies. On the other hand, because cut and trade is based on accounting for reductions (action targets), we believe it is fully compatible with the CDM, even if the CDM were to evolve to include sectoral projects, policies, etc. Indeed, with World Resources Institute, we have proposed action targets as a workable form of commitment for non-Annex I Kyoto Parties.

4. If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

Key Questions:

- What metrics are most valuable for comparison of developed and developing country mitigation efforts to U.S. efforts?

- What process should be used to evaluate the efforts of other nations and how frequently should such an evaluation take place?

- Are there additional incentives that can be adopted to encourage developing country emission reductions?

Unlike cap and trade, cut and trade can be a model for developing countries. Many commentators have observed that it is highly unlikely that developing countries would adopt caps in the foreseeable future, and were they to do so the caps would almost certainly be of the "hot air" variety. CIEL and WRI originally proposed action targets for developing countries (see paper by Baumert and Goldberg in the forthcoming issue of Climate Policy). To be clear, the CIEL/WRI action target proposal differs in many respects from the Cut and Trade approach recommended for the U.S., especially with respect to stringency of targets and the requirement to pay into a fund to cover any "excess" emissions. Nevertheless, Cut and Trade, because of its small compliance costs and certainty with respect to level of effort, could provide an excellent example to developing countries. This feature, as much as any other, recommends it for adoption in the U.S.

Cut and Trade
A Better Model for Addressing Climate Change[1]

Introduction

While useful and important in many respects, the Cap and Trade model for reducing greenhouse gas (GHG) emissions is an imperfect model for combating climate change. This paper suggests a new approach that borrows significantly from the Cap and Trade structure, but also addresses some of the significant shortcomings – particularly emissions goal attainment and transitional costs – inherent in that approach. This new way of addressing climate change: "Cut and Trade," integrates Cap and Trade's mandatory, market-based trading mechanisms, but offers a significant structural adjustment that will achieve parallel environmental benefits while minimizing the economic impacts of progressive climate policy by revising the way policy makers think about achieving emissions reductions. Cut and Trade is more than a variation on a familiar theme, it is an approach to climate policy that will produce significant GHG reductions while mitigating the costs of implementation, stabilizing energy prices and protecting American jobs.

The Mechanics of the Cut and Trade Model

The traditional Cap and Trade system combines mandatory emissions ceilings with a market-based credit trading mechanism to help industry absorb the burdens of implementation and compliance. The alternative proposed here – Cut and Trade – employs the same trading scheme, but instead of imposing emissions caps (which could have undesirable economic consequences) it sets reduction-based "Action Targets." Rather than imposing rigid ceilings, these Action Targets – either fixed or dynamic – aim to reduce GHG emissions by an agreed percentage over the term of the commitment period in a way that is both responsive to and reflective of our national environmental and economic circumstances. For example, given a commitment period of one year, a 20% "fixed" Action Target would aim to reduce emissions by one-fifth (20%) of a ton for every ton of GHGs emitted in a previous year. Under a dynamic-target regime, the reduction target (number of tons of reductions to be achieved) would be both set and achieved over the course of the commitment period. For the emitter, this is conceptually simple: for each ton emitted, one-fifth of a ton of reductions must be achieved. This could be thought of as a pay-as-you-go approach for the emitter.

Under either target model, the environmental and economic benefits of the Cut and Trade approach would be the same. For a given amount of reduction, Cut and Trade would have a much smaller cost to emitters, and presumably to consumers as well, than would Cap and Trade. Alternatively, for a comparable cost to emitters and consumers, Cut and Trade could achieve substantially greater environmental benefits than would Cap and Trade.

As is the case with Cap and Trade, Cut and Trade permits emitters to buy and sell emissions allowances (or credits) on the open market in order to achieve their reduction goals. Because Cut and Trade provides the same incentive as Cap and Trade to identify and transfer the cheapest emissions reductions, it is efficient in the same sense that Cap and Trade is efficient.

---

[1] This proposal is being submitted by Donald M. Goldberg, Senior Attorney at the Center for International Environmental Law, with assistance from Danielle Rosengarten and Taylor Ferrell, in response to the white paper "Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System" released by Senators Pete Domenici and Jeff Bingaman in February 2006. It attempts to answer many of the questions raised therein while providing a new lens through which to view climate policy. The author hopes the Committee finds his suggestions helpful in the forthcoming policy debate on implementing workable solutions to the challenge of addressing climate change.

To understand why Cut and Trade can achieve comparable reductions at substantially lower cost (or, alternatively, substantially more reductions for comparable cost), it is useful to compare how the two mechanisms operate. Under Cap and Trade, if the government seeks an emissions reduction of 20%, it must first estimate the amount of emissions that would be expected to occur under "business-as-usual" during the commitment period. Then it must create and distribute, by auction or allocation, 20% fewer allowances than the amount estimated. Emitters, in turn, are required to hold or retire one allowance for each ton emitted.

Cut and Trade does not involve the creation, auction or allocation of emissions allowances. Instead, emitters are required to achieve the requisite number of reductions (in our example, 1/5 ton of carbon-equivalent emissions (TC_e) per ton emitted) or purchase them through the market. Because the emitter must hold only one-fifth as many allowances for a given amount of emissions as would be required under Cap and Trade, the cost to the emitter, and ultimately the consumer, is one-fifth as great under Cut and Trade as it would be under Cap and Trade.

The reason Cut and Trade can deliver a comparable amount of reductions at a much lower cost is that it avoids the enormous resource transfer that occurs with Cap and Trade – from the emitter to the government, if allowances are auctioned, or from the government to the emitter if allowances are allocated. The direction of the transfer does not matter to the consumer. Either way, assuming the emitter can pass its costs through to the consumer (which in the long run is a near certainty) the consumer "sees" this transfer as an increase in prices.

This price increase is over and above the increase that would be expected to occur to cover the cost of abatement in either system. Relative to the cost of abatement, the cost of the transfer is quite high. This can be seen in figure one, where rectangle **A** represents the transfer cost and triangle **B** represents the abatement cost.

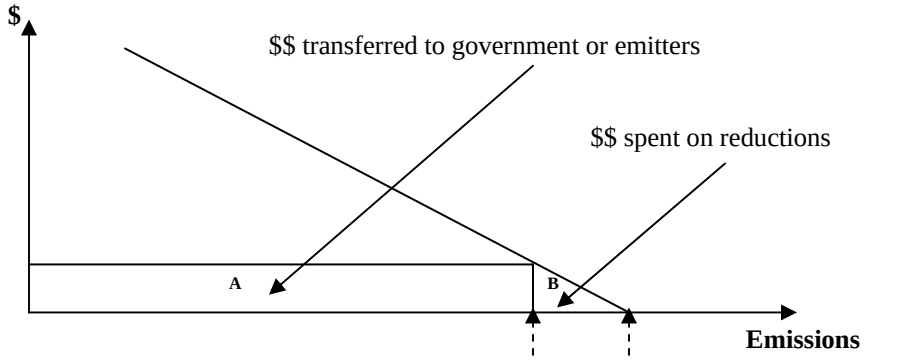


Figure 1

The enormous saving created by Cut and Trade could be offset somewhat by transaction costs, which are like to be different under the two systems. If a reliable accounting system for keeping track of reductions under Cut and Trade is more expensive than an accounting system of comparable reliability for keeping track of emissions under Cap and Trade, then transaction costs will be higher under Cut and Trade. On the other hand, if a reduction accounting system proves cheaper than an emissions accounting system of comparable accuracy, then the reverse will be true. While this issue requires further study, it seems unlikely that transaction costs under Cut and Trade will offset the substantial savings achieved by eliminating the resource transfer discussed above.

It should also be noted that Cut and Trade, if adopted as a national approach to emissions abatement, could interface with the system set up by the Kyoto Protocol. Federal regulations could allow domestic emitters to utilize AAUs, ERUs, CERs, or any other tradable units created by the Kyoto Protocol to meet their commitments, providing them with the benefits of the additional efficiency that results from the broad geographic scope of the Kyoto Protocol.

Accounting for Emissions Reductions

All reductions would be verified and certified through a national program similar to the registration program created in § 1605(b) of the energy Policy Act of 1992.[2] However, unlike the 1605(b) registration program, an effective cut and trade verification program would require the replacement of the current broad definition of "entity"[3] with a strict definition that requires entity reporting at the highest meaningful level of aggregation. Therefore, this accounting system would build on the strengths of 1605(b), providing continuity from previous industry efforts and rewarding those entities that have already begun to take measures consistent with the approach.

To maximize emissions abatement, and to ensure compatibility with the evolving international regime, the accounting system should have broader coverage than merely private sector activities. More specifically, Cut and Trade should be able to account for reductions resulting from national, state, or local policies, including renewable energy portfolio standards, vehicle efficiency standards, and appliance efficiency standards, among others. The system would recognize emissions-reducing actions, even if they were adopted primarily for oil security, air pollution, or other non-climate reasons.

Accounting standards should be as simple and transparent as possible. They might incorporate performance benchmarks or rate-based emission baselines (e.g., CO_2 per unit of output) on a sector or sub-sector level, where possible. In addition to promoting policy change, this could reduce transaction costs. To the extent possible, an accounting system should be developed through broad stakeholder participation (given the inevitable policy issues that will arise) with the input of technical competence and expertise.

Upstream vs. Downstream Regulation

In designing a Cap and Trade program, an important consideration is whether to impose the allowance requirement "upstream," (e.g., at the mine mouth, well head, refinery, port on entry, etc.), or "downstream," on the actual emitter. The argument for the former is that it greatly simplifies administration; there are simply too many emitters to impose permit requirements on all of them. The argument for the latter is that the downstream emitters are best placed to determine the quantity and price of allowances, as they are closer to the point at which reductions are actually made, and in many cases they will be making the actual reductions. It is crucial that decision-makers have access to all the relevant information in order for markets to operate efficiently, and in the case of GHG emissions, more relevant information exists downstream than upstream.

Cut and Trade can help solve this conundrum by imposing the requirement to obtain reductions on upstream entities, but providing downstream entities with the incentive to achieve the actual reductions. Upstream producers would be required to obtain a quantity of reductions – determined by the Action Target – for each ton of carbon produced or sold. Thus, given an Action Target of 20%, they would be required, as in our earlier examples, to obtain 1/5 TC_e for each ton of carbon produced or sold. Naturally, this approach would require some modification for other

[2] In order to register reductions under Rule 1605(b), reporting entities with substantial emissions must provide an inventory of their total emissions and calculate the net reductions associated with entity-wide efforts to reduce emissions or sequester carbon. Registered emission reductions must reflect net reductions, based on an entity-wide assessment of changes in all emissions, including changes in sequestration and avoided emissions. *See* Rule 1605(b) Sec.300.7. Further, registering entities must determine, document, and maintain its organizational boundary for accounting and reporting purposes. *Id.* at Sec. 300.4.

[3] Rule 1605(b) currently defines an entity as "any holding company, corporation, subsidiary, partnership, joint venture, business, operating entity, government, government agency, institution, organization or household that is treated as a distinct entity under an existing U.S. Federal state or local law. See Rule 1605(b) Sec. 300.3.

greenhouse gases, but conceptually the approach would be the same: reduction obligation upstream; abatement actions downstream.

A "Safety Valve" for Cut and Trade

Because the cost of complying with Cut and Trade is demonstrably lower than the cost of Cap and Trade, a safety valve is not really needed. Nevertheless, it may be desirable to give emitters the option of paying money into a fund in lieu of reducing emissions. If the fund is to be used solely for the purpose of obtaining additional reductions, the amount paid in would be based on the same ratio that underpins Cut and Trade. Given a 20% Action Target, emitters would pay an amount sufficient to purchase 1/5 TC_e for each ton they emit. This money would be used to purchase reductions or to finance activities that would result in reductions (e.g., transformative investments in the transportation sector, such as helping automakers develop and market hybrid cars).

A safety valve used only for this purpose would probably require a lower fee, per ton of emission, than has typically been proposed for such a mechanism. For example, if reductions were selling for \$50 per TC_e, the safety valve price would be \$10 per ton of emissions (assuming a 20% Action Target.[4] If, on the other hand, the safety valve price were set higher, then additional proceeds, beyond what would be needed to purchase reductions, would be available for other activities, such as adaptation (e.g., coastal wetlands and habitat protection), research and development of new technologies (e.g., advanced coal, carbon capture and storage, biomass, and "retooling Detroit"), and low-income energy assistance (e.g., LIHEAP).

Cut and Trade Makes Sense Conceptually

Due to its stringent emissions ceilings and the potentially high costs of complying with them, the emissions-reduction goals of Cap and Trade will almost certainly suffer compromise – either through necessarily soft or under-aggressive caps (possibly weakened further by a low safety valve number) or less-than-rigorous enforcement. By design, the Cut and Trade model solves these challenges by linking environmental goals to economic realities. Rather than assigning rigid targets and penalizing non-compliance, Cut and Trade moderates the economic impacts of achieving emissions reductions while providing emitters considerable certainty with respect to the levels of effort that will be required of them. It does this by creating flexible emissions goals that are responsive to economic swings, and by pinning goals to actual, rather than anticipated emissions.

Example 1: Company A anticipates that, if it takes no actions to reduce, its emissions during the commitment period will be 1,000 TC_e. Under Cut and Trade, with an Action Target of 20%, Company A expects that it will need to acquire 200 allowances to meet its obligation. If business is better than expected, however, causing its output (hence its emissions) to be 10% greater than anticipated, it will need to acquire an additional 20 allowances – a total of 220. Given the same scenario under Cap and Trade, Company A would have to purchase an additional 100 allowances. Conversely, if Company A's emissions are 10% lower than expected, it will need to acquire 20 fewer allowances – a total of 180 – under Cut and Trade. Under Cap and Trade its obligation would have dropped by 100 allowances, to 900.

[4] A typical amount is \$25 per ton of carbon equivalent.

Cut and Trade would also provide an additional layer of information and transparency with regard to emissions reductions. Typically, emissions inventories reflect increases or decreases in emissions, but they generally do not provide information about the causes of those increases or decreases. A country's emissions may vary for reasons unrelated to its emissions control policies, making it difficult to assess the effectiveness of those policies. Cut and Trade would require countries to identify their abatement actions and measure the resulting reductions, adding an important dimension to their emissions data. This process of examining actions (or the lack thereof) might help accelerate learning in climate protection efforts and help build capacity to take further actions. Emissions inventories may tell policy-makers whether emissions have gone up or down, but they do not explain the reasons for those changes. In contrast, the information required to assess compliance with Action Targets should enhance the ability of regulators and stakeholders to distinguish between actions that were effective from those that failed to produce desired reductions.

Cut and Trade is Good for the Economy

Cut and Trade will not only have lower and more certain implementation costs than Cap and Trade, but it will also have significantly reduced impacts on energy prices while retaining more American jobs than would the Cap and Trade approach. By relying on Action Targets rather than emissions ceilings, Cut and Trade improves upon the Cap and Trade model by linking targets to economic realities. Whereas Cap and Trade requires that emissions not exceed a certain designated level each year regardless of that year's economic or environmental circumstances, Cut and Trade is responsive to actual emissions because the target hinges on actual, rather than projected, emissions. This conceptual difference significantly eases the burden emissions reductions will place on our nation's economy because large fluctuations in economic and emission levels will have only moderate effects on the level of abatement required (see the example of Company A, above). Additionally, if this model should become a paradigm for international emissions reduction efforts, this important responsiveness feature will allow developing nations to realize significant emissions reductions without undergoing economic paralysis.[5]

As both its proponents and critics have emphasized, Cap and Trade could cause a significant rise in energy prices, making electricity and other energy-intensive goods and services unaffordable for many. This would be difficult for both emitters and consumers, who may not be able to change their behavior quickly enough to absorb rapid price increases, not least because equipment and appliances that consume energy tend to be expensive and durable, and affordable climate-friendly substitutes may not be readily available. Additionally, the economic burdens of increased energy prices are not distributed uniformly throughout the economy. Rather, they disproportionately impact low-income households, which dedicate much more of their disposable income to energy consumption than do high-income households. Cut and Trade, in contrast, would prevent a dramatic increase in energy prices, a feature that could significantly mitigate the adamant resistance climate-policy advocates have long faced.

Cut and Trade can Reduce Industry Migration and Resulting Leakage

Another significant benefit to Cut and Trade is that it will prevent climate control-induced polluter flight and, in so doing, retain American jobs while meeting environmental goals. In recent years, the Administration has expressed concerns that adopting Cap and Trade will cause industries to move their GHG-emitting operations to uncapped countries, resulting in leakage and job loss. Cut and Trade would substantially reduce the risk of such migration, because compliance costs – the main driver of migration – would be much lower under Cut and Trade than under Cap and Trade. Thus,

[5] For a more detailed examination of this issue, see Baumert and Goldberg, Action targets: a new approach to international greenhouse gas controls, Climate Policy (forthcoming).

companies would have less incentive to shift their operations. The result: greater American job security.

Even in the event of some migration, most environmental benefits would be retained, which is not the case with Cap and Trade. This is shown in Example 2.

Example 2: Suppose Country A, expecting its emissions during the commitment period to be 100 million TC_e, adopts a Cap and Trade obligation to cut its emissions to 80 million TC_e. During the commitment period, firms accounting for 5 million TC_e move their emitting activities from Country A to Country B (which has no obligation). This reduces Country A's reduction obligation – and the resulting global environmental benefit – by 5 million TC_e. Look at the same situation under Cut and Trade. Assume as before that Country A's expected emissions are 100 million TC_e, and it has committed to an Action Target of 20% (the equivalent of an 80 million TC_e cap). Assume, further, that as a result of this obligation, firms accounting for 5 million TC_e shift their emitting activities to Country B (bearing in mind that this number is selected for illustrative purposes only; the migration of industry should be less than would occur under Cap and Trade). This shift reduces Country A's reduction obligation only slightly – from 20% of 100 million TC_e to 20% of 95 million TC_e (that is, from 20 million TC_e to 19 million TC_e). Thus, if Country A meets its obligation under Cut and Trade, the migration of 5 million TC_e to Country B reduces the global environmental benefit by only1 million TC_e.

Conclusion

As we have shown, Cut and Trade addresses Cap and Trade's shortcomings (in particular, its potential economic impacts and political impracticality) while generating a useful set of collateral benefits – increased predictability, improved data and reduced loss of environmental benefit resulting from industry migration. The detrimental impacts of unchecked GHG emissions are now clear well beyond the environmental and scientific communities, but the fact is the concept of aggressive climate policy is still unsettling to those with legitimate concerns about the costs of compliance and enforcement. Cut and Trade sets and achieves the goals we need to meet to address the very real threats posed by climate change, and it does so in a way that minimizes economic burdens on domestic energy producers and international governments alike. By devising a set of rules that emitters can play by, Cut and Trade can achieve these environmental goals while avoiding the risk of unacceptable costs that make climate policy particularly difficult for governments to embrace and economies to endure.

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305-6072

Lawrence H. Goulder
Shuzo Nishihara Professor of Environmental and Resource Economics
Department of Economics and Freeman-Spogli Institute for International Studies

Landau Economics Building 328
Phone: 650 723-3706
Fax: 650 725-5702
e-mail: goulder@stanford.edu

14 March 2006

Mr. Jonathan Black
Office of Senator Jeffrey Bingaman
703 Hart Senate Office Building
Washington, DC 20510

Dear Jonathan,

Thanks very much for sending me a copy of the Climate Change White Paper recently released by your office. I commend your office for its efforts to bring about a coherent and effective national climate policy. Congratulations also for producing a very clear and well organized document that identifies the key issues regarding policy design.

Here are a few comments or recommendations:

1. I would recommend an economy-wide approach, and one in which the point of regulation is upstream. I favor an upstream approach in large part because of its advantages in terms of coverage and administrative convenience. It is much easier to capture transportation-sector-related emissions, in particular, through an upstream approach.

2. One aspect of the policy that deserves consideration is how to deal with imports and exports. If an upstream policy is introduced, I would recommend that emissions from imported fuels also be subject to the cap, and that exported fuels be exempted from it. This would prevent foreign suppliers from gaining a competitive advantage in the domestic market, as well as prevent domestic producers from facing a disadvantage on the world market.

I would recommend against trying to deal with the emissions associated with imported refined products. I believe the administrative difficulties associated with doing so would be very great. If one does not deal with these emissions, foreign-made refined products will have some advantage over domestically produced products, but I believe this limitation cannot easily be avoided.

3. The White Paper tends to focus on providing compensation or reducing negative impacts through allocation of allowances. While this is a useful tool for offering compensation, I believe that it would be worthwhile to contemplate additional possible compensation mechanisms, including sector-specific corporate tax cuts.

4. The White Paper asks what industries should receive relief (through freely allocated allowances or other instruments). I would suggest that this should largely be based on the likely magnitude of the profit impacts in the absence of compensation – specifically, the likely percentage reduction in profit. This in turn will reflect the energy or fossil-fuel intensity of production. Clearly political considerations will influence where one draws the line between industries that receive compensation and those that do not.

5. On page 7 the White Paper asks what other mechanisms might be employed to promote invention of new, low-emissions technologies. I am glad this question was raised, because I believe that the emissions allowances alone will not have sufficient value to promote adequate additional technology-development efforts. I believe R&D tax credits deserve consideration as an additional incentive mechanism.

6. On page 9 the White Paper asks how many allowances should be reserved for an offset pilot program. I believe that it is important for a national program to encourage biological sequestration as well as emissions-reductions. From an efficiency point of view, the quantity of sequestration that qualifies as an offset should simply be determined by the price of allowances: that is, whatever amount of sequestration is induced at the given allowance price is beneficial. Thus, I feel that there is no economic reason to put a limit on the amount of sequestration. At the same time, it is obviously very important that rules be introduced to help assure that what is called sequestration is in fact additional relative to what would have occurred under business-as-usual. There is no perfect solution to the "baseline problem," as you well know. I believe it is better to include offsets from sequestration, despite the difficulty of establishing baselines, than to rule out sequestration offsets.

7. Perhaps a minor point. In the middle of page 9 the White Paper suggest that in a downstream program, fossil-fuel producers have no compliance costs. Although I may be misinterpreting the issue, I think that they would have virtually the same compliance costs under a downstream program as they would under an upstream program. In both cases, they would need to reduce their output. Under the upstream program, this results directly from the (upstream) caps on emissions. Under the downstream program, it results from the policy's impact on demand for fossil fuels.

8. On page 14 the White Paper asks what metric might be used to for comparing mitigation efforts across countries. One possible metric is the allowance prices, since these indicate the costs of compliance at the margin.

9. A general issue raised by the White Paper is how many of the allowances need to be freely allocated (as opposed to auctioned). My work and the work of others (including modelers at the EIA) indicate that only a small percentage of allowances need to be freely allocated to prevent profit losses to fossil-fuel producers and other major industrial stakeholders. In my view, a crucial challenge is to educate decision makers on this point – to reassure them that a cap and trade system need not cause profit losses to key industries. (Perhaps I don't need to alert you to this point!)

I hope these comments are helpful. I would be happy to provide additional input at any time. Again my congratulations to you and your office for taking the lead on a most important issue, and for doing so in such an intelligent and effective way.

With best wishes,

[Larry]

Lawrence H. Goulder

Submitter's Name/Affiliation: John German, American Honda Motor Co., Inc.
Contact: Edward B. Cohen
Email: Edward_cohen@hna.honda.com
Phone: (202) 661-4400

Honda appreciates the opportunity to comment and commends the committee for its consultative process in developing the legislation. Our comments are limited to how to incorporate cars and light trucks into carbon trading programs.

Honda firmly believes that climate change needs to be addressed at the federal level. State-by-state GHG regulations are impractical, expensive and ineffective. Emissions trading programs can be effective market-place mechanisms for achieving environmental objectives and cap-and-trade programs are actively being developed worldwide to provide a sound economic framework for reducing carbon emissions. Many of these plans implicitly assume that motor vehicles can easily be incorporated into cap-and-trade programs that already exist for other energy sectors. However, there has been relatively little analysis of the mechanisms needed to incorporate vehicles into cross-sector trading programs. Thus, Honda's submission for question one focuses on whether or not this assumption is realistic.

A single program for both stationary and mobile source (passenger vehicles) emissions poses significant problems. These problems include double counting between fuel producers and vehicle manufactures, dividing fuel producer allocations between light duty vehicles and all other transportation uses, the time offset between vehicle manufacture and fuel use, timing of allocations to vehicle producers, interaction between actions taken by vehicle manufacturers and fuel producers on the other allocations, and handling of alternative fueled vehicles and flexible-fueled vehicles. Even if all of the problems could be solved, incorporating vehicles into overall carbon trading programs would still not reduce overall carbon emissions, as the vehicle allocations must be subtracted from the fuel producers allocation to avoid double-counting.

Instead, the Committee should provide for a separate GHG trading program for cars and light trucks. This would likely be just as effective, while avoiding most of the complexity in incorporating vehicles into an overall carbon trading system. Such a system would still be based on CO_2 per mile and should allow manufacturers to buy and sell efficiency credits to and from the government at a fixed rate.

Honda's submission for question two explains why a carbon intensity system, such as CO2 per mile, is necessary for a vehicle trading program. Honda would oppose any system that allocates total carbon emissions by manufacturer, instead of per vehicle. Under a carbon intensity system, whether the allowances are auctioned or allocated does not affect the effectiveness of the program. As the value of CO2 per mile is fixed, auctioning credits is meaningless and the allowances must be allocated.

Question 1. Point of Regulation
Submitter's Name/Affiliation: John German, American Honda Motor Co., Inc.

Who is regulated and where?

Many energy and environmental specialists are looking to implement carbon trading across all carbon sectors. Most of these plans implicitly assume that motor vehicles can easily be incorporated into cap-and-trade programs that already exist for other energy sectors. However, there has been relatively little analysis of the mechanisms needed to incorporate vehicles into cross-sector trading programs. Honda's submission examines whether or not this assumption is realistic and suggests an alternative method for vehicles that will likely work better. The focus here is on light duty vehicles (LDVs), while recognizing that transportation includes other vehicles and systems that are likely to require their own focused analyses.

Previous studies have identified most of the problems with trying to incorporate vehicles into carbon trading programs, but none are comprehensive. The 2003 study by the Pew Center, for example, simply presented the advantages and disadvantages of all the different options. The CCAP study in 2000 was based primarily upon arguments that there were other reasons for improving vehicle efficiency than just carbon emissions. Neither study tried to solve the problems from integrating vehicle manufacturers into overall carbon trading program. A recent paper by John German of American Honda Motor Co. examined the problems and assessed the ability to solve them[1]. Some of the key problems are:

- Double counting must be avoided. This is not a problem if only fuel producers or vehicle manufacturers are included in a trading program. Vehicle manufacturers have little impact on VMT and fuel producers have little impact on vehicle technology, so it is desirable to include both. Systems that provide allocations to vehicle manufacturers must subtract this amount from fuel producer allocations.
- Currently, only vehicles with gross vehicle weight ratings less than 8,500 pounds are subject to fuel economy testing necessary for proper emission accounting. This requires that fuel producer allocations be divided between LDVs and all other transportation uses. It also raises the question as to how the other transportation uses should be handled in the trading system.
- Proper allocation requires accurate estimates of vehicle scrappage rates, VMT by vehicle age, average carbon content of in-use fuel, and in-use mpg compared to test results. Except for the average carbon content in fuel, none of these factors are well understood. None of the factors can be forecasted with any accuracy.
- Actions taken by vehicle manufacturers to improve efficiency do not affect current year carbon emissions, only future emissions. Other sectors are dealing with current

[1] John German, American Honda Motor Co., "Reducing Vehicle Emissions Through Cap-and-Trade Schemes", to be published soon by Elsevier as part of the proceedings from the 2005 Asilomar Conference on CO2. A final draft of this paper is attached to provide greater detail on all of the issues.

year emissions. This time offset creates multiple problems in accounting and operation of incentives.

- If allocations are given to manufacturers for the lifetime estimated emissions when the vehicle is built, it results in an artificial cycling of both carbon availability and pricing, based on vehicle turnover. This will make it difficult for other sectors to manage their allocations, especially the oil producers. This can be fixed by allocating manufacturer credits annually over the vehicle lifetimes as the carbon savings occur. However, allocating credits annually instead of when the vehicle costs are incurred substantially reduces the incentive for manufacturers to participate.
- Actions taken by vehicle manufacturers affect the allocation for fuel producers and vice versa. This makes it impossible to set separate allocations for manufacturers and fuel producers. Both must be held accountable for the entire reduction in carbon emissions, but currently there is no known way to administer such a program.
- Handling of alternative fueled vehicles is problematic. Vehicle manufacturers are needed to produce the vehicle and fuel producers must make the fuel available, but there is no way to split the carbon allocation between manufacturers and producers. Flexible fueled vehicles create an additional problem, which is accounting for the amount of the alternative fuel that will actually be used.

Perhaps there is a way to solve all of the problems and make a workable vehicle trading system, but 10 years of effort by many different organizations has yet to yield a good system. Different systems solve some of the problems, but the overall complexity is overwhelming.

Even if the problems could be solved, vehicles would still not reduce overall carbon emissions. To avoid double counting, the vehicle manufacturer allocations must be subtracted from the fuel producer allocations. Thus, the primary justifications for creating a hybrid vehicle trading system are to reduce the overall costs of reducing carbon emissions and to capture other benefits for reducing fuel use beyond just GHGs, such as energy security, trade deficit, and oil price shocks. Incorporation of vehicles into an overall carbon trading system is a very complex and likely unworkable way to try to capture these benefits.

Instead, the Committee should provide for a separate GHG trading program for mobile sources (cars and light trucks). This could capture the same benefits with a lot less complexity. Such a system would still be based on vehicle carbon-intensity incentives (e.g. CO_2 emissions per mile). Due to the limited number of manufacturers who control the large majority of the market, trading between manufacturers is not likely to be very successful. Thus, the system should allow manufacturers to buy and sell efficiency credits to and from the government at a fixed rate. This rate could be set based upon the going carbon trading rate plus monetization of benefits to the nation for conserving energy and reducing oil consumption. If desired, the incentives could be class based to address customer choice, safety, and inter-manufacturer equity concerns.

Such a system would provide certainty on the monetary value for improving efficiency and would allocate the full value immediately, increasing the incentive for manufacturers

to bring technology to the market. It would also be far simpler to administer and would keep the credits out of the overall sector carbon trading system, avoiding most of the problems with incorporating vehicles into an overall trading system.

The CO2 per mile requirement could be set either of two ways. One method would be for the government to establish an independently determined cap. This would work like the CAFE system, with the addition of fixed-price trading based on the average CO2 per mile for each manufacturer compared to the cap. Total revenues could be positive or negative, depending on whether the fleet as a whole exceeded or failed to achieve the cap. The second method would be to create a revenue-neutral system with a floating CO2 per mile midpoint. Manufacturers that are above the midpoint on average would receive rebates and manufacturers below the midpoint would pay fees. In either case, the value of improving CO2 per mile would be identical, so each system would have identical effectiveness in reducing CO2.

One unavoidable problem is that the improvements in vehicle efficiency would still need to be subtracted from the fuel producers' allocation. Otherwise, oil producers would have windfall benefits from vehicle manufacturer actions. The government would need to monitor actual efficiency improvements and in-use VMT and use this data to adjust carbon caps for the fuel producers

In conclusion, emissions trading programs can be effective market-place mechanisms for achieving environmental objectives. However, a single program for both stationary and mobile source (passenger vehicles) emissions pose significant problems relating to effectiveness, cost-effectiveness, administrative feasibility, distributional equity and political acceptability. A stand-alone trading program for cars and light trucks would likely be just as effective, while avoiding most of the complexity in incorporating vehicles into an overall carbon trading system.

.

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

Please begin your response HERE. (no page limit)

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

Please begin your response HERE. (no page limit)

Reducing Vehicle Emissions Through Cap-and-Trade Schemes

John German, American Honda Motor Company

Global warming is a worldwide problem that is growing in importance. Carbon released during fossil fuel burning is the primary contributor to greenhouse gas (GHG) emissions and cap-and-trade programs are actively being developed worldwide to provide a sound economic framework for reducing carbon emissions. Cap-and-trade programs have been used successfully in several emissions-related undertakings, such as the United States (U.S.) effort to control acid rain by limiting sulfur dioxide emissions and the transition from leaded to unleaded gasoline. Today, carbon trading programs are already being implemented for selected sectors, such as electric utilities.

Encouraged by the past success of emissions trading programs, many energy and environmental specialists are looking to implement carbon trading across all carbon sectors. Most of these plans implicitly assume that motor vehicles can easily be incorporated into global cap-and-trade programs that already exist for other energy sectors. However, there has been remarkably little analysis of the mechanisms needed to incorporate vehicles into cross-sector trading programs. This chapter examines whether or not this assumption is realistic and suggests an alternative method for vehicles that will likely work better. The focus here is on light duty vehicles (LDVs), while recognizing that transportation includes other vehicles and systems that are likely to require their own focused analyses.

1. Previous studies

Two recent studies have already examined the creation of GHG cap-and-trade programs to reduce GHG emissions from motor vehicles. Robert R. Nordhaus and Kyle W. Danish published the most recent in May 2003 for the Pew Center (Nordhaus and Danish, 2003). Called “Designing a Mandatory Greenhouse Gas Reduction Program for the U.S,” this was a comprehensive study covering all carbon sectors and included a detailed assessment of different ways to incorporate transportation into a trading program. The Pew study examined four cap-and-trade structures:

- An upstream program applying, for example, to fuel producers
- A fully downstream program applying, for example, to vehicle owners or manufacturers
- A hybrid sectoral program with tradable standards. This combines a downstream cap-and-trade program for large sources in the electricity and industrial sectors with enhanced product efficiency standards for energy end users, such as carbon dioxide (CO_2) per mile standards for vehicles. Vehicle manufacturers could trade between their own product lines, with each other, and with firms subject to the downstream cap-and-trade program.
- A hybrid sectoral program with capped tradable standards. This is similar to the hybrid sectoral program with tradable standards, except that a cap would be set on the total emissions from vehicles. Thus, manufactures would have to

account for the total projected emissions associated with each product they sold, not just vehicle efficienc y.

Each of these structures was evaluated for environmental effectiveness, cost-effectiveness, administrative feasibility, distributional equity, and political acceptability. Table 1 presents a summary of the findings in the Pew study.

Table 1 – Summary of Pew 2003 Study results with respect to vehicles

	Environmental Effectiveness – (coverage, certainty, enforceable)	**Cost-effectiveness flexibility, predictability, long -term incentives**	**Administrative Feasibility – administrative cost, adaptability**	**Distribution Equity**	**Political Acceptability**
Cap & Trade – upstream	Good	Hypothetically least cost if includes flexibility measures	Good	Depends on allocation and auctioning provisions	Works by limiting fuel availability and raising fuel cost
Cap & Trade – downstream			Prohibitive administrative cost		
Sectoral Hybrids – tradable standards	Must expand coverage (vessels, locomotives, HD, aircraft, buses) Emission reductions uncertain	No incentive to reduce end-use, Vehicle fuel sales must be exempted from upstream cap & trade Likely considerably more costly than upstream cap & trade	Must translate mpg into annual CO2 (annual VMT assumptions, timing) Requires continuously promulgating adjustments Double-counting risks Evasion if upstream trading allowed	Possible concern	Avoids gasoline price increases
Sectoral Hybrids – capped tradable standards	Emission reductions more certain, although still relies heavily		Raises issues with allowance allocation, shutdowns, new market entrants, mfr.		

	on estimates		market share shifts, overall sales		

The authors of the Pew study concluded,

> …the analysis would argue against an economy-wide downstream cap-and-trade program (as difficult to administer), a stand-alone large source cap-and-trade program (as incomple te), and a GHG tax that is not part of a larger tax reform initiative (as unviable politically). The analysis does suggest that the comprehensive, upstream cap-and-trade approach and the sectoral hybrid approach are the most viable alternatives for a domestic GHG reduction program.

FINAL DRAFT – 01/16/06 The study goes on to state that if the sectoral hybrid approach is taken, "then careful attention will have to be given to minimizing economic costs and administrative complexity, and assuring that the program can be effectively enforced." The authors simply assumed these concerns could be dealt with, however. No attempt was made to address specific design issues.

The second, earlier, report by Steve Winkelman, Tim Hargrave, and Christine Vanderlan of the Center for Clean Air Policy (CCAP) in April 2000 focused on ways to incorporate transportation into GHG trading (Winkelman et al., 2000). The policies examined were similar to the later Pew 2003 study; upstream, downstream, and hybrid approaches. The CCAP analysis also inve stigated the influences of fuel producers, vehicle manufacturers, customers, and land-use policies on the three aspects of carbon emissions: vehicle miles traveled (VMT), vehicle efficiency, and fuel carbon content.

Table 2 summarizes the direct and indirect influences of these different factors, illustrating how downstream, upstream, and hybrid programs affect carbon emissions. For example, vehicle manufacturers are the primary influence on vehicle technology, while fuel producers have more leverage on VMT.

Table 2 - Direct and Indirect Influences on Transportation GHG Emissions (CCAP 2000)

Entity/Factor	Vehicle Miles Traveled	Vehicle Efficiency	Fuel Carbon Content
Consumers	Travel Decisions	Consumer Preferences, Vehicle Maintenance	Consumer Preferences
Vehicle Manufacturers	(indirect influence: vehicle efficiency impact on driving costs)	Vehicle Technology	Vehicle Technology
Fuel Producers	Fuel Price	NA	Product Mix
Land use & Transportation Infrastructure	Available Travel Options	NA	NA

The authors found that "The hybrid approach is aimed at combining the benefits of the upstream and downstream systems in a synergistic way. It appears to fall short of this goal, however, because additional complexities are introduced without any clear environmental benefit." The study recommended combining land use policies and an upstream trading system with carbon efficiency standards similar to the current Corporate Average Fuel Economy (CAFE) standard, although inclusion of carbon efficiency standards was based primarily upon arguments that there were other reasons for improving vehicle efficiency than just carbon emissions.

While both of these studies explore the relative merits of the various GHG cap-and-trade systems for transportation, they fall short in addressing the major implementation challenges associated with each alternative. The following sections explore in detail the major policy options in order to highlight obstacles that must be addressed in cap-and-trade systems. Based on an understanding of these issues, an alternative regulatory framework is suggested that has the potential to achieve the same environmental goals while avoiding much of the administrative complexity of current cap-and-trade systems.

2. Upstream trading

Upstream trading refers to trading between producers of carbon-based fuels or products. For the transportation sector this would be fuel refiners and importers of refined petroleum fuel. In a pure upstream emissions trading system, fuel producers would be required to hold GHG emission allowances for each ton of CO_2 equivalent emissions produced each year. In addition, fuel producers would be required to hold allowances for each ton of emissions produced due to consumption of the fuels they sell.

Such a system reduces emissions via two mechanisms. First, emissions can be reduced as a direct result of the allocation of emission allowances. Each fuel producer can reduce emissions by reducing fuel output, manufacturing process emissions, or average fuel GHG intensity measured by fuel carbon content, or by purchasing additional allowances from the allowance market. In all of these cases, the total quantity of GHGs emitted to the atmosphere is reduced, although reductions may come from a non-transportation sector in the last case. Secondly, direct activities to reduce emissions on the part of fuel producers can reduce fuel demand by increasing the cost of fuel production. Demand will decrease as a result of the price elasticity of fuel, although the effect may be small.

The advantage of upstream trading systems is that administration is simplified due to the relatively small number of regulated firms in the upstream industry. There are approximately 175 petroleum refiners, 200 oil importers, and 900 gasoline pipelines in the U.S. Data about their operations are readily available. This makes upstream trading schemes reasonably simple to administer at low cost, while providing comprehensive coverage. However, while fuel producers can affect the GHG emissions from their own operations, they have no direct control over fuel consumption in an upstream system. The only consumption control fuel producers have is on price. An upstream trading program

has the effect of raising fuel prices. This increased fuel price signal creates incentives to produce and use low carbon fuels, reduce vehicle use and maintain vehicles in good condition, and purchase carbon efficient vehicles.

The increased price will be limited by the cost of reducing carbon in other sectors. For example, if it costs $50 to reduce a ton of carbon in the electric sector, this translates to just $0.13 per gallon of gasoline. Thus, if the fuel price needed to meet the carbon cap on fuel producers exceeds $0.13 per gallon, fuel producers will simply buy credits from the electricity sector.

Even at $2.50 per gallon, gasoline costs are relatively low compared to fuel prices outside the U.S. and to historical trends in the U.S. Gasoline costs are still a relative minor economic factor in vehicle ownership. A $0.13 per gallon increase will only have a small impact on VMT and vehicle purchase decisions, and virtually none on low carbon fuels or vehicle technology.

The problem with vehicle technology is that the fuel savings are largely offset by the cost of the technology. The net benefit over a wide range of vehicle technology is less than $200. In addition, the average customer only values the fuel savings for their ownership period, which is roughly 50,000 miles, so the net benefit valued by the customer is frequently less than zero. When compared with the multitude of important tradeoffs facing customers in their purchase decision and the emotional factors involved, most customers treat fuel economy technology as a very low priority.

FINAL DRAFT – 01/16/06 The dynamics of an upstream cap-and-trade system for transportation can be illustrated with a simple example. If we assume that regulated fuel producers will not reduce fuel production, each firm is then faced with three compliance strategies: reduce emissions associated with fuel production, produce and sell cleaner fuels; or purchase emissions allowances from other sectors. If it costs $50 to reduce a ton of carbon in the electric sector, this translates to just $0.13 per gallon of gasoline. Thus, if the marginal cost of reducing fuel related emissions exceeds $0.13 per gallon, a fuel producer minimizing marginal abatement cost will simply buy credits from the electricity sector. Even if one assumes that the entire increase in marginal cost is passed on to consumers, a $0.13 per gallon increase will be unlikely to change driver behavior. Because fuel cost represents only a relatively minor economic factor in vehicle ownership, it is unlikely to have a large impact on VMT and vehicle purchase decisions, and virtually none on low carbon fuels or vehicle technology.

Overall, upstream trading schemes have low administrative costs, but they promise little direct reduction of motor vehicle fuel consumption. Emissions reductions, especially in the near term, are likely to come from other sectors where the marginal cost of GHG abatement is lower. Of course, from a global climate change perspective, this is fine because the atmosphere doesn't care if CO_2 reductions come from vehicles or somewhere else. Due to the oil intensive nature of transportation, however, this may not be the best solution for energy security and trade deficits. Moreover, upstream trading programs are likely to be hampered by political barriers to increasing fuel price. While upstream

trading has important benefits and should not be discarded, a supplemental program targeting motor vehicle fuel consumption is likely to be desirable.

3. Downstream Trading

Downstream trading schemes shift the responsibility for carbon emissions from fuel producers to vehicle owners or operators. The narrowest downstream trading scheme would be similar to the rationing coupons issued in World War II, except that the coupons could be freely traded. The problems with this approach are obvious. There are over 200 million vehicles on U.S. roads, with allocations and trading provisions needed for all. This is a huge administrative burden and there is no low cost technology for monitoring vehicle emissions. There are also privacy concerns with mandatory monitoring of individual vehicles. This approach is simply not feasible politically or administratively.

The more practical alternative for downstream trading schemes is to bring vehicle manufacturers into the programs. Vehicle technology is one of the major factors in reducing carbon emissions and fuel price is a relatively weak lever to bring technology to market. Incentives and mandates affecting vehicle technology could have a major effect on vehicle GHG emissions. There are numerous advantages to this approach:

- In theory the mechanism is simple, requiring only that vehicle manufacturers to turn in allowances for imputed lifetime emissions.
- It avoids fuel price increase, which would be politically sensitive.
- There are few automotive manufacturers, so the administrative costs are low.
- Vehicle manufacturers have a great deal of control over the installation of fuel efficiency technology.
- Vehicle manufacturers can influence fuel type.
- Vehicle manufacturers can influence purchase decisions with vehicle pricing and marketing, although manufacturers are limited in what they can do in isolation from changes in customer preferences and the broader carbon-related decision-making context.

It clearly makes sense to try to include vehicle manufacturers in trading programs. Some people stop here and just assume this is the best approach. Even those who acknowledge the problems with economic costs, administrative complexity, and double counting, such as the Pew report, often assume that the program can still be effectively enforced with careful attention to the structure. There are problems with downstream trading schemes focused on vehicle manufacturers, however, which may not be easily remedied.

3.1. Problem 1 – Double Counting

Perhaps the largest problem with downstream trading schemes is the timing of the allocations and credits to vehicle manufacturers. Fuel producers and other upstream allocations are done for the current year. This is also true for downstream allocations

and credits for utilizes. However, allocations for vehicle manufacturers are based on projected carbon for the vehicle lifetime. Technology added by vehicle manufacturers now will accrue actual carbon reductions in the future over the vehicle lifetime.

One consequence is double counting of credits. For example, assume that manufacturers improve fuel efficiency or sell alternative fueled vehicles. The carbon from these vehicles will be lower in the future. Manufacturers are given credits for the future reduction in carbon, which they can trade to someone else. In the future, fuel producers will receive credits when vehicles use less fuel, but these are the same credits that were already taken by vehicle manufacturers. The same credits, therefore, are traded twice. Note that increasing efficiency in the other parts of transportation would create similar problems. For example, if the fuel efficiency of freight trucks or the system/logistical efficiency improved, the carbon reductions would also be realized through long time horizons, often longer than light duty. Carbon reduction credits earned by the freight industry should not be doubled counted by fuel suppliers in the future, either.

There are three possible ways to eliminate double counting. The first is to switch to upstream trading with fuel producers. This is not really a solution. It simply avoids downstream trading by reverting to upstream trading, with the problems discussed above.

Secondly, upstream trading with fuel producers could be eliminated and the trading system restricted solely to downstream trading with motor vehicle manufacturers. This would focus on efficiency technology for LDVs, which is a likely to be a stronger lever than trying to reduce VMT or change product mix through higher fuel prices. Unfortunately, LDVs consume less than half of the petroleum fuel produced. It would not be desirable to eliminate all other transportation sectors from upstream trading just to focus on vehicle efficiency in LDVs. One possible solution would be to exempt vehicle fuel sales from the upstream cap-and-trade system for other fuel users. This requires forecasting future VMT, scrappage rates, and in-use efficiency. If these forecasts are low, then overall carbon emissions will exceed the cap. When combined with the elimination of incentives to reduce vehicle end-use, this is not likely to be a desirable option. Finally, the downstream trading scheme could be modified to include a hybrid program, whereby allocations are split between vehicle manufacturers and fuel producers. This could provide some incentives for manufacturers to improve efficiency and for fuel producers to reduce use. While this approach is attractive in theory there are a number of problems, which are evaluated in Section 4.

3.2. Problem 2 – Manufacturer Allocations

All the normal problems with allocating versus auctioning carbon caps apply to trading with vehicle manufacturers. However, there are two additional considerations that apply to vehicles. The first is how to handle existing vehicles on the road in the carbon allocations. Who is responsible for the existing fleet of vehicles? The second issue is

whether the manufacturers should be held responsible for the total lifetime carbon from their vehicles, or just the carbon intensity measured by CO2 emissions per mile resulting from the operation of their vehicles.

The total carbon approach would allocate a set amount of carbon that could be emitted from each manufacturer's fleet over its lifetime. John DeCicco suggested this approach in his paper, "An Oil Consumption Cap-and-Trading Scheme for Light Duty Vehicles" (DeCicco, 1993). The advantage of this system is that it holds manufacturers responsible for customer purchase decisions and use, creating incentives for manufacturers to reduce carbon using all of the possible levers, including technology, vehicle characteristics, lower carbon fuel, and reduced VMT.

The problem with the total carbon approach is that it holds manufacturers responsible for customer purchase decisions and use, as well as sales and market shifts. The compliance burden on manufacturers increases if their sales increase, if the market shifts to larger vehicles, or if people drive more. There are also very anticompetitive consequences. Increasing sales makes it more difficult to meet the requirements, while decreasing sales yields windfall credits without any improvement in efficiency. The net effect is to tend to freeze manufacturers into their existing market share. A total carbon system would be even worse than the Uniform Percentage Increase (UPI) method for CAFE standards. The problems with UPI were discussed at length in a National Academy of Science report on CAFE (National Research Council, 2002).

Downstream trading based on the carbon intensity of vehicle driving wo uld hold manufacturers responsible for the average CO_2 per mile of their vehicles, not the total carbon per fleet. This would be similar to combining CO_2 emissions standards with broader trading. This is equitable and provides a good lever for efficiency technology. It has little influence on VMT or the type of vehicle purchased by consumers, however, and it does not control total carbon emissions. Manufacturers can earn credits even if total carbon increases due to higher sales or increasing in-use driving. While it would be desirable to combine a carbon intensity system for vehicle manufacturers with an upstream system for fuel producers, there are several problems with this approach as well, which are discussed in Sections 4 and 5.

3.3. Problem 3 – Accounting

To avoid double counting, vehicle efficiency improvements must be subtracted from future carbon allocations for other sectors. As carbon intensity allocation is likely to be the only workable system for vehicles, future changes in vehicle carbon emissions must be estimated annually by predicting yearly scrappage rates, annual VMT by vehicle age, in-use fuel economy shortfall resulting from a gap between certification test results and average in-use fuel economy, and the carbon content of the fuel. If vehicle carbon emissions are estimated incorrectly, then extra burden may be put on other sectors or the desired carbon reduction may not be achieved.

It is difficult to forecast the future and the assumptions may prove to be very inaccurate. For example, lifetime VMT per vehicle may change. This will cause vehicles to use more or less carbon compared to the original accounting. Also, in-use efficiency may change due to factors such as more congestion, higher speeds, and more sprawl, with similar impacts on total carbon emissions. To further compound the problem, most of these factors are not well known. For example, estimates of the in-use fuel economy shortfall are now based on 25-year-old data and scrappage rate estimates are based on very limited and imprecise surveys. In addition, vehicle use characteristics in terms of lifetime and annual VMT are likely to vary by vehicle type and manufacturer.

There are further issues with alternative fueled vehicles. How is double counting handled with respect to alternative fuel producers? How are credits determined for flexible fuel vehicles that can run on more than one fuel? The future use of alternative fuels on flexible fuel vehicles and the actual GHG emissions impact must both be accounted for with reasonable accuracy.

Another important issue is that vehicle accounting is not compatible with the rest of the trading system, due to the mismatch in the timing of the carbon reductions. For example, if carbon prices are low, manufacturers are encouraged to buy credits instead of using advanced technologies. However, the efficiency of the current in-use fleet doesn't change and the credits are used to increase vehicle emissions in future years as the fleet turns over. Thus, the carbon ceiling for the current year goes down. The future vehicle fleet will use more fuel and less carbon is allowed, which will cause oil producers to exceed their allocations in the future and force them to buy credits. This will drive up the price of carbon in the future.

On the other hand, if carbon prices are high, manufacturers are encouraged to exceed requirements and sell credits. Again, the efficiency of the current fleet doesn't change, so the carbon ceiling for the current year goes up. The future vehicle fleet will use less fuel and more carbon is allowed, which will drive down prices in the future.

The mismatch in the timing of the carbon reductions results in an artificial cycling of both carbon availability and pricing, based on vehicle turnover. This will make it difficult for other sectors to manage their allocations, especially the oil producers.

3.4. Additional Concerns and Questions

There are a number of other potential problems that a downstream vehicle trading program must address. Several of these key areas of concern are listed below:

- How should equipment other than the LDV fleet be handled, including pickups and sport utility vehicles over 8,500 gross vehicle weight, heavy trucks, farm equipment, buses, lawnmowers, motorcycles, and construction equipment?

. □ If a vehicle efficiency standard is used alone, how should the lack of environmental certainty be addressed?
. □ There is a need to consider how to monetize non-GHG considerations, such as energy security and the trade deficit, into a vehicle trading system designed to reduce GHG emissions.

4. Upstream/downstream hybrid

The analysis in the last section suggests that a compromise approach between upstream or downstream vehicle trading programs might be to split the carbon allocation between vehicle manufacturers and fuel producers. In theory, this could provide some incentives both for manufacturers to improve efficiency and for fuel producers to reduce carbon use.

To help visualize how such a hybrid would operate, let us assume a 2015 target of 200 million tons (mmT) CO_2 reductions from vehicles and that the responsibility for achieving these reductions is split equally between vehicle manufacturers and fuel producers. Table 3 provides a summary of the assumptions and issues in this example to make it easier to follow the discussion.

Table 3 – Hybrid program summary

	Vehicle manufacturers	Fuel Producers
Baseline	Vehicle sales * Lifetime VMT / in-use MPG * carbon content	Gallons sold * carbon content
2005 – million metric tons CO2	17 * 150 / 21.0 * 19.5 / 2205 = 1074 mmT	1982 mmT (inc. rail, bus, freight, ship, boat, air, 75-05 LD)
2020 – each reduce 100 mmT	17 * 150 / 23.2 * 19.5 / 2.205 = 972 mmT	How is LD handled versus other transportation sectors?
	What if: sales change, lifetime VMT increases, in-use FE shortfall changes	How are vehicle efficiency improvements handled in the future?
	Actions by one will reduce emissions of the other without any action, although offset in time by fleet turnover If want to influence both manufacturers and oil producers, must hold both accountable for total reductions • Actions by each still influences requirements for the other	

The first step is to calculate baseline CO_2 emissions. For cars and light-duty trucks, baseline CO_2 emissions over the vehicle lifetime are approximately 1,074 mmT per model year. This result is obtained by multiplying 17 million new LDV sales per year by 150,000 lifetime miles traveled per vehicle, divided by an average in-use fuel economy of 21 miles per gallon (mp g), multiplied by 19.5 pounds of CO_2 per gallon of gasoline, divided by 2,205 pounds per metric ton. For fuel producers, baseline CO_2 emissions are simply the carbon content of the fuel sold. Per the Annual Energy Outlook 2005 with

Projections to 2025 (EIA, 2005), total CO_2 emissions for all transportation sources are 1,982 mmT for 2005.

For 2020, additional assumptions are that new vehicle sales remain constant, in-use VMT doesn't change, and the average carbon content of in-use fuel doesn't change. With these assumptions it is possible to calculate the level of in-use mpg needed to reduce 100mmT from vehicles. Next, manufacturers can back-calculate the new vehicle efficiency needed using estimates of scrappage rates and VMT/year by vehicle age, assuming that the relationship between fuel economy tests and in-use mpg doesn't change. Changes in the carbon content of in-use fuel can also be included in the model for new vehicle efficiency, although this raises the issue of whether vehicle manufacturers or fuel producers should receive credit. Of course, if any of these six assumptions are wrong it means that the projected savings will not equal the actual savings.

For fuel producers, there are some additional considerations. For the 2005 baseline year, LDVs emitted 1,074 mmT CO_2 and all transportation sources emitted 1,982 mmT, which means that over 900 mmT was generated by other sources, such as rail, buses, freight, shipping, boats, airplanes, construction, and lawnmowers. Should the fuel for LDVs be separated from other uses and, if so, how? Should the 100 mmT reduction for vehicles be included in a larger, overall reduction for all transportation? What is the baseline for the fuel producers? Should the 100 mmT reduction in CO_2 be compared to 2005 CO_2 emissions or to a "business as usual" base case for 2020? This last is a critical issue, as VMT has been steadily increasing and will continue to do so barring some catastrophic event.

Assuming that all the accounting issues can be managed, there is still a major problem with interactions between actions taken by vehicle manufacturers and fuel producers. For example, if vehicle manufacturers take steps to improve the efficiency of their vehicles from 2005 through 2020 such that the in-use vehicle fleet achieves a 100mmT reduction in CO_2 emissions in 2020, then fuel producers don't have to do anything to reach their 100mmT reduction goal. The vehicle manufacturers would have already accomplished the entire reduction.

This can be corrected by doub ling the reduction required from fuel producers, so that they will be held to a 100 mmT reduction in addition to the 100 mmT required from the vehicle manufacturers. This would force fuel producers to take steps to reduce carbon content in the fuel, carbon from refining and transporting fuel, or raise the price of fuel by limiting quantities or buying credits from other sectors. Reducing the carbon content of fuel or raising fuel prices would reduce vehicle CO_2 emissions, both directly and indirectly by encouraging the purchase of more efficient vehicles and reducing VMT. Now the vehicle manufacturers can wait for the steps taken by the fuel producers to reduce vehicle CO_2 emissions by 100 mmT, without significant action on the manufacturers' part.

Actions taken by vehicle manufacturers and fuel producers will always reduce the

emissions from the other without any action being taken. This interaction is offset in time by fleet turnover, making it virtually impossible to determine what the effects will be. This interaction between vehicle manufacturers and fuel producers makes it virtually impossible to determine separate allocations. If the goal is to involve both vehicle manufacturers and fuel producers to achieve a 200 mmT CO_2 reduction, both must be held accountable for the full amount of the 200mmT. This would not be an enforceable system, as it would not be possible to allocate shortfalls between the vehicle manufactures and fuel producers.

5. Incorporating Vehicles into a Carbon Trading Program

A single example is discussed in this section to help illustrate the difficulty in incorporating vehicles into an overall carbon trading program. The example is drawn from the U.S. Climate Stewardship Act

FINAL

DRAFT – 01/16/06 of 2003 (U.S. Senate, 2003). Jonathan Hughes, who is conducting research on vehicle trading schemes for the UC Davis Institute of Transportation Studies, suggested the fuel economy credit conversion methodology presented in the sidebar (Hughes, 2005).

Hybrid Upstream Emissions Trading System

An upstream trading system for transportation was proposed in the McCain-Lieberman Climate Stewardship Act of 2003 and is currently under discussion by the California Climate Action Team in the State of California. These systems have the benefit of administrative simplicity due to the relatively small number of firms that would be regulated and a high potential for environmental effectiveness due to broad coverage, certainty and enforceability. However, incentives to reduce fuel consumption via the indirect mechanism of price signals are less than those for systems specifically targeting VMT reduction or fuel economy improvements. In order to promote improvements in vehicle fuel economy, a pure upstream system could be modified to incorporate vehicle manufacturers. As an example, the Climate Stewardship Act of 2003 would allow vehicle producers that more than comply with the CAFE standards to sell excess credits to a central GHG allowance market. However, the provision would require a complex accounting methodology to convert improvements in fuel economy to GHG emission allowances. In order to avoid double counting and estimation issues, allocations of allowances to vehicle manufacturers for improved vehicles would need to occur annually over the vehicle lifetime. In addition, such a system must reduce the annual allocation of emission allowances to the allowance market and to fuel producers by an amount equivalent to the annual amount awarded to auto makers in order to avoid double counting of emissions reductions.

The advantage of this system is better accounting and control of the emission reductions. Instead of allocating the entire credit to the manufacturer when the vehicle is produced, it would allocate credits annually over the vehicle lifetimes as the carbon savings occur. The annual allocation to fuel producers would be reduced by the annual

amount awarded to vehicle manufacturers. This would ensure that emission reductions would not be double counted.

This is the best approach proposed to date for a hybrid upstream/downstream vehicle program. Nonetheless, there is still an issue with allocation between vehicle manufacturer and oil producers, although there is no longer a possibility of double-counting credits. The allocation is done annually, which means scrappage rates, VMT by vehicle age, in-use fuel economy shortfall, and fuel carbon content must be calculated for each model year. If the estimates are not accurate, it will benefit one of the parties and make it harder for the other. Also, changes in these variables will affect the allocations to vehicle manufacturers and fuel producers, changing the cost of complying with trading requirements.

Allocating credits annually substantially reduces the incentive for vehicle manufacturers to participate. Manufacturers will have to utilize engineering resources and spend capital up front to implement efficiency improvements, but the credits will be allocated over the 25 to 30 year vehicle life. While this is also true for other sectors, especially the electric sector, vehicle manufacturers are unique in that they do not capture the savings from the future reduction in fuel use and they would not be required to participate in carbon trading. Further, the amount of the future credits would be uncertain, as they depend on assumptions about future lifetime VMT and fuel carbon content which are likely to be inaccurate. Thus, there would likely be little motivation for vehicle manufacturers to significantly improve vehicle efficiency.

Another problem is that offering an alternative fueled or flexible fueled vehicle does not do any good if the fuel is not available. On the other hand, offering alternative fuels does not do any good if vehicles are not available. Both are needed to move the market towards lower carbon fuels. The system does not address this problem.

Finally, the system does not reduce overall carbon emissions. Oil producer allocations are reduced, but this is offset by allocations to the vehicle manufacturers. In sum, the total number of allocations does not change. This is also true if the vehicle credits are given to vehicle manufacturers when the vehicles are sold, instead of when the fuel is used. Allowable CO_2 emissions will increase in the baseline year when the vehicle manufacturers are allowed to sell CAFE credits into the system, as the reductions in vehicle CO_2 only occurs in the future. Then, in the future, overall CO_2 allowances are reduced corresponding to the reduced CO_2 allocation to fuel producers. In sum, over the vehicle lifetime, the initial increase in credits and the future reductions in allocations will exactly offset each other, assuming all the factors were estimated correctly. There is no net decrease in CO_2 emissions.

One argument in support of a hybrid vehicle trading system is that, even if it doesn't reduce overall carbon emissions, it could help to reduce the overall cost by encouraging fuel efficiency technology. However, this system has no explicit mechanism to minimize GHG reduction costs in transportation by selecting between fuel and vehicle technologies that offer lower marginal costs. It just requires that any improvements made by vehicle

manufacturers be subtracted from future fuel producer allocations. The cost control is entirely on the side of the vehicle manufacturers.

Another argument in support of a hybrid vehicle trading system is that there are other benefits to reducing oil consumption, such as energy security, trade deficits, and the effect of oil price shocks on the economy. However, creating a very complex trading system, with no mandatory participation by vehicle manufacturers, is unlikely to be the optimum solution.

6. Conclusions

Previous studies have identified most of the problems with trying to incorporate vehicles into carbon trading programs, but none are comprehensive. The 2003 study by the Pew Center, for example, simply presented the advantages and disadvantages of all the different options. The CCAP study in 2000 was based primarily upon arguments that there were other reasons for improving vehicle efficiency than just carbon emissions. Neither study tried to solve the problems from integrating vehicle manufacturers into overall carbon trading program, which are overwhelming. Some of the key problems are outlined below.

Double counting must be avoided. This is not a problem if only fuel producers or vehicle manufacturers are included in a trading program. Vehicle manufacturers have little impact on VMT and fuel producers have little impact on vehicle technology, so it is desirable to include both. Systems that provide allocations to vehicle manufacturers must subtract this amount from fuel producer allocations.
Currently, only vehicles with gross vehicle weight ratings less than 8,500 pounds are subject to fuel economy testing necessary for proper emission accounting. This requires that fuel producer allocations be divided between LDVs and all other transportation uses. It also raises the question as to how the other transportation uses should be handled in the trading system.

Proper allocation requires accurate estimates of vehicle scrappage rates, VMT by vehicle age, average carbon content of in-use fuel, and in-use mpg compared to test results. Except for the average carbon content in fuel, none of these factors are well understood. None of the factors can be forecasted with any accuracy.

Actions taken by vehicle manufacturers to improve efficiency do not affect current year carbon emissions, only future emissions. Other sectors are dealing with current year emissions. This time offset creates multiple problems in accounting and operation of incentives.

If allocations are given to manufacturers for the lifetime estimated emissions when the vehicle is built, it results in an artificial cycling of both carbon availability and pricing, based on vehicle turnover. This will make it difficult for other sectors to manage their allocations, especially the oil producers. This can be fixed by allocating manufacturer credits annually over the vehicle lifetimes as the carbon savings occur. However, allocating credits annually instead of when the vehicle costs are incurred substantially reduces the incentive for manufacturers to participate.

Actions taken by vehicle manufacturers affect the allocation for fuel producers and vice versa. This makes it impossible to set separate allocations for manufacturers and fuel producers. Both must be held accountable for the entire reduction in carbon emissions, but currently there is no known way to administer such a program.

Handling of alternative fueled vehicles is problematic. Vehicle manufacturers are needed to produce the vehicle and fuel producers must make the fuel available, but there is no way to split the carbon allocation between manufacturers and producers. Flexible fueled vehicles

create an additional problem, which is accounting for the amount of the alternative fuel that will actually be used.

Maybe there is a way to solve all of the problems and make a workable hybrid vehicle trading system, but 10 years of effort by many different organizations has yet to yield a good system. Different systems solve some of the problems, but the overall complexity is overwhelming.

Even if the problems could be solved, vehicles would still not reduce overall carbon emissions. To avoid double counting, the vehicle manufacturer allocations must be subtracted from the fuel producer allocations. Thus, the primary justifications for creating a hybrid vehicle trading system are to reduce the overall costs of reducing carbon emissions and to capture other benefits for reducing fuel use beyond just GHGs, such as energy security, trade deficit, and oil price shocks. Incorporation of vehicles into an overall carbon trading system is a very complex and likely unworkable way to try to capture these benefits. The sidebar offers a proposal that could avoid several of the problems identified in this chapter.

A BETTER APPROACH

The primary arguments for creating a hybrid vehicle trading system are that it could reduce the overall costs of reducing carbon emissions and there are other reasons for reducing fuel use beyond just greenhouse gases.

These same advantages could be obtained with a lot less complexity by creating a stand alone incentive program for vehicle efficiency. This would still be based on vehicle carbon-intensity incentives based on CO_2 emissions per mile. If desired, the incentives could be class based to address customer choice, safety, and inter-manufacturer equity concerns. Due to the limited number of manufacturers who control the large majority of the market, trading between manufacturers is not likely to be very successful. Thus, the system should allow manufacturers to buy and sell efficiency credits to and from the government at a fixed rate. This rate could be set based upon the going carbon trading rate plus monetization of benefits to the nation for conserving energy and reducing oil consumption.

Such a system would provide certainty on the monetary value for improving efficiency and would allocate the full value immediately, increasing the incentive for manufacturers to bring technology to the market. It would also be far simpler to administer and would keep the credits out of the overall sector carbon trading system, avoiding most of the problems with incorporating vehicles into an overall trading system.

One unavoidable problem is that the improvements in vehicle efficiency would still need to be subtracted from the fuel producers' allocation. Otherwise, oil producers would have windfall benefits from vehicle manufacturer actions. The government would need to monitor actual efficiency improvements and in-use VMT and use this data to adjust carbon caps for the fuel producers.

REFERENCES

1. DeCicco, John M., “An Oil Consumption Cap and Trading Scheme for Light Duty Vehicles”, Policy brief prepared for the American Council for an Energy-Efficient Economy, Washington D.C., April 1993

2. Hughes, Jonathan, personal communication, December 2005.

3. National Research Council, Effectiveness And Impact Of Corporate Average Fuel Economy (Cafe) Standards, National Academy Press, Washington, D.C., 2002

4. Nordhaus, Robert R. and Kyle W. Danish, “Designing a mandatory greenhouse gas reduction program for the U.S.”, Prepared for the Pew Center on Global Climate Change, May 2003

5. U.S. Energy Information Administration (EIA), Annual Energy Outlook 2005 with Projections to 2025, Report # DOE/EIA-0383, Washington, DC, January 2005

6. United States Senate, U.S. Climate Stewardship Act of 2003, S. 139. 2003.

7. Winkelman, Steve, Tim Hargrave, and Christine Vanderlan, Transportation And Domestic Greenhouse Gas Emissions Trading, Published by the Center for Clean Air Policy, April 2000

Question 2. Allocation
Submitter's Name/Affiliation: John German, American Honda Motor Co., Inc.

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

Our response addresses only allocations to vehicle manufacturers. All the normal problems with allocating versus auctioning carbon caps apply to trading with vehicle manufacturers. However, there are two additional considerations that apply to vehicles. The first is how to handle existing vehicles on the road in the carbon allocations. Who is responsible for the existing fleet of vehicles? The second issue is whether the manufacturers should be held responsible for the total lifetime carbon from their vehicles, or just the carbon intensity measured by CO2 emissions per mile resulting from the operation of their vehicles.

The total carbon approach would allocate a set amount of carbon that could be emitted from each manufacturer's fleet over its lifetime. John DeCicco suggested this approach in his paper, "An Oil Consumption Cap-and-Trading Scheme for Light Duty Vehicles".[1] The advantage of this system is that it holds manufacturers responsible for customer purchase decisions and use, creating incentives for manufacturers to reduce carbon using all of the possible levers, including technology, vehicle characteristics, lower carbon fuel, and reduced VMT.

The problem with the total carbon approach is that it holds manufacturers responsible for customer purchase decisions and use, as well as sales and market shifts. The compliance burden on manufacturers increases if their sales increase, if the market shifts to larger vehicles, or if people drive more. These variables are beyond the ability of a manufacturer to control. There are also very anticompetitive consequences. Increasing sales makes it more difficult to meet the requirements, while decreasing sales yields windfall credits without any improvement in efficiency. The net effect is to tend to freeze manufacturers into their existing market share and, to some extent, product mix. A total carbon system would be even worse than the Uniform Percentage Increase (UPI) method for CAFE standards. UPI would impose the same percentage increase on individual manufacturers' average fuel economy, which rewards technology laggards and imposes the largest requirements on companies that have already installed the most technology. The problems with UPI were discussed in a National Academy of Science report on CAFE[2] (a copy of the pertinent section is attached) Total carbon system would have the same anti-competitive effect as UPI with respect to technology, plus it would impose larger burdens on manufacturers with increasing sales and smaller burdens on manufacturers with decreasing sales.

[1] DeCicco, John M., "An Oil Consumption Cap and Trading Scheme for Light Duty Vehicles", Policy brief prepared for the American Council for an Energy-Efficient Economy, Washington D.C., April 1993
[2] National Research Council, Effectiveness And Impact Of Corporate Average Fuel Economy (CAFE) Standards, National Academy Press, Washington, D.C., 2002, pages 92-93.

Downstream trading based on the carbon intensity of vehicle driving would hold manufacturers responsible for the average CO_2 per mile of their vehicles, not the total carbon per fleet. This would be similar to combining CO_2 emissions standards with broader trading. This is equitable and provides a good lever for efficiency technology. It has little influence on VMT or the type of vehicle purchased by consumers, however, and it does not control total carbon emissions. Manufacturers can earn credits even if total carbon increases due to higher sales or increasing in-use driving. Still, despite the shortcomings, a system based on carbon intensity (e.g. CO2 per mile) is the only workable method for vehicles.

With CO2 per mile caps, whether the allowances are allocated or auctioned has no impact on the program's effectiveness. If the allowances are auctioned then each manufacturer will pay fees overall, while allocating the allowances will create much more of a revenue-neutral system. However, in each case, CO2 per mile has the same value. Thus, a given improvement in CO2 per mile will generate the same monetary value to the manufacturer, regardless of whether the allowances are allocated or auctioned.

As discussed in our response to question one, a stand-alone trading system for vehicle manufacturers is likely to be a much better solution than incorporating vehicles into an overall sector trading program. In such a program the value of CO2 per mile is fixed, which means that auctioning credits is meaningless and the allowances must be allocated.

Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards (2002)
http://www.nap.edu/openbook/0309076013/html/R1.html, copyright 2002, 2001 The National Academy of Sciences, all rights reserved

Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards

Committee on the Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards

Board on Energy and Environmental Systems
Division on Engineering and Physical Sciences

Transportation Research Board

National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C.

NATIONAL ACADEMY PRESS 2101 Constitution Avenue, N.W. Washington, DC 20418

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report and the study on which it is based were supported by Grant No. DTNH22-00-G-02307. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

Library of Congress Control Number: 2001097714
International Standard Book Number: 0-309-07601-3

Available in limited supply from:

Board on Energy and Environmental Systems
National Research Council
2101 Constitution Avenue, N.W.
HA-270
Washington, DC 20418
202-334-3344

Additional copies are available for sale from:

National Academy Press
2101 Constitution Avenue, N.W.
Box 285
Washington, DC 20055
800-624-6242 or 202-334-3313
(in the Washington metropolitan area)
http://www.nap.edu

Copyright 2002 by the National Academy of Sciences. All rights reserved.

Printed in the United States of America

Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards (2002)
http://www.nap.edu/openbook/0309076013/html/92.html, copyright 2002, 2001 The National Academy of Sciences, all rights reserved

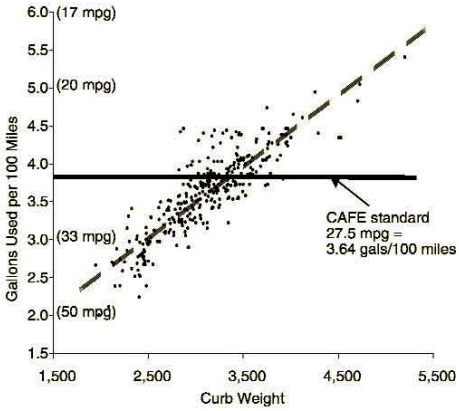


FIGURE 5-1 The operation of the current CAFE standards: passengers cars, gasoline engines only, 1999.

consideration should be given to developing a new system of fuel economy targets that responds to differences in vehicle attributes. For example, the standards might be based on some vehicle attribute such as weight, size, or load. If such attribute-based targets were adopted, a manufacturer would still be allowed to average across all its new vehicle sales. But each manufacturer would have a different target, one that depended upon the average size of the criterion attribute, given the mix of vehicles it sold.[23]

A tradable fuel economy credits system, as described above, could be implemented in combination with the attribute-based targets. The choice of method for setting vehicle economy targets could be separate from choice of incentives to meet targets.

In the current fleet, size, weight, and load-carrying capacity are highly correlated: large cars tend to be heavier, to have room for more people, and to have more trunk capacity than small cars. Choice of a particular attribute as the basis for CAFE measurement will result in incentives for engineers to design vehicles with new combinations of the attributes and to respond to incentives by further varying that particular attribute.

An attribute-based system might use vehicle weight as the criterion. The dashed, upward sloping line in Figure 5-1 shows the average relationship between vehicle weight and fuel consumption. A weight-based CAFE system would use that upward sloping line as its target rather than the current horizontal line.[24]

While a weight-based CAFE system has a number of attractive features, it also has one major disadvantage: It removes incentives to reduce vehicle weight. Judging by recent weight and profit trends, it seems likely the result would be an increase in the proportion of very large vehicles, which could cause safety problems as the variance in weight among vehicles increased. It could also cause an increase in fleetwide fuel consumption. (These issues are discussed at more length in Attachment 5A.)

Figure 5-2 illustrates an alternative that combines most of the desirable features of the current CAFE standards and the weight-based standard. The target for vehicles lighter than a particular weight (here, 3,500 lb) would be proportional to their weight (e.g., the dashed line in Figure 5-1). But to safeguard against weight increases in heavier vehicles, the target line turns horizontal. Cars heavier than this weight would be required to meet a target that is independent of their weight. (The details of positioning the lines are discussed in Attachment 5A).

These targets provide a strong incentive for manufacturers to decrease the weight of heavier cars—and even a small incentive to increase the weight of the lightest cars. The safety data suggest that the combined effect would be to enhance traffic safety. Accordingly, the committee has named it the Enhanced-CAFE standard (E-CAFE). The Enhanced-CAFE standard may be calibrated separately for cars and for trucks, or it is possible to create a single standard that applies to both types of vehicles, thereby removing the kinds of manipulation possible under the current dual classification system.

The committee views the Enhanced-CAFE system as a serious alternative to the current CAFE system. It holds real promise for alleviating many of the problems with the current regulations. Attachment 5A presents a full description and analysis.

Uniform Percentage Increases

Another possible change would be to require each manufacturer to improve its own CAFE average by some target, say 10 percent; this is often referred to as the uniform percentage increase (UPI) standard. Thus, a manufacturer that was now right at the 27.5 mpg CAFE standard would have to improve its performance to 30.25 mpg. A manufacturer that

[23]The manufacturer could average actual gallons per mile and compare that average with the average of target gallons per mile. Alternatively, the manufacturer could average deviations, plus and minus, between actual gallons per mile and target gallons per mile. Whether averaging is done first and deviation calculated second or deviations are calculated first and averaging is done second is mathematically irrelevant.

[24]These possible weight-based targets do not begin to exhaust the possibilities. Many alternative weight-based targets could be designed, or the targets could be based on load-carrying capacity, interior volume, exterior volume, other utility-related attributes, or a combination of these variables (e.g., weight and cargo capacity). The committee did not try to identify and analyze all such possibilities—that would have been well beyond the scope of this study.

Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards (2002)
http://www.nap.edu/openbook/0309076013/html/93.html, copyright 2002, 2001 The National Academy of Sciences, all rights reserved

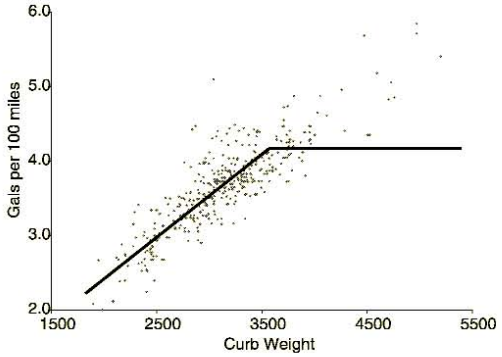


FIGURE 5-2 Fuel economy targets under the Enhanced-CAFE system: cars with gasoline engines, 1999.

was exceeding the current standard at, say, 33 mpg would have to improve its performance to 36.3 mpg.

The UPI system would impose higher burdens on those manufacturers who had already done the most to help reduce energy consumption. The peer-reviewed literature on environmental economics has consistently opposed this form of regulation: It is generally the most costly way to meet an environmental standard; it locks manufacturers into their relative positions, thus inhibiting competition; it rewards those who have been slow to comply with regulations; it punishes those who have done the most to help the environment; and it seems to convey a moral lesson that it is better to lag than to lead.

In addition to fairness issues, the change would not eliminate the problems of the current CAFE system but would create new ones. Implementation of such rules provides strong incentives for manufacturers to not exceed regulatory standards for fear that improvements will lead to tighter regulations. Thus, such rules tend to create beliefs counterproductive for longer-term goals.

Adopt Energy Demand-Reduction Policies

Several alternatives would be aimed more broadly at reducing total gasoline consumption or at reducing all fossil fuel consumption, not simply at reducing the per-mile gasoline consumption of new vehicles. Alternatives include gasoline taxes, carbon taxes, and a carbon cap-and-trade system. Either gasoline taxes or carbon trading/taxes might be part of a comprehensive national energy policy. If these more broadly based policies were implemented, policies aimed directly at fuel economy of new cars might be used along with the broadly based policies, or they could be used in place of one another.

The committee did not devote much time to discussing carbon trading, carbon taxes, and fuel taxes. This does not imply that it considers these options to be ineffective or inappropriate. In fact, such policies could have a much larger short-term and mid-term effect on fuel consumption and greenhouse gas emissions than any of the other policies discussed in this report. The committee did not address these policies comprehensively because they were not part of its charge; instead, it presents here a basic, though incomplete, discussion of these options.

Gasoline Taxes

One alternative, addressed directly at gasoline use, would be an increase in the federal excise tax on gasoline from its current level of $0.184/gal.[25] Every $0.10/gal increase in the gasoline tax would increase the price of gasoline by almost as much.[26]

Increasing the gasoline tax would encourage consumers to drive more efficient vehicles. This would indirectly provide incentives to the manufacturers to increase the fuel efficiency of their vehicles. In addition, a gasoline tax would have an immediate broad impact on gasoline consumption: It would encourage consumers not only to buy more efficient new vehicles but also to drive all vehicles less. If the policy goal is to reduce gasoline consumption and the environmental and oil market impacts of gasoline consumption, then a gasoline tax increase would broadly respond to that goal.

Gasoline taxes, however, have faced significant opposition. Critics point out that gasoline taxes fall particularly hard on rural families and those in more remote locations, where long-distance driving is a normal part of life. It is often asserted that gasoline taxes are regressive and impact the lowest income families the most, even though urban poor and wealthy people typically spend a smaller portion of their income on gasoline than do middle-class families. If the federal gasoline tax were increased, Congress could make the tax revenue neutral or could take other measures to ensure that the change would not cause undue harm.

Carbon Taxes/Carbon Cap-and-Trade Systems

To address problems of global greenhouse gas release, the United States could (1) impose a carbon tax or (2) adopt a carbon cap-and-trade system, under which the total annual emissions of carbon dioxide would be capped or limited to some policy-determined level.

In a system of carbon taxes, each fossil fuel would be

[25]In addition, state excise taxes average $0.20/gal, according to the Energy Information Administration (2000).

[26]The price of gasoline would increase by slightly less than the increase in the gasoline tax because the imposition of the tax would reduce oil demand, which in turn would reduce crude oil price and would reduce the per-gallon earnings of refiners and marketers. However, the price and earnings reductions would be small.

Published in the Proceedings of the Global Warming and Energy Policy Conference, Fort Lauderdale, B. N. Kursunoglu, S. L. Mintz and A. Perlmutter eds. (2000).

FREE-MARKET APPROACHES TO CONTROLLING CARBON DIOXIDE EMISSIONS TO THE ATMOSPHERE

A discussion of the scientific basis

Klaus S. Lackner, Richard Wilson and Hans-Joachim Ziock*

1. Introduction

Human activities are changing the Earth on a global scale affecting virtually every region and every ecosystem [1]. Not all changes have been intentional or for the better. A case in point is the emission of greenhouse gases. There is a growing consensus that the accumulation of greenhouse gases in the atmosphere needs to be curtailed since it has the potential of substantially changing the climate [2]. The dominant greenhouse gas is carbon dioxide (CO_2) generated in the combustion of fossil fuels [3].

Here, we present a trading framework for controlling the introduction of excess carbon into the environment. Trading would limit net carbon influx into the surface pool, which includes the atmosphere, the biosphere and the top layers of the oceans. All these reservoirs are severely strained by the magnitude of the fossil carbon influx. Our goal is to trade introduction of carbon into the surface pool (emission) against carbon removal from the surface pool (sequestration) and gradually achieve a net zero carbon economy. We will discuss the scientific logic on which such trading could be based and the various implications of such a scheme.

At present, there is a lack of political and economic mechanisms to encourage the reduction of greenhouse gas emissions. Consequently emissions keep growing, but with appropriate incentives in place it appears technologically feasible to manage the carbon flux on earth so that carbon would not accumulate in places where it could cause harm.

Preventing the accumulation of CO_2 in the atmosphere is a major challenge to 21st century societies. It requires carbon management strategies that reduce overall carbon consumption, collect carbon from fossil fuel processing power plants, or remove carbon from the atmosphere. In addition to technical solutions, market incentives must be found that provide for cost-effective implementations of these solutions. The realization that fossil energy is readily available and far from running out, together with the observation

* K.S.Lackner and H.-J. Ziock, Los Alamos National Laboratory; R. Wilson, Harvard University.

that fossil energy technology is well developed and cost-effective provides a powerful incentive for solving this problem. [4, 5]

We have developed a scheme of permits, certificates of sequestration, and credits that would be relatively simple to implement and would provide economic incentives for reducing the large net influx of carbon into the atmosphere or reservoirs tightly coupled to the atmosphere. Our goal is to provide the economic mechanisms necessary to achieve a net zero carbon economy.

Controlling Carbon Emissions

Stabilizing atmospheric greenhouse gas levels, as demanded by the 1992 UN Framework Convention on Climate Change from Rio de Janeiro [6], requires a nearly net zero carbon economy. To a good approximation it is the integral and not the rate of emission that causes concern. As the gradient between the atmosphere and adjacent reservoirs decays, holding the CO_2 concentration in the atmosphere constant requires larger and larger emission reductions, which will bring total allowed emissions rapidly down to 30% of what they are today. Ten billion people sharing equally into 30% of the present world CO_2 emission would have a *per capita* emission allowance of roughly 3% of the present *per capita* emission in the United States. Achieving such reductions is beyond the scope of energy conservation and energy efficiency improvements and requires drastic changes in the world's energy sector.

The amount of fossil carbon extracted over the next century is likely to be large compared to the amount that can be readily accepted by the surface reservoirs. These reservoirs, which include the atmosphere, the biosphere and the upper layers of the ocean, need to be considered together as they readily exchange carbon with each other [3]. At current rate of consumption, the emissions of the next century would equal the entire biomass, nearly half of all soil carbon and more than half the amount of CO_2 required to lower the ocean pH everywhere by 0.3.* If the last century is any guide, total carbon consumption could easily be 4 to 5 times larger than the 600 Gt C assumed in this comparison.

Simply prohibiting the use of fossil fuel would not be practical. The world economy depends on it. At present, 85% of all commercial energy is derived from fossil fuels, which are by far the cheapest and most abundant energy resource available. Coal in particular is likely to last for centuries. Estimates indicate a total availability of fossil carbon on the order of 8,000 Gt, roughly 85% in the form of coal [7]. To set the scale, present annual carbon consumption is 6 Gt [8]. Limits on fossil energy derive from environmental concerns not resource availability.

Outlawing emissions to the atmosphere, rather than the use of fossil fuels, might become an option that would allow the use of centralized facilities to generate carbon free energy carriers like electricity and hydrogen. This would require cost-effective means of collecting CO_2 at the source and disposing of it in a permanent and environmentally acceptable way.

* Doubling the partial pressure of CO_2 over the ocean surface would in any event cause a decrease in pH by 0.3 in ocean surface water.

Instead of collecting CO_2 at the point of generation, net zero emissions could also be achieved by collecting carbon from any of the surface reservoirs and moving it into long term storage unconnected to the readily interacting surface pools. Such an approach would allow the continued use of carbonaceous fuels for distributed and mobile energy demand. For distributed sources, and in particular vehicles, on board capture of CO_2 is impractical due to the huge infrastructure required for shipping carbon dioxide to central collection points [9]. The only other alternative would be a complete transition to electricity or hydrogen as energy carriers for distributed power applications. A transition to such energy carriers would require a very costly change in the existing infrastructure.

In managing carbon, one needs to consider CO_2 a waste product. In the US the CO_2 output is 22 t/person/year. While there may be limited uses, this amount is far too large for ready use. Avoiding carbon emissions to the air or the disposal of waste CO_2 would not come free. Technologies to approach a zero emission technology in part exist, in part are under development. There are several approaches to collecting CO_2 from concentrated sources like central power plants. Retrofitting seems to incur energy penalties between 10 and 40%, new plant designs could accommodate CO_2 collection without noticeable energy penalties [10]. Integrating CO_2 collection with the removal of other pollutants from the effluent stream may prove very cost-effective [11, 12]. Preventing heavy metals and particulates from a coal-fired power plant from entering the atmosphere may be most readily accomplished in a gasifier plant that also collects all its waste CO_2. Carbon disposal strategies that can cope with large amounts of carbon and keep it out of the surface pool include injection into underground reservoirs [13-16], and the formation of solid mineral carbonates from readily available magnesium silicates [17-19]. The costs of these approaches vary, but they are comparable to the cost of transporting CO_2 to the disposal site, and are likely to end up in the range of a few tens of dollars per ton of CO_2.

This is in stark contrast to some economic models, which consider marginal costs for carbon disposal in the range of hundreds to thousands of dollars per ton of CO_2. New technologies almost certainly will prevent such high prices. Extracting CO_2 back from the air, either through biomass production or dedicated chemical absorption processes [9], also would eliminate the inherent singularity in the marginal cost of complete collection at the source. Collecting all the carbon that is easily captured at a central plant, and making up the difference by collecting in the form of biomass (starting at $25/t of carbon dioxide without credit for energy production [20]) or from the air (roughly $15/t of carbon dioxide [21]) and disposing it by some of the methods mentioned above will lead to a marginal cost without a singularity at net zero emissions. Indeed by extracting CO_2 from the air, it would be possible to operate for some time in a negative net carbon economy. Extraction from the air would also allow the current energy and transportation infrastructure to keep operating through its intended lifetime.

One way of internalizing the cost of managing carbon is through uniformly enforced regulations. Given the nature of the problem this is at best difficult. In any case it would be inefficient, in that optimal sequestration options are not always directly linked to a specific emission. Thus, one needs to find a way of assigning a value to reducing the amount of CO_2 that accumulates in the atmosphere. This could be done either using a tax on carbon consumption or through a permit system where carbon consumption is only allowed after a permit is purchased to cover carbon use. The size of CO_2 emission

reductions achieved would be determined by the amount of the tax or the cost of a permit. At first, lower cost solutions would be applied, but these would eventually saturate. At that time, higher cost solutions and further CO_2 emission reductions would only be achieved, if the cost of the tax or permit exceeds the price of further CO_2 emission reductions.

Our approach to internalizing the cost of carbon emissions to the atmosphere is rooted in free-market principles and it has a scientific basis that considers the long-term perspective of the problem. We are concerned with the large amount of carbon that could potentially be moved into the surface pool. In this pool we include the atmosphere, the terrestrial biosphere and the upper layers of the ocean. Each of these has such rapid exchange with the atmosphere that, on a generational time scale, they need to be considered together. Exchange between these pools is largely outside of human control. Even though on average 50% of the carbon emitted to the atmosphere flows into other surface sinks, annual fluctuations can be as large as 100% [22]. As atmospheric carbon levels are stabilized one can expect the outflow into other reservoirs to diminish, as these reservoirs are finite in size and the gradient to maintain a flux gradually decreases.

Rather than attempting to affect short-term atmospheric concentrations, our goal is to develop a platform from which the world can chose the appropriate carbon balance in the surface pool and still retain access to the vast fossil carbon reserves. On long time scales, the differences between various carbon forms become less important. It does not matter whether carbon enters the atmosphere or is instead added to the larger surface pool. Our long-term outlook keeps us from distinguishing between biomass carbon and CO_2 in the air. Also the difference between methane and CO_2 as greenhouse gases becomes a minor complication as methane oxidizes to CO_2 on a short time scale.

The exact impact of accumulation of carbon in the environment is still widely debated. However, as use would grow, the discussion may be made irrelevant by the scale of the emissions. The available fossil carbon dwarfs the capacity of the surface carbon reservoirs that are in contact with the atmosphere. The carbon stored in coal deposits alone is equivalent to about 3,500 ppm of CO_2 in the atmosphere. With increasing levels of CO_2 the debate is likely to shift away from climate change to additional ecological impacts of increased carbon in the surface pool. These will not be limited to effects of atmospheric carbon dioxide but also include the ecological impact of greatly increasing biomass on land and in the ocean as well as the consequences of acidifying the oceans.

The surface carbon pool and sequestered carbon

We distinguish between surface carbon and sequestered carbon. Surface carbon is carbon in the atmosphere or carbon that can readily be exchanged with the atmosphere. Sequestered carbon, in contrast, is well insulated from the atmosphere. Underground reservoirs of carbon are sequestered, so is the carbon in mineral carbonates like limestones and dolomites. Man-made carbonates because of their permanence should also be considered sequestered. Similarly methane hydrates on land or under the ocean are securely sequestered. At what depth in the ocean one can consider organic materials

sequestered is likely to be controversial. The distinction ultimately rests on the residence time.

Rather than focusing the debate on greenhouse gas emissions, we submit that in the course of fossil energy consumption sequestered carbon, i.e. fossil fuels, are transformed into surface carbon. On a fifty-year time scale, it is not important whether the carbon enters the surface pool as CO_2, methane or elemental carbon. The ease by which these reservoirs are transformed into each other makes this distinction only of short-term value.

As an example, consider the issue of methane emissions to the atmosphere. Methane is a far more potent greenhouse gas than CO_2 contributing on a molar basis 25 times as much as CO_2 to the greenhouse effect [23]. However, the life time of methane in air is about a decade [22 , 24]. As methane is oxidized to CO_2 it leaves behind little more than the long-term problem of increased carbon dioxide levels. This is typically acknowledged by using a time weighted potency factor, which is about 15 for a fifty year time horizon [22]. If, however, one desires to prevent the greenhouse effect from exceeding some threshold that may be reached in 50 years from now, then the fact that carbon today enters the atmosphere as methane rather than CO_2 is immaterial. If methane alone were the cause of global climate change, curtailing methane emissions would solve the problem in a decade or two. Methane levels are related to methane emissions on a decadal scale not to the integral of the emission. Unless methane emissions grow dramatically, their relative importance as compared to the integral of emitted CO_2 will further diminish. Methane's short lifetime makes a qualitative difference.

One may consider specific reduction targets for long-lived potent greenhouse gases, but one should keep this effort separate from the management of carbon, which is a major player in the long-term greenhouse gas balance, but also introduces other environmental issues that need to be controlled.

The size of the interchangeable surface carbon pool is 42,000 Gt C if one considers the ocean part of this pool. The flexibility or absorption capacity of this pool is far smaller. Allowing doubling in each reservoir but the ocean where we chose an arbitrary limit in acidity, i.e. doubling the H^+ concentration, we are limited to about 3,300 Gt. We consider doubling of environmentally important parameters neither desirable, nor without environmental effect. Yet to hold change below this threshold may be difficult. Rational limits that adequately protect the environment are likely far smaller. Yet 3,300 Gt C is not out of the realm of possible emissions for the coming century.

Our approach to managing the surface carbon budget justifies a permitting approach that is far upstream in the carbon production process and thus is particularly simple. The primary act that requires a permit is the introduction of carbon into the surface carbon pool. Other approaches also consider this point for matter of convenience and practicality, but in our way of looking at it, the most expedient is also the most rational.

The Carbon Board

A governmental body, the Carbon Board, would be given the task of issuing carbon permits. A permit is a document that allows the introduction of a specified mass of carbon into the surface carbon pool. A permit is used once and becomes invalid the

moment the associated carbon has entered the surface pool. The Carbon Board should have some discretion in issuing permits and may consider several goals in its permit allocations. The first target would naturally be limiting current CO_2 *emissions*. The second target may be aimed at a desired overall CO_2 *concentration* or *rate of change in concentration.* The desired rate of change could well be negative.[*] The Carbon Board must consider the supply of carbon permits, and the price of a carbon permit. The Carbon Board needs to assure that permits are always available and it should discourage hoarding. For this reason the board must be careful to avoid issuing an excess of carbon permits. In principle there is no need for an unused permit to expire, but managing the supply may be easier and speculative hoarding discouraged if permits expire.

If the carbon board would adjust supplies so as to keep the price of a permit constant, the permit would effectively act as a carbon tax. If on the other hand the Carbon Board would strictly set a permit supply target, permits would act more like a commodity.

The Carbon Board, like the Federal Reserve Board, would need a certain amount of independence, but at the same time it would need to be guided by general government policy. The Carbon Board would completely control the national supply of permits. On the other hand, demand for permits would change with the state of the economy, changes in energy consuming technologies, changes in the cost of alternative energy, and ultimately in the cost of CO_2 removal from the surface carbon pool. The latter would result in a carbon removal certificate. Such a certificate would replace a carbon permit and thus would limit the demand for permits.

Who needs a permit?

By charging a permit fee at the introduction of sequestered carbon into the surface pool, one minimizes the cost of the regulatory process. Rather than dealing with a myriad of points of CO_2 emission, this approach allows one to charge the fee at an early point in the process chain, where the large scales and simple accounting makes the problem much more tractable than at later stages where there are many emitters and therefore many necessary permits.

Carbon permits are required for mining and other means of extracting fossil fuels. Without international permits, oil and all other fossil fuel imports would require permits when they enter the country.[†] The oxidation state of the carbon does not matter. Extraction of CO_2 from the ground would require the same carbon permit per mole of carbon as coal. The same is true for CO_2 that leaks from a CO_2 disposal site. The incidental release of methane from a coalmine would need a permit, as would the venting of CO_2 that is stripped from natural gas. Certainly, the flaring of methane at remote sites would require a permit. All the large and easy to measure carbon fluxes should be incorporated by this scheme. Small nuisance emissions could be ignored, as they would raise accounting costs without correspondingly large benefits. One should also note that in issuing permits, one can allow for a multiplier relative to the actual transfers, which

[*] To achieve a negative rate of change would require certificates of sequestration in addition to permits. These certificates will be discussed below.

[†] A potentially contentious issue may be the treatment of indirect carbon imports through finished goods.

would allow one to effectively take into account these small nuisance emissions without permitting them separately.

Exempt from permitting are natural transitions from the sequestered reservoir into the surface pool, *e.g.* in volcanic exhalations, natural oil seeps, *etc*. Presumably these natural events are already in equilibrium with counteracting transitions, like natural rock weathering, which, of course, does not generate a certificate of sequestration.

Once introduced into the surface carbon pool, the downstream fate of the carbon does not require any tracking or further permitting. The use of carbon that originated in the surface pool does not require a permit at any stage in the process. For example, the burning of biomass would not require a permit. Combustion of gasoline, regardless of its origin does not require a permit. Extraction required a permit and once the fossil fuel has entered the economy, it, or any of its derivatives, are part of the surface pool and thus do not need to be re-permitted. Losses of carbon, for example from natural gas pipelines, do not require additional permits, even though pipeline leakage may be subject to other regulations.

A permitting scheme based on these simple principles directly interacts with the economy at a small number of points. The cost of the permit would of course be felt throughout the economy. Nearly all activities that require permitting are already subject to careful accounting and thus the permit accounting would not introduce major burdens into the economy. For example the amount of coal that enters the economy is well known and can already be audited. Today, only incidental releases are not yet subject to careful accounting.

Certificates of Carbon Removal

A certificate of carbon removal would be issued for removing carbon from the surface pool and returning it to the sequestered carbon pool. In contrast to the carbon permit, which would always be required when carbon enters the surface pool, a certificate would only be issued if it is applied for, if the transfer can be proven, and if it follows a certified method. A certificate of carbon removal can replace a permit when carbon is introduced into the surface pool. Since certificates of carbon removal are issued for "permanent" disposal, there is no need to limit the lifetime of a certificate. However, it loses its value once it has been applied against a specific carbon emission. The Carbon Board would be responsible for certifying methods of carbon removal as an acceptable means of acquiring certificates. For a method to be certified, it must demonstrably remove carbon from the surface pool and put it back into the sequestered pool. It must do more than what would occur naturally and it must be possible to quantify the additional carbon removed. At the very least, the method must provide a verifiable and reliable lower limit on the carbon removed. Certificates can only be obtained for demonstrated long-term carbon removal. The cost of issuing a certificate of sequestration would have to be born by the applicant.

Instead of moving carbon into the naturally sequestered carbon pool, carbon could be moved into a certified temporary carbon pool. This approach recognizes that not all carbon pools are equally volatile and that carbon remaining in a well-defined location for all practical purposes may be considered sequestered. For a location to be declared as a

certified sequestration site, it must be shown that its net carbon flux can be accurately monitored. Once an area is certified and thus subject to carbon management, a net influx of carbon leads to the issuance of carbon removal certificates, whereas a net carbon out-flux would necessitate the purchase of additional permits. Accounting may occur, for example, on an annual basis. Given that the cost of permits would be likely to rise with time as the earliest and cheapest CO_2 disposal methods would be adopted first, the responsibility concerning future leakage would strongly discourage questionable short-term solutions. However, financial instruments could be designed to make use of manifestly temporary storage. Rather than introducing a different form of certificate, a temporary method could lead to the immediate issuance of a certificate, followed by a scheduled purchase of permits that over the life of the storage cancels out the initial certificate. The entire transaction could be packaged into a single instrument that not only deals upfront with the re-emission of carbon, but also with the uncertainties of future prices of permits and certificates of carbon removal. Such instruments, although novel, would certainly fall within the scope of present day financial instruments for hedging future risks.

An important consideration for a certified element of the sequestration pool is that its initial baseline carbon content needs to be clearly established. Equally important is that its natural stable carbon content could be reasonably estimated, if at some future date one were to move this reservoir back into the unaccounted surface pool. There needs to be an imputed carbon level for areas leaving the sequestration pool. For example, if one attempts to make grassland a certified element of the sequestration pool by actively farming it to increase the carbon stored as rootmass, credit for artificially high carbon levels in the ground must be returned if the area should be taken out of the sequestered pool. Once the land is not actively maintained, the expectation is that it will revert back to a lower carbon content. The Carbon Board in developing guidelines must assure that the system does not encourage undesirable behaviors like depleting a field of carbon prior to declaring it a certified carbon pool. Simiarly the Board must guard against a ratcheting effect when a reservoir is repeatedly declared a certified carbon pool when it is low in carbon and taken out again when it is high in carbon.

How are carbon permits issued?

There are a number of options to bring permits into circulation, each with its own distinct set of advantages and disadvantages. One we do ***not*** favor would follow the example set by sulfur dioxide emission trading. In that scheme, allowances were assigned to current polluters who could then sell off excess allowances. This resulted in a playing field that was very skewed in favor of entrenched interests. Instead we propose that every party, large or small, new or old, must purchase permits for all carbon it transfers into the surface pool.

The details of the implementation are important. Our approach, although we consider it fairer than the scheme used for sulfur permits, raises the overall cost of carbon, whereas an approach analogous to the sulfur dioxide implementation attempts to limit the cost impact to the margin, where application of technology can make a difference. However, once certificates instead of permits dominate the market, the

incremental CO_2 mitigation cost would become the same for both approaches. The advantage of one approach over the other is the time and cost involved in reaching the final state and the perception of fairness, which may be vital to the acceptability of the scheme. Ideally, the money collected for permits would be spent in reducing the cost of CO_2 mitigation efforts. The proceeds could be used to develop vigorous research and development efforts into carbon sequestration, verification and quantification of carbon sequestration and in the development of monitoring systems.

However, it is hard to prescribe such behavior. As a result the approach resembles a carbon tax. It is very important to strive for an implementation that is revenue neutral. Economic modeling by Jorgensen and collaborators and by Manne and Richels suggests that a simple carbon tax (or similarly a permitting scheme) would be deflating to the economy, whereas if it were made revenue neutral by a rebate of another tax it would be stimulating. This suggests a comparable tax reduction, preferably in an energy related field.

Figure 1 makes the points shown above. Curve *A* represents the marginal cost of avoiding a unit of carbon transfer. At the current transfer rate, the unit cost is zero, reflecting the fact that there is currently no financial gain associated with avoiding the introduction of carbon into the surface pool. A permit scheme is then invoked to fix the net amount of carbon that can be introduced into the surface pool. The amount is given by line *C*, the price of a permit is given by line *D*. If one fixes the number of permits, the price of a permit would adjust itself to match the marginal cost of a unit of carbon mitigation. This occurs at the intersection of lines *D* and *C* and curve *A*. *D* represents the marginal unit cost of carbon mitigation. Similarly if one were to hold the price of the permit constant, the number of permits would need to be adjusted so that *C* meets *D* on the curve *A*. At that point, one has reduced the net carbon transfer to the value given by line *C*. Note that the abscissa indicates net carbon introduction into the surface pool and thus does not include carbon that has already been compensated for by some form of sequestration resulting in certificates of sequestration. The integral under the curve *A* between lines *B* and *C*, and denoted by the dark area, is the actual cost to achieve the given reduction of net carbon transfer. The reduction could be achieved by various means including certified sequestration, reduction in consumption, increased energy efficiency and increased energy conservation. Market forces would optimize between the different approaches. The lightly shaded area represents the total revenue from carbon permits. The cost of mitigation and the cost of permits are not in any fixed relationship. At net zero carbon transfer no permits are issued and all carbon is handled

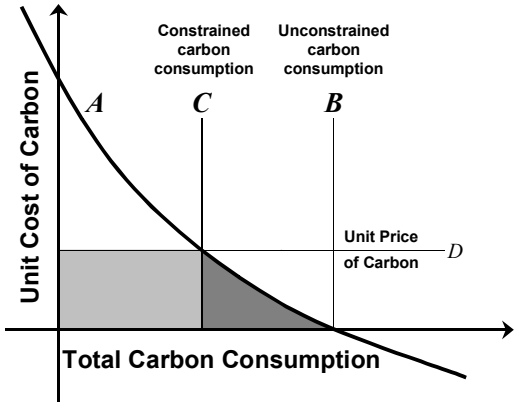


Figure 1: Sketch of unit cost of carbon mitigation, permit prices and amount of carbon reduction. See text for details.

through certificates. However, for small reductions in net global carbon emissions, the revenues collected from the sale of permits would far exceed the money actually needed to reach the level of carbon mitigation achieved.

The way in which the permit system might operate over a period of time can be illustrated by an example. In the first year, permits would be issued for 100% of anticipated demand so that all players would get used to the scheme. In subsequent years, the number of permits would be successively reduced. Further pressure for permit cost increases would result from the trend of continual increases in energy demand. At first the effect would be in promoting efficient use and fuel switching because these are the cheapest technical options. As permits and the work needed to reduce CO_2 emissions become progressively more expensive, sequestration options and alternative forms of energy would begin to be cost effective.

The advantage of bringing the system in slowly is that the market place would have time to adjust. Bringing the system in quickly is likely to be far more expensive. By assigning a large fraction of permits without charge, this cost would be avoided, but it would introduce the questions of who should get these free permits and why.

While a permit scheme controls the supply of net carbon transfers, a tax controls their cost. Rather than controlling the location of the vertical line *C* in Fig. 1, taxes fix the horizontal line *D*. The relationship between fixing the number of permits and levying a carbon tax is akin to that of a free market versus price controls. Based on past experience with price controls, we surmise that under most circumstances the permit system is economically more efficient. It introduces a price response to technological improvements that is lacking in a tax system thereby naturally moving to the lowest cost solution.

Figure 1 would clearly change with time. Increases in carbon consumption would push the crossing of the horizontal axis by curve *A* farther to the right. Advances in technology that increase efficiency would have the opposite effect. Advances that reduce the cost of CO_2 disposal would tend to flatten curve *A*. Once a permit system is put in place and the number of permits issued is reduced with time, line *C* would continually move to the left, unless increasing world demand for carbon pushes it back to the right. The increasing energy demand would at the same time tend to steepen curve *A*. The market would be dynamic and it would be the responsibility of the Carbon Board to ensure that line *C* approaches the vertical axis with time.

The presence of a Carbon Board that can adjust the number of permits to achieve various goals makes the system even more flexible. A Carbon Board that simply fixes the available permits creates a free market with a supply-limited commodity. A Carbon Board that always adjusts the number of permits to hold their price constant has effectively implemented a carbon tax. Other more complex strategies provide intermediate solutions. One possible and appealing approach would be to have the Carbon Board take into consideration the gradual reduction of energy cost that can be expected in a deregulated market.[*] The price of permits could be adjusted so as to keep overall energy prices constant balancing out reductions in energy prices resulting from

[*] Notwitstanding the teething pains of the California energy market deregulation, experience elsewhere points to ultimate cost improvements due to increased efficiencies in the market.

increased efficiencies and improved technologies. This would minimize the impact on the overall economy.

Moving to an international approach

The most straightforward international implementation of the permit/certificate system would be to elevate the Carbon Board to the international level and apply the same approach. Two major obstacles render this approach unlikely even though it has some appeal.

The obstacles are the vast disparity of economic strength among countries and the likely resulting redistribution of funds between sovereign countries. At a cost of $10/t of carbon, the permit system would today collect 60 billion dollars worldwide. An International Carbon Board would have to allocate this wealth fairly among all member countries. While the US consumes about 25% of all fossil carbon, it only has 5% of the world population. One might consider different formulas for initially distributing the revenues from permits, but in the end it appears that a fair system would calculate the shares based on a *per capita* basis. However, before *per capita* income is essentially uniform worldwide, this approach would not affect everyone equally and could therefore be viewed as unfair. Alternative schemes might use a distribution formula based on land area, GDP, or even fossil fuel production. Regardless of which approach is finally adopted, real and/or perceived inequities would remain and some groups are likely to object, as they would feel treated unfairly.

Per capita distribution would be most fair in the sense that the benefit derived from energy consumption ultimately affects or should affect the well being of individuals. A similar statement can be made about the detrimental impacts resulting from fossil fuel use. As it is the individual who ultimately pays the cost of the permit, the revenue generated should be allocated on a *per capita* basis. Arguments in favor of other approaches could, however, be made. For example, one can argue that large land areas intrinsically require more energy, especially in the transportation sector, and thus countries in that category may deserve a small break. Similarly, countries with a high GDP act as locomotives for the rest and thus could get a certain break. However, these arguments appear contrived, if they are used for more than fine-tuning a formula that is essentially based on a population count.

One means of implementing a per capita revenue distribution scheme is to print certificates with a country name on each certificate. The fraction of certificates with a given country's name would be based solely on that country's population. The country in question would pay the International Carbon Board for the permits it received, but would then be free to use those permits internally or sell them on the open market. As a result, countries with a small per capita GDP would be assured of a sufficient number of permits to meet their internal needs and be protected against market pressures, which tend to drive the price of permits up on the open market. At the same time they would be able to generate revenue from the sale of their unused permits. Finally at a later date, they would receive back from the International Carbon Board the revenues they paid earlier to

receive their permits. Early on this approach would transfer money from the wealthier nations to the poorer ones, providing them with a means for economic improvement.*

A scheme that allots permit revenues on a per capita basis implies a large transfer of wealth from the developed to the developing world. In order to obtain any reduction in CO_2 emissions, the total number of permits worldwide would have to be less than those needed to satisfy current consumption demands. Countries with a small per capita GDP would end up with far more permits than they would need. These countries could in turn sell their excess permits, while countries like the US would need to purchase the vast majority of the permits they need on the international market.

To follow this line of reasoning a little further before abandoning it as impractical, we note that even though the cost of energy would rise in the developing nations, revenues from permit sales would more than compensate for this effect. On the other hand, some of the most vociferous countries like China may find themselves near the boundary where the overall effect is neutral, but as their economy grows, they would become net importers of permits. Energy savings and carbon mitigation would be implemented worldwide, in the developed countries it would reduce the need to import permits, in the developing world it would free more permits for export. The transfer of wealth could be viewed as international aid to countries who need it the most, as measured by per capita GDP or energy consumption which are closely related.

Even though this approach may have some appeal it is not very likely to be implemented, as the economic impact on the industrial nations is very large. It does however raise some interesting issues concerning the developed countries' stand in the Kyoto meeting.

Without an International Carbon Board, an international system could gradually evolve from a collection of national systems. A permit system allows countries one by one to enter into a carbon-controlled economy. One of the major concerns with carbon control of any form is that it puts the country that introduces it at an economic disadvantage. The strength of this approach is that the National Carbon Board can control the cost of a permit and thus keep the disadvantage small. Thus, it allows a country to make the first step without the risk of being left in the cold, if nobody else participates. For a relatively small price, carbon management can be implemented and the National Carbon Board can await international participation before seriously reducing the number of available permits. This we consider a major advantage of our approach.

International negotiations could lead to agreements that oblige National Carbon Boards to set certain policies. For example, the Kyoto treaty could have been couched in these terms.

Permits from a National Carbon Board are by necessity limited to the country of origin. Otherwise countries could issue excess permits to siphon money off the international market. However, an international committee that certifies and supervises sequestration on an international basis could issue international certificates of

* Some precautions must however be taken to avoid abuses. As in the case of national permits, measures must be put in place to prevent hoarding. In addition one must prevent gross inequities in internal redistribution of permit receipts. As an extreme case, consider a ruling class in a poor country directly benefiting by keeping revenues resulting from the sale of permits on the international market while withholding permits and thereby energy from the internal market. One solution may be for the International Carbon Board to sell all permits and allocate the revenues to each participating country based on its population.

sequestration that could be traded in all participating countries. This is possible since certificates are backed by physical removal of carbon from the surface pool. Certificates could even be issued for carbon sequestration undertaken in countries that do not yet use the permit scheme. The availability of international certificates would lead to the convergence of permit prices by adding downward pressure on permit prices in countries with high cost permits. By transferring certificates across international boarders, the efficiency of the process would increase.

Two countries could join into sharing their permit system by merging their carbon boards. This approach is not limited to countries with similar economies, but could work as well between countries of different economic strength. It would, however, imply a financial transfer from the stronger economy to the weaker economy. This may work in cases where an association between countries already exists and other mechanisms are currently used to transfer wealth. A country like Canada could "adopt" a partner country with low GDP. The combined per capita carbon consumption could be close to the world average and the revenue from permits could be assigned in a bilateral agreement.

Unless a joint implementation of this form occurs, it is clear that there is not much incentive for countries with a low per capita GDP to introduce permit schemes unless they feel that they want to keep their per capita carbon emissions much lower than the high GDP countries would do. Thus, the scheme as outlined does not provide any economic incentive for poor countries to reduce their carbon emissions even if it could be easily achieved. In order to provide such an incentive, we introduce the concept of a credit.

Credits

A credit differs from a sequestration certificate. It does not represent removal of carbon from the surface pool, but acknowledges the avoidance of carbon introduction in countries not yet using permits. There is no need to introduce credits in participating countries as permits adequately reward for carbon emission avoidance. As an example of an action that generates credits, consider the implementation of a power plant that is more carbon efficient than some internationally agreed standard, *e.g.* 0.25 kg of carbon per kWh. Every year, the plant would be issued credits for the power output multiplied by the excess carbon efficiency.

On the international market, credits would be used like sequestration certificates. Credit could be given for efficient fossil power plants or the introduction of non-fossil power plants. Other examples include energy efficient infrastructure or the introduction of fuel-efficient vehicles. Not every action that avoids carbon needs to be rewarded by credits, but the international community can decide whether or not it wishes to reward certain behaviors that lower world carbon emissions. In addition, countries that do not use permits could participate through international certificates of sequestration. This would allow such countries to both generate revenue from their CO_2 disposal work and to position themselves for the day when their economies are on firm enough ground to participate in the full international permit system. As economic parity with countries that are part of the existing international permit system is achieved, credits would be reduced and political pressure would increase to join the international system. One approach

would be to have the international community to take care of carbon emission related to exported goods and charge a carbon sequestration fee on goods imported from non-participating countries.

Conclusions

This paper is a report on work in progress and it is already clear that there are several items that have to be added to it to be complete. We have deliberately attempted to think the problem through *ab initio* and consequently references to early work are limited.

The present state of the art suggests that technologies for sequestration could become competitive with other means of reducing greenhouse gas emissions. Absent sequestration technologies, the desired reduction in carbon emissions is nearly unattainable. Our framework of tradable permits, certificates of sequestration and credits would allow financial markets to develop that encourage the reduction of carbon emissions. Technical approaches that are encouraged by such a scheme range from simple conservation measures, over energy efficiency and renewable energy to carbon sequestration. Carbon could be captured in centralized plants and immediately be disposed of or it could be recovered from other locations in the environment. This includes carbon capture from the atmosphere.

Recovery of carbon from the atmosphere, whether it is done with biomass or chemical means, provides the one option to leave the existing infrastructure intact and, nevertheless, to manage carbon fluxes. This may prove particularly helpful for automobiles where capture on board is virtually impossible. Methods like these could not function without certificates of sequestration.

Unlike sulfur credits, which represent a right to pollute, CO_2 certificates of sequestration provide a means for brokering between potential sinks and sources. The atmosphere's buffering capacity for the process represents years of world output and thus does not limit this process.

By shaping the market, a carbon board could pursue different strategies for managing atmospheric CO_2. It could …

(a) fix emission levels at some defined value - perhaps zero;
(b) adjust emissions and CO_2 sinks to fix atmospheric CO_2 *concentration;*.
(c) adjust emissions and sinks to a desired rate of change of concentrations, be they positive or negative;
(d) maintain constant energy prices and rely on improvements in technology to drive down CO_2 emissions;
(e) rapidly expand the issuance of permits if global warming does not take place, or is benign, and one does not need CO_2 sequestration and CO_2 emission limits;
(f) limit pressure on CO_2 emissions such that a country remains competitive with others in similar economic conditions.

We conclude with a possible pathway to a net carbon economy worldwide. It could begin with some of the major industrial countries, which are willing to lead, implementing national permit schemes. To avoid large scale economic distortion between countries, each participating nation would start with plenty of permits available

thus making their cost negligible. All which is accomplished in this first phase is the introduction of an accounting scheme. An expiration date on permits would discourage hoarding.

The next phase would see international negotiations encouraged by some or all of the lead countries gradually reducing the availability of permits. Anyone interested in progress can offer a small step forward and await the response of others. If others follow, the next step can be taken. In parallel, one would see the introduction of national and international certificates of sequestration and possibly the introduction of international, or bilateral credits. By working on national and international levels, one can introduce international certificates where agreement can be reached and deal with the more difficult implementations on a local level.

Follow-up agreements on the Kyoto agreement could set targets for national carbon boards to accomplish. National and international use of the funds raised could lead to technology improvements and support for countries that experience economic hardship due to the changes in the energy markets.

Hopefully, the certificates would eventually replace permits on a large scale. As one approaches a net zero carbon economy, further technological advances would start to reverse the cost structure and begin to lower the cost of certificates. Hopefully, more and more countries could reach a level of economic activity that would allow them to participate in the permit scheme. In this stage non-participation would become inconvenient to the country that does not participate, because it is in effect exporting carbon pollution which would have to be reduced by others and quite likely would be charged back to the originator.

As the system approaches a net zero carbon economy, instead of issuing permits, governments could purchase unused credits to further reduce atmospheric carbon dioxide levels. By this avenue, the world could adjust the atmospheric carbon dioxide level to whatever is considered optimal.

List of References

1. Vitousek, P.M., et al., *Human Domination of Earth's Ecosystems* 1997. **277**: p. 494-499.
2. *Climate Change 1995: The Science of Climate Change*, ed. J.T. Houghton, et al. 1996, Cambridge, United Kingdom: Cambridge University Press.
3. Falkowski, P., et al., *The Global Carbon Cycle: A Test of Our Knowledge of Earth as a System.* Science, 2000. **290**: p. 291-296.
4. Edmonds, J., J. Dooley, and J. Clarke. *Carbon Management: The Challenge*. in *Carbon Management: Implications for R&D in the Chemical Sciences*. 2001. Washington, DC: National Research Council. Chemical Sciences Roundtable.
5. Yegulalp, T.M., K.S. Lackner, and H.-J. Ziock. *A review of emerging technologies for sustainable use of coal for power generation*. in *Proceedings of the 6th symposium on (SWEMP 2000) Environmental Issues and Management of Waste in Energy and Mineral Production*. 2000. Calgary, Canada: Balkema, Rotterdam.
6. *United Nations Framework Convention on Climate Change*. 1992.

7. *1995 Energy Statistics Yearbook*. 1997, New York: United Nations.
8. *Energy Outlook 1999*. 1998, Energy Information Administration (EIA): Washington DC.
9. Lackner, K.S., H.-J. Ziock, and P. Grimes. *Carbon Dioxide Extraction from Air: Is it an Option?* in *Proceedings of the 24th International Conference on Coal Utilization & Fuel Systems*. 1999. Clearwater, Florida.
10. Herzog, H., E. Drake, and E. Adams, *CO_2 Capture, Reuse, and Storage Technologies for Mitigating Global Climate Change*. 1997, Energy Laboratory, Massachusetts Institute of Technology: Cambridge Massachusetts.
11. Ziock, H.-J. and K.S. Lackner, *Zero Emission Coal. Contribution to the 5th International Conference on Greenhouse Gas Technologies, Cairns, Australia, August 14-18, 2000*. 2000, Los Alamos National Laboratory: Los Alamos, New Mexico.
12. Feibus, H., *The Future for Coal as A Fuel For Electric Power Generation: A Technical Strategy. Presented at the NEDO Clean Coal Seminar in Hokkaido, Japan, on September 18, 1997.* 1997, Department of Energy.
13. Dunsmore, H.E., *A Geological Perspective on Global Warming and The Possibility of Carbon Dioxide Removal as Calcium Carbonate Mineral.* Energy Convers. Mgmgt, 1992. **33**(5-8): p. 565-572.
14. Hitchon, B., ed. *Aquifer Disposal of Carbon Dioxide*. 1996, Geoscience Publishing Ltd.: Sherwood Park, Alberta Canada.
15. Socolow, R. *Fuels Decarbonization and Carbon Sequestration: Report of a Workshop*. in *Fuels Decarbonatization and Carbon Sequestration*. 1997. Washington DC: Princeton University, the Center for environmental studies.
16. Parson, E.A. and D.W. Keith, *Climate Change: Fossil Fuels Without CO_2 Emissions.* Science, 1998. **282**(5391): p. 1053-1054.
17. Lackner, K.S., et al., *Carbon Dioxide Disposal in Mineral Form: Keeping Coal Competitive*. 1997, Los Alamos National Laboratory: Los Alamos, New Mexico. p. 90.
18. Goff, F. and K.S. Lackner, *Carbon Dioxide Sequestering Using Ultramafic Rocks.* Environmental Geoscience, 1998. **5**(3): p. 89-101.
19. Lackner, K.S., et al., *Carbon Dioxide Disposal in Carbonate Minerals.* Energy, 1995. **20**: p. 1153-1170.
20. Ranney, J.W. and J.H. Cushman, *Energy From Biomass*, in *The Energy Source Book*, R. Howes and A. Fainberg, Editors. 1991, American Institute of Physics: New York.
21. Lackner, K.S., P. Grimes, and H.-J. Ziock, *Carbon Dioxide Extraction from Air?* 1999, Los Alamos National Laboratory: Los Alamos, New Mexico.
22. Schimel, D., et al., *Radiative Forcing of Climate Change*, in *Climate Change 1995: The Science of Climate Change*, J.T. Houghton, et al., Editors. 1996, Cambridge University Press: Cambridge, United Kingdom. p. 65-131.
23. Rodhe, H., *A Comparison of the Contribution of Various Greenhouse Gases to the Greenhouse Effect.* Science, 1990. **248**: p. 1217-1219.
24. Dlugokencky, E.J., et al., *Continuing decline in the growth rate of the atmospheric methane burden.* Nature, 1998. **393**: p. 447-450.

Submitter's Name/Affiliation: John A. "Skip" Laitner
Contact:
Email: EconSkip@aol.com
Phone: (703) 780-6407

Provide an executive summary of your response(s). ***Do not exceed the remainder of this page.***

Despite the growing evidence on the science of climate change, there is an unfortunate but widespread belief within the policy community that any steps taken to reduce such greenhouse gas emissions will impose significant costs on the economy. However, this belief is primarily the result of reports generated by highly stylized economic models which capture few of the real world opportunities to reduce emissions in ways that can actually increase the productivity of our economy. This response is an additional topic that questions the ability of most economic models to provide a meaningful assessment of market based programs designed to address climate change.

Additional Topics –Reassessing Economic Models Evaluating Climate Policies
Submitter's Name/Affiliation: John A. "Skip" Laitner

If there is an additional topic related to the design of a mandatory market based program that you would like to address, please submit comments on this form.

Time to Reassess the Economics of Climate Change

The year 2005 may be regarded as the year in which scientific discoveries and new research confirmed the serious concerns in the science community about the emerging threat from global climate change. The findings reported last year in the many peer-reviewed journals all point to an unavoidable conclusion: The physical consequences of climate change are no longer theoretical; they are real, they are here, and they can be quantified (Levin and Pershing 2006). The growing evidence has prompted both scientists and policymakers to rethink the link between global warming and hurricane activity, for example, and to reconsider the impact of climate change on both ecosystems and the economy. In a similar way, perhaps it is time to reexamine the costs and benefits of reducing greenhouse gas emissions that are thought to contribute to global warming and associated climate change.

Despite the growing evidence on the science of climate change, there is an unfortunate but widespread belief within the policy community that any steps taken to reduce such greenhouse gas emissions will impose significant costs on the economy. However, this belief is primarily the result of reports generated by highly stylized economic models which capture few of the real world opportunities to reduce emissions in ways that can actually increase the productivity of our economy (Laitner, et al. 2003). Indeed, the evidence suggests that over the next several decades the United States could reduce greenhouse gas emissions by perhaps 30-40 percent at a net benefit to the economy – if consumers and businesses were willing to make such decisions (Hanson and Laitner 2003). What is this evidence?

First, the majority of greenhouse emissions are in the form of energy-related carbon dioxide gases. These gases are emitted when we use fossil fuel resources including coal for electricity generation, natural gas for heating our homes and schools, and gasoline for powering our cars and trucks. Unfortunately, much of this energy is used in highly inefficient ways. The good news, however, is that there are a large number of studies which document significant opportunities to improve overall energy efficiency. The American Council for an Energy-Efficient Economy, for example, routinely evaluates a large number of efficiency improvements that can save money while effectively reducing energy-related carbon dioxide emissions (see, for example, Martin et al. 2000, Sachs et al. 2004, and Nadel et al. 2004). Many of these technologies pay for themselves in 3-5 years. Since these technologies have lifetimes of 10-15 years or more, this would be good for the economy.

Second, the measure of economic activity, what we call Gross Domestic Product, or GDP, is nothing more than adding up how much we invest in our economy, how much we spend as households, how much we import and export from foreign countries, and how much we spend on our various governmental programs. So if we choose to invest in more productive technologies

that pay for themselves within a few short years, in effect, we may be generating higher economic returns as we actually use less energy. Or, as it might be better said, we may be generating higher economic returns by using energy more efficiently (Hanson and Laitner 2004).

Unfortunately, many of my colleagues in the economics profession begin almost any analysis of climate policies with the key assumption that all investment, all labor, and all energy resources are already fully employed and efficiently allocated. By definition, this starting assumption implies an inevitable trade-off between economic growth and reduced energy use. If we are, indeed, already producing the needed goods and services in a very efficient way, then any change in the economic recipe would automatically imply an economic penalty. But is this right?

When we dig a little deeper into the assumptions, this apparently negative result seems more an artifact of modeling convenience than a reflection of the technologies now available within the marketplace. As I have already suggested, the real world evidence points to the existence of many little inefficiencies that can add up to a big opportunity for protecting the climate and enhancing economic activity. Let's review just a few of those opportunities from the U.S. perspective.

University of California economist, Stephen DeCanio, reviewed about two dozen studies different studies about economic efficiency. He found a typical 14 percent gap in the economic efficiency of all businesses based on today's technologies and management practices. An annotated database contains references to some 1500 studies which all show overall economic savings that range from 10 to 40 percent compared to existing use of capital and labor, and in some cases energy. University of Michigan professor Marc Ross and his colleagues have developed an economic model to evaluate the impact of energy efficiency improvements within industry. They generally found cost-effective opportunities to reduce energy use by 10 to 20 percent with a concomitant reduction in pollution levels that are normally associated with energy use. According to the U.S. Department of Energy (DOE), improved maintenance can lead to potential gains of 10 percent or more in industrial boiler efficiency. Many manufacturing facilities can recapture lost energy through the installation of more efficient steam equipment and processes. A typical industrial facility can realize steam savings of 20 percent by improving their steam system. According to the DOE, if steam system improvements were adopted industry-wide the benefits would be $4.0 billion in fuel cost reductions and equally large reductions in carbon dioxide emissions. In the U.S., compressed air systems account for $1.5 billion per year in energy costs. Many industries use compressed air systems as power sources for tools and equipment used for pressurizing, atomizing, agitating, and mixing applications. Optimization of these systems can provide energy efficiency improvements of 20 to 50 percent. At the same time, motor-driven equipment accounts for almost two-thirds of the electricity consumed in the U.S. industrial sector. By installing energy efficient motors and applying sound motor management techniques, a company can reduce its motor systems energy costs by as much as 18 percent. Process heating is vital to nearly all manufacturing processes, supplying the heat needed to produce basic materials and commodities. This single use of energy accounts for nearly 17 percent of all industrial energy use. Advanced technologies and operating practices offer significant opportunities to reduce energy consumption in process heating by an additional 5 to

25 percent over the next decade (with all examples in the above paragraph updated from Laitner 2002).

There are also large possible savings in our fleet of cars and trucks. If we take steps to increase the overall fuel economy of our nation's cars and trucks by just 5 miles per gallon over the next 10 years, gasoline and petroleum demand would be decreased by almost 20 percent compared to standard forecasts. Carbon dioxide emissions from petroleum usage would also be reduced by about 20 percent. Perhaps as important as the climate benefits, consumers and businesses would save between 50 and 70 billion dollars in lower fuel bills. Oil imports would be similarly reduced by an amount that is more than twice the expected production of the controversial Alaska National Wildlife Reserve (author calculations). Studies by Barrett and Hoerner (2005) and Bezdek and Wendling (2005) suggest that even greater levels of fuel economy would be cost-effective and generate net positive benefits for the economy. Moreover, these improvements in fuel economy would likely ensure a greater energy security with less volatility in world oil prices. Indeed, it is likely that more efficient use of our petroleum resources would lower the world oil price compared to standard forecasts.

Finally, what we waste in the production of electricity throughout the United States is more than Japan uses to power its entire economy. The reason? The nation's electricity system is, at best, 33 percent efficient. This is a level of inefficiency that has been unchanged since the 1960s. This means that for every kilowatt-hour (kWh) of electricity that we deliver to homes and businesses, we waste the equivalent of about 2 kWh in the generation and transmission of that electricity. If we do the math, it turns about that we lose about one-fourth of the total US consumption in the form of waste heat from electricity generation. Technologies such a combined heat and power, with efficiencies typically exceeding 70-80 percent, can substantially reduce both emissions and wasted energy dollars (Casten and Downes 2005, Bailey and Worrell 2005, and Hanson and Laitner 2005).

All of these and many other examples underscore the very large opportunity for additional energy efficiency gains that are cost-effective. In the case of the United States (and indeed, for most regions of the world), adding up and evaluating all of the many different opportunities for efficiency improvements suggests that the economy will likely expand at about the same three percent annual rate of growth that is projected by standard economic forecasts. The good news is that these efficiency improvements can support the same level of economic activity while using no more energy over the next 15 years than now used today. Carbon dioxide emissions might be expected to stay at roughly comparable levels as well. Even better, such improvements can pay for themselves through lower energy costs. The bad news is that even maintaining greenhouse gas emissions at today's level will provide only a down payment on what will have to be an even larger and more expensive reduction in those emissions. But the added flexibility of taking steps today can become a critical first step toward a more effective deployment of even more productive energy technologies in the future. That's the opportunity. The challenge is to encourage an immediate and more productive investment pattern in the first place.

References

Additional Topics –Reassessing Economic Models Evaluating Climate Policies
Submitter's Name/Affiliation: John A. "Skip" Laitner

Bailey, Owen and Worrell, Ernst, 2005. "Clean Energy Technologies: A Preliminary Inventory of the Potential for Electricity Generation," Berkeley, CA: Lawrence Berkeley National Laboratory, April.

Barrett, James, and Hoerner, Andrew, 2005. "The Impact of Increased Corporate Average Fuel Economy (CAFE) Standards on the U.S. Auto Sector," Washington, DC: Redefining Progress.

Bezdek, Roger H. and Wendling, Robert M, 2005. "Potential Long-Term Impacts of Changes in Us Vehicle Fuel Efficiency Standards." *Energy Policy*, 2005, 33, pp. 407–19.

Casten, Thomas R. and Downes, Brennan, 2005. "Critical Thinking About Energy: The Case for Decentralized Generation of Electricity," *Skeptical Inquirer*, January/February 2005, pp. 25-33.

Hanson, Donald A. and Laitner, John A. 'Skip,' 2004. "An Integrated Analysis of Policies That Increase Investments in Advanced Energy-Efficient/Low-Carbon Technologies." *Energy Economics*, 2004, 26(4), pp. 739-55.

Hanson, Donald and Laitner, John A. 'Skip,' 2005. "Tripling the Nation'S Clean Energy Technologies: A Case Study in Evaluating the Performance of Energy Policy Models," *Proceedings of the 2005 ACEEE Summer Study on Energy Efficiency in Industry*. Washington, DC: American Council for an Energy-Efficient Economy.

Laitner, John A. 'Skip', 2002. "Improving Environmental Leadership: Asking Better Questions about Existing Inefficiencies." *Corporate Environmental Strategy*, 2002, 9(4), pp. 379-82.

Laitner, John A.; DeCanio, Stephen J.; Koomey, Jonathan G. and Sanstad, Alan H., 2003. "Room for Improvement: Increasing the Value of Energy Modeling for Policy Analysis." *Utilities Policy*, 2003, 11, pp. 87-94.

Levin, Kelly and Jonathan Pershing, 2006. "Climate Science 2005: Major New Discoveries," Washington, DC: World Resources Institute.

Martin, Nathan et al., 2000. *Emerging Energy-Efficient Industrial Technologies*, Washington, DC: American Council for an Energy-Efficient Economy.

Nadel, Steven, Anna Shipley and R. Neal Elliott, 2004. "The Technical, Economic and Achievable Potential for Energy-Efficiency in the U.S. – A Meta-Analysis of Recent Studies," *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings*, Washington, DC: American Council for an Energy-Efficient Economy.

Sachs, Harvey, et al., 2004. *Emerging Energy-Saving Technologies and Practices for the Buildings Sector as of 2004*. Washington, DC: American Council for an Energy-Efficient Economy.

Additional Topics –Reassessing Economic Models Evaluating Climate Policies
Submitter's Name/Affiliation: John A. "Skip" Laitner

John A. "Skip" Laitner is a resource economist with more than 30 years of experience in studying energy and climate change, including the assessment of cost-effective technologies that can reduce both energy use and related greenhouse gas emissions. He can be reached at EconSkip@aol.com.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

A global warming cap-and-trade program will run on "emissions allowances" that are worth hundreds of billions of dollars over the life of the program. Thus, how allowances are allocated is a major public policy decision. The methodology for distributing them is one of the most important design decisions that Congress will make.

The overarching goals of the allocation methodology must be:

(i) to keep the cost of the program as low as possible for residential, commercial and industrial consumers (especially low-income consumers), by encouraging investment in end-use energy efficiency measures and by avoiding wealth transfers from consumers to upstream entities; and

(ii) to mitigate costs for firms investing in the technologies needed to significantly reduce emissions in key sectors (e.g., mainstreaming coal gasification and carbon capture in the electric sector; retooling the auto industry to produce hybrids and other low-emitting vehicles; accelerating deployment of renewables (wind, biofuels, solar).

Congress should not use allowances to compensate owners of power plants or other industrial facilities that lose market share to better performing competitors, and Congress absolutely should not use them to provide windfall profits to firms that will increase market share or profitability under a cap-and-trade program or that will pass allowance costs (beyond actual compliance costs) onto their customers, or both.

1. *The atmosphere is a public resource.*

Emissions allowances represent permission to use the atmosphere for disposal of carbon pollution. The capacity of the atmosphere to absorb carbon is extremely limited. This limited carrying capacity is not a private resource owned by historical emitters. Rather, it is quintessentially a public resource or public trust. Private entities should not have a right to dump harmful pollution in the public's atmosphere for free.

We have framed this discussion in these terms in order to focus on underlying principles, not only means of implementation. Economists generally agree that an auction is the most economically efficient allocation method.[1] A direct government auction of allowances is only one institutional method of implementing the underlying concept that the allowances are a public

[1] *See e.g.*, Terry Dinan, "Shifting the Cost Burden of a Carbon Cap-and-Trade Program," (Congressional Budget Office, July 2003); CBO, "Issues in the Design of a Cap-and-Trade Program for Carbon Emissions," (Nov. 25, 2003).

resource. Another method is to distribute allowances themselves for specifically designated public purposes according to statutorily specified criteria.[2]

2. *Using emissions allowances to promote investment in energy efficiency critical to achieving ambitious carbon reductions with the least impact on energy prices.*

Analysis and modeling conducted in connection with the northeast states' Regional Greenhouse Gas Initiative (RGGI) indicates that increasing end-use efficiency for customers is the most effective means of reducing the impact of a carbon cap on electricity rates.[3] Indeed, this analysis demonstrated that by using a portion of the allowance proceeds to promote efficiency, the states could reduce power sector carbon dioxide emissions by 10% from current levels and at the same time save average customers over $100 per year on their energy bills.[4] Reducing demand growth for electricity saves consumers money and lowers the price of allowances, as reducing total fossil generation reduces the size of the allowance price signal needed to achieve compliance with the emissions cap.

A landmark study by the American Council for an Energy Efficiency Economy demonstrated even more dramatic results in the natural gas sector – increasing energy efficiency by 5% could reduce natural gas prices by 20%.[5] Since natural gas-fired electricity generation is at the margin in many regions, increasing the efficiency of natural gas use in non-electric applications will reduce the impact of a carbon cap on both gas prices and electricity rates.

The California Air Resources Board has demonstrated the same effect in the motor vehicle sector: California's global warming standards for vehicles will provide consumers lower fuel and maintenance costs that more than offset increases in new vehicle costs. Especially if adopted more widely, the result will be to reduce gasoline prices by reducing overall gasoline demand.

3. *Using emissions allowances to promote rapid deployment of "big change" low-emitting technologies is critical to enabling future carbon reductions at reasonable cost.*

In order to prevent dangerous global warming it is essential to begin making meaningful reductions in heat-trapping pollution now and to get on a path toward reducing emissions by 50 percent or more by mid-century. Many analyses demonstrate the need for rapid deployment of

---

[2] One mechanism is the Climate Change Credit Corporation proposed in the Climate Stewardship Act. Another example is the public trustee designated to receive allowances under the proposed Clean Power Act.

[3] ICF Consulting "RGGI Electricity Sector Modeling Results, Updated Reference, RGGI Package and Sensitivities," September 21, 2005, available at http://www.rggi.org/docs/ipm_modeling_results_9_21_05.ppt; Economic Development Research Group, "Economic Impacts of RGGI Under Proposed SWG Package Scenarios," September 21, 2005 available at http://www.rggi.org/docs/remi_stakeholder_presentation_11_17_05-final.ppt#492,1,.

[4] Economic Development Research Group, "Economic Impacts of RGGI Under Proposed SWG Package Scenarios," September 21, 2005.

[5] ,Elliott, Neal R, Anna Monis Shipley, Steve Nadel and Elizabeth Brown, "Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets," American Council for an Energy Efficient Economy, September 12, 2003.

clean and low-emitting energy technologies in key sectors such as electricity and transportation, which together make up more than two-thirds of U.S. global warming emissions, in order to achieve the carbon reductions needed under a long-term declining cap at reasonable cost. Although not an exclusive list, the prime candidate "big change" technologies include coal gasification and carbon capture in the electric sector; a range of drive-train and related technologies (including hybrid gas-electric engines) in the auto industry; and renewable energy resources such as wind and solar in the electricity sector, and biomass for both electricity and transportation sectors.

But we face a serious dilemma. We need to start rapid deployment of these "big change" technologies *now* in order to hold down the long-term costs of sharply cutting U.S. emissions, yet it is generally agreed that the initial price signals from feasible cap-and-trade programs will not be sufficient alone to jump-start that deployment. The allowance distribution formula can solve this problem, by incentivizing firms to invest in rapid deployment of these key technologies.

Wherever possible these incentives should be stated in performance terms (such as emissions per megawatt/hour) and implemented through efficient mechanisms (such as a reverse-auction based on energy savings or energy production per allowance awarded or dollar invested).

It is important to note that most of the allowances distributed in this way would go without cost to the same industries that typically seek other forms of "free" allocation, but in proportion to their investments in energy efficiency and low-emitting technologies. Distributing allowances this way is far preferable, for example, to allocating allowances on the basis of historical emissions or energy usage.[6] But there is no reason to limit support for clean energy investments to incumbents only. Rather, Congress should ensure the allowance value is available to *any* firm – incumbent or new entrant – that can efficiently and effectively carry out investments in energy efficiency and clean energy technology.

We also note that under a long-term declining cap (recommended in our introductory comments and in answer to question 5), these technology incentives would have a much larger and more stable long-term source of funding than will come from the authorizations and tax incentives in the Energy Policy Act of 2005. Technology incentives under this proposal would also be larger and more stable than under the NCEP recommendations or the proposed legislation put forward by Senator Bingaman last year. Furthermore, these incentives could be accomplished without any budgetary impact.

4. *Free allocation of allowances on the basis of historical emissions, energy generation or use, or other historical factors would result in an enormous transfer of wealth from consumers to energy producers.*

[6] If granted free allowances on a historical basis – or on any basis unlinked to making these investments – there is no guarantee that the firms will use allowance value for those purposes. They may distribute the allowance value to shareholders, or invest in other ventures deemed more profitable than retooling to reduce emissions.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Economists at the Congressional Budget Office, Resources for the Future (RFF) and other institutions have determined that allocating all emissions allowances to fossil-fuel providers without cost would give those providers an asset worth seven times the cost that that sector could not pass on to mid- and downstream entities, and ultimately to energy consumers. For example, Stanford University and RFF economist Larry Goulder has shown that in an economy-wide upstream cap and trade program, it would take free allocation of only 13% of the allowances to offset the lost profits (or reduced asset values) of fossil-fuel providers, i.e., the program costs that could not be passed on.[7] Similarly, looking at a mid-stream[8] program for the electricity sector, Dallas Burtraw and colleagues have shown that it would take free allocation of only 10% of the allowances to offset lost profits or reduced asset values of electricity producers.[9] The Congressional Budget Office has reached the same conclusion.[10] In the United Kingdom, the government has determined that free allocation of allowances to electric generators has resulted in windfall profits of over $500 billion.[11] Congress should not repeat this mistake.

The claim that industries need to be compensated even for the limited costs they cannot pass on is really quite extraordinary. It is deeply rooted in our legal tradition that when someone – whether an individual or an industry – endangers public health, safety, or the environment by releasing harmful pollution, that individual or industry bears the responsibility for the costs of mitigation. Nearly all of our modern public health, safety, and environmental laws follow this principle: Complying with duly-enacted pollution control laws and regulations is part of the cost of doing business. Some of this cost can be passed on to consumers. But that portion which cannot be passed on is properly absorbed by company shareholders.

The U.S. and other developed countries have uniformly rejected claims from certain OPEC countries that they deserve compensation for lost profits if developed countries curtail their oil use to curb global warming or to enhance energy security. Why should we not take the same view regarding the compensation claims of carbon-intensive fuel providers here at home?

Notably, many of the coal-fired facilities seeking historical allocations have been enormously profitable in recent years due to high gas prices. The government is generally not in the business of ensuring corporate profitability for power plant owners. State and federal regulators do not require coal-fired power plants to return excess profits to customers when high natural gas prices or other factors increase market clearing prices and raise revenues for coal-fired plants; generators get to keep those profits. Similarly, government should not be in the business of requiring consumers to bail out generators who become less profitable under a carbon cap. Such a system would create the worst of both worlds for consumers – they would reap none of the

[7] Morgenstern et al., "The Distributional Impacts of Carbon Mitigation Policies," Issue Brief 02-03 (Resources for the Future, Feb. 2002), http://www.rff.org/Documents/RFF-IB-02-03.pdf.
[8] A program focused on electricity producers is often called a "downstream" program. But a true downstream program would apply to electricity consumers. Similarly, a true downstream program for transportation would apply to vehicle owners and operators. We prefer to refer to programs that apply to electricity producers (or oil refiners) as "midstream" programs.
[9] Morgenstern et al., *supra* note 1.
[10] *See* note 2, *supra*. .
[11] House of Commons, Environmental Audit Committee, "The International Problem of Climate Change: UK Leadership in the G8 and EU," p. 17 (Mar. 16, 2005).

benefits of a competitive market and continue to shoulder the costs of a regulated market. In a competitive world, businesses cover their up and down risks. Regulatory risks are well known, including the risk of carbon regulation, which has been on the horizon for many years.

For these reasons we do not support using allowances to compensate firms for losses in profitability or asset value under a carbon cap. However, should Congress decide to do this in order to reduce political opposition to global warming legislation, it should carefully tailor its efforts in order to avoid providing windfall profits. Based on the work of RFF, CBO, and others, any allocation to address lost profits or reduced asset values should be limited to less than 15 percent of the total number of allowances.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

As indicated in our overview response above, we support allocating at least a quarter of the allowances to stimulate rapid deployment of a suite of technologies that are essential to enabling achievement of immediate carbon emission reductions and a long-term declining carbon cap at least cost. These include key investments in energy efficiency, renewable energy, and low-carbon fossil energy production. We also support allocating a percentage of the allowances to R&D on the next generation of breakthrough technologies.

As noted above, we face a serious dilemma. We need to start rapid deployment of these "big change" technologies *now* in order to hold down the long-term costs of sharply cutting U.S. emissions, yet it is generally agreed that the initial price signals from feasible cap-and-trade programs will not be sufficient alone to jump-start that deployment.

For example, IGCC/CCS deployment requires about $2 billion/yr in investment on a levelized cost basis. A University of Michigan study for NCEP estimates that capital investments of $153 million are required for capacity to produce 200,000 hybrids per year (not including engineering costs).[12] This report shows the long-term cost savings, through job retention, of providing incentives to automotive manufacturers and suppliers to re-tool their existing plants to make in the United States hybrid and advanced diesel engines and components that would otherwise be produced offshore.

[12] "Fuel-Saving Technologies and Facility Conversion: Costs, Benefits and Incentives," Office for the Study of Automotive Transporation, University of Michigan, November 2004.

Funds on this scale for these and other technologies will not be easily found through tax incentives or appropriations. The allowance distribution formula can solve this problem, by incentivizing firms to invest in rapid deployment of these key technologies.

We propose to dedicate at least 25 percent of total allowances to incentivize technology deployment and R&D. Although not an exclusive list, the prime candidate "big change" technologies include:

- *Coal gasification and carbon capture in the electric sector*. IGCC with CCS appears to meet every test of technological feasibility. CCS is essential to maintaining a vibrant market for coal under a long-term declining cap. Large-scale implementation of IGCC/CCS in this country would open the door to its application in China and India as well – a key to sustaining development in those nations without unacceptable carbon emissions. Despite these factors, investment in IGCC/CCS is currently limited by two factors. First, many electric generators that see the attractiveness of this technology are waiting for others to undertake the first projects. Second, beyond initial applications associated with enhanced oil recovery, there is a cost differential (compared to conventional coal plants) that is unlikely to be covered by initial allowance prices.

  During this period, incentives in the form of allowance allocations can accelerate the deployment of these IGCC/CCS plants in meaningful numbers. As indicated above, these incentives should be structured as a performance standard – a low-carbon emissions standard for coal-based energy – in order to allow other potential coal-using technologies to compete with IGCC/CCS on an open basis.

- *Retooling the automobile.* A wide range of improved drive-train (including hybrid gas-electric engines) and related technologies (such as HFC-free air conditioners) are available to dramatically reduce global warming pollution from passenger vehicles and, by extension, many other segments of the transportation sector. The California Air Resources Board's global warming emission standards, for example, will reduce per-vehicle emissions by nearly 30 percent by 2016, making broader use of improved drive-train and other technologies that are already in use in some models. Achieving the California standards does not depend on hybrid gas-electric vehicles, although obviously they count towards compliance. Much greater reductions can be achieved after 2016 if hybrid or other advanced fuel efficient technologies are fully deployed across the fleet.

  Incentivizing domestic production of hybrids and other technologies would assist domestic auto companies in becoming more competitive. An allowance allocation to automakers (and suppliers) tied to the global warming emissions performance of manufacturers' fleets would help incentivize and smooth the transition to building advanced, clean technologies.

- *Renewable energy.* A third "big change" technology is renewable energy. The deployment of cellulosic biofuels has great potential as a replacement for petroleum-derived fuels. Allowance allocations could help mainstream construction of plants to convert cellulosic materials into both transportation fuels and electricity, and could help farmers accelerate the supply of cellulosic feedstocks. In addition to reducing global warming pollution, an

allowance allocation for this purpose would help achieve the president's objective of ending our oil addiction. It would also help the farm sector adjust to agricultural subsidy reforms required by our WTO commitments and our budget deficits.

Other renewable energy resources, such as wind and solar, should also be supported. While wind power is competitive in many markets wind still provides only a tiny fraction of U.S. electricity and the on-again-off-again nature of the production tax credit inhibits the large scale investment in wind that is needed for it to achieve its potential. A more stable funding incentive would markedly increase wind generation's penetration. Off-shore wind is a particularly promising technology for serving a significant share of the electricity load along the East Coast, yet there are no operating off-shore wind facilities in the United States. The global market for solar power is growing rapidly but large investments are needed in solar panel manufacturing to bring down costs to make this technology competitive in on-grid applications.

As noted above, wherever possible these incentives should be stated in performance terms (such as emissions per megawatt/hour) and implemented through efficient mechanisms (such as a reverse-auction based on energy savings or energy production per allowance awarded or dollar invested). However, there are good reasons to segregate or target certain incentives rather than to have one overall competitive pool of incentives. First, there are key areas where targeting is appropriate – for example, there is a compelling need for low-emitting means of using our coal resources. So legislation should target some of these specific areas for at least an initial period.

Institutionally, as indicated above, we support implementing these incentives partly by allocation formulas written into the statute, and partly by allocating allowances to a publicly chartered entity. The Climate Change Credit Corporation proposed under the Climate Stewardship Act is one example. The entity would allocate allowances according to specific criteria provided by statute, through a mix of performance based allocations, reverse auctions, and other means. The entity would have to have a balanced board of directors representing public voices as well as private sector voices. The entity would have to operate transparently according to rulemaking procedures. But because it would be vested with allowances by law, it would not be subject to annual appropriations.

A portion of these technology-advancement allowances – perhaps five percent of total allowances – should be dedicated to RD&D into breakthrough technologies that are not yet ready for broad deployment assistance. This amount would be sufficient to reverse the dangerous decline in RD&D budgets that has occurred over the past decade and a half. A high priority should be given to joint ventures with the private sector putting up half of the research funds. This will help assure that the research is well targeted. In order to replenish the funding for further RD&D, the statute should provide that the publicly chartered entity will receive an equal share in the patent rights for successful technologies developed with these public funds.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

We support allocating five percent of total allowances for helping communities heavily affected by climate impacts. Examples activities include (but are not limited to) Gulf Coast wetland restoration and Alaskan village relocation). Adaptation allowances also could be used to assist workers and communities that are disproportionately impacted by mitigation measures (e.g., coal-miners and coal-mining communities).

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2c:

Consumer Protections

- What portion of the overall allocation pool should be reserved to assist consumers?
- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

At least half of total allowances should be allocated for the benefit of consumers.

In response to question 2f we offer a specific proposal to assist electricity consumers by giving allowances to distribution companies with directions to use the value of those allowances to support end-use efficiency investments and as rebates to assist consumers (especially low-income consumers) adjust to energy price impacts.

The same proposal can be applied to the natural gas sector (other than gas consumed in electric power generation) by giving the allowances to regulated distribution companies with the same conditions for supporting end-use efficiency investments and consumer rebates.

In the oil sector, there is no rate-regulated distribution sector. The solution here is to allocate at least half the allowances related to oil to the public entity (e.g., the CCCC) that serves as the public's trustee, with instructions to use the value of those allowances to support consumer incentives to purchase lower-emitting vehicles, to support other emission-reducing strategies (e.g., public transportation, "smart growth" development patterns), and to assist low-income oil consumers.

Similarly, we recommend allocating at least half the allowances related to the industrial greenhouse gases (such as HFCs) to the public trustee entity with similar instructions. As an example, one opportunity would be to help pay for measures to reduce HFC leakage in key end uses, such as automobile air conditioners.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

Five percent of total allowances should be set aside to encourage emission reduction and sequestration activities by sources that are not covered by the cap, such as soil carbon sequestration by farmers and methane capture at small landfills not covered by EPA regulations. NRDC strongly supports the proposal in the White Paper to use allowances from within the programs overall emissions budget for this purpose rather than to create additional "offset" allowances based on these activities. Establishing appropriate emissions baselines for non-covered sources is an inherently uncertain exercise because it is impossible to observe the emissions that would occur from these sources in the absence of the program. Using allowances from within the cap is a good way to create incentives for beneficial activities without risking the environmental integrity of the emissions cap.

NRDC does not support providing allowances as credit for activities solely on the basis of them being reported as emission "reduction" under DOE's 1605b program. Early emission reductions are their own reward because they position firms to comply with the cap at the lowest possible cost. (This would not be true only if allowances were allocated based on historical emissions from a year after the emission reduction activity occurred. NRDC opposes such an allocation system for numerous reasons described above). Comments during the development of the 1605b program reporting guidelines explicitly argued that DOE should not require the rigorous reporting rules that would be needed for a crediting program, in order to encourage "broad participation" the program. Indeed, a careful review of the emission "reductions" reported under the 1605b program clearly shows that most of the reported activities, such as increased output at existing nuclear power plants, were business-as-usual business decisions that had nothing to do with the prospects of greenhouse gas regulations, and thus deserve no rewards now.[13]

[13] See http://www.nrdc.org/globalwarming/fmandatory.asp

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2e:

Special considerations for fossil-fuel producers?

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

See our introductory comments under Question 2 relating to claims for compensation.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2f:

Allocations for downstream electric generators?

- Should electricity generators be included in the allocation if they are not regulated? (Clarification: We mean to ask if an electric generator should be included in the allocation if the greenhouse gas regulation occurs at a point of regulation that is upstream or downstream from the generator, but not the generator itself.)
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

The decision about allowance allocations is fundamentally a distributional issue and is independent of the point of regulation. The electricity industry merits special consideration in the allocation system both because this industry is responsible for the largest share of U.S. emissions and because of the unique regulatory structures under which it operates. In order to ensure that allowances are used to reduce costs for customers and do not create windfall profits for power plant owners, it is necessary to consider the regulatory treatment of allowances in different regions.

Most of the electricity used in the United States (and an even greater portion of the global warming emissions from the electric sector) is generated by companies operating under cost-of-service regulation, although a significant portion is generated and sold into competitive markets. The allocation system needs to be both workable and equitable regardless of regulatory status, and it needs also to be structured to adapt dynamically to changes in state rate regulatory regimes (i.e., as states transition from regulated to deregulated status, or vice-versa).

Some generators subject to cost-of-service regulation are advocating allowance allocation without cost, arguing that this will hold down rates to their electricity customers. They argue that if allowances are allocated without cost, generators will not be able to reflect the allowances market value in rate increases to customers, because rate regulators will not approve increases for zero-cost allowances. But there is no guarantee that regulators will do this. The allowances still have an opportunity cost (since the generators could sell them) and disallowing pass-through may prompt the utility to make uneconomic decisions regarding whether to generate or purchase power to serve its customers. And the regulators cannot prevent the pass-through of allowance costs for power that utilities purchase from unregulated generators, or power that generators sell into competitive wholesale markets.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

In competitive electricity markets, where electricity rates are set by marginal costs, there is no question that customers would see electricity rate increases that reflect the market value of allowances, regardless of whether they were initially paid for or allocated without cost. In that case, allocation without cost leads to a windfall for the generators.

There are a number of problems with developing two sets of allocation rules based on this distinction. First, the distinction is not clean and simple. Even in cost-of-service markets, state rate regulations and practices differ in important details. As a result, regulators can be expected to vary in their treatment of freely-allocated allowances. Second, as already mentioned, state rate regulation continues to be in transition. Some states are moving towards competition; others back towards some forms of regulation. The allowance allocation formula needs to be dynamic in adjusting to these changes. Third, these markets overlap. Vertically integrated utilities that operate under cost-of-service regulation frequently buy and sell power in competitive wholesale markets.

One solution would be to allocate allowances to electricity *distribution* companies on behalf of their customers (load-serving entities), rather than generators. Under this approach, the portion of allowances that are freely allocated to the electricity sector would be allocated in proportion to some combination of the distribution company's number of customers and electricity sales using a methodology designed in a way that would not penalize utilities that have already made substantial investments in energy efficiency. The allocation should also be updated periodically in order to avoid penalizing utilities that operate in areas where the economy is growing or providing windfalls to those operating in areas of economic decline. But the updating methodology should not penalize utilities that successfully reduce demand for electricity by helping their customers improve energy efficiency.

In markets with cost-of-service regulation, the distribution company and the electricity generator are generally the same entity but, for the reasons stated above and in the discussion of windfall profits in the overview response, it makes an enormous difference if the allocation goes to the distribution company on behalf of its customers rather than to the generator on behalf of its shareholders.

Distribution companies are regulated even in markets with competitive generation. In these areas, allocating the no-cost fraction of allowances to the distribution companies instead of the generators helps protect electricity customers. The legislation should direct distribution companies to use the value of the allowances they receive to reduce the cost of the program for customers in the most cost-effective way possible, by supporting energy efficiency programs, providing additional assistance to low income customers, and returning value directly to all customers through lower distribution charges.

Allocating to distribution companies would be effective regardless of the point of regulation. For example, in an upstream system fossil fuel producers would be required to obtain allowances from distribution companies. In this case the cost of these allowances would be rolled into fuel prices, higher fuel prices would raise generation costs, but most of these increased costs would be compensated by the revenue that the distribution company obtained by selling allowances to

the fuel producers. The incentive to reduce emissions would be retained because the costs of the most carbon intensive fuels would increase the most, encouraging more efficient generation and a switch to cleaner fuels. Electricity generators should be able to earn allowances by capturing CO_2 and permanently disposing of it in geologic reservoirs.

In a midstream system electricity generators would be required to obtain allowances from distribution companies. In many cases this will be the same entity. In other cases the cost of allowances will raise the marginal cost of generation but customers will again be largely compensated by the revenue that the distribution company obtained by selling allowances to the generator. In this case the generators have a direct incentive to reduce emissions to reduce the number of allowances they need to obtain.

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2g:

Allocations for energy-intensive industries?

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

Energy-intensive electricity consumers would benefit from investments in energy efficiency by electricity distribution companies under the proposals made under 2f. Similar arrangements could be developed to support efficiency investments by intensive natural gas users. Energy intensive industries could also benefit from allowance allocations made to support big-change technologies under 2a (remembering that the list of specific technologies set forth there was not intended to be exclusive).

Question 2. Allocation
Submitter's Name/Affiliation: David Doniger, Natural Resources Defense Council

Clarifying Questions 2h:

Allocations to other industries/entities?

- What other industries/entities (e.g. agriculture, small businesses, etc.) should be considered in the allocation pool?
- What should be the basis for their share of the total allocation as well as for the distribution among such industries/entities?

Small businesses, farmers, and others would benefit as energy consumers from the proposals we have made above regarding allocations to support energy efficiency investments, and for certain rate rebates.

Submitter's Name/Affiliation: The Pacific Forest Trust (PFT)
Contact: Michelle Passero
Email: mpassero@pacificforest.org
Phone: (415) 561-0700 ext. 18

The Pacific Forest Trust (PFT) appreciates the opportunity to submit comments on Senators Domenici and Bingaman's white paper on Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System. PFT commends the Senators for taking the initiative to address climate change and develop policy to mitigate greenhouse gases emissions at the federal level. In particular, PFT strongly supports their effort to explore design elements of a national mandatory, market-based greenhouse gas program.

The Pacific Forest Trust is a California-based nonprofit organization dedicated to sustaining America's private forests for their public benefits. For the past ten years, PFT has actively participated in the development of forest projects and policy that achieve climate benefits by reducing greenhouse gas emissions. We have been active members of the World Resources Institute and World Business Council for Sustainable Development effort to develop generic and sector specific guidance for greenhouse gas emission reduction projects, and the forest sector in particular. PFT, under the leadership of California Senator Byron Sher, sponsored Senate Bill 812, which amended the California Climate Action Registry (CCAR) Protocols to include framework for the forest sector and forest-based greenhouse gas (GHG) emission reduction projects, and led the subsequent multi-stakeholder process to develop the CCAR's corresponding forest protocols.

Based on our expertise in forest management, conservation, and climate policy, PFT submits the following policy and technical comments regarding the role offsets and GHG emission reductions projects in a national, mandatory, market-based greenhouse gas program. We feel our comments are most appropriately handled by the Additional Topics form provided by the US Senate Committee on Energy and Natural Resources and therefore, do not address Questions 1-4. In our comments, we discuss the importance and necessity of including offsets, in general, as a compliance flexibility mechanism in a mandatory program. Next, we explain the unique role of forests as both a source and sink of GHG emissions and how to maximize climate benefits from the forest sector. Finally, we outline widely-accepted design principles of offsets, as well as design elements specific to forest-based emission reduction projects.

The Pacific Forest Trust appreciates the due consideration Senators Domenici and Bingaman, as well as the other members of the Senate Energy and Natural Resources Committee, are devoting to the pressing policy issue of climate change and greenhouse gas mitigation. We believe the white paper is an important step towards developing scientifically sound policy that will effectively mitigate the detrimental impacts of human-induced climate change, but not at the expense of the U.S. economy. We look forward to working further with the Senate Energy and Natural Resources Committee, industry representatives, environmental organizations, and other stakeholders to develop and implement this policy.

Additional Topics
Submitter's Name/Affiliation: The Pacific Forest Trust

If there is an additional topic related to the design of a mandatory market based program that you would like to address, please submit comments on this form.

The Pacific Forest Trust (PFT) appreciates the opportunity to submit comments to the Senate Energy and Natural Resources Committee regarding Senators Domenici and Bingaman's white paper on Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System. PFT commends the Senators and Committee for taking the initiative to address climate change through the development of a federal program. PFT strongly supports the Committee's exploration of design elements of a national, mandatory, market-based greenhouse gas program.

The Pacific Forest Trust is a California-based nonprofit organization dedicated to sustaining America's private forests for their public benefits. For over ten years, PFT has actively participated in the development of forest projects and policy to achieve climate benefits by reducing greenhouse gas emissions. We have been active members of the World Resources Institute and World Business Council for Sustainable Development effort to develop generic and sector specific guidelines for greenhouse gas emission reduction projects, and the forest sector in particular. PFT sponsored Senate Bill 812, which amended the California Climate Action Registry (CCAR) Protocols to include framework for the forest sector and forest-based greenhouse gas (GHG) emission reduction projects, and led the subsequent multi-stakeholder process to develop CCAR's corresponding forest protocols. We also implement forest-based emission reduction projects on the ground and have executed market transactions with buyers seeking to offset greenhouse gas emissions.

Based on our expertise in forest-based GHG emission reduction projects and climate policy, PFT submits the following policy and technical comments regarding the role of offsets and GHG emission reduction projects in a national, mandatory, market-based GHG program:

PFT supports the development of a mandatory, national greenhouse gas program and the inclusion of a limited amount of offsets to achieve overall emission reductions

Immediate action to address climate change is necessary to reduce the impacts and costs that climate change will inevitably have on our environment and economy. A broad-based, mandatory, national greenhouse gas program can provide a means to achieve the maximum amount of GHG emission reductions at the least cost. An integral component to the cost-effectiveness of such a program is the inclusion of compliance flexibility mechanisms, such as emissions trading and the inclusion of offsets. Offsets are emission reductions achieved by entities outside of the well-defined mandatory program. The inclusion of offsets and forest-based offsets in particular can provide additional flexibility to achieve mandatory greenhouse gas emission reduction targets most efficiently. The inclusion of forest-based offsets in a mandatory greenhouse gas trading program would also achieve many public benefits in addition to emission reductions, such as the protection and enhancement of water quality, habitat and biodiversity.

Additional Topics
Submitter's Name/Affiliation: The Pacific Forest Trust

PFT supports the inclusion of forest-based greenhouse gas emission reduction projects as qualified offset activities

The forest sector is unique in that forests are both a source and a reservoir for carbon dioxide (CO_2) emissions. Through photosynthesis, forests naturally absorb CO_2 emissions from the atmosphere and store it as carbon (C) in their biomass. The amount of carbon stored in biomass is referred to as a forest's carbon stocks. When forests are disturbed through activities like deforestation, harvest, and fire, their carbon stocks are released back to the atmosphere as CO_2 emissions both immediately and over time. When a forest's CO_2 emissions are greater than the amount of carbon that it stores, the forest is a net source of CO_2 emissions. Globally, forests are the second largest source of anthropogenic CO_2 emissions, contributing roughly 20% of the world's total CO_2 emissions – largely due to forest loss.

While the forest sector can contribute to the climate change problem, it can and should be a part of the solution. Reforestation and forest management projects improve the ability of forests to remove and store CO_2 emissions, thereby increasing forest carbon stocks. Forest conservation projects protect forestlands from conversion to another use and in so doing, prevent the release of CO_2 emissions associated with it. Through these GHG emission reduction projects, CO_2 emitted from our forests is minimized, existing carbon stocks are maintained, and additional CO_2 emissions can be absorbed from the atmosphere and stored in our forests.

The inclusion of forest-based GHG emission reduction projects as qualified offset activities in a mandatory, national, GHG program can have multiple public benefits. In addition to GHG reductions, the inclusion of forest-based offsets can produce economic benefits for forest landowners, as landowners receive an additional income stream for the climate benefits their forests provide. This additional income stream can help maintain rural timber economies.

Moreover, forest-based GHG emission reduction projects achieve many local environmental benefits. The conservation, restoration, and management of forestland to maintain and increase carbon in our forests can foster the biodiversity and resiliency of our forests. These activities also protect and enhance the quality of watersheds and critical habitats for species. These efforts, in effect, can help foster the very values that America will likely seek to protect from the negative effects of climate change.

Widely-accepted design principles for offsets and GHG emission reduction projects

To achieve meaningful emission reductions through offsets, policies must include clear and rigorous accounting, reporting, and verification guidelines. These guidelines should be based on principles that ensure all GHG emission offset projects, including forest offsets, are additional, permanent, verifiable, enforceable, and avoid/account for any leakage. The following recommendations outline key design principles for the development of effective and meaningful offset projects:

Baselines

The characterization of project baselines is critical to the accounting and issuance of offset credits. The underlying principle for characterizing a project baseline is determining what would have happened in the absence of the project or "business as usual." Baselines are long-term projections of the forest practices and resulting carbon stocks that would have occurred within a project's physical boundaries in the absence of the project. They provide a basis for assessing "additionality" and CO_2 emissions and reductions throughout the duration of a project.

Additionality

All offset projects should demonstrate that the project activity is in addition to the established baseline or business as usual scenario. These additional activities should result in emission reductions above and beyond business as usual practices. For example, forest offset projects should result in increased carbon stocks over time relative to the baseline.

Leakage

In general, leakage is the displacement of GHG emissions from inside the offset project boundaries to the somewhere outside the project boundaries, thereby transferring and not reducing GHG emissions. One way to address leakage that occurs within an entity is through entity level (sometimes referred to as "corporate level") reporting of emissions. Entity level reporting would require an entity to report the CO_2 emissions of entity-wide activities, not just the offset projects, thereby tracking any changes or leakage within an ownership.

Leakage that occurs outside the entity that is caused by shifts in consumer demand (e.g. market leakage) is more difficult to track or quantify. However, default deduction tables may be a way to address market leakage – until there is more global participation in GHG accounting and trading.

Permanence

Projects should achieve long-term, or "permanent", emission reductions. While it is impossible to prevent natural disasters from occurring and causing releases of forest carbon to the atmosphere, conservation easements can provide legal permanence for emission reductions and can be used for forest-based offset projects. Easements are voluntary, legal instruments that affix to the land title and guide management practices. Such limitations act as a legal security for protecting land and natural resources, as well as carbon stocks – in spite of any subsequent changes in land ownership. In return for an easement, the landowner is compensated for any limitations agreed to either through financial payment and/or tax benefits. All forest projects should be secured with an easement that dedicates the project area to forest use.

Additional Topics
Submitter's Name/Affiliation: The Pacific Forest Trust

Forest-based offset projects should promote healthy and diverse native forests

The inclusion of forest offset projects in a mandatory greenhouse gas trading system provides significant opportunities to achieve multiple public benefits. Forest offset projects like forest management, reforestation and conservation should be designed to promote and maintain native species, which would achieve not only GHG emission reductions, but also other public policy goals of native habitat restoration and protection. In addition, forest offset policy should not lead to perverse incentives that would lead to environmental harm such as the conversion of native habitats for the purpose of carbon sequestration.

Offset projects should be verified by third parties

Offset projects from any sector should be third-party verified. Third party verification is critical to ensuring the credibility of any reported emission reductions from offsets that are achieved outside of a mandatory cap and should be a policy requirement.

The Pacific Forest Trust would be happy to share our insights and expertise with fellow stakeholders to develop standards for the quantification, reporting, and certification of forest emissions and reductions specific to a national greenhouse gas program. We reiterate our thanks and appreciation for the opportunity to submit comments and hope to assist further in the promising development of a mandatory, market-based greenhouse gas program.

Submitter's Name/Affiliation: Jeff Sterba, PNM Resources
Contact: Jeanette Pablo
Email:jeanette.pablo@pnmresources.com
Phone: 202-742-4448

Executive Summary

1. *Point of Regulation*
   - Given the magnitude of the issue of climate change, PNM Resources (PNM) believes that, in order to be comprehensive and effective, a greenhouse gas (GHG) regulatory program should cover all sectors of the economy.

   - On point of regulation of fossil fuels, it is our view that a GHG program should take a hybrid approach: an "upstream" regulatory approach for fuels with millions of users - petroleum and natural gas, and a "downstream" approach for coal which has fewer users. Regarding the upstream point of regulation for natural gas and petroleum, PNM does not have a specific recommendation but urges the Committee to take into consideration administrative simplicity and economic efficiency. For coal, we recommend downstream regulation for coal users with an exception for *de minimis* users.

2. *Allocation*
   - In PNM's view, the great majority of allowances (e.g., 95%) should be allocated without cost in order to transitionally manage the costs associated with regulation. The remaining 5% could be auctioned with the revenues funding important climate change policy objectives through a dedicated Technology Fund to promote new emission-free technologies, and, to a lessor extent, measures for mitigation and adaptation such as low-income residential consumers and vulnerable segments of the manufacturing sector.

   - PNM also believes it is important to provide credits for early reduction and offsets, so long as they meet standards for environmental integrity.

3. International Trading
   - PNM believes there could be significant economic value and substantial potential emission reductions in allowing U.S. companies to invest outside the U.S. to achieve verifiable offsets. We would also support participating in international trading to the extent reasonably feasible.

4. Comparable International Action Requirement
   - PNM Resources believes it is appropriate for the U.S. to take the lead in addressing climate change; however, the nature, scope, and economic impact of climate change requires the U.S. to pursue mechanisms, such as the Asia-Pacific Partnership, to bring in other major nations.

5. Safety Valve
   - We urge the Committee to include a safety valve in any mandatory program in order to provide greater compliance cost certainty and mitigate the distorting effects allowance market price spikes would have in encouraging substantial and undesirable investments in natural gas generation, particularly at the early stages of the program.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Who is regulated and where?

* * *

Given the magnitude of the issue of climate change, PNM believes that, in order to be comprehensive and effective, a GHG regulatory program should cover all sectors of the economy and all sources of GHG emissions. Limiting coverage of the program to certain sectors would result in higher overall compliance costs because it would fail to reach low-cost GHG reduction options available in unregulated sectors. A sector-specific approach would not be as effective in reducing overall U.S. emissions and would unfairly place the burden of achieving reductions on some sectors while allowing others to go unregulated. To illustrate this point: according to the Environmental Protection Agency, electricity generation was responsible for 40% of carbon dioxide (CO2) emissions from fossil fuel combustion in 2004, while transportation activities accounted for 33% of CO2 emissions from fossil fuel combustion that same year with over 60% resulting from gasoline consumption, mostly for personal use.[1]

With respect to the point of regulation of fossil fuels, it is our view that a GHG program should take a hybrid approach: an "upstream" regulatory approach for petroleum and natural gas and a "downstream" approach for coal. Regarding the upstream point of regulation for natural gas and petroleum, PNM does not have a specific recommendation, but urges the Committee to take into consideration administrative simplicity and economic efficiency. For coal, we recommend downstream regulation for coal users with an exception for *de minimis* uses.

There are several advantages of structuring a hybrid regulatory program that utilizes both upstream and downstream regulation. Upstream regulation of petroleum and natural gas would ensure broad coverage of sources of emissions while reducing the number of entities that must be regulated. Regulating coal-related emissions through a downstream approach would build upon successful elements and utility experience operating under the cap and trade system already in place under the successful U.S. acid rain program.

PNM's views on the scope of a federal regulatory program and the proper point of regulation in the production chain are discussed further in our response to clarifying questions 1a and 1b, respectively. However, we also believe it is important to point out that a number of states and local governments are already engaged in the development of regulatory programs to reduce GHG emissions, including cap and trade programs. It is critical that utilities and other regulated entities not be subject to duplicative and/or conflicting regulatory requirements of multiple governmental jurisdictions. A single national GHG emissions regulatory program, with federal oversight, is the most effective approach to ensuring an administratively simple and economically efficient GHG emissions program.

[1] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004, Environmental Protection Agency, 2005), p. ES-8.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

* * *

PNM strongly supports an economy-wide approach to regulating GHGs. PNM believes that in order to be economically efficient and effective at reducing GHG emissions the most equitable approach for regulating GHG emissions is to include all sectors of the economy and cover all sources of GHG emissions either directly or indirectly. Limiting the program to particular sectors or to particular types of sources would result in higher overall compliance costs because it would fail to reach low-cost GHG reduction options available in unregulated sectors. The full benefits of an emissions trading program, which allows regulated entities to capture the most inexpensive reductions wherever they are, would be lost under an approach limited to certain sectors.

A sector-specific approach would also not be as effective in reducing the nation's overall GHG emissions as an economy-wide program. As the Committee itself points out, no single sector of the U.S. economy makes an overwhelming contribution to overall U.S. GHG emissions. Consequently, a program limited to certain sectors of the economy would only be taking partial steps toward reducing the nation's overall GHG emissions. Such an approach would also be unfair because it would place the burden of achieving reductions on selected sectors, while allowing others to go unregulated. Under a sector-specific program, regulated sectors of the economy could also have incentives for shifting emissions to non-regulated sectors – in other words, the risk of "leakage" would be higher. Furthermore, leaving certain sectors or types of emissions sources unregulated now would allow those entities to lock in more carbon-intensive technologies or practices, making it more costly to require reductions from those entities later.

Since every sector of the economy is a contributor to the nation's GHG emissions, a national program should be economy-wide in scope. The scope and nature of GHG emissions demands a comprehensive solution to reducing emissions that only an economy-wide approach can achieve.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

* * *

It is PNM's view that a GHG program should take a hybrid approach to regulation of CO_2 emissions from the use of fossil fuels: an "upstream" regulatory approach for petroleum and natural gas and a "downstream" approach for coal. Regarding the upstream point of regulation for natural gas and petroleum, PNM does not have a specific recommendation, but urges the Committee to take into consideration administrative simplicity and economic efficiency. Coal users would be regulated downstream at the point of emission with an exception for *de minimis* users. PNM would recommend that petroleum coke be regulated downstream in the same manner as coal in a hybrid program.

There are several advantages to structuring a regulatory program for fossil fuels in a manner that utilizes a hybrid approach for CO_2 emissions. Placing the point of regulation for petroleum and gas upstream ensures broad coverage of sources of emissions, while reducing the number of entities that must be regulated. Similarly, regulating coal-related emissions downstream at the utility level instead of upstream results in coverage of a significant portion of emissions while keeping the number of regulated entities down to a manageable level. Moreover, the electric utility industry has implemented and established administrative processes for accounting and trading of emissions allowances under the Clean Air Act title IV's successful acid rain cap and trade program. This experience could help provide a basis for developing a much more comprehensive GHG program.

However it is also important to point out that it would be a mistake to expect the experience from the acid rain program could provide anything more than general direction for development of a GHG cap and trade program. A GHG emission trading system is likely to be far more costly, complicated and difficult to administer than the acid rain cap and trade program.

The vast majority of coal-fired generation units across the U.S., over 75%, operate under cost of service regulation. A downstream approach to regulating coal-related emissions requires attention to the treatment by utility regulators of allowance costs associated with coal use by utilities. Under a hybrid approach, utilities would incur allowance costs directly when they consume coal; when they consume petroleum and natural gas they would incur higher fuel prices (because those fuels would be regulated upstream). Although regulated utilities are permitted by regulators in many states to recover the higher fuel costs in their rates via a fuel adjustment clause, it must be made clear that utilities can pass through allowance costs associated with coal-related emissions. Regulated utilities in states like New Mexico, that are not allowed to recover higher fuel costs through a fuel costs adjustment mechanism, and are are subject to additional uncertainty and risk of having cost recovery for higher fuel costs disallowed. If a hybrid regulatory approach is adopted, then the Committee should address how federal and state electric

utility regulators are to develop regulatory approaches that would ensure cost of service utilities have reasonable assurance of cost recovery for prudently incurred costs for higher fuel and/or allowances associated with a GHG regulatory program.

With respect to transportation sector emissions, alternatives such as fuel economy standards or CO_2 emissions standards for new automobiles could also be considered in addition to regulating the carbon content of transportation fuels.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

* * *

PNM strongly supports an allocation of allowances over an auction approach and believes the great majority of allowances (e.g., 95%) should be allocated to the electric power sector at no cost. This is necessary in order to transitionally manage the economic impacts and costs that coal-based utilities and their customers will face complying to mandatory GHG regulations.

Under mandatory climate change regulation it is important that adequate allowances be given to mitigate compliance costs. States and utilities that rely on fossil-fired generation for the majority of their electricity will bear a disproportionate share of the compliance cost burden compared to the utility industry and U.S. as a whole. This is why the issue of allowances versus auctioning of allowances is so important to fossil-based utilities like PNM.

Based on our forecasts of electricity generation in 2010, and simplifying assumptions about the range of costs of allowances under a NCEP-type cap and trade program, our analysis indicates that purchasing 100% of the allowances needed to comply with the an emissions cap through an auction would cost PNM approximately 20 times the amount we would o0therwise would incur if 95% of the allowances were allocated at no cost to the company.

The difference in the magnitude of compliance cost between an auction and no-cost allocation approach is striking. PNM's analysis clearly shows that an auction would dramatically increase compliance costs to the utility and that allocating 95% of allowances would substantially reduce compliance costs and, thereby, mitigate increases in electricity prices to New Mexico consumers.

Under the proposal discussed above, PNM would recommend the remaining 5% of allowances that were not allocated could be auctioned and the revenues used to fund important public policy objectives through a non-profit Technology Investment Fund. The Technology Investment Fund could be headed by a public-private panel tasked to direct how the funds would be allocated.

PNM supports providing the Technology Investment Fund with a dedicated funding source primarily to promote R&D as part of any regulatory program. A small portion of the Technology Investment Fund could also be dedicated to funding measures for mitigation and adaptation. Two categories of energy consumers that may be considered by the Committee as potentially eligible for mitigation and adaptation are low-income residential consumers and vulnerable segments of the manufacturing sector.

PNM believes it is also important to provide credits towards allowances to entities that undertake early GHG emissions reduction and emissions offset projects, so long as they are measurable, quantifiable and can be verified. Moreover, if early reduction projects and offset

projects meet such standards, the allowance credits for these activities should be *in addition* to the allowance pool because by definition these activities will not be covered by the cap-and-trade program.

It is possible that firms may incur costs (or lose revenues) from a regulatory program either because they are themselves regulated or because their suppliers or customers are subject to regulation. For instance, even if the program were to regulate generators' coal-related emissions on a downstream basis, coal producers may incur unrecoverable losses of revenues because allowance costs associated with coal combustion may reduce their utility customers' demand for coal. To the extent this occurs, it may be appropriate to allocate some portion of allowances to address these and similar economic impacts.

Comment [j1]: JES edit

Allowances for new units could be allocated in such a way as to provide incentives for low-emitting generation. In addition to electricity generators, other large users of coal could be regulated under our proposal and presumably would receive allowance allocations under a formula similar to electric utilities. Finally, it may be appropriate to consider phasing out allowance allocations over an extended period of time, such as 40-50 years, once the economy has adapted to the mandatory system.

PNM's views on the allocation of allowances and related considerations are discussed in greater detail in our responses to clarifying questions 2a through 2g.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

* * *

Two kinds of technology classes are critical to addressing the challenge of climate change: (1) existing emission free or low emission technology that is not yet cost competitive with conventional generation technologies, and (2) future "breakthrough" technologies that can achieve the levels of reductions needed to stabilize and then reduce atmospheric concentrations of GHGs in the mid to latter part of the century.

We have followed with interest Anne Smith's research. At the National Commission on Energy Policy workshops on climate change, she noted that only existing technologies would be advanced to commercialization by current cap-and-trade proposals. With respect to new technologies, like others, we have been persuaded by her argument that "the standard market-based environmental policy tools of cap-and-trade and emissions taxes cannot provide credible incentives for the technological change needed to stabilizing atmospheric concentrations of greenhouse gases at any level."[1] We are also impressed by the significant level of R&D funding that organizations like the Electric Power Research Institute believe will be necessary to develop the next generation of non-carbon and low-carbon energy technologies that will be needed to to stabilize and then reduce concentrations of carbon dioxide in the atmosphere.

[1] *Price, Quantity, and Technology Strategies for Climate Change Policy*, by W. David Montgomery and Anne E. Smith, CRA International (October 11, 2005), p. 1.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

In PNM's view, any GHG program must consist of two components: the first to slow emissions growth and advance commercially available zero-carbon and low-carbon energy technologies and the second to create new zero-carbon emitting technologies needed to achieve meaningful emissions reductions. We believe that a cap-and-trade approach with a safety valve may be the most appropriate approach for the first component and the creation of a Technology Investment Fund may be the most appropriate approach for the second component.

PNM supports the creation of a Technology Investment Fund to provide a dedicated funding source for technology deployment and R&D investments as part of a mandatory program. There are a number of sources for generating the funds, including proceeds from auctions of the unallocated 5% of allowances, revenues generated by a safety valve mechanism, a per ton surcharge on CO_2 emissions or on the carbon content of fuels, or other mechanisms. Whichever mechanism or combination of mechanisms is chosen, it is important that the funding is stable and predictable. For this reason, it may not be appropriate to rely solely on safety valve revenues as a source of funding because such revenues likely would be highly variable. Indeed, in some years of the program the price of allowances might be at or below the safety valve price, in which case there would be no safety valve-related revenues. To ensure a steady stream of reliable funding for the Technology Investment Fund, we must also avoid the uncertainties of the annual appropriations process.

A number of alternative options are available for administering the Technology Investment Fund. However we strongly recommend that the Technology Investment Fund should be administered by an independent panel comprised of representatives balanced between the private sector and those involved in the public sector (government, private sector, NGOs, educational and institutional sectors). The panel could be directed to disburse the proceeds in a number of key areas. For instance, it would make sense to target a sizeable portion of the Technology Investment Fund for the development of new applications to reduce GHG emissions through means such as energy efficiency and new technology or product development. Another portion could fund development and deployment of technologies that reduce, capture, and/or sequester GHGs.

PNM recognizes the difficulty of developing a mandatory U.S. cap-and-trade program. It is also true that we believe a well-funded R&D program targeted to accelerate the development of zero-carbon energy technologies should be our nation's number one climate policy priority. To that end, if the implementation of a mandatory program is delayed for several years, PNM could support imposition of a fossil generation surcharge and the creation of the Technology Investment Fund immediately. For example, a $1 surcharge on MWh would generate approximately $2.8 billion annually. A two-cent per gallon on gasoline would generate $ 2 billion annually. The surcharge should be phased out as the revenues increased from auctioning the 5% allowances once the cap-and-trade program were in place.

Comment [j2]: JES edit

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

* * *

In PNM's view, measures for mitigation and adaptation could fall under the scope of the Technology Investment Fund as discussed on page 3 of this question.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Questions 2c:

Consumer Protections

- What portion of the overall allocation pool should be reserved to assist consumers?
- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

* * *

One of the purposes of the allocation of allowances is to offset undue burdens to the ultimate consumer and, possibly, to promote deployment of existing but higher cost zero carbon and low-carbon emitting technologies; however, under any allocation system certain categories of consumer may need additional, short term assistance, such as low income consumers and certain segments of the manufacturing sector.

Funds from sale of the 5% of allowances could also be used to remove barriers to deployment of renewable technologies by significantly reducing the costs for energy consumer technology (such as residential solar panels). PNM would support consideration of using allowances or allowance sales to for these purposes and would be happy to work with the Committee to develop appropriate treatment of these concerns.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

* * *

Allowance credits for early reduction and offset projects are critical to keeping compliance costs manageable and at an acceptable level. PNM believes it is important to provide credits for early reduction and offsets, so long as they are measurable, quantifiable and can be verified. Moreover, if early reductions and offset projects meet such standards, the credits for these activities should be *in addition to* the allowance pool and should be issued without limits.

PNM also supports setting aside a small number of allowances for certain types of new electric generation as discussed below in response to question 2f.

Clarifying Questions 2e:

Special considerations for fossil-fuel producers?

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

* * *

Coal producers (and perhaps other producers of fossil fuels) may argue that they will incur a loss in revenues from a mandatory GHG emissions regulatory program and will not be able to recover these lost revenues from customers. To the extent that such a showing is made, it may be appropriate to allocate some portion of allowances to address these and similar economic impacts in the early years of the program and until energy markets have adequate time to adjust.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

o

Clarifying Questions 2f:

Allocations for downstream electric generators?

- Should electricity generators be included in the allocation if they are not regulated? (Clarification: We mean to ask if an electric generator should be included in the allocation if the greenhouse gas regulation occurs at a point of regulation that is upstream or downstream from the generator, but not the generator itself.)
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

* * *

As stated in our response to clarifying question 1b, PNM suggests the Committee consider a hybrid program that would entail downstream regulation of coal-related emissions from electric power generation But, whether or not such a hybrid program is adopted, allocating allowances to electric generators should be considered. The Committee notes that electricity generators will face higher costs under a GHG regulatory program as fossil fuel prices rise. If a full upstream program is adopted, generators will not bear allowance costs directly, rather those costs will be built into the price of the fuel they purchase. Fossil-fired generators in competitive markets may not be able to recover these higher fuel costs because they may not be able to pass these costs through to wholesale or retail customers. For fossil generators in regulated markets, cost recovery depends on State and Federal regulatory policies. If electric generators receive allowances, they could use the revenue generated from the sale of those allowances to offset higher fuel costs that cannot be passed through to customers and to mitigate price impacts on consumers to the extent the costs would otherwise be passed through.

Similarly, even if natural gas-related emissions were regulated on an upstream basis, electricity generators may need to receive allocations to mitigate unrecoverable costs resulting from higher prices for natural gas.

Allowances awarded to existing electric generator units should be based on historical emissions, similar to the U.S. acid rain program. Under either a hybrid or upstream program, allocations should be available only for fossil-fired generation because it will incur all the

electricity sector's compliance costs and non-carbon emitting generation will benefit from higher electricity prices.

PNM would also advocate that a portion of allowances provided to generators under a hybrid program should be set-aside for new coal units.

In considering whether to distinguish between utilities subject to cost-of-service regulation and utilities whose rates are set by the market, the Committee should look at what is administratively feasible, and manageable as well as general policy concerns. Whatever policy reasons may exist for distinguishing between generators subject to cost-of-service regulation and unregulated generators, it is by no means clear whether a program that tries to make such a distinction could be administered. First, for many utilities, including PNM, the same fleet of generating units serves both regulated and unregulated markets. Second, it is not clear exactly what constitutes cost-of-service regulation, particularly in the context of generators owned by utilities subject to long-term retail rate freezes. Third, utilities may change from cost-of-service to deregulated status and vice-versa, as state regulatory policies change or FERC allows or disallows market-based rates. Finally, ownership of generation units may change over time, as generation units are transferred between regulated utilities and unregulated power producers. For this reason, it may be infeasible to implement allowance allocation policies that distinguish between generators under cost-of-service regulation and those who are in deregulated markets.

Under the hybrid approach, utilities would not receive an allowance allocation for natural gas or oil since those fuels would be regulated upstream. One approach to allocation of allowances among the three fuels (petroleum, natural gas, and coal), which has the advantage of administrative simplicity, would be to allocate allowances among each fuel sector (i.e., to producers and/or users of a particular fuel) based on a pro-rated share of GHG over some reasonable base period. For example, if coal generation were responsible for thirty percent of GHG emissions, coal-burning utilities would receive thirty percent of the allowances.

Clarifying Questions 2g:

Allocations for energy-intensive industries?

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

* * *

Our recommendation to regulate coal-related emissions downstream would mean that any energy-intensive industries that use more than *de minimis* amounts of coal would be regulated and presumably receive allowance allocations under a formula similar to electric utilities.

Question 2. Allocation
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Clarifying Questions 2h:

Allocations to other industries/entities?

- What other industries/entities (e.g. agriculture, small businesses, etc.) should be considered in the allocation pool?
- What should be the basis for their share of the total allocation as well as for the distribution among such industries/entities?

* * *

PNM does not have a specific recommendation on this subject.

Question 3. International Trading
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

* * *

Like many other utilities, PNM is more knowledgeable about U.S. domestic proposals and voluntary programs than international activities. In looking beyond the U.S. for purposes of responding to this question, PNM observes that there may be some benefit to understanding GHG emissions reductions programs currently being pursued in other countries to determine what might work best in the U.S. (and what might not work at all).

With respect to the specific question on whether a U.S. system should be designed to eventually allow for trading with other GHG cap-and-trade systems around the world, PNM believes the priority should be to develop a viable, cost effective domestic program and as a secondary matter to look to the international arena for linkage. We would, however, encourage a provision to allow U.S. companies to invest outside the U.S. to obtain verifiable offsets. The benefits of reducing GHG emissions in the atmosphere will be the same no matter what country the emissions reductions occur. To the extent it is more cost-effective for utilities and other regulated entities to invest in projects that reduce GHG emissions in other countries it should be allowed.

While there could be significant value in pursuing an approach to link whatever system is finally adopted in the U.S. with other GHG cap-and-trade systems, we observe that the Canadian and European Union systems have taken different approaches and there is little opportunity for trading between these systems at least at present.

Question 4. Comparable Action
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program?

* * *

There is a difference between delaying implementation of a U.S. climate change program until developing nations commit to a mandatory reduction program and recognizing the need for international action given the scope and nature of climate change. PNM seeks regulatory certainty but also recognizes the critical importance for all nations to address climate change to achieve the necessary emissions reductions over time without disrupting critical economies.

At PNM, we understand the advantage to moving sooner rather than later on climate change and we seek the regulatory certainty that would be provided by climate change particularly if coupled with multi-pollutant legislation. When PNM builds or acquires new generation capacity we do so with a 30-40 year time horizon in mind. Investment decisions we are making today regarding new generation will reverberate for decades and must fit with what we perceive to be the regulatory climate and compliance costs we believe will be in effect during the life of these assets. Accordingly, moving forward on climate change and multi-pollutant legislation is important to providing the regulatory certainty PNM and other utilities need in order to make the resource acquisitions decisions today that are in the best interest of our customers and shareholders.

We recommend the U.S. take a dual track approach to address climate change in the U.S. through legislation and initiatives such as the very promising Asia Pacific Accord to address climate change within other nations, particularly large emitters.

Additional Topic
Submitter's Name/Affiliation: Jeff Sterba, PNM Resources

If there is an additional topic related to the design of a mandatory market based program that you would like to address, please submit comments on this form.

* * *

Safety Valve

PNM urges the Committee to incorporate a safety valve in any mandatory cap-and-trade climate change program for the following reasons:

- In the near-term, absent a safety valve mechanism, if price spikes in the allowance market were to occur, a key consequence could be to encourage substantial switching to natural gas which is an undesirable outcome.

- Many of the issues surrounding allocations within the utility industry bear a keen relationship to reducing costs. Inclusion of a price cap would lower the stakes in the allocation battle and facilitate resolution of the issue.

- By providing a stable and predictable cost environment, a price cap would allow a more stringent program to be implanted over time.

WESTERN BUSINESS ROUNDTABLE

March 13, 2006

The Honorable Pete Domenici
Chairman
Senate Energy Committee
364 Dirksen Senate Building
Washington, DC 20510

Dear Mr. Chairman:

On behalf of the members of the Western Business Roundtable ("The Roundtable"), I am writing in response to your and Senator Bingaman's request for comments on your "Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System" white paper (*released February 2, 2006*).

Our membership is comprised of a coalition of CEOs and senior executives of corporations and organizations representing a broad cross-section of Western business interests – including those engaged in construction, manufacturing, mining, electric power generation and oil and gas exploration and development. Because our companies and their employees live and work in the West, we understand the importance of sensible environmental policy in the Western states. For this reason, the members of The Roundtable (and its predecessor, the Western Regional Council) have devoted significant time and resources to visibility and air quality issues over the past 30 years.

We appreciate the opportunity to comment on your proposal to move forward with a mandatory carbon dioxide (CO2) regulatory regime. This issue has tremendous macro-economic, consumer pocketbook, environmental and national security implications. It is only appropriate that a careful, balanced and thoughtful stakeholder input process be engaged in prior to any decision to draft legislation to mandate CO2 regulations.

ROUNDTABLE RECOMMENDATIONS

1. **Substantial scientific uncertainty exists regarding the impact on climate, if any, of anthropogenic emissions of CO2, as well as the benefits, if any, of mandatory carbon regulations. Further study is clearly required before a regulatory approach on this issue can seriously be debated.**

   The effects of human interaction on climate are unclear, at best, as shown by the continuing debate among leading climatologists on many key questions surrounding this issue. In the face of such uncertainty among the scientific experts in this field, moving forward with any mandatory regulatory model strikes us as premature.

The opinions expressed in this letter represent the views of a majority of Roundtable Members, but not necessarily all of our members.

2. **There are a variety of emerging technologies, both on the energy production and sequestration sides of the CO2 equation, that hold tremendous promise. These technologies will take time to develop but must be allowed to lead any effort to address carbon emissions concerns.**

   America has enough fossil fuels to meet its energy needs well into the 24th century. Current research is moving America ever closer to technologies that can tap these energy resources with less and less environmental impact. The ultimate goal of near-zero or zero-emission technologies, capable of capturing and sequestering CO2, is now within reach.

   There are dozens of research efforts being pursued by federal and state governments and the private sector. These technology development efforts must be allowed to proceed and mature.

   Of course, as major architects of the Energy Policy Act of 2005, you have intimate knowledge of the extensive additional commitment to clean fossil research, development and commercialization that Congress and the Bush Administration have undertaken to just within the last year.

   All of these are long-term programs grounded on the premise that outstanding scientific and technical minds, married with proper incentives, can produce technologies that offer a roadmap to a near-zero emission power generation sector of the future, including state-of-the-art generation, coal gasification, hydrogen research and carbon sequestration.

3. **Voluntary incentives promote progress, while mandates discourage innovation. Technology innovation is crucial to any CO2 solution.**

   Voluntary incentives, such as those promoted by the Bush Administration's "FutureGen" program and the Energy Policy Act of 2005, are already helping to drive the technological development of a range of near-zero and zero emission technologies. These programs, which have only emerged over the past several years, are just now beginning to bear fruit. They need to be given sufficient time to work.

   For example, FutureGen, a global coalition of coal companies and electric utilities, is working with the U.S. Department of Energy to develop and site the ultimate coal-fueled power plants of the future offering near-zero emissions, CO2 capture, sequestration technologies and hydrogen-production facilities. FutureGen is on a fast track for beginning construction within three years, with operations commencing by 2012.

   We believe that technology-based solutions and reasonable timetables point the way toward emissions improvements from fossil-fueled generating plants. America's electricity generation sector already complies with some of the most stringent environmental regulations in the world. Under these regulations, coal used for

electricity generation has tripled since 1970 while key criteria emissions have been substantially reduced.

4. **Prematurely-instituted mandatory CO2 controls could force catastrophic cost increases on consumers already reeling from high prices.**

   Given the economic consequences of mandatory CO2 regulation, such a step should not be undertaken until both the scientific basis and technology solution(s) are clarified. For that reason, we oppose moving forward with mandatory caps on carbon emissions or carbon taxes at this time.

   Setting mandatory caps without refining the enabling technologies to control emissions is akin to taking off in an airplane without knowing where or if there is an airport on the other end of your journey.

   Premature regulation of carbon has had significant economic impacts where instituted elsewhere in the world. For instance, since being ratified by other nations, the Kyoto Protocol has resulted in sharp increases in electricity costs for Europeans, even as most nations are failing to comply with the treaty. Thirteen of the 15 original European signatories to Kyoto are on track to miss their 2010 emissions targets, according to a recent report.

   Thus, any regime aimed at reducing CO2 emissions must factor in respect for economic impacts and must be structured in a way that does not result in the displacement of coal for electric power generation with expensive alternatives in the short or the long term – especially imported fuels from politically unstable areas of the world.

Conclusion

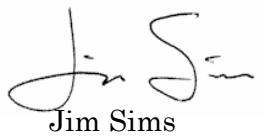
We believe the most sensible path regarding federal CO2 management policy is to support the vision you have already laid out under the Energy Policy Act of 2005. Thus, the Roundtable urges the Senate to continue to focus its attention on assuring robust support for programs that:

- Improve the scientific understanding of the existence and cause of climate change;
- Develop a better understanding of the ability of plant life and oceans to serve as carbon-absorbing sinks;
- Advance technologies that can chemically or physically capture and sequester CO2; and
- Promote increases in efficiencies to reduce the energy input needed for electricity generation.

Given proper support, these programs – over the next decade – will give us the answers we need regarding the need for regulatory action.

On behalf of the many member organizations of the Western Business Roundtable, thank you for the opportunity to comment on this important policy initiative, which is so important to the continued vitality of the West.

Sincerely,



Jim Sims
President and CEO

cc:

Vice President Dick Cheney
DOE Secretary Samuel Bodman
U.S. Environmental Protection Agency
House Energy and Commerce Committee Members
Senate Energy Committee Members
Senate Environment and Public Works Committee
Western Governors
Western Governors Association
American Legislative Exchange Council

The Roundtable is a non-profit business trade association comprised of CEOs and senior executives of organizations doing business in the Western United States. Our member companies are involved in a broad range of industries, including agricultural products, accounting, chemicals, coal, construction and construction materials, conventional and renewable energy production, energy services, engineering, financial services, internet technologies, manufacturing, mining, oil and gas, pharmaceuticals, pipelines, telecommunications, and public and investor-owned utilities. We work for a common sense, balanced approach to economic development and environmental conservation, and we support public policies that encourage economic growth, opportunity and freedom of enterprise.