Climate Policy Center

www.cpc-inc.org

An Evaluation of State Carbon Dioxide Reduction Policies

by
Andy Keeler
The University of Georgia

January 2004

1. Introduction

President Bush's rejection of both the Kyoto Protocol and significant domestic action on US greenhouse gas emissions has led to a situation where only state and local governments are likely to put forth any significant policies that affect GHG emissions behavior over the next several years. We have already seen a number of these policies proposed and passed.

The desire of state governments to take action is understandable on at least four counts. First, they are responding to the desires of their citizens to take action to help avert the significant long-term risks of climate change [see, for example, New Hampshire Revised Statutes Annotated 2003 and State of Maine 2002]. States cite their vulnerability to climate change and the importance of beginning mitigating activities and policies to lessen this vulnerability.

Second, states wish to begin preparing their economies for a transition to reduced GHG emissions in the future by guiding their choices toward less GHG-intensive means of producing goods and services and carrying out household activities. Citizens, businesses, and governments will make many decisions concerning the acquisition, maintenance, and modification of technology during the years before the US has a mandatory federal GHG policy. These technologies have long lives and are likely to last well into the era of mandatory climate policy. Significant areas include new housing, automobiles, power plants, and public transportation systems. The states desire to guide choices that will be consistent with what many expect to eventually be mandatory federal efforts to reduce GHG emissions.

Third, there is an advantage in trying new and innovative programs on a smaller scale in advance of design and implementation on a larger one. Some expect the states to be laboratories of democracy where new GHG-reducing policies are tried and refined before being implemented on a larger scale (CCAP 2002).

Finally, states are expressing frustration at the lack of a federal program and are viewing their own policies as a way to pressure on the federal government to craft a unified policy response, as

California's tailpipe emission standards of the 1960's are widely held to have been instrumental in bringing about national automobile emissions standards.

There are two reasons to be concerned about the role of state climate policies in the context of a long-term approach to limiting the concentration of CO_2 in the atmosphere. First is the efficiency and effectiveness of the policies themselves. There is an extensive literature examining climate policies and, more broadly, policies to improve energy efficiency. The pros and cons of subsidies, tax breaks, taxes, trading programs, energy efficiency standards, and other policies are not directly at issue here – what is at issue is the extent to which policies have particular strengths and weaknesses when implemented at the state, rather than at the national, level.

The most serious of these challenges is leakage. If states try to put mandatory controls on energy or technology, they risk losing economic activity to other states that do not have such controls. They also risk having significant purchases of capital goods take place in other states. For example, California faces the risk of consumers buying cars in other states. Such leakage encourages inefficient patterns of economic activity, punishes the economy of the state implementing the controls, and makes the cost of reducing GHGs much higher than necessary.

The second concern about state policies is the difficulties they may create for an eventual national policy. When states set up regulatory structures and put policies into place, businesses and individuals form strategies and make investments in response to those systems. They will understandably resist federal programs that require expensive or difficult changes in these strategies and investment patterns. The kinds of programs that states adopt, including their levels of stringency and the obligations and benefits given to different sectors of the economy, are likely to exert a strong influence on determining what kinds of policies are considered at a national level. I am particularly concerned with how existing state policies affect the political and economic landscape for putting in place a comprehensive cap and trade policy for GHGs at the national level.

These concerns raise two related issues about state policies for GHG reduction: whether these policies represent effective use of the scarce economic and political resources available to reduce GHG emissions; and whether there are design considerations that can make such policies more effective and efficient than they might otherwise be.

These concerns raise two related questions about state policies for GHG reduction:

- Do these policies represent effective use of the scarce economic and political resources available to reduce GHG emissions?
- Are there design considerations that can make such policies more effective and efficient than they might otherwise be?

This article proceeds by briefly characterizing the main policies being implemented or considered at the state level. I then describe an idealized national policy against which to assess the likely effects of state policies. Next, I analyze state policies in terms of a) whether their implementation at a state level presents particular problems and b) how they might affect the design and implementation of a national policy to directly limit GHG emissions.

2. Types of State Programs

States have adopted, or have considered adopting, a wide variety of programs that affect the net GHGs they emit. This paper tries to anticipate ways that these policies change the landscape for the eventual adoption of broad national policies that put a price on marginal GHG emissions and/or sequestration. It is therefore useful to categorize these programs in terms of the degree of direct connection with national policies.

One class of policies affects land use, transportation, or emissions for reasons that are not directly or primarily related to climate change. Rabe (2002) has classified a number of programs of this type as climate policies, including programs in North Carolina and other states that reduce animal waste or improve technologies for its disposal, and programs in Georgia that reduce vehicle miles traveled. Land use and planning policies that seek to bring about development in such a way as to conserve energy also fit in this category. These programs are primarily aimed at other environmental problems and have the side benefit of reducing greenhouse gases. They can be termed climate programs in that their implementation does affect the level of GHGs that are emitted; however, they do relatively little to affect the choices made by economic actors that affect the allocations, targets, and incentives in a national policy.

Another set of policies is aimed at providing positive incentives to engage in behaviors that reduce GHG emissions/increase net sequestration. Providing information and even cost-sharing to increase forest carbon sequestration fit in this category. Also included are direct and tax subsidies to low-carbon energy sources. So are voluntary pledges and reduction efforts. These policies may or may not represent an efficient use of resources in reducing GHG emissions. They are, for the most part, unlikely to interact significantly with the formation and implementation of a national policy.

A third set of policies is most likely to interact with national policies. Some place mandatory duties and obligations on power users and/or manufacturers. These policies include utility-based trading programs that cover carbon emissions (as are being implemented in Massachusetts and New Hampshire, and are planned for a nine–state northeastern region). A renewable portfolio standard (RPS), which specifies a minimum level of power generation from low- or zero-carbon sources, also places mandatory obligations on the electricity sector. States are also considering and implementing technology standards, the most notable example being the California mandate for reduced GHG-emissions vehicles.

A fourth policy that could turn out to be significant is the formation and implementation of state-level registries of GHG emissions behavior. This paper will focus on the two latter sets of policies.

3. What Is Important for a National Cap-and-Trade Policy?

A national cap-and- trade policy involves a number of key choices, four of which are particularly important for our evaluation of state policies. These choices include the breadth of the system, the stringency of the cap on emissions, the point in the energy supply chain at which permits must be held and measured against emissions, and the way that allowances will be allocated.

The breadth of the systems refers to the determination of which entities and processes will be covered by a cap on carbon emissions. The broader the system, the lower the cost of any given level of emissions reductions (Keeler 2002). Broader systems allow less chance of leakage and therefore pose less risk of encouraging inefficient patterns of economic activity. A key choice here is between a system that only covers large stationary sources – electric utilities and big industrial boilers – and a system that also covers the transportation, home heating, and other sectors.

The stringency of the cap on emissions has an obvious and central importance. Lower caps mean lower emissions, *ceteris paribus*, and also mean higher costs.[1] The stringency of the cap depends not just on the quantitative limit, but also on the part of the economy that is covered. The choice is a reflection of the political willingness to bear costs to reduce GHG emissions, and will clearly be a central and vigorously debated parameter in any GHG reduction legislation. The extent to which the cap changes over time, and how far in the future it is specified, is also important. On the one hand, it is advantageous for economic actors to have a clear understanding of the incentives to reduce for a long period of time in order to make good investment decisions. On the other hand, there are advantages to being able to adjust the stringency of the cap in response to information about new technologies, costs, and other possible changes in the overall GHG reduction system.

The architecture of the system – the point at which GHG emissions are measured against the allowances required – has implications for both the costs of running the system and the breadth of the sources covered. Fortunately, CO_2 emissions can be accurately predicted from data on fuel type and composition, so actual measurement is not necessary for an allowance system.[2] If allowances are held and emissions measured at the point of fossil fuel combustion, it is impractical to cover users that are not electric utilities or large industrial boilers. A choice to administer a system at the level of combustion is essentially a choice to restrict the system to large emitters, or to have separate systems for different classes of emitters.

The way allowances are allocated has relatively little effect on the price of energy, but it can have significant effects on the overall efficiency of the policy and profound consequences for the distributional effects of the system – who gains and who loses. The allowances are valuable and fungible assets, and billions of dollars per year are at stake in determining how to allocate these in a national carbon cap and trade system. In the Acid Rain Trading Program, as well as other programs in the United States,[3] the great majority of allowances have been "grandfathered," meaning that they have been given without cost, based on some pattern of historical production or emissions. Grandfathering has been advantageous for electric utilities. However, allowances could also be sold or auctioned, thus raising revenue for the federal government that could be

[1] There is a point of view that holds that reductions in emissions lower costs (Porter and Van der Linde 1995 , Bernow, et. al. 1998), but in my view this is a minority opinion and runs counter to most economic analyses (see Jacoby 1999 for a full discussion).

[2] If emitters can measure and verify that they are producing less CO_2 than predicted by fuel type, then they can be credited with these reductions (CCAP 2002). Electric utilities already have continuous emissions monitors that measure actual CO_2 emissions, but most other sources do not.

[3] Examples include the lead banking program, RECLAIM, and the NOx OTAG program in the northeastern United States.

used to offset reductions in other taxes, reduce the deficit, or invest in particular environmental projects. A large and far from settled literature discusses the advantages and disadvantages of raising revenue through environmental taxes, but it is generally agreed that there are significant efficiency advantages in making the value of allowances part of government revenues rather than giving them out for free (see Goulder and Bovenberg and Smith and Ross for a discussion of these issues relative to GHG emissions trading). A carbon system, has the additional problem of defining who should receive allowances – primary energy producers, utilities, processors, and refiners, or end users.

In any system that grandfathers allowances, participating entities have strong incentives to get the largest allocation possible. Therefore, collecting and interpreting historical and other data to apportion grandfathered allowances will be a contentious process with potentially large returns to manipulating data or rules. Allocation schemes that can steer clear of grandfathering based on individual firm history avoid this set of conflicts.

In sum, I take the position that the ideal cap-and- trade program (leaving aside political feasibility) is one that covers all CO2 emissions in the economy, is administered at the point at which fuel enters the economy, and sells or auctions some portion of allowances to produce revenue. This paper will base its evaluation of state programs on this characterization.

4. Evaluation of State Programs

A. Cap-and-trade programs

Electric utility cap-and-trade programs have been passed into law in New Hampshire and Massachusetts. In each case, quantitative limits are placed on utilities that operate inside state boundaries. Both states also allow these emissions limits to be exceeded if qualifying "offsets" are purchased from entities outside the utility system that demonstrate GHG reductions under rules and protocols that have yet to be fully worked out. Governor Pataki of New York has called for a regional CO_2 utility cap-and-trade program, and nine northeastern states have expressed interest in participating (Environmental News Service 2003).

These programs have the core advantage of placing a clear price signal on the carbon emissions of electricity generation. They draw on both the theoretical and practical strengths of cap-and-trade programs and are quite similar in design to the national policy that serves as the backdrop for this paper. However, these programs may have some unintended consequences because of their limited geographic scope. They also have the potential to strongly influence the design and adoption of a national policy, and not in entirely positive ways.

The potential for leakage is even more serious in these programs than it is in a national utility-based cap-and-trade program. First, higher-carbon electricity may be imported from other states as the price of generation rises in the cap-and-trade region. If importation is prevented through the design of the cap-and-trade system, there is increased risk that electricity-intensive economic activity will shift to areas without an explicit carbon price in the electricity bill. Also possible is leakage to non-electric power (e.g., oil and gas home heating) and to small, non-utility electric generation that would be exempt from the utility cap and trade (e.g., small natural gas turbines or fuel cells that would work on a plant, neighborhood or household level).

Leakage not only limits the effectiveness of state carbon caps but also changes the pattern of electricity generation away from states that have cap and trade programs. Utilities that add generation capacity in response to other states' programs will tend to increase their output and earnings and will have an economic incentive to maintain that level of generation under any future national program. They are also likely to argue that investments in new generation capacity that would be made less valuable by a national GHG cap represent "stranded costs" for which they should be compensated. All of this makes the implementation of a national cap more difficult and provides arguments to make any such cap less stringent, *ceteris paribus.*

The implementation of a number of utility-based programs make it more likely that a national cap-and-trade would also be utility based. Systems would already be in effect with rules, reporting systems, and other accompanying regulations. The restriction to utilities implies the drawbacks in coverage, efficiency, and leakage relative to a broader system.

Closely related is the fact that the existence of state systems makes it much more likely that a national cap-and-trade will be implemented at the level of large combustion sources. This means that transportation, non-electric home heating, and non-utility electric generation sources will not be covered, since the only practical way to have truly broad coverage is with a system that measures allowance against carbon content at the point at which fossil fuels enter the US economy.[4]

As functioning systems, the state cap-and-trade programs will produce information that is likely to influence the stringency of a national carbon target. In particular, a national cap is likely to be influenced by the average carbon emissions per BTU--and the cost of achieving this level-- in the state programs. This information will assist federal decision making in that the choice of an appropriate national level of GHG reduction can be based on the cost and effectiveness of the approaches that these utilities have implemented. However, if the state caps are fairly lax, utilities might claim they made decisions based on this expectation of a fairly low carbon price and a stricter cap presents an unfair burden. This objection could influence a national policy to have a weaker cap than might otherwise be decided upon.

A more difficult issue is the assignment of allowances. State cap-and-trade programs are likely to grandfather allowances to electric utilities. This will create a strong presumption that a national system will do the same. Therefore, utilities will be in a more favorable position than others that might receive these allowances. Consumers would not receive the benefits of the value of these allowances, either through some form of direct rebate or through the beneficial fiscal or expenditure effects of increased government revenue. To the extent that revenues would then be unavailable for purposes like investments in low-carbon technologies or retraining of displaced workers[5], this grandfathering limits the political options available to build support for the program.

The assignment of allowances is the single biggest determinant of the financial effects of a national cap and trade program on individual entities. Companies that receive grandfathered

[4] See Keeler (2002) for further discussion of this issue.
[5] See Center for Climate Policy (2002).

allowances for a substantial share of the historical emissions will tend to do very well under an allowance program, even if the costs to the economy as a whole are significant. Goulder and Bovenberg have estimated that energy companies will be fully compensated for their economic losses if only 15 percent of the allowances for oil and gas companies and 4.3 percent of the allowances to the coal industry are grandfathered; Smith and Ross find that 9 percent of allowances need to be grandfathered to compensate the owners of fossil energy sources.

This analysis suggests three desirable design parameters for state and regional cap-and-trade programs:

- Design the program around the carbon content of energy sold and used in the state, and not energy generated in the state.

- Limit the initial phase of the program to four or five years, and expressly provide that allowances for this first phase do not entitle utilities to any particular allowance in subsequent phases or in the allocation of a program that supersedes the state program (i.e., a national carbon-cap-and trade).

- Try to keep some share of the available allowances from being grandfathered to utilities; either sell that portion to produce revenue or give it to other entities that are affected by the implementation of the system.

B. Renewable Portfolio Standards

Renewable portfolio standards (RPS) specify a minimum percentage of a state's electricity that must be generated from renewable sources, which generally means no- or low-carbon sources. RPSs can generally be expected to raise the cost of electricity by some small amount, and have effects similar to subsidies in possibly encouraging an inefficient mix of energy technologies. The difference is that the increased costs are borne by electricity consumers rather than by taxpayers. To the extent that electricity prices are raised, both generating capacity and economic activity may shift to other states, partially offsetting some of the GHG reductions that the policy brings about. However, if RPS systems allow existing out-of-state renewable sources to be used toward their requirements, the effect of these systems may simply be to change the location at which that energy is used without affecting overall CO_2 emissions. To the extent that RPS policies create profits for producers of electricity from qualifying sources, these producers will expect to do at least as well under any national GHG policy.

C. Technology/Efficiency Standards

A variety of technology standards focusing on energy efficiency or alternative fuels could be implemented at a state level. These range from mandating given levels of insulation in building codes to California's mandate for low-GHG vehicles. There is a large literature on the efficacy and efficiency of pursuing technological innovation through the imposition of standards (see Jaffe, Newell, and Stavins 2002). What should be noted here is that standards for consumer goods and for many classes of capital goods are particularly problematic for state, as opposed to national, programs. There is relatively little chance of leakage in standards for building codes,

but standards for industrial boilers or consumer durables will be hard to enforce if there are significant price and/or performance differences and if alternative products are freely available in adjoining states.

From the standpoint of national policies, the biggest influence could come from the implementation of technology standards in the transportation industry. Specifically, if these standards are viewed as a substitute for other policies, they may keep the transportation industry outside of a national cap and trade policy. Automobile manufacturers, trucking companies, and others with a stake in the continued use of fossil fuels for transportation could claim that they were making significant progress through meeting the technology standards for large states, and that including them in a cap-and-trade would be double jeopardy. This would be unfortunate from the standpoint of moving toward a comprehensive and efficient national GHG limitation policy. Technology standards affect emissions per vehicle mile traveled (VMT) but can increase VMT by reducing the cost per mile driven. Transportation, which emits an estimated one-third of CO2 GHG emissions in the United States, would then remain on different footing from other sectors of the economy.

There is no practical or theoretical reason why sectors covered by technology standards cannot also be covered by cap-and-trade programs, although some would argue that this makes the standards irrelevant. Certainly national policy could encompass the transportation industry or other technologies affected by state technology or efficiency standards. The risk is political – once under a severe regulatory program, industries may be better able to avoid being part of a second, more comprehensive policy.

D. Subsidies and Tax Incentives

States have used subsidies and tax breaks to encourage the use of alternative power sources, particularly biofuels. The federal government has, of course, done this on a much grander scale with its subsidies of ethanol production. The effectiveness of subsidies for low-carbon technologies depends on the quality of the technologies and the degree of behavioral change brought about by the subsidies. The risk is that subsidies will encourage economically inefficient technologies, which will mean that we are collectively paying more to reduce GHGs than we might with other expenditures. Effectiveness depends on how well the subsidy is targeted, as well as on its magnitude. Given the current fiscal crisis faced by state governments, significant expansion of subsidy programs is extremely unlikely.

Subsidy programs do very little to influence or impede a national cap-and-trade policy. To the extent they remain in place, they may alter the mix of technologies used to meet the cap, but they are unlikely to have any significant negative effect on program design or implementation.

E. Registry and Offset Programs

GHG registries are a form of reporting and disclosure where businesses register official measurements of their GHG emissions with a government entity. The U.S. Department of Energy has had a voluntary emissions registry, known as 1605(b), for a decade. There are also a number of state registries, the most well-established and comprehensive of which is in Wisconsin.

The registries are valuable because their information is useful in formulating GHG policyand they make businesses more aware of the source of their GHG emissions. The risk in registry programs lies not in the information they provide, but rather in their role in the allocation process in a future national cap-and-trade program.

Businesses express a legitimate fear that if they begin to take steps now to reduce their GHG emissions, they will be disadvantaged if allowance allocations are given out proportional to GHG emissions. This is because they will have lower emissions than those companies that have not made investments to reduce emissions, and therefore will receive fewer allowances. By documenting their baseline emissions in a registry, they can receive consideration for those reductions in any future allowance allocation schemes.

This process raises two problems. First, it gives businesses an incentive to inflate their baselines, and then give these estimates the legitimacy of being in a state registry. States will generally like to show large reductions and will therefore have little incentive to challenge inflated "before" emissions estimates as long as the "after" estimates are correct. Hence, there will almost certainly be significant conflict between states over the validity of their registries and the fairest way to determine grandfathered allocations.

More broadly, registry programs create a process where there is a widespread expectation – probably encouraged by state officials[6] -- that allowances will be grandfathered based on existing patterns. This expectation will make it more difficult to adopt allocation schemes that are not based on grandfathering, or that cede allowances to entities other than current GHG emitters, even if such schemes have significant advantages.

Were a national policy to base allocations on a scheme that did not rely on the historical emissions of specific entities, there would be no incentive to use the registry process strategically. Even if allowances were grandfathered based on industry-wide average rates, this problem could be avoided. The registries would then fulfill their function as valuable informational tools without throwing up roadblocks for a national policy. However, there is a strong presumption that the model of the Acid Rain Program will be followed. The more state registries are formed and used, the more likely a less than optimal, contentious allocation process will be selected, thus creating an additional hurdle to finding a fair and transparent way to allocate allowances in a national cap-and-trade program.

Offset programs allow entities not covered by a mandatory GHG cap to get credit for demonstrated and verified reductions in GHG emissions in the form of emissions allowances. For example, if a forestry project can demonstrate that 100 tons of additional carbon is sequestered through specific management decisions, it will receive 100 tons worth of credits that it can sell to entities that are covered by a GHG cap and trade system. Landfills that can reduce methane emissions and transportation projects that reduce GHGs in urban areas are two of many

[6] For example, Rabe (2002) quotes a Wisconsin state official discussing their experience with the Acid Rain Program and the GHG registry: "We said we would make sure that they were grandfathered and they were. They remember that, so they will trust us when we say we will make sure their early reduction of greenhouse gases are protected as well."

other potential sources of GHG offsets. In theory this is good policy: it creates incentives for measurement and reduction of GHGs in otherwise uncovered sectors, and reduces the overall cost of any given level of emissions reductions.

Two potential problems arise when states set up offset programs as part of their cap-and-trade systems. First is a possibility that the rules governing offsets may not be carefully crafted at the state level, e.g., providing credits for reductions that are not well measured and verified to be real and permanent. This will create an expectation that these rules will be carried over into a national system – particularly if investments have been made in response to particular baseline and accounting rules.

The other problem is that the entities providing offsets will expect to be treated similarly in a national program that replaces state programs, and will work hard to influence the political system to continue these arrangements. If successful, such an outcome will mean that the mandatory program will be narrower in coverage than it would otherwise be, resulting in higher costs per unit of GHG reduction and the disproportionate incidence of those costs on the entities by the mandatory program.

As with registries, it is entirely possible that national GHG programs will be formulated in such a way that state offset policies are not impediments. It depends entirely on the way that existing policies, rights, and obligations affect national program design. I believe there is significant risk that state rules for offsets will be grandfathered into a national system; therefore the states should be very careful in setting up these programs, both in terms of measurement and accounting rules and also in terms of the time horizon for which offset rules and rights are guaranteed.

5. Conclusion

The states are proving their determination to cut GHG emissions by enacting a variety of policies. These policies are likely to change the regulations and the economic incentives facing the electric utility sector in particular, although many parts of the economy will be affected in lesser ways.

This paper has argued that there are circumstances that make these policies less effective and efficient than similar policies introduced and implemented at a national level. This is unfortunate, but it is not a significant criticism – there is indeed little prospect of a national policy in the immediate future.

This paper finds that the most significant risk of state programs is that they will create a series of rights and expectations that will be an impediment to a broad and efficient GHG policy administered at the national level. Utilities are likely to use their allocations under state programs as a minimum entitlement under a federal program. Where states have different criteria for setting carbon limits, it will be difficult to move to an even footing without choosing the least stringent common denominator. The transportation industry may use the existence of technology standards to argue for exemption from a national cap-and-trade program. Individual companies will use the state registry programs as a demand for freely conferred allowances.

In the absence of federal policies, states have strong reasons and significant political support from environmental constituencies to enact the kinds of policies described here. Without arguing against the validity of these motivations, this paper finds reason to keep an eye firmly on an eventual national policy response to this problem when deciding whether mandatory state policies are in the best interest of comprehensive and efficient GHG reduction. If states do opt for mandatory policies, this paper suggests that state programs should try to anticipate a later national program in key aspects of program design. They should try to grandfather allowances only partly, and should set up their programs initially for a fairly short duration. States that proceed with registry programs should try to follow a set of common procedures to avoid placing businesses from different states on unequal footing. Unfortunately, the policy that would be most effective at limiting damage from state programs is a clear statement from Congress –in its soon-to-be-enacted cap-and-trade program-- that allowances will be only partly grandfathered, and that this grandfathering will not be based on individual company data. It is, of course, the lack of any prospect of a mandatory national policy that has led states to take a leadership role in the first place.

References

Bernow, Stephen, William Dougherty, Max Duckworth, Sivan Kartha, Michael Lazarus, and Michael Ruth, 1998, *Policies and Measures to Reduce CO2 Emissions in the United States: An Analysis of Options through 2010,* Tellus Institute and Stockholm Environmental Institute, http://www.seib.org/energy/publications/policies&measures.pdf (accessed 12/08/2003).

Center for Clean Air Policy, 2002, "State and Local Climate Change Policy Actions" http://www.ccap.org/pdf/State_Actions.pdf (referenced 12/8/2003).

Climate Policy Center, 2002, *The Sky Trust Proposal to Reduce U. S. Carbon Emissions,* http://www.cpc-inc.org/library/files/10_skytrustno.pdf (accessed 12/08/2003)

Environmental News Service, 2003, "Northeast Governors to Create CO2 Emissions Trading System," http://www.naturalist.com/eco-news/index.cfm?p=display&id=7493 (accessed 12/08/2003).

Goulder, Lawrence, and A. Lans Bovenberg , 2001, "Neutralizing the Adverse Industry Impacts of CO2 Abatement Policies: What Does ItCost?" in C. Carraro and G. Metcalf, eds., *Behavioral and Distributional Effects of Environmental Policies*, University of Chicago Press.

Jacoby, Henry, 1999, "The Uses and Misuses of Technology Development as a Component of Climate Policy," in *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality* , Walker, C.E., M.A. Bloomfield & M. Thorning (eds.), Washington, DC: American Council for Capital Formation Center for Policy Research.

Jaffe, Adam B., Richard G. Newell, and Robert N. Stavins, 2002, "Environmental Policy and Technological Change," *Environmental and Resource Economics* **22:** 41–69.

Keeler, Andrew, 2002, *Designing a Carbon Dioxide Trading System: The Advantages of Upstream Regulation*, Center for Climate Policy, http://www.aecsinc.org/AECS%20white%20papers/Upstream.pdf, accessed 12/04/2003).

Maine State Planning Office and University of Maine**,**2002, "State of Maine Climate Change Action Plan - Responding to Global Climate Change and Achieving Greenhouse Gas Emissions Reductions in Maine: *Roles for Industry, Business, Government and Citizens,* http://www.umaine.edu/mcsc/Research/EnvPol.htm (referenced 12/4/2003).

New Hampshire Revised Statutes Annotated. 2003. Title 10, Section 125-O.

Porter, M. and C. van der Linde. 1995, "Towards a New Conception of the Environment-Competitiveness Relationship," Journal of Economic Perspectives 9:4.

Rabe, Barry , 2002, ***Greenhouse & Statehouse: The Evolving State Government Role in Climate Change,*** Pew Center on Global Climate Change, http://www.pewclimate.org/global-warming-in-depth/all_reports/greenhouse_and_statehouse_/index.cfm (accessed 12/08/2003). November 2002.

Smith, Anne, and Martin Ross, 2002, “Allowance Allocation: Who Wins and Loses Under a Carbon Dioxide Control Program?” Center for Clean Air Policy, http://www.ccap.org/pdf/ccap_cra_report.pdf (accessed 12/08/03).