REDUCING CONFLICTS BETWEEN CLIMATE POLICY AND ENERGY POLICY IN THE U.S.: THE IMPORTANT ROLE OF STATES

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May 25, 2005

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ABSTRACT

The absence of U.S. national action on global climate change policy has prompted initiatives by the U.S. Congress, cities, states, and regions toward what is likely to become a long-term, collaborative effort to harmonize national energy and climate policies. This upward evolution in the face of a reluctant administration is historically consistent with the development of national legislation on other environmental and social issues in the U.S. At the heart of this movement is the need to resolve conflicts between high-intensity use of low-cost fossil energy supplies, and the dominating impact of carbon dioxide emissions on global climate change. U.S. states are among the largest carbon dioxide emitters in the world and play a critical role in supplying and transforming energy, as well as consuming it, for economic advantage. State governments are also likely to have to shoulder some of the cost of potentially extensive climate damages and bear the brunt of the cost of implementing future federal mandates. As a result, many are taking proactive stances on the development of climate mitigation policy to prepare for, accelerate, and/or guide national policy. As U.S. states show leadership on addressing greenhouse gas emissions, they also play an important role in forging policies and measures that reduce economic conflict between energy and climate goals. A number have launched or completed greenhouse gas mitigation plans and other major policies in the past few years that address these conflicts through: 1) Finding ways to reduce mitigation costs, including the use of incentive-based policy instruments; 2) Promoting an open and democratic policy process that includes major stakeholders; 3) Promoting equity across socioeconomic groups, regions, and generations; and 4) Promoting interregional cooperation. The results are promising and suggest that the state arena for climate and energy policy is evolving quickly and constructively toward alternatives that reduce conflict. Regional efforts are also unfolding, along with greater congressional attention to the lessons learned and commitments made by sub-federal actions. In the next few years many national energy and climate conflicts are likely to be tested and addressed by states. Among these, Pennsylvania is likely to be an important player due to its high profile of energy production and potential for leadership.

May 25, 2005

I. INTRODUCTION

Soon after taking office in 2001, President George W. Bush declared that the U.S. would not ratify the Kyoto Protocol. Although this was a major blow to international cooperation in addressing climate change, it did not halt most efforts in the U.S. to deal with the problem. Momentum on climate policy had been gaining at the state and local level for many years, and, in some parts of the country, the President's decision inspired governments at these levels to take up the slack. In fact, leadership on climate change policy in the U.S. has clearly swung to the states.[1]

There are a number of advantages to pursuing climate policy at the state level. Individual states provide a smaller and more manageable scale for policy development, and a greater combined diversity of policy needs than the U.S. as a whole, thereby providing more effective policy development opportunities with fewer intractable conflicts. The large number of state entities provides numerous opportunities for experimentation in designing policy.[2] It also facilitates differentiating policies to meet special geographic needs, a critical issue given the substantial differences between state greenhouse gas trends and profiles. Historically, state actions have preceded and guided many national environmental (and other) policies by identifying effective and politically viable pathways for action (Peterson, 2004; McKinstry, 2004). Finally, even federal policies are likely to be delegated to or otherwise implemented at the state and local levels, and may even be more effective if designed there. States have important powers, including the freedom to go beyond federal authority for greenhouse gas (GHG) controls, as well as the power of the purse in funding or structuring incentives for implementation programs.

At the same time, there are some drawbacks to formulating policy at the state level. This could lead to a duplication of efforts (e.g., in research and development). It could also lead to some negative aspects of interstate competition, ranging from unintended side-effects of capital flight/carbon leakage to a deliberate "race to the bottom" in the leniency of approaches to the issue for some states with lagging economies. A lack of consistency and harmony between state implementation programs could also complicate regional and national cooperation on mitigation programs.

One of the most profound impacts of the issue is the nexus between climate policy and energy policy. For the U.S. as a whole, and in each of its states to varying degrees, fossil fuel combustion is the prime generator of carbon dioxide emissions, the dominant greenhouse gas (GHG). At the same time, in the U.S. as a whole, and again in all states, fossil fuels are the predominant energy source. Hence, climate policy must subsume energy policy, and energy policy will be highly influenced by climate policy. Moreover, in terms of domestic policy directly, and even international energy policy indirectly, state governments will be playing an increasingly major role, even to the point of possibly surpassing federal influence. Of course, state actions will not be undertaken in the absence of strong involvement, formally or informally, of powerful energy interests, including conventional fossil-based industries, with much to lose, and renewable energy and possibly nuclear industries, with a great deal to gain.

Climate policy and energy policy are often potentially at loggerheads, but a major theme of this paper will be to identify ways of reducing inherent conflicts. These include:

- Finding ways to reduce mitigation costs, including the use of incentive-based policy instruments and methods of expanding choice.
- Promoting an open and self determined policy process that includes major stakeholders working directly with state policy makers.
- Promoting equity across regions, socioeconomic groups, and generations.
- Promoting interregional cooperation.

Mechanisms for reducing conflicts will be especially important in the years ahead. Early success at state level GHG mitigation action planning has primarily been in coastal areas, such as New England and the West Coast, without major energy producers and relatively modest energy consumption. The policy process is likely to be different, and may get more difficult, as other U.S. states and regions take action. We illustrate some of these issues by focusing on Pennsylvania, which contains major energy producers and consumers, and may become a key state arena on climate policy.

II. STATUS AND DIRECTION OF U.S. STATE CLIMATE ACTIONS

To date, 39 states have developed greenhouse gas inventories and 30 states have developed some form of greenhouse gas action plan (U.S. EPA, 2003b). Many initial versions of these plans were developed in anticipation of a treaty that would lead to national legislation and coordination with sub-federal governments. At the time, U.S. states were not expected to lead national policy, but the emphasis has since shifted in this direction, along with significant local government actions.[3]

Early state and local planning efforts for the most part did not involve approval of elected or appointed officials, intensive quantification of costs or benefits, or significant public input (excepting the NJ and WI plans). In the last few years however, several U.S. states, regions, and localities have stepped forward with much more serious policy making efforts. A number of sub-federal jurisdictions have developed (or are developing) comprehensive plans that are expected to include numerical goals and timetables and a portfolio of actions across all economic sectors (AZ, CA, CT, MA, ME, New England, NJ, Northeastern States, NY, OR, Puget Sound, RI, West Coast, WI). A number of other states are exploring GHG reduction opportunities as a co-benefit to economic, energy or other environmental policies, including NC, NM, and PA. Mitigation planning efforts at this level are rapidly evolving to include advanced quantification of cost and benefits, substantial public participation, direct approval by officials in both the executive and legislative branches, and formal cooperation across jurisdictions (CT and RI).

Increasingly, U.S. jurisdictions involved in climate mitigation planning are also considering pathways to and coordination with federal and international programs that are widely expected to emerge in coming years. Coordination with regional agreements in New England (The New England Governors/Eastern Canadian Premiere's Agreement or NEG/ECP), the Northeast (the Regional Greenhouse Gas Initiative, or RGGI), the West Coast (the West Coast Climate Initiative), and the northern Midwest (the Powering the Plains initiative) are significant

steps in this direction. U.S. jurisdictions have also become more active in considering the joint beneficiaries (or co-benefits) of greenhouse gas reduction in developing and implementing economic, energy and environmental policies (Peterson 2004; Pew, 2003; SAIC, 2003). A wide array of actions in other policy areas is evolving from consideration of the co-benefits of greenhouse gas mitigation.[4]

State mitigation actions on climate change are globally significant. If U.S. states were compared to other national jurisdictions, they would represent 35 of the world's top 75 carbon dioxide emitters (CDIC, 2001). The State of Texas is the world's seventh largest emitter, and Pennsylvania is the 23rd largest (see Table 1). Moreover, the six North Central States as a region are responsible for 353.51 Million Metric Tons Carbon Equivalent (MMTCE), or more than all but three countries.

The reluctance of the current U.S. administration to pursue national policy has not deterred the U.S. Senate from taking a more proactive stance. In 2003, Senators McCain and Lieberman introduced S 139, The Climate Stewardship Act of 2003, and the first omnibus national legislation for climate policy. (A number of related authorization and appropriation bills have also been introduced to address more specific elements of the climate change issue.) The McCain-Lieberman legislation represents a long-term vehicle for development and negotiation of a national climate change policy. In October 2003, the bill received 43 votes in favor, a significant number for emerging legislation on a major issue. Political support for the bill has been influenced by the support and actions of U.S. Governors and local officials who, no doubt, are reacting to growing public opinion. The design of the bill also has been influenced by the experience of state and regional level policy efforts. Congressional drafters anticipate that future iterations of the bill will become more specific where state and regional actions intersect, opening the door for a more coordinated relationship (Congressional Staff, 2004).

The upward evolution of national climate policy from state actions in the U.S. is not a unique pathway to national legislation. A number of national environmental laws passed in the last century found their start in sub-federal actions, including those addressing clean water, clean air, surface mining laws, wildlife conservation, and soil conservation (McKinstry, 2004b). (A variety of social policies also were driven by state actions, including civil rights). The 1990 amendments to the Clean Air Act are particularly relevant. An accumulation of science by the mid-1980's established acid rain as a major international issue, with particularly intense effects in Northern Europe and the Northern U.S. Federal response to the problem was slow, and collective response by Governors was initially complicated by the geographic politics of economic winners and losers. In the late 1980's, a few northern states forged ahead to enact acid rain controls and formation of a collective regional effort. New market-based policy mechanisms were piloted through this process and ultimately adopted in Title IV of the Clean Act, as amended. Many policy-makers believe the climate change issue may be traveling a similar pathway today.

TABLE 1. COMPARISON OF CO2 EMISSIONS FOR U.S. STATES VS. NATIONS IN 1999 AND 2000

Rank	National or Sub national Jurisdiction	MMTCE
1	United States	1528.70
2	China (Mainland)	761.59
3	Russian Federation	391.66
4	Japan	323.28
5	India	292.27
6	Germany	214.39
7	**Texas**	**181.11**
8	United Kingdom	154.98
9	Canada	118.96
10	Italy (Including San Marino)	116.86
11	Republic of Korea	116.54
12	Mexico	115.71
13	Saudi Arabia	102.17
14	**California**	**99.52**
15	France (Including Monaco)	98.92
16	Australia	94.09
17	Ukraine	93.55
18	South Africa	89.32
19	Islamic Republic of Iran	84.69
20	Brazil	83.93
21	Poland	82.25
22	Spain	77.22
23	**Pennsylvania**	**74.28**
24	Indonesia	73.57
25	**Ohio**	**71.49**
26	**Florida**	**64.28**
27	**Indiana**	**63.95**
28	**Illinois**	**63.13**
29	Turkey	60.47
30	Taiwan	57.99
31	**New York**	**57.86**
32	**Louisiana**	**56.83**
33	Thailand	54.22
34	Democratic People's Republic of Korea	51.54
35	**Michigan**	**51.46**
36	**Georgia**	**44.93**
37	Venezuela	43.05
38	**Kentucky**	**39.97**
39	**North Carolina**	**39.86**
40	Malaysia	39.41
41	Egypt	38.82
42	Netherlands	37.90
43	Argentina	37.72
44	**Alabama**	**37.62**
45	**Tennessee**	**34.34**
46	**New Jersey**	**34.14**

47	**Missouri**	**33.95**
48	Kazakhstan	33.10
49	Czech Republic	32.42
50	Uzbekistan	32.38
51	**West Virginia**	**30.81**

Sources: World data from Marland et al. (2000); U.S. state data from U.S. EPA (2004).

Unlike the Acid Raid issue, however, which was addressed by a single policy mechanism for one sector (a phased cap and trade program for electric power generation), U.S. state actions to address climate change have followed a portfolio approach that combines a variety of voluntary and mandatory policy mechanisms across a all economic sectors (Dernbach, 2000; Peterson, 2004). Other nations seeking to comply with the Kyoto Protocol appear to be following a similar path. U.S. state climate policy mechanisms include a variety of traditional approaches such as funding mechanisms (incentives and disincentives); regulation (caps, codes and standards); technical assistance (direct or in kind); research and development; information and education; and monitoring and reporting (including impact disclosure). Covered sectors include power generation, residential, commercial, industry, transportation, waste management, agriculture and forestry. These sectors cut across private and public sector facilities and programs, as well as producers and consumers of energy. Typically these actions are united under a series of jurisdictional targets and timetables and an emissions reporting system (sometimes referred to as an emissions registry). Six greenhouse gases recognized by the UNFCCC have been recognized in sub federal efforts, including carbon dioxide, nitrous oxide, methane and three synthetic gases (HFC's, SFC's, PFC's). Recently more attention has been given to black carbon as a potential gas (CT, ME, Puget Sound) due to growing scientific evidence (Hansen and Sato, 2001; GAO, 2003).

Because an estimated 83 percent of greenhouse gas emissions in the U.S. (89 percent in PA) result from combustion of fossil energy and carbon dioxide (U.S. EPA 2003a), most state, local, and regional policies have focused on energy issues. These include electric power generation, direct fuel use for heating and cooling of buildings and facilities, and transportation. The percentage contribution of these sectors to state emissions inventories varies. In highly populated jurisdictions that are not large energy producers, or are relatively efficient energy users, transportation often dominates. For instance, 50 percent of the CA state GHG inventory was due to transport emissions in 1990 (EPA, 2003a), and 55 percent of the inventory in the Puget Sound (Washington State) four-county region in 2000 (PSCAA, 2003). The states of PA, WA, and CT make interesting comparisons of the variation in emissions sources and rates (Table 2 below).

TABLE 2. IMPORTANT STATE INDICATORS FOR CLIMATE POLICY, 2000

	Connecticut		Washington		Pennsylvania		
Indicators	Level	% Of U.S.	Level	% Of U.S.	Level	% Of U.S.	Total U.S.
Population	3,405,584	1.21	5,894,141	2.09	12,281,054	4.36	281,423,231
Per Capita Gross State Product ($)	47,548		37,002		32,529		35,147
Per Capita Carbon Emissions (tons)	3.2		3.9		5.2		5.4
Per Capita Fossil Intensity (Btus)	183,317		215,774		295,618		297,624
Energy Production							
Coal (thousand short tons)	0	0	4,300	0.40	74,600	6.95	1,073,689
Oil (thousand barrels)	0	0	0	0	2,233	0.11	2,097,124
Gas (million cubic feet)	0	0	0	0	149,414	0.78	19,181,980
Renewables/Hydro (million kwh)	2,679	0.75	81,754	22.93	5,021	1.41	356,480
Nuclear (million kwh))	15,428	2.01	8,250	1.07	73,731	9.59	768,826
Energy Consumption							
Coal (thousand short tons)	1,477	0.14	6,498	0.60	63,474	5.86	1,084,080
Oil (thousand barrels)	69,318	0.96	156,472	2.17	256,755	3.56	7,210,595
Gas (million cubic feet)	159,712	0.68	286,653	1.23	702,847	3.01	23,368,308
Renewables/Hydro (million kwh)	2,007	0.66	78,257	25.71	1,890	0.62	304,361
Nuclear (million kwh)	16,365	2.17	8,605	1.14	73,771	9.79	753,893
Forested Land (million acres)	1.9	0.25	22.2	2.97	20.1	2.69	747

Sources of data:

Gross State Product: BEA (2003).
Population: BOC (2003).
Consumption and Production: DOE (2002).
Forested Land (Pennsylvania): Sierra Club (2003).
Forested Land (Connecticut and Washington): National Association of State Foresters (2002).

Due to the energy-intensive nature of many sectors in the U.S., policymaking may involve high economic and political stakes. A careful menu of energy policy choices has evolved in U.S. state efforts to achieve greenhouse gas mitigation through adaptation of existing energy policy as well as new approaches, including:

Electric Power Generation (electric utilities, distributed generation)

- Development of low emitting energy supplies, including renewable energy, non-fossil alternatives, and high efficiency fossil technologies
- Implementation of improved transmission and supply chain efficiency

Buildings, Manufacturing and Facilities (residential, commercial and industry sectors)

- Creation of demand reduction programs, including energy efficiency and conservation
- Implementation of fuel switching from high to low emission energy supplies

Transportation (passenger, freight and aviation)

- Development of low emission and or high efficiency vehicle technologies
- Development of low emitting fuel sources, including renewable and non fossil alternatives
- Implementation of demand reduction programs, including reduced travel demand and shifts to high efficiency/low emission transport modes

Due to the challenges of some implementation programs and the scale of emissions reductions needed in the long term to stabilize the earth's climate (75-85 percent net reductions in the next century, IPCC, 2001; NAS, 2003), a number of potential conflicts exist between energy and climate policy needs. These include the need for cost reduction, consensus, fairness and jurisdictional cooperation. A number of alternatives exist for addressing these conflicts through local, state and regional actions and elevate the importance of efforts at these levels.

III. REDUCING CONFLICTS BETWEEN CLIMATE AND ENERGY POLICY THROUGH STATE AND LOCAL ACTIONS

A. Reducing Conflicts by Reducing Mitigation Costs and Expanding Co-Benefits

Conflicts associated with high costs or low measured benefits of GHG mitigation can be reduced by broadening participation of non-energy sectors toward climate goals, expanding value or credit of co-benefits, or developing alternative solutions within the energy sector, including credit and market incentives mechanisms.

1. Broadening Participation of Non-Energy Sectors Toward Climate Goals

Because GHG's mix freely in the atmosphere, reductions are of equal value wherever they occur and regardless of the entity. As non-energy sectors (such as forestry, agriculture, waste management and some industrial entities) join the campaign to reduce GHG's, the level of effort required by the energy sector decreases. Clearly the role of energy sectors dominates mitigation efforts due to the scale of carbon dioxide emissions from fuel combustion in comparison to emissions from other GHG's. At the margin, however, additional efforts by other sectors to reduce other GHG's, or increase carbon storage (thereby reducing emissions flows associated with conversion of carbon stock), can be significant in tipping the balance toward meeting targets and holding compliance costs to a minimum (Rose and Oladosu, 2002). Not surprisingly, state and local climate mitigation processes have become increasingly comprehensive in their coverage of sectors and gases to broaden participation and reduce per unit costs. In addition, comprehensive processes provide a negotiating framework that brings focus to sectors that have not taken much action in the past, such as transportation, or for newly identified

approaches that may not be well known, such as black carbon reductions. To facilitate this dynamic, state and local plans have not assigned proportional targets to sectors based on their contribution to the GHG inventory. Instead, processes have been designed to search for the lowest cost and highest benefit options regardless of the past emissions record of the sector. In effect, this allows the political process to shop for the most cost-effective, fair, and high value reduction options.

2. Expanding Value or Credit of Co-Benefits

Direct costs and benefits are typically the most important criteria in choosing and designing mitigation policies. To a lesser extent, and depending on the measure, ancillary costs and benefits and feasibility issues may also be critical, including the distribution of cost and equity considerations. Recent mitigation action plans have involved extensive calculation of direct costs and cost-effectiveness, as well as the benefits of energy or budget savings of measures (CT, ME, PS, RI). They have not systematically evaluated secondary, or indirect costs or benefits, or various elements of performance risk, instead evaluating these issues on a case-by-case basis. The benefits of avoided climate change (avoided damages) in particular have not been quantified and, as a proxy, the level of GHG reduction achieved for each measure was calculated. Calculations for GHG reductions tend to be more robust on cost estimation, but weak on benefits estimation. They specifically exclude monetary estimates of the primary benefit of climate mitigation – the avoidance of future climate damage. This weakness in estimation methods elevates the role of ancillary costs and benefits (or co-benefits) in determining the value of policy actions. Policy analyses have increasingly focused on measures with significant co-benefits or ancillary cost reductions for human health, environmental quality, economic development, or institutional objectives such as growth management. The overlap between GHG reductions and co-benefits has become very important in policy-making processes, along with mechanisms to add market value from co-benefits. One practical impact has been to soften the focus on potentially expensive energy policies.

A variety of potential approaches to credit co-benefits have been explored. For instance, the contribution of GHG actions to compliance with air quality, water quality, or transportation planning regulations can be determined by quantification of GHG measures. Where a net contribution appears, some form of credit for the action may be possible in the form of a baseline adjustment, a scoreable reduction against a pollutant budget, or as an offset for sectors facing compliance. Credits or baseline recognition under State Implementation Programs (SIP's) have been explored as one way to sweeten the value of GHG actions that simultaneously reduce criteria air pollutants. The U.S. EPA, for instance, issued a Land Use Guidance for SIP's (EPA, 2000) to provide a pathway for incentives to actions that reduce air pollution from land use patterns that reduce travel demand and transport emissions. Reduction in travel demand, or vehicle miles traveled (VMT), reduces GHG's by reducing petroleum consumption (each gallon of gasoline emits 19.6 pounds of carbon dioxide when combusted). Substitution of renewable energy for fossil generation has recently been piloted in the Washington Regional Council of Governments as a U.S. EPA SIP contingency action (ERT, 2003). Water savings technologies that also reduce energy use and greenhouse gas emissions may be important opportunities in the arid western U.S. For instance, coal based power production through advanced Integrated Gasification and Combined Cycle (IGCC) technology is estimated to save 30 to 50 percent of

water needs compared to conventional coal technology (Herzog, 2004). By providing "extra credit" for air quality benefits in this manner, the cost of some mitigation actions can be defrayed. As more measures are adopted, and more sectors participate in mitigation action plans, the cost to individual sectors or entities of reaching a common jurisdictional target is reduced. Energy sectors benefit from this expansion in scope of GHG mitigation.

Offsets rules have been developed for certain sectors to credit actions by other sectors in a manner that allows GHG actions with air quality benefits to be valued for their ability to reduce regulatory compliance costs (see for instance, the MA Offsets Rule). Water quality trading has also emerged as a potential mechanism for crediting GHG actions that also improve water quality. Under the Clean Water Act National Pollution Discharge Permit System (NPDES) total maximum daily loads (TMDL's) are established for water bodies. Compliance of entities covered in the watershed can be achieved by direct source reductions, or purchase of credits from entities with lower costs of compliance. Water pollution associated with soil erosion and nitrogen loading tends to be one of the major contributions to TMDL's. Best management practices to reduce soil loss and nitrogen runoff have the ancillary benefit of reducing carbon dioxide by reducing losses of soil carbon and reducing energy inputs to farming (diesel fuel and fertilizer), as well as reduced outputs of nitrous oxide. By providing a pathway for water quality crediting of GHG credits, these actions become more economically viable under GHG mitigation plans as well. And by providing credit for these actions under GHG targets that cover energy intensive sectors, the burden of compliance with these targets is spread.

The crossover of air quality, water quality and quantity, and GHGs under a multi-pollutant trading program such as NPDES is part of a forward evolution of "amenities stacking" or valuation of ecological services that may also include habitat protection credits under the Endangered Species Act, wetlands protection credits under Section 404 of the Clean Water Act, tax credits for land preservation under local, state or federal law, and other public incentives for private actions to protect the environment. The IRS has recognized these values in recent land transactions and easement valuations to protect land from development.

3. Developing Alternative Solutions, Including Credit and Market Incentives Mechanisms

Another important pathway for crediting and cost reduction of some mitigation actions is the development of alternative solutions that reduce the cost of implementation, or other policy conflicts. Historically, the search for alternative solutions in environmental control programs has been successful in the U.S. and is believed to be a driving force behind the better than expected cost effectiveness of programs once implemented (Jaffe, 1995). These solutions are typically developed during consensus policy development processes to address potential or perceived conflicts, and play a critical role in conflict or dispute resolution. Consensus driven state climate policy processes have been largely successful at finding alternative approaches in energy sectors, where initial policy proposals are sometimes met with opposition, when they are coupled with advanced technical support.

One key area involves the provision of financial incentives that create, encourage or force markets to reward GHG mitigation. The best-known approaches of market credit development

for GHG's are cap and trade programs that establish regulatory limits to emissions to create a market for reduction actions by entities covered under the caps. Several cap and trade programs of various designs have been implemented in the U.S. for other objectives, including the Clean Act Title IV SO2 reduction program, and the lead gasoline phase out. These programs have the potential to allow markets to find the lowest cost reductions, thereby reducing per unit costs for entities facing compliance. They also provide substantial flexibility in choosing and designing control strategies and technologies in contrast to regulatory programs that mandate certain approaches that may be outdated or less cost-effective (see, e.g., Ellerman et al., 2000; Rose and Oladosu, 2002; CCAP and FIELD, 1999). Preliminary results from the simulation of RGGI and a Western States program indicate significant cost reductions can be achieved through regional permit trading, though extension to a national program would yield sizably more gains (Rose et al., 2005).

Cap and trade programs have not, however, been universally accepted or implemented at the state or national level for a number of reasons. Many energy industries have opposed the establishment of binding caps on emissions that could constrain market growth and product output. Recently a number of design alternatives in the U.S. have been explored that modify the way standards are set for electric power generation caps to allow growth (such an output based allocation system) or provide compensation for affected parties by sharing or recycling of revenues from auction of permits. The methods for participation by other energy or non-energy sectors have not been resolved. So far these efforts have not included participation by transportation, residential, or commercial sectors, where the lion's share of emissions often occurs. Offset and credit mechanisms can be an important part of the process of integrating cap and trade programs across sectors. However, many environmental groups have opposed the use of offsets as a means to increase flexibility and reduce costs of covered parties under caps.

Other incentives mechanisms are potentially important for GHG mitigation. Renewable portfolio standards force a percentage of sold (or consumed) electricity to be supplied by low emission renewable sources, and are common among U.S. states. In Pennsylvania, a similar and newly enacted Advanced Energy Portfolio Standard will gradually introduce low emissions power, primarily from renewable sources, into the market, as well as greater energy efficiency and conservation from more conventional sources. Cost share of fixed or variable mitigation program costs are common, such as payments to farmers for installation of best management practices or waste recovery facilities. These programs support measures that serve as alternatives to more costly energy reduction measures. Extra credit in applications for financing is common, such as preferential qualifying credit for transportation projects or energy production facilities. Preferential treatment in siting decisions can also reduce the time and risk associated with recovery of costs. For instance, installation of IGCC electric generation units with carbon capture and sequestration to save carbon may cost up to 20 percent more than traditional pulverized coal-fired units for electric power generation. By providing faster approval of the project than normal, or a higher guarantee of rate recovery, the financing costs to these projects can be substantially reduced due to the time value of money and reduction of risk premiums in financial markets. Policy makers may chose to endorse this sort of market intervention due to superior environmental performance, and a host of related co-benefits, including water savings. This may be a critical issue in the future in Pennsylvania as decisions are made on the degree and type of market interventions to support emissions reduction from power generation.

B. Reducing Conflicts by Utilizing A Fair and Open Policy Process

Climate change is an "unsettled" issue in the U.S. compared to other environmental issues addressed through national law or regulation. As a result, without a reasonable degree of public consensus, public policy makers are generally unable and unwilling to implement aggressive GHG mitigation programs that involve significant costs or lifestyle changes. As a consequence GHG action plans by U.S. states and the federal government have relied primarily on very low cost (and often low return) measures absent consensus building to support more substantial actions. As leadership for climate policy as shifted, recent planning efforts by U.S. states have become far more intensive in seeking consensus for actions and targets that can achieve substantial reductions (CT, ME, OR, NY, PS, RI). Because potential costs to energy-intensive sectors are high, and consensus on cost, benefit and implementation issues is typically low, planning efforts are laden with conflicts and resistance at the start. These conflicts can be largely resolved through effective processes that provide avenues for fact based evaluation and design of alternatives.

Processes that are transparent, inclusive and objective can reduce conflicts that arise over differences in opinion on costs, benefits, and implementation pathways. Stepwise processes that establish technical consensus at early stages are more successful at the next stages of negotiation that explore of policy options and design. The search for alternative designs has been largely successful at finding lower cost, higher benefit options for energy sectors. Processes that provide sufficient time for extended discussion before formal voting also tend to achieve stronger consensus by allowing parties to advance on a technical learning curve. As greater understanding develops, more effort results from non-energy sectors and flexibility mechanisms, and more appreciation is gained for the challenges within energy sectors. As a consequence, stakeholders in energy- intensive sectors often enjoy a fairer hearing of their needs and concerns in a managed stakeholder process than in unstructured proceedings that limit fact based exploration of issues.

U.S. state climate planning processes now typically involve some form of stakeholder dialog with technical and facilitation support provided by consultants working with agency staff. These have been primarily nonbinding advisory processes lead by the executive branch at the cabinet level. The degree of public involvement has varied, but the trend is clearly toward open process with full public observation, if not participation. While this requires more effort at the outset than closed, internal processes, it has lead to higher levels of comfort and credibility of results (CT, ME, Puget Sound, RI) and lower costs in the long term. Stakeholders are typically representative of all emitter sectors as well as environmental groups and government. Energy industries are well represented. Typically stakeholder groups are augmented with technical experts through sector based subgroups (technical work groups) responsible for evaluating mitigation options. Guidance from technical work groups to stakeholders provides stakeholders the ability to identify a full range of policy options and policy design alternatives, as well as an understanding of cost variables that can be managed to address potential conflicts. The process of achieving technical consensus on the range and viability of options, and methods for their evaluation, typically resolves many of the differences between opposing stakeholder views (CT, ME, PS, RI).

Direct involvement of stakeholders in advisory processes builds their interests and expertise into policy design and implementation decisions. Recommendations resulting from open, quantitative and highly participatory processes are generally broader and more aggressive than closed processes, particularly when conducted with explicit goals, parameters, and decision criteria to guide the decision process. For instance, the Connecticut Climate Change Stakeholder Dialog produced 55 recommendations to meet goals of the New England Governors/Eastern Canadian Premiere's agreement following an extensive series of working group discussions, stakeholder meetings, and negotiated agreements. Similarly, the Maine climate change process resulted in 54 recommendations from stakeholders, and the climate stakeholder dialog in Rhode Island resulted in 52 consensus recommendations to meet the same goal. These states are in the process of implementing many of these recommendations today, including legislative action, as a result of strong new consensus forged within the process.

Opponents of GHG mitigation plans often fear that democratic decision processes challenge their existing positions. To them, the use of open process is a choice between new and unknown solutions, versus the best negotiable alternatives (BNA) that that can be drawn from currently known and accepted solutions (Fisher and Ury, 1991). In reality, the range of potential existing solutions in a given jurisdiction is small compared to the full range of potential solutions that can be developed through effective analysis and planning. As a result, open technical processes tend to identify a broader range of viable alternatives than closed processes, and also develop more alternatives to address policy barriers.

C. Reducing Conflicts by Promoting Equity

Equity issues are often accorded secondary importance in policy-making in general and in the environmental realm.[5] The context of climate, however, makes a significant difference. At the international level, no supranational institution exists that can impose a climate change treaty; hence, participation is voluntary. "Opt-in" will be heightened by perceptions that the policy is fair to a given entity itself and vis-à-vis its relation to others.[6] The context within the U.S. differs, however. It is not a matter of states opting into a national accord, though it could evolve into this. It is a matter of individual state or regional initiatives. At the same time, state governments are not likely to find it prudent to impose targets, timetables, and policy designs solely from the top down, but rather with public input (AZ, CT, ME, NY, RI, PS). This process provides valuable information and pays attention to powerful interest groups, both of which can help promote the likelihood of compliance.

In practice, equity issues play an important role in U.S. state mitigation planning efforts in the form of explicit decision criteria by which individual measures are judged as priorities. This equity judgment may take the form of review of the distribution of cost and benefits and concern over disproportionate impacts on special populations or locations. Stakeholders of the New York Greenhouse Gas Task Force expressed concern about differential impacts of higher electricity prices on upstate versus downstate consumers in significantly different income classes. During the Connecticut Climate Change Stakeholder Dialog a variety of senior citizens groups expressed very strong concern about the lack of transit access and the need to weight low emissions transit options more heavily to address transportation access inequities. States tend to be sensitive to interregional competitive concerns, which have a bearing on both the perception

of interregional fairness and also on actual economic impacts. The latter will exert downward pressure on the stringency of policies in all states, while pressures in the former can be in either direction depending on conditions in a given state. For instance, one key finding of the Connecticut Climate Change Stakeholder Dialog was the potential for displacement from imports of low cost, high emissions electric power under a production based regional cap and trade program; sacrifices by the northeast region were likely to be offset to a large degree by expanded economic operation of plants outside the region (CT).

1. Intraregional Equity

With respect to intraregional fairness, there are ranges of dimensions. Focus is often placed on policy outcomes (e.g., what is the distribution of impacts across industries, socioeconomic groups, and geographic areas). However, analysts and policy-makers have emphasized the importance of the fairness of the process itself. This is especially important in a context where cooperation, or popular support, is key. The stakeholder approach discussed earlier is a major mechanism for promoting process fairness. It does, of course, require careful attention to ensuring the process is inclusive and balanced for equity sake, in addition to all the other design objectives noted earlier. While states may be tempted to exclude parties opposed to mitigation action within stakeholder processes, their input is critical to the process of identifying alternative design options that reduce conflict (AZ , CT, ME, NY, PS). In the Connecticut Climate Change Stakeholder Dialog this led to recommendations to explore cap and trade mechanisms that minimize leakage of emissions and economic activity from electric power imports from outlying states (CT). With regard to outcome equity, this has been addressed extensively elsewhere and there are a few purely intraregional issues that differ from the national context. Perhaps the only significant difference is the more local focus of the Environmental Justice approach, which emphasizes locational choice and fairness with respect to race.

Energy plays a strong role in intraregional equity issues. By virtue of its major contribution to GHG emissions, it will be singled out. At the same time, there is a danger of limiting attention to one sector even for pragmatic reasons of readily identifying its emissions. Theory tells us, and empirical studies have shown, the cost of meeting GHG reduction objectives can be reduced significantly by extending to multi-sector and multi-pollutant trading (Rose and Oladosu, 2002).

2. Interregional Equity

Almost the entirety of the applicable literature on interregional equity is in the context of a cooperative effort among states to share the burden of mitigation, in a manner analogous to the international scene (see, e.g., Solomon and Lee, 2000; Rose and Zhang, 2004). However, the reality is that of an evolving process over time, with both individual state and regional cooperative efforts progressing unevenly without central direction or oversight.

The first state climate action plans were developed under great uncertainty about their commitments vis-à-vis other states. The initial states deserve credit for their leadership and altruistic motives, given the possibility that few other states might even share the burden.[7] Equity issues and the ease of reaching an agreement are related to interregional disparities.

Relatively socio-economically and industrially homogenous states such as Vermont and Rhode Island are likely to reach consensus easier than highly heterogeneous states such as New York and Pennsylvania.

One case of potential inequity results when energy is extracted or refined in one location that generates the GHG's, but actually is consumed in others. Interregional equity considerations of this kind are especially prominent. The tendency thus far has been to ascribe responsibility to the production side, but a strong case can be made for shifting or sharing responsibility. The U.S. Environmental Protection Agency has moved somewhat in this direction by calculating the location of GHG emissions from electricity on both the basis of production and consumption, now a common practice in state greenhouse gas inventories.[8] In practice states now count emissions and reduction credits from activities within their boundaries, even if the emissions occur elsewhere. Specific issues include the consumption of gasoline purchased outside the jurisdiction but consumed within it (NY), the consumption of power imports (CT, ME, NY, PS), and the import or export of waste to resource recovery facilities (CT). Standard GHG accounting practices developed at the national level may not adequately address these and other state issues.

3. Intergenerational Equity

Intergenerational equity is a major aspect of the *sustainability* theme inherent in many climate action plans. Sustainable development refers to a continuous increase in the standard of living and/or quality of life far into the future (see, e.g., Parris and Kates, 2003). It emphasizes concern for future generations even if they are not present now to represent themselves. Current actions on GHG mitigation, absorption, and sequestration reduce the flow of emissions to the atmosphere and thus reduce the growth of atmospheric concentrations far into the future. While few studies have performed a rigorous analysis of the precise amount of intergenerational benefits of these actions, it is safe to say they move in the right direction. Still, it should be kept in mind that the cumulative nature of GHG emissions imposes damages each of the hundreds of years into the future. In the literature on climate policy, it is standard practice to discount these damages in order to place them in present value terms for comparison to mitigation /sequestration costs. Discounting reflects the time value of money, inter-temporal productivity tradeoffs and other important factors, and cannot be easily dismissed in benefit-cost analysis. However, the non-discounted values of damages and their exponential trend (especially when considering irreversible impacts) should be kept in mind if stabilization of atmospheric concentrations of GHGs is not achieved.

Energy plays a key role in sustainability. For non-renewable resources, the consensus is that, since their extraction automatically reduces the stock available for future generations, some portion the value should be placed in a fund for future use in general or to fund current efforts that will benefit our descendants (e.g., research on renewable energy). At the same time, renewable energy is prized for its inherent sustainability.

D. Reducing Conflicts by Promoting Regional and Eventually National Cooperation

Just as broadening participation of non-energy sectors can reduce costs to the energy sector, the expansion of actions to broader geographical scales can increase mitigation choices

and flexibility. Energy markets, in particular, rarely coincide with state or local boundaries, and mechanisms to enable recognition, crediting and other forms of sharing across boundaries are important to capturing the full range of mitigation options. By creating mechanisms for comparability and cooperation, both costs and market conflicts can be reduced for energy industries, with the greatest potential ultimately at the global scale.

States have begun this process by structuring comparable approaches to mitigation plans, and by starting to link them through regional agreements, such as the NEG/ECP, the RGGI, and the West Coast Climate Initiative. At the state (and local) level, the first step toward mutual recognition and linkage of programs has been the framework design of the plans themselves. This involves adoption of comparable target years, baseline methods, policy mechanisms, and reporting and registry systems. Comparable approaches are essential to mutually acceptable comparisons of the level of effort at the multi sector and single sector level; level of effort is an important component of political negotiations toward state commitments under a regional system. Comparable reporting and forecasting methods are also critical to functional crediting and offset systems across state or regional boundaries.

Increased harmonization of state and regional programs is also an important step toward definition of federal programs. At some point it is likely, if not inevitable, that congress will formulate national legislation – most likely under the McCain-Lieberman framework. State and regional programs are likely to influence federal design and the equity judgments of burden sharing in future national strategies. States are also likely to play an important role in implementation of policy.

IV. FUTURE STATES AND REGIONS

As noted earlier, the most progress on climate action plans has been in states that are not major fossil energy producers or users. This is in sharp contrast to the Midwest, South-Central, Mountain-West, and Middle-Atlantic States. Some differences in energy production/use and economic/demographic conditions are illustrated for three states in Table 2.[9] Connecticut, Maine and Rhode Island have developed climate action plans, along with Oregon and major region of Washington--Puget Sound. Recently Arizona announced the formation of a GHG planning process as well. In contrast, Pennsylvania has just begun serious consideration of this issue and is already the scene of intense lobbying efforts from several directions. At present, Pennsylvania is an observer, along with Delaware, Maryland, and New Jersey in the New York-New England RGGI "cap and trade" agreement.

The breakdown of GHG emissions from various sources in Pennsylvania is presented in Tables 3 and 4, from a recently completed GHG Emissions Inventory (Rose et al., 2003). The Tables clearly indicate the dominant role of carbon dioxide emissions and the prominent role of electricity generation, where the greatest increase over the past decade has been in the transportation sector. The numbers in the tables may serve as both an indication of the cost of and the resistance to progress on GHG mitigation overall and by individual producer and consumer categories.

TABLE 3. SUMMARY OF ALL PA GHG EMISSIONS (MMTCE)

Emission Source	1990	% of 1990	1999	% of 1999
CO_2 from Fossil Fuels	71.57	92.42	72.23	90.53
GHG's from Non-Energy Industrial Processes	1.92	2.48	2.95	3.70
CH_4 from Oil and Natural Gas	1.43	1.85	1.47	1.84
CH_4 from Coal Mining	1.98	2.56	2.27	2.84
CH_4 from Domestic Animals	0.08	0.10	0.07	0.09
GHG's from Municipal Waste Management	1.25	1.61	1.16	1.45
GHG's from Manure Management	0.79	1.02	0.81	1.02
CO_2 from Forestry and Land-use Change	-2.40	-3.10	-2.01	-2.52
GHG's from Burning Agricultural Waste	*	*	*	*
GHG's from Municipal Waste Water	0.15	0.19	0.15	0.19
CH_4 & N_2O from Mobile Combustion	0.42	0.54	0.44	0.55
CH_4 & N_2O from Stationary Combustion	0.25	0.32	0.25	0.31
Total	77.44	100.00	79.79	100.00

* Less than .005
Source: Rose et al. (2003).

TABLE 4. PA CO_2 EMISSIONS FROM FOSSIL FUEL COMBUSTION (MMTCE)

Emission Source	1990	% of 1990 Fossil Fuel	1999	% of 1999 Fossil Fuel
Residential	6.00	8.38	6.38	8.83
Commercial	3.42	4.78	3.25	4.50
Industrial	18.69	26.11	14.97	20.73
Transportation	16.03	22.40	18.71	25.90
Electricity	27.43	38.33	28.92	40.04
Total	71.57	100.00	72.23	100.00

Source: Rose et al. (2003).

At the national level, fossil energy intensity has served as a rough proxy for relative mitigation costs. In general, industrialized countries are considered to have relatively higher marginal mitigation cost curves than developing ones, though there are some exceptions, such as some Scandinavian countries. Because Scandinavian countries use relatively little fossil energy, it is much more difficult to reduce emissions; in fact, on this basis, these countries received preferential treatment (as did some major fossil energy producers, such as Australia) in their

Kyoto emission reduction targets. Interestingly, conditions in Scandinavian countries are similar to those of the New England States, who have been in the forefront of action in the U.S.[10] Referring back to Table 2, under a production-based accounting system, fossil energy intensity in Pennsylvania is more than 50 percent higher than in Connecticut measured on a per capita basis and 100 percent higher on a per dollar of GSP basis.

Conflict can be reduced significantly by utilizing the flexible policy instruments for implementing mitigation. Also, regions and industries can be afforded additional emission permits to cushion extremely negative impacts. Grandfathering some portion of the permits or rebating some of the carbon tax revenues can be used for this purpose. In fact, a recent study of the U.S. as a whole indicated that only about seven percent of the permits overall would need to be granted freely in order to offset the asset value effect of GHG mitigation requirements to meet the Kyoto target under certain conditions (Smith and Ross, 2002). Several perspectives exist in regard to compensation. First, it is counter to the "polluter pay principle." At the opposite end of the spectrum is the pragmatic view that compensation can effectively reduce political opposition to a worthy policy goal, while still making everyone better off in terms of environmental benefits. In addition to liability issues and pragmatism, equity principles are applicable to this issue.

V. CONCLUSION

Since the change in the U.S. administration in 2000, the pace and depth of U.S. state, local and regional climate mitigation actions has risen sharply, with the launch of seven comprehensive state plans, four regional agreements, major local government plans, and a wide array of individual policies and measures at the sub federal level. The results of these efforts is significant in terms of the number of new policy actions, the level of GHG reductions they can achieve, and the level of technical and political consensus that has emerged. This wave of activity has generally defied the notion that climate policy and energy policy face irreconcilable conflicts in the U.S., and instead found a number of ways to reduce conflicts and identify alternative solutions that work at the state and regional level. In coming years this trend is likely to be translated upward to Congress, with more specific delineation of state and federal roles, and stronger national legislative and policy initiatives. Pennsylvania stands at a unique crossroads in this process as a potential leader that is a high-energy producer and proximate to both the nation's most environmentally progressive regions and its greatest energy producers.

ENDNOTES

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**Professor of Energy, Environmental, and Regional Economics, Department of Geography and Center for Integrated Regional Assessment, The Pennsylvania State University, University Park, PA, USA 16802. The author acknowledges the prior support on the subject of this paper from the U.S. National Science Foundation, U.S. Environmental Protection Agency, U.S. Department of Energy, Pennsylvania Department of Environmental Protection, Center for Energy and Economic Development, and Center for Clean Air Policy. He also acknowledges collaborations with Gbadebo Oladosu and ZhongXiang Zhang in work related to the presentation here.

Both authors are grateful to Campbell Watkins for his helpful comments on the pen-ultimate draft of the paper. The views expressed are solely those of the authors and do not necessarily represent those of any current or previous organization with which they are affiliated. We alone are responsible for any errors or omissions.

[1] President Bush proposed policy alternatives to the targets and timetables in the Kyoto Protocol, but these were perfunctory in comparison.

[2] McKinstry et al. (2004) cite Justice Oliver Wendell Holmes' dictum that states can serve as valuable laboratories for experimentation in new areas. Many national laws have their roots in state action, including specific programs first developed at the state level.

[3] GHG mitigation initiatives have also been successful at other levels of government in the U.S. Kousky and Schneider (2003) note that by mid-2003, 140 cities in the U.S. had established GHG reduction targets and had begun mitigation action planning. These initiatives differ significantly from the discussion presented in this paper, however. Nearly all of the municipal efforts are confined to city government emissions or to emissions for which the cities have some control (e.g., emissions of commuting employees, transportation and land-use planning). The emphasis in this paper is on comprehensive reduction, i.e., not just government emissions but those of the private sector as well. For various reasons of scale (including multi-plant operations, location of major emitters such as utilities outside city limits, economies of scale, regulatory and taxing authority, and overall political clout), states may be the minimum political unit that can effectively develop comprehensive GHG mitigation action plans.

[4] Over 200 individual policy actions related to greenhouse gas reduction have been undertaken by US states in the last decade, often driven by close objectives with high co-benefits, such as energy policy, transportation efficiency, natural resource conservation, or other objectives (Peterson, 2004).

[5] Equity in climate change has received more attention than nearly any other aspect of environmental policy (see, e.g., a separate chapter addressing the issue in the latest report by the IPCC, 2000). At the outset, we also acknowledge the long-standing difficulty of applying this criterion because of the absence of a universal consensus on the best definition of equity. Extensive analysis of equity and climate change has clarified many basic concepts and has explored the implications of alternative definitions (e.g., ability to pay, egalitarian, horizontal equity). However, only from the pragmatic standpoint of showing that several seemingly divergent definitions may lead to very similar outcomes has it narrowed the field of best criteria (see, e.g., Rose et al., 1998).

[6] The second author has emphasized this point beginning in an article in this journal (Rose, 1990) and in various contexts (see Rose, 1992; Rose and Zhang, 2004; and Oladosu and Rose, 2005).

[7] An alternative viewpoint is that addressing climate change opens up a number of positive economic opportunities (e.g., leadership in technology and attraction of green industry), so that early action is a way of getting a jump on the competition.

[8] One of the issues here is obtaining the requisite data to make an informed judgment. Examples of problems include how to attribute geographic utilization of transportation fuels and, given the new de-regulated electricity market, pinning down the source of generation.

[9] The Forested Lands data are included as an indication of the extent to which the three states can contribute to carbon absorption.

[10] Scandinavian countries have been in the forefront of promoting an international accord, funding research and development, and taking a leadership in voluntary action, such as the Clean Development Mechanism (CDM) and Joint Implementation (JI).

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