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The Evolving State Government Role in Climate Change

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Prepared for the Pew Center on Global Climate Change

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Foreword *Eileen Claussen, President, Pew Center on Global Climate Change*

The current level of state activity surrounding the issue of climate change is striking. Measures that have proven controversial at the federal level, such as renewable portfolio standards and mandatory reporting of greenhouse gas emissions, have been implemented at the state level, often with little dissent.

In this Pew Center report, author Barry Rabe of the University of Michigan describes a diverse array of state initiatives to reduce greenhouse gas emissions. Based on case studies of nine states — Georgia, Massachusetts, Minnesota, Nebraska, New Jersey, North Carolina, Oregon, Texas, and Wisconsin — the report identifies the strengths as well as the limitations of these state-level initiatives, some of which could serve as prototypes for federal programs.

A number of themes emerged from the case studies. Foremost among these is that there are multiple drivers that influence states to reduce their greenhouse gas emissions, and states derive multiple benefits from doing so. New Jersey, for example, views climate change explicitly and comprehensively, and has integrated all sectors of the economy into programs to reduce greenhouse gas emissions. Conversely, Texas passed an ambitious renewable portfolio standard primarily out of a desire to ensure long-term energy security for its residents, to secure its position as an "energy state," and to take advantage of increasing opportunities in renewable energy.

Indeed, state climate change efforts illustrate that climate change can be a bipartisan issue, an economic development opportunity, and an opportunity for policy entrepreneurship. But state action is not a substitute for a comprehensive national or international approach. A number of factors limit the ability of states to address climate change, including the reluctance of some states to deal with the issue, constitutional limits to their engagement in international relations, limited funding, and potential inefficiencies if states address climate change in different, incompatible ways. Rather, state leadership is getting the United States started down the path of reducing greenhouse gas emissions and providing learning opportunities for policy-makers. We would do well to be mindful of their successes as we work toward federal and international programs, and actively involve states in their design and implementation.

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Executive Summary

Most analysis of policy options to address global climate change has focused on national and international levels of governance. Even within the United States, most scholars and journalists have concentrated on federal government capacity to engage in international negotiations and formulate nation-wide policies. This emphasis has tended to overshadow a remarkably — and increasingly — active process of policy formulation evident in the American states. This report is intended to provide an overview of this aspect of American climate change policy, considering recent trends and highlighting a range of case studies that cut across traditional policy sectors.

States have been formulating climate change policy for more than a decade, although their efforts have expanded and intensified in the past several years. In some cases, states have considered climate change mitigation explicitly while in others it has been an incidental benefit. Reflective of the vast scope of activity that generates greenhouse gases, state policies have been enacted that reduce these emissions in such areas as promotion of renewable energy, air pollution control, agriculture and forestry, waste management, transportation, and energy development, among others. In almost all cases, there have been multiple drivers behind and multiple benefits from these state policies. In Texas, for example, the desire for energy independence, economic development, and air pollution control drove the state to promote renewable energy. Not all states have demonstrated interest in these initiatives and some legislatures have taken steps to prevent state agencies from pursuing any efforts that are designed to reduce greenhouse gases. Nonetheless, there has been a remarkable increase and diversification of state policies since the late 1990s, reflected in their current operation in every region of the country. Collectively, they constitute a diverse set of policy innovations rich with lessons for the next generation of American climate change policy.

Much of this report is devoted to an examination of leading examples of innovation in various sectors, from renewable energy efforts in Texas to a cross-cutting approach in New Jersey. Nine case studies are presented in particular depth, followed by supplemental cases where appropriate. These cases tend to vary markedly from one another in detail and yet are linked by common design characteristics. First, they tend to have been supported through broad, bipartisan coalitions that received significant support from

diverse stakeholders. State climate change policies have been signed into law by Governors who are Democrats, Republicans, and Independents. Second, they regularly have viewed climate change mitigation as an economic development opportunity. State policies have been crafted to foster long-term economic well-being, which has contributed to their broad base of support. Third, they reflect abundant state-level opportunities for innovation and policy entrepreneurship, often involving state officials who build coalitions around a particular idea for new policy. Many of the most effective entrepreneurs are not particularly well known outside their respective states but have helped redefine climate change policy with their efforts.

When viewed as a collection of efforts, these initiatives outline possible elements of a long-term climate change strategy for the United States. Diffusion of innovation from one state to others is already occurring and clusters of contiguous states are beginning to consider cooperative efforts. Some of these policies may also serve as models that warrant emulation by the federal government in developing a more comprehensive strategy for the nation. This is entirely consistent with the long-standing tradition in American governance whereby states serve as laboratories for subsequent federal policy. In turn, the vigorous and creative nature of state innovation in this area suggests that any future federal policy initiatives on global climate change consider carefully the significant roles that state governments may be able to play in achieving long-term reduction of greenhouse gases.

I. Introduction

Global climate change is commonly characterized as an unprecedented challenge to the international community that necessitates substantial commitment from national governments. From Rio to Kyoto, international deliberations focus upon ways to secure national collaboration on an environmental challenge that crosses all political boundaries and requires novel approaches to collective action. In the United States, most scholarly and journalistic attention concerning climate change remains riveted on Washington, D.C. Would the Clinton or Bush Administrations actively pursue Senate ratification of the Kyoto Protocol? Will Congress take new steps to reduce greenhouse gases through "cap and trade" systems or other proposed national policies? Can national institutions even think about long-term environmental and energy policies given more salient and immediate threats such as terrorism and homeland security?

Preoccupation with these kinds of questions obscures an array of policy initiatives being taken within American boundaries that could achieve significant reductions in greenhouse gases. Though not as sweeping or as dramatic as an international regime to foster global trading of carbon dioxide (CO_2) and other greenhouse gases, a growing number of state government policies is quietly redefining American climate change policy. With few exceptions, they have only begun to receive serious scholarly or journalistic attention in recent years (Dernbach, et al., 2000; Arrandale, 1999; Arrandale, 2001). Nonetheless, they cut across virtually every sector relevant to greenhouse gas (GHG) reduction, from agriculture to waste management, and demonstrate that it is indeed possible to muster political support that transcends traditional partisan and interest group lines.

Collectively, these policies point to the beginnings of a bottom-up approach to addressing global climate change, one particularly relevant for a nation as physically large and economically diverse as the United States. Indeed, many American states release a higher amount of greenhouse gases per year than many other nations that are considering participation in an international climate change system. Texas, for example, regularly exceeds France in annual emissions, just as Wisconsin surpasses Uzbekistan. In turn, states can address GHG emissions directly, or through the many key policy areas they dominate — from electricity regulation to land use — that are profoundly relevant to any future effort to reduce greenhouse gases.

This report provides an overview of the recent experience of states, shedding light on the dynamics of this relatively obscure but increasingly significant body of policy innovation. It demonstrates that a remarkably diverse array of states have begun to move forward well ahead of the federal government. As a series of case studies will indicate, there is no "one best way" to define and develop state climate change policy. In some instances, states have decided to pursue careful study of the issue, declare climate change a pressing threat, and take deliberate action that is very specific in its intent to reduce GHG emissions whether or not national or international agreements are soon ratified. In other instances, states refrain from even defining the policy initiative as related to climate change and GHG reduction. Instead, they emphasize the economic development or other advantages of various steps and view any emissions reductions as an unintended benefit. Regardless of the incentive and intent, the outcome is the same: American statehouses continue to be fertile laboratories for policy innovation and are turning their attention to crafting policies that can reduce GHG releases.

II. Bottom-Up Climate Change Governance

The very idea of more localized approaches to combat climate change is not, of course, an exclusively American conception. Existing international agreements and pronouncements that address climate change endorse — albeit in opaque terms — a significant role for "subnational" governments in policy development and implementation. For example, the 1992 Agenda 21 Principles endorse a "bottom-up" approach to GHG policy development. This supports substantial experimentation and mechanisms for providing "decentralized feedback to national policies." In turn, the Rio Declaration on Environment and Development, which set the stage for subsequent international negotiations and the Kyoto Protocol, declares that global warming is most likely to be addressed effectively through broad political participation "at the lowest, most accessible, and policy-relevant" level. As policy analysts David Feldman and Catherine Wilt have noted, such strategies "clearly reject centralized, bureaucratic approaches" (Feldman and Wilt, 1994, 1998).

These statements reflect a growing consensus that endorses an expanded role for state and local governments in many spheres of public policy. The conventional wisdom of the 1960s and 1970s reflected severe doubts about the capacity of state and local governments to protect the environment (Ophuls, 1977; Crenson, 1971). The inherently cross-boundary nature of many environmental problems and potential for localized units to shirk responsibility were seen as insurmountable. Applied to climate change, this conventional wisdom would assume states were unlikely to act without exact marching orders from the federal government.

More recent analysis, however, has embraced certain state, local, and regional governments as highly committed to environmental protection. A growing body of scholarship concludes that these subnational units are increasingly proving more capable and innovative than their central-level counterparts. Indeed, important research findings on the protection of "common-pool resources" and the evolution of "civic environmentalism" embrace a new governance approach that gives states center stage in policy development and implementation (Ostrom, 1990; Ostrom et al., 1996; John, 1994).

The past decade has featured a striking convergence of opinion in this regard. A mounting series of studies and reports from such American think tanks as the National Academy of Public Administration, the Brookings Institution, the American Enterprise Institute, and the Hoover Institution, among others, confirm the promise of decentralization. Many endorse expanded decision-making authority for state governments, allowing them to play a major role in addressing the "next generation" of environmental challenges (National Academy of Public Administration, 1995, 1997, 2000; Kettl, 2002; Butler and Macey, 1996; Ferejohn and Weingast, 1998).

Climate change has not figured prominently in these studies and yet many policy areas with direct relevance to GHG emissions now fall under the purview of state governments. States already implement many federal environmental, energy, agriculture, transportation, waste, and natural resource laws; they issue more than 90 percent of all environmental permits and conduct more than 75 percent of all environmental enforcement actions (Rabe, 2002a). They are involved in a range of policy innovations that could influence greenhouse gases, including pollution prevention, information disclosure, technology sharing, cross-boundary collaboration, and even constructive engagement with other nations and Canadian provinces.

Many federal policies relevant to climate change have proven difficult to modify given the familiar problems of institutional gridlock. But in those instances where consensus has been attained, the effect has been creation of some additional opportunities for state innovation. The 1992 Energy Policy Act, for example, set broad rules for restructuring the delivery of electricity and attempting to reduce American dependence on foreign oil. Perhaps its most important impact has been to give states new latitude to redesign their electricity markets and consider alternatives to fossil fuels. Similarly, the 1990 Clean Air Act Amendments introduced many states to the practice of emissions trading, through a novel approach for reducing sulfur dioxide emissions that was also influential in the formation of the Kyoto Protocol. That experience has prompted states to begin applying this concept to CO_2 and other greenhouse gases. Less-visible steps at the federal level have also contributed to this shift. During the 1990s, for example, the U.S. Environmental Protection Agency (EPA) launched a National Environmental Performance Partnership System (NEPPS) that offered states the prospect of increased regulatory flexibility in exchange for demonstrated commitment to innovation and improved performance. Some states, such as New Jersey and Wisconsin, have used this process to explore how conventional regulatory tools such as permits might be modified to achieve GHG reductions.

There are, however, significant limitations facing any long-term strategy that relies primarily on the initiative of states. Many cases of state policy innovation in climate change are matched by other states that have proven indifferent or hostile to the issue. In turn, limited fiscal resources deter innovation, particularly given the current fiscal distress facing many states. Moreover, the very notion of a purely decentralized approach raises basic questions of efficiency. A potential tapestry of standards and programs that varied markedly from state to state could serve to heighten compliance costs for regulated parties as opposed to a more uniform approach. Nevertheless, the recent evolution of state policy poses a fundamental challenge to conventional thinking about the design of and political prospects for climate change policy in the United States and, in the process, offers a variety of policy options for possible adoption at the national level.

III. The Evolving State Role in Climate Change

Over the past decade, it is possible to identify distinct periods in state approaches to climate change. Many of the most prominent state climate change initiatives are of fairly recent vintage, approved after the negotiation of the Kyoto Protocol in December 1997. A number of these are only in the earliest stages of policy implementation. Yet at least some states were clearly beginning to think about this issue and take some initial steps nearly a decade before Kyoto.

This initial stage of innovation coincided with the ascendance of climate change in the media and at the national level in the late 1980s. Many early state programs focused on chlorofluorocarbons (CFCs), reflecting growing concern about their impact on both ozone-layer depletion and global warming. These efforts were ultimately eclipsed by national and international agreements on CFC elimination but helped put climate change on the agenda of many state governments. Despite the early emphasis on CFCs, a small subset of states passed legislation or executive orders between 1988 and 1990 that expressed concern about other greenhouse gases and endorsed some initial steps (U.S. Office of Technology Assessment, 1991). Many of these were focused on the activities of state governments, commonly promoting greater energy efficiency in government-operated buildings and vehicles. New Jersey Executive Order 219, for example, signed by Republican Governor Thomas Kean in February 1989, called upon all units of state government to take the lead in reducing greenhouse gases. This and related initiatives were largely symbolic, setting non-enforceable recommendations and lacking any resources for implementation. They continue, however, to be recognized in state policy circles as having established a precedent for further state action.

After this initial flurry of activity, many states pursued analytical work on their GHG emissions and began to review future policy options in the early- and mid-1990s. Federal grants from EPA's State and Local Climate Change Program were combined with state resources to underwrite detailed reviews of GHG sources and emission trends within individual states. Dozens of states produced detailed "greenhouse gas inventories;" some used these to formulate "action plans" that began to outline various strategies for emission reduction. These analyses provided an empirical foundation for much subsequent state policy activity and also served, in many states, as an initial opportunity to bring together constituents from

diverse state agencies, industries, universities, and advocacy groups to meet and consider climate change as a state policy issue. Multi-state networking also began during this period, often through conferences or research reports that allowed states to begin to think more collectively about these issues.

Such analysis continues in many states but also led to a more active period of policy formation in the late 1990s. Some significant legislation to reduce greenhouse gases was enacted during the late 1990s, such as Oregon's pioneering 1997 law that established CO_2 standards for new electrical power plants. At the same time, a significant number of states moved in a very different direction, reflecting the burgeoning controversy surrounding the Kyoto Protocol. During 1998 and 1999, 16 states[1] passed legislation or resolutions that were highly critical of the Protocol and opposed ratification by the U.S. Senate. Many of these were purely advisory and employed similar language from state to state. Some states, however, chose to go further and block any unilateral steps to reduce greenhouse gases. Michigan, for example, amended its Natural Resources and Environmental Protection Act in 1999 to prevent state agencies from proposing or promulgating any rule to reduce greenhouse gases unless it had been requested by the legislature. No such requests have been forthcoming and the state has also shied away from pursuing federal grants for preliminary study of the issue. In West Virginia, legislation passed in 1998 prevented state agencies from entering into any agreements with any federal agencies intended to reduce the state's GHG emissions.

State efforts to contain involvement on climate change have been supplanted in more recent years with an unprecedented period of activity and innovation. New legislation and executive orders expressly intended to reduce greenhouse gases have been approved in approximately one-third of the states since January 2000, and many new legislative proposals are moving ahead in a large number of states. Many additional state actions of recent vintage are also likely to reduce emissions but are simply not explicitly labeled as GHG programs. Some programs are already beginning to diffuse, being replicated by multiple states after one takes the first step. Nebraska's passage of a program designed to sequester carbon through agricultural practices was signed into law in April 2000 and has already prompted Illinois, North Dakota, Oklahoma, and Wyoming to pass legislation with virtually identical language within one year.

A pair of state-level actions in July 2002 are particularly noteworthy. Legislation was signed by California Governor Gray Davis requiring the California Air Resources Board to set CO_2 standards for motor

vehicles by the end of the current decade (see Box 1). Opponents contend that federal law preempts the state from taking this action; this issue is likely to be decided in the courts. In addition, 11 state attorneys general wrote to President Bush and called for expanded national efforts to reduce GHG emissions. They indicated a commitment to intensify state efforts if the federal government failed to act. These actions may prompt serious debate about the appropriate respective roles of federal and state governments in climate change policy.

Box 1

California Legislation to Reduce GHG Emissions from Motor Vehicles

California reassumed its historic role as a national leader in air emissions when AB1493 was signed into law by Governor Gray Davis on July 22, 2002 in dual ceremonies in Los Angeles and San Francisco. The legislation reached Davis' desk after intense, partisan debate in both chambers of the California Legislature, reflected in a one-vote margin in the Assembly. The bill was sponsored by Democratic Assemblywoman Fran Pavley, a first-term legislator from Agoura Hills, and backed by a coalition of environmental groups, Silicon Valley business leaders, large California municipalities, and entertainers. "In time, every state — and hopefully every country — will act to protect future generations from the threat of global warming," said Davis. "For California, that time is now."

The legislation requires the California Air Resources Board (CARB) to develop regulations by January 1, 2005 that will achieve "the maximum feasible and cost-effective reduction" of greenhouse gases from cars, sport utility vehicles, and light-duty trucks. These regulations would go into effect one year later, after a period in which the Legislature could review and amend them. Vehicle manufacturers would be expected to implement changes for their 2009 models, although they could secure credits for any emissions reductions achieved between 2000 and the start of the 2009 model year. CARB is an 11-member body appointed by the governor.

This new policy, however, remains very limited in details. The legislation does not establish any specific emissions reduction targets or goals and gives no guidance to CARB on how reductions might be achieved. It also prohibits CARB from imposing any new taxes, reducing speed limits, banning categories of vehicles, requiring any reduction in vehicle weight, or imposing mandatory trip-reduction plans on motorists, in developing its regulatory strategy. Instead, CARB is expected to review a host of other approaches and develop a comprehensive plan by 2005.

California's actions are based on its longstanding autonomy in setting air quality standards. This was made possible by the creation of CARB prior to the formation of EPA. The state has historically used this authority to take actions independent of the federal government, which may then be emulated by other states. Consequently, California led the nation in earlier initiatives such as use of unleaded gasoline, catalytic converters, and clean diesel fuel, establishing precedent for the GHG reduction legislation. In these instances, the action by a state which registers approximately 10 percent of the nation's noncommercial vehicles ultimately led to federal action to establish a more uniform standard for the nation.

The implementation of the new legislation, however, remains highly uncertain, due both to the vagueness of the legislation and strong interest group opposition. A multi-million dollar campaign failed to block the legislation but a coalition has vowed to challenge the legislation in the courts as an excessive extension of CARB authority. Leading opponents have included the Alliance of Automobile Manufacturers, the California Chamber of Commerce, and the California Farm Bureau Federation. Opponents initially considered the possibility of a November 2002 state ballot initiative to repeal AB 1493, but decided to focus on a litigative strategy for now. Nonetheless, CARB is moving ahead with rule-making. A July 2002 poll released by the Public Policy Institute of California reported that 81 percent of respondents supported the bill.

IV. Common Design Features

The recent flurry of activity demonstrates the variety of policy options open to states, as the diverse range of case studies will suggest. Most of these innovations, however, share some common design characteristics, many of which run contrary to conventional thinking about the ways in which new public policy is forged. Indeed, the bulk of analysis on policy formation emphasizes "triggering events," particular crises that receive substantial media attention and result in public outrage that forces a governmental response (Birkland, 1997; Baumgartner and Jones, 1993).

Climate change represents, to this point, a somewhat different type of issue. The potential impacts on the environment and human health are profound, but it remains very difficult to establish a firm linkage between a specific emissions release and a local environmental impact. This complexity compounds the difficulty of reaching consensus on policy at any level of government. However, it has not prevented an increasing number of states from pursuing important initiatives. Three significant lessons emerge from this experience:

Climate change can be a bipartisan issue. At the state level, political leadership on climate change has not been dominated by members of one political party. Among Governors, Democrats like Oregon's John Kitzhaber and Independents like Maine's Angus King have proven supportive of innovation. So have Republican Governors such as George W. Bush (Texas), Christine Whitman (New Jersey), and Tommy Thompson (Wisconsin), all of whom assumed prominent positions at the national level in 2001. A growing number of states have been successful in finding ways to bring divergent groups together, defuse the rhetorical overkill so common in climate change deliberations, and work toward constructive policy development.

Climate change mitigation can be an economic development opportunity. Climate change does not have to be an anti-economy issue. Many states have acted to address greenhouse gases because they think it is in the long-term interests of their economies. In almost all cases, states are taking into account multiple factors, interested in finding ways to avoid the impacts of climate change as well as taking advantage of opportunities to earn money by reducing greenhouse gases. Coastal states are concerned about sea-level rise, agricultural states are both worried about changing productivity rates and

optimistic about opportunities to be paid to store more carbon in their soils, industrial states are eager to secure reliable energy supplies, and wind-swept states are beginning to think they may be sitting on a renewable energy gold mine. An increasing number of states have responded accordingly, often targeting the sector of greatest concern or opportunity. No two states frame the climate change issue in the same way, but all those who are engaged on the issue see it as compatible with economic development goals.

Climate change mitigation offers opportunities for policy entrepreneurship. Innovation in both the private and public sectors often emanates from creative individuals who cultivate an idea and foster supportive coalitions (Mintrom, 2000; Carpenter, 2001). Such "entrepreneurs" are often found atop an organizational chart but climate change policy appears highly influenced by a wide range of individuals. In every case of state policy innovation examined below, one or more entrepreneurs emerged who proved crucial to the entire process. Some climate change entrepreneurs work within state agencies or state legislative staffs, both in leadership and mid-level roles, whereas others are employed by the private sector or by advocacy groups. Ironically, whereas the preponderance of analysis on climate change policy has focused on internationally known figures, perhaps the biggest contributors to GHG reductions through policy change are relatively anonymous figures who are unlikely to seek higher office and are not particularly eager to secure notoriety for their efforts.

V. Climate Change Policy, State-Style: Case Studies

The growing body of state policies that can contribute to the reduction of GHG emissions provides an array of potential candidates for case study analysis.

Subsequent sections offer brief case studies of nine distinct policy initiatives that include states from all corners of the United States (see Table 1). These cases were selected to maximize diversity in terms of their particular policy approach to climate change, physical size and economic composition, geographic location, and partisan control. All of them have either demonstrated capacity or significant potential for GHG reduction, although their inclusion is not intended to designate them as constituting "best practice" in their particular area. Each case review follows a similar format, introducing the general area of policy represented, the basic elements of the policy innovation, factors facilitating enactment, and indicators of performance where possible. Brief introduction of related cases is also provided where appropriate.

Table 1

State **Case Studies:** Greenhouse Gas Policy Innovations

Policy Sector	Primary State Case	Form	Date of Approval	Partisan Control at Time of Passage			Other States
				Governor	House	Senate	
Renewable Energy	Texas	Legislation	1999	R	R	R	15 with RPS
Air Pollution Regulations	Massachusetts	Regulation	2001	R	D	D	New Hampshire
Agriculture	Nebraska	Legislation	2000	R	Non-partisan/ Unicameral		Illinois, Oklahoma, North Dakota, Wyoming
Forestry/Natural Resources	Minnesota	Legislation	1991	R	R	D	Montana, Oregon
Waste Management	North Carolina	Legal Settlement	2000	D	D	D	Wisconsin
Transportation	Georgia	Administrative Agreement	1996	D	D	D	California, Washington
Energy Development	Oregon	Legislation	1997	D	R	R	Minnesota
Reporting/Registry	Wisconsin	Regulation Legislation	1993 2000	R	R	D	California, New Hampshire
Comprehensive	New Jersey	Executive Order	1998	R	R	R	New York, New England States

The cases were selected through extensive consultation with staff of the Pew Center on Global Climate Change, representatives of multi-state organizations such as the National Association of State Energy Officials and the Environmental Conference of the States, and federal agencies such as EPA and the Department of Transportation. Approximately eighty individuals were interviewed for these case studies in late 2001 and 2002, representing diverse sectors and perspectives. Interviews averaged from thirty minutes to three hours and followed

a standard, semi-structured interview protocol. Interview participants were assured that there would be no direct attribution of their comments without securing permission. Interviews proved invaluable supplements to other primary sources, such as state legislation, reports, and relevant policy documents.

A. Climate Change as a Renewable Energy Issue: Texas

Electricity generation is a dominant contributor to U.S. GHG releases, responsible for nearly two-fifths of national CO_2 emissions in recent years.

For almost a century, state governments have played central roles in the regulatory oversight of electricity, through utility commissions that make fundamental decisions on pricing, approval of new facilities and technologies, and conservation (Gormley, 1983). Federal energy legislation passed in 1992 posed new challenges for states, opening the opportunity to consider electricity restructuring and leading potentially to new competition and involvement of non-traditional electricity suppliers.

Numerous states have responded to this challenge with legislation that attempts to provide industrial and residential consumers with some degree of choice in selecting an electricity provider. California's troubled experiment with restructuring is, of course, most familiar to Americans and has given other states pause in implementing new initiatives of their own. Some states, however, have seized upon restructuring in attempting to increase the reliance on so-called "renewable energy sources." Derived from "naturally regenerated" sources such as the sun and wind, such energy offers multiple advantages, including considerable potential to reduce GHG emissions from the combustion of fossil fuels.

State and federal governments have used a number of mechanisms in recent decades to foster renewable energy, most notably tax credits and grants. More recently, 16 states have enacted legislation that includes "renewable portfolio standards" (RPS) or goals that require utilities to provide a certain amount or percentage of renewable power as part of their total offering of electricity (Fialka, 2002). (See Table 2.) The RPS concept originated abroad, and is used in a range of nations, including Australia, the Netherlands,

Table 2

State Renewable Portfolio Standards

State	Share of Electricity Portfolio to Be Met by Renewable Energy
Arizona	1.1% by 2007
California	20% by 2017
Connecticut	13% by 2009
Hawaii*	7% by 2003; 8% by 2005; 9% by 2010
Illinois*	5% by 2010; 15% by 2020
Iowa	2% by 1999
Maine	30% by 2000
Massachusetts	11% by 2009
Minnesota*	3.6% by 2002; 4.8% by 2012
Nevada	15% by 2013
New Jersey	6.5% by 2012
New Mexico	5% of standard offer by 2002
New York*	15% by 2020
Pennsylvania	Varies by utility (0.2 to 2% in 2001; increasing thereafter)
Texas	2.2% by 2009
Wisconsin	2.2% by 2011

* Indicates a renewable portfolio "goal" as opposed to "standard;" no penalty for non-compliance.

and the United Kingdom. Its American development has been clustered among states in the Northeast, Midwest, and Southwest, most commonly inserted into restructuring legislation passed in the late 1990s.

Texas' development of an RPS is particularly noteworthy, given its substantial historical production and consumption of fossil fuel as well as its seemingly vast potential for renewables. Texas created an RPS through the Restructuring of Electric Utility Industry Acts, which received wide support from both chambers of the state legislature and was signed into law by then-Governor George W. Bush on September 1, 1999. The Texas program mandates "cumulative installed renewable capacity" measured in total megawatts (MW), climbing gradually from 1,280 MW in January 2003 to 1,730 MW by January 2005, 2,208 MW by January 2007, and 2,880 MW by January 2009 (Chapter 39, Texas Restructuring of Electric Utility Industry Acts). The state anticipates that between three and four percent of its electricity will be provided by these sources by the end of the current decade. Texas also established a Renewable Energy Credits Trading Program that gives utilities considerable flexibility in meeting the standard requirement. Under the program, any electricity provider that cannot meet the RPS must "satisfy the requirements by holding renewable energy credits in lieu of capacity from renewable energy technologies" (Texas Restructuring of Electric Utility Industry Acts, 1999). Every renewable energy project in Texas that has been certified generates one "renewable energy credit" for every kWh of electricity that it produces. These credits can be purchased by electricity providers to meet any shortfall in their own generation of renewable energy.

The Texas RPS has been hugely successful, particularly through dramatic increase in wind power capacity. Texas had 187 MW of wind power in operation when the legislation was signed in 1999. By January 2002, that total had grown to 1,101 operational MW of wind power, reflecting the establishment of nine new sources (see Table 3). It is estimated that the reduction in fossil fuel use facilitated by this new renewable energy will reduce state CO_2 emissions by 1.83 million tons per year. The state not only expects to clear all four of its targets for renewables with ease, but also has begun to consider amending the legislation to increase them. Texas officials are, in fact, so excited about the long-term prospects for wind-based electricity that they have been prodding President Bush and Congress to take steps that would simplify export of Texas-based wind electricity to other states and Mexico in future decades. "Ultimately, Texas will be the nation's largest renewable energy supplier," noted one interest group leader with close ties to the former Governor. "We have always been an energy state and will always be an energy state."

Recognition that Texas' status as an "energy state" was imperiled in the late 1990s contributed heavily to the shift in support for renewables. Despite its prodigious historical capacity to produce and consume fossil

fuels, Texas became a net energy importer in the early 1990s and consumed more than ten percent more energy than it produced by 1998 (Virtus Energy Research Associates, 1998). At this point, the state ranked dead last in the nation in its percentage of energy derived from renewables and was steadily seeing a decline in the percentage of its gross state product attributable to fossil fuel extraction. As one study noted, Texas ranks among "the most thoroughly explored mineral resource provinces on earth." In fact, were the more than one million existing wells for oil and gas spread uniformly across the state, "there would be a well every half a mile in every direction throughout the entire state" (Virtus Energy Research Associates, 1998).

Table 3

Operational **Texas Wind Power** January 2002

Project	County	Size
Pre Senate Bill 7 (September 1999)		
Texas Wind Power Project	Culberson County	35.00 MW
Fort Davis	Jeff Davis County	6.60 MW
Big Spring I	Howard County	34.32 MW
Big Spring II	Howard County	6.60 MW
Southwest Mesa	Upton/Crockett Counties	74.90 MW
Delaware Mountain	Culberson County	30.00 MW
Total		**187.42 MW**
Post Senate Bill 7		
Woodward Mountain Wind Ranch	Pecos County	159.70 MW
Indian Mesa	Pecos County	82.50 MW
King Mountain Wind Ranch (1)	Upton County	76.70 MW
King Mountain Wind Ranch (2)	Upton County	2.60 MW
King Mountain Wind Ranch (3)	Upton County	200.00 MW
Trent Mesa	Taylor County	150.00 MW
AEP Clear Sky Wind Park*	Pecos County	160.50 MW
Hueco Mt. Wind Ranch at El Paso	Hudspeth County	1.32 MW
Llano Estacado Wind Ranch at White Deer	Carson County	80.00 MW
Total		**913.32 MW**
Overall Total		**1,100.74 MW**

* Includes the 25.50-MW project formerly known as Indian Mesa I.

Source: Texas Renewable Energy Industries Association.

These findings began to emerge at the very time at which the state was beginning to consider electricity restructuring. The state asked existing utilities to develop multi-year plans for future generation needs and also authorized extensive analysis of public opinion to discern citizen preferences on the future electricity market. This analysis followed the "deliberative opinion poll" format pioneered for election campaigns at the University of Texas at Austin (Fishkin 1991, 1995). Unlike the "single shot" approach of conventional polling, the deliberative approach gathers large clusters of diverse citizens and provides

them extensive information and access to varied perspectives. Polling takes place throughout a multi-day exercise, intended to give a picture of informed public opinion.

This format required all of the state's major utilities to organize sessions involving hundreds of citizens selected at random during 1996. All participants were asked to review a "fact book" on electricity generation and then heard, according to one participant, "a presentation from every sector with a dog in the hunt" of electricity generation. After multiple days of these sessions, somewhat surprising findings began to emerge. Whereas organizers had assumed citizens were primarily concerned with securing the lowest possible cost for their electricity, the findings instead suggested that long-term reliability of supply was paramount. This reflected concerns over public safety and economic well-being if Texas electricity supplies proved unreliable under deregulation. In turn, the polling process also discerned considerable public support for development and use of renewable energy, even in instances where cost might be slightly greater than traditional sources. This reflected strong citizen support for minimizing environmental damage through the generation of electricity.

Findings from the poll were presented to the state utility officials and were clearly influential as Texas began to consider deregulation legislation between 1997 and 1999. "This finally gave voice to the public's desire for renewable energy," noted one former state official. A diverse set of interests converged to promote the RPS, all of which concurred that its considerable potential to reduce greenhouse gases should not be emphasized as a supporting factor. "How you interpret the bill depends on who you are," noted one of its strongest sponsors. "If we had characterized this as something to do with greenhouse gases, it would have hurt the bill's chances. So we didn't." Instead, supporters emphasized that the RPS represented an incremental step to increase long-term electricity supply in an environmentally friendly way.

The Texas RPS has launched unprecedented attention to renewables, including new projects involving landfill gas, hydro, and solar sources. But the dominant area of activity has been the so-called "Texas Wind Rush." The first extensive study of RPS implementation, published in late 2001 by the Lawrence Berkeley National Laboratory, concluded that wind power is proving to be surprisingly cost-effective in Texas when compared with traditional sources, especially given the federal wind power production tax credit. This study also notes that "it can be said with near certainty that, given previous development plans, the major driver in the resurgence of wind energy development in Texas has been the state's aggressive RPS" (Wiser and Langniss, 2001).

B. Climate Change as an Air Pollution Issue: Massachusetts

States can influence GHG releases from electricity generation not only through their oversight of pricing and power plant siting, but also through their roles in setting and enforcing air pollution standards. Federal laws, such as the 1990 Clean Air Act Amendments, impose numerous requirements that states are bound to implement. Nonetheless, states have continued to play an innovative role, with clusters of states long taking action to combat air pollution from either mobile or industrial sources that is later embraced by federal policy. Just as the "California effect" has long guided auto emission standards, and may do so once again with the state's 2002 legislation on GHG emissions from autos, other states took the lead in finding mechanisms to combat sulfur dioxide emissions well in advance of the 1990 legislation (Vogel, 1995; Lowry, 1996; Ellerman et al., 2000).

Consequently, it is not surprising that some states are taking the lead in defining the next generation of clean air policy, expressly including CO_2 in "multi-pollutant" strategies. Legislation and rules that propose an integrated strategy for CO_2, as well as the more accepted targets of nitrogen oxide, mercury, and sulfur dioxide, are moving forward in a number of states. Massachusetts was the first to take formal action for operational power plants in April 2001, when Republican Governor Jane Swift established a multi-pollutant cap that includes CO_2 for six major facilities. "The new, tough standards will help ensure older power plants in Massachusetts do not contribute to regional air pollution, acid rain and global warming," said Swift in announcing the regulations (Swift, 2001).

As in the case of Texas, Massachusetts pursued electricity restructuring and created an RPS in the late 1990s. Deregulation had the unintended effect, in this instance, of making a half-dozen aging power plants more viable economically than under the previous regulatory regime. These coal and oil plants collectively produce approximately forty percent of the state's total electricity generation but are responsible for more than ninety percent of total greenhouse gases released from Massachusetts-based electric generating facilities. They had repeatedly escaped a number of new air pollution standards established after 1970 since all were opened in earlier decades.

The Massachusetts rule requires each plant to achieve specified reduction levels for each of the pollutants, including a ten percent reduction from 1997-1999 CO_2 levels by the middle-to-latter stages of the current decade. The state does not impose one method to achieve these reductions but would clearly prefer that they be converted to natural gas if kept operational. As a result, the rule offers an incentive for a fuel

shift by delaying the compliance deadline to October 2008 for any facility undergoing such a conversion. Plants using other techniques, such as pollution control equipment, would have to comply in 2006. It also allows the plants some opportunity to secure credits through verifiable "off-site reduction" measures such as carbon sequestration or renewable energy generation (310 CMR 7.29 Emissions Standards for Power Plants).

The rule emerged after Swift's predecessor, Paul Cellucci, challenged in early 2000 the owners of the six facilities to reduce their emissions voluntarily. Their proposals were incorporated into a formal review process by the Massachusetts Department of Environmental Protection, which issued draft regulations in June. However, this process was not completed before Cellucci resigned prior to completing his term, accepting appointment as Ambassador to Canada in early 2001. Swift faced some electric utility opposition to the rules, particularly when she refused to provide greater flexibility in such areas as crediting emission reductions by other plants owned by affected companies. "The average Joe Ratepayer by 2003 and 2004 will be paying more for electricity," asserted Neal Costello, spokesperson for the Competitive Power Coalition of New England. "In layman's terms, the lights could in fact go out" (McElhenny, 2001).

Swift rejected those arguments, citing the expected completion of more than a dozen new, cleaner plants by 2005 and the compliance flexibility included in the rule. "There was some tension over this but there was a lot of recognition that we had not focused much at all on key environmental considerations when we went through deregulation," noted a state official active in all stages of the rule process. "We have a lot of progressive utilities in the state, and, whatever the differences, we wanted to give them some certainty on how to move ahead with multi-pollutant approaches. That was a key factor in securing support."

Ironically, the rule may prove to be a hallmark achievement of Swift's brief governorship. Partisan divides in Massachusetts politics have grown intense in recent years, perhaps reflected in decisions by Cellucci and former Governor William Weld to leave office before completion of their respective terms and in Swift's decision not to seek nomination to a full term (Gurwitt, 2001). Little new policy of any sort has been approved during this period, making it rather remarkable that a path-breaking initiative that specifically calls for CO_2 reductions would move forward with such little controversy.

Whereas Massachusetts has pursued CO_2 reductions through regulation, other states have begun to enact legislation to facilitate a multi-pollutant approach to air pollution that includes CO_2. For example, the New Hampshire Clean Power Act targets CO_2 and other emissions. It received bipartisan support and was signed into law by Democratic Governor Jeanne Shaheen on May 9, 2002. This legislation builds on

New Hampshire's extensive prior engagement in climate change issues (Shaheen, 2001). The Clean Power Act requires the state's three existing fossil-fuel power plants to stabilize their CO_2 emissions at 1990 levels, which is approximately three percent below their 1999 levels, by December 31, 2006. Two of these plants, located in Bow and Portsmouth, use coal, and the third, located in Newington, uses oil and natural gas. All three plants are owned by Public Service of New Hampshire, a division of Northeast Utilities that also operates plants covered by the Massachusetts CO_2 rule (Biello, 2002). In order to achieve the mandated reductions, the plants must either reduce their emissions or purchase emissions credits from other plants outside New Hampshire that have achieved such reductions, or use some combination of these strategies. Shaheen noted growing evidence of climate change in New Hampshire in announcing her decision to sign the legislation and explained that it "threatens skiing, foliage, maple sugaring, and trout fishing — all crucial to our state's economy" (Shaheen, 2002).

C. Climate Change as an Agricultural Issue: Nebraska

Industrial activity has tended to overshadow natural resources in many debates over future climate change initiatives. This is particularly true in developed countries such as the United States, where sectors such as agriculture constitute an increasingly small share of the economy. Nonetheless, agricultural activity is responsible for 8 percent of U.S. CO_2-equivalent[2] GHG emissions, mostly in the form of methane due to livestock cultivation and nitrous oxide due to fertilizer use. Despite its relatively small contribution to emissions, this sector has substantial opportunities to mitigate climate change, because (1) reductions in these non-CO_2 greenhouse gases yield substantially greater bang for the buck in terms of "global warming potential," and (2) it could offset emissions from other sectors through increased storage of carbon in farm land. "Additional amounts of carbon can be sequestered in soils by relatively minor changes in agricultural practices," noted Richard Adams, Brian Hurd, and John Reilly. "'Growing carbon' on agricultural lands would create a new crop for farmers" (Adams, Hurd, and Reilly, 2001). According to U.S. Department of Agriculture analyses being utilized by Nebraska and other agricultural states, American cropland has the potential to sequester about 154 million metric tons (MMT) of carbon per year, more than eight percent of total U.S. emissions. The issue of animal waste and possibilities for reduced methane release are addressed later in this report with an analysis of a new initiative in North Carolina.

Agricultural states such as Nebraska are alert to these possibilities. They increasingly view carbon sequestration policy as a dual strategy to promote better soil conservation practices and facilitate future participation in national or international carbon markets. State-sponsored analyses confirm that Nebraska

stored substantially more carbon before sodbusting began in the 1800s and that tilling practices during the middle decades of the past century markedly reduced this capacity. But they note that conservation reforms of recent decades, including reduced emphasis on aggressive tilling, have increased sequestration capacity. In 2001, the Nebraska Department of Natural Resources estimated that current agricultural practices serve to sequester about 1.7 MMT of carbon each year and that various reforms could increase this significantly (Nebraska Department of Natural Resources, 2001).

Nebraska became the first state to enact legislation to link agricultural policy with GHG reduction. Legislative Bill 957 was approved by the unicameral legislature with only one dissenting vote and signed into law by Republican Governor Mike Johanns on April 10, 2000. The legislation noted the importance of preparing Nebraska to become engaged on this issue and established a Carbon Sequestration Advisory Committee (CSAC) with a diverse membership that represented varied sectors of agriculture, energy, and state government. It also authorized a transfer of funds from the Nebraska Environmental Trust Fund, which distributes proceeds from the state's lottery. These funds were subsequently matched by other sources, such as the Nebraska Agricultural Policy Task Force, the Nebraska Corn Board, and the Nebraska Public Power District, to fund initial CSAC efforts.

The CSAC continued to build on earlier Task Force efforts to study the issue and commissioned a pair of Department of Natural Resources reports. The first of these, released in December 2001, provides a detailed assessment of the scientific and policy issues surrounding future development of a sequestration program. This includes discussion of a series of agricultural reform practices that could increase sequestration capacity and also provide other benefits such as decreased use of fossil fuels, protection of long-term soil productivity, improved water quality, and reduction in off-site sediment damages (Nebraska Department of Natural Resources, 2001; Lynne and Kruse, 2001). The second report, released in March 2002, establishes a baseline survey for cropland and grassland on a county-by-county basis.

These reports converge to offer a two-part process to guide the next steps in policy development for Nebraska. They establish the framework for pilot projects that would allow carbon credits and possible trading within one or more of the state's 23 Natural Resource Districts (NRD). These districts cut across Nebraska's 93 counties, and are organized around river basins rather than political boundaries. They have long provided a main venue for state and local officials to work with the agricultural community on soil, water, energy, and related concerns. At least three NRDs have already expressed interest in serving as pilots and would work with the baseline data provided in the 2002 report.

The CSAC could also be the basis for a permanent Nebraska entity that would "play a leadership and organizational role in carbon related issues" (Nebraska Department of Natural Resources, 2001). The December report endorsed either sustaining the CSAC as currently comprised or developing a "climate change/greenhouse gas task force." In either case, the proposal recognizes the need to maintain an institutional "lead unit" for the state on agricultural carbon sequestration and related issues, to build upon the strong initial interest expressed by the agricultural community and take advantage of future policy development opportunities. These and other recommendations are under review by the Nebraska Legislature at present.

Nebraska's engagement in this issue stems from a series of developments in the late 1990s that brought together many stakeholders who were initially indifferent to the issues of carbon sequestration and global climate change. As the state Policy Task Force began to consider long-term challenges for the agricultural sector, two members of the group attended an Ohio conference that addressed sequestration issues. A presentation by Professor John Brenner of Colorado State University particularly captured the attention of the Task Force members, as it singled out Nebraska for its potential in carbon sequestration. "I began to see this as something that could improve air, water, people's health, AND could be a source of money," explained one of the participating Task Force members. "Usually, the only way farmers can make money is to harvest a resource. This was a way to provide payment to conserve those resources."

This triggered extensive discussion of the sequestration issue within the Task Force. "There was some initial enthusiasm but some of the farmers thought this was a liberal, Communist thing," recalled one Task Force member. "But as we really looked at it we could see how it might work." The Task Force agreed to host a conference at the University of Nebraska, including the same presentation from Brenner that members had heard in Ohio. More than 100 people attended and it is widely agreed that this event changed the tenor of subsequent discussion. "We got a lot of smiles and head-shaking, with folks asking: 'What the hell are you trying to do with this global warming stuff?'" noted one of the Task Force co-chairs. "But after the University of Nebraska meeting, they began to understand and things began to move ahead."

The Task Force provided a strong supportive coalition for conceptualizing and ultimately drafting the legislation. It found a staunch supporter in State Senator Merton "Cap" Dierks, a veterinarian with fifteen years of legislative experience. Dierks used his role as chair of the unicameral Agriculture Committee to address various concerns and secure a rapid transition from bill development to drafting (Dierks,

2001). Diverse stakeholders remain very supportive of the initiative and have begun to explore whether it might be possible for Nebraska to trade carbon credits with European nations or Canada in the event that they ratify the Kyoto Protocol.

The popularity of this approach is further demonstrated by its rapid diffusion to other states. Illinois, North Dakota, Oklahoma, and Wyoming did not formally consult with Nebraska officials, but passed strikingly similar versions of the sequestration legislation during 2001 (Illinois House Bill 842, August 7, 2001; North Dakota Senate Concurrent Resolution No. 4043, March 23, 2001; Oklahoma House Bill 1192, April 2001; Wyoming House Bill 0047, March 2001). Comparable legislation has been proposed but defeated in Idaho and South Dakota. Perhaps the biggest challenge facing the Nebraska program is funding, as there is currently no source of state funding allocated to either institutionalize the CSAC or implement pilot projects. Nebraska, like many other states, is facing an enormous fiscal shortfall. As is true for many state climate change innovations, lack of resources seems a more serious impediment than lack of political support.

D. Climate Change as a Forestry Issue: Minnesota

Forestry parallels agriculture in its potential as a source of carbon sequestration, both through the maintenance of existing forests and the planting of new trees. Some states have even begun to link these areas, exploring whether planting trees on low-producing cropland might be a useful long-term strategy for reducing GHG releases. In turn, international deliberations have proven increasingly receptive to incorporating "carbon sinks" created by forests into national calculations of greenhouse gases. Numerous international efforts have promoted expanded tree-planting in recent decades. These include the 1986 Noordwijk Declaration, whereby environmental ministers from 68 countries adopted a goal of increasing forest cover by 30 million acres per year. Nationally, former President George H.W. Bush launched the America the Beautiful Program in 1990, intended to plant nearly one billion additional trees per year. Many of these initiatives have attempted to combine the aesthetic and ecological benefits of expanded tree cover with potential impact on greenhouse gases.

These factors converged in Minnesota in the late 1980s. At the very time the state legislature began to endorse the idea of expanded commitment to forestry, including shade-oriented plantings in urban areas, state officials began to consider a number of possible steps to reduce state GHG emissions. In 1990, the Minnesota legislature noted that "trees are a major factor in keeping the earth's carbon

cycle balanced, and planting trees and perennial shrubs and vines recycles carbon downward from the atmosphere." It called upon the state's Department of Natural Resources (DNR) and Pollution Control Agency (PCA) to complete a study on future strategies for promoting and funding expanded tree planting (Laws of Minnesota, Chapter 587, Section 2).

A working group including representatives of both agencies as well as diverse stakeholders reported back to the Legislature in January 1991. They concluded that there was significant potential for expanded tree planting and carbon sequestration. Noting that Minnesota forests already "contain about 276 million tons of carbon," the report observed that in the "long term, it may be possible to increase the amount of carbon stored in the forest by 25 percent. Increases of 25 percent would be equivalent to fixing three years of annual emissions of CO_2" by the state (Minnesota Department of Natural Resources, 1991). Consequently, the report endorsed the creation of an urban and rural tree-planting program with an annual budget of $13.5 million. It also suggested that a significant portion of the funding for this initiative come from a tax on all sources of CO_2 emissions in Minnesota.

The carbon tax was further endorsed in a separate PCA study but faced considerable opposition from a number of carbon-generating sectors (Grant, et al., 1991). But once the tax proposal was shelved, a broad consensus formed behind the idea of a massive tree-planting initiative, resulting in the 1991 enactment of the Minnesota Releaf Program. This legislation called upon the DNR to "encourage, promote, and fund the planting, maintenance, and improvement of trees in this state to reduce atmospheric carbon dioxide levels and promote energy conservation" (Laws of Minnesota, Chapter 254, Article 2, Section 20, 1991). The legislation was relatively brief but established "primary criteria" of CO_2 "reduction and mitigation" and "promotion of energy conservation" in determining which activities would be funded under Minnesota Releaf. "Once we got beyond the issue of the tax, there was a lot of support for this," noted one state official. "There was never any pressure to drop the carbon dioxide or greenhouse gas label and the Legislature clearly liked it, seeing it as a moderate approach."

The Program received a significant boost through money provided from an environmental trust fund that collects revenues from oil overcharge penalties, the state lottery, and other sources. Between 1991 and 2001, Releaf supported 361 tree planting, forest health maintenance, and tree inventory projects involving nearly 200 communities and counties across Minnesota (Minnesota DNR, 2001). Releaf was implemented by the DNR Division of Forestry and has worked closely with the Minnesota Shade Tree Advisory Committee,

which includes more than 50 stakeholders with an interest in community forestry. The program established guidelines that prohibited use of funds to supplant existing local tree planting activities and required DNR Area Foresters to sign off on "needs determination" forms before funding could be considered.

Releaf also developed a strong emphasis on strategic planting to foster energy conservation, such as planting around homes to maximize shade or concentrated efforts to create wind breaks. "This became very popular as communities realized they could do two things at once, planting trees which look nice and also saving energy and money in the process," explained one state legislator who has remained a prominent supporter of Releaf. Officials acknowledged that the science of forest carbon sequestration remains inexact, particularly in far northern climates, and so viewed the emphasis on energy conservation as a natural extension of the program.

Releaf continues to exist but has been dogged since the latter 1990s by huge fluctuations in funding. Trust fund revenues can only be allocated to relatively new planting projects and Releaf has never emerged as a line item in the Minnesota budget. General revenues were allocated to the program in most of the recent biennial budget cycles but a current state deficit in excess of $2 billion leaves the future of the program uncertain. The ongoing shortage of funds has also precluded any formal evaluation of the program. Moreover, the growing problem of oak wilt infestation, a contagious tree disease, has dominated all regional forestry deliberations and is likely to continue to crowd out Releaf for any available funding.

Numerous other states have launched tree-planting initiatives over the past decade, although few have been as far-reaching as Minnesota's. One of the most novel efforts involves the Montana Carbon Offset Coalition, a quasi-public entity established with support from the Montana Legislature. It offers Montana landowners full cost sharing to plant trees in areas where they do not regenerate naturally and payments to store carbon in the land and trees. In turn, landowners sign century-long contracts that transfer control of carbon offsets to a private entity, Montana Watershed, Inc.

E. Climate Change as a Waste Management Issue: North Carolina

Several forms of waste also contribute to GHG accumulation, whether through direct release to the atmosphere or through various waste management techniques. Solid waste, for example, can be a significant source of methane emissions through venting from sanitary landfills. At the same time, major state advancements in rates of solid

waste recycling have made significant contributions to reducing total GHG releases, even though most state recycling programs make no attempt to link these.

Animal waste, however, constitutes a particularly challenging form of waste management with potential climate change impact, most notably through generation of methane releases. This is a growing concern in agricultural states that have large animal-raising industries, particularly given the increasing concentration of these activities into enormous concentrated animal feeding operations (CAFOs). North Carolina has probably faced greater challenges with this issue than any other state, as it is the nation's leading producer of meat and animal products, ranking first in turkey production and second in hog production. The state's pig population has grown from a little more than two million in 1984 to seven million in 1994 and nine million in 2002. Not only has the total number of pigs and other animals grown dramatically, but their increasingly dense concentration into CAFOs has generated significant problems stemming from traditional waste-handling methods of open-air lagoons and sprayfields.

A series of massive spills of waste into lakes and rivers drew national attention to North Carolina's problems in the mid-1990s. Then-Governor Jim Hunt secured support for a $1 million state allocation to expand research on waste technologies in 1996 and the state established a moratorium on new hog farms a year later. However, Hurricane Floyd raised this issue to another level of saliency in late 1999, triggering substantial flooding that released huge volumes of animal waste into waterways and led to widespread concerns about public health risk.

Attorney General Michael Easley, a Democrat who was campaigning to succeed Hunt, began to pursue litigation against large hog producers at the same time the North Carolina Legislature began to consider new regulatory steps. On July 25, 2000, Easley announced a settlement between the state and Smithfield Foods, Inc. that involves a long-term corporate commitment to reform animal waste management practices. Smithfield and its five subsidiary companies included in the agreement represent approximately 70 percent of North Carolina's hog industry. The agreement does not expressly address methane and other greenhouse gases released by current animal waste practices but has significant potential to achieve substantial reductions.

Under the agreement, Smithfield agreed to a series of financial payments over more than two decades. Its first step involves a commitment of $15 million to the Animal and Poultry Waste Management

Center, a research consortium directed by North Carolina State University and Iowa State University that is headquartered in Raleigh. The Center is responsible for identifying, developing, and testing a range of alternative waste management technologies. Once the Center has designated a technology as "technically and environmentally sound," the participating companies will be required to implement it. Moreover, Smithfield and its subsidiaries are expected to assume responsibility for funding implementation of the agreement, through payments of $50 million over a twenty-five year period. Up to $2 million of these funds may be used by the state to monitor compliance with the agreement and any violations are enforceable in court. "When we began negotiations on this late last year, the goal of phasing out lagoons seemed a nearly impossible task," noted Easley in announcing the settlement. "But I am here today to tell you that we have found a solution that will take us a giant step forward" (North Carolina Office of Attorney General, 2000).

Smithfield was joined shortly thereafter by Premium Standard Farms in signing a virtually identical agreement with the state. Premium agreed to contribute $2.5 million to the settlement, which when combined with the larger Smithfield operations will address approximately 75 percent of North Carolina's hog producing market. "Both of these firms were looking down the barrel at a bunch of problems and just about everyone agrees that this was a pretty creative settlement," noted one observer.

Completion of these agreements then launched the initial reviews by the Animal and Poultry Waste Management Center, which is known nationally for its technical skill and distance from political influence. The agreement called upon the Center to begin work immediately on a series of full-scale demonstration projects. For example, the Borham Farm, located in Zebulon, is testing a covered earthen anaerobic digester, which is designed to capture methane prior to its release. The methane will be used to fuel a generator that will provide electricity for the farm. Center associates note that at least eight of the 17 technologies currently being examined "have some element that will capture at least part of the greenhouse gases" likely to be generated, although completion of testing and recommendations is not expected until late 2003.

Other states are also beginning to examine new technologies for animal waste, such as Wisconsin's pilot attempt at a manure-to-energy system that utilizes anaerobic digestion. Low-interest loans from the Wisconsin Department of Commerce helped make it possible for the Tinedale Farm in Wrighton to launch its new waste management system in July 2001. This system replaces the traditional method of discharging manure from nearly 2,500 cows into lagoons. Instead, a digestion system will simultaneously reduce methane releases and produce biogas to fuel a pair of internal combustion engines and replace an estimated 0.75 MW of coal-fueled electricity generation per year.

F. Climate Change as a Transportation Issue: Georgia

Few sectors are as important to climate change as transportation, which is responsible for approximately twenty-six percent of total U.S. anthropogenic GHG emissions. At the same time, no sector may be so impervious to policy innovation at the state level, given the American affinity for driving cars and trucks and traditional reliance on the federal government to set relevant regulatory standards. State transportation departments may face a further disincentive to innovation given their primary focus on maximizing highway construction and repair. "These departments are set up as pavement agencies," noted a Georgia official who works closely with transportation agencies. "They have always had a clear mission and it is hard for them to think about anything else." These factors converge to explain why states have been more reluctant to launch GHG reduction initiatives in this sector than any other addressed in this report. Nonetheless, there are some exceptions to this pattern and perhaps the beginning of a shift in state thinking on this issue, reflected in California's far-reaching legislation approved in July 2002 (see Box 1 on page 8).

An increasingly common state practice has involved programs to attempt to reduce auto and truck usage and, in turn, foster greater use of mass transit or telecommuting. States consistently avoid discussion of potential impacts of such initiatives on GHG releases, tending instead to emphasize other attributes such as increased convenience and reduction of conventional air pollutants. "If this program was touted as an initiative for climate change, I don't know if it would be supported," noted a Georgia state official active in a major transportation program. "It has that potential but we just don't talk about it." But given the fact that Americans collectively traveled approximately four trillion miles in cars and trucks in 2000, as opposed to only 46.6 billion miles via mass transit, there may be significant opportunity for states to begin to make a dent in total GHG releases from transportation regardless of core program intent (Downs, 2002).

Georgia may have one of the most pressing challenges in transportation policy and has responded with a voluntary program intended to achieve a series of environmental and economic development goals. The thirteen-county area that constitutes metropolitan Atlanta grew from about one million people in 1960 to about four million in 2000, and continues to expand at a rate of approximately 150,000 people per year. The region was developed with little coordinated planning for transportation and has become a textbook example of the problems related to sprawl (Bullard, Johnson, and Torres, 2000; Stone, 1989). For many years of the past decade, the region led the nation in number of vehicle miles traveled daily in

commuting from home to work, averaging more than 40 billion miles per year. "We have a lot of people who have a lot of cars who drive a lot of miles," noted one state official.

By the mid-1990s, this staggering volume of transportation began to be recognized as a huge public policy problem. The Atlanta area developed a reputation for declining air quality, reflected in its classification by EPA as a "serious non-attainment area" for ground-level ozone and dismal rating in many national air-quality rankings. This endangered Georgia's supply of federal highway construction funds and also fostered growing concern about overall quality-of-life in the region and its possible impact on long-term economic well-being. National and regional media began to run negative stories about sprawl and poor air quality in Atlanta and, according to one state official, "there was concern, from the Governor on down, that economic development would be lost" unless something was done to address this problem.

The state responded by developing a multi-faceted strategy guided by the non-profit Clean Air Campaign (CAC). This organization was formed in 1996 and involves a coalition of more than 70 groups representing the public and private sectors, as well as environmental, educational, and public health interests. The CAC receives 80 percent of its funding from federal Congestion Mitigation and Air Quality (CMAQ) grants, which are matched by state and corporate funds. It works with the Georgia Environmental Facilities Authority (GEFA), an "instrumentality" of state government, to implement many of its initiatives. Under the Georgia Constitution, such instrumentalities are attached to a state agency and have a board appointed by the Governor. However, they retain substantially more autonomy than a conventional department and may therefore be more amenable to innovative approaches. "We were very careful in setting it up this way, rather than run everything through a single government agency likely to have a narrow focus," noted one prominent member of the CAC. "The business community has really bought into this and we have been able to build a broad base of support." The CAC also works with several Transportation Management Associations (TMAs) that provide related services to smaller sections of the region, such as the area surrounding Hartsfield International Airport.

The CAC emphasizes a range of voluntary initiatives based on a six-point behavioral model (Awareness, Attitude, Participation, Satisfaction, Utilization, Impacts) designed to raise public awareness on the issue and ultimately reduce reliance on traditional transportation modes. Some of its core themes build directly on the region's experience in hosting the 1996 Summer Olympics, when the region and state experimented with a number of voluntary transportation initiatives for the first time. "There were

enormous gridlock concerns as the Olympics approached," recalled a GEFA staff member. "So we experimented with all of these new strategies and they worked well. Air emissions went down dramatically during the Olympics despite all the visitors and it was then that we realized we were really on to something."

Much of the CAC's early focus has involved public information, most notably an aggressive mass media campaign "to link air quality with traffic congestion" and begin to encourage consideration of alternatives to traditional practices. Campaign ads feature prominent Georgians, from governors to corporate leaders. This type of activity is increasingly being supplemented with a range of voluntary programs that emphasize consultation with public agencies and private entities to tailor individualized strategies to reduce vehicle use. These consultative services explore such options as expanded use of mass transit, development of biking and walking options, car and van pooling, and development of flexible working hours to keep drivers off the road during high-congestion travel periods. In one instance, CAC outreach efforts led to negotiations between management and laborers of a General Motors automotive assembly plant in Doraville on increasing mass transit use. The deliberations led to the realization that the plant's second shift ran too late to allow workers to use transportation options, leading to a decision to alter closure time to facilitate a major increase in mass transit use.

The Campaign also offers a series of region-wide services, including a free ride-matching program that can be accessed by phone or web. For employers who participate in ride-matching or other programs designed to either pool van or car use or increase mass transit use, the Campaign provides a Guaranteed Ride Home program. This offers a free taxi ride anywhere in the region to an employee of a participating firm in the case of an emergency. The Campaign also offers an extensive set of instructional materials that can be used in regional classrooms and provides live traffic reports on-line, including extensive use of Navigator Traffic Cameras from the Georgia Department of Transportation.

The Campaign has included a strong evaluation component, both to gauge public awareness of the issues and also to assess impact on transportation practices and emissions. CAC and Department of Natural Resources officials note that total vehicle miles traveled per person in the region have declined by an average of one mile per person per day between 1998-99 and 2000-01. Their most recent evaluation concludes that the Campaign has helped move the state considerably closer to its goal of attaining the federal air ozone quality standard by mid-decade through demonstrated pollutant reduction. For 2001, it has been estimated that a reduction of 476,000 VMT can be attributed to the Campaign, resulting in a reduction

of 79,333 tons of CO_2 per year. Research conducted by the Southern Coalition for Advanced Transportation also indicates that the Campaign has had high public visibility and has contributed toward attitudinal change that has increased receptivity to alternative modes of transportation (Southern Coalition for Advanced Transportation, 2002).

Other states have begun to confront their transportation challenges with similar programs. The State of Washington, for example, preceded Georgia through passage of 1991 legislation that established the Commute Trip Reduction (CTR) program. This initiative is somewhat more coercive than the Georgia CAC in that it mandated participation by all firms employing more than 100 individuals in nine Washington counties. Operated by the Washington Department of Transportation after the earlier involvement by the State Energy Office, the CTR program has provided a range of direct and indirect assistance to employers in an effort to foster alternatives to traditional transportation practices. More than 70 local governments in the nine-county area have enacted ordinances that require employers to take actions to reduce commuting. Collectively, the program is estimated to achieve 40,000 tons of CO_2 reductions per year.

The state expanded the program through a 2001 Executive Order (01-03) that directed the Interagency Task Force for Commute Trip Reduction to adopt guidelines for telework and flexible work hours for all state agencies, boards, commissions, and academic institutions whether or not they were affected by the 1991 law. The guidelines were released in late 2001 and all state entities are now submitting compliance plans with the Washington Department of General Administration and Department of Personnel.

G. Climate Change as an Energy Development Issue: Oregon

The siting of new industrial facilities has proven increasingly contentious in recent years, particularly when significant environmental consequences and regulatory barriers are involved. This has proven a growing concern in electricity generation, given widespread interest in diversifying supply to mitigate potential shortages and bringing cleaner electricity into the national market. Oregon seized this controversial area in the late 1990s as an opportunity to simultaneously streamline its outmoded facility siting process and formally link any future siting initiatives with explicit commitments to reduce greenhouse gases.

Oregon's integration resulted in the creation of North America's first formal standard for CO_2 releases from new electricity generating facilities. This standard requires that any new or expanded power

plant proposed for operation in the state attain a level of CO_2 releases of 0.675 pounds per kWh, which is 17 percent below the most efficient natural gas-fired plant currently in operation in the United States. Proposed facilities may meet this standard through either development of new technologies that achieve greater efficiencies than existing practice or purchase of CO_2 offsets through monetary contributions that underwrite carbon mitigation projects.

Oregon has a long history of involvement in making ambitious and explicit commitments to GHG reduction, ranging from strict energy codes to promote energy efficiency to efforts to reduce reliance on single-occupant vehicles. In turn, the state set a series of broad goals, linked in part to its "Oregon Benchmarks" program of performance management, to more carefully measure GHG releases and reduce emissions rates in coming decades. Electricity emerged as a growing focus of these efforts during the mid-1990s, when state officials began to view facility siting as a possible venue for further innovation. By the mid-1990s, the state's traditional "need-for-facility" rules in the electricity generation siting process seemed badly outdated. Such rules were commonplace in an earlier era of electricity regulation, in which little thought was given to cross-border export and facility siting proponents were required to demonstrate need for adding capacity that would be consumed exclusively by state residents. They seemed anachronistic in Oregon given its proximity to natural gas sources, location in the continental electricity grid, and long-term uncertainty of its hydropower supplies (Lowry, 2002). At the suggestion of a multi-agency task force, the Oregon Legislature authorized in 1995 a one-time exemption from the need-for-facility rule. In its place, the Oregon Energy Facility Siting Council conducted a competition to allow one facility to be sited with capacity of up to 500 MW. The successful applicant would receive the approval based on its capacity to demonstrate the lowest level of environmental impacts, with the primary criteria being minimization of the proposed facility's "net monetized air emissions per kilowatt-hour, including carbon dioxide" (Carver et al., 1998).

Rather than convince the Council that there was intra-state consumer demand for more energy, this new policy incorporated environmental and GHG considerations into the siting approval process. After an extensive review, the exemption was granted to the 305-MW Klamath Cogeneration Project, to be located in Klamath Falls in southern Oregon. This proposal featured a high-efficiency generator for steam cogeneration and a $4.9 million commitment to purchase "carbon dioxide offsets" through solar rural electrification, methane use at sewage treatment plants and coal mines, reforestation of 6,250 acres of underproductive lands in western Oregon, and expansion of the geothermal heating district for the city of

Klamath Falls. These offset commitments will reduce the total CO_2 emissions from the new facility, which are already well below the national averages due to the new technology, by 28 percent.

The success of this one-time experiment set in motion a search for a long-term strategy to link energy development with CO_2 reductions. This led to a proposal to abolish the need-for-facility standard in exchange for a CO_2 emissions standard applicable to any new natural gas-based power facilities in the state. The proposal received relatively little attention in the state media, passed both chambers of the Legislature without an opposing vote, and was signed into law by Democratic Governor John Kitzhaber in June 1997. For industry, this new process offered a simplified siting process and flexibility in terms of technology development and compliance. For environmentalists, it promised far cleaner energy sources, both in CO_2 and conventional pollutants, from any new or expanded power plants operating in Oregon.

The creation of a CO_2 standard 17 percent below best performance in the nation coincided with the creation of the Oregon Climate Trust (since renamed Climate Trust) to "purchase carbon dioxide offsets with funds provided by power plant developers" (Oregon Office of Energy, 1998). The Trust is a nonprofit organization governed by a seven-member board with representation from state government, industry, and environmental groups. As in the Georgia transportation case, this process for project review and fund distribution was intended to foster public trust and broaden control beyond a single state agency. The Trust is required to spend at least eighty percent of its funds on direct carbon reduction projects, with the remainder used to cover administrative costs and project monitoring and evaluation. Projects are approved through an open competition that can include proposals from other states and nations. Decisions are based on a variety of factors but most important are "whether the Trust funding will make a significant difference in whether the project goes forward or not, and the project's realistic potential for CO_2 reductions" (Brown, 2001).

The first project approved under the new legislation involves an expansion of the Klamath Cogeneration Project through the construction of an additional gas turbine that will add nearly 200 MW to the facility. In addition to using the most advanced technology available, the facility has agreed to provide cogeneration steam to an area lumber company, to halt use of oil as a backup source to natural gas except in cases of emergency, and to contribute $1.2 million to the Climate Trust for carbon mitigation projects. The Trust completed a competitive review process and announced a number of project grants in 2001 and 2002. These included purchase of old growth and other forests for removal from the commercial

forestry cycle, creation of a web-based carpool matching program, and support for new wind and landfill gas energy projects. These projects are collectively intended to reduce or capture at least 764,300 metric tons of carbon over periods that range from 10 to 100 years for various projects.

One of the Trust's most recent projects, approved in May 2002, represents its first international venture. It features a contract with Ecuador's Jatun Sacha Foundation and Conservation International to capture and store atmospheric carbon in a rainforest. This will entail planting native hardwood trees on a 680-acre site in the northwest coastal mountains of Ecuador, a rainforest deemed by Conservation International as one of the world's five most threatened areas for biodiversity. The project is intended to sequester at least 65,000 metric tons of CO_2 over a hundred-year period. The Trust has also established a cooperative project with Seattle City Light, the municipally-owned utility for Seattle, which intends to pursue carbon mitigation projects related to purchase of electricity from the Klamath facility (Swope, 2002).

Minnesota has also turned to the process of long-term energy development as an opportunity to begin to establish linkages with efforts to reduce greenhouse gases. A few years after the state developed the Releaf program, legislation passed in 1993 that called upon the Minnesota Public Utility Commission (MPUC) to "quantify and establish a range of environmental costs associated with each method of electricity generation. A utility shall use the values established by the commission in conjunction with other external factors, including socioeconomic cost, when evaluating and selecting resource options in all proceedings before the commission, including resource plan and certificate of need proceedings" (Minnesota Statute 216B.2422, 1993). Staff from the MPUC and MPCA subsequently developed a range of interim values for six emissions, including sulfur dioxide, nitrogen oxides, lead, volatile organic compounds, particulates, and CO_2. After an extended series of public hearings and a review by a Minnesota administrative law judge, the MPUC voted in January 1997 to accept a range of $.30 to $3.10 per ton as the estimated environmental cost of CO_2. This estimate was based on 1995 dollars and values are to be updated using the Gross National Product Price Deflator Index as data become available (Rule E-999/ CI-00-1636, May 3, 2001). Legal challenges from out-of-state coal exporting sources and other constituencies are pending and the utilization of the system has been delayed by the slow pace of electricity transition in Minnesota. Nonetheless, it demonstrates a further use of integrating energy development and planning with tools designed to reduce greenhouse gases.

H. Climate Change as a Reporting and Crediting Issue: Wisconsin

One of the most creative tools to emerge in environmental policy entails mandatory public disclosure of emissions. This is most commonly accomplished through the federal Toxics Release Inventory, which was modeled on early state programs in Maryland and New Jersey and provides uniform data on a wide range of environmental releases. The very existence of such an inventory has triggered a number of federal and state policy initiatives that encourage private firms to reduce their emissions voluntarily and receive some form of credit or recognition for their efforts, such as EPA's hugely successful 33/50 program that challenged firms to voluntarily reduce their release of toxic chemicals by up to 50 percent (Karkkainen, 2001; Hearn, 2002).

Such a linkage is now being attempted in Wisconsin for greenhouse gases. The state established mandatory reporting for large CO_2 generators in May 1993 as part of its emissions inventory reporting regulation and remains the only national or subnational government in the United States with this requirement. This has provided both the state and reporting firms an unusually detailed glimpse into their releases. It has helped pave the way for the final stages of developing a registry that will allow any Wisconsin firm to report reductions of CO_2 or any other greenhouse gas. Such reductions would be registered by the state Department of Natural Resources (DNR) with the intent of obtaining credit for reduction in any future federal or state GHG regulatory program.

The idea of such a registry is not new. The U.S. Department of Energy established a voluntary registry in the early 1990s through the 1605(b) program; other states such as California and New Hampshire have been active in developing their own registries. But Wisconsin's is unique in that it builds on a half-decade of mandatory reporting experience for CO_2 and has several design features intended to maximize participation. The legislation authorizing the registry was approved with broad support and signed into law by former Republican Governor Tommy Thompson in May 2000. Regulations have been adopted by the Wisconsin Natural Resources Board and the registry is expected to be operational in early 2003.

The reductions registry was, in many respects, a logical next step from earlier initiatives. Wisconsin was extremely active in the study of greenhouse gases and possible policy remedies throughout the 1990s, making it a natural candidate to include CO_2 in emissions reporting requirements. The Wisconsin Air Contaminant Emission Inventory Reporting regulation was adopted in 1993 and included CO_2 as one of the

547 contaminants that must be reported annually to the DNR (Wisconsin Chapter NR 438.03, 1993). All facilities releasing more than 100,000 tons of CO_2 annually are required to participate, which includes all electrical utilities and most large boilers in operation. Unexpectedly, dozens of sources that fall well below the threshold voluntarily report their emissions annually, providing the state with a detailed, multi-year profile of its major CO_2 sources. In 2000, for example, 192 Wisconsin-based sources reported a total of 50,414,110 tons of CO_2 emissions. This included most major electric utilities in the state, a wide range of large industries, and a mixture of smaller sources including the City of Kenosha Water Utility, the Kraft Pizza Company, the Wisconsin Air National Guard, and various hospitals and medical centers (see Table 4).

Table 4

Wisconsin Reported Carbon Dioxide Releases by Industrial Category, 2000

Industrial Category (SIC Code)	Reporting Units (No.)	CO_2 Emissions (Tons)
Nonmetal Minerals (14)	21	6,993
Heavy Construction (16)	3	5,165
Food and Kindred Products (20)	18	99,071
Lumber and Wood Products (24)	6	3,190
Furniture and Fixtures (25)	2	1,400
Paper and Allied Products (28)	26	7,494,673
Printing (27)	5	1,263
Chemicals and Allied Products (28)	1	20
Petroleum and Coal Products (29)	4	4,957
Rubber and Misc. Plastic Products (30)	4	4,893
Stone, Clay and Glass Products (32)	4	316,118
Primary Metal Industries (33)	8	21,624
Fabricated Metal Products (34)	13	19,858
Industrial Machinery and Equipment (35)	15	315,165
Electric and Other Electronic Equipment (36)	4	22,313
Transportation Equipment (37)	7	6,499
Instruments and Related Products (38)	1	775
Misc. Manufacturing Industries (39)	1	102
Air Transportation (45)	1	622
Electric, Gas and Sanitary Services (49)	30	42,072,833
Wholesale Trade-Nondurable Goods (51)	2	2,499
Insurance Carriers (63)	1	14
Personal Services (72)	2	1,357
Health Services (80)	8	9,448
Educational Services (82)	1	54
Executive, Legislative and General (91)	1	1,011
Justice, Public Order and Safety (92)	1	2,250
National Security (97)	1	51
Other	1	2
Totals	192	50,414,110

Source: Wisconsin Department of Natural Resources (2002).

The development of this reporting system coincided with the creation of a Wisconsin Climate Change Committee by former DNR Secretary George Meyer. This body reviewed the substantial analytical work that had already been completed concerning greenhouse gases and climate change in Wisconsin and outlined a series of policy recommendations in a May 1998 report (Wisconsin Climate Change Action Plan, 1998). One of these "proposed actions" involved the development of a system to assure "credit for early emission reductions" of greenhouse gases: "A significant deterrent to industry adoption of energy efficiency measures and the shift to 'cleaner' fuels as a greenhouse gas reduction strategy is the concern that those who take early actions to reduce emissions would be penalized if a future regulatory program required them to make emissions reductions over and above those they had already made" (WDNR and WCCC, 1998). This recommendation was translated into the registry legislation enacted in 2000.

The creation of the Wisconsin registry reopens the question of whether such a tool can draw a significant number of applicants and provide an incentive for early reductions, given the opportunity to secure future credit. State officials are hopeful that several unique features will assure a high level of engagement. First, the extended experience with CO_2 reporting is unique and could indeed simplify the analytical process needed to quantify reductions. "The link with the emissions inventory is the real hook here, compared to other registries," noted one DNR official. "Firms are already reporting their emissions; we already have all of that data. So this gives us a huge advantage over other registries."

Second, the Wisconsin registry allows an unusually wide range of air emissions reductions to be included. Whereas 1605(b) and other early registries focus solely on CO_2 or greenhouse gases, Wisconsin includes all greenhouse gases as well as a large number of other substances, including mercury, volatile organic compounds, nitrogen oxides, and fine particulate matter, among others. Entities are allowed to submit reductions for one or more of these emissions and state officials believe that this opportunity to register multiple reductions simultaneously will heighten participation. Some of these emissions, such as mercury, are receiving growing attention in the state. Regulations to require mercury emissions reductions are being proposed. Others, such as volatile organic compounds, are of interest because of the requirement to offset such emissions from new sources in areas that have not attained the federal ozone air quality standard.

Third, Wisconsin has a well-established tradition of securing credit for steps to reduce air emissions. The state passed major acid rain legislation in 1986, four years before related federal legislation. Wisconsin mandated substantial sulfur dioxide reductions and assured firms that their reductions would be credited under any future federal law. Most of the state's largest GHG sources "buy into the registry idea because we came through for them on acid rain," explained a senior DNR official. "They had to go ahead of other states because of our legislation, but that made it much easier for them to comply with the 1990 federal law. We said we would make sure they were grandfathered and they were. They remember that, so they trust us when we say we will make sure their early reductions of greenhouse gases are protected as well. That's what makes this inventory so promising."

Wisconsin officials are also hopeful that the registry can be utilized in two other ways. The DNR has been increasingly active in recent years in exploring performance-based alternatives to traditional command-and-control regulation (Wilson, 2002; Davies et al., 2001). Major GHG reductions have already been considered in a state policy initiative involving a major state utility, Wisconsin Electric Power Company,

and could easily be included in the registry. In addition, officials responsible for registry development have been active in an informal network called the "State Registries Collaborative," which allows for discussion among leaders of the approximately one dozen states most interested in this approach. The Wisconsin experience could be a test case for diffusion of the registry idea, possibly on a multi-state, regional, or national basis. Perhaps the biggest challenge facing the registry is an acute shortfall of revenue facing the state and the DNR, which leaves a very small staff to finalize registry details and oversee implementation.

I. Climate Change as a Comprehensive Issue: New Jersey

Ultimately, any long-term strategy to confront global climate change will require the integrated engagement of all sectors that directly and indirectly generate greenhouse gases. As indicated by the earlier cases, most state innovation has been confined to one or two sectors. New Jersey, however, offers an illustration of what a more comprehensive, multi-sectoral strategy might entail. It is the first state to establish an official GHG reduction goal and has actively involved all relevant sectors in attempting to attain that goal.

New Jersey's long-standing concern about climate change took new shape in 1998 when Robert Shinn, then Commissioner of the Department of Environmental Protection (DEP), issued Administrative Order 1998-09 that established a goal of reducing the state's total GHG releases to 3.5 percent below 1990 levels by 2005. This order was supported by then-Governor Christine Todd Whitman (current EPA Administrator) and endorsed by an unusual coalition of industry representatives and environmental groups. The state generated 136 million metric tons (MMT) of CO_2-equivalent emissions in 1990 and was projected in 1998 to release 151.2 MMTs by 2005. Consequently, goal attainment would require a reduction to 130.8 MMTs by 2005 and the state formally included reduction goals for various sectors, including energy, transportation, waste management, and natural resource conservation (see Table 5). The goal has been formally incorporated into the DEP's Strategic Plan and Performance Partnership Agreement (PPA) with EPA under the National Environmental Performance Partnership System (NEPPS). New Jersey is the first state to commit to GHG reduction as part of a long-term strategy to realign federal and state regulatory duties under the auspices of NEPPS, which was intended to give states greater flexibility in program management in exchange for taking innovative steps that could achieve measurable improvements in environmental performance. The 3.5 percent GHG reduction goal has also been included as one of forty-one leading "quality of life" indicators established by the state government (New Jersey Future, 2000).

Table 5

New Jersey Greenhouse Gas Action Plan – Proposed CO_2 Reductions by Market Sector

Market Sector	Projected MMT of CO_2 in 2005 w/ "Business as Usual" (A)	Proposed MMT of CO_2 in 2005 with GHG Action Plan	MMT of CO_2 Reduced (B)	CO_2 Percentage Reduction (%) (B/A)	Percentage of Total Plan Reductions (%) (B/C)
Energy Conservation – Residential Buildings	25.8	24.3	1.3	6.0	6
Innovative Technologies – Residential Buildings			0.2	0.8	1
Energy Conservation – Commercial Buildings	26.7	18.5	4.5	16.9	22
Innovative Technologies – Commercial Buildings			3.7	13.9	18
Energy Conservation – Industrial	25.6	22.9	0.4	1.6	2
Innovative Technologies – Industrial			2.3	9.0	11
Energy Conservation – Transportation	46.2	44.0	1.5	3.3	7
Innovative Technologies – Transportation			0.7	1.5	4
Pollution Prevention	5.4	4.6	0.8	14.8	4
Waste Management	19.8	15.3	4.5	22.7	22
Natural Resources	1.7	1.2	0.5	29.4	3
Totals	151.2	130.8	20.4 **(C)**	13.5	100

Source: New Jersey Department of Environmental Protection (2002).

The state has repeatedly emphasized recent patterns of sea level rise and long-term threats to New Jersey's coastal sustainability in the event GHG levels continue to escalate. "We really began to look at this issue in the mid-1990s when we were debating what to do about New Jersey's coastal islands, which were facing this huge problem of rising sea level," recalled a former senior state official. "I raised the issue of whether it made sense to start reducing CO_2 now. Perhaps if we started, other states would join in and we could slow the sea level increase. The response was great and that made it clear to me that we could do something on this issue." State officials also emphasized other potential threats to New Jersey from climate change and repeatedly noted that addressing greenhouse gases served as an "umbrella effect," as it was also likely to contribute to reduction of other pollutants that caused significant air quality problems in the state.

Pursuit of the GHG reduction goal has entailed a multi-faceted process, weaving together a diverse mixture of strategies. Some of these are drawn directly from prior New Jersey experience in regulatory innovation and partnerships with other nations, most notably the Netherlands (Rabe, 2002b). Perhaps the most visible of these initiatives has been the creation of "covenants," whereby organizations sign a pledge to reduce their GHG emissions in accordance with the state goal (New Jersey Department of Environmental Protection, 2002). To date, a series of New Jersey corporations and even a military base have signed such covenants. In one instance, the Public Service Enterprise Group (PSEG), the state's largest utility, signed the covenant in 2000 and further formalized this in a January 2002 agreement that expands its commitment to GHG reductions. This agreement commits PSEG to reduce total CO_2 emissions from all of its coal, natural

gas, and oil power plants by 15 percent from 1990 levels by 2005. Whereas most of the covenants are purely voluntary and not enforceable, this PSEG agreement includes a commitment to monetary penalties if pledged reductions are not attained. In addition, a pair of state departments has signed a covenant and the state has pledged to purchase 15 percent of its electricity from renewable sources. Much of the responsibility for the covenant program and other GHG initiatives has been concentrated in the Office of Innovative Technology in the DEP Division of Science, Research, and Technology, reflecting its technical expertise and independence from a more narrowly focused (and potentially turf-protective) part of state government.

New Jersey has not, however, concentrated only on large industrial sources. Indeed, the presidents of all of New Jersey's 56 colleges and universities have signed the covenant and are working toward implementation through the New Jersey Higher Education Partnership for Sustainability. Some institutions have become particularly active in response, including a massive geothermal energy project at Robert Stockton College (Stiles and Gitchell, 1999). In turn, Partners for Environmental Quality, a non-profit organization that represents nine religious denominations and more than 6,000 New Jersey-based congregations, has also signed the covenant and is working with individual congregations to reduce their GHG emissions (Johnson, 2000). Even public schools have entered into this process through the New Jersey Sustainable Schools Network and covenant signing by elected school boards. "There's a tendency to assume just big industries are involved in this issue but we realized that addressing climate change involves everyone," noted a state official. "That's one of the reasons we developed the covenant approach and one of the reasons we want to educate people through this process."

The state has coupled this effort with a series of regulatory initiatives, many of which are concentrated in the electricity sector. Like other states, New Jersey seized upon electricity deregulation legislation as an opportunity to pursue GHG reduction features. But the state is unusual in that it combines an RPS with two other mechanisms that could also impact greenhouse gases. Under the state's 1999 Electric Discount and Energy Competition Act, an RPS went into effect in 2001 that gradually increases toward a mandatory level of 6.5 percent renewable energy in the overall state supply by 2012. The legislation also creates a "social benefit charge" for every utility bill that is expected to generate $358 million per year for energy efficiency and renewable energy projects and reduce greenhouse gases by two MMTs of CO_2 equivalent per year (Shinn and Polsky, 2002). These funds are to be allocated through a competitive process overseen by a new Independent Statewide Administrator as opposed to utility

companies. In addition, the new law establishes "environmental disclosure requirements" that require all utility customers to receive information about the "environmental characteristics" of the electricity they are using, including information about CO_2 emissions. A number of states have attempted one or two of these elements, but New Jersey is one of only three states that have pursued all three simultaneously.

New Jersey has also begun to experiment with a flurry of other mechanisms that could further contribute to GHG reductions. These include development of a multi-tier system for permitting that incorporates greenhouse gases into traditional permitting despite the fact that they are not regulated substances. Under this approach, firms that were able to demonstrate superior environmental performance in reduction of various emissions, including greenhouse gases, would receive public recognition through their placement in gold and silver "tracks" and also secure more administrative flexibility in complying with routine permitting provisions. The state has also ventured beyond its boundaries, entering into a formal agreement with the Netherlands that allows for development of joint trading projects and a series of environmental technology reciprocity agreements with Canada that would accelerate approvals of various technologies that could promote energy efficiency or reduce greenhouse gases.

New Jersey has achieved a reduction in annual GHG emissions since the release of the 1998 Administrative Order and may actually surpass its 2005 reduction goal by one percent. Much of this decrease can be attributed to changes in electricity supply, such as increased reliance on nuclear power, unrelated to the new state programs. As a result, the state has given thought to establishing a more ambitious target as these programs begin to be implemented. The state is currently considering possible "next steps" and began public hearings in March 2002 on a proposal to mandate reporting of both CO_2 and methane from large sources. This has been under consideration for some time, having been initially endorsed in the 1999 New Jersey "action plan" for greenhouse gases. The state is expected to promulgate a mandatory GHG reporting rule in late 2002. The current administration, headed by Democratic Governor James McGreevey, has begun to examine the effectiveness of the voluntary covenant system as opposed to alternative approaches that would be "more regulatory" in nature.

VI. Looking Ahead: Lessons for the Future

State government capacity to devise innovative approaches to public policy problems in advance of federal or international action is well established. Nonetheless, it remains rather remarkable that so many states have taken such diverse steps given the enduring difficulty of reaching consensus on climate change in Washington, D.C. If anything, the level of state engagement seems to be intensifying. These initiatives consistently cut across traditional partisan divides and demonstrate engagement on this issue in every region in the United States. Collectively, they underscore the possibility of a fundamental transition in climate change policy, moving beyond familiar battle lines in search of creative and meaningful innovation.

State GHG mitigation efforts take many forms and involve numerous sectors. No singular policy tool or approach predominates, reflecting the breadth of current activity. Some initiatives, such as those in Massachusetts and Texas, are regulatory in nature with detailed statutory provisions that guide implementation within an existing bureaucracy. Other efforts, such as those in Georgia and Nebraska, emphasize voluntary initiatives that are designed and implemented by new entities that cut across traditional agency lines. It is far too early to distill long-term impacts, but the range of activities suggests the possibility of multi-faceted strategies that might blend these themes into a comprehensive framework. Such integration is most evident in New Jersey, which attempts to engage all relevant sectors with a variety of approaches.

There are, of course, likely limitations facing decentralized approaches to climate change policy. A number of states have shown little if any interest in this area and some have taken formal steps to minimize the possibility of innovations. States also face constitutional limits to active engagement in international relations, reflected in the dominant role of national governments in crafting international climate change strategies. In addition, a major impediment to any further development of these state strategies is the very limited base of funding available to assure their implementation. Ironically, many state programs are moving into early stages of implementation at the very moment that dozens of states find themselves in an enormous fiscal crunch and the federal government is again running sizable deficits. The National Governors Association and the National Association of State Budget Officials reported in May 2002 that state budgets are in worse condition than at any time in the last 20 years. Few of these state programs have reliable

sources of support and have to compete with established programs and units. In turn, federal grant programs have proven helpful but have been largely confined to analysis and action plan development. Consequently, perhaps the greatest near-term threat to the continued vitality of state-level innovation in climate change may involve funding scarcity rather than political opposition. Resource scarcity has not, however, deterred many states from accelerating and diversifying their efforts, particularly in the last few years.

Looking ahead, states may continue to take the lead in climate change policy, through either continued development of homegrown initiatives or diffusion of new policies to other states and regions. Regional cooperation may prove increasingly possible, as reflected by an August 2001 declaration by the Governors of the New England states and Premiers of the five eastern provinces of Canada to develop a common framework for achieving GHG reductions. They have established goals to reduce regional GHG emissions to 1990 levels by 2010 and to ten percent below 1990 levels by 2020. There is also provision for a longer-term strategy to achieve even greater reductions. In August 2002, the premiers and governors reaffirmed their commitment to these goals and endorsed plans to pursue common energy efficiency programs for traffic lights, government-owned vehicles, and office equipment. They have also laid the groundwork for a regional GHG inventory and registry that could facilitate emissions trading across jurisdictional boundaries. They will also consider expanding their regional boundaries, possibly including states such as Maryland, New Jersey, and New York. Leaders in the creation of CO_2 standards in Massachusetts and New Hampshire have been influential in the design of this new regional strategy, having found strong allies in neighboring states and provinces.

All of this activity also provides a laboratory for consideration of next steps in federal policy. Much important federal energy, environmental, and transportation legislation is due for reauthorization and the best of recent state experience could indeed provide models for nation-wide initiatives. If mandatory CO_2 reporting has proven feasible in Wisconsin, is it possible for the federal government to establish a national reporting system? If Texas and more than a dozen other states are able to implement renewable portfolio standards and develop significant sources of renewable energy, is the federal government capable of taking such steps? If Massachusetts, New Hampshire, and Oregon can establish regulations to reduce CO_2 from electricity generation with little controversy, is it conceivable that the federal government could learn from these initiatives as it contemplates the next round of air quality policy? In fact, current proposals before Congress consider such possibilities, making recent state experience a possible model for future steps by the federal government. Some state policies, such as the July 2002 actions by California and 11 state attorneys general, may actually go a step further and prod new federal policy, thereby reflecting intensified state demand for a federal response to the challenge of climate change.

Endnotes

1. Alabama, Arizona, Colorado, Idaho, Illinois, Indiana, Kentucky, Michigan, Mississippi, North Dakota, Ohio, Pennsylvania, South Carolina, Virginia, West Virginia, and Wyoming.

2. Carbon dioxide equivalent (CO_2e) is a measure used to compare the global warming potentials of various greenhouse gases. Global warming potential is an expression of the warming impact of a gas over a given period — usually 100 years — as compared to carbon dioxide. For example, one metric ton of methane is assumed to exert the same impact on the climate system as 21 metric tons of carbon dioxide over 100 years. For more information on the global warming potential of greenhouse gases, see research conducted by the Intergovernmental Panel on Climate Change, available at www.ipcc.ch.

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