

## State Greenhouse Gas Programs: An Economic and Scientific Analysis

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President George W. Bush's decision to focus federal climate change efforts on scientific research and voluntary reductions in greenhouse gas emissions has not ended government efforts to cap or mandate reductions of such emissions. State policymakers across the country are trying to implement the Kyoto Protocol, the rejected global warming treaty, on a state-by-state basis. Several have already explicitly capped emissions by electric utilities.

In their 2002 legislative sessions, 25 state legislatures considered 71 bills explicitly seeking to reduce greenhouse gas emissions. Bills included voluntary and mandatory emissions reporting and carbon sequestration programs, renewable energy requirements, and transportation initiatives.

State policymakers across the country are trying to implement the Kyoto Protocol, the rejected global warming treaty, on a state-by-state basis.

In the 2003 session, many state legislatures will consider new state-level efforts to reduce greenhouse gas emissions. Some legislators will propose making voluntary programs mandatory; others will seek to set higher goals for emission reductions or alternative energy source use. Laws passed in California, New Jersey, and other states on the "cutting edge" of this movement are likely to serve as models.

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This *Heartland Policy Study* surveys legislative activities in 2001-02. It then presents economic and scientific analyses showing state-level efforts to reduce greenhouse gas emissions would impose unbearable burdens on state treasuries and on consumers and businesses, yet would have no net effect on the global climate. There are, however, some “win-win” policies states can adopt, which are also presented in this report.

<b>Table 1</b> <b>Possible Cost of State</b> <b>Greenhouse Gas Programs</b> <b>(to reduce emissions to 7 percent</b> <b>below 1990 levels)</b>		
<b>State</b>	<b>% of 2001 State Revenues</b>	<b>Per Household</b>
Alabama	33%	\$13,200
California	23%	\$7,200
Connecticut	20%	\$6,200
Georgia	27%	\$9,600
Hawaii	14%	\$7,100
Illinois	32%	\$10,200
Iowa	27%	\$10,500
Louisiana	35%	\$26,600
Massachusetts	17%	\$6,300
Mississippi	28%	\$17,000
New Hampshire	54%	\$4,700
New Jersey	19%	\$8,200
New York	26%	\$7,600
North Carolina	27%	\$7,200
Ohio	28%	\$14,200
Pennsylvania	31%	\$11,300
Tennessee	34%	\$9,300
Vermont	27%	\$6,200
Virginia	29%	\$7,700
Washington	30%	\$5,300
Wisconsin	26%	\$9,300
<b>37-state average</b>	<b>29%</b>	<b>\$10,000</b>

## Summary of Findings

**Efforts by state governments to reduce greenhouse gas emissions are very expensive and produce little or no economic or environmental benefit.**

States facing record budget deficits due to lower-than-expected revenues in 2002 and 2003 should *not* adopt greenhouse gas reduction programs that would cost taxpayer dollars, destroy jobs, and do nothing to protect the environment. A strong case can be made for repealing programs already in place.

Specific findings include:

Ø A national program to reduce U.S. greenhouse gas emissions to 7 percent below 1990 levels by 2010 would increase gasoline prices at least 65 cents a gallon and double the price of electricity for consumers and businesses, destroy at least 2.4 million jobs, cause average household income to fall \$3,372, and cost state governments \$116 billion a year in revenue.

Ū Individual states attempting to accomplish the same level of reductions would face costs *10 times* as great as under the national program, costing the average state government \$3.2 billion a year and the average household \$10,000 a year. (See Table 1.)

Ū The benefits of reducing greenhouse gas emissions are small or nonexistent. By 2060, global warming is likely to

have a small (0.2 percent of GDP) *positive* effect on the U.S. economy and a small (1 to 2 percent of GDP) *negative* effect on the global economy. The global benefits of reducing emissions today are an order of magnitude less than the cost.

Ū The science of climate change is too uncertain and unsettled to justify acting now to reduce greenhouse gas emissions.

Ū Even if states were successful in reaching their greenhouse gas emission reduction goals, such reductions would be too small to have a measurable impact on the global climate.

Ÿ Even assuming global warming theory is correct and the decision is made to reduce emissions, there is no scientific reason why emission control efforts should start now rather than 20 or even 50 years from now.

Ɔ State legislators should oppose new efforts to cap or reduce greenhouse gas emissions because such efforts are expensive, slow economic growth, hurt the poor and elderly, and produce few if any economic or environmental benefits.

Ɔ State legislators should repeal regulations and subsidies that discourage energy efficiency, encourage sequestration projects that offer additional environmental benefits, and support projects that enhance society's ability to adapt to gradual changes in climate.

## Organization of this Report

Part 1 describes recent state legislative activity on greenhouse gas programs. Such efforts fall into five categories: explicit emission caps (typically on utilities), renewable energy requirements, carbon sequestration initiatives, alternative transportation programs, and carbon reporting schemes.

State legislators should oppose new efforts to cap or reduce greenhouse gas emissions because such efforts are expensive, slow economic growth, hurt the poor and elderly, and produce few if any economic or environmental benefits.

Among the lessons learned from these efforts are: Oregon and New Jersey were able to rely on alternative energy sources (hydroelectric and nuclear) that other states may not have; New Jersey demonstrates the huge expense of a comprehensive greenhouse gas reduction effort; voters do not support expensive programs; and sequestration programs appear to offer the greatest hope of being cost-effective.

Part 2 performs an economic analysis of state greenhouse gas reduction efforts. State-by-state estimates of the cost of a national program to reduce emissions to 7 percent below 1990 levels by the year 2010 are presented. New estimates are presented for the likely costs facing states that attempt to reduce emissions on their own. Seven reasons why reducing emissions

tends to be expensive are given, and the false promise that emission permit trading would lower these costs is exposed.

Part 3 evaluates the scientific basis of the global warming theory. We analyze data purporting to show global warming and present superior data showing no warming trend. Scientific research finds individual state efforts would be too small to have any impact on global climate, and emission reduction efforts can be safely postponed until they are more clearly justified. Strong cases can be made for encouraging farmers and foresters to adopt techniques that increase carbon sequestration, and for investing in institutions and infrastructure that enable vulnerable populations to adapt to climate change, rather than attempt to forestall change.

Part 4 presents recommendations to elected officials who feel pressure to “do something” about global warming, but who realize greenhouse gas reduction programs are economic losers driven by fear and speculation, not sound science. Possible “win-win” programs include repealing regulations and subsidies that discourage energy efficiency, encouraging sequestration projects in forestry and agriculture that produce environmental benefits other than their effects on greenhouse gases, and investment in “hardening” infrastructure to cope with possible climate changes.

Appendix 1, at the end of the report, describes 71 bills introduced in 25 state legislatures during the 2001-2002 session.

Appendix 1, at the end of the report, describes 71 bills introduced in 25 state legislatures during the 2001-2002 session. Appendix 2 describes the dubious legal status of interstate compacts, such as the New England/Canada global warming pact signed in 2001. Appendix 3 contains a table showing

the possible cost to 37 states of reducing greenhouse gas emissions to 1990 levels. (A similar table on pages 34-35 presents the possible cost of reducing emissions to 7 percent below 1990 levels.)

## PART 1

# Overview of State Programs

At the time this study went to press, 2003 legislative sessions were reconvening and bills addressing greenhouse gases had yet to be introduced. Nevertheless, a review of activity in 2001-2002 can provide insight into which states are likely to be most active, and what types of greenhouse gas emission curbs they are likely to entertain.

The following discussion divides greenhouse gas emission reduction programs into five types: explicit emission caps (typically on utilities), renewable energy goals and mandates, carbon sequestration initiatives, programs targeting emissions from cars and trucks, and carbon reporting schemes.

This part of the report describes programs already in place and how they were adopted. It avoids analyzing either the economics or science of the programs, which takes place in Parts 2 and 3. A summary of “lessons learned” appears at the end of this section. Appendix 1 summarizes an analysis by the American Legislative Exchange Council (ALEC) of 71 greenhouse gas emission reduction bills considered by 25 state legislatures during the 2001-2002 legislative sessions and their current status.

## Explicit Emission Caps

Bills seeking to directly limit carbon dioxide emissions typically cap power plant emissions at a baseline emissions level or a baseline year and mandate a reduction in emissions to that level or some percent below the baseline. Legislators in 12 states — California, Florida, Hawaii, Illinois,

### What Are Greenhouse Gases?

Greenhouse gases are “gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.” The principal greenhouse gas is water vapor, which accounts for 97 percent of the total greenhouse effect. Anthropogenic (man-made) greenhouse gases are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

Carbon dioxide is the most common anthropogenic gas and is usually singled out for control in greenhouse gas programs. Programs that seek to control other gases typically define the influence and longevity of those gases relative to that of carbon dioxide. The Intergovernmental Panel on Climate Change (IPCC), a United Nations organization, gives a carbon dioxide molecule the global warming potential (GWP) value of 1. Other gases are then assigned GWPs relative to carbon dioxide. A molecule of methane, for example, has a GWP of 21, and nitrous oxide is 310 GWP.

In 2000, total greenhouse gas emissions from all sources in the U.S. were estimated to be 7.1 million Gg (gigagrams) GWP. Carbon dioxide emissions totaled 5.8 Gg, nearly 82 percent of total emissions.

*Sources:* United Nations Framework Convention on Climate Change, text of the Kyoto Protocol, Article 1, Section 5; UNFCCC, “Review of the Implementation of Commitments and of Other Provisions of the Convention,” February 16, 2000, page 14; UNFCCC, “Greenhouse Gases Inventory Data Base.” (All sources can be found at <http://ghg.unfccc.int/>.)

Massachusetts, Michigan, Minnesota, New Hampshire, New York, North Carolina, Washington, and Wisconsin — introduced bills during the 2001-2002 legislative session seeking such caps.<sup>2</sup>

A cap was signed into law in New Hampshire in 2002. Oregon, New Jersey, and Massachusetts had laws limiting carbon dioxide emissions prior to the 2001-2002 legislative session.<sup>3</sup> In addition, a group of New England governors and eastern Canadian premiers signed a nonbinding pact in 2001 to reduce greenhouse gas emissions to 1990 levels by 2010 and to at least 10 percent below 1990 levels by 2020.

### **New Hampshire**

H.B. 284, passed by the New Hampshire legislature in March 2002, includes carbon dioxide in a “multi-pollutant” emissions cap on existing fossil fuel power plants. Statewide carbon dioxide emissions are capped at 5.4 million tons per year through 2010. By March 2004, the New Hampshire Department of Environmental Services must recommend a stricter standard to apply after 2010.

The Oregon standard cannot be a model for states with fewer hydroelectric resources. It is too strict even for Oregon in the long run.

### **Oregon**

Oregon’s standards, enacted in 1997 (HB 3283), require all new or expanded power plants to emit 0.675 or less pounds of carbon dioxide per kWh.<sup>4</sup> If a plant cannot meet this standard on its own accord, it may meet part

or all of its reduction target by paying mitigation funds to a “qualified nonprofit,” which in turn must use the funds to carry out projects that avoid, sequester, or displace the excess carbon dioxide produced by the plant. Qualifying projects are overseen by the Oregon Climate Trust and have included, among other things, planting trees and funding alternative fuel energy programs.

The Oregon standard is reachable, at least for now, because renewable energy sources, mainly hydroelectric dams, already provide 79 percent of Oregon’s electricity. Only Washington, with 80 percent, makes greater use of renewable energy.<sup>5</sup> In states other than Oregon and Washington, the 0.675 per kWh standard is unattainable, since it is 17 percent below the nation’s most efficient natural gas plant, which in turn is significantly below the emission

<sup>2</sup> “Sons of Kyoto: CO2 Regulation in the States,” American Legislative Exchange Council, July 11, 2002.

<sup>3</sup> John C. Ryan, “On Climate, States Lead,” *Christian Science Monitor*, July 25, 2002. Governor Jane Swift signed the law in April 2001.

<sup>4</sup> “Oregon Switches to Cleaner Power,” *EPA Climate Change Solutions*, December 2000.

<sup>5</sup> Energy Information Administration, *Renewable Energy Annual 2001*, November 2002, Table C15, [http://www.eia.doe.gov/cneaf/solar.renewables/page/rea\\_data/tablec15.html](http://www.eia.doe.gov/cneaf/solar.renewables/page/rea_data/tablec15.html).

level of a typical coal- or oil-powered plant.<sup>6</sup> In other words, the Oregon standard cannot be a model for states with fewer hydroelectric resources.

The Oregon standard is too strict *even for Oregon* in the long run. Interest groups have targeted hydroelectric dams for removal due to their impact on fish and other wildlife.<sup>7</sup> Oregon is a prime battleground in what has become a nationwide anti-hydroelectric campaign fueled by calls to return rivers to their pre-industrial age natural channels and cycles.<sup>8</sup> If Oregon's strict carbon dioxide standards are not loosened, removal of dams in the state would result in supply shortfalls and higher prices to the state's electricity consumers.

## New Jersey

New Jersey has imposed the nation's most comprehensive restrictions on greenhouse gas emissions. In 1998, then-governor Christie Whitman set a goal of reducing total greenhouse gas emissions to 3.5 percent below 1990 levels by 2005. To reach that goal, the state has imposed a "social benefit charge" on every utility bill in the state. The tax collects \$358 million a year to fund greenhouse gas reduction programs.<sup>9</sup> If the program is successful, the state's taxpayers will have spent approximately \$55/ton per year for every ton of carbon avoided.<sup>10</sup> This does not include indirect costs to consumers and businesses in the form of higher energy prices and compliance with regulations.

One New Jersey program recruits public and private entities to pledge to reduce their greenhouse gas emissions. New Jersey's 56 colleges and universities, a few major corporations, a coalition of nine religious denominations, and the state's dominant utility (Public Service Enterprise Group, or PSEG) have all agreed to make the pledge. A central tenet of the pledge program has been that participation is voluntary and pledges would not be enforceable.

New Jersey collects a tax on utility bills that collects \$358 million annual a year to fund greenhouse gas reduction programs.

Recently, however, the state has begun to take a harder line in enforcing pledges. In January 2002, in the course of reaching a consent decree regarding unrelated Clean Air Act violations, state officials pressured a division of PSEG to convert its unenforceable pledge into legally

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<sup>6</sup> "Oregon Switches to Cleaner Power," *supra* note 4.

<sup>7</sup> Jennifer Hattam, "Why Vote?" *Sierra Magazine*, September/October 2000.

<sup>8</sup> "Oregon Prepares to Remove 2 Dams," *Environmental News Network*, June 2, 1999.

<sup>9</sup> Eric Pianin, "On Global Warming, States Act Locally," *Washington Post*, November 11, 2002.

<sup>10</sup> In 1990, New Jersey emitted 32.2 million metric tons of carbon equivalent (mmtce), so the target is 96.5 percent of that amount, or 31.0 mmtce. Under a business as usual scenario, New Jersey would have emitted approximately 37.5 mmtce in 2005, so the required emission reduction is 6.5 mmtce. \$358 million divided by 6.5 mmtce is \$55/ton.

binding obligations. The company must cut its carbon dioxide emissions by 15 percent from 1990 levels within four years or pay up to \$1.5 million in penalties.<sup>11</sup>

New Jersey also has renewable energy mandates and is considering a mandatory carbon dioxide emissions reporting program, both described below. While New Jersey appears likely to reach its goal of a 3.5 percent reduction from 1990 greenhouse gas levels, it will achieve this goal largely by increasing its reliance on nuclear power.<sup>12</sup> Although nuclear power is not specifically encouraged in any of New Jersey's greenhouse gas reduction programs, the state's experience underscores that nuclear power is one of the most efficient ways of reducing greenhouse gases.

### **Massachusetts**

Through the regulatory process, Massachusetts Governor Jane Swift in April 2001 established a multi-pollutant cap that includes carbon dioxide emissions.<sup>13</sup> The carbon dioxide cap followed on the heels of renewable energy requirements created in the late 1990s, and specifically targets six of the state's coal- and oil-powered electricity generators.

In August 2001, six New England governors, in conjunction with five eastern Canadian premiers, signed a pact to reduce greenhouse gas emissions to 1990 levels by 2010 and at least 10 percent below 1990 levels by 2020.

By 2006 or 2008, depending on which course plant operators choose to take, the plants must cut their greenhouse gas emissions to 10 percent below 1999 levels. Plant operators have some discretion on how to achieve these requirements, and most are likely to switch to natural gas. The plants may partially fulfill their requirements by demonstrating off-site greenhouse gas mitigation measures.<sup>14</sup>

### **New England/Canada Climate Change Pact**

In August 2001, six New England governors, in conjunction with five eastern Canadian premiers, signed a pact to reduce greenhouse gas emissions to 1990 levels by 2010 and at least 10 percent below 1990 levels by 2020. The agreement commits each state to undertake an evaluation and planning process every five years and ensure its reduction targets are as

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<sup>11</sup> Barry G. Rabe, "Greenhouse & Statehouse: The Evolving State Government Role in Climate Change," prepared for the Pew Center on Global Climate Change, November 2002, page 37.

<sup>12</sup> As described on the PSEG Web site at <http://www.pseg.com/environment/overview.html>.

<sup>13</sup> Anne Egelston, "Oregon, Massachusetts lead the way in GHG reductions," *Environmental Finance*, July-August 2001, page 31.

<sup>14</sup> Barry G. Rabe, *supra* note 11, page 16.

aggressive as possible. The agreement was signed by three Republicans, two Democrats, and an independent.<sup>15</sup>

The agreement is not legally enforceable, and any of the party states may abandon the pact at will. The bipartisan nature of the agreement and the Northeast's historic preference for command-and-control environmental policy, however, make repudiation by any of the participant states unlikely in the near future. Moreover, New England state legislators have already stepped up the pace of introducing greenhouse gas reduction bills.

Under the New England/Canada pact, each of the states and provinces will develop its own approach to meeting the targets. However, the pact explicitly encourages participants to reduce power plant emissions, use cleaner-burning fuels, increase renewable energy usage, and promote energy efficiency and conservation. State agencies in Massachusetts, New Hampshire, and Rhode Island have already drafted plans to that end.

Most legal scholars believe interstate compacts are unconstitutional and hence not enforceable.

Although New England states are currently the only U.S. participants in the pact, there are ongoing discussions about a number of Middle Atlantic states joining the pact. New York and New Jersey have been particularly aggressive about greenhouse gas issues, and states such as Maryland, North Carolina, and Pennsylvania may also seek to join the pact.

Interstate pacts may appear to be an attractive means of preventing businesses and residents from moving to neighboring states to avoid energy taxes, alternative fuel mandates, and other greenhouse gas emission reduction programs. However, most legal scholars believe they are unconstitutional and hence not enforceable. A discussion of the questionable legality of such pacts appears in Appendix 2 at the end of this report.

## Renewable Energy Requirements

A less direct way to reduce greenhouse gas emissions is to require energy producers to generate a specific portion of their power through alternative energy sources. Such measures typically require energy suppliers to harness wind, biomass, solar, or other renewable energy sources for their power generation. States vary dramatically in the share of their electric generation that currently comes from renewable energy sources, ranging from as high as 80 percent in Washington and 79 percent in Oregon to only 1 percent in Illinois, New Mexico, and Texas.<sup>16</sup> Targets easily reached in one state will be impossible to attain in many others.

Thirteen states (Arizona, California, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas, and Wisconsin) have enacted

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<sup>15</sup> Jim Graham, "Region's governors in accord on warming," *Concord Monitor*, August 28, 2001.

<sup>16</sup> Energy Information Administration, *supra* note 5.

legislation requiring utilities to provide a specific percentage of their power generation from renewable sources. (See Table 2.)<sup>17</sup> The renewable mandate varies from Arizona’s 1.1 percent requirement by 2007 to Maine’s 30 percent requirement, which utilities were to have met by 2000.

<b>State</b>	<b>Renewable Mandate</b>	<b>By What Year</b>
Arizona	1.1%	2017
California	20%	2017
Connecticut	13%	2009
Hawaii*	9%	2010
Illinois*	15%	2020
Iowa	2%	1999
Maine	30%	2000
Massachusetts	11%	2009
Minnesota	4.8%	2012
Nevada	15%	2013
New Jersey	6.5%	2012
New Mexico	5%	2002
New York*	15%	2020
Pennsylvania	0.2% - 2.0%	2001
Texas	2.2%	2009
Wisconsin	2.2 %	2011

\* Legislation in Hawaii, Illinois, and New York sets only goals, rather than enforceable mandates.

Another three states — Hawaii, Illinois, and New York — have passed legislation with non-binding renewable energy “goals,” which may be precursors to efforts to set mandatory quotas. Hawaii has a goal of 9 percent renewable by 2010, while Illinois and New York have a 15 percent renewable goal by 2020.

New Jersey’s 1999 Electric Discount and Energy Competition Act requires that 6.5 percent of the state’s electricity be generated from renewable sources by 2012. Utility companies must provide “environmental disclosures” to their customers describing carbon dioxide emissions and the environmental impacts of the electricity they are supplying.<sup>18</sup> The current administration of Gov. James E. McGreevey is working on other measures, including expanding the state’s renewable energy requirements and building more energy-efficient public schools.

Texas is home to the nation’s most prominent energy companies, so it is somewhat surprising that its state legislators have joined the alternative energy mandates parade. President Bush supported the 2.2 percent

renewables mandate in Texas and signed it into law while he was governor.<sup>19</sup> While the President no longer thinks global warming theory is sufficiently credible to justify federal

<sup>17</sup> Barry G. Rabe, *supra* note 11, page 12.

<sup>18</sup> New Jersey Board of Public Utilities, Division of Energy, *Renewable Portfolio*, available at <http://www.bpu.state.nj.us>.

<sup>19</sup> Steve Ernst, *Puget Sound Business Journal*, March 1, 2002.

regulation of greenhouse gas emissions,<sup>20</sup> Texas's current political leaders seem content to maintain the mandate.

Supporters of the Texas program have not been upfront with the public regarding the true goals of their efforts. According to Barry Rabe, professor of environmental policy at the University of Michigan, "supporters emphasized that the [Texas plan] represented an incremental step to increase long-term electricity supply in an environmentally friendly way."<sup>21</sup>

"A diverse set of interests converged to promote the [Texas plan], all of which concurred that its considerable potential to reduce greenhouse gases should not be emphasized as a supporting factor," said Rabe. "How you interpret the bill depends on who you are," asserted one of the bill's strongest legislative supporters. "If we had characterized this as something to do with greenhouse gases, it would have hurt the bill's chances. So we didn't."<sup>22</sup>

## Carbon Sequestration

While New England states have focused on reducing the use of fossil fuels to reduce carbon dioxide emissions, agricultural states such as Idaho, Illinois, Nebraska, North Dakota, Oklahoma, and Wyoming have focused on agricultural carbon sequestration. As the first state to implement such a program, Nebraska (Legislative Bill 957, signed into law April 10, 2000) has served as a model for other states. California also has a sequestration program.

"If we had characterized this as something to do with greenhouse gases, it would have hurt the bill's chances. So we didn't."

– A sponsor of Texas's renewable energy mandate

Vegetation provides a natural means of removing carbon dioxide once it is in the air. Plants require carbon to grow; through natural processes, they transform atmospheric carbon into new growth, part of which is stored below-ground in root systems. To study agricultural sequestration possibilities and implement sequestration-maximizing agricultural practices, Nebraska's unicameral legislature passed a measure, with only a single dissenting vote, establishing the Carbon Sequestration Advisory Committee. The measure was signed into law in April 2000. The

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<sup>20</sup> In a March 13, 2001 letter to Senator Chuck Hagel, widely circulated at the time, the President wrote, "I do not believe, however, that the government should impose on power plants mandatory emissions reductions for carbon dioxide, which is not a 'pollutant' under the Clean Air Act. ... At a time when California has already experienced energy shortages, and other Western states are worried about price and availability of energy this summer, we must be very careful not to take actions that could harm consumers. This is especially true given the incomplete state of scientific knowledge of the causes of, and solutions to, global climate change and the lack of commercially available technologies for removing and storing carbon dioxide."

<sup>21</sup> Barry Rabe, *supra* note 11.

<sup>22</sup> *Ibid.*

legislation authorized initial Committee funding from the Nebraska Agricultural Policy Task Force, the Nebraska Corn Board, and the Nebraska Public Power District.

Similar to the Nebraska strategy of sequestering carbon through agricultural programs, California, Minnesota, Montana, Oregon, and Washington have programs to sequester carbon through forestation. In 1990, the Minnesota legislature concluded “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.”<sup>23</sup> The legislature directed the Minnesota Department of Natural Resources (DNR) and the state’s Pollution Control Agency (PCA) to examine future strategies for promoting and funding tree-planting programs.<sup>24</sup>

California, Minnesota, Montana, Oregon, and Washington have programs to sequester carbon through forestation.

The DNR and PCA concluded aggressive tree-planting campaigns could increase by 25 percent the ability of state forests to sequester carbon, and recommended a tree-planting program for rural and urban areas to cost \$13.5 million a year, to be funded largely by tax increases.<sup>25</sup> However, Minnesotans were

leery of new taxes, and the program was forced to proceed without the contemplated funding. A scaled-down tree-planting campaign is now being funded by state lottery funds and industry fees. “Once we got beyond the issue of the tax, there was a lot of support for this,” noted a state official involved in the process.<sup>26</sup>

Montana and Oregon have also begun forestation programs similar to Minnesota’s. Montana’s program is particularly noteworthy in that the state will pay private landowners the cost of planting trees, in exchange for the landowners assigning the carbon-offset value of the new trees to a state-sanctioned company. This company, in turn, may sell these credits to outside entities at a future date.

## Alternative Transportation

Most states have programs to reduce pollutants emitted by cars, buses, and trucks by encouraging alternative forms of transportation, including HOV lanes, natural gas- and fuel cell-powered buses, heavily subsidized mass transit systems, trip reduction programs, and more.<sup>27</sup> Typical of such programs is Georgia’s.

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<sup>23</sup> Laws of Minnesota, Chapter 587, Section 2.

<sup>24</sup> Ibid.

<sup>25</sup> Barry G. Rabe, *supra* note 11, page 22.

<sup>26</sup> Ibid.

<sup>27</sup> Environmental Protection Agency, Region 6, describes several of these programs and provides links to other resources at [http://www.epa.gov/region6/6xa/alt\\_better\\_way.htm](http://www.epa.gov/region6/6xa/alt_better_way.htm).

Teaming with some private-sector participants, the state in 1996 formed the Clean Air Campaign (CAC). The CAC uses largely voluntary initiatives to induce citizens to use alternatives to the private automobile. The CAC produces advertisements by prominent citizens extolling the virtues of walking, biking, carpooling, using mass transit, and other alternative transportation modes.<sup>28</sup>

Supporters of Georgia's greenhouse gas reduction program presented their proposal as a way to reduce the number of automobile miles traveled per day and therefore a solution to traffic congestion.

With a rapidly growing population and plenty of land suitable for development in all directions, the Atlanta metropolitan area is one of the nation's largest and fastest growing. Supporters of the state's greenhouse gas reduction program presented their proposal as a way to reduce the number of automobile miles traveled per day and therefore a solution to traffic congestion and other alleged negative consequences of car-oriented development. "If this program was touted as an initiative for climate change, I don't know if it would be supported," said a Georgia state official supporting greenhouse gas reductions. "It has that potential but we just don't talk about it."<sup>29</sup>

California has attempted to take its alternative transportation program to where no other state has gone before: an explicit cap on transportation emissions. The program is controversial and probably illegal.

Carbon dioxide emission caps for cars and trucks were initially proposed in California in the form of Assembly Bill 1058. California consumers were at first receptive to the vague "feel good" requirement that car and truck manufacturers bear the cost of producing cars that do not contribute to global warming. However, public opinion changed when critics of the bill called attention to its expected negative consequences — steep hikes in the prices of cars and trucks and a reduced range of choices for consumers as manufacturers stopped selling larger and more powerful vehicles in the state — and its minimal effect, if any, on the global climate. Legislative support for AB 1058 disappeared.<sup>30</sup>

After being given up for dead in light of public opposition, carbon dioxide curbs were resuscitated as Assembly Bill 1493 in a flurry of backroom political maneuvering that had proponents of consumer choice crying foul.<sup>31</sup> Governor Gray Davis, in a decision widely regarded as an election-year move to curry the favor of environmentalists, signed the bill in July 2002. The new law empowers the California Air Resources Board (CARB) to set mandatory carbon dioxide emission reductions for new cars and trucks sold in California.

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<sup>28</sup> Barry G. Rabe, *supra* note 11, page 26.

<sup>29</sup> *Ibid.*

<sup>30</sup> Jim Sander, "Greenhouse gas fight may carry on," *Sacramento Bee*, July 7, 2002.

<sup>31</sup> *Ibid.*

Unwilling to set specific requirements for emission reductions, California's legislators delegated the responsibility to CARB and set a deadline of the 2009 model year. AB 1493 forbids CARB to require such unpopular measures as new gasoline taxes, new taxes on miles driven, or mandatory reductions in vehicle size. The result is that elected officials may say they "did something" about global warming, but CARB is left in an untenable situation.

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Currently available technology cannot meet the efficiency and emissions requirements of California's new law *without* reducing vehicle size.<sup>32</sup> "Let's be clear about what this is," observed Eron Shosteck, spokesperson for the Alliance of Automobile Manufacturers. "This is a state version of fuel economy standards."<sup>33</sup>

California's decision to limit vehicular carbon dioxide emissions may be struck down by the federal courts. Under federal law, state governments are not allowed to preempt federal corporate average fuel economy (CAFE) standards. After California passed an earlier law requiring zero or near-zero emissions on a significant portion of automobiles sold in the state, a federal judge in June 2002 prohibited enforcement of the law on those grounds.<sup>34</sup>

"California and the more 'environmentally conscious' states are setting national policy," said Professor Thomas Cahill, director of air pollution studies at the University of California at Davis. "They are going around the Congress."<sup>35</sup> Since federal courts in the past have ruled this impermissible, state policymakers should avoid making the same mistake and resist proposals to follow California's lead.

## Reporting Schemes

A typical first step toward regulating or capping greenhouse gas emissions is the creation of a voluntary or mandatory greenhouse gas reporting system. Eight states — California, Illinois, Maine, Maryland, New Hampshire, New Jersey, Vermont, and Wisconsin — have each created mandatory reporting systems. Texas is contemplating a registry, and New Jersey, which requires utilities and large manufacturers to periodically report their carbon dioxide emissions, began public hearings in March 2002 on a proposal for mandatory reporting of carbon dioxide and

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<sup>32</sup> Andrew Parker, "Davis is missing the point with new auto bill," *Mustang Daily News*, August 8, 2002.

<sup>33</sup> Paul Rogers, "California can set auto trend with global warming bill," *San Jose Mercury News*, July 15, 2002.

<sup>34</sup> Elizabeth Shogren, "Feds back suit to stop state's pollution rule," *Tri-Valley Herald*, October 10, 2002.

<sup>35</sup> Paul Rogers, *supra* note 33.

methane.<sup>36</sup> Massachusetts, Connecticut, and Rhode Island are considering registries as part of their New England/Canada Climate Change Pact programs.

Wisconsin provides a typical example of a mandatory reporting system. In 1993 the state implemented the Wisconsin Air Contaminant Emission Inventory Reporting regulations, listing carbon dioxide as one of the 547 “contaminants” that must be annually reported to the state’s Department of Natural Resources. The regulations require all facilities releasing more than 100,000 tons of carbon dioxide per year to participate. This includes all electricity producers, most large boiler operators, and a variety of other plants.<sup>37</sup>

A typical first step toward regulating or capping greenhouse gas emissions is the creation of a voluntary or mandatory greenhouse gas reporting system.

One noteworthy aspect of the Wisconsin plan is a credit for early reductions in greenhouse gas emissions. The state promises companies that take action now to reduce their emissions will receive a credit against any future mandatory cap on emissions.

## Lessons Learned

The workings of carbon emission reduction programs already in place and the manner in which those programs were enacted offer some preliminary lessons for elected officials. Among those lessons are the following:

1. Oregon and New Jersey were able to set strict caps on greenhouse gas emissions from utilities because of their unusual circumstances: Oregon has large hydroelectric resources, and New Jersey was able to increase its reliance on nuclear power. Neither solution seems sustainable. States without significant hydroelectric or nuclear power resources probably will regret following the lead of these two states.
2. New Jersey demonstrates how voluntary programs — whether for emission reduction, alternative energy sources, or reporting greenhouse gas emissions — can quickly become mandatory. It is probably naive to assume voluntary programs will remain voluntary for long. Instead, they are usually launching pads for demands that participation be made mandatory.
3. New Jersey also highlights the immense cost of even small reductions in carbon dioxide emissions. The tax on utility bills raises \$358 million a year, or \$55 for every ton of carbon emissions thought to be averted. This does not include the higher cost of energy from

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<sup>36</sup> New Jersey Board of Public Utilities, Division of Energy, *Request for proposals to develop renewable energy technology projects*; and *The Governor’s Energy Summit - The Future of Energy in New Jersey*, available at <http://www.bpu.state.nj.us>.

<sup>37</sup> Barry G. Rabe, *supra* note 11, page 33.

alternative sources, regulatory compliance costs, and the loss of economic activity due to higher energy prices.

4. The deceptive manner in which the renewable energy mandate was adopted in Texas and alternative transportation schemes were launched in California and Georgia suggests the public is opposed to paying higher prices or surrendering mobility to “help stop global warming.”

The deceptive manner in which the renewable energy mandate was adopted in Texas and alternative transportation schemes were launched in California and Georgia suggests the public is opposed to paying higher prices or surrendering mobility to “help stop global warming.”

5. Sequestration programs can be “win-win” strategies that reduce ambient carbon dioxide while also producing environmental benefits. Even here, though, Minnesota’s experience suggests taxpayers are not eager to subsidize such programs with their hard-earned money.

## PART 2

# Economic Analysis

Extensive economic research on the costs and benefits of different climate change policies has been conducted by prominent and respected scholars.<sup>38</sup> Authoritative economic analysis of other environmental issues also can be brought to bear on climate change.<sup>39</sup>

At the heart of the case for state greenhouse gas reduction programs is the claim that the benefits outweigh the costs. Our review of the evidence suggests this is unlikely to be true of most programs being considered by most states. Most state programs would cost far more than whatever benefits they are likely to produce. Such programs impose huge burdens on state budgets — at a time of record state deficits — and on families, workers, the poor, and senior citizens.

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### Overview of the Analysis

The analysis that follows assumes for the sake of argument that anthropogenic (man-made) uncontrolled greenhouse gas emissions would cause global warming, and that national and state efforts to control emissions could avert or delay the onset of warming. The scientific basis for these claims is analyzed in Part 3.

The estimates of the cost of reducing emissions cited below refer only to reducing emissions to 1990 levels or 7 percent below 1990 levels, not *ending* such emissions. This means concentrations of greenhouse gases in the environment will continue to rise, just more slowly than they otherwise would. The *benefit* of reducing emissions, in other words, is not “stopping global warming,” but only to delay the onset of global warming by a few years.

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<sup>38</sup> See Michael A. Toman, ed., *Climate Change Economics and Policy: An RFF Anthology* (Washington, DC: Resources for the Future, 2001); Charls E. Walker, Mark A. Bloomfield, and Margo Thorning, eds., *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality* (Washington, DC: American Council for Capital Formation, Center for Policy Research, May 1999); Jonathan H. Adler, ed., *The Costs of Kyoto: Climate Change Policy and Its Implications* (Washington, DC: Competitive Enterprise Institute, 1997); William Cline, *The Economics of Global Warming* (Washington, DC: Institute of International Economics, 1992); and Robert Mendelsohn and James E. Neumann, *The Impact of Climate Change on the United States Economy* (Cambridge, MA: Cambridge University Press, 1999).

<sup>39</sup> Two important references are Terry L. Anderson and Donald R. Leal, *Free Market Environmentalism* (New York, NY: Palgrave, 2001); and T.H. Tietenberg, *Emissions Trading: An Exercise in Reforming Pollution Policy* (Washington, DC: Resources for the Future, 1985).

Our analysis begins by reporting a range of credible cost estimates for the Kyoto Protocol, an international treaty negotiated by the Clinton-Gore administration but not submitted to the U.S. Senate and subsequently rejected by President George W. Bush.<sup>40</sup> Kyoto would have required the U.S. to reduce its emissions to 7 percent below 1990 levels by 2008-2012. Estimates of the cost per metric ton of carbon equivalent (mtce) are presented and an average expected cost for a national program (\$226) is established. The indirect costs of a national program on consumers, the economy, and state governments due to higher energy costs, as calculated by WEFA Inc., an economic consulting firm,<sup>41</sup> are then reported.

We determine state efforts are likely to cost 10 times as much per metric ton of carbon equivalent reduced as a national program.

Next, three reasons are given why state efforts are likely to cost 10 times as much per mtce reduced as a national program. Baseline emissions for 37 states are calculated and the number of mtce each would need to eliminate in order to return to 1990 emission levels and to 7 percent below 1990 levels. The number of mtce to be cut is multiplied by the cost per

mtce to calculate the likely cost to each state's consumers and businesses. These figures are then converted into dollars per household.

The benefits of reducing greenhouse gas emissions are then discussed. We find the best available research suggests U.S. workers and consumers would actually *benefit* from modest warming. Consequently, actions that might defer warming, such as reducing emissions, are "all pain and no gain" for U.S. workers and consumers. Averting global warming might, however, produce a small benefit for the rest of world. This benefit is too small to justify costly action today.

It is often argued by advocates of greenhouse gas programs that significant reductions in energy consumption would result simply by exploiting cost-effective opportunities that consumers and businesses currently overlook. We explain why this belief is erroneous and identify four reasons why reducing emissions tends to be expensive. (These are in addition to the three reasons why state efforts are likely to be especially expensive.) Finally, we explain why emission permit trading is unlikely to lower those costs.

## Cost of a National Program

Credible studies of the cost of implementing the Kyoto Protocol have been produced by a dozen respected scholars and economic consulting firms, including Charles River Associates, Data

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<sup>40</sup> The Kyoto Protocol is an amendment to the 1992 United Nations Framework Convention on Climate Change (UNFCCC), more popularly known as the Rio Treaty. Whereas the Rio Treaty set voluntary goals for reducing greenhouse gases, the Protocol requires participating developed countries to reduce their emissions by specific amounts by 2008-2012. The U.S. withdrew from the Kyoto Protocol in 2002 but remains a party to the 1992 Rio Treaty.

<sup>41</sup> In 2000, WEFA Inc. merged with Resource Data International to form Global Insight Inc.

Resources International (DRI), and WEFA Inc., and by a semi-independent government agency within the U.S. Department of Energy, the Energy Information Administration. While these studies project the costs of a hypothetical *national* program, they provide a useful starting point for establishing the cost of state efforts and the effect of restrictions on the geographic scope of a greenhouse gas program. A key part of these studies is their estimates of the cost per mtce of avoided emissions. Those estimates are shown in Table 3 on the following page.

Estimates of the cost (in 2001 dollars) per mtce avoided range from as little as \$21 (William Nordhaus and Joseph Boyer's estimate assuming global trading of emission permits) to \$376 (the Energy Information Administration's (EIA) estimate with trading only within the U.S.). The average estimated cost per mtce of a national greenhouse gas reduction program is \$41 with global trading allowed, \$95 when trading is limited to Annex 1 (developed) countries, and \$226 when trading is allowed only within the U.S.

The cost of reducing emissions is incurred primarily by the energy sector of the economy and is passed through to consumers and businesses in the form of higher energy prices. Because energy costs have a major impact on economic growth (a point discussed at greater length below), many of the studies mentioned above also estimate the impact a national greenhouse gas reduction program would have on the U.S. economy.

The average estimated cost per mtce of a national greenhouse gas reduction program is \$41 when global trading is allowed, \$94 when trading is limited to Annex 1 (developed) countries, and \$226 when trading is allowed only within the U.S.

The EIA's study of economic impacts is particularly notable since it was produced by a government agency in 1998, when the Clinton-Gore administration was attempting to persuade the public that the cost of the Kyoto Protocol was not prohibitive. The EIA nevertheless found reducing U.S. carbon dioxide emissions to 7 percent below 1990 levels by 2010 would reduce national GDP in 2010 by a staggering \$397 billion, or 4.2 percent of the baseline reference. The price of electricity would increase 86.4 percent and gasoline prices would increase 52.8 percent.

The WEFA study produced similar results, and because it breaks out costs on a state-by-state basis it may be of particular interest to state elected officials. According to WEFA, reducing emissions to 7 percent below 1990 levels by 2010 would have the following consequences:

- # Consumers would see price increases in excess of 55 percent for electricity and 70 percent for home heating oil.
- # Commercial establishments would see electricity price increases of 60 percent.
- # Gross Domestic Product (GDP) would fall by \$300 billion annually (\$375 billion in 2001 dollars), 3.2 percent of baseline GDP projections.

**Table 3**  
**Cost per Ton of Carbon Equivalent Avoided in the Year 2010**

	Global Trading		Annex 1 Trading Only		National Trading Only	
	as reported (year \$)	in 2001 \$	as reported (year \$)	in 2001 \$	as reported (year \$)	in 2001 \$
Energy Information Administration, 1998 <sup>a</sup>	---	---	---	---	\$348 (1996)	\$376
Manne & Richels, 1999 <sup>b</sup>	\$70 (1990)	\$88	\$100 (1990)	\$125	\$240 (1990)	\$300
WEFA Inc., 1998 <sup>c</sup>	---	---	---	---	\$265 (1996)	\$286
Charles River Associates, 1999 <sup>d</sup>	---	---	\$100 (1996)	\$108	\$250 (1996)	\$270
Jacoby & Wing, 1999 <sup>e</sup>	---	---	\$76 (1990)	\$95	\$193 (1990)	\$241
Council of Economic Advisors, 1998 <sup>f</sup>	\$23 (1996)	\$25	\$61 (1996)	\$66	\$193 (1996)	\$208
MacCracken, Edmonds, Kim, and Sands, 1999 <sup>g</sup>	\$26 (1992)	\$31	\$73 (1992)	\$86	\$168 (1992)	\$198
Resource Data International Inc., 1999 <sup>h</sup>	\$40 (1997)	\$42	\$110 (1997)	\$117	\$180 (1997)	\$191
CONSAD Research Corp., 1998, high estimate <sup>i</sup>	---	---	---	---	\$165 (1995)	\$182
Nordhaus & Boyer, 1999 <sup>j</sup>	\$17 (1990)	\$21	\$57 (1990)	\$71	\$127 (1990)	\$159
CONSAD Research Corp., 1998, low estimate <sup>k</sup>	---	---	---	---	\$140 (1995)	\$154
Energy Information Administration 2000 <sup>l</sup>	---	---	---	---	\$139 (1999)	\$144
<b>Average</b>	---	<b>\$41</b>	---	<b>\$95</b>	---	<b>\$226</b>

2001 dollars adjusted using the Gross Domestic Product Deflator Inflation Calculator at <http://www.jsc.nasa.gov/bu2/inflateGDP.html>

a Energy Information Administration, *Impact of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*, 1998.

b Alan S. Manne and Richard G. Richels, "The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives?" in *The Energy Journal*, Vol. 20 (1999), pages 1-23.

c Mary Novak et al., *Global Warming: The High Cost of the Kyoto Protocol, National and State Impacts*, 1998.

d W. David Montgomery, "Commentary," in Charls E. Walker et al., *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality* (Washington, DC: American Council for Capital Formation, 1999), pages 141-147.

e Henry D. Jacoby and Ian Sue Wing, "Adjustment Time, Capital Malleability and Policy Cost," *The Energy Journal*, Vol. 20 (1999), pages 73-92.

f Testimony of Dr. Janet Yellen before the Senate Foreign Relations Committee, March 4, 1998, and analysis by Charles River Associates, as reported in Table 1 of W. David Montgomery, *supra* note d.

g Christopher N. MacCracken, James A. Edmonds, Son H. Kim, and Ronald D. Sands, "The Economics of the Kyoto Protocol," *The Energy Journal*, Vol. 20 (1999), pages 25-71.

h Joyce Yanchar Brinner, "Commentary: The Impact of Meeting the Kyoto Protocol on Energy Markets and the Economy," in Charls E. Walker et al., *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality* (Washington, DC: American Council for Capital Formation, 1999), pages 63-72. DRI's numbers are for three scenarios that are not identical to the labels in this table. International trading accounts for 23 percent of U.S. emission reductions in DRI's Case 1, 42 percent in Case 2, and 71 percent in Case 3. The three cases roughly correspond to domestic trading only, Annex 1 trading, and global trading.

i CONSAD Research Corporation, *The Kyoto Protocol: A Flawed Treaty Puts America at Risk*, May 1998.

j William D. Nordhaus and Joseph G. Boyer, "Requiem for Kyoto: An Economic Analysis of the Kyoto Protocol," *The Energy Journal*, Vol. 20 (1999), pages 93-130.

k *Supra* note i.

l Energy Information Administration, *Analysis of Strategies for Reducing Multiple Emissions from Power Plants: Sulfur Dioxide, Nitrogen Oxides, and Carbon Dioxide*, December 2000, Table ES4. The study looked only at the impact of a 1990-7% cap on emissions from electric utilities, not on other emitters.

- # The number of jobs in the U.S. would be 2,400,000 below the baseline projection.
- # Average annual household income would be nearly \$2,700 (\$3,372 in 2001 dollars) less than the baseline.
- # Real wages in the manufacturing sector would be 2.1 percent below the baseline.

WEFA breaks out by state the expected job losses and increased jobless rates. (See Table 4.) According to WEFA, Hawaii would lose 9,700 jobs and unemployment would reach 8.2 percent; Illinois would lose 190,000 jobs and see an unemployment rate of 6.1 percent; New York would lose 140,000 jobs and unemployment would be 7.8 percent; and Washington would lose 47,000 jobs and its unemployment rate would rise to 6.8 percent. These numbers are particularly important because recent legislative activity suggests Hawaii, Illinois, New York, and Washington are the states most likely to approve legislation explicitly capping greenhouse gas emissions in 2003.

According to WEFA, implementing the Kyoto Protocol would cost state governments \$93.1 billion a year in 1992 dollars (\$116 billion in 2001 dollars) in lost revenues.

WEFA calculated the unemployment numbers at the height of the recent economic boom, before the current economic slowdown induced an unrelated increase in unemployment. In 1997, when the WEFA study was conducted, the national unemployment rate stood at 5.0 percent.<sup>42</sup> Today, the national unemployment rate is 6.0 percent. Factoring in the baseline unemployment rate of the current economy, unemployment rates would likely be at least 1.0 percent higher.

WEFA also calculated the impact of these job losses and slower economic growth on state government treasuries. (See Table 5.) The results are eye-opening: According to WEFA, implementing the Kyoto Protocol would cost state governments \$93.1 billion a year in 1992 dollars (\$116 billion in 2001 dollars) in lost revenues. California's state government alone would lose \$14.4 billion a year. Other big losers are New York (\$8.9 billion), Texas (\$7.5 billion), Florida (\$7.2 billion), and Illinois (\$6.5 billion).

### **State Efforts Would Be Even Costlier**

The estimates of the cost per mtce in Table 3 assumed Kyoto-style emission caps would apply to all states and a national emission permit trading system or national carbon tax would be used to reduce emissions at the lowest possible cost. Efforts by states to "go it alone" would be much more expensive for three reasons: States would not be able to take advantage of lower marginal cost opportunities outside their borders; states would rely on command-and-control style regulations rather than market-driven approaches; and other states and countries would increase their emissions, partially offsetting whatever reductions a state achieves.

<sup>42</sup> U.S. Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/cps/home.htm>.

**Table 4  
Economic Impact of Kyoto Protocol by Year 2010  
(by State)**

State	Jobs Lost	Unemployment Rate	State	Jobs Lost	Unemployment Rate
Alabama	67,500	6.3 percent	Nebraska	19,000	4.8 percent
Arizona	102,300	5.7 percent	Nevada	27,300	6.5 percent
Arkansas	4,300	8.5 percent	New Hampshire	12,400	6.1 percent
California	278,000	7.7 percent	New Jersey	120,500	7.8 percent
Colorado	47,400	5.3 percent	New Mexico	13,500	8.7 percent
Connecticut	28,100	7.0 percent	New York	140,000	7.8 percent
Delaware	4,500	5.6 percent	North Carolina	107,200	6.1 percent
Florida	142,000	6.6 percent	North Dakota	3,600	3.7 percent
Georgia	80,300	5.5 percent	Ohio	119,800	5.7 percent
Hawaii	9,700	8.2 percent	Oklahoma	26,600	5.4 percent
Idaho	11,600	5.3 percent	Oregon	22,900	6.6 percent
Illinois	190,700	6.1 percent	Pennsylvania	108,000	6.4 percent
Indiana	99,700	6.1 percent	Rhode Island	3,400	5.3 percent
Iowa	21,600	6.3 percent	South Carolina	32,500	7.0 percent
Kansas	18,400	5.4 percent	South Dakota	7,200	4.8 percent
Kentucky	56,500	7.1 percent	Tennessee	39,500	6.6 percent
Louisiana	64,500	8.8 percent	Texas	124,600	6.3 percent
Maine	7,000	6.4 percent	Utah	12,700	3.9 percent
Maryland	33,000	5.9 percent	Vermont	2,300	4.8 percent
Massachusetts	45,600	5.5 percent	Virginia	34,600	5.1 percent
Michigan	96,500	5.5 percent	Washington	47,400	6.8 percent
Minnesota	46,900	4.9 percent	West Virginia	19,400	7.1 percent
Mississippi	28,600	7.9 percent	Wisconsin	69,800	4.7 percent
Missouri	48,700	5.5 percent	Wyoming	7,600	8.3 percent
Montana	41,500	9.9 percent	<b>Total</b>	<b>2,717,300</b>	

Source: Mary Novak et al., *Global Warming: The High Costs of the Kyoto Protocol*, WEFA Inc., 1998, <http://www.api.org/globalclimate/wefanatimpacts.htm>.

**Table 5  
State Tax Revenues Lost Due To Kyoto Protocol  
(by State)**

<b>State</b>	<b>Revenue Loss in 2010 (1992 \$)</b>	<b>Revenue Loss in 2010 (2001 \$)</b>	<b>State</b>	<b>Revenue Loss in 2010 (1992 \$)</b>	<b>Revenue Loss in 2010 (2001 \$)</b>
Alabama	\$929 million	\$1.16 billion	Nebraska	\$502 million	\$627 million
Arizona	\$1.7 billion	\$2.1 billion	Nevada	\$1.0 billion	\$1.2 billion
Arkansas	\$513 million	\$641.1 million	New Hampshire	\$447 million	\$558 million
California	\$11.5 billion	\$14.4 billion	New Jersey	\$3.6 billion	\$4.5 billion
Colorado	\$2.0 billion	\$2.5 billion	New Mexico	\$377 million	\$471 million
Connecticut	\$1.8 billion	\$2.2 billion	New York	\$7.1 billion	\$8.9 billion
Delaware	\$264 million	\$330 million	North Carolina	\$2.5 billion	\$3.1 billion
Florida	\$5.8 billion	\$7.2 billion	North Dakota	\$173 million	\$216 million
Georgia	\$2.7 billion	\$3.4 billion	Ohio	\$3.5 billion	\$4.4 billion
Hawaii	\$329 million	\$411 million	Oklahoma	\$753 million	\$940 million
Idaho	\$393 million	\$491 million	Oregon	\$1.2 billion	\$1.5 billion
Illinois	\$5.2 billion	\$6.5 billion	Pennsylvania	\$3.8 billion	\$4.7 billion
Indiana	\$1.8 billion	\$2.2 billion	Rhode Island	\$260 million	\$325 million
Iowa	\$785 million	\$980 million	South Carolina	\$815 million	\$1.0 billion
Kansas	\$780 million	\$974 million	South Dakota	\$191 million	\$238 million
Kentucky	\$997 million	\$1.2 billion	Tennessee	\$1.5 billion	\$1.9 billion
Louisiana	\$945 million	\$1.2 billion	Texas	\$6.0 billion	\$7.5 billion
Maine	\$322 million	\$402 million	Utah	\$713 million	\$890 million
Maryland	\$2.0 billion	\$2.5 billion	Vermont	\$167 million	\$209 million
Massachusetts	\$2.9 billion	\$3.6 billion	Virginia	\$2.3 billion	\$2.9 billion
Michigan	\$3.4 billion	\$4.2 billion	Washington	\$2.4 billion	\$3.0 billion
Minnesota	\$1.8 billion	\$2.2 billion	West Virginia	\$319 million	\$398 million
Mississippi	\$423 million	\$528 million	Wisconsin	\$1.8 billion	\$2.2 billion
Missouri	\$1.6 billion	\$2.0 billion	Wyoming	\$116 million	\$145 million
Montana	\$288 million	\$360 million			

Source: Mary Novak et al., *Global Warming: The High Costs of the Kyoto Protocol*, WEFA Inc., 1998, <http://www.api.org/globalclimate/wefanatimpacts.htm>. 2001 costs based on authors' calculations.

## Finding the lowest marginal cost opportunities

The most efficient way to reduce carbon emissions is to concentrate investments in areas where emission reductions cost the least. This means an efficient greenhouse gas reduction program would be one where emitters with the lowest marginal cost<sup>43</sup> of reducing emissions would make most or all of the necessary reductions. “Numerous studies have shown that global mitigation costs can be reduced substantially by allowing emission reductions to take place wherever it is cheapest to do so – regardless of geographical location.”<sup>44</sup>

Programs that restrict the geographic area under the control of a comprehensive greenhouse gas reduction program will have fewer opportunities to exploit the lowest-cost options, and consequently a higher cost per ton of carbon avoided.

An international program that included developing as well as developed countries and that relied on a carbon tax or a system of tradable emission permits would presumably direct investments to lowest marginal cost opportunities. That is why estimates of the cost per mtce avoided in Table 3 are lowest for the “global trading” scenario. Opportunities to inexpensively reduce emissions abound in developing countries, where coal and other fossil fuels are often

used inefficiently and without emission control devices. Opportunities to sequester carbon by planting trees or stopping deforestation are also available for a small fraction of the cost of reducing emissions in the U.S.<sup>45</sup>

Programs that restrict the geographic area under the control of a comprehensive greenhouse gas reduction program will have fewer opportunities to exploit the lowest-cost options, and consequently have a higher cost per mtce avoided. William Nordaus and Joseph Boyer estimate achieving Kyoto’s goal of reducing emissions to 7 percent below 1990 levels would have been eight times as expensive if developing countries were left out, and 14 times more costly if trading among developed countries were not allowed, than it would have been under a program in which global trading were permitted.<sup>46</sup>

The marginal cost of reducing emissions varies widely across industries as well as geographically. According to W. David Montgomery, “Utilities could achieve [a 1990] cap at under \$100 per ton of emission reduction, while to reduce emissions from residential energy use, personal vehicles, and from the energy intensive sector would cost \$700 per ton by 2030. These

<sup>43</sup> “Marginal cost” is the cost of the last item produced, and is typically contrasted with the average cost of production. Economic decisions are made on the basis of marginal costs and benefits.

<sup>44</sup> Alan S. Manne and Richard G. Richels, “The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives?” *The Energy Journal*, Vol. 20, 1999, page 6.

<sup>45</sup> Henry Linden, “Science Does Not Support ‘Consensus’ on Climate Change,” *The Electricity Journal*, February 1994, pages 68ff.

<sup>46</sup> William D. Nordhaus and Joseph G. Boyer, “Requiem for Kyoto: An Economic Analysis of the Kyoto Protocol,” *The Energy Journal*, Vol. 20, 1999, page 125.

disparities in marginal cost provide a measure of how large the economic costs of regulatory programs that implicitly ban trades across sectors might be.<sup>47</sup>

Imposing heavy costs on some industries and a much lighter (or no) burden on others introduces distortions in investment and pricing that result in inefficiency, lost economic activity, and lower employment.

Moreover, targeting industries with relatively low emission reduction costs may not generate enough reductions in emissions to achieve the goals of the program. As Christopher MacCracken and colleagues observe:

The marginal cost of reducing emissions varies widely across industries as well as geographically.

At a marginal cost of approximately \$100 per tonne carbon equivalent, utilities [could] provide approximately 45 percent of the mitigation in the year 2010 by substituting gas plants for coal plants. But the marginal cost must reach \$255 per tonne carbon equivalent before the mitigation reaches 70 percent of the 2010 requirement. If the non-utility sectors have difficulty in reducing emissions, either because technical options are unavailable or because emissions mitigation requirements were not anticipated in investment planning during the decade prior to the first compliance year, 2008, then the marginal cost could exceed \$250 per tonne of carbon equivalent emission.<sup>48</sup>

Differences in the marginal cost of reducing carbon emissions have dramatic consequences for state efforts to control greenhouse gas emissions. A state program that mandates reductions by emitters inside the state's borders would miss lower-cost opportunities outside the state, so its cost per mtce avoided, all else equal, would be much higher than that of a national program. In terms of the cost per mtce estimates in Table 3, it is evident that a typical state program cannot be more efficient than a national program with no trading, the most expensive of the three sets of estimates.

Experience shows states are likely to rely on regulatory approaches that are industry-specific – such as capping emissions from electric utilities or mandating that they generate a certain percentage of their output from alternative fuels – resulting in high-marginal cost reduction efforts in some industries while low-cost opportunities remain unexploited in other industries. Legally, politically, and economically, state governments have fewer tools at their disposal with which to implement a greenhouse gas reduction program than has the federal government. This probably makes it inevitable that state programs will target individual industries, resulting in investment distortions and economic losses well in excess of a national program.

It is likely that, in the absence of a national or international greenhouse gas program, many states would be unable to meet the Kyoto goal of reducing emissions to 7 percent below 1990

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<sup>47</sup> W. David Montgomery et al., *Impacts on the United States of Carbon Abatement Policies*, Charles River Associates, 1997, page 60.

<sup>48</sup> Christopher N. MacCracken, James A. Edmonds, Son H. Kim, and Ronald D. Sands, "The Economics of the Kyoto Protocol," *The Energy Journal*, Vol. 20, 1999, page 45.

levels by 2010. Emissions from housing, office buildings, and transportation can be reduced only slowly and usually at high cost. Capping or mandating reductions in utility emissions will only get the typical state part-way to its goal, and this will vary widely from state to state. Meeting the Kyoto goal could require some states to deliberately deindustrialize their economies, forcing energy-intensive industries to leave the state, perhaps through land use regulations or punitive taxation, though even this route may face constitutional hurdles.

It is likely that, in the absence of a national or international greenhouse gas program, many states would be unable to meet the Kyoto goal of reducing emissions to 7 percent below 1990 levels by 2010.

The inability of state greenhouse gas programs to target the lowest marginal cost opportunities for emission reductions means any progress toward the Kyoto goal will cost more per mtce avoided than a national program. But how much more? According to John P. Weyant, director of the Energy Modeling Forum at Stanford University,

Rough estimates suggest a two- to fourfold increase in the cost of an emissions-reduction program if it is implemented too rapidly, is not implemented globally, and leads to higher cost emissions-reduction measures being implemented before lower cost options. Higher cost emissions reductions can easily be implemented before lower cost ones if a system of mandatory technology choices (for example, efficiency standards or a specific control technology) is implemented. Such “command and control” regimes have frequently been implemented in response to other environmental concerns.<sup>49</sup>

Table 3 showed the average of the estimated cost per mtce avoided more than doubled when trading opportunities were reduced from Global Trading to Annex 1 Only Trading (\$95:\$41 = 2.3). The cost per mtce doubled again when Annex 1 Only Trading was reduced to National Trading Only (\$226:\$95 = 2.4). We think it is reasonable to assume the cost per mtce would double yet again when trading opportunities are reduced from nationwide to within the borders of a single state. Of course, this is a simplifying assumption that won't apply to every state or every greenhouse gas program. Some states (such as California) have larger and more diversified economies than the typical state, creating more opportunities to trade. Other states (such as those in the Northeast and Great Plains) have fewer opportunities for trades, making our assumption conservative when applied to them.

### **Cost of regulatory compliance**

States trying to reduce carbon emissions on their own are forced to use regulations, such as renewable mandates and emission caps, rather market-based mechanisms, such as a carbon tax

<sup>49</sup> John P. Weyant, “The Costs of Carbon Emissions Reductions,” in William D. Nordhaus, ed., *Economics and Policy Issues in Climate Change* (Washington, DC: Resources for the Future, 1998), page 193.

or emission permit trading. State energy taxes high enough to generate significant emission reductions (e.g., \$0.65/gallon on gasoline) are politically unpopular and known to be economically destructive. Only a national emission trading program would attract the capital and expertise needed to create a genuine emission trading program and enough participants to create significant efficiency gains.

Relying on regulations would be much more expensive than the market-based approaches assumed by WEFA and other analysts. T.H. Tietenberg, a leading environmental economist and professor of economics at Colby College, surveyed 11 empirical studies comparing the cost of complying with command-and-control regulations to the least-costly methods of achieving the same level of pollution reduction.<sup>50</sup> In all 11 cases, complying with regulations cost more than the least-cost methods, with a mean average ratio of six and a median ratio of four. In other words, command-and-control regulations typically cost between four and six times as much as the least-costly means of reducing emissions by the same amount.

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Regulation is expensive because regulators don't have knowledge of local conditions and opportunities, and consequently can't control all the decisions that lead to efficiency or waste. This is particularly problematic in the case of managing greenhouse gases, since "carbon emissions are a pervasive result of the use of fossil fuels, and every decision that bears on the use of fossil fuels will affect these emissions. Regulatory programs can only be brought to bear on a finite subset of these decisions, where specification of requirement, monitoring, and enforcement are possible."<sup>51</sup>

Taking a regulatory approach to greenhouse gas reductions often has a second deficiency called "new source bias." By imposing costly technology mandates on new plants, machines, buildings, etc., they raise the cost of new investments and consequently discourage replacement of existing capital. This slows down the natural turnover of capital, which is responsible for significant advances in energy efficiency. Money that would have gone to new, cleaner goods and services is diverted instead to keeping older, dirtier machines and facilities in use, offsetting some or all of the intended gains.

### **"Leakage" to other countries or states**

Another reason state efforts are more expensive than a national program is because efforts to reduce greenhouse gas emissions in one country or one state can be partially or entirely offset by increases in the emissions of other countries or states, a process called "leakage." This occurs for

<sup>50</sup> T.H. Tietenberg, *supra* note 39.

<sup>51</sup> W. David Montgomery, *Towards an Economically Rational Response to the Berlin Mandate* (Washington, DC: Charles River Associates, July 1995), page 37.

two reasons. First, programs that reduce emissions in some countries or states reduce demand for fossil fuels, allowing businesses in other countries or states to purchase them at lower prices. Second, businesses located in countries or states with lower energy prices and fewer regulations have cost advantages over those in countries and states with high energy prices and burdensome regulations. Consequently, economic activity migrates from countries and states that impose emission controls to those that do not.

Businesses located in countries or states with lower energy prices and fewer regulations have cost advantages over those in countries and states with high energy prices and burdensome regulations. Consequently, economic activity migrates from countries and states that impose emission controls to those that do not.

Every study of the Kyoto Protocol forecasts significant leakage. “The imposition of increased energy costs will devastate the U.S. steel industry without a significant decrease in worldwide energy-related emissions from steel making,” concluded a study by the Argonne National Laboratory. “Production will simply be shifted to developing countries and may lead to higher levels of overall pollution due to lower standards in those countries.”<sup>52</sup> According to the WEFA study, 41 percent of the loss in U.S. GDP due to the Kyoto Protocol would

have come from lost exports and increased imports from developing countries.<sup>53</sup>

The rapid shift of manufacturing from developed countries such as the U.S. to developing countries such as China is greatly increasing the leakage problem. In 2007, Greater China (encompassing China, Hong Kong, and Taiwan) is expected to have a gross domestic product of \$12.4 trillion, triple the size of Japan, more than all the countries of the European Union combined, and second only to the U.S. economy at \$13.7 trillion.<sup>54</sup> China’s exports will account for 13.7 percent of total global exports.<sup>55</sup>

Driven by this global economic transformation, developing countries are expected to dramatically increase their use of fossil fuels and consequently their share of global greenhouse gas emissions. According to the Energy Information Administration, “In 1999, developing nations consumed 58 percent of the amount of oil consumed in the industrialized world, but by 2020 they are expected to consume almost 90 percent as much oil as the industrialized world.”<sup>56</sup> The U.S. today is responsible for approximately 25 percent of global carbon dioxide emissions, but this amount will fall to just 10 percent in 2020 due to increasing manufacturing activity in developing countries.

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<sup>52</sup> U.S. Department of Energy, Argonne National Laboratory, *The Impact of Potential Climate Change Commitments on Energy Intensive Industries: A Delphi Analysis*, June 1997.

<sup>53</sup> Mary Novak et al., *Global Warming: The High Costs of the Kyoto Protocol*, WEFA Inc., 1998, page 30.

<sup>54</sup> Dexter Roberts et al., “Greater China,” *Business Week*, December 9, 2002, page 52.

<sup>55</sup> *Ibid.*

<sup>56</sup> Energy Information Administration, *International Energy Outlook 2002*.

States that have adopted Kyoto-type emission reductions may already be experiencing economic losses attributable to leakage. October 2002 data showed New England's economy was badly trailing the rest of the nation in emerging from the recent slowdown. "The figures show how the length and depth of the current slowdown has befuddled economists," reports the *Cape Cod Times*. "The region's economic performance will lag behind the national average ... as far as the eye can see." Particularly disappointing is "the abysmal performance of Massachusetts ... By some measure, job losses in the state could soon hit 132,000 or 4 percent of the state's work force."<sup>57</sup> Given the data collected by WEFA, the current economic performance of New England, and Massachusetts in particular, may have been foreseeable.

Individual states are more likely to see their efforts undermined by leakage than are nations since Article I, Section 10 the U.S. Constitution prohibits states from imposing tariffs or other restrictions on interstate commerce. Industry, commerce, and residents can move with relative ease to states or (less easily) countries where energy costs are lower or costly regulations are not enforced. Consequently, each ton of carbon a state avoids emitting will prompt new emissions in a different state or country that offset some or all of the initial reduction.

States that have adopted Kyoto-type emission reductions may already be experiencing economic losses attributable to leakage.

Different types of greenhouse gas programs experience different amounts of leakage. Policies that raise costs for energy-intensive industries are likely to have high levels of leakage by driving customers and investors to other states or countries with lower energy costs. Policies focusing on utilities and with long time frames – giving utilities time to replace older generating capacity with newer, lower-emitting capacity – would have less leakage. Imposing higher fuel economy standards on cars and trucks, as California is attempting, could have a leakage rate of 100 percent, meaning its true cost per ton is *infinite*. We explain why later in this section.

Estimates of leakage for national greenhouse reduction programs range from 12 percent<sup>58</sup> to 70 percent.<sup>59</sup> In other words, reducing carbon emissions by 10 metric tons would cause emissions by other countries or states to *increase* between 1.2 and 7 tons. A *net* reduction of 10 tons would therefore require a reduction by the first country or state of between 11.4 and 33.3 tons, or 11 percent to 233 percent more than if there were no leakage.<sup>60</sup> We believe it is conservative to estimate that a typical state greenhouse gas program would experience a 50 percent leakage rate. In other words, two tons would have to be reduced for every one *net* ton of reduction achieved.

<sup>57</sup> Justin Pope, "Recovery in N.E. may trail country," *Cape Cod Times*, October 30, 2002.

<sup>58</sup> Stephen P.A. Brown, "Global Warming Policy: Some Economic Implications," *Policy Report #224*, National Center for Policy Analysis, May 1999, page 1.

<sup>59</sup> J. Pezzey, "Analysis of Unilateral CO2 Control in the European Community and OECD," *The Energy Journal*, Vol. 13 (1992), pages 159-171.

<sup>60</sup> The formula is  $a(1-b) = c$  where  $a$  is the number of tons initially reduced,  $b$  is the leakage rate, and  $c$  is the net number of tons reduced.

## Estimates of possible state costs

Table 6 shows total net greenhouse gas emissions in 1990 (in million metric tons of carbon equivalent, or mmtce) for 37 states for which reliable emissions data are available, and the number of tons to be cut to return to 1990 levels and to 7 percent below 1990 levels. The number of tons to be cut in order to reach 7 percent below 1990 levels ranges from 36.46 mmtce for California to .66 mmtce for Vermont.

<b>State (a)</b>	<b>1990 GHG emissions (mmtce) (b)</b>	<b>1990 - 7% (mmtce)</b>	<b>Baseline for 2010 (mmtce) (c)</b>	<b>Reduction required to return to 1990 level (mmtce)</b>	<b>Reduction required to reach 1990 - 7% (mmtce)</b>
Alabama	32.2	29.95	40.08	7.88	10.13
California	115.9	107.79	144.25	28.35	36.46
Colorado	3.5	3.26	4.36	0.86	1.10
Connecticut	11.4	10.60	14.19	2.79	3.59
Delaware	4.3	4.00	5.35	1.05	1.35
Florida	53.4	49.66	66.46	13.06	16.80
Georgia	40.3	37.48	50.16	9.86	12.68
Hawaii	4.0	3.72	4.98	0.98	1.26
Illinois	66.1	61.47	82.27	16.17	20.79
Indiana	61.3	57.01	76.29	14.99	19.28
Iowa	17.0	15.81	21.16	4.16	5.35
Kansas	20.8	19.34	25.89	5.09	6.54
Kentucky	35.4	32.92	44.06	8.66	11.14
Louisiana	62.2	57.85	77.41	15.21	19.57
Maine	4.6	4.28	5.73	1.13	1.45
Maryland	18.9	17.58	23.52	4.62	5.95
Massachusetts	21.7	20.18	27.01	5.31	6.83
Minnesota	22.5	20.93	28.00	5.50	7.08
Mississippi	25.1	23.34	31.24	6.14	7.90
Missouri	29.3	27.25	36.47	7.17	9.22
Montana	4.1	3.81	5.10	1.00	1.29
Nevada	8.9	8.28	11.08	2.18	2.80
New Hampshire	3.1	2.88	3.86	0.76	0.98
New Jersey	35.3	32.83	43.93	8.63	11.10

**Table 6  
Reductions Needed to Reach Kyoto Goals**

State (a)	1990 GHG emissions (mmtce) (b)	1990 - 7% (mmtce)	Baseline for 2010 (mmtce) (c)	Reduction required to return to 1990 level (mmtce)	Reduction required to reach 1990 - 7% (mmtce)
New Mexico	16.2	15.07	20.16	3.96	5.10
New York	75.7	70.40	94.21	18.51	23.81
North Carolina	31.9	29.67	39.70	7.80	10.04
Ohio	88.9	82.68	110.64	21.74	27.97
Oregon	19.9	18.51	24.77	4.87	6.26
Pennsylvania	76.0	70.68	94.59	18.59	23.91
Rhode Island	2.6	2.42	3.24	0.64	0.82
Tennessee	29.1	27.06	36.22	7.12	9.15
Utah	16.9	15.72	21.03	4.13	5.32
Vermont	2.1	1.95	2.61	0.51	0.66
Virginia	29.2	27.16	36.34	7.14	9.19
Washington	17.0	15.81	21.16	4.16	5.35
Wisconsin	27.1	25.20	33.73	6.63	8.53

(a) 1990 emission estimates are available for only the 37 states listed here.

(b) U.S. EPA, "State Greenhouse Gas Inventories,"

<http://yosemite.epa.gov/OAR/globalwarming.nsf/content/EmissionsStateGHGInventories.html>.

(c) The equation is 1990 emissions in column b multiplied by  $(1+r)^y$  where  $r = .011$  and  $y = 20$ . EIA estimates greenhouse gas growth rate at 1.1 percent per year.

The data from Table 6 and the preceding analysis make possible the calculation of four estimates of the likely costs to be incurred by states attempting to reduce their greenhouse emissions to 1990 levels or to 7 percent below 1990 levels. For clarity, we present in Table 7 figures only for the 7 percent below 1990 levels scenario; this is the minimum reduction environmentalists say is necessary to begin to stop global warming. Data regarding the cost of returning only to 1990 emission levels appear in Appendix 3 at the end of this report.

We stress that the numbers that follow are illustrative of the costs likely to be incurred, and are not to be interpreted as detailed forecasts or predictions. They are estimates of the cost of one of many possible scenarios for each state, based on the experiences of other states, cost estimates for implementing a national program (the Kyoto Protocol), and WEFA's econometric analysis of the impact of Kyoto on state budgets. As mentioned earlier, the cost per mtce avoided varies by geography and industry, so states would face costs greater than or less than those reported below. A more sophisticated analysis than what we perform here is necessary to take these other factors into account.

Since the "leakage rate" for state programs varies dramatically, the types of policies a state adopts will have a major influence on actual costs. Finally, it is assumed that not all 50 states

will attempt to regulate their greenhouse gas emissions; if they did, there would be less leakage and greater opportunities to exploit low marginal cost opportunities to make reductions. Consequently, the possible costs to individual states cannot be combined to produce a sensible estimate of the national cost.

Table 7 presents estimates of the following costs:

- 1. Direct cost to state governments:** In Part 1 it was reported that New Jersey is spending \$55 per ton to reach its greenhouse gas reduction goal of 3.5 percent below 1990 levels. Since the goal is modest and the state has been able to increase reliance on nuclear power to meet this goal, \$55/ton is likely to be the *minimum direct cost to a state government* of operating a comprehensive greenhouse gas reduction program.<sup>61</sup> Multiplying the number of tons to be cut by \$55 produces the results shown in Column B of Table 7 below. The annual cost ranges from \$36.3 million for Vermont to \$2.0 billion for California.
- 2. Direct and indirect cost to state governments:** To the direct cost to state treasuries must be added an estimate of lost revenues due to slower economic growth. The direct and indirect cost to state governments is the direct cost shown in Column B plus WEFA's estimates of the indirect loss of revenue, reported earlier in Table 5. This is the minimum credible estimate since it assumes a state program would have an effect on the state's business climate no worse than a national program would, which isn't likely due to the much higher cost of the program and greater leakage. The results appear in Column C of Table 7. The annual loss to state treasuries ranges from Vermont's \$245 million to California's \$16.4 billion.
- 3. Cost to state consumers and businesses of a national program:** The number of tons to be cut can be multiplied by \$226, the average of the 12 estimates of a national greenhouse gas reduction program (expressed in 2001 dollars) as presented in Table 3, to produce the cost to state consumers and businesses of a hypothetical national program to reduce emissions to 7 percent below 1990 levels by 2010. This is the annual cost that would be passed through to consumers and businesses in the form of higher energy prices and lost wages. The results appear in Column D of Table 7. Once again Vermont is lowest at \$149 million, and California is highest with \$8.2 billion.
- 4. Cost to a state's consumers and businesses of a typical state program:** Finally, we incorporate into the calculation the higher cost state programs would face than a national program. Failure to exploit low marginal cost opportunities would double the cost of the programs, and relying on regulations rather than markets will increase the cost per mtce four-

The likely annual cost to consumers and businesses in Vermont would be \$1.5 billion and to consumers and businesses in California, \$82.4 billion.

<sup>61</sup> It is possible New Jersey's program is not actually reducing emissions at all. "Leakage" could mean whatever reductions are taking place in New Jersey are being offset by increasing emissions outside the state. It may also be possible that economic processes other than the state's greenhouse gas program are responsible for changing emission levels.

fold, making the cost per mtce avoided  $\$226 \times 5 = \$1,130$ . “Leakage” will offset 50 percent of any individual state’s reductions, doubling the state’s cost for every *net* ton of emissions reduced to \$2,260. All three of these estimates are at the low end of the ranges described earlier. Column E of Table 7, then, is a conservative estimate of the possible cost to each state’s consumers and businesses of a typical state greenhouse gas program. The likely annual cost to consumers and businesses in Vermont would be \$1.5 billion and to consumers and businesses in California, \$82.4 billion.

The numbers in Table 7 are enormous and probably incomprehensible to many readers. To put these costs into perspective, they can be expressed as percentages of current state government revenues and in cost per household. Those calculations also appear in Table 7.

Our estimates of the likely cost of state greenhouse gas programs vary considerably with the number of tons of carbon being reduced, population, and whether a state’s economy is dependent on energy-producing or -intensive industries. The mean average figures in the final row of Table 7, however, help draw a picture of what an average state would have to do to reduce greenhouse gas emissions to 7 percent below 1990 levels:

- ! Businesses and consumers would have to reduce their greenhouse gas emissions by 9.6 million metric tons from business-as-usual levels by 2010.
- ! The state government would have to spend approximately \$530 million a year (\$55/ton) to implement a comprehensive greenhouse gas program; this is 4.8 percent of the average state government’s total general fund revenues in 2001.

- ! State governments also would lose revenue due to slower economic growth caused by high energy costs and burdensome regulations, bringing the total annual cost to the state government to \$3.2 billion, or 28.6 percent of the average state government’s 2001 revenues.

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- ! The state’s consumers and businesses would pay \$2.2 billion a year more for goods and services due to the higher cost of energy for a national greenhouse gas program.
- ! A state greenhouse gas program would likely cost 10 times more than a national program, meaning the state’s consumers and businesses could pay a staggering \$21.8 billion every year.
- ! A national greenhouse gas program would probably cost the average household \$995 in lost income and higher prices for goods and services.
- ! A state greenhouse gas program could cost the average household \$9,955 a year.

**Table 7**  
**Possible Annual Cost of State Greenhouse Gas Programs**  
**(to reduce emissions to 1990 -7% levels)**

State	(A) Reduction required to reach 1990-7% (mmtce)	(B) Minimum direct cost to state government (\$ millions)	(C) Minimum direct and indirect cost to state government (\$ millions)	(D) Cost to consumers and businesses of nat'l program (\$ millions)	(E) Cost to state consumers and businesses of state program (\$ millions)	(F) 2001 State government revenues (\$ millions)	(G) Direct cost as percent of 2001 state revenues	(H) Direct and indirect cost as percent of 2001 state revenues	(I) # of households (millions)	(J) National program cost per household	(K) State program cost per household
Alabama	10.13	\$557	\$1,717	\$2,289	\$22,894	\$5,180	10.8%	33.2%	1.74	\$1,316	\$13,157
California	36.46	\$2,005	\$16,405	\$8,240	\$82,400	\$71,430	2.8%	23.0%	11.50	\$717	\$7,165
Colorado	1.10	\$61	\$2,561	\$249	\$2,486	\$6,720	0.9%	38.1%	1.66	\$150	\$1,498
Connecticut	3.59	\$197	\$2,397	\$811	\$8,113	\$11,990	1.6%	20.0%	1.30	\$624	\$6,241
Delaware	1.35	\$74	\$404	\$305	\$3,051	\$2,330	3.2%	17.4%	0.30	\$1,017	\$10,170
Florida	16.80	\$924	\$8,124	\$3,797	\$37,968	---	---	---	6.34	\$599	\$5,989
Georgia	12.68	\$697	\$4,097	\$2,866	\$28,657	\$15,310	4.6%	26.8%	3.00	\$955	\$9,552
Hawaii	1.26	\$69	\$480	\$285	\$2,848	\$3,440	2.0%	14.0%	0.40	\$712	\$7,119
Illinois	20.79	\$1,143	\$7,643	\$4,699	\$46,985	\$24,100	4.7%	31.7%	4.59	\$1,024	\$10,236
Indiana	19.28	\$1,060	\$3,260	\$4,357	\$43,573	\$9,270	11.4%	35.2%	2.33	\$1,870	\$18,701
Iowa	5.35	\$294	\$1,274	\$1,209	\$12,091	\$4,650	6.3%	27.4%	1.15	\$1,051	\$10,514
Kansas	6.54	\$360	\$1,334	\$1,478	\$14,780	\$4,410	8.2%	30.2%	1.04	\$1,421	\$14,212
Kentucky	11.14	\$613	\$1,813	\$2,518	\$25,176	\$6,760	9.1%	26.8%	1.59	\$1,583	\$15,834
Louisiana	19.57	\$1,076	\$2,276	\$4,423	\$44,228	\$6,530	16.5%	34.9%	1.66	\$2,664	\$26,643
Maine	1.45	\$80	\$482	\$328	\$3,277	\$2,350	3.4%	20.5%	0.52	\$630	\$6,302
Maryland	5.95	\$327	\$2,827	\$1,345	\$13,447	\$9,800	3.3%	28.8%	1.98	\$679	\$6,791
Massachusetts	6.83	\$376	\$3,976	\$1,544	\$15,436	\$22,870	1.6%	17.4%	2.44	\$633	\$6,326
Minnesota	7.08	\$389	\$2,589	\$1,600	\$16,001	\$12,150	3.2%	21.3%	1.89	\$847	\$8,466
Mississippi	7.90	\$435	\$963	\$1,785	\$17,854	\$3,440	12.6%	28.0%	1.05	\$1,700	\$17,004
Missouri	9.22	\$507	\$2,507	\$2,084	\$20,837	\$7,670	6.6%	32.7%	2.19	\$951	\$9,515
Montana	1.29	\$71	\$431	\$292	\$2,915	\$1,270	5.6%	33.9%	0.36	\$810	\$8,098
Nevada	2.80	\$154	\$1,354	\$633	\$6,328	\$1,730	8.9%	78.3%	0.75	\$844	\$8,437

**Table 7**  
**Possible Annual Cost of State Greenhouse Gas Programs**  
**(to reduce emissions to 1990 -7% levels)**

State	(A) Reduction required to reach 1990-7% (mmtce)	(B) Minimum direct cost to state government (\$ millions)	(C) Minimum direct and indirect cost to state government (\$ millions)	(D) Cost to consumers and businesses of nat'l program (\$ millions)	(E) Cost to state consumers and businesses of state program (\$ millions)	(F) 2001 State government revenues (\$ millions)	(G) Direct cost as percent of 2001 state revenues	(H) Direct and indirect cost as percent of 2001 state revenues	(I) # of households (millions)	(J) National program cost per household	(K) State program cost per household
New Hampshire	0.98	\$54	\$612	\$221	\$2,215	\$1,140	4.7%	53.7%	0.47	\$471	\$4,712
New Jersey	11.10	\$611	\$5,111	\$2,509	\$25,086	\$20,980	2.9%	24.4%	3.06	\$820	\$8,198
New Mexico	5.10	\$281	\$752	\$1,153	\$11,526	\$3,990	7.0%	18.8%	0.68	\$1,695	\$16,950
New York	23.81	\$1,310	\$10,210	\$5,381	\$53,811	\$39,880	3.3%	25.6%	7.06	\$762	\$7,622
North Carolina	10.04	\$552	\$3,652	\$2,269	\$22,690	\$13,390	4.1%	27.3%	3.13	\$725	\$7,249
Ohio	27.97	\$1,538	\$5,938	\$6,321	\$63,212	\$21,300	7.2%	27.9%	4.45	\$1,420	\$14,205
Oregon	6.26	\$344	\$1,844	\$1,415	\$14,148	\$5,240	6.6%	35.2%	1.33	\$1,064	\$10,637
Pennsylvania	23.91	\$1,315	\$6,015	\$5,404	\$54,037	\$19,440	6.8%	30.9%	4.78	\$1,130	\$11,305
Rhode Island	0.82	\$45	\$370	\$185	\$1,853	\$2,530	1.8%	14.6%	0.41	\$452	\$4,520
Tennessee	9.15	\$503	\$2,403	\$2,068	\$20,679	\$7,160	7.0%	33.6%	2.23	\$927	\$9,273
Utah	5.32	\$293	\$1,183	\$1,202	\$12,023	\$3,620	8.1%	32.7%	0.70	\$1,718	\$17,176
Vermont	0.66	\$36	\$245	\$149	\$1,492	\$900	4.0%	27.3%	0.24	\$622	\$6,215
Virginia	9.19	\$505	\$3,405	\$2,077	\$20,769	\$11,840	4.3%	28.8%	2.70	\$769	\$7,692
Washington	5.35	\$294	\$3,294	\$1,209	\$12,091	\$10,830	2.7%	30.4%	2.27	\$533	\$5,326
Wisconsin	8.53	\$469	\$2,669	\$1,928	\$19,278	\$10,290	4.6%	25.9%	2.08	\$927	\$9,268
Totals	356.75	\$19,621	\$116,619	\$80,626	\$806,255	\$407,931	---	---	---	\$36,832	\$368,321
<b>Mean Average</b>	<b>9.64</b>	<b>\$530</b>	<b>\$3,152</b>	<b>\$2,179</b>	<b>\$21,791</b>	<b>\$11,331</b>	<b>4.8%</b>	<b>28.6%</b>	<b>---</b>	<b>\$995</b>	<b>\$9,955</b>

Sources: (A) Number of tons to be reduced taken from Table 4 and EPA "State Greenhouse Gas Inventories." (B) Number of tons in column (a) x \$55, the cost of New Jersey's comprehensive greenhouse gas program. (C) Column (b) plus data from Mary Novak et al., *Global Warming: The High Cost of the Kyoto Protocol*, WEFA Inc., 1998. (D) Number of tons in column (a) x \$226, the average of 12 estimates of the cost per mtce to reduce emissions to 7 percent below 1990 levels; (E) Column (d) times 10, because state regulatory programs are likely to be five times as costly as a national market-based program and suffer a 50 percent "leakage" rate. (F) National Association of State Budget Officers, *The Fiscal Survey of States*, November 2002, Table A1, "Fiscal 2001 State General Fund, Actual (millions)." (G) Column (b) divided by column (f). (H) Column (c) divided by column (f). (I) *Statistical Abstract of the U.S. 2001*, Table 56, "Households - States: 2000". (J) Column (d) divided by column (i). (K) Column (e) divided by column (i).

<b>Table 8 Top Ten State Deficits and the Cost of Reducing Greenhouse Gas Emissions</b>			
<b>States</b>	<b>Deficit (in billions) *</b>	<b>Cost of Reducing Greenhouse Gases (in billions)</b>	<b>Greenhouse Gas Program as % of Deficit</b>
California	\$34.8	\$16.4	47%
New York	\$10.0	\$10.2	102%
Texas	\$9.9	---	---
New Jersey	\$5.0	\$5.1	102%
Minnesota	\$4.6	\$2.6	57%
Ohio	\$4.0	\$5.9	148%
Massachusetts	\$3.0	\$4.0	133%
Wisconsin	\$2.6	\$2.7	104%
Michigan	\$2.4	---	---
Illinois	\$2.25	\$7.6	338%

\* William D. Eggers, "Show Me the Money: Budget-Cutting Strategies for Cash-Strapped States," American Legislative Exchange Council, November 2002.

One way to gauge the costs of greenhouse gas programs is to compare them to the budget deficits many states are reporting this year. (See Table 8.) The likely direct and indirect cost of reducing greenhouse gas emissions would exceed the projected budget deficits of six of the states with the largest projected deficits — New York, New Jersey, Ohio, Massachusetts, Wisconsin, and Illinois. The direct and indirect effects of greenhouse gas emission programs would carve a 28.6 percent hole in the average state's budget, making today's fiscal problems look small by comparison.

A second way to put costs into perspective is to contemplate what *could have been purchased or produced* had the money or other resources been used for something else, what economists call the "opportunity cost" of any spending decision.

Bjorn Lomborg, an associate professor of statistics at the University of Aarhus in Denmark, says "the cost of the Kyoto Protocol for the U.S. alone, even with Annex 1 trading, would more than amply cover the *entire* expense for providing the whole of mankind with clean drinking water and sanitation. It is estimated that this would avoid several million deaths every year and prevent half a billion people becoming seriously ill each year. This would probably be a far better help for the developing countries than a temperature reduction from Kyoto of some 0.15°C in 2100."<sup>62</sup>

The same principle applies at the state level. Money spent trying to delay global warming could instead fund any number of state-level programs such as education, road building and maintenance, and social welfare programs, or the money could be returned to individual citizens to decide how best to spend. By reducing average household income by \$10,000 per year to meet greenhouse gas reduction goals, a state government would be taking two to three months of take-home pay from the average family in the state. For many families, such a burden would be unbearable.

<sup>62</sup> Bjorn Lomborg, *The Skeptical Environmentalist: Measuring the Real State of the World* (Cambridge, MA: Cambridge University Press, 2001), page 315.

“For many people,” points out Jerry Taylor, natural resources director at the Cato Institute, “\$500 per year is the difference between decent food, clothing, and shelter and poor food, clothing, and shelter; the difference between carrying decent health insurance and going without health insurance; the difference between having disposable monthly income and having no disposable monthly income.”<sup>63</sup>

Taylor’s \$500 has to be multiplied by two to get the cost to a typical household of a national greenhouse gas program, and by 20 to reach \$10,000, the possible cost per household of a typical state greenhouse gas program. It is simply not possible that most families would choose to spend their money this way if they were fully informed of the costs and benefits of climate change.

By reducing average household income by \$10,000 per year to meet greenhouse gas reduction goals, a state government would be taking two to three months of take-home pay from the average family in the state.

## Benefits of Greenhouse Gas Reductions

Since greenhouse gases pose no known danger to human health, the only benefit from reducing emissions would be avoiding the alleged harms caused by global warming: property damage due to rising water levels and more frequent violent weather, spread of diseases from the tropics, loss of crops due to summer heat and droughts, etc. In Part 3 we examine the scientific evidence that anthropogenic greenhouse gases could cause global warming and consider whether state efforts to reduce emissions, even if successful, are likely to matter. Here, we assume for the sake of argument that climate change would occur if greenhouse gas emissions are not controlled, and ask what the economic consequences of climate change would be.

### Best estimates of benefits

Early estimates of the possible harmful effects of climate change failed to take into account offsetting benefits, such as increased crop yields due to the fertilization effect of higher carbon dioxide levels in the air. An article in *The New Scientist* titled “Africa’s Deserts Are in ‘Spectacular’ Retreat” documents how vegetation is reclaiming large expanses of barren land across the entire southern edge of the Sahara desert.<sup>64</sup> “The southern Sahara desert is in retreat,” writes Fred Pearce, “making farming viable again in what were some of the most arid parts of Africa. ... Burkina Faso, one of the West Africa countries devastated by drought and advancing deserts 20 years ago, is growing so much greener that families who fled to wetter coastal regions are starting to go home.”

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<sup>63</sup> Quoted in “Whitman EPA Adopts Clinton Arsenic Standard,” *Environment & Climate News*, January 2002.

<sup>64</sup> Fred Pearce, “Africa’s Deserts Are in Spectacular Retreat,” *The New Scientist*, September 16, 2002, <http://www.newscientist.com/hottopics/climate/climate.jsp?id=ns99992811>.

<b>Table 9</b> <b>Estimated Annual Impact of Effective Doubling of CO2 (billions of 1990\$)</b>		
Sector	2060 economy	1990 economy
<b>Market sector impact estimates</b>		
Agriculture	+\$41.4	+\$11.3
Timber	+\$3.4	+\$3.4
Water resources - market only	-\$3.7	-\$3.7
Energy	-\$4.1	-\$2.5
Coastal structures	-\$0.1	-\$0.1
Commercial fishing	-\$0.4 to +\$0.4	-\$0.4 to +\$0.4
Total (market sectors)	+\$36.9 (+0.2% of 2060 GDP)	+\$8.4 (+0.2% of 1990 GDP)
<b>Nonmarket sector impact estimates</b>		
Water quality	-\$5.7	-\$5.7
Recreation	+\$3.5	+\$4.2

Source: Robert Mendelsohn and James E. Neumann, *The Impact of Climate Change on the United States Economy*, Table 12.2, page 320.

Other beneficial effects of global warming include longer growing seasons in temperate climates, lower heating bills, lower construction costs, lower mortality rates, and lower rates of morbidity (illness). A careful estimate of the harms *and benefits* of global warming to the U.S. economy was presented in 1999 by Robert Mendelsohn, a Yale University professor and leading scholar in this field, and James E. Neumann.<sup>65</sup> Their findings, based on a synthesis of previous studies by other leading experts, are summarized in Table 9.

Mendelsohn and Neumann assumed an increase in temperature of 2.5°C, a 7 percent increase in precipitation, and an increase to 530 ppm atmospheric carbon dioxide by 2060, which they admit “may be somewhat more severe than the most recent scientific assessment in IPCC (1996a).”<sup>66</sup>

Surprisingly, perhaps, Mendelsohn and Neumann find the net impact of global warming on the U.S. economy in the year 2060, if no action were taken to slow or stop emissions, would be *positive*, to the tune of \$36.9 billion, or about 0.2 percent of projected GDP. In 2001 dollars this would be about \$11.5 billion. The benefits of global warming to the agricultural and timber industries more than outweigh losses to the energy industry or damage to coastal structures. Say the authors, “The empirical studies, taken as a group, suggest that modest warming would have a small but beneficial impact on the U.S. economy.”<sup>67</sup>

In reaching their estimate, Mendelsohn and Neumann reviewed and corrected what they saw as errors in the work of other experts, such as William Nordhaus and William Cline, who estimated the costs of global warming would exceed the benefits by \$55.5 billion and \$61.1 billion, in 1990 dollars, respectively. Other experts who have studied the matter, such as economist Thomas Gale Moore, agree with Mendelsohn and Neumann that earlier estimates exaggerated the costs of warming. Moore, for example, uses historical data to calculate that if temperatures were 4.5°F warmer in the U.S., 41,000 fewer people would die each year from

<sup>65</sup> Robert Mendelsohn and James E. Neumann, *supra* note 38.

<sup>66</sup> *Ibid.*, page 319.

<sup>67</sup> *Ibid.*, page 315.

respiratory and circulation diseases.<sup>68</sup> The annual benefits of global warming to the U.S., he estimates, would exceed costs by \$104.8 billion in 1990 dollars.<sup>69</sup>

Forestalling global warming, then, probably produces no net benefits to the U.S. What about the rest of the world? Would other countries be harmed by climate change? The Intergovernmental Panel on Climate Change cites two estimates of the worldwide cost of global warming, 1.4 percent and 1.9

percent of world GDP, and contends “damages for the non-OECD region [range from] about 1.6-2.7 percent of GDP, some 50 percent higher than the OECD average.”<sup>70</sup> Moore, however, doubts whether global warming would harm most developing countries at all. He writes:

Thomas Gale Moore estimates the annual benefits of global warming to the U.S. would exceed costs by \$104.8 billion in 1990 dollars.

Poor countries dependent on agriculture are more sensitive to changes in climate. But the growth of carbon dioxide should actually help. Many of those countries are in tropical areas and will be largely unaffected because the climate will not change appreciably near the equator. Other subtropical regions should receive more rainfall and may benefit, although farmers may need to learn to grow new crops. Some low-lying countries — Bangladesh, for example — may suffer from more frequent sea flooding as water levels rise. Such places, including low-lying islands, may be the only major losers from warming.<sup>71</sup>

A Federal Reserve Bank of Dallas study published in 1998 surveyed credible studies on the global costs of warming and placed the global harm from carbon dioxide emissions for 2001-2010 in the range of \$7.40 to \$52.90 per metric ton of carbon equivalent, with a mean average of \$22.80.<sup>72</sup> This is an order of magnitude less than the \$226 per ton it would cost to reduce emissions to 7 percent below 1990 levels, and barely one-quarter of the cost even with emission trading with Annex 1 countries.

According to Stephen P.A. Brown, one of the coauthors of the Dallas Fed paper, spending \$22.80 per ton would enable us to reduce carbon dioxide emissions by only about 14 percent of

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<sup>68</sup> Thomas Gale Moore, *Climate of Fear: Why We Shouldn't Worry about Global Warming* (Washington, DC: Cato Institute, 1998), pages 120-121.

<sup>69</sup> *Ibid.*, page 112.

<sup>70</sup> IPCC, *Climate Change 1995: Economic and Social Dimensions of Climate Change*, pages 204-205.

<sup>71</sup> Thomas Gale Moore, *supra* note 68, page 128.

<sup>72</sup> Stephen P.A. Brown and Hillard G. Huntington, “Some Implications of Increased Cooperation in World Oil Conservation,” *Economic Review*, Federal Reserve Bank of Dallas, second quarter 1998, page 7.

the amount called for by the Kyoto Protocol.<sup>73</sup> Spending an amount equal to the upper bound estimate of marginal benefits, \$52.90 per ton, would mean it is cost effective to reduce emissions by about 45 percent of the amount required by the Kyoto Protocol. Brown, who estimates complying with the Kyoto Protocol would require spending \$200 per ton, concludes, “this accord promises a lot of pain and very little gain.”

### Discounting future benefits

The benefits of reducing greenhouse gas emissions, to the extent they exist at all, occur far in the future. This means money spent now to secure these benefits could have been used to buy other things that would produce benefits today. The rate at which we *discount* the value of benefits expected to appear in the future is expressed by an annual rate, similar to the interest paid on a savings account, which economists sometimes call the “social rate of time preference” or simply the discount rate.

Discounting the benefits of avoiding climate change 50 years into the future makes it apparent that *no actions* are currently justified by cost-benefit analysis.

The cost of acting now to reduce greenhouse gas emissions is very high because, according to computer models, the effects of such reductions won't be apparent for approximately 50 years. One hundred dollars invested today in bonds or securities earning a long-term rate of return of 6 percent would be worth about \$1,842 in 50 years.<sup>74</sup> If we choose to spend that \$100 today to reduce

greenhouse gas emissions by one ton, we lose the opportunity to spend \$1,842 50 years from now, enough to reduce emissions by more than 18 tons, assuming no change in technologies over that time. It is likely, with advancing technology, that \$1,842 spent 50 years from now would enable us to reduce emissions by five or even 10 times that amount.

This illustration allows us to see that avoiding \$1,842 in damages 50 years from now is worth about \$100 to us today, or only about 5 percent of the future value. Expressed differently, a dollar of benefit in the year 2050 is worth about 5 cents today. Benefits 50 years distant need to be worth about 20 times as much as alternative benefits available to us today in order to justify their purchase.

Discounting the benefits of avoiding climate change 50 years into the future makes it apparent that *no actions* are currently justified by cost-benefit analysis. Even very high estimates of future damage from climate change lead to a discounted present value of benefits of only

<sup>73</sup> Stephen P.A. Brown, “Global Warming Policy: Some Economic Implications,” *Policy Report #224*, National Center for Policy Analysis, May 1999, page 6.

<sup>74</sup> The equation is  $(1 + r)^y$ , where  $r$  is the average rate of return and  $y$  is the number of years. For this example, we chose  $r = .06$  and  $y = 50$ . A useful calculator for performing this sort of analysis can be found at <http://www.eng.buffalo.edu/~jaw14/ie320.project4.html>.

\$10 per ton of carbon reduced or less, versus an abatement cost of at least \$150 a ton, or 15 times as much.

Applying the concept of discounting to the global warming debate is controversial.<sup>75</sup> In particular, critics worry the current generation of investors and emitters won't actually set aside the \$100 that would become \$1,842 in 2050 available to reduce emissions. What if we spend even this modest sum on something else? There is also concern that 6 percent or similar estimates of the appropriate discount rate over-estimate the likely long-term rate of return on investments over so many decades.

Making investments in emission reductions that yield less than the return on alternative investments in fact impoverishes future generations.

The debate is worth having, but opponents of using discounting have a tough position to defend. Discounting is a standard tool of policy analysis on issues ranging from financing public facilities to education and fighting crime. How can climate change be exempted from the use of an analytical tool that is required in all other debates? And if the purpose of reducing greenhouse gas emissions is to benefit future generations, it must be compared to other investments that would do the same thing. Nearly any investment in capital and services that raises productivity and produces wealth benefits future generations. Making investments in emission reductions that yield less than the return on alternative investments in fact impoverishes future generations.<sup>76</sup>

## Why the Costs Are So High

Cost estimates of the kind presented in this analysis are often dismissed by critics as exaggerations. They point to past cases where industry spokespersons claimed regulations would be too difficult or expensive to bear, but were later found to be relatively inexpensive. But WEFA (and most of the other analysts cited earlier) made a series of assumptions in its analysis that make it extremely unlikely its findings are exaggerated. For example, WEFA assumed:

- 1) Nothing would be spent attempting to control emissions of greenhouse gases other than carbon dioxide, a cost that “may exceed the cost of reducing carbon through the energy sector.”<sup>77</sup>
- 2) Nothing would be spent by sectors of the economy other than the energy sector, where economies of scale are immense and enforcement costs are small.

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<sup>75</sup> See William D. Nordhaus, *Economics and Policy Issues in Climate Change* (Washington, DC: Resources for the Future, 1998), for a good overview of the debate.

<sup>76</sup> Nancy Birdsall and A. Steer, “Act Now on Global Warming — But Don’t Cook the Books,” *Finance and Development*, 30(1) (1993), pages 6-8.

<sup>77</sup> Mary Novak et al., *supra* note 53, page 12.

- 3) The least-cost methods of reducing emissions would always be used, even though T.H. Tietenberg and others have documented that complying with environmental regulations routinely costs between four and six times as much as least-cost methods.

WEFA assumed the least-cost methods of reducing emissions would always be used, even though complying with environmental regulations in the past has routinely cost between four and six times as much as least-cost methods.

- 4) Energy efficiency would improve at twice the actual rate of the past 10 years even without the greenhouse gas reduction program being implemented (i.e., in the “business as usual” scenario).<sup>78</sup>

These assumptions, like those used in our calculation of the cost of state programs, seem designed to underestimate expenses

rather than overestimate them. Nevertheless, advocates of government action claim significant gains in energy efficiency would cost little, or even save consumers and businesses money. One influential statement of this belief appeared in 1997 as a letter signed by several noted economists, which read in part:

Economics studies have found that there are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs. For the United States in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measures may in fact improve U.S. productivity in the longer run.<sup>79</sup>

Though often cited, this passage is misleading because it assumes, as the rest of the letter makes clear, that “the revenues generated from such policies can effectively be used to reduce the deficit or to lower existing taxes.” This is a crippling assumption, since *any* public policy involving new taxes could be justified by making the same claim, regardless of the merits of the program. In order to be persuasive, the economists’ letter has to explain why emission reduction programs themselves are beneficial. On this key point, the letter is silent. In fact, one of the signers of the economists’ letter, William Nordhaus, estimated the cost of stabilizing global greenhouse gases, *net* of any offsetting benefits, would be a staggering \$7 trillion.<sup>80</sup>

The economists’ letter does not lend meaningful support to any specific state or national program to reduce greenhouse gas emissions. Instead, it simply observes a difference between the amount of energy consumed now and the amount that would be consumed if all apparently cost-effective options were exploited, what has been called the “conservation gap.” The letter

<sup>78</sup> Ibid., page 15.

<sup>79</sup> Kenneth Arrow, “Economists’ Statement on Climate Change,” Redefining Progress, February 13, 1997, <http://www.redefiningprogress.org/publications/econstatement.html>.

<sup>80</sup> William Nordhaus, *Managing the Global Commons: The Economics of Climate Change* (Cambridge, MA: MIT Press, 1994), page 82.

does not address *why* rational self-interested consumers are neglecting opportunities to save money by using less energy.

Those who say a conservation gap exists are usually overlooking the hidden costs of adopting new technologies, such as the risk faced by first-time buyers or early adopters, the time and sometimes cost of learning how to use a new product, and the loss of values that still inhere to currently owned assets (even assets considered fully depreciated by accountants). Also overlooked are agency problems (renters, for example, sometimes don't own the appliances they use or pay only for the electricity they use), uncertainty over the future price of energy, and the real preferences of consumers who may prefer to buy energy-consuming rather than energy-saving features (such as engines with greater horsepower in cars and trucks) with their limited budgets.<sup>81</sup>

Those who believe there are costless opportunities to conserve energy are usually overlooking the hidden costs of adopting new technologies.

Advocates of the conservation gap question the judgement of consumers and investors, even though the latter are usually in a better position to judge and act on what is in their own best interest. A typical trick played by advocates is to substitute their own, much lower, discount rate for those of actual consumers. In other words, they think other people should be willing to pay more at the time of purchase for an energy-saving product, even though it may take many years for the investment to pay for itself. People who must pay bills and balance competing demands may be forgiven for thinking they should be allowed to make such decisions themselves.

The second explanation for seemingly overlooked conservation opportunities is that money-saving opportunities are sometimes discouraged or prohibited by law. Most common are laws that subsidize some producers and regulate others. "The federal government, for example, sells water at heavily subsidized rates to California farmers who grow rice, a crop that generates massive amounts of methane, a major greenhouse gas," writes economist Thomas Gale Moore. "Eliminating the water subsidies would be economically efficient, even if policy makers were indifferent to possible climate change."<sup>82</sup> Costly regulations in the U.S. have practically ruled out new nuclear power generators as a source of electricity, even though some European<sup>83</sup> and developing<sup>84</sup> countries are increasing reliance on this zero-emission energy source.

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<sup>81</sup> Richard G. Newell, "Balancing Policies for Energy Efficiency and Climate Change," *Resources*, Summer 2000, pages 15-16.

<sup>82</sup> Thomas Gale Moore, *supra* note 68, page 130.

<sup>83</sup> S. Fred Singer, "Europeans Debate Nuclear Power," *Environment & Climate News*, February 2003, page 3.

<sup>84</sup> "The highest growth in nuclear generation is projected for the developing world, where consumption of electricity from nuclear power is projected to increase by 4.7 percent per year between 1999 and 2020. ... The nations of developing Asia account for half the reactors currently under construction worldwide,

(continued...)

If there are market imperfections that cause cost-effective energy-saving opportunities to go unrealized, they need to be carefully documented with models that take into account actual consumer preferences rather than merely the wishes of experts. The conservation gap we are aware of results from government subsidies and costly regulations, which suggests greenhouse gas emission reduction programs should consist of repealing existing laws rather than passing new laws. Moreover, proof must be submitted that correcting imperfections would cost less than allowing them to continue. It can hardly be assumed that launching another government program or passing another law will make markets *more* rather than less efficient.

The conservation gap we are aware of results from government subsidies and costly regulations, which suggests greenhouse gas emission reduction programs should consist of repealing existing laws rather than passing new laws.

Finally, advocates of the conservation gap theory must prove the amount of costless conservation that exists is large relative to the change they believe is necessary. In the current context, this means enough to genuinely affect the Earth's climate. No such evidence has been put forward. To the contrary, there are four reasons (in addition to three given earlier in this section) why reducing greenhouse gas emissions in the short term tends to be expensive:

- 1) Energy is a key economic resource whose price and availability have significant and lasting effects on economic growth.
- 2) Alternative energy sources are currently expensive and have features, such as intermittency, that make them less desirable than fossil fuels.
- 3) Switching rapidly to alternative fuels would require the premature retirement of billions of dollars of capital such as power plants, refineries, factories, and infrastructure.
- 4) Attempting to reduce emissions from transportation is futile since vehicle miles traveled increase as fuel economy improves, lighter vehicles provide less protection to their occupants, and the cost per ton of carbon avoided, as documented below, is much higher than alternative strategies.

### **Energy and economic growth**

Reducing greenhouse gas emissions is expensive because abundant and inexpensive energy is a key ingredient of economic growth, and indeed of human progress. As economist Julian Simon wrote, "Energy is the master resource, because energy enables us to convert one material into

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<sup>84</sup> (...continued)

including eight in China, four in South Korea, two in India, and two in Taiwan." Energy Information Administration, *International Energy Outlook 2003 with Projections to 2025*, <http://www.eia.doe.gov/oiaf/ieo/>.

another. As natural scientists continue to learn more about the transformation of materials from one form to another with the aid of energy, energy will be even more important.”<sup>85</sup>

Historically, low energy costs in the U.S. have been accompanied by rapid increases in productivity and Gross National Product (GNP).<sup>86</sup> From 1950 to 1972, real energy prices fell, energy and capital per worker-hour rose, and productivity grew 2.6 percent per year. GNP per worker-hour rose by an impressive 2.6 percent per year. From 1973 to 1984, by contrast, energy prices rose, energy and capital per worker-hour fell, and productivity grew only 1 percent per year. GNP per worker-hour rose by only 1 percent per year during that period.

Historically, low energy costs in the U.S. have been accompanied by rapid increases in productivity and Gross National Product (GNP).

Inexpensive and abundant energy is important for any country, but it is particularly important for the U.S. because the capital stock of the United States — its factories, industries, universities, hospitals, office buildings, and other machines and buildings — are more energy-intensive than those of any other country in the world. The population densities of Germany, Britain, and France are approximately eight times that of the U.S. Our population is growing (due mostly to immigration) while theirs are shrinking, and our standard of living is rising more rapidly. All these conditions require high and rising energy consumption. Finally, energy historically has been inexpensive in the United States (relative to European countries) thanks to ample natural resources, relatively low taxes, and a secure system of property rights. This has profoundly shaped our industries, architecture, homes, and lifestyles.

Energy is required to produce nearly every good and service we enjoy. While this is obvious in the case of many manufactured goods, such as aluminum cans or cars and trucks, it is also true of the fruits, vegetables, and meat we eat. Farming in the U.S. is surprisingly energy-intensive, with some 70 percent of a typical farm’s total energy bill hidden in the prices of manufactured inputs such as fertilizer and pesticides. Policies that raise energy prices — as nearly all greenhouse gas emission reduction programs do — would increase the cost of food and reduce the net income of farmers.<sup>87</sup>

The key role energy plays in the U.S. economy means increasing the cost of energy has negative effects felt throughout the economy. Higher energy costs reduce the productivity of U.S. workers and industries relative to the past and to competitors in other countries, lowering incomes and threatening jobs. They raise the cost of food, travel, home heating, and recreation, thereby lowering *everyone’s* standard of living. Rising energy costs lead to less investment in the

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<sup>85</sup> Julian Simon, *The Ultimate Resource 2* (Princeton, NJ: Princeton University Press, 1996), page 162.

<sup>86</sup> The following numbers are taken from John R. Moroney, “Energy, Carbon Dioxide Emissions, and Economic Growth,” in Charls E. Walker, Mark A. Bloomfield, and Margo Thorning, eds., *supra* note 38, page 45.

<sup>87</sup> Terry Francl, Richard Nadler, and Joseph Bast, “The Kyoto Protocol and U.S. Agriculture,” *Heartland Policy Study #87*, The Heartland Institute, October 1998.

U.S. economy due to anticipation of lower future productivity and gains to investment and better returns in other parts of the world not subject to anti-energy policies.<sup>88</sup>

The key role that energy plays in the U.S. economy means increasing the cost of energy has negative effects felt throughout the economy.

Higher energy prices hit the poor and minorities in the U.S. especially hard. Both groups spend a higher proportion of their incomes on necessities, such as food, housing, utilities, and energy, making higher energy costs similar to a regressive tax paid disproportionately by the least well off.

According to one study, “by 2010, the black poverty rate under the [Kyoto] Protocol is 18 percent higher than under the reference case; the Hispanic rate is 14 percent higher.”<sup>89</sup> Senior citizens on fixed incomes would also be especially hard hit by rising costs for home heating, food, and other necessities.<sup>90</sup> Along with the poor, they will be hardest hit if states cut back on social programs to fund solar panels, windmills, and other expensive types of renewable energy.

Policies that raise energy costs also strike hard at energy-producing and energy-intensive industries, which employ hundreds of thousands of people in the U.S. Had the Kyoto Protocol been adopted and fully implemented, for example, two-thirds of the jobs in the U.S. coal industry would have been lost by 2030, along with 7 percent of jobs in motor vehicle manufacturing and 4 percent of jobs in steel and other metal production. These displaced workers would eventually have found other jobs, but at lower wages.

### **Why alternative fuels are rarely used**

If alternatives to fossil fuels were cheap and in ample supply, a transition might be relatively costless. Available data, however, show they are expensive and rarely used.

Alternative fuels account for only a tiny share of total energy production in the U.S. According to the Energy Information Administration, generation from nonhydropower renewable energy sources accounted for just 2.1 percent of total U.S. power generation in 2001 and was projected to reach just 3.3 percent of generation in 2025.<sup>91</sup> Solar technologies of all types are expected to account for only 0.07 percent of total U.S. electric generation in 2025.<sup>92</sup>

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<sup>88</sup> W. David Montgomery et al., *supra* note 47, page 5.

<sup>89</sup> Management Information Services, Inc., *Potential Economic Impacts of the Kyoto Climate Change Protocol on Blacks and Hispanics in the U.S.*, June 2000, page 50.

<sup>90</sup> Stephen S. Fuller, *The Impact of the Kyoto Protocol on America’s Senior Citizens*, prepared for the Congress of California Seniors, March 1999.

<sup>91</sup> Energy Information Administration, *Annual Energy Outlook 2003 with Projections to 2025*.

<sup>92</sup> *Ibid.*

Globally, the picture is no better. Renewable energy use, including hydro, stood at 9 percent in 1999 and is expected to *drop* to 8 percent by 2020.<sup>93</sup>

The small market share of alternative fuels persists despite massive subsidies by governments around the world, including more than \$11 billion in U.S. Department of Energy subsidies earmarked for commercializing alternative fuels and myriad federal and state tax credits for wind, solar, and other renewable energies.<sup>94</sup> Why are alternative fuels so rarely used?

Even after accounting for substantial federal and state subsidies benefitting alternative energy sources, these technologies carry steep price premiums for both the producer and the consumer when compared to traditional energy sources. A U.S. Department of Energy report that took into account revenue requirements and rates of return using different discount rates based on the varying expected life-spans of different types of facilities found alternative fuels cost more than coal or natural gas.<sup>95</sup> While technological advances are continually driving down the cost of alternative energies, similar advances are making conventional energy sources less expensive, often at the same or an even faster pace.

Solar technologies of all types are expected to account for only 0.07 percent of total U.S. electric generation in 2025.

In addition to being more expensive than fossil fuels, alternative fuels tend to be rarely used because they depend on conditions that are highly location-specific (e.g., areas with high winds, many cloudless days, and low cost of land to accommodate solar collection panels), and the power they generate tends to be intermittent, requiring additional storage capacity or new investments in baseline capacity from conventional fuels for when the wind doesn't blow or the sun doesn't shine. There is growing public resistance to windmill farms, which are noisy, injure wildlife, and often best sited on highly visible mountain tops, ridges, and along coasts.<sup>96</sup>

### **Premature retirement of capital**

Attempting to move quickly from coal and natural gas to solar, wind, or other alternative energies requires that capital goods currently used to produce and distribute power — mines, railroads, power plants, refineries, power lines, and more — must be retired from service before the end of their useful lives. This transition could cost hundreds of billions of dollars.

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<sup>93</sup> Energy Information Administration, *International Energy Outlook 2003*, <http://www.eia.doe.gov/oiaf/ieo/>.

<sup>94</sup> Jerry Taylor and Peter VanDoren, "Evaluating the Case for Renewable Energy: Is Government Support Warranted?" *Policy Analysis*, Cato Institute, January 10, 2002, pages 3-4.

<sup>95</sup> U.S. Department of Energy, Office of Utility Technologies, Energy Efficiency and Renewable Energy, *Renewable Energy Technology Characterizations*, Topical Report, December 1997. See also Robert Bradley, "Renewable Energy: Not Cheap, Not Green," *Policy Analysis*, Cato Institute, August 27, 1997.

<sup>96</sup> Bjorn Lomborg, *supra* note 62, pages 134-135.

Much of the infrastructure for the nation's electric power industry is relatively new, the result of investments begun in response to then-President Jimmy Carter's call during the 1970s for "energy independence." Billions of dollars' worth of railroad tracks and cars built to move low-sulfur coal from the West to power plants in the East would be made obsolete if coal were heavily taxed or if substitutes were heavily subsidized. Similarly, since 1970, utilities, refineries, and manufacturers have spent billions of dollars on emission control technologies to reduce sulfur and other emissions. Those investments, paid for by consumers, would also have to be abandoned before their useful lives run out.

The normal turnover of the nation's capital stock is already at work gradually increasing the energy efficiency of the national economy by about 1.6 percent per year.

The most efficient way to make a transition to new fuels is to replace aging capital goods at the end of their useful lives. This normal turnover of the nation's capital stock is already at work gradually increasing the energy efficiency of the national economy by about 1.6 percent per year.<sup>97</sup> Over 90 percent of new utility generating capacity between 2001 and 2020 is projected to be

natural gas-fired combustion turbines and combined-cycle facilities, which have lower carbon emissions than coal-fired facilities.<sup>98</sup> If we *didn't* know that technology was steadily improving, and consequently that tomorrow's technology will enable us to reduce emissions at a lower cost than today's, we might think it prudent to spend more to make reductions today, in case they become more difficult to make tomorrow. But this is plainly not the case. It is foolish to try to fix a problem with the wrong tools knowing the right tools will be available shortly.

### **Reducing emissions from transportation**

Transportation is responsible for about a quarter of U.S. carbon dioxide emissions.<sup>99</sup> It was with that in mind that California legislators sought to require car and truck manufacturers to produce vehicles with lower carbon dioxide emissions. Programs in Georgia, Washington, and many other states aim to reduce vehicle miles traveled by discouraging low-density residential development and other aspects of "sprawl," following theories put forward by some anti-car advocacy groups.<sup>100</sup>

Focusing on transportation avoids problems facing other approaches to reducing greenhouse gas emissions. Unlike electrical power generation, where switching to alternative fuels on a large scale would be prohibitively expensive, the fuel economy of cars and trucks can be increased by

<sup>97</sup> Energy Information Administration, *Annual Energy Outlook 2001 with Projections to 2020*.

<sup>98</sup> *Ibid.*

<sup>99</sup> Energy Information Administration, "U.S. Greenhouse Gas Emissions Decrease by 1.2 percent in 2001 — Largest Decline in the 1990 to 2001 Time Period," news release, December 20, 2002.

<sup>100</sup> "Urban Sprawl and Global Warming with the WorldWatch Institute's Molly O'Meara Sheehan," *WashingtonPost.com*, July 3, 2001, <http://discuss.washingtonpost.com/wpsrv/zforum>.

incrementally modifying the conventional internal combustion engine, adding small self-charging electric motors, and/or by making vehicles smaller, less powerful, lighter, and more aerodynamic.<sup>101</sup> Cars and trucks have short life-spans relative to other capital goods that use fossil fuels, so the cost of premature turnover of capital is less. (See Table 10.)

But targeting cars and trucks has its own problems and unintended consequences. First, leakage will offset virtually 100 percent of any emission reductions achieved by a state fuel economy standard. Federal CAFE standards require car and truck manufacturers to meet national fleet-wide standards for cars and light trucks or pay fines. If one state insists on better fuel economy for the fleet of cars and trucks sold inside its borders, manufacturers will oblige by selling only smaller, lighter, and less powerful vehicles in that state, and then sell larger, heavier, and more powerful vehicles in other states, bringing their national corporate average fuel economy back to where it was before the state adopted its standards.

Second, mandating higher fuel economy for cars and trucks in a state may not reduce the total amount of carbon dioxide emitted if consumers use the savings in fuel to drive more miles or drive alone more often. In fact, both changes in consumer behavior occur and have historically cancelled out 20 percent or more of the fuel savings that might have arisen from federal CAFE standards. Summarizing their empirical analysis of gasoline prices and vehicle miles traveled, economists John W. Mayo and John E. Mathis wrote, “CAFE standards had no independent, statistically significant impact on ... the demand for gasoline.”<sup>102</sup>

Third, in order to meet higher fuel economy standards, car and truck manufacturers use materials such as aluminum and carbon fibers that require more energy to produce, and so produce more carbon dioxide, than the steel and iron they replace. As a result, by increasing the amount of energy consumed in manufacturing the vehicles, higher fuel economy standards can result in no net reduction in the amount of carbon dioxide produced over the life-span of a vehicle. As a recent National Academy of Sciences study says, “Greenhouse gas emissions from the production of substitute materials, such as aluminum or carbon fibers or plastics, could substantially offset decreases of those emissions achieved through improved fuel economy.”<sup>103</sup>

Type of asset	Typical service life (years)
Household appliances	8-12
Automobiles	10-20
Industrial equipment/machinery	10-70
Aircraft	30-40
Electricity generators	50-70
Commercial/industrial buildings	40-80
Residential buildings	60-100

Source: Adam B. Jaffe et al., *Climate Change Economics and Policy* (Washington, DC: Resources for the Future, 2002), page 180.

<sup>101</sup> Joseph L. Bast and Jay Lehr, “The Increasing Sustainability of Cars, Trucks, and the Internal Combustion Engine,” *Heartland Policy Study #95*, The Heartland Institute, June 2000.

<sup>102</sup> “The Effectiveness of Mandatory Fuel Efficiency Standards in Reducing the Demand for Gasoline,” *Applied Economics*, 1988, Vol. 20, pages 211-219.

<sup>103</sup> Quoted by H. Sterling Burnett, “CAFE's Three Strikes - It Should be Out,” *Brief Analysis #388*, National Center for Policy Analysis, February 13, 2002.

Fourth, higher fuel economy comes at a steep price in terms of reduced driver and passenger safety. The most cost-effective way to improve fuel economy is to make vehicles smaller and lighter. Such vehicles are less safe, all other considerations equal, than heavier vehicles because they have less mass to absorb the impact of collisions either with other vehicles or with stationary objects. According to the National Highway Transportation Safety Administration, for every 100-pound increase in the weight of new cars, 300 lives would be saved<sup>104</sup> and 10,543 incapacitating injuries would be avoided annually.<sup>105</sup>

Between 5,740 and 11,070 people die every year due to the federal government's current effort to increase car and truck fuel economy.

Economists Robert Crandall and John Graham, in research on this subject that is considered authoritative, estimate between 14 and 27 percent of automobile passenger deaths each year are due to federal CAFE regulations.<sup>106</sup> Since approximately 41,000 highway fatalities occur each year, this means

between 5,740 and 11,070 people die every year due to the federal government's current effort to increase car and truck fuel economy. Later research by Graham found raising CAFE standards from their current levels to 40 miles per gallon would cause an additional 5.5 percent increase in highway fatalities.<sup>107</sup> Raising CAFE standards, in other words, could kill an additional 2,255 people each year.

Finally, and as a result of the problems described above, attempting to reduce greenhouse gas emissions by increasing the fuel economy of cars and trucks is much more expensive than other approaches. The Federal Trade Commission estimated in 1989 that CAFE standards imposed a social welfare cost of \$10 for every gallon of gasoline they saved.<sup>108</sup> A paper written in 2002 by the primary author of the FTC paper, Pennsylvania State University economics professor Andrew N. Kleit, updated that analysis and looked at the economic impact of proposals to raise CAFE standards. He arrived at the following conclusions:

A short-run 1.0 mile per gallon (MPG) increase in the Corporate Average Fuel Economy (CAFE) Standard above existing, binding levels would impose welfare losses on society of \$33.9 billion per year while reducing gasoline consumption by 5.8 billion gallons per

<sup>104</sup> NHTSA, "Relationship of Vehicle Weight to Fatality and Injury Risk in Model Year 1985-93 Passenger Cars and Light Trucks," April 1997, <http://www.nhtsa.dot.gov/cars/rules/regrev/evaluate/808569.html>.

<sup>105</sup> NHTSA, "The Effect of Decreases in Vehicle Weight on Injury Crash Rates," January 1997, [www.nhtsa.dot.gov/pdf/nrd-30NCSA/Rpts/1997/sizerept.pdf](http://www.nhtsa.dot.gov/pdf/nrd-30NCSA/Rpts/1997/sizerept.pdf).

<sup>106</sup> Robert W. Crandall and John D. Graham, "The Effects of Fuel Economy Standards on Automobile Safety," *The Journal of Law and Economics*, Vol. XXXII, No. 1, April 1989, page 111.

<sup>107</sup> John Graham, "The Safety Risks of Proposed Fuel Economy Legislation," *RISK - Issues in Health & Safety*, Spring 1992, page 125.

<sup>108</sup> "Comments of the Staff of the Bureau of Economics of the Federal Trade Commission, Intent to Prepare an Environmental Impact Statement for the Corporate Average Fuel Economy Program," National Highway Traffic Safety Administration, November 13, 1989.

year. This amounts to a hidden tax of \$5.85 per gallon conserved. An increase of 23 cents per gallon in the gasoline tax would save the same amount of fuel and impose costs on society of \$670 million per year. Therefore, a short-run CAFE increase is 50 times more expensive to society than an increase in the gasoline tax.<sup>109</sup>

Kleit estimates increasing the CAFE standard for cars by 12.3 miles per gallon and for light trucks by 9.0 miles per gallon, as was proposed by Senator John Kerry (D-Massachusetts) and subsequently defeated in the U.S. Senate, would impose annual costs on society of more than \$25 billion and eliminate more than 100,000 jobs in U.S. auto and supplier industries. “Increasing the CAFE standard in either the short- or long-term,” concludes Kleit, “is neither cost-effective nor cost-beneficial.”<sup>110</sup>

The National Academy of Sciences estimates the *social benefit* of reducing consumption of gasoline by cars and trucks by 1 gallon to be 26 cents. The *cost* of using higher CAFE standards to achieve this benefit is \$5.85.

The National Academy of Sciences’ 2001 report on CAFE, using estimates of costs and benefits we dispute but accept here for the sake of argument, put the total social welfare cost of cars and trucks at 26 cents per gallon of gasoline, of which 12 cents is due to the possible threat of global warming.<sup>111</sup> In other words, the *social benefit* of reducing consumption of gasoline by cars and trucks by 1 gallon is thought to be worth 26 cents. The *cost* of using higher CAFE standards to achieve this benefit is \$5.85, or 22 *times* the estimated benefit. If the concern is for global warming alone, then using higher CAFE standards costs *nearly 50 times* the expected benefit. Obviously, this is a poor way to reduce carbon dioxide emissions.

## Emission Permit Trading

It is often suggested that emission permit trading would significantly reduce the cost of reducing greenhouse gas emissions. A “Chicago Climate Exchange” has even been created to allow companies to buy and sell emission credits in anticipation of the creation of a “cap-and-trade” regime that would give value to the credits.<sup>112</sup> The credits could be earned when firms reduce emissions, and then sold to other firms who face a higher cost of reducing their own emissions,

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<sup>109</sup> Andrew N. Kleit, “Short- and Long-Range Impacts of Increases in the Corporate Average Fuel Economy (CAFE) Standard,” February 7, 2002, page 1, <http://www.cei.org/pdf/2398.pdf>.

<sup>110</sup> Ibid.

<sup>111</sup> Committee on the Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards, Board on Energy and Environmental Systems, Transportation Research Board, National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, DC: National Academy of Sciences Press, 2001).

<sup>112</sup> Julie Deardorff, “Big Business to Buy, Sell Greenhouse Gas Credits,” *Chicago Tribune*, January 17, 2003.

bringing them into compliance with the caps and lowering the overall cost per ton of greenhouse gas avoided. Sulfur permit trading among electric utilities, created by the Clean Air Act Amendments of 1990, is frequently pointed to as an example of the successful application of emission permit trading.

Elected officials may find credits for early action attractive, since they are likely to face less resistance from businesses, would be less costly to businesses and consumers, and appear to be a “no regrets” style of policymaking: If global warming turns out to be less of a threat than now thought, the final step to mandatory caps on greenhouse gas emissions need not be taken, and no one is the worse off.

Credits for early action are a decisive and difficult-to-retract step toward costly mandatory emission reduction, and a magnet for litigation.

In fact, credits for early action are a decisive and difficult-to-retract step toward costly mandatory emission reductions and a magnet for litigation. Companies hoping to qualify for the credits will lobby to have their past and ongoing activities qualify, no matter how tortured the logic or indirect the

connection to actual emission reductions.<sup>113</sup> They will also lobby for the adoption of mandatory caps, without which their credits will be worthless and emission-reducing investments will have been wasted. These firms will form a “carbon lobby” that will almost certainly fight for mandatory caps on greenhouse gas emissions, even if scientific evidence shows there is no threat of dangerous global warming.<sup>114</sup>

Grounds for litigation emerge because under a credit for early action system, rulemaking over what qualifies for a credit must precede legislation creating the mandatory cap-and-trade program. Some firms will argue regulators had no statutory authority to create what amounts to a financial claim on their companies before a mandatory system has been created.<sup>115</sup> They will say, correctly, that their companies were not informed at the time that failing to act under a “voluntary” program would actually cost them money in the future. Others will challenge the rules adopted prior to the mandatory cap on the grounds they differ from those of the mandatory cap program, a difference that several years of lobbying will make inevitable.

Participants in an emission permit trading regime, whether voluntary or mandatory, are also likely to sue over any action the government takes that changes the value of permits, whether by changing the supply of credits, how they can be traded or to whom, and what qualifies for credits. Emission permit trading regimes in California and the national sulphur trading regime

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<sup>113</sup> For examples of such questionable claims, see Marlo Lewis Jr., “Get Your Money for Nothing and Your Credits for Free,” *The State Factor*, American Legislative Exchange Council, December 2002.

<sup>114</sup> Robert Crandall and Fred L. Smith, “CO2 Controls Are a Bad Idea, ‘Voluntary’ or Not,” *Wall Street Journal*, July 31, 2001; Brian Mannix, “Climate Change Policy Could Create the Mother of All Cartels,” *Environment & Climate News*, June 2001.

<sup>115</sup> See Marlo Lewis Jr., “Is There Legal Authority to Award Regulatory Credits for Greenhouse Gas Reductions?” *The State Factor*, American Legislative Exchange Council, December 2002.

for utilities both have suffered because the governments refuse to grant true property rights status to credits, presumably to avoid this kind of litigation.<sup>116</sup> But the price of this decision is that trading in both markets is very thin as companies seek to minimize their risk. Sulphur emissions have fallen dramatically since the emission permit trading system was put in place, but probably for reasons other than the trading system.<sup>117</sup> It is a matter of speculation whether a state or national greenhouse gas emission permit trading scheme could deny property right status to permits and still expect to be functional.<sup>118</sup>

Estimates of the cost of implementing the Kyoto Protocol already include among their assumptions the existence of a highly efficient emission permit trading program. Consequently, even the creation of an ideal trading system will not reduce any of the cost estimates presented above. Since individual states each have many fewer emitters than the country as a whole, fewer opportunities for trading would exist, and the advantages of having emission permit trading would be correspondingly less. With less volume to be expected, fewer private-sector firms and entrepreneurs will show interest in state-level trading regimes, so they can be expected to be undercapitalized and perhaps poorly designed.

Even the creation of an ideal trading system would not reduce any of the cost estimates presented above.

We believe the assumption of a highly efficient emission permit trading regime made by WEFA, DRI, and other groups is overly optimistic, and even naive. Why assume that governments, which find it difficult to regulate markets without making things worse than they otherwise would be, are qualified to *create artificial markets* that would work as well as the real thing? Creating markets would seem to require a level of skill well beyond what is available to national or state governments. The promises of emission permit trading, in the final analysis, are unlikely to be kept.

## Summary

We have surveyed the economic literature on global warming and applied conventional cost-benefit analysis to state greenhouse gas programs. The following are our principal conclusions:

- C A national program to reduce U.S. greenhouse gas emissions to 7 percent below 1990 levels by 2012 would cause states to lose at least \$116 billion a year in revenues. Such a program would destroy at least 2.4 million jobs and \$375 billion in annual economic output by 2010. Average household income would fall \$3,372.

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<sup>116</sup> Jim Johnston, "Midwesterners Leery of DOE Greenhouse Gas Program," *Environment & Climate News*, February 2003.

<sup>117</sup> Jim Johnston, "A Market without Rights: Sulfur Dioxide Emissions Trading," *Regulation*, Vol. 14, No. 4 (Fall 1991), pages 24-29.

<sup>118</sup> James L. Johnston, "Emissions Trading for Global Warming," paper presented at the Third Biennial Pacific Rim Allied Economic Organizations Conference, Bangkok, Thailand, January 16, 1998.

- C States that try to reduce emissions on their own incur costs 10 times as great as would result from a national program. States would not be able to exploit lowest-cost opportunities to reduce emissions that lay outside their borders or in industries they cannot regulate. They must rely on regulatory approaches that are far more expensive than the lowest-cost options assumed to be used under a national program. And businesses and residents find it easy to move to nearby states with lower energy costs or less burdensome regulations, causing greater economic losses.

The average state government would have to spend approximately \$530 million a year (\$55/ton) to implement a comprehensive greenhouse gas program and would lose a minimum of \$2.6 billion a year in revenues, for a total annual cost of \$3.2 billion.

- C The average state government would have to spend approximately \$530 million a year (\$55/ton) to implement a comprehensive greenhouse gas program and would lose a minimum of \$2.6 billion a year in revenues, for a total annual cost of \$3.2 billion. This is 28.6 percent of an average state government's revenues.

- C Under a national greenhouse gas program, consumers and businesses in an average state could pay \$2.2 billion a year in lost income and higher prices for goods and services, or approximately \$995 per household.
- C Under a state greenhouse gas program, an average state's consumers and businesses could pay a staggering \$21.8 billion more every year. This means the cost to the average household would be approximately \$10,000.
- C Reducing greenhouse gas emissions produces little or no benefit to U.S. consumers and businesses. If left unaddressed, by 2060 global warming is likely to have a small (0.2 percent of GDP) *positive* effect on the U.S. economy and a small (1 to 2 percent of GDP) *negative* effect on the global economy. After discounting for the social rate of time preference, the benefits of reducing emissions today are an order of magnitude less than the cost.
- C If even a small part of the money spent trying to reduce carbon dioxide emissions were spent instead on fighting hunger or disease in Third World countries, millions of lives could be saved. If left to wage earners here in the U.S. to spend, this would mean a significantly better quality of life for most families.
- C There may be "free" energy conservation opportunities available to consumers and industry, but it is unlikely they amount to more than a small percentage of the reductions in energy use called for by advocates of greenhouse gas reductions.
- C Reducing greenhouse gas emissions is costly because states cannot exploit lower-cost opportunities outside their borders or in industries they can't regulate; complying with regulations is four to six times as costly as the least-costly solution; "leakage" offsets 50

percent of every ton of carbon avoided; higher energy prices slow economic growth; alternative fuels are expensive and rarely used; and retiring capital prematurely would cost many billions of dollars.

- C Mandating lower carbon dioxide emissions from cars and trucks is not a promising route to travel. Car and truck manufacturers are likely to offset any reduction in emissions in a state adopting high fuel economy standards by selling larger, heavier, and more powerful cars and trucks in other states. Mandating higher fuel economy leads consumers to travel more and increases highway fatalities and injuries.

Mandating lower carbon dioxide emissions from cars and trucks is not a promising route to travel. Car and truck manufacturers are likely to offset any reduction in emissions in a state adopting high fuel economy standards by selling larger, heavier, and more powerful cars and trucks in other states.

- C State-level emission permit trading programs are unlikely to attract significant participation, and therefore are unlikely to significantly reduce the cost of reducing greenhouse gas emissions. Even a national program is likely to be beset by litigation due to questions of measurement, verification, and enforcement. Anticipating these problems, few companies are likely to engage in permit trading.

## PART 3

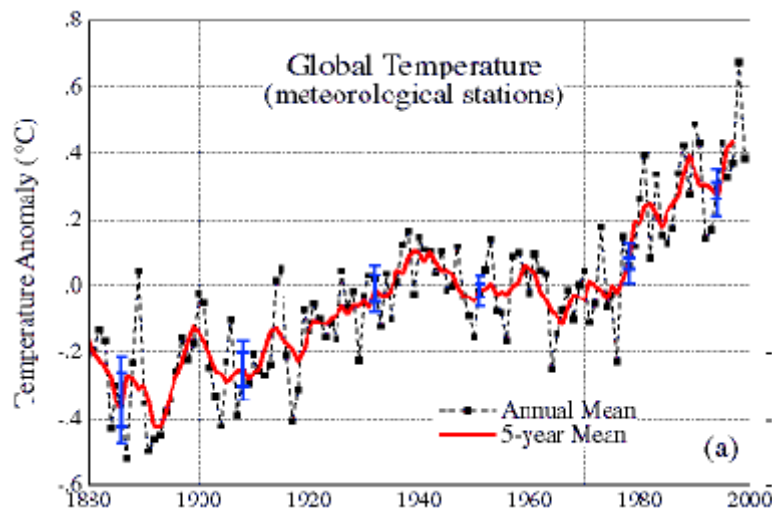
# Scientific Analysis

A scientific analysis of global warming theory finds little or no evidence that anthropogenic greenhouse gases are causing global warming or destabilizing the Earth's climate. State greenhouse gas reduction programs are therefore unnecessary. Since this conclusion is at odds with the claims of many prominent individuals and organizations, we set out the data supporting our position here.

### No Reliable Evidence of Warming

The data most often reported in the popular press and relied on by global warming alarmists are from land-based meteorological stations. They appear to show the planet warmed by about 1°C

**Figure 1**  
**Global Temperature 1890 - 2000**  
**Land-Based Stations**



Source: John L. Daly, May 2000, <http://www.greeningearthsociety.org/Articles/2000/surface1.htm>.

greenhouse gases grew dramatically — is the first clue that temperature readings do not confirm a human impact on global temperatures. Closer examination of land-based temperature stations

over the past century. (See Figure 1.) The record shows an increase of about +0.6°C from 1890 to 1940, a fall by about -0.2°C from 1940 to 1975, and then an increase of about +0.5°C from 1975 to the present.<sup>119</sup> Since the start of the industrial age, atmospheric carbon dioxide concentrations have risen from 280 parts per million (ppm) to 370 ppm. Advocates of the global warming theory assume or assert that anthropogenic greenhouse gases are responsible for the increase in global temperature.

This line of argument is implausible at best. The decline in temperatures from 1940 to 1975 — a period when anthropogenic emissions of

<sup>119</sup> John L. Daly, May 2000, <http://www.greeningearthsociety.org/Articles/2000/surface1.htm>.

reveals they are too few in number and too unevenly spaced to generate a genuine global temperature map. Only 30 percent of the world's surface is land, so land-based temperature measurements can account for less than one-third of the Earth's climate. Arctic and oceanic temperatures are under-represented, and data collected outside of the United States and Europe are poorly distributed and of uncertain reliability.<sup>120</sup>

In fact, global temperatures may not actually have increased at all during this period. The land-based stations may merely be reporting what most urban dwellers already know, which is that the concrete, factories, office buildings, and cars and trucks of cities produce "heat islands" that warm the immediate vicinity of the city relative to the surrounding region. During the past century, cities have grown around weather stations (which are typically located at city airports), skewing the temperature readings and generating the false impression of rising temperatures.

Empirical data supports this common-sense observation. A study of the U.S. land-based temperature record from 1950 to 1996, published in the *Journal of Climate*, found weather stations near urban areas reported average minimum temperatures rising at the rate of 1.2°C/century; stations in suburban areas reported a lower rate of 1.0°C/century; and rural stations reported a rate of only 0.56°C/century, too small to be statistically different from zero.<sup>121</sup>

"Small towns are likely to have urban heat islands that raise temperature about the same amount as the amount of global warming since the Little Ice Age."

– Paul Georgia

A recent study in the *Australian Meteorological Magazine* studied urban heat island effects in Australia, Europe, and North America.<sup>122</sup> The authors detected urban heat island effects even in small towns of roughly 1,000 people. The heat island effect grew more pronounced as city population increased. Observed *CO2 Science Magazine*, "The regression lines of all three continents essentially converged in the vicinity of a population of 1,000 people, however, where the mean urban-rural temperature difference was approximately  $2.2 \pm 0.2^\circ\text{C}$ ."<sup>123</sup>

A 2.2°C urban heat island effect for a town as small as 1,000 people is eye-opening. "In other words," stated Paul Georgia of the Competitive Enterprise Institute, "small towns are likely to have urban heat islands that raise temperature about the same amount as the amount of global

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<sup>120</sup> Vincent Gray, *The Greenhouse Delusion: A Critique of 'Climate Change 2001'* (Essex, UK: Multi-Science Publishing Co., Ltd., 2002), pages 15-34.

<sup>121</sup> K.P. Gallo et al., "Temperature trends of the U.S. historical climatology network based on satellite-designated land use/land cover," *Journal of Climate*, Vol.12 (1999), pages 1,344-1,348.

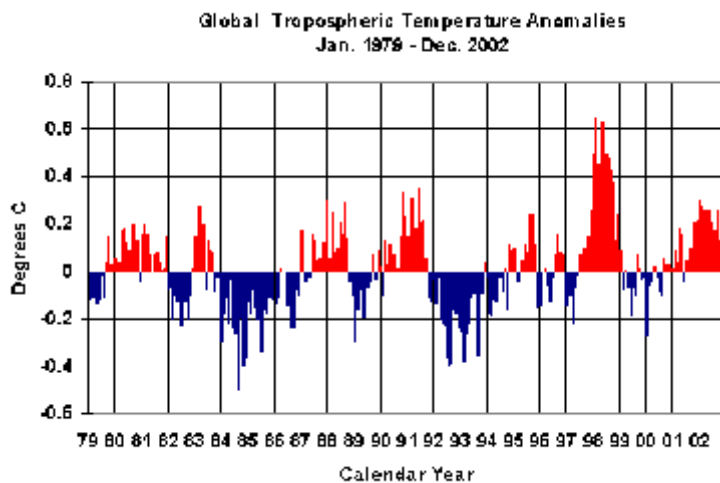
<sup>122</sup> *Australian Meteorological Magazine*, Vol. 50 (2001).

<sup>123</sup> "Urban Heat Islands in Australia," *CO2 Science Magazine*, May 15, 2002.

warming since the Little Ice Age.<sup>124</sup> It is no wonder global warming alarmists can parade data suggesting each successive year is one of the warmest in human history! Ground-based temperature readings merely reflect a growing world population, especially around the urban locations where most temperatures are measured.

There is a more reliable source of temperature data, though it dates back only to 1979. Satellite readings of temperatures in the lower atmosphere (an area scientists predict would

**Figure 2**  
**Global Temperature 1979 - 2002**  
**Lower Atmosphere**



Source: Global Hydrology and Climate Center, MSU data, <http://www.ghcc.msfc.nasa.gov/MSU/msusci.html>.

immediately reflect any global warming) are thought to be accurate within 0.01°C. and are unaffected by heat island effects. (See Figure 2.) They show a barely perceptible warming trend of +0.04°C/decade since the readings began in 1979 through February 2002. Weather balloons, which also measure temperatures in the lower atmosphere but rely on a different technology than what is used by the satellites, also find no warming trend.<sup>125</sup>

Why, if carbon dioxide concentrations in the environment are rising, aren't global temperatures rising as well? A recent study in the *Bulletin of the American*

*Meteorological Society* may offer the best explanation.<sup>126</sup> The study found initial temperature increases resulting from higher greenhouse gas concentrations lead to increasing water evaporation, which in turn causes the formation of more cumulus clouds. The clouds then deflect incoming sunlight back into space, which offsets whatever warming might otherwise have been caused by rising greenhouse gas concentrations. The result is a slight increase in cloudiness, but no effect on global temperatures.

<sup>124</sup> Paul Georgia, *Cooler Heads*, Vol. VI, No. 10, May 15, 2002.

<sup>125</sup> Patrick Michaels, "Looking Up for Answers ... What Weather Balloons Tell Us About Greenhouse Warming," *World Climate Report*, November 20, 1995, page 2.

<sup>126</sup> Richard S. Lindzen, Ming-Dah Chou, and Arthur Y. Hou, "Does the Earth Have an Adaptive Infrared Iris?" *Bulletin of the American Meteorological Society*, Vol. 82, No. 3 (March 2001), pages 417-432.

## Skeptical Scientists

While they get less attention than a small number of media favorites at such politically motivated advocacy groups as the Union of Concerned Scientists, most scientists who have studied the matter do not believe human activities threaten to disrupt the Earth's climate. More than 17,000 scientists have signed a petition saying, in part, "there is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate."<sup>127</sup>

The petition is being circulated by the Oregon Institute of Science and Medicine, an independent research organization that receives no funding from industry. According to the organization's Web site, petition signers "include 2,660 physicists, geophysicists, climatologists, meteorologists, oceanographers, and environmental scientists ... especially well qualified to evaluate the effects of Greenhouse gas on the atmosphere and climate." The petition was written by Dr. Frederick Seitz, past president of the National Academy of Sciences and president emeritus of Rockefeller University.

The OISM petition is not the only evidence most scientists doubt global warming is a serious environmental problem. More than one hundred climate scientists signed the 1996 Leipzig Declaration, which stated in part, "there does not exist today a general scientific consensus about the importance of greenhouse warming from rising levels of carbon dioxide. On the contrary, most scientists now accept the fact that actual observations from Earth satellites show no climate warming whatsoever."<sup>128</sup>

"There is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate."

– Petition signed by more than 17,000 scientists

A survey of 36 state climatologists — scientists retained by state governments to monitor and research climate issues — conducted in September and October 1997 found that 58 percent disagreed with the statement, "global warming is for real," while only 36 percent agreed.<sup>129</sup> A remarkable 89 percent agreed "current science is unable to isolate and measure variations in global temperatures caused only by man-made factors."

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<sup>127</sup> Go to <http://www.oism.org/pproject> for the complete text of the petition and names and qualifications of the signers.

<sup>128</sup> Dr. S. Fred Singer, *Hot Talk, Cold Science: Global Warming's Unfinished Debate* (Oakland, CA: The Independent Institute, 1997), pages 40-43.

<sup>129</sup> American Viewpoint, "Survey of State & Regional Climatologists, September-October 1997, Annotated Questionnaire," October 1997, <http://www.cse.org/surveyenviroreg100897.htm>.

## What about the IPCC Reports?

The documents most often cited by those who claim global warming is a serious threat are a series of three reports released in 1990, 1995, and 2001 by the Intergovernmental Panel on Climate Change (IPCC). While these reports contain extensive amounts of valuable and credible science, their public policy implications have been misrepresented to policymakers and to the general public. Four considerations must be kept in mind when reviewing these reports:

(1) The IPCC is a commission composed of governments, not scientists. Government officials select the scientists who participate, most of whom are not active climate researchers. United Nations bureaucrats, not the scientists themselves, edit and publish the resulting documents, substantially altering the text *after* peer review.<sup>130</sup>

(2) The vast majority of scientists who contribute to the IPCC reports are not asked to endorse the chapters in which their names appear, much less the entire IPCC report. Many distinguished “skeptics” — scientists who do not believe global warming is a serious environmental problem — are listed as contributors to the IPCC reports.

Many distinguished “skeptics” — scientists who do not believe global warming is a serious environmental problem — are listed as contributors to the IPCC reports.

(3) The Summaries for Policymakers, which tend to be the only parts of the IPCC reports that are widely read and cited, are not written by scientists, are not submitted to the authors of the full reports for their approval, and tend to reflect the political agenda of UN bureaucrats rather than the underlying science contained in the reports.

(4) The reports themselves contain many references to the incomplete state of climate science, the flaws in computer models used to forecast climate change, and the absence of evidence in the historical record to validate the predictions of the computer models. Without the Summaries for Policymakers “spinning” the most frightening (and often least likely) scenarios, it is doubtful anyone would cite IPCC reports in support of government action to limit greenhouse gas emissions.

Of these considerations, the fourth is perhaps the least widely known and most objectively compelling. For example, here’s what *Climate Change 2001* has to say about the reliability of forecasts based on computer models of the global climate:

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<sup>130</sup> Dr. Frederick Seitz, who contributed to *Climate Change 1995*, said, “I have never witnessed a more disturbing corruption of the peer-review process than the events that led to this IPCC report.” *The Wall Street Journal*, June 12, 1996.

The Earth's atmosphere-ocean dynamics is [sic] chaotic: its evolution is sensitive to small perturbations in initial conditions. This sensitivity limits our ability to predict the detailed evolution of weather; inevitable errors and uncertainties in the starting conditions of a weather forecast amplify through the forecast (Palmer, 2000). As well as uncertainty in initial conditions, such predictions are also degraded by errors and uncertainties in our ability to represent accurately the significant climate processes. In practice, detailed weather prediction is limited to about two weeks.<sup>131</sup>

Even the scientists most prominently identified with the IPCC reports have attempted to distance themselves from the “spin” put on their work by environmental advocates and government bureaucrats. Dr. Benjamin Santer, lead author of the science chapter of *Climate Change 1995*, said, “It’s unfortunate that many people read the media hype before they read the chapter. ... I think the caveats are there. We say quite clearly that few scientists would say the attribution issue [i.e., whether climate change could be attributed to human actions] was a done deal.”<sup>132</sup> Similarly, Dr. Bert Bolin, then chairman of the IPCC, said in a June 2, 1997 debate, “the climate issue is not ‘settled’; it is both uncertain and incomplete.”<sup>133</sup>

“The climate issue is not ‘settled’; it is both uncertain and incomplete.”

– Dr. Bert Bolin

The National Academy of Sciences concluded in 1998, “the evidence of natural variations in the climate system — which was once assumed to be relatively stable — clearly reveals that climate has changed, is changing, and will continue to do so with or without anthropogenic influence.”<sup>134</sup> Similar concessions that the science of climate change is rapidly evolving and the dynamics of climate are only poorly understood can be found in all six studies of climate change produced by the National Academy of Sciences since 1998.<sup>135</sup>

Perhaps the briefest and most honest assessment of the science of climate change appeared in the introduction to a major feature report on advances in paleoclimatology in a recent issue of *Science* magazine:

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<sup>131</sup> *Climate Change 2001: The Scientific Basis*, introduction to Chapter 7. [http://www.grida.no/climate/ipcc\\_tar/wg1/265.htm](http://www.grida.no/climate/ipcc_tar/wg1/265.htm).

<sup>132</sup> Quoted in Richard Kerr, “Greenhouse Forecasting Still Cloudy,” *Science*, May 16, 1997, page 1040.

<sup>133</sup> Quoted in Jerry Taylor, “The Heated Rhetoric of Global Warming,” *This Just In*, Cato Institute, September 15, 1997.

<sup>134</sup> National Academy of Sciences, *Decade-to-Century-Scale Climate Variability and Change: A Science Strategy* (1998), summary.

<sup>135</sup> David E. Wojick, “The New View of Natural Climate Variation: Fundamental Climate Science Issues Raised in 6 Major National Academy of Sciences Studies,” January 2003.

Despite all we now know about past climates, we have only scratched the surface of what we need to understand before we can predict our climatic future.<sup>136</sup>

## Hardly Catastrophic

Even if the future were to bring a warmer world, experts have increasingly come to the conclusion that projected warming would be benign or even beneficial to the planet's plant and animal life.<sup>137</sup>

Experts have increasingly come to the conclusion that projected warming would be benign or even beneficial.

Dr. Patrick Michaels, research professor of environmental sciences at the University of Virginia, points out most of the warming would occur in winter near the poles, where the reduction in temperature extremes would be quite welcome.<sup>138</sup> Warming in other

regions of the world is occurring mostly at night and during the winter, and is reflected in rising lowest temperatures, rather than rising highest temperatures. Hundreds of scholars have demonstrated that a higher concentration of carbon dioxide in the atmosphere would be beneficial to forests and agriculture.<sup>139</sup>

Paul Georgia, an environmental policy analyst at the Competitive Enterprise Institute, observed in a May 2002 report that even if warming were to occur, mean surface temperatures were much higher during the Medieval Warm Period (roughly 800 to 1200 AD) than they are today. The warmer temperatures experienced during that period allowed the Vikings to settle presently inhospitable Greenland.<sup>140</sup>

Moreover, "The period of highest temperatures since the last Ice Age, from about 5000-3000 BC, is known as the 'climatic optimum,' a time when mankind began to build its first civilizations," observed James Plummer and Frances B. Smith in a study for Consumer Alert. "There is good reason to believe that a warmer climate would have a similar effect on the health and welfare of our own far more advanced and adaptable civilization today."<sup>141</sup>

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<sup>136</sup> Jesse Smith and Julia Uppenbring, "Earth's Variable Climatic Past," *Science*, Vol. 292, April 27, 2001, page 657.

<sup>137</sup> Patrick Michaels and Robert Balling, *The Satanic Gases: Clearing the Air about Global Warming* (Washington, DC: Cato Institute, 2000), page 177.

<sup>138</sup> *Ibid.*, page 137.

<sup>139</sup> S.H. Wittwer, *Food, Climate and Carbon Dioxide* (Boca Raton, FL: CRC Press, 1995).

<sup>140</sup> Paul Georgia, "Latest Global Warming Report Already Obsolete," Competitive Enterprise Institute, news release, May 16, 2001.

<sup>141</sup> James Plummer and Frances Smith, "Comments on EPA Air and Radiation Docket," May 23, 2001.

## Impact of Greenhouse Gas Reductions

The United States as a nation contributes about 25 percent of human-induced global greenhouse gas emissions. The average state contributes one-fiftieth (2 percent) of this amount, or one-half of 1 percent of mankind's planetary greenhouse gas emissions. (Obviously, populous states such as California produce more than this while less populated states such as North or South Dakota produce less.) Programs to reduce greenhouse gases can plausibly aim at no more than a 10 percent reduction in greenhouse gas emissions, and will typically achieve much less than this.

Simple arithmetic shows a typical state's successful effort to reduce greenhouse gas emissions would reduce anthropogenic planetary greenhouse gas emissions by just five one-hundredths of 1 percent, or 0.05 percent (.25 x .02 x .10). Even this assumes emissions won't increase in other states or countries, the "leakage" phenomenon described in Part 2. The unavoidable conclusion is that the effort by states to reduce greenhouse gas emissions is only a symbolic statement with no real-world effect at all.

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The futility of states acting alone runs parallel to the futility of developed countries attempting to reduce emissions without the participation of developing countries, as is envisioned by the Kyoto Protocol. Critics and supporters of the Kyoto Protocol agree that had it been adopted by the U.S. and other developed countries and fully implemented, its impact on the global climate would have been almost too small to observe. The same climate models that predict global warming also predict 94 percent of projected warming would occur even if Kyoto were fully implemented. The actual reduction in global temperature in the year 2100 would be a mere 0.14°C.<sup>142</sup>

But even if developing nations agreed to participate in a Kyoto-style global emissions control program, the physics of the global atmosphere would still frustrate the effort. The *concentration* of greenhouse gases in the atmosphere, not annual *emissions*, is the supposed trigger for global warming. It is the accumulation of greenhouse gases to twice their pre-industrial levels that some computer models project would cause the harms mentioned in the global warming literature. Carbon dioxide remains in the atmosphere for up to 100 years, and other greenhouse gases are even longer-lived. As a result, each year's additions are tiny compared to the total amount of greenhouse gases already in the atmosphere.

The long lives of greenhouse gases in the atmosphere mean emission reductions required to genuinely stabilize greenhouse gas concentrations in the atmosphere would be enormous. Bert Bolin, the former chairman of the IPCC, concluded in 1997 that "no reasonable future reductions

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<sup>142</sup> Thomas Wrigley, "The Kyoto Protocol: CO<sub>2</sub>, CH<sub>4</sub>, and Climate Implications," *Geophysical Research Letter*, Vol. 25, 1998, pages 2285-2288.

by Annex I countries would stabilize global emissions.”<sup>143</sup> In fact, greenhouse gas emissions from the developed world could be reduced to *zero* — no cars, no factories, no fossil fuel use for heating homes — and emissions from developing countries would still be enough to increase greenhouse gas concentrations.

Cuts in current emissions deep enough to matter are simply beyond our current ability, and there is nothing to be gained by *not* waiting until 2020 or 2040.

Another implication of climatic physics is anything we do now that affects greenhouse gas emissions will have no effect on global climate for many decades. Even reductions in emissions of 50 percent or 60 percent would not stabilize global temperatures until the twenty-second century.<sup>144</sup> William Cline, who opposes discounting and errs on the side of

exaggerating the future costs of climate change, nevertheless finds the annual costs of taking action to prevent warming exceed the benefits until at least 2060, and if the costs are assumed to be moderate, until 2150.<sup>145</sup>

Together, these facts mean it is foolish to reduce emissions today, rather than waiting for new technologies and greater societal wealth to reduce the real cost of making such reductions. Cuts in current emissions deep enough to matter are simply beyond our current ability, and there is nothing to be gained by *not* waiting until 2020 or 2040. Thomas Gale Moore summarizes the choice we face:

Even in the unlikely event that all countries around the world agreed to cap carbon dioxide emissions at levels that would prevent warming — some 50 percent or 60 percent below current emissions — the gain would be small or nonexistent while the cost would be staggering. If returning emissions to 1990 levels would cost the economy of the United States and the world somewhere around 2.5 to 3.5 percent of income, slashing emissions well below that would be catastrophic. Fortunately, since most people will benefit from a warmer globe, such steps are unnecessary.<sup>146</sup>

## The Sequestration Option

Instead of reducing emissions, it is possible to capture carbon dioxide and other greenhouse gases out of the air and store, or sequester, them in places where they cannot escape into the atmosphere. The vast forests, meadows, and farm fields of the U.S. may already sequester as

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<sup>143</sup> Quoted in Thomas Gale Moore, *supra* note 68, page 150.

<sup>144</sup> *Ibid.*, page 146.

<sup>145</sup> William R. Cline, *supra* note 38, page 280.

<sup>146</sup> Thomas Gale Moore, *supra* note 68, pages 150-151.

much or more carbon dioxide than all of the country's cars, trucks, factories, and utilities create, though scientists are still uncertain.<sup>147</sup> As Peter Huber recently wrote:

All in all, North America doesn't dump carbon dioxide into the air. It sucks the gas out. Bottom line: America's "terrestrial uptake" of carbon runs about 1.7 Pg per year, just ahead of our fossil fuel emissions. The rest of the world doesn't keep its carbon books in balance. But America does.<sup>148</sup>

Although current agricultural practices already sequester significant atmospheric carbon, practices targeted for their carbon-storing propensity could dramatically increase the amount of carbon stored by America's farmers. According to the U.S. Department of Agriculture, U.S. agriculture has the potential to sequester 154 million metric tons of carbon per year — nearly 10

According to the U.S. Department of Agriculture, U.S. agriculture has the potential to sequester 154 million metric tons of carbon per year — nearly 10 percent of total carbon dioxide emissions in the U.S.

percent of total carbon dioxide emissions in the U.S.<sup>149</sup> As noted by Richard Adams, Brian Hurd and John Reilly in *Climate Change: Science, Strategies, & Solutions*, "Growing carbon on agricultural lands would create a new crop for farmers."<sup>150</sup>

One of the most effective ways to sequester carbon is through no-till, low-till, and reduced tillage farming technologies. In addition to their sequestration benefits, such techniques have proven beneficial in terms of cost and yields. Nearly 20 percent of farmed acreage in the U.S. is now being farmed in this manner. Reduced-till techniques save labor, fuel, and machinery wear, while increasing tilth, organic content, and soil moisture. Such techniques virtually eliminate soil erosion and improve surface water quality by reducing runoff of agricultural chemicals. Air quality, too, is improved, as reduced-till techniques reduce dust and engine emissions. This method of farming also creates wildlife habitat for small animals that live in the plant waste that stays on the ground.

Changes in forest management can also increase the sequestration of carbon dioxide. The IPCC estimates newly planted and regrowing forests globally could sequester 197 to 584 mmtc

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<sup>147</sup> S. Fan et al., "A Large Terrestrial Carbon Sink in North America Implied by Atmospheric and Oceanic Carbon Dioxide Data and Models," *Science*, Vol. 282, October 16, 1998, pages 442-446.

<sup>148</sup> Peter Huber, *Hard Green: Saving the Environment from the Environmentalists* (New York, NY: Basic Books, 2000), page 110.

<sup>149</sup> Nebraska Department of Natural Resources, "Carbon Sequestration, Greenhouse Gas Emissions, and Nebraska Agriculture — Background and Potential," December 1, 2001, page 45.

<sup>150</sup> Richard M. Adams, Brian H. Hurd, and John Reilly, "Impacts on the U.S. Agricultural Sector," in Eileen Claussen, ed., *Climate Change: Science, Strategies, & Solutions* (Arlington, VA: Pew Center on Global Climate Change, 2001), pages 25-42.

per year.<sup>151</sup> Simply ending deforestation in Third World countries, according to the IPCC, would reduce carbon emissions by 1,788 mmt. Meeting the targets set by the Kyoto Protocol, by comparison, would require reducing carbon emissions by approximately 800 mmt per year, less than half as much.

Simply ending deforestation in Third World countries, according to the IPCC, would reduce carbon emissions by 1,788 mmt, more than twice the reduction developed nations would be required to make under the Kyoto Protocol.

Sequestration has a number of advantages over greenhouse gas reduction programs. Planting trees, ending deforestation, and changing farming practices all pay dividends in the form of pulp for paper production, timber for housing and other construction, habitat for wildlife, less erosion, and less run-off of fertilizers and pesticides into rivers and streams. Because sequestration efforts produce value, they are typically less expensive than switching fuels. Because they

can make a country or state a more enjoyable and healthy place to live, they do not slow economic growth or cause “leakage” to other countries or states without similar programs.

## The Adaptation Option

There is a temptation in the global warming debate to dismiss as being cold-hearted or short-sighted those who say “just let it happen” or “we’ll deal with it when it arrives.” In other contexts, such comments may reflect an attitude of carelessness or neglect for the effects of our conduct on those around us or who will follow us. Nevertheless, these comments may express the most scientifically sound strategy for coping with global warming.

Research presented earlier in this report indicates the economic impact of climate change is likely to be small — an *increase* in U.S. GDP of about 0.2 percent by 2060, and possibly a *loss* of between 1 and 2 percent of global GDP. Because the possible costs of global warming are only likely to be incurred several decades from now, we concluded earlier that it is more beneficial to current *and future* generations that money be invested today in activities that produce a higher rate of return than reducing greenhouse gas emissions. Such investments will help increase the wealth of our children and their children, so that when (and if) global warming occurs, they will have the wealth, infrastructure, and technology to *adapt* to it.

Adaptation has strong foundations in ecological science and human history. Change, not constancy, is the rule in ecological systems, and species that are able to adapt are the ones that survive and thrive. The ability to adapt to widely different and changing climates is one of the

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<sup>151</sup> Jocelyn Kaiser, “Panel Estimates Possible Carbon ‘Sinks’,” *Science*, Vol. 288, May 12, 2000, page 942.

most distinct features of mankind. Humanity's adaptation to changes in climate, sea levels, population pressures, natural resources, and physical and political limits is the stuff of history books. Adapting to a mildly warmer climate over the course of a century is hardly beyond our species' abilities.

Adaptation can take several forms:<sup>152</sup>

# *Improvement to infrastructure:* Improving sea walls, drainage systems, and sewage treatment systems and hardening buildings and public utilities against extreme weather can be done gradually and at modest cost as part of building and improvement plans already in place.

The ability to adapt to widely different and changing climates is one of the most distinct features of mankind.

# *Capacity building:* Acquiring the wealth, knowledge, and expertise to respond to new demands created by a changing climate. For example, the knowledge and wealth of people in The Netherlands has enabled them to reclaim thousands of acres of land from the ocean. A robust research program in biotechnology, agriculture, medicine, and engineering can similarly prepare future generations for climate changes.

# *Changes in land use allocation:* Land once used for one type of crop can be planted in another that is better suited to the climate. Buildings and factories located on vulnerable coastlines can gradually be abandoned as their useful lives come to an end, with new construction taking place further inland and on higher ground.

# *Improvements in food handling systems:* Increases of 50 percent or more in food supply can be attained simply by reducing losses due to insects and spoilage. Taking greater care in the handling of food crops can offset marginal losses in productivity that might be caused by changing weather.

# *Aquaculture:* Rising sea levels — one possible consequence of global warming — could create new opportunities for raising kelp, abalone, oysters, and a range of fish species.

Like sequestration, adaptation has advantages over reducing greenhouse gas emissions. All of the strategies described above involve only small investments to supplement spending that would have occurred anyway. Adaptation can take place over a long period of time, avoiding the risk of large investments made before new technologies emerge that could dramatically lower the cost. Each strategy produces benefits beyond its role in fighting the global warming threat, such as more durable and longer-lived infrastructure, safer food, and new economic opportunities.

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<sup>152</sup> Jesse H. Ausubel, "Mitigation and Adaptation for Climate Change: Answers and Questions," *The Bridge*, Vol. 23, No. 3 (Fall 1993). Also, see IPCC, *Climate Change 1995 — Economic and Social Dimensions of Climate Change*, pages 249-262, for a lackluster account of some of these options.

## Summary

A review of scientific research on the global warming issue leads us to the following conclusions:

- # There is no reliable evidence that global warming is occurring. The temperature record regularly referred to in media reports is inaccurate and contaminated by urban heat island effects.
  - # Most scientists do not believe human activities are threatening to disrupt the Earth's climate.
  - # The reports of the Intergovernmental Panel on Climate Change contain much valuable and credible information about climate change, but they have been misrepresented to policymakers and the general public. They do not “prove” anthropogenic greenhouse gases are disrupting the global climate.
- Most scientists do not believe human activities are threatening to disrupt the Earth's climate.
- # A small amount of warming, should it occur, would be beneficial to human health and prosperity, agriculture, and wildlife. Mankind has thrived in periods of the past when temperatures were warmer than those forecast for 2100 and beyond.
  - # State programs to reduce anthropogenic greenhouse gas emissions will have no measurable effect on the global climate for decades or even centuries to come. The problem is not greenhouse gas *emissions* but *concentrations*, which require massive reductions in emissions to change, and even then would change very slowly.
  - # Sequestration — absorbing carbon dioxide from the air and storing it where it cannot escape into the atmosphere — is a “win-win” strategy superior to reducing emissions.
  - # Adaptation — being prepared to change land use and other activities should climate change occur — is also superior to attempting to reduce emissions.

## PART 4

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# Recommendations to Policymakers

Although many states are experimenting with programs to reduce greenhouse gas emissions from their state's businesses and residents, such efforts are not rooted in sound economics or science. Costs for all but a few programs far exceed whatever benefits may result. The science behind the global warming issue is very much in dispute, and it is not likely to be resolved in the direction of those who claim human activities pose a serious threat to the Earth's climate.

There are alternatives to reducing greenhouse gas emissions that avoid the pitfalls of those efforts. State policymakers should repeal existing laws and programs that discourage energy conservation, and adopt measures that encourage sequestration and adaptation.

### Repeal existing laws and programs

Antiquated standards, building codes, and zoning ordinances often stand in the way of energy efficiency and reduced greenhouse gas emissions. The cement industry, for example, could reduce the volume of carbon dioxide released into the atmosphere by between 5 and 15 million tons per year by substituting fly ash for about 5 percent of the Portland cement it uses.<sup>153</sup> The industry doesn't do so because, legally, it cannot: In the U.S., the Standard Specification for Portland Cement (ASTM C150) does not allow any ingredients in cement except clinker, calcium sulfate, and very small amounts of processing additives. Other countries allow and even encourage substitution.

In many parts of the country, obsolete or overly specific building codes prohibit the use of building designs, such as geodesic domes, that conserve construction material and reduce heating requirements. Zoning ordinances often prohibit solar panels for hot water or electric power generation, multiple land uses that would reduce the distance traveled to work or a grocery store, and running small businesses out of private homes.

Command-and-control environmental regulations often stymie the development and use of the lowest-cost emissions control technology.

Command-and-control environmental regulations often stymie the development and use of the lowest-cost emissions control technology. The research by T.H. Tietenberg, cited earlier, found that the cost of complying with federal air quality regulations was as much as 22 times the cost of the least-cost alternative. An experiment conducted in 1992 by Amoco Corp. and EPA found giving managers at a refinery in Yorktown, Virginia the flexibility to reduce emissions in

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<sup>153</sup> Gary Sauer, "Cement, Concrete and Greenhouse Gas," presentation to the Council of Great Lakes Industries Second Roundtable on North American Energy Policy, April 1997. Available from the authors.

the most efficient way, rather than follow the regulatory rule book, achieved “equivalent levels of protection ... at 25 percent of the cost of current regulatory programs.”<sup>154</sup> Nationwide, billions of dollars wasted on complying with government rules and regulations could be put to work actually reducing emissions.

Nationwide, billions of dollars wasted on complying with government rules and regulations could be put to work actually reducing emissions.

Public policies also interfere with the design, siting, and operation of nuclear power plants. Utilities in other countries are able to build and operate nuclear power plants much less expensively than in the U.S., and the process for siting such facilities is insulated from the political process.<sup>155</sup> It is long past

time for political leaders to resolve the issue of where to store nuclear waste.

Other examples of misguided public policies include the failure to adopt congestion-based pricing of highways (congestion can be responsible for 30 percent of auto emissions)<sup>156</sup>; charging a flat fee for collecting household garbage rather than charging by the bag (the latter reduces household solid waste tonnage by 25 percent or more)<sup>157</sup>; and mandatory recycling legislation, which increases air pollution emissions from collection activities and can discourage the use of energy-efficient packaging material.<sup>158</sup>

## Encourage Sequestration and Adaptation

Sequestration of greenhouse gases and investing in gradual adaptation, rather than futile efforts at prevention, can be cost effective and politically popular. Both involve much lower costs than reducing greenhouse gas emissions, produce benefits besides their role in fighting global warming, and are largely unaffected by “leakage” and other problems that affect emission reduction efforts.

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<sup>154</sup> Bradley I. Raffle and Debra F. Mitchell, *Effective Environmental Strategies: Opportunities for Innovation and Flexibility Under Federal Environmental Laws*, Amoco Corp., June 1993.

<sup>155</sup> Ben Bolch and Harold Lyons, *Apocalypse Not: Science, Economics, and Environmentalism* (Washington, DC: Cato Institute, 1993), page 114.

<sup>156</sup> See Kenneth A. Small, “Using the Revenues from Congestion Pricing: A Southern California Case Study,” *Policy Insight*, Reason Foundation, September 1992; Robert W. Poole, Jr., “Introducing Congestion Pricing on a New Toll Road,” *Policy Insight*, September 1992.

<sup>157</sup> See Lisa A. Skumatz, “Variable Rates for Municipal Solid Waste: Implementation, Experience, Economics, and Legislation,” *Policy Study* No. 160 (June 1993), Reason Foundation.

<sup>158</sup> Kenneth Chilton, “Solid Waste Policy Should Be Directed By Fundamental Principles, Not Ill-Founded Feelings,” *Resources, Conservation and Recycling*, No. 8 (1993), pages 1-20; Harvey Alter, “The Origins of Municipal Solid Waste: The Relations Between Residues from Packaging Materials and Food,” *Waste Management & Research*, No. 7 (1989), pages 103-114.

It is a fortuitous coincidence that low-till techniques help farmers reduce costs and manage their land for long-run productivity as well as increase the capacity of soil to contain carbon. Policymakers should not offer to subsidize farmers who use low-till techniques because the market is already rewarding those that do. However, states can assist by including the latest research and tips on low-till techniques in their seminars and other agricultural programs. Where appropriate, farmers who use these techniques should get credit for the beneficial effects on neighboring streams.

Like farming, forestry can play a much bigger role in battling global warming by adopting techniques that comply with the requirements of good forestry. The rise in influence of anti-logging groups during the past several decades has dramatically reduced the amount of logging on public lands, resulting in a greater fire hazards and more forest fires. In addition to harming wildlife and recreational opportunities and destroying valuable stands of timber, forest fires release hundreds of millions of tons of carbon each year.

It is a fortuitous coincidence that low-till techniques help farmers reduce costs and manage their land for long-run productivity as well as increase the capacity of soil to contain carbon.

States with significant forestry industries ought to do what they can to restore prudent and ecologically sound logging practices to their forests and woodlands. Harvesting stands of mature trees for lumber or paper production removes potential fire threats and allows younger trees, which absorb more carbon dioxide as they grow than do mature trees, to take their place. And, of course, a healthy lumber industry creates jobs and supports rural communities.

Finally, the public is prepared to accept the need to adapt to climate change by making carefully targeted investments where they are needed. For example, higher sea levels, should they occur, could be addressed by modest improvements to dikes and seawalls in some areas, and by relocating homes and businesses in other areas. This cost — spread out over the course of a century — would be a small fraction of the cost of attempting to prevent climate change through energy taxes or emission caps. Making infrastructure stronger and more efficient is often the right thing to do regardless of climate considerations.

## **Conclusion**

A majority of states have already implemented greenhouse gas reduction programs, and some states explicitly cap greenhouse emissions in a fashion similar to what would have been required by the Kyoto Protocol. Many state legislatures in the 2003 session will consider new efforts to reduce greenhouse gas emissions.

All efforts to cap or reduce emissions will impose considerable expenses on taxpayers and businesses. In addition to direct expenses required to fund the programs, higher energy prices and cumbersome regulations imperil the economic well-being of states. State efforts to reduce carbon dioxide and other greenhouse gas emissions would cost millions of workers their jobs and cost state treasuries billions of dollars in direct expenditures and billions more in lost revenues.

The emerging consensus among scientists is that global climate change is a natural phenomenon, probably not affected by human action. To the extent it occurs at all, global warming would be beneficial to plant and animal life. Attempting to “stop global warming” by reducing greenhouse gas emissions — even efforts as ambitious as the international Kyoto Protocol, and certainly programs adopted by the individual states in the U.S. — would have virtually no effect on global temperatures.

The alternative to reducing greenhouse gas emissions is not to do nothing.

The alternative to reducing greenhouse gas emissions is not to do nothing. States can repeal existing laws and programs that stand in the way of greater energy efficiency and lower emissions. They can encourage projects

that sequester carbon dioxide and facilitate a safe and cost-effective adaptation to possible climate changes. This “win-win” strategy is a comprehensive alternative that promises results far superior to the emission reduction strategy.

# Appendix 1

## State Bills in the 2001-2002 Session

<b>State Bills in the 2001-2002 Session Seeking to Reduce Greenhouse Gas Emissions</b>		
<b>State</b>	<b>Bill</b>	<b>Summary</b>
California	AB 1058	Requires Air Resources Board to identify and implement maximum feasible carbon dioxide emissions from automobiles and light-duty trucks. Failed to pass, but substantially reemerged in AB 1493.
	AB 1493	Requires Air Resources Board to identify and implement maximum feasible carbon dioxide emissions from non-commercial vehicles. Signed into law.
	AB 2650	Prohibits trucks from idling engines more than 30 minutes at California ports. Signed into law.
	ABX 10075	Creates power plan emission standards for carbon dioxide. Language amended out in March 2001.
	SB 527	Authorizes Air Resources Board to issue administrative penalties for air pollution violations. Mandates California's Climate Action Registry to include listings for greenhouse gases. Signed into law.
	SB 532	Creates trading system for renewable energy credits. Failed to pass.
	SB 812	Mandates California's Climate Action Registry to provide referral advice regarding carbon sequestration projects. Establishes uniform reporting rules to facilitate carbon reduction credits in any future regulatory regime. Signed into law.
	SB 1038	Requires 17 percent of energy production from publicly owned utilities must be from renewable sources.. Signed into law.
Florida	SB 2472	Directs CO2 power plant emissions be capped at 1990 levels by 2007, and also caps other emissions. Language substituted out in March 2001.
Hawaii	HB 2210	Requires state agencies to slash greenhouse gas emissions to 30 percent below 1990 levels. Reductions must be met by 2012. Failed to pass, but similar bill SB 2179 signed into law.
	HB 2513	Establishes carbon tax on power plants to fund CO2 Emissions Reduction Special Fund. Encourages a broad scope of greenhouse gas reduction programs. Failed to pass.
	HCR 179	Requests Department of Health to develop action plan for reducing CO2 emissions. Died on adjournment.
	SB 2179	Requires state agencies to slash greenhouse gas emissions to 30 percent below 1990 levels. Reductions must be met by 2012. Signed into law.
	SB 2771	Establishes carbon tax on power plants to fund CO2 Emissions Reduction Special Fund. Encourages a broad scope of greenhouse gas reduction programs. Failed to pass.
	SCR 96	Requests Department of Health to develop action plan for reducing CO2 emissions. Died on adjournment.
Idaho	SB 1379	Creates Carbon Sequestration Advisory Committee to guide implementation of a carbon trading system and a carbon sequestration fund. Signed into law.
Illinois	HB 63	Creates new state goals for renewable energy. Failed to pass.
	HB 842	Creates Carbon Sequestration Study Act. Signed into law.
	HB 885	Caps annual CO2 emissions from fossil fuel power plants as part of multi-pollutant law. Failed to pass.

**State Bills in the 2001-2002 Session  
Seeking to Reduce Greenhouse Gas Emissions**

State	Bill	Summary
	SB 372	Limits annual CO2 emissions from fossil fuel power plants as part of multi-pollutant law. Signed into law.
Louisiana	HCR 33	Creates Global Climate Change Policy Commission to study voluntary greenhouse gas reduction programs. Failed to pass.
	SCR 14	Creates a commission to evaluate and coordinate state policy options to mitigate the projected impact of climate change. Signed into law.
Maine	HP 78	Creates voluntary greenhouse gas emission registry. Signed into law.
	HP 1066	Creates voluntary greenhouse gas emission registry. Directs Department of Environmental Protection to study warming consequences for Maine. Signed into law.
Maryland	Exec Order 2	Creates agency to develop plan for reducing greenhouse gas emissions at state facilities. Signed into law.
	HB 334	Requires state agencies and legislative panel to study and report on reducing greenhouse gases and establishing a registry. Withdrawn March 2002.
	HB 1066	Creates task force to study climate change and recommend mitigation strategies. Establishes CO2 registry. Failed to pass.
Massachusetts	301 CMR 7.29	Caps NOx, SO2, Hg, and CO2 emissions. Defines sequestration activities taking place with pilot projects. Announced April 2002 by state Department of Environmental Regulation.
	HB 2211	Directs efforts to coordinate greenhouse gas reduction strategies with other New England states. Failed to pass.
	HB 3649	Creates excise tax based on vehicle fuel efficiency. Died on adjournment.
	SB 2319	Established a grant program for climate change mitigation for communities that complete an emissions inventory and establish an emissions reduction plan. Signed into law.
Michigan	HB 6474	Requires that 15 percent of total energy sold by 2012 must be from renewable sources. Died on adjournment.
	SB 693	Caps CO2 emissions as part of multi-pollutant program. Failed to pass.
Minnesota	HF 3144	Caps power plant CO2 emissions. Failed to pass.
	SF 3078	Caps power plant CO2 emissions. Failed to pass.
	SF 3431	Requires Public Utilities Commission to take into account greenhouse gas emission reductions as a factor in evaluating power project bids. Amended out before final passage.
Nebraska	LR 390	Directs Agricultural Committee to analyze carbon sequestration recommendations. Failed to pass.
New Hampshire	HB 284	Creates cap and trade system for CO2 and other emissions from electric generation plants. Signed into law.
New Jersey	AB 1628	Requires pollution disclosure on utility customer bills. Taxes energy produced in violation of air quality standards. Failed to pass.
New York	AB 431	Creates CO2 cap and trade system. Increases investments in renewable energy. Failed to pass.
	AB 5577	Creates CO2 cap and trade system. Failed to pass.
	AB 10363	Creates CO2 cap and trade system. Failed to pass.

**State Bills in the 2001-2002 Session  
Seeking to Reduce Greenhouse Gas Emissions**

State	Bill	Summary
	AB 11895	Requires state to adopt California-style greenhouse gas and CO2 emission standards for vehicles manufactured after 2009. Died in rules committee.
	SB 4790	Establishes council to make greenhouse gas reduction recommendations. Failed to pass.
	SB 5115	Creates CO2 cap and trade system as part of multi-pollutant program. Failed to pass.
	SB 7296	Creates CO2 cap and trade system as part of multi-pollutant program. Failed to pass.
North Carolina	HB 1015	Directs state agency to study greenhouse gas reduction options. Failed to pass.
	SB 1078	Directs state agency to study greenhouse gas reduction options. Signed into law.
North Dakota	4043	Directs legislature to study desirability of promoting sequestration programs. Signed into law.
Oklahoma	HB 1192	Establishes Carbon Sequestration Act Advisory Committee and related cash fund. Signed into law.
Oregon	HB 2200	Requires state forester to develop a forestry carbon offset system for registration, transfer, or sale of forestry carbon assets. Signed into law.
Pennsylvania	HB 2489	Directs \$250,000 toward study on greenhouse gas emission reduction strategies. Failed to pass. However, same as SB 5, signed into law.
	HR 200	Requires state agencies to inventory their greenhouse gases and plan to reduce emissions. Failed to pass.
	SB 5	Directs \$250,000 toward study on greenhouse gas emission reduction strategies. Signed into law.
	SB 553	Requires electric companies to track CO2 emission characteristics as part of multi-pollutant program. Failed to pass.
Rhode Island	HB 7127	Directs state to charge a fee on non-fuel efficient vehicles each time vehicle is registered. Died on adjournment.
	HB 7543	Directs Department of Environmental Management to develop plans for fossil fuel and greenhouse gas emission reductions; would exempt from taxation alternative energy equipment. Died on adjournment.
	SB 2485	Directs state to charge a fee on non-fuel efficient vehicles each time vehicle is registered. Died on adjournment.
Vermont	SJR 73	Launches Greenhouse Gas Action Plan to pursue all means of reducing greenhouse gas emissions. Failed to pass.
Washington	HB 1921	Creates committee to study climate change, mitigation strategies, and economic competitiveness. Failed to pass.
	HB 1922	Recommends caps and eventual total elimination of greenhouse gas emissions. Failed to pass.
	HB 2326	Creates agency to study climate change. Partially enacted into law.
	HB 2327	Requires energy facilities to mitigate all greenhouse gas emissions at market cost as condition for new site certification application. Failed to pass.
	SB 5530	Recommends caps and eventual total elimination of greenhouse gas emissions. Failed to pass.
	SB 5674	Creates committee to study CO2 mitigation strategies. Failed to pass.
	SB 5912	Facilitates siting of new power plants that commit to CO2 targets. Failed to pass.

**State Bills in the 2001-2002 Session  
Seeking to Reduce Greenhouse Gas Emissions**

<b>State</b>	<b>Bill</b>	<b>Summary</b>
	SB 6718	Requires state government to conduct its business with no net increase in greenhouse gas emissions from 2000. Died on adjournment.
Wisconsin	AB 860	Caps CO2 as part of multi-pollutant program. Failed to pass.
	SB 456	Caps CO2 as part of multi-pollutant program. Failed to pass.
Wyoming	HB 47	Creates carbon sequestration advisory committee. Signed into law.
	HB 129	Directs funds to catalog carbon storage activities. Enacted into law.

Source: American Legislative Exchange Council, "CO2 Suppression: State Legislature Tracking," 2001-2002 Legislative Session, updated January 15, 2002.

## Appendix 2

# Questionable Legal Status of Interstate Compacts

One way states can avoid causing businesses and residents to move to states with lower energy prices or less cumbersome regulations is to negotiate pacts with other states to adopt similar greenhouse gas reduction policies. Such initiatives, however, run afoul of the U.S. Constitution and federal law. Article 1, Section 10 of the Constitution states “No State shall enter into any Treaty, Alliance or Confederation ... No State shall, without the Consent of Congress ... enter into any Agreement or Compact with another State, or with a foreign Power. ...”

The New England/Canadian provinces pact clearly runs afoul of the Constitution by seeking to implement the Kyoto Protocol despite the decisions by two Presidents not to submit the treaty to the U.S. Senate for approval. Not only has the Senate failed to ratify the Protocol, but a Senate resolution opposing the treaty was adopted in 1997 by a vote of 95-0.

According to Jon Reisman, associate professor of economics and public policy at the University of Maine at Machias, “There is settled precedent supporting the position that the NEG/ECP climate agreement violates the U.S. Constitution.”<sup>159</sup>

Reisman points to *Holmes v. Jennison*, in which Chief Justice Taney emphasized the broad intent underlying Article I, Section 10 of the Constitution:

As these words (‘agreement or compact’) could not have been idly or superfluously used by the framers of the Constitution, they cannot be construed to mean the same thing with the word treaty. They evidently mean something more, and were designed to make the prohibition more comprehensive. ... The word ‘agreement’ does not necessarily import and direct any express stipulation; nor is it necessary that it should be in writing. ...

And the use of all of these terms, ‘treaty,’ ‘agreement,’ ‘compact,’ show that it was the intention of the framers of the Constitution to use the broadest and most comprehensive terms; and that they anxiously desired to cut off all connection or communication between a State and a foreign power; and we shall fail to execute that evident intention, unless we give to the word ‘agreement’ its most extended signification; and so apply it as to prohibit every agreement, written or verbal, formal or informal, positive or implied, by the mutual understanding of the parties.” 14 Pet. (39 U.S.) 540, 570-572 (1840).

State elected and appointed officials would be well-advised, then, to avoid entering into multi-state “pacts” and similar schemes that may open the state to expensive litigation and probable defeat in court.

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<sup>159</sup> Statement for the Record of the Joint Committee Hearing on U.S. Environmental Treaties, July 24, 2002.

## Appendix 3

### Cost of State Greenhouse Gas Programs (to reduce emissions to 1990 levels)

State	(A) Reduction required to reach 1990 (mmtce)	(B) Minimum direct cost to state government (\$ millions)	(C) Minimum direct and indirect cost to state government (\$ millions)	(D) Cost to state consumers and businesses of nat'l program (\$ millions)	(E) Cost to state consumers and businesses of state program (\$ millions)	(F) 2001 State government revenues (\$ millions)	(G) Direct cost as percent of 2001 state revenues	(H) Direct and indirect cost as percent of 2001 state revenues	(I) # of households (millions)	(J) National program cost per household	(K) State program cost per household
Alabama	7.88	\$433	---	\$1,182	\$11,820	\$5,180	8.4%	---	1.74	\$679	\$6,793
California	28.35	\$1,559	---	\$4,253	\$42,525	\$71,430	2.2%	---	11.50	\$370	\$3,698
Colorado	0.86	\$47	---	\$129	\$1,290	\$6,720	0.7%	---	1.66	\$78	\$777
Connecticut	2.79	\$153	---	\$419	\$4,185	\$11,990	1.3%	---	1.30	\$322	\$3,219
Delaware	1.05	\$58	---	\$158	\$1,575	\$2,330	2.5%	---	0.30	\$525	\$5,250
Florida	13.06	\$718	---	\$1,959	\$19,590	---	??	---	6.34	\$309	\$3,090
Georgia	9.86	\$542	---	\$1,479	\$14,790	\$15,310	3.5%	---	3.00	\$493	\$4,930
Hawaii	0.98	\$54	---	\$147	\$1,470	\$3,440	1.6%	---	0.40	\$368	\$3,675
Illinois	16.17	\$889	---	\$2,426	\$24,255	\$24,100	3.7%	---	4.59	\$528	\$5,284
Indiana	14.99	\$824	---	\$2,249	\$22,485	\$9,270	8.9%	---	2.33	\$965	\$9,650
Iowa	4.16	\$229	---	\$624	\$6,240	\$4,650	4.9%	---	1.15	\$543	\$5,426
Kansas	5.09	\$280	---	\$764	\$7,635	\$4,410	6.3%	---	1.04	\$734	\$7,341
Kentucky	8.66	\$476	---	\$1,299	\$12,990	\$6,760	7.0%	---	1.59	\$817	\$8,170
Louisiana	15.21	\$837	---	\$2,282	\$22,815	\$6,530	12.8%	---	1.66	\$1,374	\$13,744
Maine	1.13	\$62	---	\$169	\$1,695	\$2,350	2.6%	---	0.52	\$326	\$3,260
Maryland	4.62	\$254	---	\$693	\$6,930	\$9,800	2.6%	---	1.98	\$350	\$3,500
Massachusetts	5.31	\$292	---	\$796	\$7,965	\$22,870	1.3%	---	2.44	\$326	\$3,264
Minnesota	5.50	\$303	---	\$825	\$8,250	\$12,150	2.5%	---	1.89	\$437	\$4,365
Mississippi	6.14	\$338	---	\$921	\$9,210	\$3,440	9.8%	---	1.05	\$877	\$8,771
Missouri	7.17	\$394	---	\$1,076	\$10,755	\$7,670	5.1%	---	2.19	\$491	\$4,911

State	(A) Reduction required to reach 1990 (mmtce)	(B) Minimum direct cost to state government (\$ millions)	(C) Minimum direct and indirect cost to state government (\$ millions)	(D) Cost to state consumers and businesses of nat'l program (\$ millions)	(E) Cost to state consumers and businesses of state program (\$ millions)	(F) 2001 State government revenues (\$ millions)	(G) Direct cost as percent of 2001 state revenues	(H) Direct and indirect cost as percent of 2001 state revenues	(I) # of households (millions)	(J) National program cost per household	(K) State program cost per household
Montana	1.00	\$55	---	\$150	\$1,500	\$1,270	4.3%	---	0.36	\$417	\$4,167
Nevada	2.18	\$120	---	\$327	\$3,270	\$1,730	6.9%	---	0.75	\$436	\$4,360
New Hampshire	0.76	\$42	---	\$114	\$1,140	\$1,140	3.7%	---	0.47	\$243	\$2,426
New Jersey	8.63	\$475	---	\$1,295	\$12,945	\$20,980	2.3%	---	3.06	\$423	\$4,230
New Mexico	3.96	\$218	---	\$594	\$5,940	\$3,990	5.5%	---	0.68	\$874	\$8,735
New York	18.51	\$1,018	---	\$2,777	\$27,765	\$39,880	2.6%	---	7.06	\$393	\$3,933
North Carolina	7.80	\$429	---	\$1,170	\$11,700	\$13,390	3.2%	---	3.13	\$374	\$3,738
Ohio	21.74	\$1,196	---	\$3,261	\$32,610	\$21,300	5.6%	---	4.45	\$733	\$7,328
Oregon	4.87	\$268	---	\$731	\$7,305	\$5,240	5.1%	---	1.33	\$549	\$5,492
Pennsylvania	18.59	\$1,022	---	\$2,789	\$27,885	\$19,440	5.3%	---	4.78	\$583	\$5,834
Rhode Island	0.64	\$35	---	\$96	\$960	\$2,530	1.4%	---	0.41	\$234	\$2,341
Tennessee	7.12	\$392	---	\$1,068	\$10,680	\$7,160	5.5%	---	2.23	\$479	\$4,789
Utah	4.13	\$227	---	\$620	\$6,195	\$3,620	6.3%	---	0.70	\$885	\$8,850
Vermont	0.51	\$28	---	\$77	\$765	\$900	3.1%	---	0.24	\$319	\$3,188
Virginia	7.14	\$393	---	\$1,071	\$10,710	\$11,840	3.3%	---	2.70	\$397	\$3,967
Washington	4.16	\$229	---	\$624	\$6,240	\$10,830	2.1%	---	2.27	\$275	\$2,749
Wisconsin	6.63	\$365	---	\$995	\$9,945	\$10,290	3.5%	---	2.08	\$478	\$4,781
Totals	277.35	\$15,254	---	\$41,602	\$416,025	\$407,931	---	---	---	\$19,003	\$190,027
<b>Mean Average</b>	<b>7.50</b>	<b>\$412</b>	<b>---</b>	<b>\$1,124</b>	<b>\$11,244</b>	<b>\$11,331</b>	<b>4.8%</b>	<b>---</b>	<b>---</b>	<b>\$514</b>	<b>\$5,136</b>

Sources: (A) Number of tons to be reduced taken from Table 4 and EPA "State Greenhouse Gas Inventories." (B) Number of tons in column (a) x \$55, the cost of New Jersey's comprehensive greenhouse gas program. (C) WEFA did not calculate possible revenue loss for this scenario. (D) Number of tons in column (a) x \$150, the lowest cost estimate by DRI, WEFA, and EIA for reducing emissions to 1990 levels; (E) Column (d) times 10. (F) National Association of State Budget Officers, *The Fiscal Survey of States*, November 2002, Table A1, "Fiscal 2001 State General Fund, Actual (millions)." (G) Column (b) divided by column (f). (H) Cannot be calculated since WEFA did not estimate loss of state revenues for this scenario. (I) *Statistical Abstract of the U.S. 2001*, Table 56, "Households - States: 2000". (J) Column (d) divided by column (i). (K) Column (e) divided by column (i).

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