Global Warming and New England

Progress, Opportunities and Challenges After Two Years of the Regional Climate Change Action Plan

NEW ENGLAND CLIMATE COALITION

September 2003

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The New England Climate Coalition (NECC) is a coalition of state and local environmental, public health, municipal and religious organizations concerned about the effects of global warming. NECC supports reductions in emissions of global warming gases sufficient to protect the region's environment and economy from the dangers posed by global warming.

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Acknowledgments

The author thanks Rob Sargent of the state PIRGs for his leadership and guidance in crafting this report and Frank Gorke of MASSPIRG for coordinating the project. Thanks also to Susan Rakov and Jasmine Vasavada of the state PIRGs and Brooke Suter of Clean Water Action for their editorial assistance, and MASSPIRG legal intern Oliver Hall for his research assistance. Sincere thanks to Jenny Weeks of Northeast States for Coordinated Air Use Management (NESCAUM), Michael Stoddard of Environment Northeast, Adam Markham of Clean Air-Cool Planet, and Katherine Morrison of U.S. PIRG for providing editorial review.

The New England Climate Coalition thanks the Jessie B. Cox Charitable Trust, the Energy Foundation, the John Merck Fund, the Pew Charitable Trusts and the Rockefeller Brothers Fund for their generous financial support of this project.

The author alone bears responsibility for any factual errors. The recommendations are those of the New England Climate Coalition. The views expressed in this report are those of the author and do not necessarily reflect the views of our funders or those who provided editorial review.

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Design and Layout: Kathleen Krushas, To the Point Publications

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Executive Summary

New England has a long way to go to meet regional goals for reducing emissions of global warming gases set forth in a landmark agreement two years ago.

Global warming gases – such as the carbon dioxide that is released to the atmosphere from the burning of fossil fuels – blanket the Earth, trapping the sun's heat, causing global temperatures to rise, and threatening New England's future environmental and economic stability.

By implementing proven techniques to increase the energy efficiency of our homes, cars and workplaces, and by taking advantage of clean, renewable sources of energy such as solar and wind power, New England could reduce its emissions of global warming gases while at the same time reducing its dependence on imported fossil fuels.

The 2001 regional Climate Change Action Plan – signed by the governors of the six New England states and the premiers of the eastern Canadian provinces – put the region on course to this cleaner future. In the two years since the agreement was adopted, several New England states have begun to plan for how they will meet the plan's overall emission reduction goals. Meanwhile, regional leaders have endorsed a series of "action items" that set goals for the reduction of global warming emissions from specific sectors of the economy.

An analysis of those commitments shows that, despite many promising initiatives, regional and state leaders have a great deal more work to do to meet the short-, medium-, and long-term goals of the Climate Change Action Plan.

Global warming emissions in New England have risen sharply over the last decade and will likely continue to rise without concerted action – threatening serious harm to New England's health and economy.

- Emissions of carbon dioxide (the leading cause of global warming) from energy use in New England increased by about 13 percent between 1990 and 2000, according to energy consumption data collected by the federal government.
- Future increases in energy use projected by the U.S. Department of Energy could lead to a further 13 percent increase in carbon dioxide emissions by 2010 and a 24 percent increase over 2000 levels by 2020 if no additional steps are taken to reduce emissions.
- Scientists believe that, at current rates of growth in global warming emissions, New England could experience severe impacts from global warming in the foreseeable future. Average temperatures in New England have already increased by 0.7° F over the last century, and further increases of 6° F to 10° F are possible over the next century. Such an increase could cause the annual average temperature in Boston a century from now to approach that of Atlanta, Georgia today – causing sea-level rise, shifts in species distribution and public health threats while jeopardizing such cornerstones of the New England economy as maple syrup production, fall foliage-related tourism and skiing.

Regional commitments made to date, if implemented, would significantly reduce global warming emissions in New England, but not to the extent called for by the regional Climate Change Action Plan.

- The regional Climate Change Action Plan calls for reducing global warming emissions in New England to 1990 levels by 2010 and to 10 percent below 1990 levels by 2020. In the long run, the plan commits to reducing emissions by the 75 to 85 percent necessary to eliminate any dangerous threat to the climate. Achieving the short-term goal will require approximately a 22 percent reduction in emissions from projected levels by 2010, while meeting the medium-term goal will require a 36 percent reduction from projected levels by 2020.
- Promised reductions in emissions from the transportation, electricity generation and public sectors, and from increased conservation efforts, would reduce carbon dioxide emissions in the region by 6 percent below projected levels by 2010 and 16 percent below projected levels by 2020.

- *In other words, the regional commitments made to date will bring the region less than one-third of the way to achieving its short-term global warming emission reduction goals and less than half the way to achieving its medium-term goals. The commitments also will not position New England to make the long-term emission reductions scientists believe will be needed to forestall global warming.*

The New England states and the region as a whole have begun to lay the groundwork for further reductions in emissions, but more work remains to be done.

- Of the six New England states, only Rhode Island has thus far issued a state climate change action plan that estimates needed emission reductions, recommends policy options to achieve the state's goals, and sets forth a process for working toward implementation of those policies. Connecticut and Massachusetts are currently drafting state plans to reduce global warming emissions and Maine has pledged to issue a plan within the next year. New Hampshire and Vermont currently possess plans that are either out-of date or insufficiently detailed to provide much guidance in achieving the goals.

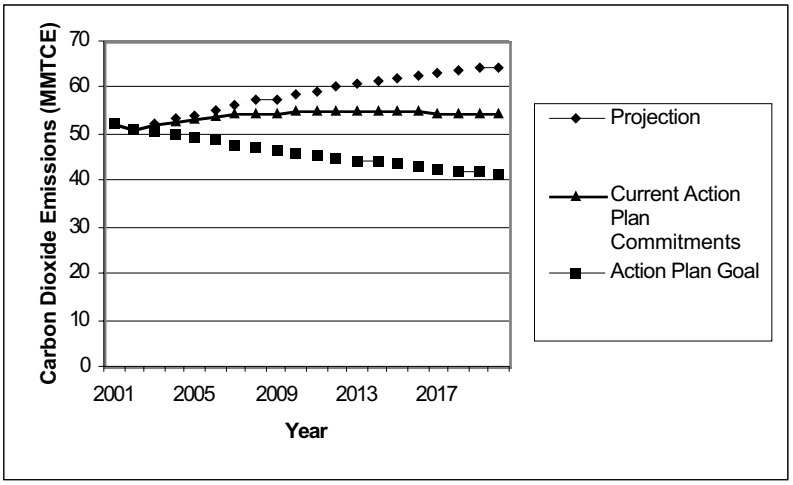
- Efforts to update global warming emission inventories (which track total emissions in the region) and create emission registries (which enable companies and other entities to establish baseline emission levels, allowing for possible crediting under future emission-reduction programs) are proceeding, but the process must continue to give states the tools they need to bring about significant short-term reductions in global warming emissions.

The adoption of strong guiding principles and strong policies for the reduction of global warming emissions could bring the goals of the Climate Change Action Plan within reach.

- Studies by the Tellus Institute and Northeast States for Coordinated Air Use Management (NESCAUM) have both shown that the short-term goal of the Action Plan is achievable with the right mix of public policies.

More than 100 organizations throughout New England have endorsed a set of ten action principles to reduce global warming emissions in the region (see page 32). Among the key principles are:

Fig. ES-1. New England Carbon Dioxide Emissions from Energy Use with Action Plan Commitments



- **Each sector of the economy should be responsible for at least its proportionate share of global warming emission reductions.** This means that state and regional leaders should impose concrete goals for reducing emissions from all sectors, including the transportation sector – the largest source of global warming emissions in the region. States should consider policies such as zero-emission vehicle programs, financial incentives for the purchase of more energy-efficient vehicles, curtailing suburban "sprawl," and expanding public transit and other transportation alternatives, which can lead to significant reductions in transportation-sector emissions.

- **Regional leaders should commit to significant reductions in emissions from the electricity generating sector.** The electricity sector is the region's second-largest source of global warming emissions. Maine, Massachusetts and New Hampshire have adopted policies to limit carbon dioxide emissions from older power plants, while Connecticut and Massachusetts require the generation of increasing amounts of power from clean renewable sources. All states in the region should follow their lead, adopt similar policies, and strengthen their existing policies. In addition, all states in the region should work toward adoption of a strong regional cap on power-sector carbon dioxide emissions.

- **States and the region should commit to achieving the maximum possible reductions in energy use through energy efficiency and conservation programs.** Updated commercial and residential building codes, improved efficiency standards for appliances, and expanded funding of energy efficiency programs can produce emission reductions far beyond those currently called for at the regional level while, in many cases, saving money for consumers and businesses.

- **The region must develop the analytical, planning and tracking tools states will need to further reduce global warming emissions.** States that have not completed adequate Climate Change Action Plans should commit to doing so within the coming year. Global warming inventories for each state must be revised to reflect more recent trends in emissions. And the region and states should begin establishing mandatory programs for the reporting of carbon dioxide emissions.

- **The region should establish a timeline for meeting the long-term global warming emissions reduction goal of 75 to 85 percent and ensure that global warming plans assist any displaced workers in making a successful transition to new employment.**

New England's governors deserve credit for committing to reducing the region's contribution to global warming. Actions taken over the last two years have helped lay the groundwork for the region to achieve those goals. Now it is time for the states – working together when appropriate – to implement the policies needed to reduce the threat of global warming.

Introduction

New England's efforts to reduce the region's contribution to global warming can be likened to the steps a family takes to get its finances in order.

The family must first acknowledge that there is a problem – that the inefficient use of limited resources poses a long-term threat to the family's health and well-being. The family must then establish a budget to ensure that future spending does not outstrip its resources. Finally, the family make common sense choices about where and how to spend its money and, most importantly, follow through on those commitments.

In 2001, the six New England governors, along with their peers in eastern Canada, took the first step toward reducing the region's contribution to global warming by adopting a Climate Change Action Plan. The plan forcefully acknowledged that global warming is a serious problem for the region's environmental and economic future.

The plan went even further, adopting a global warming emissions "budget" of sorts for the region. New England and eastern Canada, the document pledged, would reduce their emissions of global warming gases to 1990 levels by 2010 and to 10 percent below 1990 levels by 2020. Ultimately, the plan envisions long-term emission reductions to levels that will not alter the global climate – reductions of up to 75 to 85 percent below current-day levels.

Finally, the plan made a series of specific commitments for the reduction of global warming emissions from particular segments of the regional economy and set out a process of planning and evaluation designed to ensure that the overall goals of the plan are met.

Two years after the adoption of the plan, it is still too soon to determine if New England will achieve its global warming emission reduction goals. It is not too soon, however, to evaluate whether the specific pledges made at the regional level will put New England on track to meet those goals, or to evaluate whether the planning processes envisioned by the plan are proceeding appropriately.

This report marks an initial effort to balance the region's global warming "checkbook." Based on information collected by federal and state agencies, we will estimate New England's current and future emissions of carbon dioxide (the leading cause of global warming) and quantify the reductions that will be needed to meet the regional goals. We will then examine the various commitments made by regional leaders to determine if they are sufficient to meet the goals – or if additional commitments are necessary. We will evaluate the region's progress toward the development of a planning and evaluation infrastructure that could serve as a foundation for further efforts to reduce global warming emissions. And finally, we will suggest guiding principles and policy options state and regional leaders could pursue to bring the Climate Change Action Plan's goals within reach.

Our efforts have been limited by the lack of information about energy use and global warming emissions in particular segments of the New England economy, as well as by the lack of clarity and precision of several of the region's Action Plan commitments. In some cases, for example, the most recent state-level global warming inventories reflect emissions from 1990. Where possible, we have used data from government and other sources to make "best guess" estimates of the impacts of various regional policies. We invite further review and refinement of these estimates and believe that the development of more complete, detailed and accurate sources of information on energy use and global warming emissions is integral to the success of the region's efforts against global warming.

Even acknowledging these uncertainties, the picture that emerges from this analysis is clear: while the region has made important strides over the past two years, and while the commitments made to date will result in significant reductions in global warming emissions, much more work remains to be done. Now is the time for the six New England states to take the next step, using the Action Plan commitments as a jumping-off point for the implementation of policies to reach the regional goals and position New England to meet its responsibilities in the fight against global warming.

Global Warming in New England

The climate of New England has undergone significant changes in the last century. There is international scientific consensus that human factors are behind rising temperatures worldwide over the last 50 years. Scientists project that these trends will continue and intensify as concentrations of carbon dioxide and other "global warming gases" in the atmosphere grow, increasing global average temperatures and resulting in severe and difficult-to-predict local climate changes.

Global warming is caused by the greenhouse effect. For more than a century, the chemical makeup of the Earth's atmosphere has been changing, largely as a result of the burning of fossil fuels, which releases large amounts of carbon dioxide into the atmosphere. Since 1750, the atmospheric concentration of carbon dioxide has increased by 31 percent. The current rate of increase in carbon dioxide concentrations is unprecedented in the last 20,000 years.[1] Concentrations of other global warming gases have increased as well.

Carbon dioxide and other gases in the Earth's atmosphere contribute to the greenhouse effect by trapping heat from the sun near the planet's surface. As concentrations of these gases in the atmosphere increase, more heat is trapped, leading to increased global temperatures. During the 20th century, global average temperatures increased by about 1° F (0.6° C).

Effects of Global Warming on New England

New England's climate, like the climate worldwide, has begun to show the effects of global warming. Between 1895 and 1999, the region's average temperature increased by 0.7° F and average precipitation increased by 4 percent.[2] Climate change has not taken place evenly across the region; temperature increases over the last century have ranged in magnitude from 1.0º F in Massachusetts to 2.3º F in Rhode Island. Precipitation in Maine dropped by 12 percent over the last century, while precipitation in Massachusetts increased by nearly 30 percent. Winter temperatures have experienced greater warming than summer temperatures throughout the region.[3]

Scientists predict that the degree of global warming that will be experienced in New England over the next century will dwarf that which has occurred thus far. An increase in regional annual minimum temperatures of between 6º F and 10º F and increases in precipitation of between 10 and 30 percent (although less certain) are possible within the region by 2090 should present trends continue.[4] Such changes would have dramatic effects: adding 10º F to Boston's annual average temperature, for example, would leave the city with an average temperature similar to present-day Atlanta.[5]

The resulting impacts on the environment, the economy, and public health would be dramatic. Among the possible effects are:

- Reduced air quality as higher summer temperatures facilitate the formation of ozone smog.
- Shifts in forest and ocean species and an increase in toxic algal blooms.
- Increased spread of insect-borne diseases, such as Lyme disease.
- Rising sea levels, leading to beach erosion, increased coastal flooding, and property damage.[6]
- Declines in freshwater quality due to more severe storms, increased precipitation and intermittent drought.
- Increased risk of heat-related illnesses and deaths.
- Disruption to traditional New England industries such as fall foliage-related tourism, maple syrup production and skiing.[7] (See "The Economic Costs of Global Warming," next page.)

The likelihood and severity of these potential impacts is difficult to predict with certainty. But this much is clear: climate changes such as those predicted by the latest scientific research would have a dramatic, disruptive effect on New England's environment, economy and public health – unless immediate action is taken to limit our emissions of global warming gases such as carbon dioxide.

The Economic Costs of Global Warming

Global warming is commonly thought of as an "environmental problem." But it is an economic problem as well, particularly in New England. In addition to potential economic harm from severe storms, changes in agricultural crop production, and rising heat-related illnesses, New England's special attributes could cause the region to bear even more significant economic costs from global warming.

- **Maple syrup and foliage-related tourism** – Northern New England's forests produce dazzling displays of color during the fall and hundreds of thousands of gallons of maple syrup in the spring. Fall foliage-related tourism represents 20 to 25 percent of annual tourism in Vermont and Maine, while maple syrup production is a $20 million industry in the region.[8] Global warming could eventually force the habitat of the region's hardwood forests north by as much as 300 miles and sugar maples could virtually disappear from the region.[9] Even in the short run, maple syrup production could decline severely, since sap production is extremely sensitive to small shifts in the freeze/thaw cycle. Indeed, maple syrup production has declined over the past decade in every New England state but Maine.[10]

- **Skiing** – The ski industry is responsible for about $1.4 billion in annual direct and indirect spending in Vermont and about $400 million in New Hampshire.[11] Rising temperatures could reduce skiing opportunities – particularly in the fall and early spring. Snow-making might allow for continued operation of downhill ski areas in warmer conditions, but cross-country skiing and snowmobiling – which rely on natural snowpack – may be especially hard hit.

- **Coastal economies** – Coastal real estate, tourism and fishing could all be affected by sea level rise and other changes brought about by global warming. The south-facing coasts of Massachusetts and Rhode Island appear to be especially susceptible to the loss of land due to sea-level rise; it is estimated that about 33 acres of land on Cape Cod are lost each year.[12] Preserving coastal beaches and property could become a major economic drain – for example, the cumulative cost of sand replenishment on the Massachusetts coast from a 20-inch sea level rise by 2100 is estimated at between $490 million and $2.6 billion.[13] The decline of estuarine habitats due to sea-level rise and other factors could also have significant impacts on the commercial fishing industry in the region, already reeling from the after-effects of decades of overfishing.

With regard to New England's economy, the question facing the region is not whether we can afford to make the changes necessary to reduce our emissions of global warming gases. It is whether we can afford not to.

Global Warming Emissions in New England

In 1990 (the last year for which reliable estimates are available) the six New England states emitted approximately 49.8 million metric tons carbon equivalent (MMTCE) of the four major global warming gases.[14] (See "Global Warming Gases and Their Treatment in This Report," next page.)

New England's emissions of global warming gases – and particularly its emissions of carbon dioxide – are significant on a global scale. New England's total 1990 energy-related carbon dioxide emissions would have ranked the region 27th in the world among countries reporting their emissions that year, just above Turkey and just below the Netherlands.[15]

Global Warming Gases and Their Treatment in This Report

Several gases are capable of exacerbating the greenhouse effect that causes global warming. The major global warming gases are:

- **Carbon Dioxide** – Released mainly through the combustion of fossil fuels, carbon dioxide is by far the leading gas responsible for global warming.
- **Methane** – Methane gas escapes from garbage landfills, is released during the extraction of fossil fuels, and is emitted by livestock and some agricultural practices. It is the second-most important global warming gas in New England in terms of its potential to exacerbate the greenhouse effect.
- **Fluorocarbons** – Used in refrigeration and other products, many fluorocarbons are capable of inducing strong heat-trapping effects when they are released to the atmosphere. Because they are generally emitted in small quantities, however, they are estimated to be responsible for only about 1 percent of New England's contribution to global warming.
- **Nitrous Oxide** – Nitrous oxide is released in automobile exhaust, through the use of nitrogen fertilizers, and from human and animal waste. Like fluorocarbons, nitrous oxide is a minor, yet significant, contributor to global warming.

In this report, we will communicate global warming emissions in terms of "carbon equivalent" – in other words, the amount of carbon that would be required to create a similar global warming effect. Other studies frequently communicate emissions in terms of "carbon dioxide equivalent." To translate the latter measure to carbon equivalent, one can simply multiply by 0.273.

This report focuses mainly on emissions of carbon dioxide from energy use, since these emissions are responsible for the vast majority of New England's contribution to global warming. Steps to reduce emissions of other global warming gases should also be part of New England's efforts to curb global warming.

Transportation was the leading source of global warming emissions in the region, responsible for more than one-third of total emissions. Fuel consumption by electric utilities (21 percent), residential energy use (16%) and commercial (9%) and industrial (8%) energy consumption were also leading contributors to global warming emissions. (See Fig. 1 next page)

These estimates – and those presented in the rest of this report – do not fully reflect New England's contribution to global warming because they exclude "upstream" emissions from the out-of-state production and distribution of fossil fuels consumed in New England. Because the region is only a marginal producer of fossil fuels, New England imports most of its energy from elsewhere, thus causing significant emissions that are not captured in this analysis.

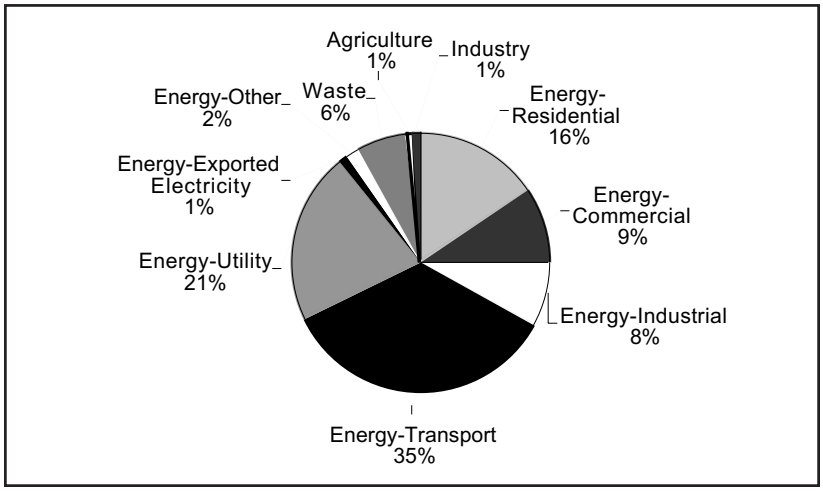
Energy-Related Carbon Dioxide Emissions: Past, Present and Future

Approximately 90 percent of New England's overall 1990 global warming emissions resulted from the release of carbon dioxide from the combustion of fossil fuels. The remainder of this report will deal specifically with these energy-related carbon dioxide emissions.

Global warming emission inventories for 1990 prepared by the six New England states estimated energy-related carbon dioxide emissions of about 44.8 MMTCE. The methodology for calculating global warming emissions inventories has changed significantly since the 1990 inventories were developed. Based on more recent estimates of energy use from the U.S. Energy Information Administration (EIA), we estimate that 1990 energy-related carbon dioxide emissions were approximately 45.8 MMTCE. This figure represents the baseline 1990 estimate that will be used throughout this report.

EIA estimates of historic and projected energy use in New England suggest that emissions of carbon dioxide from the burning of fossil fuels

Fig. 1. Sources of Global Warming Emissions in New England, 1990[16]



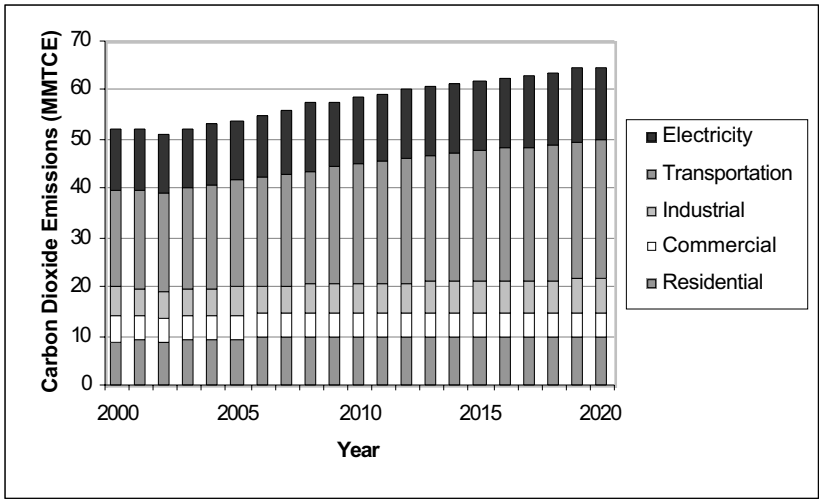
in New England increased by about 13 percent between 1990 and 2000 – to 51.9 MMTCE.[17] The distribution of carbon dioxide emissions among the various sectors is virtually unchanged since 1990, with a slight increase in the percentage of emissions coming from the industrial sector and a slight decrease in the percentage of emissions coming from the electricity sector. This may be due, however, to changes in the definitions of the two sectors by EIA.[18] In other words, carbon dioxide emissions from all sectors of the economy have increased significantly over the last decade.

Based on the EIA's projections, carbon dioxide emissions in New England are expected to increase by about 13 percent over 2000 levels (28 percent over 1990 levels) by 2010, and by 24 percent (41 percent over 1990 levels) by 2020 if no further action is taken to reduce emissions.

While the EIA projects that energy use in the commercial sector will stabilize, energy consumption by the automobile-dominated transportation sector is expected to increase dramatically. By 2020, transportation could be responsible for as much as 44 percent of the region's carbon dioxide emissions, up from 38 percent in 2000.[19] (See Fig. 2)

Clearly, global warming is a problem that must be addressed to preserve the future health of New England's environment and economy, as well as that of its people. The challenge is great. But in recent years, public officials from across the region have begun to recognize the severity of the problem and the need for immediate action to address it. Their efforts reached a crucial turning point with the adoption of a regional Climate Change Action Plan in 2001.

Fig. 2: Projected Energy-Related Carbon Dioxide Emissions in New England



The Regional Climate Change Action Plan

In August 2001, the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) adopted a Climate Change Action Plan that set targets for the reduction of global warming emissions in the region and committed the region to several steps that would help to meet those targets.

Global Warming Emissions Reduction Goals

Specifically, the plan committed the region to short-, medium- and long-term goals for the reduction of global warming emissions:

- **Short-term**: Reduce regional global warming emissions to 1990 emissions by 2010.
- **Mid-term**: Reduce regional global warming emissions by at least 10 percent below 1990 emissions by 2020, and establish a five-year process, commencing in 2005, to adjust the goals if necessary and set future emissions reduction goals.
- **Long-term**: Reduce regional global warming emissions sufficiently to eliminate any dangerous threat to the climate; current science suggests this will require reductions of 75 to 85 percent below current levels.[20]

An analysis of how the region's commitments to date will help achieve these goals makes up the bulk of this report. But a comparison of the short- and mid-term goals to the carbon dioxide emission trends described in the previous chapter demonstrates the magnitude of the task ahead.

To achieve the short-term goal of reducing global warming emissions to 1990 levels by 2010, New England would need to reduce its carbon dioxide emissions by 6.1 MMTCE – or 12 percent – below actual 2000 levels, or 12.7 MMTCE (22 percent) below levels projected for 2010 in the absence of new efforts to reduce emissions.

The medium-term goal of achieving a 10 percent reduction from 1990 levels by 2020 is equally challenging – requiring New England to reduce carbon dioxide emissions by 10.7 MMTCE (or 21 percent) from actual 2000 levels or 23.3 MMTCE (or 36 percent) from levels projected for the year 2020. (See Table 1.) Achieving the long-term 75 to 85 percent reductions needed to protect the climate will require New England to make even more significant emission reductions in the decades ahead.

It is possible that the region could partially achieve the goals through means other than reducing carbon dioxide releases from energy use – for example, by expanding carbon "sinks," such as forests and crops that absorb carbon from the atmosphere, or by reducing emissions of other global warming gases, such as methane and nitrous oxide. But because carbon dioxide emissions make up the bulk of the region's contribution to global warming, addressing them will be the primary task of any global warming emission reduction strategy.

Table 1. Reductions in Global Warming Emissions Needed to Meet Regional Action Plan Goals

		Reduction Needed (MMTCE)		% Reduction Needed	
	Goal (MMTCE)	vs. 2000 emissions	vs. projected emissions	vs. 2000 emissions	vs. projected emissions
2010	45.8	6.1	12.7	12%	22%
2020	41.2	10.6	23.3	21%	36%

Strategies for Achieving the Goals

In addition to committing to goals for the reduction of global warming emissions, the governors and premiers agreed to nine action items to help move the region toward attainment of the goals:

1) **Establish a regional, standardized global warming emissions inventory.** The inventory would begin with 1990 emissions, with results to be reported every three years, providing a way for states, and the region, to determine whether they are moving toward attainment of the goals.

2) **Establish a plan for reducing global warming emissions and conserving energy.** Each state will create a plan listing measures to achieve global warming emission reductions in view of the regional goals.

3) **Promote public awareness.** By 2005, the public should be aware of the problems and impacts of global warming and of the actions they can take to reduce global warming emissions. The public should also be aware of the adaptive measures they can take to deal with the impacts of climate change.

4) **State and provincial governments lead by example.** By 2012, reduce public-sector end-use emissions by 25 percent.

5) **Reduce global warming gases from the electricity sector.** By 2025, reduce the amount of carbon dioxide emitted per Megawatt-hour (MWh) of electricity use by 20 percent of current emissions.

6) **Reduce total energy demand through conservation.** Increase the amount of energy saved through conservation programs by 20 percent by 2025.

7) **Reduce and/or adapt to negative social, economic and environmental impacts of climate change.** Broaden the understanding of forecast climate impacts and plan to adapt, where possible.

8) **Decrease the transportation sector's growth in global warming emissions.** Slow the growth rate of transportation emissions in the near future. Better understand the impact of transportation programs on emissions. Work with federal officials to improve the energy efficiency of vehicles.

9) **Create a regional emissions registry and explore the creation of a trading mechanism for global warming emissions.**

The nine action items can be roughly broken down into two categories, those that set sector-specific goals for the reduction of global warming emissions (Action Items 4, 6, 7 and 8) and those that relate to planning, evaluation and public education (Action Items 1, 2, 3, 5 and 9). Both sets of action items are important to the overall success of the plan – achieving the goals related to planning, evaluation and education is critical to ensuring that states and provinces have the tools to develop effective global warming emission reduction strategies. Ultimately, however, the plan will be seen to succeed or fail based on whether the region can attain real emission reductions such as those specified in the sector-specific goals.

In addition to the 2001 commitments, the governors and premiers adopted a second set of joint action items at their meeting in 2002. The actions, which focused on taking advantage of "low-hanging fruit," committed to efforts in four areas:

1) **LED traffic lights** – Encourage and promote the replacement of conventional traffic lights with energy-saving, cost-effective LED traffic lights.

2) **College and university partnerships** – Encourage the region's colleges and universities to sign onto the broad goals of the Climate Change Action Plan and work within their own institutions to reduce global warming emissions to 10 percent below 1990 levels by 2012.

3) **State/provincial purchasing programs for high efficiency-low emission office equipment** – Encourage the purchase of more energy-efficient office equipment by investigating barriers to cost-effective purchases and proposing how those barriers can be reduced.

4) **Use of cleaner, more energy-efficient vehicles in state/provincial fleets** – Encourage the purchase and use of cleaner, more efficient vehicles in jurisdictional fleets by investigating barriers to economically feasible purchases and proposing how those barriers can be reduced.

The following two sections of this report will review these two sets of goals with an eye toward determining whether further reductions in global warming emissions will be required beyond those pledged in the 2001 action items (and subsequent action items adopted in 2002) and whether the planning and evaluation process is moving forward appropriately.

Units of Measurement and Basic Energy Terms

Throughout this report, we will use a series of terms to communicate important ideas about the use of energy in New England and its resultant carbon dioxide emissions.

•**BTU** – British Thermal Unit, a measure of energy. BTU is commonly used as a unit of measurement that allows various energy sources (gallons of gasoline, tons of coal, etc.) to be compared based on their energy content.

• **Kilowatt-hour (kWh), Megawatt-hour (MWh)** – Measures of electricity consumption. One Megawatt-hour equals 1,000 kilowatt-hours.

• **Carbon efficiency** – The amount of carbon dioxide released per unit of electricity consumption. We use the term "carbon efficiency" in place of the frequently used term "carbon intensity" because of the latter term's alternate definition as a measure of carbon dioxide releases per dollar of economic output.

• **Primary energy** – Refers to energy input to the electricity generating process. Because significant amounts of energy are "lost" in the transmission and distribution of electricity, primary energy use presents a better frame through which to view carbon emissions from electricity generation.

• **Site energy** – Refers to energy consumed by end users. Differs from primary energy in that it does not include electricity losses in transmission and distribution.

Action items 4, 6 and 7 of the Climate Change Action Plan (See page 15) commit the region to attaining specific, numeric goals in the reduction of global warming emissions from the public and electricity sectors and through conservation efforts in all sectors. Action item 8 commits to more general goals with relation to transportation-sector emissions. The following analysis shows that successful implementation of these four action items (and action items subsequently adopted in 2002) – while they would result in significant reductions in global warming emissions – would still leave the region well short of achieving its goals.

The Public Sector

Goal: Reduce end-use emissions of global warming gases through improved energy efficiency and the use of lower-carbon fuels within the public sector by 25 percent by 2012, as measured from an established baseline.

Estimated Annual Savings: 0.3 MMTCE by 2010; 0.4 MMTCE by 2020

The public sector – which includes federal, state and local government agencies – is a major user of energy in New England. Public-sector energy use is not specifically tracked, but the federal government does estimate various measures of energy consumed in government-owned commercial-sector buildings, in transportation, and in public housing.

Based on these estimates, the public sector in New England can be estimated to use about 117 trillion BTUs of primary energy annually, representing about 3 percent of the primary energy consumed in New England in 2000, and is responsible for about 1.6 MMTCE of carbon dioxide emissions.[21] Assuming that public sector emissions are reduced by 25 percent below this baseline by 2012, the region can expect reductions of approximately 0.3 MMTCE by 2010 and 0.4 MMTCE by 2020.

Public sector energy savings are important for reasons beyond their direct contribution to reducing the region's global warming emissions. State governments, as well as other public sector entities, have a responsibility to "lead by example" by making the maximum economically feasible investments in energy efficiency and conservation. Producing a 25 percent reduction in global warming emissions within 10 years would clearly demonstrate to private sector actors and individuals that significant reductions in global warming emissions are within their grasp.

The Electricity Sector

Goal: Reduce the amount of carbon dioxide emitted per megawatt-hour of electricity use within the region by 20 percent of current emissions by 2025.

Estimated Annual Savings: 0.6 MMTCE by 2010; 1.5 MMTCE by 2020 (Reductions do not include savings due to conservation commitments.)

The regional commitment to reducing global warming emissions from the electricity sector is phrased in terms of "carbon efficiency," or the amount of carbon dioxide that is emitted per unit of electricity. As a result, absolute emissions of carbon dioxide could actually increase over the next two decades if demand for electricity outstrips the gains in carbon efficiency achieved due to improved energy efficiency, increased use of low-carbon fuels, or increased use of renewable forms of energy.

In 2002, the average carbon efficiency for electricity generated in New England was projected to be approximately 30.7 MMTCE per quad BTU (or 0.104 MTCE/MWh) of site electricity use.[22] If New England were to set itself on track to meet the regional goal, average carbon efficiency would be approximately 25.8 MMTCE per quad BTU (0.088 MTCE/MWh) in 2020.

Achieving this rate of carbon efficiency would result in targeted annual emission reductions of about 0.6 MMTCE by 2010 and 1.5 MMTCE by 2020. Despite these reductions, the projected growth in electricity consumption over the next two decades would cause electricity-sector emissions to be higher in 2020 than they are today.

Such an increase in electricity-sector emissions is not inevitable. By combining improved carbon efficiency with reduced energy consumption, New England could return electricity-sector emissions at least to 1990 levels. Improving carbon efficiency also has benefits that go beyond global warming. The most carbon-intensive fuels used to generate electricity in New England – coal and oil – also happen to be the fuels largely responsible for air pollution that causes acid rain, contaminates fish with toxic mercury, and contributes to the development of health-threatening smog. So, while improving the carbon efficiency of electric power in New England is only part of the solution, it is an important part, with many ancillary benefits for the region's environment and public health.

Conservation

Goal: By 2025, increase the amount of energy saved through conservation programs (as measured in tons of global warming emissions) within the region by 20 percent using programs designed to encourage residential, commercial, industrial and institutional energy conservation.

Estimated Annual Savings: 0.7 MMTCE by 2010; 3.0 MMTCE by 2020

Federal, state and local governmental entities supervise and implement a smorgasbord of projects designed to boost energy efficiency and conservation. Quanti-

Carbon Efficiency and Nuclear Power

The carbon efficiency of electric power generation in New England has long been better than that of other parts of the country due to the large proportion of the region's power that comes from nuclear and, to a lesser extent, hydroelectric sources – neither of which directly release carbon dioxide or greenhouse gases to the atmosphere. While the region's reliance on nuclear power may reduce global warming emissions, those benefits are exaggerated when one looks at the entire nuclear fuel cycle. Either way, the economic and environmental dangers of nuclear power far outstrip any of its potential benefits as a so-called "no emissions" alternative.

Among the dangers of nuclear power are the following:

- **Environmental and public health** – The incidents at Three Mile Island and Chernobyl illustrated to millions of Americans the immense destructive potential of nuclear power. Less well-known, however, are the many safety violations and "near-misses" that have occurred with unsettling frequency nationwide – the most recent example being the discovery in 2002 of a football-sized cavity in the reactor vessel head of the Davis-Besse nuclear reactor in Ohio.

  The potential for nuclear power plant accidents is frightening enough. When combined with the potential for terrorist attack or sabotage, the risk becomes too great to bear. For example, tests at 11 nuclear reactors in 2000 and 2001 found that, at six of the plants, mock intruders were capable of disabling enough equipment to cause reactor damage.[23] And the Union of Concerned Scientists has raised serious concerns about reactors' ability to survive a September 11-style aerial assault on their control buildings.

  Nuclear power production also results in the production of tons of spent fuel, which must be either stored on-site or shipped across highways or rail lines to permanent storage – where it must be held safely for tens of thousands of years without contaminating the environment or the public.

- **Cost** – Nuclear power has often proven to be expensive in market terms, thanks to the high cost of building, maintaining, and ultimately decommissioning nuclear reactors. But looking only at the market costs of nuclear power obscures the hundreds of billions of dollars that have been spent by U.S. taxpayers for research

fying the reductions in energy use – and global warming emissions – that result from these programs is a difficult task. Not only are the results of these programs inconsistently reported, but energy efficiency improvements also have different life spans. For example, the installation of an energy-efficient compact fluorescent light bulb may yield guaranteed energy savings for the lifetime of the bulb – a few years – while the construction of a new house that meets tough residential energy codes may result in energy savings that last decades. The potential for double-counting – with both federal and state agencies claiming credit for the same efficiency improvements – also complicates the analysis.

Due to this uncertainty, the following assessment of the benefits of energy-efficiency programs should be considered only a rough accounting, based on very liberal assumptions of program benefits. We encourage states and the NEG/ECP to conduct a more thorough assessment as they create plans to meet the action item goal.

Current energy efficiency programs can be broken into several categories – those operated by the federal government, those operated directly by the states, and those operated by states or electric utilities either through systems benefit charges or other regulatory requirements.

Federal Programs

Major federal energy efficiency programs are administered by the Environmental Protection Agency and the Department of Energy. EPA-administered programs include the Energy Star program for labeling of energy-efficient appliances and equipment and certification of energy-efficient buildings, and the Natural Gas Star program for improvement of natural gas efficiency through the reduction of methane losses.[24] DOE-administered programs include grant support through the State Energy Program, the Building Technology and Industrial Technology programs, the Rebuild America program of public-private energy efficiency partnerships, and support for the development and implementation of commercial and residential energy codes.[25]

Based on reports from EPA and DOE, national carbon dioxide emission reductions achieved through these programs annually were estimated at approximately 32 MMTCE, with the Energy Star program responsible for the majority of emission reductions. This figure does not include savings due to improved state energy codes, a topic that will be addressed shortly.

Assuming that the energy efficiency benefits of these programs would be roughly proportionate to New England's share of national energy use, the region would have saved approximately 1.2 MMTCE as a result of these programs in 2002.[26]

and development and other subsidies to nuclear power operators. In fact, were it not for the government-backed insurance structure and liability caps set up under the Price-Anderson Act, it is unlikely that nuclear power could survive economically at all.

For these reasons and others, nuclear power should remain "off the table" as a potential means to improving the carbon efficiency of the electricity sector, and state and regional leaders should resist the temptation to support the relicensing of existing plants when their current licenses expire. It would be tragic if New England's efforts to forestall one environmental catastrophe – global warming – were to increase the risks of a very different kind of catastrophe befalling the region.

Shutting down nuclear reactors when their licenses expire will inevitably make New England's task of improving the carbon efficiency of the electricity sector more difficult. With the licenses of the Pilgrim and Vermont Yankee nuclear plants scheduled to expire in 2012 and the license of Millstone Unit 2 set to expire in 2015, now is the time for regional leaders to begin planning for an energy future in New England without nuclear power.

State Efficiency Programs Other than Utility-Based or Systems Benefit Charge-Supported Programs

As noted above, states administer a variety of energy efficiency programs, though no comprehensive list of such programs typically exists at the state level. In 2002, the NEG/ECP conducted a survey of state efforts to reduce public-sector global warming emissions, which included some efficiency programs, including Rhode Island's Energy Revolving Fund and New Hampshire's Building Energy Conservation Initiative (BECI). Annual global warming emission reductions from these two programs were estimated at 0.1 MMTCE.[27]

The adoption of updated residential and commercial building codes has also led to energy efficiency improvements. Of the six New England states, five (excluding Maine) have reasonably up-to-date residential building energy codes, with two states – Rhode Island and New Hampshire – possessing or in the process of adopting codes that reflect the most recent standards. Five states (excluding Vermont) have mandatory commercial building energy codes, with three states – Maine, Massachusetts and Rhode Island – possessing or in the process of adopting the most recent code revisions.[28]

Because implementation of building codes varies widely, assessing the carbon dioxide emission reductions from code improvements is notoriously difficult. Massachusetts has estimated annual savings of approximately 0.32 MMTCE from its residential and commercial energy code updates.[29] Assuming a similar rate of savings for other New England states that have adopted (or are adopting) similar codes, region-wide annual savings would be approximately 0.65 MMTCE.

Utility/Systems Benefit Charge-Supported Programs

For many years, states have required utilities to implement energy-saving programs through the process of public utilities regulation. With the recent deregulation of electric utilities in many states, support for energy efficiency programs has largely shifted to state- or utility-administered programs supported by systems benefit charges (SBC) on utility bills.

All six New England states possess energy efficiency programs supported by a systems benefit charge.[30] In some states, public agencies administer the programs. In other states, such as Massachusetts, utilities administer them. Reporting of the energy savings of these programs is, as with other efficiency programs, inconsistent.

The American Council for an Energy-Efficient Economy (ACEEE) has made a comprehensive attempt to quantify the benefits of utility- and SBC-supported conservation and efficiency efforts. In 2000, these programs were estimated to have saved approximately 4.8 billion kilowatt-hours of electricity in the region – equal to about 4.1 percent of electricity sales.[31] Assuming that carbon dioxide emission reductions occurred at a similar rate to the reduction in electricity consumption, these programs would have reduced global warming emissions in the region by approximately 0.5 MMTCE in 2000.[32] ACEEE notes that the data on which its estimates are based are self-reported by utilities and state agencies and cannot be verified for accuracy.

Adding the benefits of all these programs together – and assuming similar annual savings from these programs for the 2002 baseline year – we estimate that the total carbon dioxide emission reductions attributable to energy efficiency programs in 2002 was approximately 2.5 MMTCE. Again, we emphasize that this represents a very rough estimate and that it likely overstates the potential savings that result from these programs due to the possible double-counting of some energy savings and the inability to verify claims of energy savings by some entities.

Table 2. Summary of Estimated Benefits of Energy Efficiency Programs in New England

	Carbon Savings (MMTCE)
Federal Programs	1.18
State Programs	0.77
Utility/SBC Programs	0.50

Interpreting the Regional Goal

Estimating the impact of the regional action plan goal for conservation depends on how the goal is interpreted. In this analysis, we will take a liberal interpretation of the goal, assuming that *annual* savings as a result of newly installed efficiency measures will increase by 20 percent between 2002 and 2025, and taking the total efficiency savings listed above as the 2002 baseline. We also assume that most of the savings from each year's improvements in efficiency are "locked in" for future years – that is, that efficiency improvements made in one year will continue to deliver energy savings years down the road.[33]

Achieving the goal of a 20 percent increase in energy saved through conservation and efficiency programs by 2025, the marginal improvement in energy efficiency would reduce regional carbon dioxide emissions by about 0.7 MMTCE by 2010 and 3.0 MMTCE by 2020.

Given the unrealized potential for energy efficiency improvements in various sectors of the New England economy, it may be possible to reach the 20 percent goal earlier – perhaps by 2010 or sooner. An analysis of remaining energy efficiency potential in Massachusetts, for example, has suggested that savings equaling 31 percent of residential electricity consumption and 21 percent of commercial and industrial electricity consumption would be cost-effectively achievable over the 2003 to 2007 time period.[34] Such an expanded effort – perhaps driven by improved building codes, appliance energy efficiency standards, and increased funding for efficiency programs – could yield significantly greater reductions in global warming emissions for the region.

Moreover, energy efficiency improvements on such a scale could be very good for the New England economy. A 2002 study by Northeast Energy Efficiency Partnerships projected that the New England states could save between $4.8 billion and $5.9 billion by 2020 through the adoption of updated building codes and energy-efficiency standards for appliances.[35]

Unfortunately, the fiscal crisis in the states has led some state officials (for example, in Connecticut) to consider reversing course on energy efficiency by diverting funds from SBC-supported efficiency programs to general state use. Such a policy would be economically counterproductive and would make the goals of the Climate Change Action Plan more difficult to achieve.

The Transportation Sector

Goal: Reduce the rate of growth of transportation sector emissions "in the near future."

Estimated Annual Savings: 2.0 MMTCE per year by 2010; 5.3 MMTCE by 2020

Of the four sector-specific action items in the Climate Change Action Plan, the transportation sector commitment is the least well-defined, with no specific numeric reduction in global warming emissions attached. The failure to commit to specific reductions in the transportation sector is crucial – not only is the transportation sector the largest source of global warming emissions in New England, but the sector's emissions are anticipated to grow, in both real and percentage terms, over the next two decades.

Because the commitment in the action plan was left vague, it is necessary to impose a possible scenario to allow for global warming emission reductions to be quantified. For the purposes of this analysis, the commitment is assumed to translate into a reduction in the annual growth rate of transportation-sector emissions to 1.5 percent in the 2002-2005 period, down from the 1.8 percent growth rate projected by EIA for the 2002-2020 period.[36] The growth rate is further assumed to drop to 1.0 percent between 2006 and 2010, 0.5 percent between 2011 and 2015, and zero percent thereafter. Should this scenario come to pass, the region would reduce its annual transportation-sector carbon dioxide emissions by 2.0 MMTCE by 2010 and 5.3 MMTCE by 2020 versus projected levels.

Even if the region were to achieve such a reduction in the growth rate of transportation-sector emissions, global warming gas releases from the sector would be substantially higher in 2020 than they were in 2000 or in 1990. Emissions under such a scenario would be approximately 23 MMTCE in 2020, 15 percent higher than transportation-sector emissions in 2000 and 31 percent higher than 1990 emissions. Allowing transportation-sector emissions at such levels – while still achieving the regional medium-term goal

of reducing emissions by 10 percent below 1990 levels by 2020 – would force the rest of the New England economy ***combined*** to emit less than the transportation sector alone.

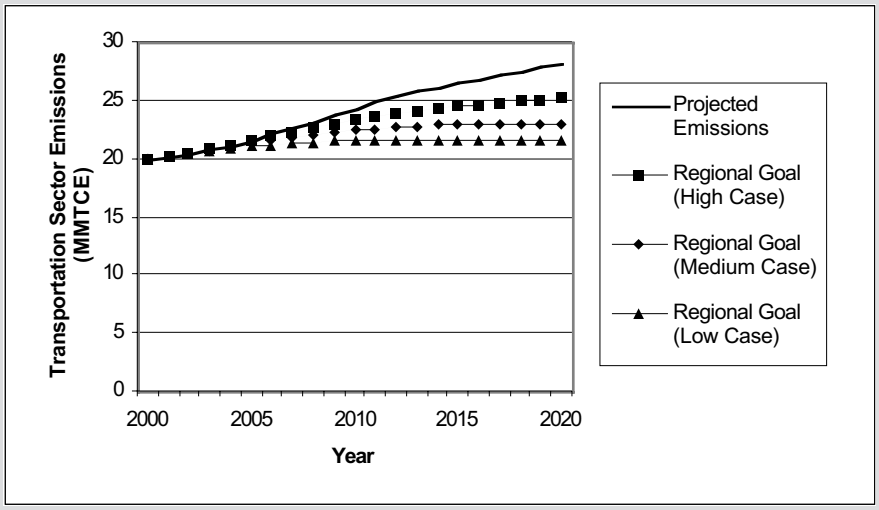
The lack of a firm transportation-sector commitment – and a strategy to achieve that commitment – is perhaps the single largest weakness of the Climate Change Action Plan. To prevent transportation-sector emissions from becoming a "budget buster" in the region's efforts to meet its goals, New England states and regional leaders must commit to strategies that will provide real reductions in transportation-sector emissions, beginning in this decade.

Interpreting the Transportation Sector Goal

The Climate Change Action Plan's transportation-sector goal is open to interpretation. A look at how various interpretations of the commitment would impact transportation-sector emissions shows the tremendous importance of transportation-sector strategies to the region's overall global warming emission reduction plans.

The chart that follows shows the results of three interpretations of the regional commitment. The "Medium Case" is as described above. The "High Case" projects more modest reductions in the growth rate of transportation-sector emissions, with the annual growth rate dipping to 1.5 percent beginning in 2005 (as opposed to 2003 under the Medium Case), 1.0 percent beginning in 2010, and 0.5 percent beginning in 2015. The "Low Case" projects more aggressive reductions in the growth rate, to 1 percent beginning in 2003, 0.5 percent beginning in 2005, and zero percent after 2010.

Fig. 3. Transportation-Sector Carbon Dioxide Emissions Under Various Interpretations of the Regional Goal



The differences between the various cases are significant. Under the High Case, the region would reduce transportation-sector carbon dioxide releases versus projected levels by 3.2 MMTCE by 2020 – less than the 5.3 MMTCE projected for the Medium Case. Under the Low Case, reductions versus projected levels would reach 6.7 MMTCE. (See Fig. 3.)

Under none of these three interpretations, however, would transportation-sector carbon dioxide releases return to their levels of 2000 or 1990. To achieve that target, regional leaders must find ways to not just stabilize, but reduce, overall emissions from transportation.

The 2002 Action Items

At the 2002 meeting of the Council of New England Governors and Eastern Canadian Premiers, the body adopted four additional action items to be implemented on the regional level. The action items were intended to take advantage of the "low-hanging fruit" for energy and global warming gas savings in the region. Of the four items, three (LED traffic lights, high-efficiency office equipment, and state vehicle fleet purchases) relate to the public sector, while one (college and university partnerships) has both public- and private-sector components.

LED Traffic Lights

Goal: Encourage and promote the replacement of conventional traffic lights in the region with more efficient, cost effective LED traffic lights.

Estimated Annual Savings: 0.007 MMTCE by 2010; 0.01 MMTCE by 2020 (included in public sector goal)

Incandescent traffic signals are a significant consumer of electricity. Replacing these signals with more efficient light-emitting diodes (LEDs) can reduce this energy consumption by as much as 85 percent.

The American Council for an Energy Efficient Economy has estimated that switching the traffic signals at the nation's 260,000 signalized traffic intersections would save 3 billion kilowatt-hours of electricity annually.[37] This would translate to a 0.09 percent reduction in national electricity demand.[38]

Assuming that the same percentage reduction in electricity demand would take place in New England, that the region meets its commitment to improve the carbon efficiency of the electricity sector, and that full phase-in of LED traffic signals would take place over a 10-year period beginning in 2004, the region could experience a reduction in carbon dioxide emissions of as much as 0.01 MMTCE by 2013. This figure likely represents the upper bound of potential savings given its assumption that all traffic lights in New England are currently incandescent and that all of them would be replaced with LEDs within 10 years.

While the benefits in terms of total global warming emission reductions may be small relative to other measures, the switch to LED traffic lights appears to be a straightforward way to achieve cost-effective energy savings and emission reductions. By adopting a large number of other such "no regrets" measures, the region could begin to see significant reductions in emissions that would bring it closer to meeting the regional goals.

High-Efficiency Office Equipment

Goal: Encourage the purchase of more energy-efficient office equipment by committing participating jurisdictions to work with their procurement departments to investigate and remove barriers to cost-effective purchases.

Estimated Annual Savings: 0.01 MMTCE by 2010 (maximum, part of public sector goal).

State, county and local governments in the U.S. spend approximately $12 billion each year on electricity and about $50-70 billion per year on electricity-using products.[39] Shifting even a portion of the public sector's immense buying power toward the purchase of more energy-efficient equipment could result in significant savings in terms of money, energy use, and global warming emissions.

The regional action item adopted by NEG/ECP is vague, committing the states only to investigating and removing barriers to the purchase of more energy-efficient office equipment – not to actually purchasing them. Thus, it is difficult to quantify how much greater penetration energy-efficient office equipment would make into state offices under the regional commitment.

Researchers with the Lawrence Berkeley National Laboratory and the Stockholm Environmental Institute estimated the total national energy savings that could accrue from energy-efficient government purchasing. They concluded that state and local government purchasing of energy-efficient office equipment could save approximately 10.1 trillion BTU of site energy by 2010 under the most likely scenario for equipment efficiency and workplace penetration. This would translate to approximately a 0.01 MMTCE

reduction in carbon dioxide emissions in New England, based on the region's share of nationwide energy consumption and the carbon efficiency of the region's electricity.[40]

This estimate likely significantly overstates the savings that would accrue to the region as a result of the action item. First, much of the reduction estimated above would come from local public-sector facilities, which are not explicitly included in the action item commitment. Second, several New England jurisdictions have already moved toward procurement of energy-efficient office equipment. Massachusetts state government, for example, already requires the specification of Energy Star-labeled office equipment for its state contracts.[41] Vermont adopted a similar policy in 2002. Thus, the potential for new savings due to the action item commitment may be lower than estimated here.

Another potential benefit of energy-efficient government purchasing is economic. The Lawrence Berkeley/Stockholm Environmental Institute study mentioned above projected that procurement of energy-efficient appliances and equipment at all levels of government could save taxpayers approximately $1 billion nationally by 2010.[42] At a time of severe state budget crises, even smaller amounts of monetary savings would be a welcome fiscal relief.

Energy-Efficient Vehicles in State Fleets

Goal: Encourage the use of cleaner, more efficient vehicles by encouraging states to work with their procurement departments to investigate and remove barriers to cost-effective purchases.

Estimated Annual Savings: 0.07 MMTCE by 2010; 0.11 MMTCE by 2020 (maximum, included in public sector goal)

Public sector agencies – and state governments in particular – consume large amounts of motor fuel. In 2001, according to the Federal Highway Administration, state, county and municipal governments in the six New England states consumed nearly 100 million gallons of gasoline, as well as additional amounts of diesel fuel and alternative transportation fuels such as ethanol, natural gas and electricity. Transportation-related motor fuel use by the non-federal public sector would have been responsible for about 0.27 MMTCE of carbon dioxide emissions in the region in 2001.

Were public sector entities to reduce their carbon dioxide emissions from motor fuel use by 25 percent by 2010 and 40 percent by 2020, they could reduce resulting carbon dioxide emissions by 0.07 MMTCE by 2010 and 0.11 MMTCE by 2020. There is more than one way to achieve this goal – public-sector entities can either purchase vehicles that achieve better gasoline mileage, switch to lower-carbon alternative fuels, or reduce the number of vehicle-miles traveled in state vehicles.

Again, as was the case with high-efficiency office equipment, the above estimates include both state and local public sector entities, so the reductions that would be brought about by a solely state-government effort would be lower than those projected here. In addition, any savings that would result from this action item would also count toward the public-sector emission reduction goal in the 2001 plan.

College and University Partnerships

Goal: Reduce carbon dioxide emissions among colleges and universities participating in the partnership by 10 percent below 1990 levels by 2012.
Estimated Annual Savings: 0.05 MMTCE by 2010; 0.07 MMTCE by 2020.

Colleges and universities have been among the most aggressive institutions in New England in investigating and addressing their emissions of global warming gases. In 2003, for example, Tufts University – which had already committed to meeting the emission reduction targets of the Kyoto Protocol – committed itself to meet the regional Action Plan goals. Other colleges and universities have conducted global warming gas inventories, adopted energy efficiency measures, considered the purchase of energy from renewable sources, or engaged in educational efforts to ensure that the next generation of graduating students is aware of the threats posed by global warming and the available solutions.

To build upon these efforts, the NEG/ECP adopted an action item in 2002 to encourage the development of climate change partnerships on regional campuses.

The use of energy on college campuses is not comprehensively tracked either regionally or nationwide. The Rebuild America program of the U.S. Department of Energy estimates that colleges and universities nationwide consume approximately 1 quadrillion (quad) BTU of energy per year.[43] Using this estimate, and assuming that New England's share of national college/university energy use is commensurate with the region's share of overall college enrollment (corrected for the higher average energy intensity of New England commercial buildings), New England colleges and universities could be assumed to have created approximately 0.69 MMTCE of carbon dioxide emissions in 2000 – or just over 1 percent of the region's total carbon dioxide emissions from fossil fuel use. We also assume that this estimate of carbon dioxide emissions also applies to the base year of 1990 and to the present year (2003).[44]

Reducing college and university emissions by 10 percent below 1990 levels by 2012, would result in 2010 emissions of approximately 0.64 MMTCE, for an 0.05 MMTCE total reduction.

Regardless of the direct benefits of carbon dioxide reductions, a college and university partnership program such as that proposed in the 2002 action item could be of great benefit to the region. Colleges and universities have long been models of the successful integration of new technologies, and their adoption of greater measures for energy efficiency and conservation and the use of low-carbon fuels could help hasten the spread of those technologies into other sectors of the New England economy.

Adding Up the Results

The above commitments made by the region in 2001 and 2002 will not be enough to achieve the goal of reducing global warming emissions to 1990 levels by 2010 or to 10 percent below 1990 levels by 2020.

Assuming that carbon dioxide emissions in New England otherwise grow in accordance with EIA projections for energy use over the next two decades, the commitments made by NEG/ECP to date would lead to emission reductions of approximately 3.5 MMTCE by 2010 and 10.3 MMTCE by 2020 – or 6 percent below projected emissions for 2010 and 16 percent below projected emissions for 2020.

These reductions fall well short of the savings that would be needed to achieve the regional goals. The region's remaining carbon dioxide emissions, under this scenario, would exceed the regional goal for 2010 by approximately 9.2 MMTCE and the regional goal for 2020 by about 12.1 MMTCE.

In other words, to achieve the regional goals set out in the Climate Change Action Plan, New England states must commit to more than triple the level of global warming emission reductions they have already committed to through 2010, and more than double the commitments they have made through 2020. (See Fig. 4.)

These additional commitments in the short- and medium-term will also be necessary to put New England on track to meeting the long-term regional goal of reducing global warming gas emissions to levels that will not pose a threat to the climate.

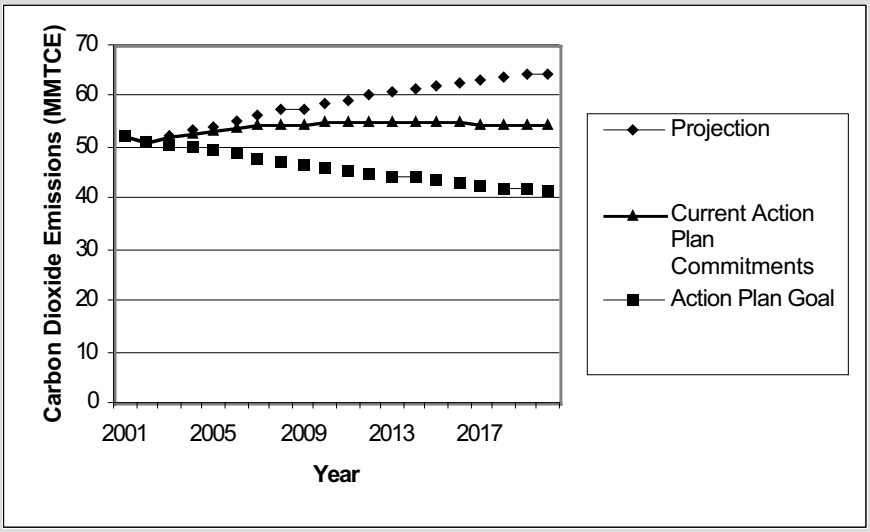
Table 3. Summary of Estimated Savings Under Action Item Commitments (MMTCE)

	2010	2020
Public Sector	0.29	0.40
Conservation	0.69	2.97
Transportation	1.95	5.30
Utility	0.56	1.55
College Partnerships	0.05	0.07
LED Traffic Lights	*0.01*	*0.01*
Office Equipment	*0.01*	*0.01*
State Fleets	*0.07*	*0.11*
TOTAL	**3.55**	**10.29**

italics=counted within public sector goal

This analysis shows that – should the sector-specific commitments made in the Climate Change Action Plan be implemented – New England could stabilize its emissions of global warming gases within the next decade. However, this achievement is not nearly sufficient to meet the emission reduction goals of the regional plan.

Fig. 4. New England Carbon Dioxide Emissions from Energy Use with Action Plan Commitments



Practical strategies do exist to meet the regional goals. Aggressive public policies to encourage energy efficiency, promote the use of renewable sources of energy, and reduce the use of the most carbon-intensive fuels could bring the regional goals well within reach. A discussion of some of the specific policy options available to the region begins on page 32.

The commitments made to date by NEG/ECP are a promising start. But to achieve the regional goals, each of the states must set new, concrete goals for emissions reductions, and implement aggressive public policies that will reduce the region's contribution to global warming.

Laying the Groundwork: Planning, Evaluation and Education

Given the shortfall in global warming emission reductions set forth in the action items of the Climate Change Action Plan, it is imperative that the states have the tools they need to go beyond the original 2001 commitments and institute new public policies that will attain the region's goals.

Because this report focuses on the attainment of global warming emission reductions in the region, we will not address action items #3 (public awareness) #7 (understanding of and adaptation to climate change impacts) in this analysis. Public awareness will, of course, play a major role in the success or failure of any regional effort to reduce global warming emissions. Not only do individual actions have the potential to help the region meet its goals, but public support will also be crucial for the types of ambitious public policies that will be required to meet the region's commitments.

Hence, we will focus on the progress made to date on three other action items: #1 (establishment of a regional standardized global warming emission inventory), #2 (establishment of state plans for reducing global warming emissions and conserving energy), and #9 (establishment of a global warming emission registry).

Global Warming Emission Inventories

The first step in determining how to meet the regional Climate Change Action Plan goals must be the development of accurate inventories of the states' current and projected global warming emissions. To date, few states have made a strong effort to revise their global warming emission inventories – for some states, the most recent emission data reported is from 1990.

By contrast, Environment Canada produces annual, province-specific estimates of global warming emissions, broken down by economic sectors and, in many cases, sub-sectors. As a result, the eastern Canadian provinces that have partnered with the New England states already have a detailed understanding of emissions trends over the past decade and the sources of those emissions.

In adopting the Climate Change Action Plan, the region's governors pledged to create a regional, standardized global warming emission inventory, with results to be reported every three years. The first such regional inventory, conducted by Northeast States for Coordinated Air Use Management (NESCAUM) at the governors' request, is due to be released this September.

Some individual states have also worked to update their inventories. Rhode Island updated its emissions inventory and projections of future emissions during the process of developing its Climate Change Action Plan. Connecticut is due to release an updated inventory this summer as its stakeholder process gets underway, and other New England states are expected to work toward updated inventories this fall.

In short, within the next several months, the New England region and the individual states will begin to gain a better understanding of their current emissions of global warming gases, how those emissions compare with emissions from prior years, and which sources are responsible for the lion's share of emissions. It is not only critical that those inventories be completed, but also that states develop the capacity to maintain and update their own inventories on a regular basis. By doing so, states can create a consistent yardstick by which to measure their progress in the fight against global warming.

State Global Warming Action Plans

A detailed review of state global warming emission reduction plans is beyond the scope of this report and will be addressed in future research. What will be addressed here is whether states have begun the process of planning for global warming emission reductions and the status of those efforts.

The six New England states are in very different places with regard to their global warming planning processes. Some states began planning even before the issuance of the Climate Change Action Plan. Other states have not yet begun to plan in earnest.

Ideally, each state global warming action plan should include several elements:

- An evaluation of current and projected levels of global warming emissions in the state.
- Proposal of a specific menu of policy options to achieve global warming emission reductions.
- Quantification of the estimated results of those policies and an assessment of whether such policies will meet the applicable state/regional goal.
- A plan for implementation of the policies, evaluation of their success and follow-up.

Connecticut

Connecticut initiated its global warming stakeholder process this spring. The goal of the process is to provide recommendations to the governor's Steering Committee by the fall of 2003.

Maine

The state of Maine issued a climate change planning document in 2000, the result of a stakeholder process that began in the mid-1990s. The document contained a menu of policy options to reduce global warming emissions in the state, estimated the global warming emission reductions that would result from each, and made general recommendations.

The planning process, however, did not identify priority policies or set forth a process for follow-up and implementation. In addition, because the planning document was issued in 2000, it does not reflect the additional commitment to global warming emission reductions made by the New England governors in 2001.

In 2003, the state took a step toward the development of a true global warming action plan by passing legislation adopting the regional global warming emission reduction goals. The law also requires the state to create a state climate action plan designed to meet the goals by July 2004.[45]

Massachusetts

Massachusetts has had an ongoing stakeholder process designed to produce a climate change action plan for the state. A draft plan was produced in 2002 for review, but a final climate action plan has not yet been issued.

New Hampshire

New Hampshire issued a global warming planning document in December 2001 that was produced by

Table 4. Status of State Global Warming Planning Efforts

State	Planning Document Issued	Emission Inventory	Emission Projection	Menu of Options	Quantification of Results	Implementation/ Follow-up
Connecticut	In Process	[b]				
Maine [a]	2000	*	*	*	*	
Massachusetts	In Process	[b]				
New Hampshire	2001	*		*		
Rhode Island	2002	*	*	*	*	*
Vermont	1998	*	*	*		

[a] – Maine has committed to developing a new plan in keeping with the regional goals.
[b] – Massachusetts and Connecticut have completed global warming emission inventories outside the scope of the planning process. Massachusetts' most recent inventory reflects 1990 emissions. Connecticut's most recent inventory reflects 1995 emissions, but an updated inventory is currently being developed.

the state Department of Environmental Services with input from a wide range of stakeholders. The document included a series of policy options for reducing global warming emissions but did not estimate the reductions that could be realized from each or prioritize new policies the state could undertake to bring about global warming emission reductions. Because of these shortcomings, the document is far from the type of comprehensive action plan that would put New Hampshire on a course to meeting the regional goals.

Rhode Island

Rhode Island initiated an extensive stakeholder process in 2001 designed to produce a global warming action plan for the state. To date, the process has resulted in the publication of a Phase 1 Action Plan that lists a series of consensus options for reducing the state's emissions of global warming gases, along with detailed analyses of the state's current and projected future sources of global warming emissions. Adoption of the 49 consensus options, according to the plan, would lead to global warming emission reductions approaching those called for by the regional plan.[46]

The Rhode Island process, however, has gone beyond simply analyzing the state's emissions and laying out a laundry list of policy alternatives. The stakeholder group has recently finished a second phase which worked through the highest priority measures for adoption, including the modeling of potential emissions reductions and the design of implementation strategies. Among the options that were discussed during phase two were policies such as a vehicle efficiency incentive program and a renewable energy standard for electricity generation – options that could lead to significant global warming emission reductions in the state.

The Rhode Island process has thus far been a positive model of planning – one that could be emulated at the state or regional level. First, the process has not ended with the creation of a "plan," but has continued to encompass the thornier issues of program design and implementation. The process has also been supported with solid technical information, allowing participants to make well-informed choices about which policy options would yield the greatest benefits at the least cost. Rhode Island has recently committed to a third stage of the process, which will focus on public education and further analysis of high priority measures.

Vermont

Vermont was the first state in the region to issue a global warming planning document in 1998. The document, which was part of a comprehensive state energy plan, contained a voluminous and detailed list of policy options for the state – including specific policy recommendations. It did not evaluate the global warming emission reductions that could be expected from each policy recommendation. In 2002, then-Vermont Gov. Howard Dean issued an executive order charging the state with developing a plan for the reduction of global warming emissions from state government activities.

Summary

All New England states have at least initiated a global warming planning process. To date, however, Rhode Island is the only state to issue an action plan with sufficient detail and stakeholder investment to serve as a true roadmap for meeting the state's global warming emission reduction goals. Connecticut and Massachusetts are currently in the midst of developing their plans and Maine has committed to a planning process geared toward meeting the regional global warming emission reduction goals.

While Vermont's 1998 planning document provides useful detail on the various policy options available to reduce global warming emissions, it does not reflect the regional commitments made by the New England governors in 2001 and is therefore likely out of date. New Hampshire's planning document falls well short of what is needed to guide the state's response to global warming.

All states could benefit from issuing plans that set forth specific policy recommendations, analyze the benefits of those recommendations, weigh the global warming emission reductions achieved against the regional goal, and set forth a continuing stakeholder process to work toward implementation of the various policies. By doing so, the states could build on the progress dictated by the regional Climate Change Action Plan commitments.

Global Warming Emission Registries

The creation of global warming emission registries – to which emitters of global warming gases report the quantity of their releases – is both important and extremely difficult. Registries can be used for several purposes: to monitor the progress of specific facilities toward global warming emission reduction goals, to establish baseline emissions against which future performance can be measured, and to serve as a basis for an emissions banking and trading system.

Designing effective registries requires the resolution of several fundamental problems. How should facilities document and verify their emissions? Should corporations be permitted to take credit for reductions made as part of specific programs, or should they be required to report their company-wide emissions? If financial incentives or credit programs are involved, how does one tell whether the emissions reductions reported to the registry were the result of a new initiative or would have happened anyway?

At the regional level, NESCAUM has taken the lead in designing a model registry system that could be used throughout the Northeast. Initially focused on voluntary reporting of emissions from the electric power sector, the registry will be designed in such a way that it could eventually be used as the basis for a regionwide carbon cap-and-trade system. Other, non-power sector companies may also be eligible to document their emissions through the registry, which is expected to be operable in 2005.[47]

The ability of registries to be successful tools in reducing global warming emissions depends on how well they are designed and how many entities register their emissions. State and regional leaders will need to continue to work to make sure that the new regional registry system accurately tracks global warming emissions. Once such a system is designed, it should be expanded to include other sectors of the economy. Eventually, such a system should be able to serve as the basis of a mandatory system of global warming emission reporting for the region.

The Climate Change Action Plan Two Years Later: Evaluating Progress and Planning the Next Steps

The adoption of the regional Climate Change Action Plan in August 2001 was a watershed moment for New England. The adoption of the action plan has spawned intense activity among various stakeholders to identify and begin to implement steps that would reduce the region's contribution to global warming.

As this report has demonstrated, those efforts must continue and increase over the next several years if the region is to meet its goals. To achieve this, it is important to recognize the progress that has been made to date and suggest the next steps for the region.

Progress to Date

Over the last two years, the following positive steps have been taken at the regional and state levels:

- **The adoption of four 2002 action items by the NEG/ECP.** While the impact of the four action items is small relative to the overall regional goals, the adoption of specific items appears to be a good model for future regional decision-making.

- **States leading by example.** Several states have taken concrete action over the last two years to "lead by example" in the fight against global warming. Maine and Vermont have both committed themselves to specific reductions in public sector emissions, with Vermont making specific commitments to the purchase of energy-efficient office equipment and fuel-efficient vehicles. Other states have worked to make environmental concerns a factor in government procurement, to improve the energy efficiency of state office buildings, and to otherwise reduce their emissions of global warming gases.

- **Policy advances to promote global warming emission reductions.** The two years since the adoption of the Climate Change Action Plan have seen significant progress on a series of policies to reduce global warming emissions. Progress toward the implementation of "four pollutant" regulations on older power plants in Massachusetts and New Hampshire, renewable energy standards for electricity generation in Connecticut and Massachusetts, and legislative debates in several states over issues such as appliance efficiency standards and incentives for the purchase of more efficient vehicles all demonstrate that New England states have the potential to adopt measures that would address the largest sources of global warming emissions in the region.

- **Progress toward global warming emission inventories and registries.** The upcoming release of updated global warming emission inventories for the New England region and the state of Connecticut will be an important step toward documenting the extent of the challenge the region faces in meeting the goals of the Action Plan. With other states about to begin work on updated inventories, there are hopeful signs that by next year, most or all of the New England states will have a reasonably accurate, up-to-date picture of the sources of global warming emissions within their jurisdictions. The groundwork being done now toward the creation of a regional global warming emission registry is also promising in that it could eventually lead to a system that would enable improved tracking of global warming emissions.

- **State global warming planning processes.** The past two years have seen progress toward the adoption of climate change action plans in Rhode Island and Massachusetts, renewed commitments to global warming planning and emissions reductions in Maine and Vermont, and the initiation of a stakeholder process in Connecticut. As noted above, the regional action items adopted by the NEG/ECP will likely not bring the region close to achieving its short-, medium- or long-term goals for global warming emissions reductions. As a result, the state planning processes will prove to be a crucial linchpin in the region's overall climate change efforts.

Principles for Action and the Next Steps

While the New England states deserve to be commended for their efforts to date to address global warming, it is clear that much more needs to be done – both on the regional and state levels – to achieve the goals set out by the regional Climate Change Action Plan.

In order to achieve those goals, regional leaders must operate under the proper guiding principles and take the appropriate concrete steps to address the largest hurdles standing in the region's way.

A broad coalition of organizations across the New England region has endorsed a set of 10 principles to guide the region in its efforts to reduce emissions of global warming gases. The Action Principles call on the region's governors to make a series of specific commitments that go beyond the commitments made in the 2001 regional Action Plan.

The principles are as follows:

1) By 2010, reduce global warming emissions to 10 percent below 1990 levels.

2) Establish a schedule and process for developing the timelines for meeting the long-term reduction goals of 75-85 percent.

3) Each consuming sector should be responsible for at least its proportionate share of the targeted emission reductions.

4) The region and each of the states should establish a system of mandatory reporting of carbon dioxide and other global warming emissions by 2005.

5) The region and each of the states should reduce emissions from the electricity sector as a whole by 40 percent from current levels. Every plan should include provisions for reducing carbon dioxide emissions from grandfathered plants – the older, fossil fuel-fired power plants that are not subject to modern federal emission standards.

6) The region and each of the states should set a target of 10 percent of electricity consumption from new, clean renewable sources by 2010 and 20 percent of electricity consumption from new, clean renewable sources by 2020.

7) Every plan should include a target of increasing energy efficiency in each sector by 20 percent by 2010.

8) The states should lead by example by: purchasing 20 percent of state facility electricity from clean, renewable sources by 2010; greening the state fleet; and reducing state government's energy use by 25 percent overall by 2010.

9) Each plan should include long-term plans for controlling sprawl. Sprawling patterns of development contribute to global warming by forcing longer and more frequent automobile trips and destroying forests and vegetated areas that serve as carbon "sinks."

10) Each plan should recognize the economic development and job creation benefits of strategies to reduce global warming emissions. Each plan should also recognize the importance of assisting displaced workers in making a successful transition to new employment.

Of the Action Principles, several deserve special attention for their importance in helping the region meet its global warming emission reduction goals.

Sharing the Burden – Transportation

One guiding principle of the region's efforts to reduce global warming emissions should be that each sector of the economy be required to do "its share." While energy efficiency improvements may be easier to achieve in some sectors than in others, all sectors should be required to make the maximum effort to achieve global warming emission reductions.

The role of transportation-sector emissions in New England illustrates the importance of this principle. Should transportation-sector emissions – already more than one-third of overall carbon dioxide emissions in the region – continue to grow at anything approach-

ing their current rates, it will be all but impossible for the region to meet its short-term goals, and very difficult to meet the medium-term goal in 2020. The regional Climate Change Action Plan gives transportation-sector emissions short shrift, pledging only to reduce the rate of growth of those emissions "in the near future."

The inability of New England states to improve automobile fuel economy through corporate average fuel economy (or CAFE) standards should not deter the states and the region from doing all that is possible to reduce transportation-sector emissions. A number of policies can help to achieve that goal.

- **Zero-emission vehicle standards** – Massachusetts and Vermont have adopted California's requirement for the introduction of significant numbers of clean, efficient hybrid-electric, battery-electric and hydrogen fuel-cell vehicles beginning in the middle of this decade. A 2003 study by Northeast States for Coordinated Air Use Management (NESCAUM) projected that the program would reduce carbon dioxide emissions from the light-duty vehicle sector in those states by about 2.25 percent by 2020.[48]

  Adoption of the Zero-Emission Vehicle program (and the Low-Emission Vehicle II emission standards of which they are a part) would also enable New England states to consider the adoption of California's forthcoming standards limiting carbon dioxide emissions from motor vehicles when those standards are proposed in 2005, a move that could lead to dramatic reductions in global warming emissions from the automobile fleet in the years to come.

- **Efficiency standards** – While individual states are barred by federal law from adopting automobile fuel economy standards, states do have limited avenues to improve automobile efficiency. By requiring the sale of low-rolling resistance replacement tires, states could bring about a 3 percent improvement in automobile fuel economy.[49] Moreover, because people replace tires more often than they replace cars, this improvement would quickly affect all cars on the road, not just new vehicles. States should also strengthen their efforts to convince federal officials to adopt stronger CAFE standards.

- **Incentives** – Financial incentives for the purchase of more efficient vehicles might seem difficult to achieve in an era of public-sector fiscal austerity. But creative solutions do exist. Rhode Island's stakeholder process has conducted in-depth discussions of the impact of a Vehicle Efficiency Incentive Program – commonly called a "feebate." Under the program, owners of low-efficiency vehicles would pay an additional fee when they register their vehicles, creating a pool of funds that would allow for the granting of incentives to buyers of more-efficient vehicles. Such a program would likely achieve the greatest benefit if it were adopted region-wide.

  Employers and state agencies can also give incentives for individuals to use public transit or to carpool, vanpool or telecommute. Such trip reduction programs already exist in most New England states and can be expanded to include a greater universe of employers and individuals.

- **Disincentives** – Financial disincentives can achieve two goals – they can discourage individuals from purchasing less-efficient vehicles and/or they can discourage individuals from driving. Increased gasoline taxes have been shown to achieve both goals – although, again, to be most successful, they would have to be implemented across the region. Other disincentives – such as basing insurance rates or registration fees on the number of miles traveled in a vehicle each year – could serve to depress vehicle-miles traveled.

- **Compact development and transit** – Another strategy to decrease vehicle-miles traveled is to build communities in which driving long distances is not a necessity. Revitalizing urban areas, controlling "sprawling" development patterns, and expanding the availability of transit services can all reduce the need to travel by automobile.

The above policies, if implemented by the New England states, could spark a significant shift toward a transportation system that is more environmentally sustainable for the long term. The first step in realizing this future is for the region's leaders to go beyond the commitment they made in the 2001 Action Plan by committing to stabilize transportation-sector emissions within the next several years and to reduce them

commensurate with the regional goal by 2020. State and regional leaders should also commit to further investigating the interactions among development patterns, traffic congestion, and transportation-sector emissions with the goal of developing a transportation system that can lead to dramatically reduced global warming emissions from the sector while ensuring efficient, affordable mobility for New Englanders.

Going a Step Further – The Electricity Sector

The Action Plan's goal of improving the carbon efficiency of the electricity sector is a positive step. But at best – if current projections hold true – the commitments made thus far will merely stabilize electricity-sector emissions near their current levels (with reductions below current levels ensuing if the region meets its targets for conservation program savings). Further reductions are needed and are possible if the region implements several common-sense principles.

- **Electricity-sector carbon cap** – In July, the governors of the New England states voiced their willingness to work with New York Gov. George Pataki and others in a process leading to the imposition of a regional cap on carbon dioxide emissions from the electricity sector in the Northeast. The success of such a program depends largely on the aggressiveness of the goals set and the effectiveness of the regional trading program established, but the willingness of New England's governors to participate in the process is a welcome sign.

  Significant reductions in carbon emissions from electricity generation are achievable. It is worth noting that in 2000, the combustion of coal and petroleum was responsible for 35 percent of the region's electricity generation, but 75 percent of electric-sector carbon dioxide emissions.[50] Demand management, efficiency improvements, and the replacement of oil and coal-fired power plants with less carbon-intensive means of generation could all result in significant reductions in carbon dioxide emissions.

  A region-wide cap that requires carbon dioxide emission reductions of 40 percent would be an appropriate goal. Such a goal would be significantly more difficult to achieve should the region allow the closure of the three New England nuclear power plants whose licenses are scheduled to expire between 2012 and 2015 – as it should for a host of economic, environmental and public health reasons. Still, an aggressive program of efficiency improvements, development of renewable energy resources, and reductions in the use of coal and oil for electricity generation could bring even this ambitious goal within reach.

- **Carbon limits on grandfathered power plants** – A somewhat overlapping policy involves the setting of carbon dioxide standards for the region's "grandfathered" power plants. Massachusetts, New Hampshire and Maine have already taken steps to impose such limits; other states should follow these initial steps and strengthen their existing efforts.

- **Renewable energy standards** – Similarly, several states have moved to require the generation of specific percentages of electricity from renewable sources. Particularly notable are Massachusetts and Connecticut, which require the generation of an increasing percentage of electricity from clean, renewable sources of energy. A regional standard of 10 percent of electric consumption coming from new renewables by 2010 and 20 percent from new renewables by 2020 should be implemented. Achievement of such a goal would allow for the retirement of the least carbon-efficient electric generating facilities while continuing to serve New England's economic needs.

Improving Energy Efficiency

Numerous opportunities exist for improving the energy efficiency of our homes, vehicles, and workplaces. Achieving the Action Plan commitment of increasing the amount of energy saved through conservation programs by 20 percent is a good start, but barely scratches the surface of what is achievable and cost-effective. Increasing energy efficiency in each sector by 20 percent over the next seven years would be an ambitious but realistic target for the region.

Several policies could help to achieve this target. The adoption of energy-efficiency standards for appliances, along with stronger residential and commercial building codes could hasten the spread of a variety of energy-saving technologies. A 2002 report found that

the six New England states could reduce carbon emissions by about 1.2 MMTCE by 2020 – while saving as much as $5.9 billion – through improved efficiency standards for products ranging from air conditioners to exit signs.[51]

Programs that reduce carbon emissions, reduce energy use, save consumers and businesses money, and keep energy dollars in the local economy are obviously worthy of support. States should increase – rather than threaten to reduce – the amount of money from both ratepayer and taxpayer sources that support cost-effective energy efficiency improvements.

Thinking Long-Term, Tracking Results and Acknowledging Benefits

While marginal improvements in energy efficiency, reductions in transportation-sector emissions, and strategies to reduce emissions from the electricity sector may be sufficient to meet the region's short- and medium-term goals, it will take a more profound transformation for New England to achieve the long-term goal of reducing global warming emissions by the 75 to 85 percent needed to forestall further impacts from global warming. The discussion of how to effect this transformation must begin now and must be guided by establishing a date – perhaps 2050 – by which the long-term goal will be achieved.

New England would get a head start toward achieving this goal were it to achieve the goals set out in the regional Action Plan on a faster timeline. The Kyoto Protocol, for example, committed the U.S. to reducing its emissions to seven percent below 1990 levels by 2010, a more ambitious goal than that laid out in the regional agreement. New England should seek to achieve the medium-term global warming emission reduction goal of the regional Action Plan by 2010. Doing so will not only position New England to achieve further reductions in global warming emissions in the future, but will also demonstrate to the rest of the country that such reductions are achievable.

At the same time, regional leaders must make the case that reducing global warming emissions will improve, rather than impair, the region's economic future. Such measures as improving energy efficiency and switching to renewable sources of energy can provide economic benefits – saving money for consumers, creating new jobs and new industries, reducing public health costs, and increasing the region's energy security; not to mention forestalling the potentially damaging impacts of global warming. In cases where such changes do cause localized economic dislocations, states should play an active role in helping displaced workers make a successful transition to new employment.

Finally, regional leaders must acknowledge the importance of more accurately tracking global warming emissions in the region. A mandatory system of global warming emission reporting should be established within the next several years in order for the region to accurately track changes in emissions of global warming gases from large sources.

A Role for the Region and the States

The commitments made by the New England governors and eastern Canadian premiers in the 2001 Climate Change Action Plan were an important step toward reducing the region's impact on global warming. Ultimately, however, it will be up to policy-makers in each of the states to implement the concrete steps that will achieve those goals.

The Climate Change Action Plan represents a good starting point for these efforts. Leaders of each of the six New England states should commit to achieving the regional goals *within their own states*. Doing so will allow citizens to better monitor the progress of their own states toward the emission reduction goals and to hold leaders accountable to their commitments.

However, on many issues – such as measures to control transportation-sector emissions or to impose electricity-sector carbon caps – the impact of actions taken by any one state could be magnified by action in other neighboring states. The economies of the six New England states are truly interconnected, in the same way we all face the same dangers from global climate change.

It is imperative, therefore, that leaders of the six states continue to work closely together on global warming emission reduction strategies – sharing good ideas and

positive steps and negotiating cooperative strategies that will allow each state, and the region as a whole, to do its part in the fight against global warming and reach its goals. By doing so, the New England states can move closer to realizing the environmental, energy security and economic benefits of beginning a shift away from our over-consumption of fossil fuels.

General Assumptions and Limitations

To document the New England region's current and future global warming emissions, this report relies primarily on information supplied by the U.S. Energy Information Administration (EIA), as well as information from state government agencies and independent studies.

In interpreting the data on potential global warming emission reductions that would result from action items adopted by NEG/ECP, we attempted to use a liberal interpretation of the available data. In other words, we believe our estimates represent a "best-case scenario" of the emissions reductions that would result from the various regional commitments.

This analysis also focused exclusively on carbon dioxide emissions from energy use, and does not include reductions in emissions of other global warming gases that might ensue from achievement of the Action Plan goals.

Where possible, we attempted to obtain region- or state-specific data for the baseline year of 2002. In cases in which only national level data were available, we estimated the proportion of energy use or emissions attributable to New England as described below. In cases in which year 2002 data were unavailable, we used the most recently available data as the baseline for calculating the impact of the regional commitments.

Baseline and Projected Carbon Dioxide Emissions

Baseline estimates of carbon dioxide emissions from energy use for 1990 were based on energy consumption data from EIA, *State Energy Data 2000*. To calculate carbon dioxide emissions, energy use for each fuel in each sector (in BTU) was multiplied by carbon coefficients for 1990 as specified in EIA, *Emissions of Greenhouse Gases in the United States 2001*, Appendix B. Several additional assumptions were made:

- Carbon dioxide emissions due to electricity imported into New England were not included in regional emission estimates.
- Combustion of wood was excluded from the analysis, per EIA, *Emissions of Greenhouse Gases in the United States 2001*, Appendix D. The exclusion is justified by EIA on the basis that wood and other biofuels obtain carbon through atmospheric uptake and that their combustion does not cause a net increase or decrease in the overall carbon "budget."
- Electricity generated from nuclear and hydroelectric sources was assumed to have a carbon coefficient of zero.
- Carbon emissions from the non-combustion use of fossil fuels in the industrial and transportation sectors were derived from estimates of the non-fuel portion of fossil energy use and the carbon storage factors for non-fuel use presented in U.S. EPA, *Comparison of EPA State Inventory Summaries and State-Authored Inventories*, downloaded from http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/JSIN5DTQKG/$File/pdfBcomparison1.pdf, 31 July 2003. To preserve the simplicity of analysis and to attain consistency with future-year estimates, industrial consumption of asphalt and road oil, kerosene, lubricants and other petroleum, and transportation consumption of aviation gasoline and lubricants were classified as "other petroleum" and assigned a carbon coefficient of 20 MMTCE per quad BTU for that portion that is consumed as fuel.

Estimates of carbon dioxide emissions from energy use for 2000 through 2020 were based on energy consumption data and projections for the New England region from EIA, *Annual Energy Outlook 2003 with Projections to 2025*, Supplementary Table 1. The same assumptions made with regard to 1990 emissions were also made with regard to 2000-2020 emissions.

EIA made significant changes to its estimation methodology between the publication of *State Energy Data 2000* (on which the 1990 baseline estimate is based) and *Annual Energy Outlook 2003*. Among the changes are the reallocation of some energy use by non-utility producers of electricity from the industrial to the electricity sector and a shift in the sources of some data used to estimate fossil fuel consumption.

The effect of the changes has been an upward revision in national energy use figures for the pre-2000

period, and a shift of some emissions from the industrial to the electricity sector. However, EIA has not published revised regional- or state-level data using the new methodology. To take this into account, we adjusted the 1990 energy use figures for natural gas in each sector upward by 2.4 percent, which corresponds with the upward revision in national natural gas use figures as reported in EIA, *Emissions of Greenhouse Gases in the United States 2001*. Estimates of the use of other fuels in 1990 were not significantly impacted by the changes and no adjustment was made.

In its projections, EIA assumes that New England will continue to receive a steady supply of energy from nuclear power plants through 2020 – despite the upcoming expiration of operating licenses for three of the region's nuclear power plants. While we do not believe that relicensing of these plants should be assumed in any projections, it is unclear whether the electricity they currently supply would ultimately be replaced by renewable or fossil-fuel sources, and thus we do not assume an increase in carbon dioxide emissions from the retirement of these plants. Failure to replace these nuclear power plants with renewable sources, however, would lead to projected emissions in 2020 being higher than are reported here.

Public Sector Emission Reductions

To estimate public-sector energy use in New England, we rely upon federal estimates of energy use and carbon emissions from the commercial, transportation and residential sectors. (The "commercial" sector is defined to include most government buildings, including institutional residential facilities such as prisons and dormitories.) New England-specific commercial sector data for government-owned buildings were derived from the EIA's *1999 Commercial Buildings Energy Consumption Survey*, Table C1. Carbon dioxide emissions from primary electricity were obtained by multiplying electricity consumption data by the New England-specific carbon coefficients calculated as described above.

Public-sector transportation-related emissions were calculated based on public-sector gasoline use data from the Federal Highway Administration, *Highway Statistics 2001*, Table MF-21, multi-sector state diesel fuel use data from EIA, *Fuel Oil and Kerosene Sales 2001*, and national public-sector alternative-fuel use data from EIA, *Alternatives to Traditional Transportation Fuels 2000*. Public-sector diesel use was assumed to represent the same proportion of total diesel use as public-sector gasoline use. Regional carbon dioxide emissions from alternative fuels were calculated by multiplying total sales of each alternative fuel nationwide by the percentage of fuel use attributed to the public sector nationwide by the percentage of alternative fuels used in the Northeast region, all as reported by EIA, *Alternatives to Traditional Transportation Fuels 2000*. New England's share of public-sector alternative fuel use was estimated based on its share of the Northeast region's population. The energy content of each alternative fuel was estimated by multiplying the number of gasoline-gallon equivalent units of each fuel by the per-gallon energy content of gasoline, approximately 114,000 BTU. A carbon dioxide emissions estimate was then derived by multiplying the energy content of each fuel by the carbon conversion factors in EIA, *Emissions of Greenhouse Gases in the United States 2001.* Estimates for electricity were based on the average carbon efficiency of electricity sales in New England as calculated above; estimates for ethanol blends included carbon estimates only for that portion of the fuel that consists of gasoline.

Energy use data for public housing is based on per-occupant estimates of energy use by public housing residents contained in EIA, *1997 Residential Energy Consumption Survey*, Table 1: Consumption and Expenditures in U.S. Households. This figure was multiplied by the number of public housing residents in New England as derived from U.S. Department of Housing and Urban Development, *Multifamily Resident Characteristics Report*, downloaded from http://pic.hud.gov/pic/RCRPublic/rcrmain.asp, 5 August 2003. National fuel-use data for multifamily dwellings of five units or more (from EIA, *A Look at Residential Energy Consumption, 1997*, Table CE1-4c) were used to estimate the proportion of energy consumed as various fuels. These estimates were then multiplied by carbon-efficiency factors (for electricity) and carbon coefficients (for other fuels) as described above to attain estimated carbon dioxide emissions for public housing in New England.

Electricity Sector Emission Reductions

Evaluation of the Action Plan's electricity sector commitment involved calculation of the carbon efficiency of the electricity generating sector from 2000 to 2020,

based on the EIA projections noted above. To calculate carbon efficiency, total electricity-sector carbon emissions for each year were divided by the amount of energy contained in electricity delivered to end users. The Action Plan goal was modeled by multiplying the year 2002 carbon efficiency by 80% (to reflect the 2025 goal) and assuming a linear improvement in carbon efficiency over the 2003-2025 period sufficient to achieve the goal.

Transportation Sector Emission Reductions

The impact of the Action Plan's transportation-sector goal was estimated by projecting a reduction in the growth rate of transportation-sector carbon dioxide emissions to 1.5 percent annually from 2003-2005, 1.0 percent from 2006-2010, 0.5 percent from 2011-2015, and zero percent thereafter.

Conservation and Efficiency Emission Reductions

Estimates of current savings from conservation and efficiency programs are based on the following reports:

Federal Programs

- Energy Star and Natural Gas Star savings from U.S. EPA, *Energy Star and Other Voluntary Programs, 2001 Annual Report*.

- DOE Building Technologies savings from U.S. DOE, Building Technology State and Community Programs, *Documentation for FY2003 BTS GPRA Metrics*, April 2002.

- DOE Industrial Technologies savings from U.S. DOE, Office of Industrial Technologies, *Summary of Program Results for CY 2001*, April 2003.

- DOE Rebuild America savings from U.S. DOE, Weatherization and Intergovernmental Program, *Rebuild America 2002*, (no publication date).

- DOE State Energy Program savings from Martin Schweitzer, et al, Oak Ridge National Laboratory, *Estimating Energy and Cost Savings and Emission Reductions for the State Energy Program Based on Enumeration Indicators Data*, January 2003.

New England shares of federal program energy savings were calculated by multiplying the federal savings by New England's share of total primary energy use as reported in EIA, *Annual Energy Outlook 2003*.

Non-Utility/Systems Benefit Charge State Program Savings

Savings from the New Hampshire Building Energy Conservation Initiative and Rhode Island Energy Revolving Fund from Conference of New England Governors and Eastern Canadian Premiers, *State and Provincial Governments Lead by Example: Survey of Public Sector Climate Change Activities*, June 2002. Programs that promote the use of renewable power were not included in the analysis.

Savings as a result of updated commercial and industrial building codes were based on an estimate of carbon dioxide emissions reductions that have resulted from Massachusetts' adoption of such codes, as reported in Conference of New England Governors and Eastern Canadian Premiers, *State and Provincial Governments Lead by Example: Survey of Public Sector Climate Change Activities*, June 2002. Benefits for the three other New England states that have, or are in the process of adopting, residential codes exceeding the 1995 MEC code and commercial codes exceeding ASHRAE 90.1-1989 were estimated by multiplying Massachusetts' rate of carbon savings per BTU of residential and commercial energy use by the total of commercial and residential energy use in each state for 2000 based on EIA, *State Energy Data 2000*. Savings for Vermont and Maine were estimated by multiplying the Massachusetts rate by commercial (Maine) and residential (Vermont) energy use. The current status of state building energy codes was derived from Building Codes Assistance Project, *Residential Energy Codes*, July 2003 and *Commercial Energy Codes*, July 2003.

Utility/Systems Benefit Charge Program Savings

Estimates of the benefits of these programs were derived from Dan York and Marty Kushler, American Council for an Energy-Efficient Economy, *State Scorecard on Utility and Public Benefits Energy Efficiency Programs: An Update*, December 2002. Carbon dioxide emission reductions from these programs were estimated based on electricity savings as a percentage of sales for the region multiplied by carbon dioxide emissions from electricity generation in the region as reported in EIA, *Annual Energy Outlook 2003*.

Calculation of Future-Year Efficiency Savings
The sum of energy efficiency and conservation savings from the sources identified above was used as the baseline of annual efficiency savings for 2002. The annual level of efficiency and conservation savings was assumed to increase by 20 percent at a linear rate between 2003 and 2025. Annual savings were presumed to be "locked in" at a rate of 100 percent in year one, 90 percent in years two through five, 80 percent in years five through 10, and 60 percent thereafter. The assumed lock-in percentages are arbitrary, but are intended to be liberal in their assumption of the lifespan of energy-efficiency program-related savings. The savings reported here include only those attributable to the marginal 20 percent increase in efficiency savings.

LED Traffic Lights

Savings from LED traffic lights are based on an estimate of national electricity savings from LED traffic lights reported in Toru Kubo, Harvey Sachs and Steven Nadel, American Council for an Energy-Efficient Economy, *Opportunities for New Appliance and Equipment Energy-Efficiency Standards: Energy and Economic Savings Beyond Current Standards Programs*, September 2001. The savings estimated in the study were converted to their energy value in BTUs using the conversion of 1kWh=3413 BTU. This was then compared to the site energy value of electricity delivered to consumers in 2002 from EIA, *Annual Energy Outlook 2003*, to determine the percentage of electricity use that would be saved nationally through a switch to LED traffic lights. This same percentage was applied to projected electricity-sector carbon emissions in New England to determine the amount of carbon emissions saved. Emissions reductions reflect the reduced carbon-intensity of the electricity sector in keeping with the 2001 Action Plan goals. Savings due to LED traffic lights were not included in the overall total because they are assumed to be used in reaching the public-sector global warming emission reduction goals of the 2001 Action Plan.

College and University Emission Reductions

Estimated nationwide energy use on college campuses was obtained from the U.S. Department of Energy, Rebuilding America program at http://www.rebuild.org/sectors/col_uni.asp. The proportion of national campus energy use attributable to New England was assumed to be commensurate with New England's share of overall college enrollment – 5.3 percent in 2000, according to the U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics, 2002*, 229. An adjustment was made for the greater energy intensity of education buildings in the Northeast versus the nation as a whole, per EIA, *Commercial Buildings Energy Consumption Survey, 1999: Consumption and Expenditures Tables*, 145. The sources of energy for New England campuses were assumed to be roughly the same as the sources of energy for college and university buildings nationwide, as identified by the Energy Information Administration. Emissions related to the provision of district heat, which can be provided either as a byproduct of electricity generation or through the operation of central boilers, were not included.

High-Efficiency Office Equipment

Potential savings from the state purchase of high-efficiency office equipment was based on a national estimate of non-federal public sector savings from Jeffrey Harris, Francis Johnson, *Potential Energy, Cost, and CO2 Savings from Energy-Efficient Government Purchasing*, (Abstract, no publication date). Estimates of the New England share of savings were based on region's proportion of electricity sales in 2001 from EIA, *Electric Power Annual 2001-Spreadsheets*, downloaded from http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html, 11 July 2003. Savings from this action item were not included in the total, since they may also count toward the public-sector emission reduction goal.

Energy-Efficient Vehicles in State Fleets

Estimates of carbon dioxide emissions from current public-sector fleets are derived as explained in "Public Sector Emission Reductions" above. These reductions were not included in the total, since they may also count toward the public-sector emission reduction goal.

Notes

1. Intergovernmental Panel on Climate Change, *IPCC Third Assessment Report – Climate Change 2001: Summary for Policy Makers*, 2001.

2. New England Regional Assessment, *The NERA Report: Foundation Document*, U.S. Global Change Research Program, March 2002, i.

3. Ibid., ii.

4. New England Regional Assessment Group, *Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change: New England Regional Overview*, U.S. Global Change Research Program, 2001, ii.

5. Ibid., iii.

6. Ibid., ii.

7. Ibid.

8. Ibid., Chapter 8; Clean Air-Cool Planet, *Fact Sheet: Climate Change and the Northern Forest*, downloaded from http://www.cleanair-coolplanet.org/information/pdf/forest-factsheet.pdf, 4 August 2003.

9. Clean Air-Cool Planet, *Fact Sheet: Climate Change and the Northern Forest*, downloaded from http://www.cleanair-coolplanet.org/information/pdf/forest-factsheet.pdf, 4 August 2003.

10. Vermont Maple Sugar Makers' Association, *Vermont Maple Facts*, downloaded from http://www.vermontmaple.org/mfacts.htm, 4 August 2003.

11. Conservation Law Foundation, *Heritage In Peril: New England and Global Warming*, downloaded from http://www.clf.org/pubs/climate, 4 August 2003.

12. See note 4, Chapter 8.

13. U.S. Environmental Protection Agency, *Climate Change and Massachusetts*, September 1997.

14 .Based on state Greenhouse Gas Emissions and Sinks Inventories downloaded from U.S. Environmental Protection Agency, *State GHG Inventories*, http://yosemite.epa.gov/OAR/globalwarming.nsf/content/EmissionsStateGHGInventories.html, 7 July 2003. Figures are for 1990 with the exception of New Hampshire, for which 1993 estimates are used. The methodology for calculating state global warming gas emissions has changed considerably since the 1990 inventories were completed. Note that this analysis excludes the sequestration of carbon in "sinks" such as forests and crops. Including the effects of sinks would reduce New England's net global warming gas emissions in 1990 to 45.2 MMTCE, based on the state inventories.

15. United Nations, Department of Economic and Social Affairs, Statistics Division, *Millennium Indicators Database*, downloaded from millenniumindicators.un.org/unsd/mi/mi_series_results.asp?rowID=576, 24 January 2003.

16. See note 14.

17. Based on energy consumption data for 1990 from U.S. Energy Information Administration, *State Energy Data 2000*, downloaded from http://www.eia.doe.gov/emeu/states/_use_multistate.html, 2 July 2003, pages 61-66, 139-144, 151-156, 199-204, 259-264, 295-300. See Methodology for carbon dioxide emission calculation methods.

18. Many non-utility generators of electricity that had been classified within the industrial sector in 1990 were reclassified to the electricity generating sector for the 2000 data. See Methodology for a fuller discussion of this and similar issues.

19. Based on energy consumption projections from U.S. Energy Information Administration, *Annual Energy Outlook 2003*, 9 January 2003, Supplementary Table 1. See Methodology for carbon dioxide emission calculation methods.

20. Council of New England Governors and Eastern Canadian Premiers, *Climate Change Action Plan 2001*, August 2001, 7.

21. See Methodology for sources and estimation techniques.

22.These figures are calculated from carbon emissions from electric generators in New England divided by consumption of site electricity, both derived from EIA estimates in *Annual Energy Outlook 2003*. It includes the consumption of electricity imported to the region, but not the carbon emissions that result from generating that electricity. Were consumption of imported electricity to be excluded, the amount of carbon released per MWh would be higher than shown here. These estimates of carbon efficiency differ from estimates published by EIA. For 2000, based on the above methodology, we calculate efficiency at 0.106 MTCE/MWh versus 0.122 MTCE/MWh calculated by EIA for a three-year average of efficiency from 1998-2000. (Source: EIA, *Updated State-Level Greenhouse Gas Emission Coefficients for Electricity Generation, 1998-2000*, April 2002.) The difference between the two estimates is largely explained by the apparent improvement in carbon efficiency in 2000 and subsequent years. Data from the U.S. EPA eGRID database suggests that carbon efficiency from electric generation in the six New England states improved from 0.138 MTCE/MWh in 1998 to 0.111 MTCE/MWh in 2000. The eGRID-based estimate for 2000 is within five percent of the figure for 2000 calculated based on EIA *Annual Energy Outlook 2003* data.

23. Union of Concerned Scientists, *Nuclear Reactor Security*, downloaded from http://www.ucsusa.org/clean_energy/nuclear_safety/page.cfm?pageID=176, 24 July 2003.

24. U.S. Environmental Protection Agency, *Energy Star and Other Voluntary Programs, 2001 Annual Report.*

25. Programs to promote energy efficiency in transportation, such as Corporate Average Fuel Economy standards, are not considered here because transportation-sector emissions are the subject of a separate action plan commitment.

26. Reporting of results by federal agencies is temporally inconsistent. Some report results from 2001, others results from 2002, and others estimates of 2003 achievements. In all cases, the most recently reported results are assumed to reflect conditions in the 2002 baseline year.

27. Council of New England Governors and Eastern Canadian Premiers, *State and Provincial Governments to Lead by Example: Survey of Public Sector Climate Change Activities*, June 2002.

28. Building Codes Assistance Project, *Residential Energy Code Status as of July 2003* and *Commercial Energy Code Status as of July 2003*, downloaded from http://www.bcap-

energy.org, 17 July 2003. Note: Vermont's commercial energy code is mandatory for state buildings.

29. See note 27.

30. M.J. Bradley and Associates, *Survey and Evaluation of State-Level Activities and Programs Related to Climate Change*, 18 October 2002.

31. Dan York, Marty Kushler, American Council for an Energy-Efficient Economy, *State Scorecard on Utility and Public Benefits Energy Efficiency Programs: An Update*, December 2002.

32. Actual carbon dioxide emission reductions due to these programs may be greater, since energy efficiency and conservation programs can reduce peak demand, eliminating the need for utilities to bring less-efficient, more-polluting auxiliary sources of power on line. These auxiliary sources of power are typically less carbon-efficient than the remainder of the electricity generating system.

33. See Methodology.

34. Fitchburg Gas and Electric Light Company, Massachusetts Electric Company, NSTAR and Western Massachusetts Electric Company, *The Remaining Energy Efficiency Opportunities in Massachusetts*, 7 June 2001.

35. Ned Raynolds, Andrew deLaski, Northeast Energy Efficiency Partnerships, *Energy Efficiency Standards: A Low-Cost, High Leverage Policy for Northeastern States*, Summer 2002.

36. Transportation-sector global warming emissions increased at an approximate 1.3 percent annual growth rate in New England between 1990 and 2000 according to EIA figures. However, EIA's projected 1.8 percent annual growth rate for the 2000 to 2020 appears to be reasonable. The average fuel economy of light-duty vehicles (the largest contributors to transportation-sector emissions) declined from 21.5 MPG in 1990 to 20.4 MPG in 2002, due in large part to the increasing prevalence of energy-inefficient light trucks and sport utility vehicles. This decline in fuel economy translates to a 6.5 percent increase in the amount of fuel consumed per mile of driving nationwide. Because vehicles typically stay on the road for a decade or more after they are sold, these energy-inefficient vehicles will create increased carbon dioxide emissions well into the next decade as they replace the more efficient vehicles made during the 1980s. Fuel Economy Source: U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975-2003*, April 2003.

37. Toru Kubo, Harvey Sachs, Steven Nadel, American Council for an Energy Efficient Economy, *Opportunities for New Appliance and Equipment Efficiency Standards: Energy and Economic Savings Beyond Current Standards Programs*, September 2001, 52.

38. Compared to EIA data from *Annual Energy Outlook 2003*.

39. Consortium for Energy Efficiency, *State and Local Government Purchasing Initiative*, downloaded from http://www.cee1.org/gov/purch/purch-main.php3, 3 July 2003.

40. Jeffrey Harris, Francis Johnson, *Potential Energy, Cost and CO2 Savings from Energy-Efficient Government Purchasing* (abstract, no publication date).

41. Katherine Johnson, Consortium for Energy Efficiency, *Green Spending: An Update on Massachusetts' Environmental Purchasing Program Incorporating Energy STAR Office Equipment*, 16 November 2001.

42. See note 40.

43. Rebuild America, *Colleges and Universities*, downloaded from http://www.rebuild.org/sectors/col_uni.asp, 2 July 2003. Other estimates of higher education energy use, such as those in the EIA's Commercial Building Energy Consumption Survey (CBECS), are significantly lower. The CBECS estimated consumption of energy by educational buildings on college and university campuses at 172 trillion BTU in 1999. However, this figure does not include campus buildings used for non-educational purposes such as dining halls (classified as food service) and administration buildings (classified as offices) and, as such, is an incomplete estimate. Source: EIA, 1999 CBECS.

44. Energy use on college campuses in New England does not appear to have increased significantly over the past decade. From 1992 to 1999, the amount of energy used by educational buildings in the Northeast declined, according to EIA Commercial Building Energy Consumption Survey 1992 and 1999. Meanwhile, New England's college enrollment actually declined between 1990 and 2000, according to U.S. Department of Education, Digest of Education Statistics 2002, 229. These two trends suggest that any increase in college energy consumption over the last decade has likely been minimal.

45. Maine Legislature, L.D. 845, approved May 21, 2003.

46. Rhode Island Greenhouse Gas Stakeholder Process, *Rhode Island Greenhouse Gas Action Plan*, 15 July 2002.

47. Jennifer Weeks, NESCAUM, personal communication, 21 July 2003.

48. Northeast States for Coordinated Air Use Management, *Emissions Benefits of Adopting the LEV II Program in the Northeast* (draft report), May 2003.

49. Chris Calwell, et al, *California State Fuel-Efficient Tire Report, Volume II*, California Energy Commission, January 2003.

50. Based on New England data from EIA, *Annual Energy Outlook 2003*.

51. See note 35.