New Hampshire Climate Change Policy Task Force

The New Hampshire Climate Action Plan

A Plan for New Hampshire's Energy, Environmental and Economic Development Future

Prepared by NH Department of Environmental Services
March 2009

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The Honorable John Lynch
Governor

Prepared by the
New Hampshire Climate Change Policy Task Force

Thomas S. Burack, Chair
Commissioner
N.H. Department of Environmental Services

New Hampshire Climate Change Policy Task Force

Chair

Thomas Burack	Commissioner, N.H. Department of Environmental Services

Members

Will Abbott	Vice-President, Policy and Land Management, Society for the Protection of New Hampshire Forests
Roland Aube	MRO Manager, Isaacson Steel
Richard Barry	Representative (R), New Hampshire House of Representatives
Charles Bass	Former U.S. Congressman
Clifton Below	Commissioner, Public Utilities Commission
Daryl Burtnett	State Director, The Nature Conservancy
William J. Cahill, Jr.	Vice-President and Group Counsel, Hanover Insurance Group
Patricia Carrier	Facilities/Environmental Manager, New Hampshire Ball Bearings Inc.
Alice Chamberlin	Executive Director, Two Countries, One Forest
Jameson French	President and CEO, Northland Forest Products
Martha Fuller Clark	Senator (D), New Hampshire Senate
George Gantz	Senior Vice President, Unitil
Suzanne Harvey	Representative (D), New Hampshire House of Representatives
Meredith Hatfield	Consumer Advocate, Office of the Consumer Advocate
Amy Ignatius	Director, N.H. Office of Energy and Planning
William Janelle	Asst. Director of Project Development, Department of Transportation
John Kanter	Nongame and Endangered Wildlife Program Coordinator, N.H. Fish and Game Department
Jim Kennedy	Vice-President, New Hampshire Wildlife Federation
Don Kent	Administrator, Natural Heritage Bureau, N.H. Department of Resources and Economic Development
Rhett Lamb	Planning Director, City Of Keene
Al Lelis	Division Manger for Safety and Environment, Osram Sylvania
Gary Long	President, Public Service of New Hampshire
Dr. Jose Montero	Director, Division of Public Health Services, N.H. Department of Health and Human Services
Jim O'Brien	Executive Director, Granite State Conservation Voters
Sheila Roberge	Senator (R), New Hampshire Senate
William Sherry	Director - US Employee Volunteerism, National Grid
Dr. Cameron Wake	Research Associate Professor, University of New Hampshire
David Withers	Property - Casualty Actuary, Department of Insurance

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Executive Summary

THE ENERGY AND CLIMATE CHALLENGE

Over the course of a year, through a process that engaged over 125 stakeholders and received input from over 200 citizens, the 29 members of Governor John Lynch's Climate Change Policy Task Force developed this Climate Action Plan which is aimed at achieving the greatest feasible reductions in greenhouse gas emissions while also providing the greatest possible long-term economic benefits to the citizens of New Hampshire. The most significant reductions in both emissions and costs will come from substantially increasing energy efficiency in all sectors of our economy, continuing to increase sources of renewable energy, and designing our communities to reduce our reliance on automobiles for transportation. In essence, a response to climate change and our economic future are inextricably tied to how we produce our energy and how much energy we use. Future economic growth in New Hampshire as well as mitigation of, and adaptation to, a changing climate will depend on how quickly we transition to a new way of living that is based on a far more diversified energy mix, more efficient use of energy, and development of our communities in ways that strengthen neighborhoods and urban centers, preserve rural areas, and retain New Hampshire's quality of life.

THE OPPORTUNITY

New Hampshire's Climate Action Plan presents an opportunity to:

- Spur economic growth through investment in our own state's economy of monies currently spent on energy imports.
- Create jobs and economic growth through development of in-state sources of energy from renewable and low-emitting resources, and green technology development and deployment by New Hampshire businesses.
- Avoid the significant costs of responding to a changing climate on the state's infrastructure, economy, and the health of our citizens.

THE IMPORTANCE OF OUR FORESTS

Preserving our working forests and avoiding conversion of our forest lands to other purposes will be critical to the success of New Hampshire's Climate Action Plan. New Hampshire is currently 84 percent forested, and the forest products industry has been and will continue to be a key component of our state's economy. In addition, our tourism and outdoor recreation economies are heavily dependent on the health of our forests. Sustainably managed forests in New Hampshire provide a broad range of benefits, including: the ability to absorb and store large amounts of carbon; renewable supply of wood for heating, lumber, and a variety of forest products; and recreational opportunities.

TASK FORCE RECOMMENDATIONS

The Task Force recommends that New Hampshire strive to achieve a long-term reduction in greenhouse gas emissions of 80 percent below 1990 levels by 2050. The goal of reducing greenhouse gas emissions by 80 percent by 2050 has been adopted by numerous states, cities and organizations[1]. This goal is based on the reductions that climate scientists believe to be necessary to stabilize greenhouse gases in the atmosphere at or below 450 parts per million CO_2. It has been projected that stabilizing the concentrations of greenhouse gases at this level will avoid the most severe and catastrophic potential impacts of climate change[2].

In order to move toward this long-term goal and provide the greatest economic opportunity to the state of New Hampshire, the Task Force recommends 67 actions to:

- Reduce greenhouse gas emissions from buildings, electric generation, and transportation.
- Protect our natural resources to maintain the amount of carbon sequestered.
- Support regional and national initiatives to reduce greenhouse gases.
- Develop an integrated education, outreach and workforce training program.
- Adapt to existing and potential climate change impacts.

Based on the greenhouse gas emission reductions projected for the recommended actions, the Task Force has chosen a mid-term goal of reducing greenhouse gas emissions 20 percent below 1990 levels by 2025. All of the recommended actions can be implemented immediately or through a phased-in approach that can expand implementation as technology evolves and economic means become available. The sooner reductions are accomplished, the greater the economic benefit; actions can either begin more quickly to provide a fairly steady rate of greenhouse gas emission reductions or they could be delayed, thus requiring larger reductions at a later time. **Delays in achieving reductions would result in increased implementation costs, thus reducing their economic benefit and making it more difficult to reach the long-term goal.**

To achieve the goals in the Plan, the Task Force recommends the formation of a public/private partnership – the New Hampshire Energy and Climate Collaborative – to oversee and guide early implementation of the NH Climate Action Plan. Effectively, the Collaborative will be "the keeper of the Plan." The primary purpose of the Collaborative will be to track and facilitate implementation of the Plan's recommendations, and to report to the Governor, Legislature, and general public on progress toward achieving the desired outcomes.

New Hampshire's Climate Action Plan will benefit the economy, increase state and regional energy security, and improve environmental quality. By implementing the actions recommended by the Task Force, New Hampshire will achieve substantial emission reductions beginning immediately, using cost-effective, available technology. The greatest reductions would come from improvements in the building sector, followed by the transportation and the electric generation sectors. These emission reductions are associated with significant reductions in energy consumption. The total impact of the recommended actions will be sufficient to place New Hampshire on a track to achieve substantial reductions in the mid-term and to be well placed to achieve the more aggressive reductions over the long-term. Additional measures will be needed in the long-term to achieve the 80 percent below 1990 levels reduction target. Such measures are likely to be based on the widespread adoption of new and advanced technologies.

Overview: *A Call to Action*

THE ENERGY AND CLIMATE CHALLENGE

Over the course of a year, through a process that engaged over 125 stakeholders and received input from over 200 citizens, the 29 members of Governor John Lynch's Climate Change Policy Task Force developed this Climate Action Plan. It is aimed at achieving the greatest feasible reductions in greenhouse gas emissions while also providing the greatest possible long-term economic benefits to the citizens of New Hampshire. The most significant reductions in both emissions and costs will come from substantially increasing energy efficiency in all sectors of our economy, continuing to increase sources of renewable energy, and designing our communities to reduce our reliance on automobiles for transportation. Our response to climate change and our economic future are inextricably linked and should focus on how we produce our energy and how much energy we use. Future economic growth in New Hampshire as well as mitigation of and adaptation to a changing climate will depend on how quickly we transition to a new way of living that's based on a far more diversified energy mix, more efficient use of energy and development of our communities in ways that strengthen neighborhoods and urban centers, preserve rural areas, and retain New Hampshire's quality of life.

There is a significant economic development potential for New Hampshire and our nation if we recognize the climate change challenge as an opportunity and approach it with resourcefulness, ingenuity, inventiveness and an entrepreneurial spirit. Energy, environment, and economic development are interrelated, just as our ecological systems consist of many interrelated and interdependent elements. Well-crafted solutions to these issues should be interrelated and will create benefits in all of these arenas, across the state and for all of our citizens.

The potential to reduce our energy consumption with existing technologies is significant. For example, every day New Hampshire citizens travel a total of 43 million miles by car, truck and bus, resulting in the consumption of 700 million gallons of gas and 200 million gallons of diesel fuel annually, and leading

to approximately 15.7 billion miles of wear on the state's roads and bridges per year. To a large extent, the billions of dollars spent each year on transportation fuel and road maintenance doesn't stay here in New Hampshire's economy, but instead goes out of the state or out of the country. Similarly, the 11 million megawatt hours of electricity, which New Hampshire citizens consume to light, heat, cool and operate our homes, offices, factories and schools each year, include significant costs for fuels that are imported from out of the state or out of the country.

NEW ENGLAND'S CHANGING CLIMATE

The greenhouse gas emissions that result from the generation of energy are also contributing to New England's changing climate. These changes include: warmer winters, reduced snowfall and snow-on-ground days, earlier spring runoff, sea-level rise, increased total rainfall, and more severe weather events that result in increased risk of flooding[1,2,3]. These changes in New England's climate are projected to increase in severity in the future and, if left unchecked, have the potential to significantly change our economy and way of life by the end of this century by:

- Affecting the viability of most ski areas (a $650 million annual industry in New Hampshire) and the snowmobiling economy (a $3 billion annual industry in the Northeast region) by almost eliminating these industries in the southern areas and reducing their operations to fewer than 20 days per year in the northern part of the state by end of the century.
- Increasing the frequency and severity of heavy, damaging precipitation events and the associated major economic impacts of cleanup, repair, and lost productivity and economic activity.
- Increasing the frequency of short-term (i.e., one to three month) summer droughts from every two to three years to annually, resulting in increased water costs, and agricultural and forestry stress.
- Increasing coastal flooding, erosion, and property damage due to rising sea levels.
- Significantly increasing human health impacts due to extreme heat (e.g., more than 20 days per year projected over 100°F), increased air pollution, and vector borne disease.
- Changing the quality and productivity of the forestry and agricultural sectors, both of which are significant contributors to the state's economy and quality of life.

THE OPPORTUNITY

New Hampshire's Climate Action Plan presents an opportunity to:

- Spur economic growth through investment in our state's economy of monies currently spent on energy imports.
- Create jobs and economic growth through development of in-state sources of energy from renewable and low-emitting resources, and green technology development and deployment by New Hampshire businesses.
- Avoid the significant costs of responding to a changing climate to the state's infrastructure, economy, and the health of our citizens.
- Preserve the unique quality of life that makes New Hampshire an outstanding place to live, work, and raise a family.

New Hampshire's economic well-being has long been heavily dependent on tourism businesses related to summer and winter outdoor recreation in the natural beauty of our mountains, lakes, rivers and seacoast region. These natural resources also attract and retain a skilled workforce. It has also been recognized for many years that economic vitality and environmental protection are inextricably linked, and there is no reason to believe that addressing climate change should be any different. In fact, there is a significant body of literature to support the economic benefits of a "green economy[4]." President Obama has stated that, "there is no better potential driver that pervades all aspects of our economy than a new energy economy[5]."

One area of the "green economy" upon which New Hampshire has already concentrated is the development of in-state renewable sources of energy. In 2006, the state enacted a renewable portfolio standard (RPS) that requires a substantial portion of our electricity to come from renewable sources such as hydro, wind, solar, or biomass. In addition, New Hampshire's participation in the Regional Greenhouse Gas Initiative (also known as "Reggie" or RGGI) will provide further impetus for investment in renewable energy sources. Of equal importance, the sale of RGGI allowances for emissions of carbon dioxide (CO_2) from large power plants will also generate funds that will be used to improve energy efficiency across all sectors of the economy, including to help weatherize homes for low income

families. Economic studies performed by the University of New Hampshire on both the RPS and RGGI programs demonstrated that over time, these programs will create jobs and, through increased fuel diversity and investment in energy efficiency, will help to reduce electricity costs[6, 7].

There is no compelling reason why New Hampshire could not and should not take a lead in the important and growing markets for such technologies as solar, photovoltaics, geothermal heating systems, components of electric powered vehicles, or wastewater treatment plants that actually generate energy. In contrast to other countries like Denmark, which now produces one third of the world's terrestrial wind turbines, and whose annual energy technology exports are over $10.5 billion and growing, the United States is not a significant exporter of wind technology. According to an opinion piece by Thomas L. Friedman in the *New York Times* on August 8, 2008, there have been 35 new wind turbine companies in China over the past 18 months, but not a single one in the United States[8]. Due to this national vacuum, New Hampshire has an opportunity to take a leadership role in these new markets. Examples of early renewable energy innovators in New Hampshire include GT Solar and New England Wood Pellet. These industries provide "green collar" jobs that pay well, require people who have both blue collar and white collar skills and knowledge, and are a great fit for the excellent pool of skilled workers in New Hampshire.

Today, we already have a set of technologies and techniques that can save us money by reducing our energy use, substantially cutting our greenhouse gas emissions, and creating new economic opportunities. In the future, our fuel mix for electricity, transportation, heating and cooling will need to be more diversified. It will also likely involve more small power generators – what is being called "distributed generation" – and working with a more sophisticated electric grid to more efficiently meet all of our electric needs. All of this change will continuously create opportunities for new jobs and economic growth.

If we design our new technologies and policies carefully, we can use less energy and greatly reduce our environmental impact. Creative people are discovering ways to make old engines work better, inventing new engines, creating greener fuels, and discovering ways to build and run equipment that needs only a fraction of the energy it uses today. While technology is not the only answer to the twin challenges of climate change and reducing energy use, it will be a powerful tool, and it will bring to New Hampshire and the wider world substantial economic growth and benefits.

TASK FORCE GOALS & RECOMMENDATIONS

The Task Force recommends that New Hampshire strive to achieve a long-term reduction in greenhouse gas emissions of 80 percent below 1990 levels by 2050, consistent with the New England Governors – Eastern Canadian Premiers resolutions and the consensus recommendations of the scientific community. The goal of reducing greenhouse gas emissions 80 percent by 2050 has been adopted by numerous states, cities and organizations[9]. This goal is based on the reductions that climate scientists believe are necessary to stabilize greenhouse gases in the atmosphere at or below 450 parts per million CO_2. It has been projected by scientists that stabilizing greenhouse gas emissions at this level will avoid the most severe and catastrophic potential impacts of climate change[10].

In order to move toward this long-term goal and provide the greatest economic opportunity to the state of New Hampshire, the Task Force recommended 67 actions to:

- Reduce emissions from buildings, electric generation, and transportation.
- Protect our natural resources to maintain the amount of carbon sequestered.
- Support regional and national initiatives to reduce greenhouse gases.
- Develop an integrated education, outreach and workforce training program.
- Adapt to existing and potential climate change impacts.

Based on the greenhouse gas emission reductions projected for the recommended actions, the Task Force has chosen a mid-term goal of reducing greenhouse gas emissions 20 percent below 1990 by 2025. The 67 recommended actions are organized into the following 10 overarching strategies:

1. Maximize energy efficiency in buildings.
2. Increase renewable and low-CO_2-emitting sources of energy in a long-term sustainable manner.
3. Support regional and national actions to reduce greenhouse gas emissions.
4. Reduce vehicle emissions through state actions.
5. Encourage appropriate land use patterns that reduce vehicle-miles traveled.

6. Reduce vehicle-miles traveled through an integrated multi-modal transportation system.
7. Protect natural resources (land, water and wildlife) to maintain the amount of carbon fixed or sequestered.
8. Lead by example in government operations.
9. Plan for how to address existing and potential climate change impacts.
10. Develop an integrated education, outreach and workforce training program.

The recommended 67 actions that support these 10 overarching strategies will enable New Hampshire to continue to do its part to address climate change immediately as well as position the state and its citizens to implement even greater reductions in the future. These actions will benefit the economy, increase state and regional energy security, and improve environmental quality.

THE BENEFITS OF ENERGY EFFICIENCY

A significant focus of the Task Force recommendations is to maximize energy efficiency across all sectors of New Hampshire's economy. For example, if we started promptly to make a substantial portion of existing homes 60 percent more efficient (i.e., reducing their energy usage by 60 percent), in the year 2025 alone, we would achieve very substantial reductions in greenhouse gases emissions as well as significant cost savings (nearly 3.5 million metric tons of CO_2 equivalents ($MMTCO_2e$) at a net savings of nearly $1.6 billion annually) to New Hampshire homeowners. Savings of a similar magnitude could be expected in every year, and would likely increase over time as energy becomes more costly.

The technology, equipment and expertise exist today to substantially reduce the amount of energy required to heat and cool the average existing home, as well as to make new homes highly efficient from the outset. Studies have shown that existing homes can be made anywhere from 15 to 60 percent more energy efficient by the use of improved air sealing, insulation, and equipment. Typically, the initial capital costs are rapidly offset by the savings in heating costs. While many of these measures can be undertaken by the average homeowner, there is also a significant and growing market for building contractors and others to provide these services. The current New Hampshire housing stock of approximately 500,000 homes provides a substantial energy efficiency services market opportunity for heating and cooling, as well as lighting and other electrical usage, that could result in thousands of new long-term jobs in construction and related trades over the next several years. New Hampshire has the technology to do this today and we simply must act now.

PUBLIC INPUT

Over 175 people attended five public listening sessions and provided over 75 oral comments. Four major themes were evident at all the public listening sessions:

- The Task Force should be bold in its decision making and recognize the magnitude of the problem that needs to be addressed.
- Significant improvements in energy efficiency in every sector, but particularly buildings, should be a major recommendation and commitment of the state action plan.
- Transportation issues, including reducing the amount of gasoline we use, improving public transportation, and encouraging consumers to select more fuel efficient cars, are critical to any plan addressing climate change.
- Comprehensive education is needed to inform the public of actions that can reduce energy use, to train the energy services trades in new technologies, and to develop appropriate curricula for our schools.

THE IMPORTANCE OF OUR FORESTS

Preserving our working forests and avoiding conversion of our forest lands to other purposes will be critical to the successful implementation of New Hampshire's Climate Action Plan. New Hampshire is currently 84 percent forested and these forest lands possess the ability to absorb and store large amounts of carbon, offsetting some of the CO_2 emissions resulting from human activities.

In addition to playing a role mitigating climate change, this extensive natural resource provides a broad range of benefits[12] including:

- Renewable supply of wood for heating, lumber, and a variety of forest products.
- Water cycle regulation.
- Groundwater recharge and water quality protection.
- Wildlife habitat.

CLIMATE SCIENCE

The variation of greenhouse gases in the atmosphere has contributed to the earth's changing climate throughout its geologic history and helped create an environment conducive to life. In fact, without pre-industrial levels of greenhouse gases, the average temperature of the planet would be some 50 degrees F lower. However, levels of carbon dioxide and other so-called greenhouse gases in the atmosphere are currently accumulating rapidly and these levels are causing air and ocean temperatures to rise at a substantial rate. In its fourth assessment report, the Intergovernmental Panel on Climate Change (IPCC) found the evidence for the warming of the Earth to be "unequivocal."[13] The IPCC concluded that most of the observed temperature increase since the middle of the 20th century is very likely due to the observed increase in greenhouse gases and a significant portion of these concentrations of carbon dioxide are from emissions of fossil fuels from human activities.

Scientists also predict that the impacts of this warming will cause significant changes to our climate affecting our health, economy, and quality of life. Regardless of the causes, the most viable solutions to climate change involve reducing energy usage in ways that save money for our citizens and businesses and create new economic opportunities. Simply put, we must cut energy use and develop more renewable energy sources. Doing so will save us money and will have wide-ranging economic and environmental benefits.

There is still much to learn about the mechanics of climate change, and work continues on improving climate models. However, if we fail to take action, the consequences to human populations are potentially severe. If we are wrong about the causes, but we take the actions that have been recommended, man and the environment will certainly be no worse off and arguably better off than under a business-as-usual scenario.

- Recreational opportunities.

New Hampshire's forest lands, therefore, play a critical role in maintaining the quality of life in our state. The forest products industry has been and will continue to be a key component of our state's economy. In addition, our tourism and outdoor recreation economies are also heavily dependent on the existence of healthy forests. In 2005, forest-based manufacturing and forest-related recreation and tourism in the state contributed over $2.3 billion to the state economy[13].

New Hampshire could be heating a significant percentage of its homes and buildings with wood from New Hampshire forests in the form of firewood, wood chips and wood pellets, and still have wood available to generate some electricity and to create durable wood products such as construction materials and furniture. Today, the state benefits from having wood pellet manufacturing plants, and more may be on the way, along with related businesses such as those that manufacture wood pellet furnaces and stoves. In addition, some of New Hampshire's top scientists are also on the cutting edge in developing technologies for deriving cellulosic ethanol fuel for transportation from tree fiber and other plant materials. These technologies are spurring investments, which are leading to new businesses and new jobs.

However, this homegrown natural resource is also at risk. Currently, about 17,500 acres of New Hampshire's forest are being developed each year for such things as new housing, shopping malls and businesses, and about 5,000 of those acres are totally cleared of trees. By recognizing the value of our forests (e.g., as a source of energy, as a source of ecosystem services, as a wonderful playground), New Hampshire may be able to slow, if not reverse, this trend, and ensure that we will retain our healthy forests and the services they provide for the long term. Sustainable management of this resource will not only provide a CO_2 emission benefit but also contribute to the long-term economic health of the state's rural economies.

ADAPTING TO A CHANGING CLIMATE

Climate change will have significant economic, health, and natural resource impacts throughout New Hampshire in the twenty-first century. Unfortunately, because of the levels of greenhouse gases already in the atmosphere, the state's climate will continue to change even if immediate steps are taken to reduce greenhouse gas emissions significantly. This is because greenhouse gases reside in the atmosphere for a century or more, and interdependent physical, chemical and biological processes in the oceans, atmosphere, and on land respond slowly to changes in the atmospheric concentration of greenhouse gas emissions. Therefore, in addition to actions that reduce or mitigate greenhouse gas emissions, New Hampshire must also plan to adapt to changes that are occurring now and more that are anticipated to occur in the future.

THE PROCESS

Development of the New Hampshire Climate Action Plan was initiated in December of 2007 following an executive order issued by Governor John H. Lynch. The order established a Climate Change Policy Task Force, whose 29 members represent a diverse group of regulators, scientists, business leaders, utility representatives, and environmental leaders from around the state. In addition, over 125 stakeholders participated on six technical and policy Working Groups; *Adaptation, Agriculture, Forestry and Waste; Electric Generation and Usage; Government Leadership and Action; Residential, Commercial and Industrial; and Transportation and Land Use*. Having enthusiastically embraced their charge, the working groups submitted over 100 separate potential actions for the Task Force's consideration. These potential actions were designed to address the causes as well as the impacts of climate change through a range of mechanisms that take advantage of specific opportunities in New Hampshire to sequester and store carbon dioxide, reduce the fossil fuel-based emissions associated with activities in the state, and reduce New Hampshire's vulnerability to a changing climate. The Task Force also developed several additional potential actions following its review of the potential actions developed by the working groups. The University of New Hampshire, through Carbon Solutions New England (CSNE), analyzed the carbon reductions, cost of implementation, and cost savings for most of the potential mitigation actions. The Task Force selected 67 recommended actions that will:

- Reduce the cost of energy to our citizens, businesses and government.
- Promote the growth of new jobs in energy services, the building trades, and renewable energy.
- Encourage growth of our communities in a way that retains our rural character and quality of life.

One of the most significant recommended actions of the Task Force is to develop a climate change adaptation plan for New Hampshire. The plan should address impacts affecting the state's infrastructure, agricultural and forestry sectors, coastal areas, sensitive ecosystems, wildlife populations, and human health.

The New Hampshire adaptation plan should address these issues by including actions that:

- Increase natural *resilience* in species and ecosystems to facilitate recovery from climate disturbances or adjust to new patterns of climate variability and climate extremes.
- Facilitate *responses* to climate change that help human communities and ecosystems to continue to exist under new conditions.
- Build *resistance* to climate change by helping human communities and ecosystems resist impacts and maintain their valued resources.

In addition to recommending the development of a detailed adaptation plan, the Task Force selected the following initial actions, which are further described in Chapter 5, to begin building the programs and infrastructure needed to address these issues:

- Develop and distribute critical information on climate change.
- Promote policies and actions to help populations most at risk.
- Charge and empower public health officials to prepare for climate change.
- Strengthen protection of New Hampshire's natural systems.
- Increase resilience to extreme weather events.
- Strengthen the adaptability of New Hampshire's economy to climate change.

REPORT OVERVIEW

Chapter 1: Introduction – Provides an overview of climate science, the existing and future potential impacts of climate change on New Hampshire, the inventory of New Hampshire's greenhouse gas emissions, and projected emissions of greenhouse gases. It also provides a detailed description of the process, including public input that the Task Force followed to develop the Climate Action Plan.

Chapter 2: Task Force Recommendations – Describes the 10 overarching strategies identified by the Task Force and lists the 67 recommended actions selected to achieve these strategies. It presents the calculations of the emission reductions that will be achieved by the selected actions and discusses recommended mid-term and long-term emission reduction goals.

Chapter 3: Adapting to a Changing Climate – Describes the estimated risks from an already changing climate and the ac-

tions needed to plan for unavoidable impacts from existing concentrations of greenhouse gases in the atmosphere.

Chapter 4: Economic Opportunities – Summarizes the economic costs and benefits, as quantified by Climate Solutions New England, for the selected actions.

Chapter 5: Summary of Actions and Implementation – Provides brief summaries of, and the short-term to mid-term implementation strategies for, each of the recommended actions.

Chapter 6: Moving the Plan Forward – Describes the organizational structure, stakeholders, and potential implementing parties of a new public/private partnership – the New Hampshire Energy and Climate Collaborative – which will oversee and guide the implementation of the NH Climate Action Plan. Effectively, the Collaborative will be "the keeper of the Plan."

EARLY ACTION IS IMPORTANT

We have an opportunity now, if not an obligation, to move as quickly as we can to address the challenge of climate change in a manner that recognizes the role that energy production and use plays in contributing to climate change. We can derive substantial economic and environmental benefits by developing and using homegrown, renewable energy sources as well as technologies that save energy. In so doing, we will create many new jobs and economic opportunities for New Hampshire's people and businesses. We can insulate ourselves from the volatility of world energy prices and at the same time enhance New Hampshire's quality of life.

The Climate Change Policy Task Force has identified a suite of actions that can be implemented immediately or through a phased-in approach that can increase as technology evolves and economic means become available. The sooner reductions are accomplished, the greater the economic benefit. There are a number of reduction pathways New Hampshire and other states can take to reduce their greenhouse gas emissions 80 percent by 2050. Actions could either begin more quickly to provide a fairly steady rate of greenhouse gas emission reductions or they could be delayed, thus requiring larger reductions at a later time. **Delays in achieving reductions would result in increased implementation costs, thus reducing the economic benefits and making it more difficult to reach the long-term goal.**

Chapter 1: Introduction

In order for New Hampshire to address climate change, we must use cleaner energy and we must use energy more efficiently. Among other things, this means that we will need to develop plentiful sources of renewable energy at the same time that we must adapt to the changes in weather and climate that are already underway due to anthropogenic (man-made) emissions of greenhouse gases into the atmosphere. Actions to curb the emission of heat trapping gases will, in almost all instances, have co-benefits, including creating new economic opportunities and jobs, reducing energy costs, and protecting natural resources and man-made infrastructure. New Hampshire's Climate Action Plan focuses on those actions that are expected to achieve the greatest reductions in greenhouse gas emissions while providing the greatest net medium- to long-term economic benefits. This Plan follows a "no-regrets" approach based on the principle that what's good for the environment will also be good for the economy. The recommended actions in this plan will:

- Promote growth of new jobs in energy services, the building trades and renewable energy development.
- Reduce the cost of energy to our citizens, businesses and government.
- Encourage the growth of our communities in ways that strengthen neighborhoods and urban centers, preserve rural areas and retain New Hampshire's quality of life.

Changes are already occurring to New England's climate, including warmer winters, reduced snowfall and snow-on-ground days, increased rainfall, rising sea level, and more severe weather events that result in increased risk of flooding[1]. These changes are projected to grow in severity and could include other impacts such as a decrease in the abundance of sugar maples, stresses on our fisheries, more widespread occurrence of insect-borne diseases, and an increase in heat-related illnesses[2]. Although the extent and timing of these potential impacts is uncertain, the costs of inaction could be large. *The Stern Review* found that failure to take actions to avoid the worst effects of climate change could depress global gross

domestic product (GDP) by as much as 20 percent below what it otherwise might have been[3*]. On the other hand, avoiding the most severe impacts of climate change would require the investment of just 1 percent of global GDP per year[4].

As a small state, New Hampshire is responsible for only a minor fraction of emissions contributing to global climate change. However, the actions identified in this plan will enable New Hampshire to continue to do its part to reduce emissions of greenhouse gases and prepare for a changing climate, especially when these actions are aggregated with the actions of its neighbors in the New England[5]. These actions, in turn, will benefit the economy, increase state and regional energy security, and improve environmental quality. Taking action now in the areas of energy efficiency, renewable energy, and more efficient transportation will provide New Hampshire with a competitive advantage as energy resources become even more costly in the future.

CLIMATE CHANGE SCIENCE

The presence and variability of greenhouse gases in the atmosphere has contributed to changes in the Earth's climate throughout its geologic history and helped create an environment conducive to life. However, levels of CO_2 and other so-called greenhouse gases in the atmosphere are accumulating at rates greater than can be attributed to natural processes. Consider that, for hundreds of thousands of years, atmospheric CO_2 levels varied between 180 and 280 parts per million (ppm). Since the Industrial Revolution (a period of roughly 200 years), the atmospheric CO_2 concentration has risen steadily above this range to more than 380 ppm and continues to rise today. There is an extensive body of evidence published in the peer-reviewed scientific literature that has concluded that a significant portion of the emissions that have contributed to this rise in the atmospheric CO_2 concentration originates from the burning of fossil fuels; and this excess CO_2 appears to be causing air and ocean temperatures to rise. An extensive analysis review of peer-reviewed scientific literature by the Intergovernmental Panel on Climate Change (IPCC) has clearly shown that if global greenhouse gas emissions continue to grow at current rates, there will be significant and far reaching changes in our future climate that will profoundly affect our health, economy, security, and quality of life[6].

During the public listening sessions held regarding the development of this action plan, four members of the public questioned the interpretation of climate science as presented above, especially the conclusions that average global temperatures were increasing and that increased temperatures were caused by the increase in CO_2 concentrations. The Task Force relied on the peer-reviewed scientific literature, especially the work conducted by the IPCC and other more regionally focused assessments of climate change published in the peer-reviewed scientific literature (e.g., Wake *et al.*, 2008). Appendix 1 provides a list of all of IPCC reports and assessments. Appendix 1 also provides a set of short reports from the IPCC that answer frequently asked questions regarding climate change science. These questions were selected to address some of the more common issues and questions that were raised at Task Force meetings and public listening sessions over the course of 2008.

The scientific literature makes it clear that we must address climate change now because of the potentially catastrophic impacts that may occur if we delay action or fail to act. In addition, the actions that are necessary to combat climate change also achieve environmental, economic, and societal benefits that are worthwhile and important on their own. In fact, most of the recommendations of the Task Force are grounded in this type of "no regrets" policy.

COST OF INACTION

A failure to act to address climate change within New Hampshire and globally is expected to result in increased impacts and costs to New Hampshire. The state was hard hit by 100-year flood events in 2005, 2006, and 2007. These floods caused major damage in several communities and resulted in the loss of life, as well as an enormous cost to affected citizens, municipalities and the state's highway system†. Flooding over this period caused an estimated $130 million in property damage across the Northeast[7]. Although short-term weather events cannot be directly attributed to climate change, scientists anticipate that the incidence and frequency of severe weather events such as these, as well as the recent 2008 ice

* The Stern Review is a 700-page report released on October 30, 2006 by economist Lord Stern of Brentford for the British government which discusses the effect of climate change and global warming on the world economy.

† NHDOT reports state highway repairs from recent flooding disasters of $28.1 million (Oct. 2005), $5.3 million (May 2006), $7 million (April 2007), $2.5 million - including $1 million for railway repairs (Aug. 2008) (Source: DES staff phone call with Bill Boynton, NHDOT – November 7, 2008).

storm, will increase with rising global temperatures. Failure to reduce CO_2 emissions will lead to climate change that will result in more severe weather events and the costs related to emergency response, storm clean-up, and reduced productivity and economic activity will be significant.

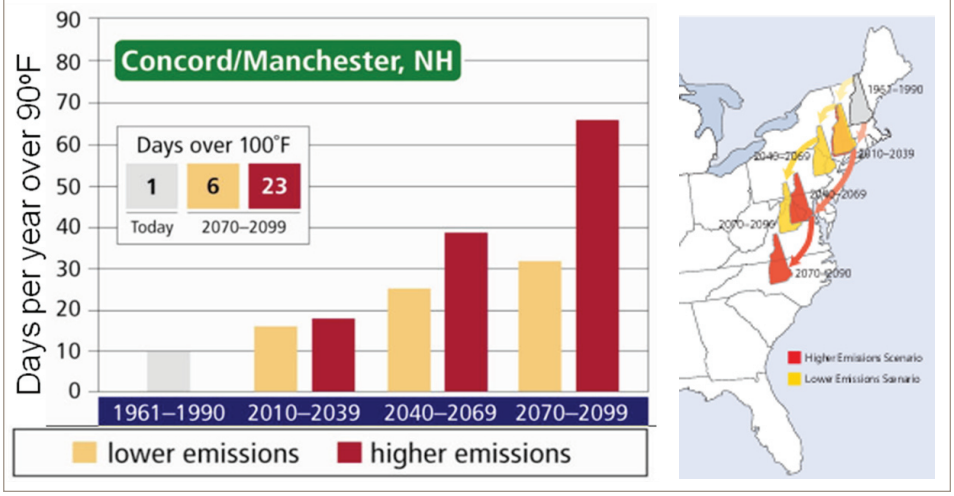
The *Northeast Climate Impacts Assessment* (NECIA)[8], a recent analysis by more than 50 independent climate, ecosystem, and health scientists and economists, examines the potential impacts that may result from the unchecked rise in greenhouse gas emissions and states that:

> *"If global warming emissions continue to grow unabated, New Hampshire can expect dramatic changes in climate over the course of this century, with substantial impacts on vital aspects of the state's economy and character."*

On a regional scale, the 2007 Northeast Climate Impacts Assessment (NECIA)[9] concludes that if greenhouse gas emissions continue to increase at current rates, by late in this century New Hampshire's climate will more closely resemble that of North Carolina (Figure 1.1).

Such a change in New Hampshire's climate presents numerous potential economic impacts:

Figure 1.1 - Temperature Effects of a Warming Climate



- Reduced viability of New Hampshire ski areas (a $650 million annual industry in New Hampshire) and other winter-based recreational industries; the snowmobiling economy ($3 billion annually in the Northeast region) almost eliminated in the southern areas and reduced to fewer than 20 days per year in the northern part of the state.
- Increased frequency and severity of heavy, damaging rainfall events and the associated major economic impacts of cleanup, repair, and lost productivity and economic activity.
- Increased frequency of short-term (one to three month) summer droughts from every two to three years to annually, resulting in increased water costs, and impacting New Hampshire's agricultural and forestry industries.
- Increased coastal flooding, erosion, and private property and public infrastructure damage from the estimated rise in sea level.
- Increased human health impacts and costs due to extreme heat (more than 20 days per year projected over 100°F), increased air pollution, and prevalence of vector borne diseases.
- Change in forest species and extinctions.

Such large-scale changes to our climate have the potential to affect human health, well being, and the economy over the short- and long-term. Economic effects could include impacts to New Hampshire's forestry and tourism industries as well as lead to greater infrastructure costs for cities and towns and state government. Higher summertime temperatures would exacerbate air pollution and create health concerns for all citizens, especially children, the elderly, and those with respiratory ailments.

Given the dependence of the state's economy on tourism and the natural environment, impacts to the state's ecosystems and landscapes are of particular concern and have implications for the New Hampshire way of life. Already the ski and snowmobile industries have been affected by warming winters[10,11,12] and there are implications for the logging industry and coastal beaches as well. Commercial logging occurs most efficiently in the winter when the ground is frozen. Warmer winter temperatures affect the number of days and, hence income, for logging activities. Coastal beaches can be affected by warmer and shorter winters with increased bacterial counts, changes in fisheries, and increased outbreaks of nuisance species such as red tide.

A May 2008 report, *The Cost of Climate Change*[13], based on

new research relying on historical impact data to project future economic impacts, projects that total global warming economic cost in the United States (under the "business as usual" emissions growth scenario) could equal 3.6 percent of gross domestic product (GDP). Impacts from hurricane damage, real estate losses, and energy and water costs will account for about half of these costs, or $1.9 trillion annually by 2100.

In addition to taking steps to reduce CO_2 emissions, New Hampshire must also invest in adaptation to better prepare for and reduce the risks of changing local conditions with climate change – as discussed in detail in Chapter 3. Even if emissions were significantly decreased immediately, New Hampshire's climate patterns are expected to continue to change over time as a result of delays in response by the global climate system. The enormous costs to the state of the three recent major floods (over an eighteen month period) as well as the recent ice storm, are exemplary of the types of costs we may face by failing to adapt to changes in climate through actions such as improved emergency management, and infrastructure improvements to increase resistance and resiliency.

REDUCTION GOALS

New Hampshire has worked cooperatively to develop a regional climate change action plan under the auspices of the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP). The 2001 NEG/ECP Climate Change Action Plan calls for a long-term goal that reduces regional greenhouse gas emissions "*sufficiently to eliminate any dangerous threat to the climate: current science suggests this will require reductions of 75-85 percent below current levels.*" In a 2007 resolution, the NEG/ECP established a target date of 2050 to achieve "*a 75-85 percent worldwide target reduction in emissions, subject to further scientific analysis of this target.*"[14]

The goal of reducing greenhouse gases 80 percent below 1990 levels by 2050 has been adopted by numerous states, cities, and organizations[15]. The 2007 IPCC report (Appendix 1) indicated that this goal was necessary to stabilize greenhouse gases in the atmosphere at or below 450 ppm CO_2 – a level that would avoid the most severe and dangerous impacts of climate change. However, recent research suggests that even more aggressive emission reductions are required to stabilize our climate system[16].

Clearly, stabilizing the concentrations of greenhouse gases in the atmosphere will only occur through global action. Even regionally, the NEG/ECP Climate Change Action Plan recognized that different jurisdictions would have varying degrees of success at meeting even the short-term goals of that plan. However, the long-term goal of reducing greenhouse gas emissions 80 percent by 2050 is the benchmark being used by many states and environmental organizations to assess whether climate action plans are putting into place the policies, market changes, technologies, and regulations needed to adequately address the causes of climate change[17]. Accordingly, the Task Force recommends that New Hampshire strive to achieve a long-term reduction of 80 percent below 1990 levels, consistent with the NEG/ECP resolutions and the consensus recommendations of the scientific community.

In the more immediate future, a mid-term goal should be consistent with specific actions that New Hampshire can take in the context of its energy profile, environmental priorities and resources, and economic circumstances. At the request of the Climate Change Policy Task Force, UNH-based Carbon Solutions New England (CSNE) conducted a detailed and comprehensive evaluation of all the potential actions New Hampshire could take to reduce its greenhouse gas emissions and move towards the long-term goal of reducing its emissions 80 percent below 1990 levels by 2050. The major result of this undertaking is a set of recommended actions (described in Chapter 5) based on the projected greenhouse gas emission reductions and economic effects that would result from these actions. Consistent with the specific action recommendations in the action plan, the Task Force recommends that New Hampshire strive to achieve mid-term emission reductions of 20 percent below 1990 levels by 2025.

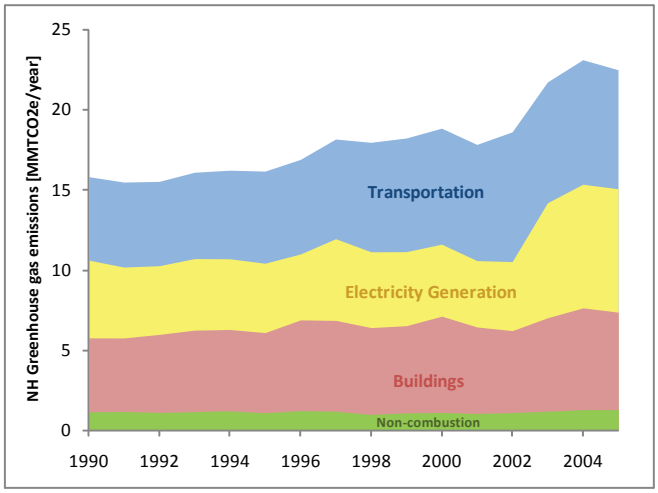
NEW HAMPSHIRE'S GREENHOUSE GAS INVENTORY

To understand New Hampshire's contribution to climate change and be better positioned to identify and select recommended actions, a greenhouse gas emission inventory was conducted for 1990-2005 using the EPA's State Inventory Tool[‡].

The inventory revealed that the vast majority of New Hampshire's greenhouse gas emissions are in the form of CO_2 resulting primarily from the combustion of fossil fuels for heat, power, and transportation. Analysis of this inventory showed that electric generation, transportation, and direct fuel use in buildings each contributed roughly one-third of the state's

[‡] The EPA's State Inventory Tool (SIT) is intended to assist with the development of a state-level greenhouse gas emission inventory. It uses interactive spreadsheet software that gives users the option

Figure 1.2 Historical Emissions by Sector



total emissions in 1990. As seen in Figure 1.2, greenhouse gas emissions from each of these sectors have steadily increased in a roughly linear fashion. Between 1990 and 2005, the state's total greenhouse gas emissions increased by 48 percent from 15.79 million metric tons of CO_2 equivalents ($MMTCO_2e$) to 22.45 $MMTCO_2e$ in 2005[§] (Table 1.1).

The emissions from the transportation sector increased rapidly from 1990 to 2005 and are presently the greatest single contributor to the state's total greenhouse gas emissions – approximately 33 percent of the total. This was principally due to an increase in fuel use as gasoline consumption in New Hampshire rose by 42 percent from 489 million gallons per year in 1990 to 695 million gallons in 2005, and diesel consumption rose by 105 percent from 52 million gallons per year to 106 million gallons[18].

The emissions originating from the building sector, which includes direct energy consumption in residential, commercial, and industrial space, grew more slowly. Building related emissions grew by nearly 32 percent from 1990 to 2005 and these emissions accounted for 29 percent of New Hampshire's total emissions in 2005. The leading cause of this increase was due to a significant expansion in the use of natural gas which increased from 14 billion cubic feet in 1990 to 25 billion cubic feet in 2005[19].

The electric generation sector experienced significant growth as well, but was punctuated by sharper increases than the building and transportation sectors. The greatest single increase in emissions occurred between 2002 and 2003, when New Hampshire's two newest natural gas powered electrical generation plants, Granite Ridge Energy LLC (Londonderry, NH) and NAEA Newington Energy LLC (Newington, NH), came online. The emissions from these two plants represent nearly 31 percent of the total increase in New Hampshire's emissions from 1990 to 2005. These two facilities also account for approximately 64 percent of the total growth in the electric generation sector over that time, bringing electric generation's emission contribution to 34 percent of the state's total. The emissions increase caused by these two facilities was not linked to a rise in energy consumption by New Hampshire residents. Instead, the vast majority of this new generation was exported to other New England states as the exported portion of New Hampshire's generation rose from 35 percent in 2002 to 54 percent in 2004[20].

Table 1.1 - Table of Historical Emissions by Sector

	Emissions [$MMTCO_2e$/yr]			
	1990	**1995**	**2000**	**2005**
Total Energy Related Emissions	**14.68**	**15.08**	**17.74**	**21.21**
Commercial	1.32	1.15	1.44	1.93
Industrial	0.83	1.09	1.64	0.98
Residential	2.47	2.76	2.93	3.17
Transportation	5.21	5.76	7.24	7.43
Electric Power	4.85	4.32	4.49	7.7
Total Non-Combustion Related Emissions	**1.1**	**1.05**	**1.07**	**1.24**
CH_4 and N_2O emissions	1	0.83	0.65	0.69
Industrial Emissions	0.1	0.22	0.42	0.55
PFC, HFC, and SF_6				
Total Emissions	**15.79**	**16.13**	**18.81**	**22.45**

Non-combustion emissions contribute a smaller but significant source of greenhouse gases to the atmosphere. The agriculture, forestry, and waste sectors together contributed 2.3 percent of the state's emissions in 2005 following a 35 percent decline in direct emissions since 1990. This decline was principally due to reductions in methane gas emissions from landfills due to flaring and landfill gas energy projects. The transportation sector provided a small amount of methane

of applying their own state-specific numbers or using default data pre-loaded for each state. The default data is gathered by federal agencies and other sources covering fossil fuel use, agriculture, forestry, waste management and industry. The SIT provides a streamlined way to update an existing inventory or complete a new inventory. The software is accompanied by updated guidance describing best practices.

[§] EPA State Inventory Tool output using default values for state emissions.

and nitrous oxide emissions over this time as well. Industrial process gases also increased steadily from 1990 to 2005, and contributed nearly 2.5 percent of the states greenhouse gas emissions in 2005, up from 0.65 percent in 1990. If growth in industrial emissions continues to expand at its current rate, this will become an increasingly important source of greenhouse gas emissions.

A significant source of emissions not addressed in the EPA inventory was the conversion of agricultural and forested lands to other uses. This conversion, resulting from development associated with New Hampshire's rapid rate of population growth, provided a steady contribution of greenhouse gas emissions. These emissions resulted from the direct release of large amounts of carbon that had been stored in agricultural and forest soils and trees, which form a natural carbon sink. This development not only releases CO_2, but it also reduces the ability of New Hampshire's forest and agricultural lands to absorb more CO_2 in the future.

Though population growth has slowed since approximately 2000, New Hampshire had been the fastest growing state in New England over the past 40 years and even in recent years the influx of new residents and other development pressures have resulted in forest lands and agricultural lands being cleared for residential, commercial, and industrial development. This land use conversion has caused the release of an additional 0.35 $MMTCO_2e$ per year, driven largely be the complete clearing of 5000 acres of forest land each year**. A significant factor not addressed by these figures is the permanent loss of the sequestration potential of these natural lands as the capacity to store carbon naturally in the soil and forests is lost.

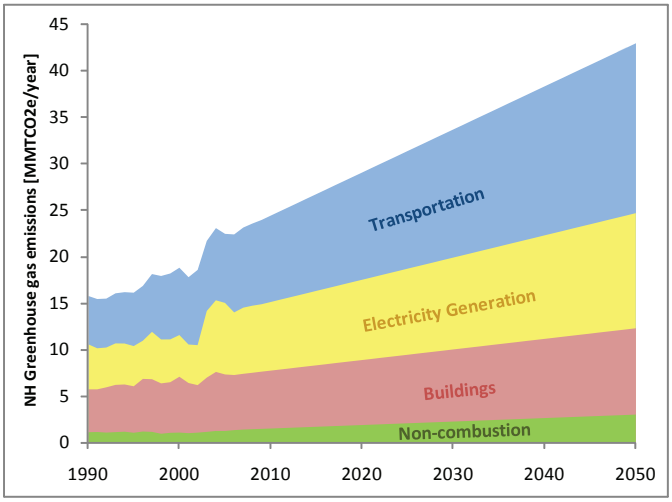
PROJECTED GREENHOUSE GAS EMISSIONS

Projections of future greenhouse gas emissions prepared by Carbon Solutions New England (CSNE) indicate that if current trends prevail under "business-as-usual" (BAU) conditions, New Hampshire's emissions will grow at a rate equal to approximately 2 percent of *current* emissions per year, roughly doubling the current emission levels by 2050 (Figure 1.3; Table 1.2).

The business-as-usual projections of New Hampshire greenhouse gas emissions due to fossil fuel use for each sector were developed by extrapolating historical emissions data out to 2050. Linear extrapolations of 1990-2005 emissions data were used to project emissions in the transportation, residential, commercial, and industrial sectors[21]. Emissions from the electricity generation sector were calculated differently because the historical New Hampshire emissions record is punctuated by large fluctuations due to the expansion and retirement of major generation plants. Linear extrapolation of future New Hampshire generation was projected based on the assumption that New Hampshire will continue to contribute 17.3 percent of New England generation. Projected emissions were calculated based on the assumption that all future expansion of New Hampshire generation capacity is provided by natural gas plants.

The transportation sector is anticipated to be the largest single contributor to the growth in New Hampshire's greenhouse gas emission as a consequence of population increase and sprawl-type development patterns. These two factors would lead to more cars on the road, each traveling a greater number of miles and collectively resulting in an annual fuel consumption increase equal to 2.8 percent of 2008 levels. By 2012, it is projected that New Hampshire would consume 719 million gallons of gas per year and 124 million gallons of diesel. By 2025, consumption would rise to 798 million gallons of gas per year and 166 million gallons of diesel[22]. This would contribute to a 30 percent increase in transportation emissions between 2012 and 2025. Such growth in transportation would result in this sector generating 40 percent of all greenhouse gas emissions by 2025.

Figure 1.3 Future Projected Emissions by Sector (Business as Usual)



The second largest contributing factor is the expected

** Based on CSNE analysis (Appendices 6 and 7).

Table 1.2 – New Hampshire Projected Greenhouse Gas Emissions (Business as Usual)

	Emissions [$MMTCO_2e/yr$]		
	2012	**2025**	**2050**
Total Energy Related Emissions	**23.76**	**29.30**	**39.95**
Commercial	1.47	1.64	1.98
Industrial	1.53	1.81	2.34
Residential	3.38	3.92	4.96
Transportation	9.74	12.66	18.27
Electric Power	7.63	9.26	12.39
Total Non-Combustion Related Emissions	**1.58**	**2.07**	**3.00**
CH_4 and N_2O emissions	0.73	0.75	0.79
Industrial Emissions PFC, HFC, and SF_6	0.84	1.31	2.21
Total Emissions	**25.34**	**31.36**	**42.95**

annual load growth in the electricity sector equal to an annual increase of nearly 1.5 percent of 2008 levels with energy generation rising from 12.6 million MWh in 2012 to 14 million MWh in 2025. The increase in electric load would result from an increase in population within the state and region. As noted above, New Hampshire is a net exporter of electricity with nearly 50 percent of its total generation currently exported out of state[††]. The increase in total generation will also result from an increase in the per capita energy consumption. Under a BAU scenario, this additional load is projected to be met largely by new natural gas-fired generation facilities and would result in a 21 percent increase in electric power emissions between 2012 and 2025. This slower growth relative to the transportation sector discussed above will result in the electric generation sector responsible for producing approximately 30 percent of all greenhouse gas emissions by 2025[‡‡].

Direct emissions from buildings (i.e., residential, commercial and industrial sources) is expected to grow more slowly, with non-electric energy use in the residential, commercial and industrial sectors expected to grow by only 9 percent between 2012 and 2025. This much slower growth relative to other sectors in New Hampshire will reduce the relative contribution of buildings' direct emissions to 25 percent by 2025[23].

Understanding these trends provided the Task Force with the opportunity to identify those actions with the potential to lead to significant emission reductions while avoiding energy use and the associated costs.

TASK FORCE PROCESS

Governor Lynch established the Climate Change Policy Task Force through Executive Order 2007-3 on December 6, 2007 (Appendix 2). The Governor charged the Task Force with developing greenhouse gas reduction goals and recommending specific regulatory, voluntary, and policy actions that the state should consider to meet these goals. The Task Force consisted of 29 members (Appendix 2), representing a broad range of sectors and interests in New Hampshire including:

- The New Hampshire House and Senate
- New Hampshire state agencies
- Municipal government
- Business and industry
- Environmental interests
- The forestry sector
- Science/academia
- Public utilities
- The insurance industry

In support of the Task Force, six working groups were formed to develop a suite of possible strategies for greenhouse gas reductions and to summarize the results in the form of individual action reports. The six working groups were:

- Residential, Commercial and Industrial (RCI)
- Electric Generation (EGU)
- Transportation and Land Use (TLU)
- Agriculture, Forestry and Waste (AFW)
- Government, Leadership and Action (GLA)
- Adaptation (ADP)

Over 125 individuals, representing a wide range of interests and expertise, participated in these working groups (Appendix 2). The working groups initially received a list of nearly 220 actions that had been considered in the climate action plans of other states. The groups reviewed these potential actions, developed additional or modified emission reduction strategies, and identified the most promising actions before analyzing their respective impacts and prioritizing the potential actions.

Each reduction strategy, called a potential action report

[††] Analysis of state energy data supplied by EIA. Energy Information Administration website (2009), NH Energy Consumption 1960-2006. http://www.eia.doe.gov/emeu/states/state.html?q_state_a=nh&q_state=NEW%20HAMPSHIRE (last accessed January 14, 2009).

[‡‡] EPA State Inventory Tool output using default values for state emissions.

(complete set in Appendices 4 and 5), was submitted to the Task Force's technical consultants, CSNE, for analysis. CSNE evaluated each of the 80-plus potential action reports developed by four of the six working groups[§§] to determine the potential CO_2 emission reductions, costs of implementation, and cost savings associated with each potential action (Appendices 6 and 7). CSNE conducted its analyses through an iterative process over a period of seven months to ensure that the reductions, costs, and savings projections for each analyzed potential action were based on grounded assumptions and reflected the collective wisdom of the working groups. CSNE routinely consulted the working groups to discuss the methodology and assumptions used in the analyses. When necessary, experts outside of this process were consulted in a similar fashion. CSNE's analyses were presented to the Task Force on two occasions in order to solicit feedback from the Task Force. All of the assumptions used in the analyses are detailed in the Approach and Assumption documents which appear in Appendix 7.

The Adaptation working group was formed to consider the current and projected impacts of climate change and to identify potential actions that should be taken to help society adapt to climate change. While not typically included in the climate action plans of other states, the Task Force believed that adaptation was a critical issue to address because the state is already experiencing the impacts of a changing climate, and these changes are projected to become more pronounced. The scale of the global climate system is such that there is a lag in the climate's response to increasing atmospheric CO_2 concentrations. This delayed response means that the full effect of today's emissions will not be realized until decades into the future. At the same time, the full benefit of any emission *reductions* will not be realized for years to come. Because CO_2 emissions remain in the atmosphere for an average of 100 years, we will continue to experience climate change impacts even if anthropogenic greenhouse gas emissions were significantly reduced immediately. Consequently, the Adaptation working group looked at what actions should be considered to prepare New Hampshire for a changing climate even as the state begins to reduce its greenhouse gas emissions.

[§§] The potential action reports for Government Leadership and Adaptation (GLA) were not analyzed by CSNE. Those potential action reports prepared by the Electric Generation (EGU), Residential, Commercial, and Industrial (RCI), Transportation & Land Use (TLU), and Agriculture, Forestry & Waste (AFW) working groups were analyzed by CSNE for carbon reductions and economic impacts.

The Task Force developed and adopted the following principles as a guide in formulating its action recommendations:

1. **Maximize greenhouse gas emission reductions to move the state, steadily and as quickly as possible, toward the goal of reducing greenhouse gas emissions 80 percent below 1990 levels by 2050.**
2. **Select actions that provide the greatest net economic benefits and economic opportunities to New Hampshire, while also considering energy security, public health, and environmental benefits.**
3. **Make investments using a phased approach that first exploits the most cost-effective, currently available technologies and incorporates more advanced technologies as they become more available and are shown to be cost-effective.**
4. **Ensure that policies (a) do not further disadvantage already disadvantaged populations, and (b) include mechanisms to mitigate adverse impacts to disadvantaged populations.**
5. **Reduce vulnerability from a changing climate by planning and taking adaptive measures to address existing and future impacts to natural resources, the built environment, and New Hampshire's way of life.**
6. **Engage the public to take action at the individual, community, state, and national levels.**
7. **Create a plan that views climate change in a regional, national, and global context, is reviewed on a regular basis to determine progress, and whose actions can evolve and develop over time in response to changing technology, economics, and sociological circumstances.**
8. **Sustain the state's resources, both cultural and natural, that provide opportunities for both mitigation and adaptation.**

PUBLIC INPUT

An extensive public process was conducted to gather input for the plan and allow the public access to the Task Force's work, and to assist the Task Force in understanding the issues and opportunities connected to climate change. On February 19, 2008, an initial public listening session was held to obtain input on the kinds of actions the Task Force should explore. After the working groups completed their draft of potential actions, the 100-plus potential action reports were released for

public comment. Five additional listening sessions were then held at locations across the state to solicit public comments. Two of these sessions were conducted using live interactive video conferencing through the Granite State Distance Learning Network, centered at the Seacoast Science Center in Rye and at the North Country Education Services Center in Gorham. This video conferencing technology enabled five additional locations to participate in the listening sessions. Participants at each video-linked site could interact with all other sites by providing questions and comments to the host site and watching questions and comments in real time from participants at the other linked sites. Video conferencing is just one example of using new technologies to reduce greenhouse gas emissions – in this case, by reducing automobile travel.

The public listening sessions attracted over 175 attendees and yielded more than 75 oral comments. A detailed summary of these comments was provided to the Task Force and is reproduced in Appendix 3. In addition, over 200 letters and emails were received and turned over directly to the Task Force (copies included in Appendix 3). Finally, any subsequent actions or approaches considered by the Task Force after completion of the public listening sessions were also distributed for public review and comment separately.

Four clear themes emerged from among all comments received:

1. The Task Force should recognize the magnitude of the climate change problem and be bold in its decision making.
2. Significant improvements in energy efficiency in every sector – but particularly energy efficiency in buildings – should be a major recommendation and commitment of the state action plan.
3. Transportation issues, including reducing the amount of gasoline and diesel fuel that we use, improving public transportation, and encouraging consumers to select more fuel-efficient cars, are critical to any plan addressing climate change.
4. Comprehensive education is needed to inform the public of actions they can take to reduce energy use, train the energy services trades in new technologies, and develop appropriate curricula for our schools.

The Task Force received many other comments on numerous themes, including promotion of renewable energy resources, development of bike paths, and ensuring that our forests are used sustainably. Five out of 100 who commented questioned the validity of conclusions in the peer-reviewed scientific literature on climate change. However, even these individuals agreed with the recommendations of promoting energy efficiency and increasing the state's use of renewable energy resources for the many benefits they provide.

The Task Force and its working groups also considered a number of related and ongoing initiatives, including:

- Governor Lynch's "25 x '25" initiative to obtain 25 percent of New Hampshire's energy from renewable resources by 2025.
- Governor Lynch's Executive Order 2005-04 to reduce energy use in state operations by 10 percent.
- The State Development Plan, being prepared by the New Hampshire Office of Energy and Planning.
- Efforts of the New England Governors/Eastern Canadian Premiers Climate Change Steering Committee.
- A Thermal Energy Study being prepared by the Office of Energy and Planning as required by legislation establishing an Electric Renewable Portfolio Standard.

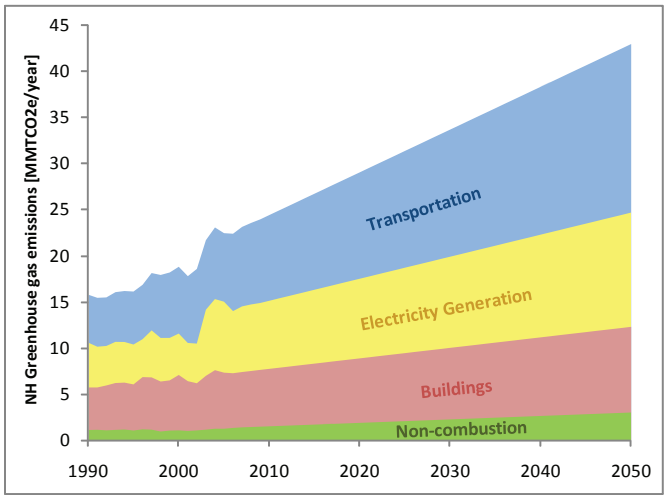
Chapter 2: Recommendations

New Hampshire's greenhouse gas emissions have been growing steadily since 1990 and are projected to double between 2008 and 2050 under a business-as-usual (BAU) scenario (Figure 2.1). These emissions are almost entirely due to energy consumption related to transportation, buildings, and electricity generation. A smaller portion of non-combustion-related gases is contributed by the transportation, industrial, agriculture, forestry and waste sectors*. The Climate Change Policy Task Force used these historical and projected (post-2005) trends to identify the best opportunities to reduce greenhouse gas emissions in the future while providing significant economic development potential to the state.

The Task Force identified 10 overarching strategies necessary to reduce New Hampshire's annual greenhouse gas emissions and position the state to achieve long-term emissions reductions of 80 percent below 1990 levels by 2050. These strategies are necessary to comprehensively address the causes and the impacts of climate change and include:

1. Maximize energy efficiency in buildings.

Figure 2.1 – New Hampshire's Historical and Projected Greenhouse Gas Emissions (Business as Usual)



*Non-combustion gas is the term used to describe those greenhouse gases that are not emitted by direct fossil fuel combustion. They include industrial process gases (e.g., SF_6, HFC, PFC), as well as methane (CH_4) and nitrous oxide (N_2O).

2. Increase renewable and low-CO_2-emitting sources of energy in a long-term sustainable manner.
3. Support regional and national actions to reduce greenhouse gas emissions.
4. Reduce vehicle emissions through state actions.
5. Encourage appropriate land use patterns that enable fewer vehicle-miles traveled.
6. Reduce vehicle-miles traveled through an integrated multimodal transportation system.
7. Protect natural resources (land, water, wildlife) to maintain the amount of carbon fixed or sequestered.
8. Lead by example in government operations.
9. Plan for how to address existing and potential climate change impacts.
10. Develop an integrated education, outreach and workforce training program.

To achieve these overarching strategies, the Task Force identified a suite of recommended actions to be implemented by individuals, businesses and government through a combination of voluntary and regulatory approaches. These recommendations were chosen by the Task Force following extensive discussion of more than 100 potential actions that were developed by the six technical and policy working groups. Its deliberations included a review of the detailed and transparent analysis of these actions conducted by Carbon Solutions New England (CSNE). This analysis provided projections of the CO_2-emission reductions, costs of implementation and cost savings associated with a majority of the actions[†]. In addition, the action reports contained qualitative evaluations of the broader social and environmental impacts associated with the actions under review. This broad evaluation enabled the Task Force to recommend specific actions for inclusion in the action plan based not only on their greenhouse gas emission reduction potential and economic development potential, but also their potential to provide other important benefits, and to avoid unintended consequences.

The identified overarching strategies and their associated recommended actions constitute a plan to enable New Hampshire to continue to do its part to address climate change; actions that will in turn benefit the economy, increase state and regional energy security, improve environmental quality, and position the state and its citizens to implement even greater greenhouse gas reductions in the future. Many of the recommended actions can be implemented immediately, while others require a phased-in approach during which some steps can be taken immediately and further implementation occurs as technology evolves, resources become available and the economic costs and benefits become more favorable. The resulting plan addresses the State of New Hampshire's previous climate change commitments, places the state on a course to achieve the emission reduction goals established by the Task Force, and promotes a comprehensive approach to early adaptation to climate change.

OVERARCHING STRATEGIES & RECOMMENDED ACTIONS

The section below describes the overarching strategies and the actions recommended by the Task Force to achieve them. A summary of the recommended actions can be found in Chapter 5. The complete action reports are provided in Appendix 4. Each action includes the original reference codes (e.g., EGU 2.1) used by the technical/policy working groups during the development of the full range of actions. Abbreviations are as follows:

- ADP Adaptation
- AFW Agriculture, Forestry and Waste
- EGU Electric Generation
- GLA Government Leadership and Action
- RCI Residential, Commercial, and Industrial Usage
- TLU Transportation and Land Use

Actions that were not recommended by the Task Force have been retained for future consideration and possible inclusion in subsequent revisions to the Climate Action Plan (Appendix 5).

All actions selected by the Task Force had consensus support unless otherwise noted (here, consensus means that the recommendation was supported by all members of the Task Force). Documentation of the support for each action is provided in Appendix 2. As shown in Appendix 2, some Task Force members abstained from voting due to their roles on other boards or for other reasons. One or more Task Force members abstained from voting on the following actions:

[†] Some of the actions were not quantifiable as they were supportive of other actions and had no direct emission reductions, costs or cost savings associated with them. Further detail of the analysis conducted by CSNE can be found in Appendix 7.

- Implement Regional Greenhouse Gas Initiative (RGGI) (EGU 2.2)
- Promote Low- and Non-CO_2-Emitting Electric Generation (EGU 2.4)
- Enable Importation of Canadian Hydro and Wind Generation (EGU 2.6)
- Allow Regulated Utilities to Build Renewable Generation (EGU 2.7)
- Install Retrofits to Address Black Carbon Emissions (TLU 1.C.3)

1. Maximize energy efficiency in buildings.

The operation of buildings accounts for 48 percent of greenhouse gas emissions in the United States according to the Pew Center on Climate Change. In New Hampshire, 32.3 percent of the net energy consumed in 2005 was used to heat buildings and structures, and another 36.6 percent was used to generate electricity, much of which is used in buildings[3]. The construction and operation of buildings, therefore, represents a major contributor to greenhouse gas emissions. The state can realize substantial reductions in its energy consumption for heat and power by maximizing the thermal and electrical efficiency of all future buildings and extensively retrofitting existing residential, commercial, industrial and municipal buildings. This will lead to significant and direct reductions in energy costs and greenhouse gas emissions. Such actions can begin immediately by implementing the most cost-effective investments in energy efficiency immediately and incorporating more advanced technologies when they become economically viable.

Actions recommended by the Task Force:

- Maximize Efficiency in New Construction (RCI 1.1)
- Maximize Energy Efficiency in Existing Residential Buildings (RCI 1.2)
- Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings (RCI 1.3)
- Install Higher-Efficiency Equipment, Processes, and Systems (RCI 2.1)
- Increase the Use of Combined Heat and Power (EGU 1.3)
- Consider Alternative Rate Design (EGU 1.1)
- Upgrade Building Energy Codes (RCI 1.4a)
- Increase Building Energy Code Compliance (RCI 1.4b)
- Establish an Energy Properties Section in Real Estate Property Listings (RCI 1.5)
- Conserve Embodied Energy in Existing Building Stock (RCI 1.8)

2. Increase renewable and low-CO_2-emitting sources of energy in a long-term sustainable manner.

While expanded energy efficiency will reduce the total demand for energy at the individual site level, there will still be a need for heat and power. Further emission reductions can be achieved as New Hampshire meets an increasing portion of its total energy demand by developing renewable and low- CO_2-emitting energy resources. This expanded capacity will reduce overall greenhouse gas emissions. In addition, to the extent that in-state energy resources can reduce the dependence on imported fossil fuel, such resources will result in more dollars staying in New Hampshire, thus having a positive impact on non-energy sectors of the state economy.

Actions recommended by the Task Force:

- Promote Renewable Energy through the Electric Portfolio Standard (RPS) (EGU 2.1)
- Increase Renewable and Low-CO_2 Thermal Energy Systems (RCI 3.1)
- Promote Low- and Non-CO_2-Emitting Electric Generation (EGU 2.4)
- Identify and Deploy the Next Generation of Electric Grid Technologies (EGU 2.8)
- Promote Low- and Non-CO_2-Emitting Distributed Generation (EGU 2.9)
- Encourage the Use of Biogenic Waste Sources for Energy Generation (AFW 2.4)

Actions recommended by the Task Force with majority support:

- Implement Regional Greenhouse Gas Initiative (RGGI) (EGU 2.2)[‡]
- Enable Importation of Canadian Hydro and Wind Generation (EGU 2.6)[§]
- Allow Regulated Utilities to Build Renewable Generation (EGU 2.7)[‡]

[‡] This action received one "no" vote.

[§] This action received a number of "no" votes due to concerns over the potential environmental impacts of the imported power and the effect imported power might have on development of in-state renewable resources.

3. Support regional and national actions to reduce greenhouse gas emissions.

New Hampshire can take significant actions to reduce its greenhouse gas emissions, but there are measures that need to be taken at the regional, national, and international levels. Such measures will ultimately lead to greater overall emission reductions and will complement the in-state efforts. By working with the Congressional delegation and participating in regional, national and international efforts, New Hampshire has the potential to affect policy that can lead to additional reductions and leverage greater reductions from in-state actions.

Actions recommended by the Task Force:

- Support Stricter Corporate Average Fuel Economy Standards (TLU 1.A.1)
- Support Fuel Economy Standards for Heavy-Duty Vehicles (TLU 1.A.2)
- Adopt a Low-Carbon Fuel Standard (TLU 1.C.1)
- Promote Advanced Technology Vehicles and Supporting Infrastructure (TLU 1.C.2)
- Support Strong Climate Action at the Federal Level (GLA 1.6)

4. Reduce vehicle emissions through state actions.

The transportation sector is the most significant single source[††] of greenhouse gas emissions in the state, and its relative contribution is projected to increase further based on current trends. The state can reduce transportation emissions by taking actions that improve the fuel economy of vehicles on the road. This objective can be achieved through technological requirements, improved traffic flow, and policies and programs that influence vehicle purchase, operation, and maintenance.

Actions recommended by the Task Force:

- Adopt California Low Emission Vehicle (CALEV) Standards (TLU 1.A.3)
- Create a Point-of-Sale Financial Incentive for Higher-Efficiency Vehicles (TLU 1.B.1)
- Install Retrofits to Address Black Carbon Emissions (TLU 1.C.3)
- Implement Commuter Trip Reduction Initiative (TLU 2.A.1)
- Increase Highway Automobile Efficiency (TLU 1.D.1)
- Address Vehicle Idling (TLU 1.D.2)
- Improve Traffic Flow (TLU 1.D.3)

5. Encourage appropriate land use patterns that reduce vehicle-miles traveled.

Though New Hampshire's growth has slowed recently, it experienced faster growth than any other state in New England over the past 40 years. Much of this growth occurs as dispersed, low-density development, characteristically known as "sprawl." This type of development leads to an increase in the per capita annual vehicle-miles traveled as residential and commercial developments become increasingly dispersed across the landscape[8]. By adopting strategies that promote compact, mixed-use, walkable-design development, the growth in annual travel can be significantly reduced. Through careful planning and development, growth can be concentrated and designed in such a way that it reduces the length of trips and increases the viability of walking, biking, and public transportation, while at the same time enhancing the aesthetics and livability of our communities. This type of development provides additional benefits by reducing the amount of CO_2 released through forest and agricultural land conversion and helping to retain the traditional rural and village character of the state. Additional benefits can be realized through the maintenance of ecosystem services, such as flood storage, that will mitigate some of the impacts of climate change.

Actions recommended by the Task Force:

- Assess Greenhouse Gas Development Impact Fees (TLU 2.C.1.a)
- Streamline Approvals for Low- Greenhouse Gas Development Projects (TLU 2.C.1.b)
- Develop Model Zoning to Support Bus/Rail Transit (TLU 2.C.2)
- Develop Model Zoning for Higher-Density, Mixed-Use Development (TLU 2.C.3)
- Continue/Expand Funding, Education, and Technical Assistance to Municipalities (TLU 2.C.8)

6. Reduce vehicle-miles traveled through an integrated multi-modal transportation system.

New Hampshire's annual vehicle-miles traveled and the resulting transportation-based emissions can be reduced by changing the manner by which people and freight move around the state. In particular, substantial gains can be made

[††] EPA State Inventory Tool output using default values for state emissions.

by reducing the number of single-occupancy vehicles on the road through the promotion and expansion of alternative modes of travel (e.g., walking, cycling, bus, train) and carpooling. At the same time, access and mobility can be improved for the majority of the population. The successful reduction of vehicle-miles traveled will require integrated planning that looks at land use, environment/climate, and transportation needs simultaneously and the development of an integrated system that locates transportation hubs near the residential, commercial, and industrial centers that they serve.

Actions recommended by the Task Force:

- Improve Existing Local/Intra-Regional Transit (Bus) Service (TLU 2.B.1.b)
- Expand Local/Intra-Regional Transit (Bus) Service (TLU 2.B.1.a)
- Improve Existing Inter-City Bus Service (TLU 2.B.2.h)
- Expand and Improve Bicycle and Pedestrian Infrastructure (TLU 2.B.1.c)
- Maintain and Expand Passenger Rail Service (TLU 2.B.2.a)
- Maintain and Expand Freight Rail Service (TLU 2.B.2.b)
- Implement a Stable Funding Stream to Support Public Transportation (TLU 2.B.2.c)
- Expand Park-and-Ride Infrastructure (TLU 2.B.2.e)

7. Protect natural resources (land, water, wildlife) to maintain the amount of carbon fixed or sequestered.

New Hampshire is the second most forested state in the nation with 84 percent of its landscape covered in trees, an area encompassing 4.8 million acres of forest[9]. Forest lands support the state's vital natural resource-based economy and provide essential ecosystem services in the form of soil stabilization, water cycle regulation, flood mitigation, wildlife habitat, and nutrient cycling. Soils of agricultural and forest lands and the trees of forests play a critical role in carbon sequestration. New Hampshire can maintain and enhance the economic benefits and ecosystem services, including net greenhouse gas emission reductions, of agricultural and forest lands by managing them in a sustainable fashion. In forests, sustainable management promotes a renewable energy source, protects wildlife, and ensures long-term ecosystem health.

Actions recommended by the Task Force:

- Invest in Forests to Maximize Carbon Storage and to Avoid Net Forest Land Conversion (AFW 1.2)
- Optimize Availability of Biomass for Electricity and Heating within Sustainable Limits (AFW 2.2)
- Promote Durable Wood Products (AFW 1.3)
- Protect Agricultural Land (AFW 1.1.3)
- Maximize Source Reduction, Reuse and Recycling (AFW 3.1)

8. Lead by example in government operations.

The state of New Hampshire has a critical role to play as a supporter and leader of climate change action in New Hampshire. The state's agencies and activities can adopt strategies that reduce the greenhouse gas emissions associated with heating and cooling buildings, the power used by equipment and the fuel consumed by its fleet of vehicles. The state can track the dollar savings associated with these efforts, and share this information. These actions will provide an economic development model for municipalities and businesses to adopt while also developing some of the infrastructure, such as alternative fueling stations, that are necessary for certain technologies to become viable. All levels and categories of government in New Hampshire, including counties, municipalities, village precincts and school districts, can adopt the same measures as are recommended for the state government and by doing so they can also be supporters and leaders of climate change action in their regions or communities.

Actions recommended by the Task Force:

- Establish an Energy Management Unit to Address State Energy Use and Greenhouse Gas Emissions (GLA 1.1)
- Establish an Energy Consumption and Greenhouse Gas Emissions Baseline Inventory for State Government (GLA 1.2)
- Establish a Self-Sustaining Fund for Energy Efficiency Projects in State Government (GLA 1.3)
- Provide for the Establishment of Local Energy Commissions (GLA 1.4)
- Include Climate Change Adaptation and Mitigation in Programs and Planning (GLA 1.5)
- Promote Public School Siting and Building Aid to Reduce Energy Use (GLA 2.6)

9. Plan for how to address existing and potential climate change impacts.

New Hampshire must continue to plan for the impacts of climate change even as it works to address its causes. Carbon dioxide remains in the atmosphere for, on average, 100 years

once it is emitted. There is also a delay in the climate's response to increasing atmospheric concentrations of greenhouse gases due to the scale of the global climate system. Therefore, climate change will continue for some time even if all man-made greenhouse gas emissions were be reduced significantly in the near future. Some level of climate change adaptation is necessary to ensure that the current and future impacts of climate change do not significantly impact the health of our residents, the strength of our economy, or the character of our natural environment. By preparing for climate change early, the state can avoid significant costs, whether economic, social or ecological, in the future.

Actions recommended by the Task Force:

- Develop a Climate Change Adaptation Plan for the State of New Hampshire (ADP 8)
- Develop and Distribute Critical Information on Climate Change (ADP 1)
- Promote Policies and Actions to Help Populations Most at Risk (ADP 2)
- Charge and Empower Public Health Officials to Prepare for Climate Change (ADP 3)
- Strengthen Protection of New Hampshire's Natural Systems (ADP 4)
- Increase Resilience to Extreme Weather Events (ADP 5)
- Strengthen the Adaptability of New Hampshire's Economy to Climate Change (ADP 6)

10. Develop an integrated education, outreach, and workforce training program.

Critical to achieving the overarching strategies and implementing the recommended actions will be a comprehensive education program for the state that ranges from grade schools to universities and colleges, households to communities, and small businesses to large corporations, and also includes churches and not-for-profit organizations. This program would focus on raising the awareness of climate change causes and impacts, the wide variety of solutions to reduce greenhouse gas emissions, and the potential economic and environmental benefits of energy efficiency and the development of renewable and low-CO_2-emitting energy resources. It should also focus on the development of a workforce trained in the installation, operation, and maintenance of advanced technologies and proficient in the design and construction of residential, commercial, and industrial buildings incorporating advances in energy efficiency and renewable energy. The education program would further integrate climate change science and solutions into all academic levels and disciplines toward the goals of empowering future generations to take action in their own lives and developing future leaders in policy, government, engineering, science, and communications.

Actions recommended by the Task Force:

- Develop an Overarching Outreach and Education Plan (RCI 4.6)
- Include Energy Efficiency and Conservation in School Curriculum (RCI 4.1)
- Increase Energy Efficiency through Building Management Education Programs (RCI 4.2)
- Reduce Residential Energy Demand through Education and Outreach (RCI 4.3)
- Establish a Comprehensive Energy Efficiency and Renewable Energy Education Program (RCI 4.4)
- Create an Energy Efficiency and Sustainable Energy Systems Web Portal (RCI 4.5)

PROJECTED EMISSION REDUCTIONS OF RECOMMENDED ACTIONS

Detailed and transparent analysis was performed by CSNE to determine the potential CO_2 emission reductions associated with the various actions considered by the Task Force. The analysis of the emission reduction potential was determined through an integrated and holistic approach, which accounted for many of the interactions among recommended actions. This analysis provided the Task Force with the means to compare a variety of scenarios. The Task Force chose the scenarios that achieved the most progress towards the long-term goal of reducing greenhouse gases 80 percent by 2050.

Based on this analysis, implementation of the Task Force's recommended actions is expected to yield a significant reduction in New Hampshire's greenhouse gas emissions (Table 2.1). These reductions will be achieved by using less fossil fuel as a result of increased energy efficiency, avoided vehicle travel and expanded use of renewable energy resources.

The CSNE analysis indicates that the recommended actions would reduce greenhouse gas emissions below the business-as-usual scenario by 18.69 $MMTCO_2e$ by 2025, a reduction of nearly 20 percent below 1990 levels of 15.79 $MMTCO_2e$. Based on these projections for the recommended actions, the Task Force has chosen a mid-term goal of reducing greenhouse

Table 2.1 – Projected Emissions Reductions Resulting from the Task Force Recommended Actions

	Emissions [$MMTCO_2e/yr$]	
Year	**2025**	**2050**
Total Projected Emissions (BAU)	**31.36**	**42.95**
Projected Emission Reductions from Recommended Actions		
Building Actions	8.43	13.02
Electricity Generation Actions	3.44	6.57
Transportation Actions	5.01	7.91
Natural Resource Actions	1.81	2.25
Total Potential Emission Reductions	**18.69**	**29.75**
Total Projected Emissions for Action Plan	**12.67**	**13.20**
Percent Reduction from BAU	***59.6%***	***69.3%***
Percent Reduction from 1990 Emissions (15.79 $MMTCO_2e$)	***19.7%***	***16.4%***

BAU – Business as Usual
$MMTCO_2e$ – million metric tons CO_2 equivalents

gas emissions 20 percent below 1990 by 2025. Considerably greater emission reductions of about 40 $MMTCO_2e$ below the BAU scenario will be required by 2050 to reach the longer-term goal – equal to the emission reductions projected for this plan which will be made feasible by technology innovation.

The Task Force recognized the need to focus on early action to reach its mid-term goal which will lay the foundation for the longer term goals. The sooner New Hampshire takes action to reduce its greenhouse gas emissions, the less costly it will be for the state, and the less CO_2 that will be emitted into the atmosphere. Delaying action will necessitate greater reductions in the future, which will come at higher cost, to achieve the same emission reduction goals[10]. Delaying action may also place the state at a disadvantage in terms of responding to any federal policies requiring reductions in greenhouse gas emissions that may be forthcoming from the Obama Administration.

While the recommended actions in this plan alone will not be sufficient to achieve the Task Force's long-term reduction goal by 2050, they constitute critical steps that would enable emission reductions to occur using a phased-in approach. Moreover, the recommended actions will meet the target emissions reduction by 2025, a time period which represents common planning horizons for states (e.g., 10 to 15 years). As previously described, a phased-in approach, whether at the scale of individual actions or the entire Climate Action Plan, will allow New Hampshire to focus its resources early on those opportunities that are currently most cost-effective and, subsequently, to consider other opportunities as technology, political will, and public support evolve and markets develop. Therefore, the following interim targets (Table 2.2) will be used to evaluate progress towards its goal to move the state toward early and progressive increases in emission reductions.

ACHIEVING THE LONG-TERM GOAL

The Task Force recognizes that there are limitations to the impact that this Climate Action Plan can and will have on the state's emissions out to 2050. While the emission reductions associated with the recommendations included in this plan allow the state to meet the 2025 target and position the state to meet the 2050 target reductions, the actions are not sufficient to achieve all of the reductions that need to be made from 2025 to 2050. By 2050, the recommended actions are projected to reduce greenhouse gas emissions below business-as-usual levels by a total of 29.8 $MMTCO_2e$, a reduction of nearly 70 percent below BAU but only 16 percent below 1990 levels (Figure 2.2). In fact, many of the recommended actions, such as those directed at building energy use, will realize reductions over the next decade but will produce few additional reductions beyond 2025. This action plan contains those measures that the Task Force believes will be most effective in rapidly addressing the state's greenhouse gas emissions over the next one to two decades while positioning the residents, government, businesses, industries, and not-for-profits to achieve still greater future reductions as technological, economic, political and social changes allow.

Table 2.2 – Interim Emission Reduction Targets

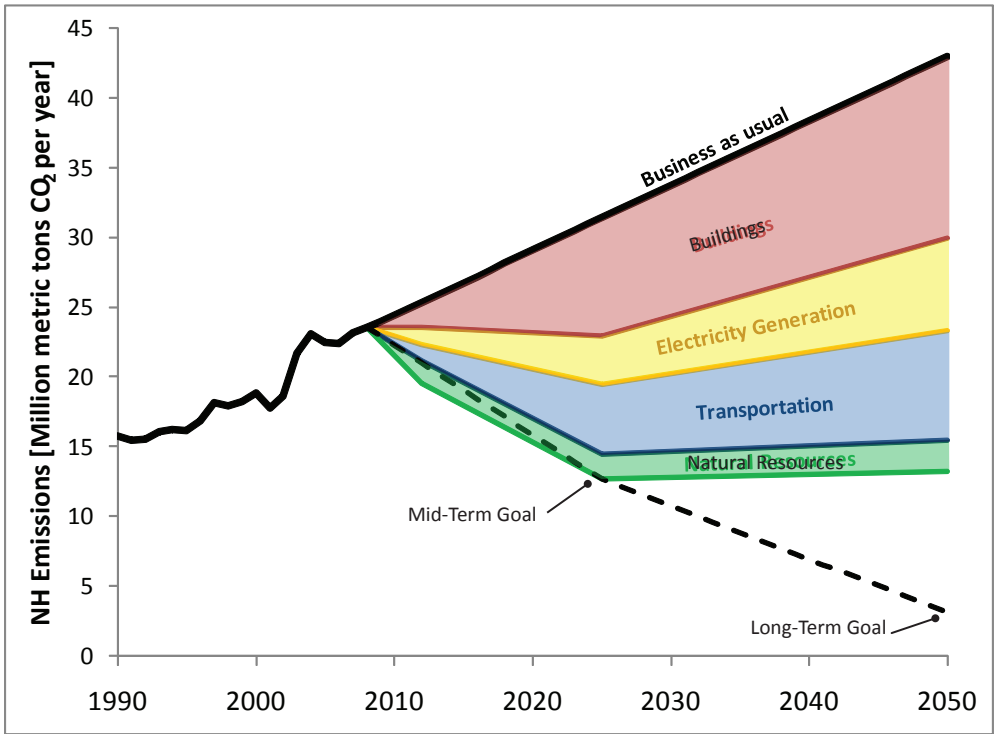
Interim Targets					
Year	**2012**	**2015**	**2018**	**2021**	**2024**
Annual Emission Targets [$MMTCO_2e$]	21.00	19.08	17.16	15.24	13.32
Percent Change Relative to 1990	33.1% above	20.9% above	8.7% above	3.5% below	15.6% below
Percent Reduction from BAU	10.9%	19.0%	27.2%	35.3%	43.5%

This Climate Action Plan, therefore, will require periodic review and revision (as discussed in greater detail in Chapter 6) to track progress against emission reduction targets, to take advantage of advances in technology and to adapt to cultural shifts and the changing climate. The Task Force recognizes that future conditions may eventually lead to the adoption of actions originally considered as part of this process but

not selected as recommendations. Actions that do not have a positive cost-benefit today may prove to be appropriate actions in the future. For this reason, additional potential actions developed by the six working groups, but not incorporated into this action plan as recommendations, have been retained to facilitate their future reconsideration (Appendix 5). These actions should be reviewed periodically to ensure that the most appropriate actions are being implemented at any given time. In addition, new actions will need to be considered.

Going forward, the State of New Hampshire will also need to work within the larger Northeast Region and with the federal government to reduce its emissions. As a relatively small state, New Hampshire's emissions from the electricity generation and the transportation sectors are affected by trends and actions taken at the regional and national levels. By working to coordinate its actions with those of other states, as it has with the Regional Greenhouse Gas Initiative, New Hampshire can leverage greater reductions not only within its own borders but also across state and even national boundaries.

Figure 2.2 - Projected Emission Reductions from Implementation of All Recommended Actions



NH Annual Greenhouse Gas Emissions [Million metric tons CO_2 per year]

SUMMARY

By implementing the recommended actions of the Task Force, New Hampshire will achieve substantial emission reductions, beginning immediately, using cost-effective, available technology. The greatest reductions would come from improvements in the building sector, followed by the transportation and the electric generation sectors.

These emission reductions are associated with significant reductions in energy consumption. Energy efficiency in buildings will significantly impact the electric generation sector. Implementation of the recommended actions is projected to lead to a 59 percent drop below BAU by 2025, from 14 million MWh to 5.8 million MWh. Direct energy consumption (e.g., oil and natural gas for heat) in buildings is projected to fall by 59 percent below BAU in 2025. In the transportation sector, implementation of the plan is expected to avoid the consumption of 374 million gallons of gas and 81 million gallons of diesel, a reduction of 52 percent and 33 percent below BAU by 2025.

The total impact of the recommended actions will be sufficient to place New Hampshire on a track to achieve substantial reductions in the mid-term and to be well placed to achieve the more aggressive reductions over the long-term. Additional measures will be needed in the long-term to achieve the 80 percent below 1990 reduction target. Such measures are likely to be based on the widespread adoption of new and advanced technologies.

Chapter 3: Adapting to Change

Climate change is projected to have significant impacts on important economic, health, and natural resource sectors throughout New Hampshire in the 21st century. New Hampshire must continue to plan for these impacts even as it works to address its causes. Carbon dioxide (CO_2), the main driver of climate change, has an atmospheric residence time ranging from decades to hundreds of years and will remain in the atmosphere for, on average, 100 years once released. There is also a delay in the climate's response to increasing atmospheric concentrations of greenhouse gases due to the scale of the interdependent physical, chemical, and biological processes that compose the global climate system in the ocean and atmosphere and on land. Therefore, climate change is expected to continue for some time even if all man-made greenhouse gas emissions were be reduced significantly in the near future.

Because New Hampshire's climate is already changing, and will continue to change over the next several decades, some level of climate change adaptation is necessary to ensure that the current and future impacts of climate change do not significantly impact the health of our residents, the strength of our economy, and the character of our natural environment. Adaptation actions and responses should be evaluated and where necessary, implemented, in order to couple actions to reduce carbon emissions with adaptation. By preparing for climate change early, the state can avoid significant costs, whether economic, social or ecological, in the future.

PURPOSE OF CLIMATE CHANGE ADAPTATION

Climate change adaptation is defined as action taken to avoid or minimize the negative impact of, or take advantage of, new opportunities created by a changing and increasingly variable climate. By contrast, actions to reduce greenhouse gas emissions (i.e., mitigation) avoid or minimize climate change by limiting the accumulation of atmospheric greenhouse gases.

Adaptation actions fall into several categories. Some actions may *increase natural resilience* in species, ecosystems, and

communities to facilitate recovery from climate disturbances or adjust to new patterns of climate variability and climate extremes[1]. Other actions may also entail proactive steps to *facilitate responses* to climate change that help human communities and ecosystems persist under new conditions in place or elsewhere[2]. Finally, other adaptation actions could *build resistance* to climate change by helping human communities and ecosystems resist impacts and maintain valued resources[3]. In some cases, the best approach may be to employ multiple actions simultaneously.

ECONOMIC IMPACTS OF CLIMATE CHANGE

Anthropogenic climate change is already underway and is projected to continue to impact New Hampshire's human health, man-made infrastructure, coastal settlements, and agricultural, forest and water resources [4]. These impacts are already affecting the state's economy[5] and without efforts to adapt, these impacts are anticipated to have a more significant influence on our economy in the future[6]. Globally, the cost of inaction has been estimated to be the equivalent to losing at least 5 percent of global gross domestic product each year, now and into the future [7].

Adopting a "wait-and-see" approach to climate change adaptation is anticipated to be more costly than taking early adaptation actions that anticipate and prepare for specific types of climate disruption. The damage caused by Hurricane Katrina illustrates the vulnerability of long-lived assets and infrastructure (e.g. dams, bridges, coastal and floodplain development) to the types of extreme weather events that are projected to occur by climate change models. A "wait-and-see" approach would be especially inadequate in responding to:

- Irreversible impacts, such as species extinction or unrecoverable ecosystem changes.
- Unacceptably high costs and damages that could result from inappropriate development in the coastal zone or 100-year floodplain that could expose lives and property to intense storms and flooding.
- Damage to long-lived investments and infrastructure (e.g., bridges, water and wastewater treatment facilities) that may be costly (or prohibitive) and time-consuming to repair or replace following intense storms.

To plan for the potential impacts from a changing climate, society requires updated and decision relevant information combined with mechanisms to educate and engage decision makers and the public. Without accurate information, appropriate decision-making can be more challenging. We could begin this process by:

- Investing in the assessment of existing sources of information, updating information and identifying gaps; actions that could include the development of updated coastal and freshwater 100-year floodplain maps, which reflect current conditions and potential future flooding under different climate change scenarios, LIDAR mapping of coastal and estuarine systems, built infrastructure risks.
- Disseminating reliable and decision-relevant information about the economic, environmental, and social impacts of climate change to decision makers and the general public.

See: *Invest in the Development and Distribution of Critical and Decision Relevant Information (ADP Action 1).* Discussed in detail in Chapter 5 and Appendix 4.9.

At the state and local level, we need to create policies to support economic development that accounts for the changing climate and attracts climate friendly employers. This would include developing new technologies for adapting to climate change and fostering new opportunities in adaptive technologies and services. Implementation may require the development of infrastructure to support businesses adapting their business model to climate change. We can do this by:

- Anticipating the effects of climate change on current industries (e.g., skiing, agriculture, tourism, forestry and logging, etc.) and assisting in stabilizing and enhancing their income.

Winter Storm Response

New Hampshire's current response to winter storm events could provide a model for coordinating state-wide efforts to extreme weather events (e.g., flooding, hurricanes) that are projected to increase in the future. The development of more extensive projections of extreme weather (e.g., frequency, magnitude) can be provided to decision-makers to facilitate integrated planning and coordination of event response by state and local entities. This development would include the communication channels over which event forecasts could be disseminated to state and local authorities and to the public to enhance preparation in advance of storms.

- Developing "green collar" training and education programs.
- Attracting alternative energy and other "clean-tech" industries.
- Taking advantage of any new economic opportunities where New Hampshire might create a niche for itself in sustainable economic development.

See*: Strengthen the NH Economy for Adaptability to Climate Change (ADP Action 6).* Discussed in detail in Chapter 5 and Appendix 4.9.

HUMAN HEALTH IMPACTS OF CLIMATE CHANGE

Challenges currently faced by at-risk populations are projected to increase in any climate change scenario. As a state we need to focus policies and actions to help the most at risk populations (e.g., elderly, low income, chronically ill, children) as well as the general population to prepare for the impacts of climate change and related social impacts. These considerations behind these preparations could include: the cost and availability of transportation; the ability to heat and cool homes; access to "cool shelters;" the availability of food and potable water; access and affordability of healthcare; and the potential need to relocate. To accomplish this we need:

- Public health and emergency response agencies to collaborate with the appropriate agencies and organizations to develop effective public outreach.
- Partnerships between these organizations to share relevant data and information.
- Education and empowerment of public health officials in New Hampshire to prepare for health related and social impacts resulting from climate change.

See*: Focus Policies and Actions to Help At Risk Populations Prepare for Impacts of Climate Change (ADP Action 2)*

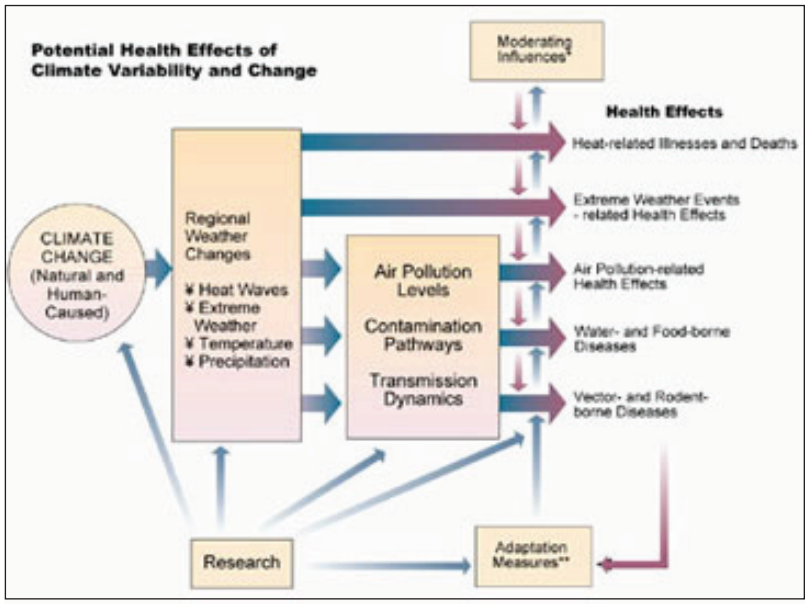
Charge and Empower Public Health Officials to Prepare for the Public Health Impacts of Climate Change (ADP Action 3). Discussed in detail in Chapter 5 and Appendix 4.9.

Without action, climate change could increase the incidence of heat stress, respiratory illness, and infectious diseases (Figure 3.2). Climate change may also increase the incidence of injury and death from severe weather events. Incresing our public health capacity and working with community planners would help society prepare for the myriad health impacts for climate change and expand access to healthcare and reliable havens from heat, air pollution, air-borne allergens, and extreme weather.

Specific Health Impacts and Stressors

Thermal Stress/Heat Waves – Humans are susceptible to high temperatures and heat waves are a major public health threat. The combined death toll from the blistering heat wave in Europe in August 2003 reached over 32,000[9]. The 1995 heat wave in the Midwest led to nearly 700 heat related deaths in less than a week[10]. Under a higher-emissions scenario, which relies primarily on high-CO_2-emitting fossils fuels as an energy source, the Concord/Manchester area is projected to experience nearly 65 days per year when the heat index is above of 90°F[11]. The elderly, young children, pregnant women, the chronically ill, and essential service workers are particularly vulnerable to heat stress of this nature. Heat-related risks and vulnerabilities to New Hampshire's population can be alleviated by increasing public health capacity in the state through actions such as community partnerships and increased access to healthcare as well as modifying buildings and having early warning systems in place and functional.

Figure 3.2 - Potential Health Effects of Climate Variability and Change[8]



Air Quality – Air quality in New Hampshire is related to weather conditions, with many of the worst air quaility days occuring during hot summer days. Under high-emissions scenarios, the Concord/Manchester area could experience a quadrupaling of poor air quality days above present levels (from 4 to 16) as defined by the EPA. Air quality is a significant health concern, especially for sensitive populations such as children, the elderly, and people with respiratory disease. Decreased air quality has been linked to the onset of asthma, and to increased frequency of asthma symptoms. In addition, increased temperatures and CO_2 levels would lead to increased pollen production in several key allergenic species such as ragweed[12].

Infectious Diseases – An increase in hot weather would likely facilitate the spread of vector-borne infectious diseases such as Lyme disease, eastern equine encephalitis and West Nile virus. Intense public health monitoring programs have already been implemented for vector-borne disease. The role of climate change in the spread and incidence of other infectious diseases is poorly understood. In general, many of these diseases can be effectively avoided with prevention and control programs and adequate financial and public health resources, including training, surveillance, and emergency response.

Storms and Flooding – More frequent and extreme weather events projected by climate change models would damage property and threaten public safety. The settlement pattern in New Hampshire has taken place largely around rivers and lakes with floodplain areas often being the easiest areas to develop. Floodplains, however, are where the most flood losses occur. Development in these areas puts people, buildings and infrastructure in harms way, and increases the rate and amount of floodwater forced downstream causing more damage[13]. Flooding would also diminish public health by spreading toxins, comtaminating water supplies, disabling local septic systems, wastewater treatment systems and combined sewer overflows, in addition to damaging roads and buildings.

NATURAL SYSTEMS IMPACTS OF CLIMATE CHANGE

Agriculture and Forestry

From July 2001 through June 2002, New Hampshire's agriculture industry generated $930 million in direct spending, representing over 2 percent of the state GDP, and supported almost 12,000 jobs[14]. In addition, the state's forests provide a wealth of ecosystem services that include recreation, tourism, wildlife habitat, timber and other forest products, protection of watersheds and drinking water supplies, carbon storage, nutrient cycling and soil conservation[15]. As a result, forests are a critical part of the New Hampshire economy. In 2005, forest-based manufacturing and forest-related recreation and tourism in the state contributed over $2.3 billion[16]. These industries will face significant challenges as the climate continues to change. Climate models project decreases in the number of frost days, where temperatures dip below freezing, and increases in the length of the frost-free growing seasons. Tree species composition is likely to change[17]. Warmer winter temperatures would also allow for the northward migration of the hemlock woolly adelgid that has decimated hemlock forests to the South[18]. The eventual changes in forest composition and function could profoundly alter the scenery and character of New Hampshire, as well as the ecosystem services our forests provide.

The Northeast's agricultural economy is dominated by dairy and high-value horticultural crops. Over the course of the century, rising temperatures and erratic weather conditions generated by climate change could threaten the productivity and economic viability of some crops and livestock that have been important historically but that are adapted to a cooler climate[19]. Some of the agricultural issues we face include changes in growing season and crop productivity, summer heat stress, increased rainfall and drought, and greater growth in weeds and insect pests[20].

Sustaining New Hampshire's agricultural and forest industries require evaluating strategies that:

- Alter the timing of planting dates in response to changing growing conditions.
- Maintain local agricultural lands.
- Alter crop mix and forest species to better match the changing climatic conditions.
- Breed new plant species and crops more tolerant of changed climate condition.
- Promote fire suppression practices inresponse to increased fire risk.
- Adopt forestry practices that enhance carbon storage.
- Maintain forest reserves for species and genetic diversity.

Coastal Areas and Sea-Level Rise

Relative sea level rose at an average rate of 2.0-2.7 mm per year over the last century in New Hampshire, nearly a foot per

century[21]. Sea-level rise is likely to accelerate in the future. The United Nations Intergovernmental Panel on Climate Change (IPCC) projects that, based primarily on increases in water volume due to increases in sea surface temperatures, global sea level is projected to rise into the twenty first century. It is projected that seal levels will rise between 7 and 14 inches if greenhouse gas emissions are reduced significantly and between 10 and 23 inches if greenhouse gas emissions continue to increase at their present rate. A recent study suggests that if current rates of ice discharge from the Greenland and West Antarctic ice sheets are taken into account, sea levels could rise as much as 2.6 to 6.6 feet (31 to 79 inches) by 2100[22].

Protecting New Hampshire's coastal areas requires actions that:

- Analyze the environmental consequences of shore protection.
- Promote shore protection techniques that protect habitat.
- Identify land use measures to ensure that wetlands migrate inland as sea level rises in some areas.
- Engage state and local governments in defining responses to sea-level rise.
- Educate decision-makers about the importance of changing zoning regulations.

Ecosystems and Wildlife

There are many significant implications of climate change for New Hampshire's ecosystems and wildlife populations. Many species are already stressed by land-use change, pollution, invasive species, and habitat fragmentation. These non-climatic stressors interact synergistically with climate stressors and result in greater overall impacts[23]. For example, when brook trout are exposed to pesticides, their nervous and reproductive systems can be affected. Those impacts increase as water temperature rises. Warmer water also reduces the amount of oxygen available to fish and can also result in less offspring being produced. The combined impact of climate change and existing environmental stressors therefore can compromise species' resilience and their opportunity for successful adaptation to climate change[24, 25].

The key to ensuring ecosystem and wildlife adaptation is to maintain overall ecosystem health and to conserve important areas. An intact ecosystem is a more resilient ecosystem, capable of recovering from perturbation (e.g., storms, heat waves). Multiple examples of each habitat type must be protected to guard against the risk that some sites may be irretrievably altered in the future.

In addition, effective conservation in the face of a rapidly changing climate requires consideration of the current location of plants, animals and natural communities as well as where they might be located in the future. Presently, fragmentation of natural systems by roads, infrastructure and other alterations has created obstacles to potential migration. Adaptation may require the addition of corridors between protected areas or stepping stones of reserve networks across gradients to ensure that species can continue to move toward their optimal climatic zones in all directions.

Protecting New Hampshire's ecosystems and wildlife requires evaluating strategies that:

- Encourage development and growth in existing urban areas while avoiding natural areas.
- Develop a system of intact protected natural areas to foster resiliency, to allow for species movement and also to protect ground water.

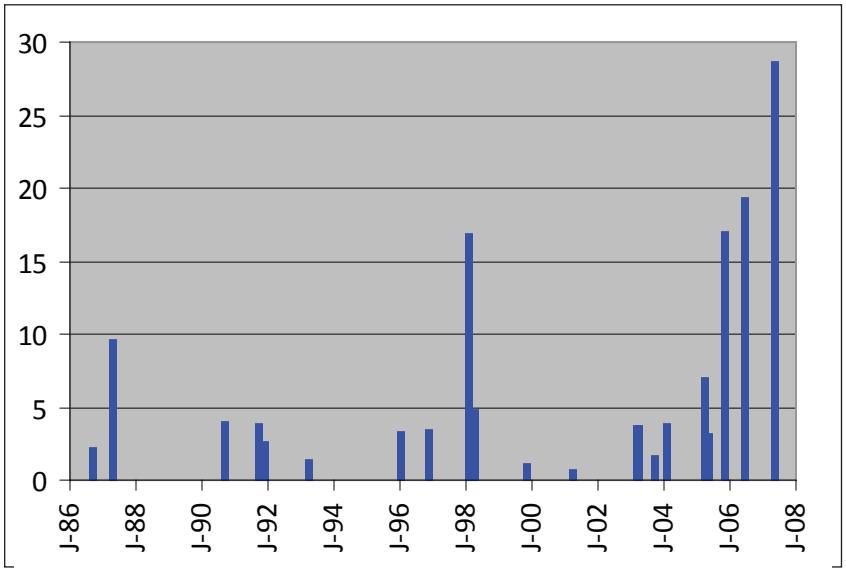
See: *Strengthen the Protection of New Hampshire's Natural Systems (ADP Action 4)*. Discussed in detail in Chapter 5 and Appendix 4.9.

INFRASTRUCTURE IMPACTS OF CLIMATE CHANGE

New Hampshire's critical infrastructure includes roads, buildings, drinking-water treatment and distribution systems, wastewater systems, communications systems, and electricity distribution networks. Storm-related damage poses the greatest threat to the state's infrastructure and can significantly disrupt daily life, affect the state's economy, and threaten the health and safety of New Hampshire residents.

Since 1986, New Hampshire has spent $138 million in total repairing the damages due to severe storms and flooding associated with Presidentially Declared Disasters (Figure 3.4)[26]. Over this time, severe storms increased in frequency and severity, causing more damage and leading to higher recovery costs for the state. The state incurred more than half of these costs, $87 million, in the last seven years. Riverine flooding is the most common disaster event in the State of New Hampshire[27]. Over the past three years, New Hampshire has experienced three 100-year flood events; with one event costing the state $35 million[28].

Figure 3.4 – Costs Related to Presidentially Declared Disasters in New Hampshire Individual Storm Event Damage (Cost in Millions of Dollars)



Projections of future impacts from climate change include increases in overall precipitation, an increase in extreme precipitation events, and more flooding. New Hampshire's municipal water and wastewater utilities are largely unprepared for increased flood frequency and volume. Even modest disruptions can have significant impacts on daily life. Potential disruptions include alteration to the hydrological regime resulting in pressure on wastewater and stormwater systems in their ability to handle large volumes of water in short time.

Protecting New Hampshire's infrastructure requires evaluating strategies that:

- Create a policy for coastal and floodplain properties that plans for residents and structures needing to relocate due to flooding or inundation.
- Guide future development away from flood prone areas and maintain adequate setbacks.
- Render the existing environment more resilient to weather related impacts.
- Utilize municipal ordinances, building codes, zoning regulations, land use practices, infrastructure planning, and incentives to protect against risks.

See*: Increase Resilience to Extreme Weather Events (ADP Action 5).* Discussed in detail in Chapter 5 and Appendix 4.9.

UNDERSTANDING THE RISKS OF CLIMATE CHANGE

Adaptation planning involves many uncertainties. State and local government must establish transparent climate change adaptation planning procedures that are fully integrated with other aspects of their work. They must ensure that their short-term and long-term commitments allow for and encourage adaptive management in an effort to establish a "no regrets" strategy for New Hampshire to adapt to climate change. By preparing for climate change early, the state can avoid significant costs, whether economic, social or ecological, in the future.

Climate change poses a threat to all aspects of New Hampshire. Going forward the state will need to better understand the risks and vulnerabilities that the human and natural communities face as projections of climate change impacts become more refined and detailed. The state will need to plan for these impacts with the best understanding of the resources that are available to address the issue at the state, regional and national level. This would require more comprehensive and integrated planning with a variety of stakeholders and should begin immediately and continue into the future.

See: *Develop a Climate Change Adaptation Plan for New Hampshire (ADP Action 8).* Discussed in detail in Chapter 5 and Appendix 4.9.

Chapter 4: Economic Opportunities

The CSNE economic team conducted an assessment of the cost of implementation and economic benefits associated with approximately 80 of the more than 100 potential actions developed by the working groups. The objective of the economic assessment was to estimate the approximate "level of magnitude" of the economic impacts, and to provide an indication of the expected timing and distribution of the impacts and benefits for each action. The detailed modeling assumptions and conclusions of CSNE's analysis for each potential action are provided in Appendices 6 and 7.

CLIMATE CHANGE POLICY ECONOMIC IMPACTS

Economic considerations of climate change policies are important. Policies that address climate change have costs. However, for many climate change policies there are significant net economic benefits[1]. The keys to realizing these economic benefits are to first identify policies that reduce greenhouse gases at a relatively low cost, and then to ensure that a significant portion of the costs are investments that reduce energy use and expenditures over time, and also reduce spending on imported energy sources.

The primary benefits of the potential climate change policy actions analyzed can be categorized as:

- Reduced spending by consumers, businesses and government on imported fossil fuels.
- Redirection of spending (from the above) directly into the state's economy, which increases state output and creates jobs.
- Reduced exposure to volatile imported energy prices, enabling a more stable business cost and investment environment in the state.
- Business development opportunities and job creation related to energy efficiency and generation of renewable sources of energy.
- Avoidance of costs associated with degradation of the natural environment and ecosystems and related decline

in natural resources, tourism and related industries.

- Avoidance of costs associated with health care and related costs related to toxic emissions and climate change.

While New Hampshire cannot avoid climate change impacts by in-state actions alone, New Hampshire's actions can help spur other states and the federal government to take steps to mitigate climate impacts which can positively further impact all of the above.

New Hampshire's economic well-being has long been heavily dependent on tourism businesses related to summer, autumn, and winter outdoor recreation in the natural beauty of our mountains, lakes, rivers and seacoast. It has also been recognized for many years that economic vitality and environmental protection are inextricably linked, and there is no reason to believe that addressing climate change should be different. This becomes even clearer when considering the high and volatile cost of imported energy sources and the burden that high usage of energy places on the New Hampshire economy.

The state is favorably positioned to benefit economically from policies to address climate change. Nationally, the most negative economic impacts from potential climate change policies are expected to be with fossil fuel producers and energy intensive industries. New Hampshire does not have fossil fuel natural resources and, because of the state's historically high energy costs, energy intensive industries have tended not to concentrate in the state. The state is well positioned to benefit from climate change policies that reduce energy use and lead to lower expenditures on energy by New Hampshire businesses and residents. Reduced energy costs will enable more New Hampshire dollars to stay in the nation, region and state rather than being "exported out" to fossil-fuel producing areas. Reducing energy use, principally fossil fuels and other sources imported into the state, will result in more money spent in and recycled (with multiplier benefits) in the New Hampshire economy; a process leading to job creation and other economic benefits.

In the current context of declining economic prospects nationally and in New Hampshire, climate change policies can provide an economic bright spot. There are many different types of jobs in the so-called green economy. Green jobs can be segmented into five different categories: *Energy Efficiency* (EE), *Environmental Services* (ES), *Green Transportation* (GT), *Renewable Energy* (RE), and *Smart Tech* (ST)[2]. Each of these aggregates includes a cluster of industries, which contribute to environmental improvement and sustainability. Most relevant to climate change policies and discussion below is the *Energy Efficiency* category. This category consists of industries applying measures or practices to help use energy more effectively or efficiently. *Environmental Services* consists of industries that provide services directly or indirectly linked to the sustainability and improvement of the environment (not directly linked to energy use). *Green Transportation* consists of industries that provide or produce relatively "environmentally friendly" transportation. *Renewable Energy* consists of industries that produce energy from sources that can be renewed. *Smart Tech* consists of industries that research, produce, or provide services that directly or indirectly relate to the improvement of technology in the four other green industry categories.

Using this classification in 2007, there were 3.6 million green jobs in the U.S. (3.2 percent of employment). Green jobs tend to be well paid. Nationally, green jobs averaged $57,000 in annual wages. This is about 25 percent above the average for all industries. New Hampshire with 17,000 green jobs has approximately the U.S. average concentration of green jobs also at 3.2 percent of total employment as green jobs[3]. The average annual earnings in green industries in New Hampshire is $54,400. This is 23 percent above the (all industries) average annual wage in the state. New Hampshire has well above average concentrations of green jobs in Smart Tech. New Hampshire has below the average concentration of green jobs in energy efficiency, green transportation, environmental services and renewable energy. If New Hampshire had a similar percentage of green jobs as Maryland, there would be an increase of about 6,000 green jobs adding about 1 percent to the state's employment base. There are opportunities for public policies, such as those associated with climate change action, to build on the strong base of smart tech employment and encourage growth in energy efficiency, renewable energy, green transportation and environmental services.

The main types of business development and employment opportunities associated with policies to address climate change in New Hampshire will be in such areas as: energy auditing; energy efficient building construction/construction trades; and research and development in the design of buildings, infrastructure and systems to be more energy efficient and with minimal environmental impact. The state has a particular strength in the development side of R&D and also in architectural and environmental engineering. For example, Autodesk in Manchester provides software to help design

buildings to minimize energy use and environmental impact. Another business and employment development area is in the field of alternative energy system/source design and production including developing more efficient uses of wind, wood, water, and other natural resources in the state.

New Hampshire climate change policies can also position the state to take advantage of President Barack Obama's expected Green Jobs Proposal. President Obama's forthcoming plan for the green economy included federal investment of $150 billion over 10 years even before the September-December 2008 sharp decline in the U.S. economy. This had been anticipated to generate 5 million jobs nationally by the campaign. Now the administration plans to accelerate this as part of its economic recovery proposal to as much as $100 billion in the next two years. This amount is significant. For New Hampshire, it could represent 16,000 jobs in the near term and 25,000 jobs over ten years on top of the current green job base. The total green jobs in New Hampshire in 2018 could be well over 40,000, or about 8 percent of total state employment, about the current percentage in financial services. Implementation of climate change policies could position New Hampshire well for leveraging and tapping into the new administration's green jobs initiatives.

ECONOMIC ASSESSMENT METHODOLOGY

To understand the costs of implementation and cost benefit, and therefore the economic development potential of many of the potential actions under review, CSNE performed detailed and transparent economic analyses to complete the analysis of the potential CO_2 emission reductions. The CSNE economic assessment was limited by available data and the short time frame for the analysis and Task Force work. As a result all potential actions could not be evaluated adequately for economic costs and benefits. CSNE engaged in some original research and also drew on the investigators' previous analysis of the potential economic impacts of the Renewable Portfolio Standard[4] and the Regional Greenhouse Gas Initiative (RGGI)[5] in New Hampshire. Investigators also drew on existing research and inquiry undertaken for other states and internationally when appropriate.

Annual costs and benefits in 2025 for individual actions were reported using the following scale:

Low	$0 to $2.5 million
Moderately Low	$2.5 million to $25 million
Moderate	$25 million to $125 million
Moderately High	$125 million to $500 million
High	$500 million to $1 billion
Very High	Greater than $1 billion

For some actions, costs and benefits were determined to be uncertain without significant additional research or not estimated (e.g., costs and benefits were generally not estimated for policy actions or studies not expected to result in direct CO_2 reductions). Actions were evaluated taking into account who is expected to experience the costs and/or benefits (e.g., consumers, government, business) and whether the impacts would be evenly distributed across each sector or concentrated on a particular subset (e.g., on lower-income consumers).

The analysis was limited to direct costs and benefits to the New Hampshire economy, and did not include consideration of regional or national economic costs or benefits associated with actions taken within New Hampshire. As much as possible, direct employment impacts and cost savings, such as those from reduced fuel consumption, were estimated.

The costs and benefits of adaptation actions, as described in detail in Chapter 3, were not specifically quantified as part of the economic analysis; however, net benefits are expected from avoided impacts of climate change within our state. Many additional benefits associated with various potential actions, such as avoided health costs resulting from improved local air quality and economic benefits of reduced traffic congestion, also were not able to be estimated as part of the economic analysis, but are identified in the detailed consideration of each potential action report provided in Appendices 4 and 5.

OVERVIEW OF RESULTS

New Hampshire's Climate Action Plan is expected to have a net positive impact on New Hampshire's economy as many of the recommendations evaluated are projected to have a net positive economic benefit by policy year 2025 (Figure 4.1). While the assessment of economic benefits of various policy actions was conducted for all years, the year 2025 benchmark was selected to reflect, as highlighted above, that up-front costs in many cases are investments that can have a positive return but that it would take some time for that positive return to be realized.

CSNE identified that much of the economic benefit of actions to address climate change stem from the reduction in expenditures on energy and the reinvestment of these savings in New Hampshire's economy. Although not always specifically quantified, additional economic benefits are expected as a result of new job creation and local economic expansion resulting from investments in New Hampshire's green economy and opportunities created by actions to reduce CO_2 emissions.

Of all the actions considered, the greatest economic and environmental benefits come from reducing residential energy use 70 percent. The next most favorable action is increasing CAFE standards to 50 mpg, followed by fuel efficiency rebates.

The following briefly summarizes the economic assessment of the actions associated with each of the ten overarching strategies described in Chapter 2. Detailed projections of the economic costs of implementation and the cost benefits associated with each action can be found in Appendix 6. Descriptions of the economic assessment for each potential action can be found in Appendix 7.

1. Maximize energy efficiency in buildings:

Implementation costs are projected to generally be high to very high, due to high estimated construction costs to retrofit existing buildings and build more energy efficient new buildings, and are also projected to be incurred immediately. Improved energy efficiency of buildings is expected to greatly reduce greenhouse gas emissions and to provide high to very high economic benefits, generally exceeding initial implementation costs, and these benefits would occur every year once the improvements in building efficiency were made . Exemplary of this category, as shown in Figure 4-1, is *Making Existing Residential Buildings 70 percent More Efficient*, which exhibits both very high projected reductions in CO_2 emissions and very high projected overall net economic benefit.

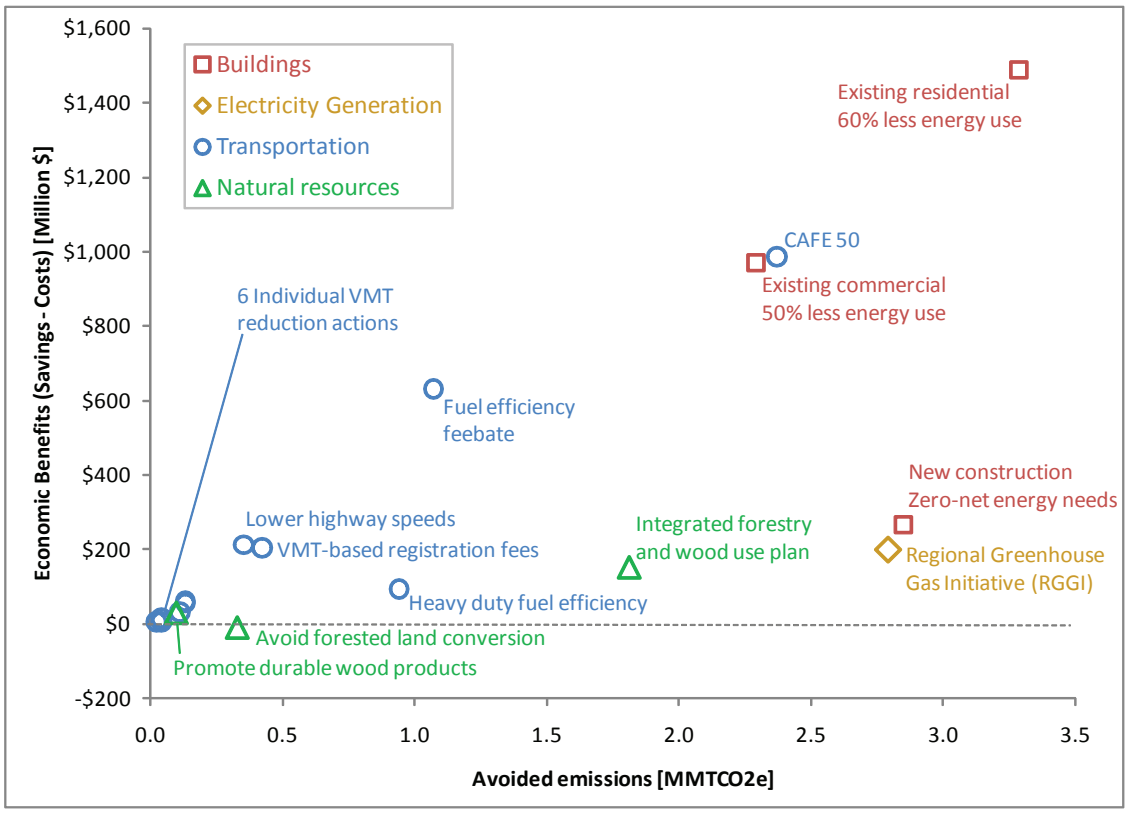
2. Increase renewable and low-CO_2-emitting resources in a long-term sustainable manner:

Implementation costs are projected to be moderate to low. These actions are projected to provide moderate to high economic benefits and result in high reductions in greenhouse gas emissions. Costs and benefits are projected to be evenly distributed over time and across all sectors.

3. Support regional and national actions to reduce greenhouse gas emissions:

Implementation costs are projected to be generally moderately high and spread out over time, primarily due to the high cost of technological improvements to increase average vehicle gas mileage, which are projected to be passed on to consumers through higher vehicle prices. The direct cost to New Hampshire to support national and regional policy changes are projected to be low, but incurred immediately. These actions are projected to result in substantial CO_2 reductions, with potential economic benefits ranging from moderate

Figure 4.1 – Annual Economic Benefits and Avoided Emission Reductions of Selected Actions in 2025



to very high and occurring over time. Figure 4.1 illustrates these results for increasing vehicle CAFÉ standards (i.e., raising average vehicle fuel efficiency) and incentives to encourage purchases of higher fuel efficiency vehicles by consumers (e.g. , rebates); both of these actions are projected to provide high emission reductions and high net economic benefit.

4. Reduce vehicle emissions through state actions:

Implementation costs for the recommended actions supporting this overarching strategy are projected to be low to moderately low, while potential economic benefits are also projected to be low to moderately low. Most implementation costs are projected to occur over time. Some benefits occur evenly over time and some take longer. Costs and benefits are projected to be evenly distributed across the sectors affected.

5. Encourage appropriate land use patterns that reduce vehicle-miles traveled:

Implementation costs for these actions are projected to be low, to occur over time, and to be largely borne by state government, although direct action by local municipalities and developers would also be required. Potential economic benefits were not estimated due to high uncertainty.

6. Reduce vehicle-miles traveled through an integrated multimodal transportation system:

The recommended actions to improve New Hampshire's transportation system are projected to have low to moderate implementation costs, with moderate to moderately low benefits, generally resulting in positive net economic benefits. Although requiring substantial public funding, most costs and benefits would affect consumers and are projected to be evenly distributed.

7. Protect natural resources (land, water, and wildlife) to maintain the amount of carbon fixed or sequestered:

Implementation costs are projected to range from low to moderately high, to occur evenly over time, and to be borne by government or business depending on the specific action. Benefits are generally projected to be moderate, to range from being evenly distributed over time to longer term, and to be more evenly distributed across sectors, with some actions providing higher benefits to business. Note that the wide range of ecosystem services provided by forested landscapes were not included in this analysis.

8. Lead by example in government operations:

Costs and benefits of recommended actions under this overarching strategy are generally projected to be low. They are expected to result in positive net financial benefits for state government over time. Most implementation costs are projected to occur immediately, while most benefits occur over time as energy efficiency measures are put in place.

9. Plan for how to address existing and potential climate change impacts:

Immediate implementation costs of the recommended actions are projected to be low, while future implementation costs are uncertain at this time. Potential economic benefits were not specifically estimated.

10. Develop an integrated education, outreach and workforce training program:

Implementation costs are projected to be low to moderately low, to be concentrated early on in implementation and to fall on state government. Benefits are projected to be moderate to moderately high, to be realized soon after implementation and to continue over the long term, and to benefit consumers and businesses.

SUMMARY

There are costs associated with policies to address climate change. A significant portion of the costs are concentrated at the initial stages of implementation. Over time, however, many of the policies considered result in net economic benefits. The details of CSNE's cost of implementation and cost benefit analysis are summarized in the tables in Appendix 6. The key to capturing net economic benefits is to give priority to policies that reduce CO_2 emissions at relatively low costs and view the costs as investments that over time reduce energy use and expenditures on energy sources imported into the state. The best example of this is reducing residential energy use.

Chapter 5: Summary of Actions

Each action recommended by the Task Force to support the 10 overarching strategies is summarized below in cluding an overview of short-term and mid-term implementation steps. It is clear from these summaries that a significant amount of resources will be required to develop these recommended actions and to coordinate the various parties involved in implementation. The first steps in this development process will be to determine those parties responsible for coordinating the implementation of the entire plan and its individual recommendations and to obtain the resources necessary to support this process. This broader implementation process is detailed in Chapter 6, and, as can be observed from the recommended actions below, will require the collaborative effort of government, business, non-profit and educational entities.

OVERARCHING STRATEGY 1: MAXIMIZE ENERGY EFFICIENCY IN BUILDINGS

Actions recommended by the Task Force:

◆ ***Maximize Efficiency in New Construction (RCI Action 1.1)***

Develop a program to maximize energy efficiency and minimize net CO_2 output in new residential, commercial, institutional, and industrial building construction with a phased-in goal for new buildings to use produce as much energy as they consume. New construction should incorporate state-of-the art energy efficiency and renewable energy systems into the design of the building envelope, operating systems (e.g., heating, ventilating, and air conditioning (HVAC)), and energy consuming appliances and devices. This action could be developed in conjunction with the national level Architecture 2030 initiative, which targets similar energy use goals for new buildings.

Overall Implementation:

- Develop probable legislation for building codes, zoning regulations, and possible tax code incentives.
- Develop program details, create financial incentives, and begin state outreach and education.
- Develop sustainable funding mechanisms.

Timeframe:

- Implementation can begin immediately.
- Scaling up will continue into the future.

◆ Maximize Energy Efficiency in Existing Residential Buildings (RCI Action 1.2)

Develop a program to retrofit existing New Hampshire housing stock to minimize or eliminate net CO_2 output, and further, to ensure that current and future investments minimize embedded CO_2 output with a phased-in goal to retrofit 30,000 homes annually in order to reduce their net energy consumption by 60 percent. Program elements should include: 1) building shell and window upgrades, including instrumented air sealing and thermographic inspections; 2) space conditioning equipment upgrades/replacements, including ductwork and duct sealing; 3) domestic hot water system upgrades; 4) Energy Star lighting upgrades/replacements; 5) water saving measures; 6) Energy Star appliances upgrades/replacements; and 7) use of renewable energy systems.

Overall Implementation:

- Develop program details, create financial incentives, and begin state outreach and education.
- Develop sustainable funding mechanisms.
- Legislation likely needed to enact these measures.

Timeframe:

- Implementation can begin immediately.
- Scaling up will continue into the future.

◆ Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings (RCI Action 1.3)

Develop a program to retrofit existing commercial, industrial, and municipal buildings in New Hampshire to minimize or eliminate net-CO_2 emissions, and further, to ensure that current and future retrofit projects maximize the use of the "embodied energy" in buildings with a phased-in goal to reduce existing buildings net energy consumption by 50 percent by 2030. Program elements should cover the following: 1) lighting; 2) heating, ventilating and air conditioning (HVAC) systems; 3) processes (e.g., air compressor equipment and variable frequency drives); 4) control equipment and technologies; 5) refrigeration equipment; 6) building shell and windows; 7) hot water systems; 8) water usage; and 9) renewable energy systems.

Overall Implementation:

- Develop program details, create financial incentives, and begin state outreach and education.
- Develop sustainable funding mechanisms.
- Legislation likely needed to enact these measures.

Timeframe:

- Implementation can begin immediately.
- Scaling up will continue into the future.

◆ Install Higher-Efficiency Equipment, Processes, and Systems (RCI Action 2.1)

Create incentives to increase the installation of higher-efficiency equipment and the adoption of higher-efficiency processes. Commercial, industrial, and municipal processes can reduce net-CO_2 output by properly designing process lines and using high-efficiency lighting and equipment. Currently, the CORE Programs offered by the electric utilities provide these services for electricity-saving measures, and the gas utilities have comparable services for reducing natural gas consumption. Programming should be expanded to cover all cost-effective measures that reduce CO_2 emissions regardless of fuel type, including the use of renewable generation and use of combined heat and power, also called cogeneration. A combination of targeted and comprehensive energy audits could be used to identify efficiency improvements and opportunities to reduce CO_2 emissions from manufacturing processes. Incentives could be offered to retrofit inefficient processes and equipment and to help offset the additional costs of premium efficiency equipment in new construction.

Overall Implementation:

- Develop program details, create financial incentives, and begin state outreach and education.
- Develop sustainable funding mechanisms.
- Legislation likely needed to enact these measures.

Timeframe:

- Implementation can begin immediately.
- Scaling up will continue into the future.

◆ Increase the Use of Combined Heat and Power (EGU Action 1.3)

Develop mechanisms to promote the use of combined heat and power (also known as CHP and cogeneration) systems for use as an on-site power plant or boiler to generate both electricity and useful heat simultaneously. This technology may be applicable where a thermal load (e.g., for space heating or

industrial process heat) already exists or is planned. Combined heat and power would be appropriate for new boilers and for retrofits of existing boilers using cleaner-burning fuels that are not already co-generating electricity. For consistency with the goal of reducing overall emissions, any program designed around combined heat and power would need to define the allowable emission limits and might also specify allowable fuels for program eligibility. Mechanisms could include regulatory changes, incentives and portfolio standards.

Overall Implementation:

- Consider incentives to promote voluntary development of combined heat and power installations.
- Consider implementing a renewable portfolio for combined heat and power (separate from the existing RPS – see EGU Action 2.1) requiring utilities to obtain a fraction of their energy supply from this technology, with flexibility to meet requirements through a market-based trading program.
- Determine eligibility requirements and necessary emission limits to ensure that the desired emission reductions would be achieved.
- Provide funding to establish and administer the program.
- Develop outreach, education and training programs required to support the integration of combined heat and power into siting and planning, building designs and operation.

Timeframe:

- Enactment could be as early as 2009 with implementation in 2010.

◆ **Consider Alternative Rate Design (EGU Action 1.1)**

To the extent that it reduces or does not raise electricity costs and manages the risk to the utilities, consider identifying and implementing appropriate alternative rate designs (e.g., decoupling) for utilities in order to remove obstacles to increasing energy efficiency. Existing rate structures may conflict with the State's energy efficiency and alternative energy goals, in that traditional rate design is based upon "throughput" incentives for utilities to sell more energy (e.g., kWh, therms) in order to increase their annual profits. Advocates of alternative rate structures believe that these mechanisms are a necessary ingredient to obtain strong utility support for energy efficiency and would complement other demand side management programs. Consumer advocates have raised issues regarding rate impacts and the potential for customers unfairly bearing all risks related to providing electricity. New Hampshire should explore these issues and develop a fair approach to new rate mechanisms that protect consumers and provide appropriate incentives to utilities to promote energy efficiency.

Overall Implementation:

- Evaluate and establish an alternate rate design as part of the existing PUC open docket investigating decoupling and other rate mechanisms (DE 07-064).
- Alternative rate designs either as general policies, or on a utility-specific basis.

Timeframe:

- Consideration of possible mechanisms could be developed in the current PUC docket.
- Full implementation of a changed rate structure would likely take several years due to the complexity.

◆ **Upgrade Building Energy Codes (RCI Action 1.4a)**

Update New Hampshire's building energy code to require improved energy efficiency in new construction and building renovations. Building energy codes represent one of the more cost-effective ways to reduce energy use and related carbon emissions. The state should participate in the International Energy Conservation Code (IECC) update process, either on its own, or by providing input through other regional partners that do participate such as Northeast Energy Efficiency Partnerships (NEEP). There is considerable evidence that if New Hampshire is to achieve deeper greenhouse gas emission reductions, the state's building energy code should be more stringent than the current IECC. In addition to updating its mandatory building energy code, the state could define a preferred "stretch code" that sets even higher, but voluntary, "green" building energy performance standards to advance the state's policy objectives.

Overall Implementation:

- Adopt latest revision to IECC.
- Begin consideration of higher performance standards in the near term for either mandatory or "stretch" codes to support RCI Actions 1.1 – 1.3.
- Legislation likely needed to enact these measures.

Timeframe:

- The latest revision to the IECC may be available for adoption in January 2009.
- The code development community appears to have adopted a three-year cycle as reasonable for code updates.

◆ **Increase Building Energy Code Compliance (RCI Action 1.4b)**

Consider mechanisms that would result in stricter enforcement of energy codes. Building energy codes – either mandatory or voluntary – are among the more cost-effective ways to reduce energy use and related carbon emissions. Mandatory energy codes can be used to set minimum requirements for energy use in both new construction and major building renovations. However, any effort to capture savings from mandatory energy codes is only as good as compliance with the codes. Consideration should be given to creating a system to promote stricter enforcement of the state's building energy code to ensure compliance in all affected structures, including those in rural communities where resources are often lacking. Such programming could include required third party certification, the fee for which could be included as a cost of construction. The state should consider a formal certification process for inspectors beyond the current voluntary process offered through the International Code Council (ICC).

Overall Implementation:

- Evaluate current barriers to effective enforcement of building energy code; begin state outreach to municipalities to improve code compliance rates.
- Legislation likely needed to require mandatory training and certification of all municipal building inspectors on the state building energy code.
- Consider revenue sources to support the inspector certification program and local enforcement of the state's energy code.

Timeframe:

- Initiatives to enhance energy code compliance can begin immediately.

◆ **Establish an Energy Properties Section in Real Estate Property Listings (RCI Action 1.5)**

Establish an energy section in the Multiple Listing Service (MLS) real estate listings. This measure would create a specific, defined set of energy-related criteria/ratings for properties presented in the MLS listings. The concept behind an MLS energy section is to reinforce the fact that energy is a major factor in home buying and to provide the consumer with a means for comparing energy usage between homes. Presumably, properties that are energy-efficient would be favored, and market pricing would reflect this advantage.

Overall Implementation:

- Adopt building energy rating standards.
- Design and implement an energy section for MLS listings of New Hampshire properties.
- Perform outreach to build awareness of this new feature available to buyers and sellers.

Timeframe:

- Design and implementation of an energy section for MLS listings can begin immediately.

◆ **Conserve Embodied Energy in Existing Building Stock (RCI Action 1.8)**

Develop state-wide policies and programs that recognize, quantify, and encourage the conservation of the energy embodied in the New Hampshire's older building stock. "Embodied energy is the total expenditure of energy involved in the creation of the building and its constituent materials,"[1] and the energy invested in it throughout its use. Embodied energy is a key component of life-cycle analysis, which examines the environmental impact of building materials and systems from raw materials, through use within a building, to demolition and disposal. A typical house in New Hampshire contains about 1.5 billion Btu of embodied energy, enough to power the family vehicle for about 25 years. When older buildings are preserved or reused their embodied energy is conserved, new material needs are minimized, and massive carbon emissions from new construction are avoided (in addition to the unspecified historical value that is retained). The concept of embodied energy is not widely recognized, even among professionals in the building and construction industries. If the potential energy savings and reductions in carbon emissions are to be realized, the proposed action will require education, research, and incentive programs.

Overall Implementation:

- Establish a technical committee to conduct research and quantify potential energy savings and emission reductions associated with the conservation of embodied energy in New Hampshire's building stock.

- Develop outreach and education to promote the concept of embodied energy conservation and to dispel myths about the use and reuse of materials.
- Prepare a list of best practices and implement demonstration projects.
- Consider creation of incentives at the state and local levels to preserve/reuse existing building stock.
- Provide funding to establish and administer the program.

Timeframe:

- A study commission could be created in the current legislative session.
- Research and education programs could be initiated at the same time.

OVERARCHING STRATEGY 2: INCREASE RENEWABLE AND LOW-CO_2-EMITTING RESOURCES IN A LONG-TERM SUSTAINABLE MANNER

Actions recommended by the Task Force:

◆ ***Promote Renewable Energy through the Electric Portfolio Standard (RPS) (EGU Action 2.1)***

Implement New Hampshire's Renewable Portfolio Standard, enacted in 2007, which mandates that 23.8 percent of retail electricity sales to in-state customers be provided by renewable energy sources by 2025. The potential renewable generation capacity in New Hampshire alone is 4,447 megawatts (MW) with a generation potential of 12,819,000 megawatt-hours (MWh) by that date. The Renewable Portfolio Standard would capture nearly 3.5 million MWh of this potential with the following mix of renewable sources of in-state retail electricity sales: existing small hydro, 1 percent; existing biomass and landfill methane, 6.5 percent; new solar, 0.3 percent; and new other (wind, geothermal, tidal, etc.), 16 percent.

Overall Implementation:

- Program development complete and ongoing.

Timeframe:

- Program has commenced and will run through 2025.

◆ ***Increase Renewable Energy and Low-CO_2-Emitting Thermal Energy Systems (RCI Action 3.1)***

Create an incentive program to promote the expanded use of renewable and low-CO_2-emitting thermal energy systems to reduce fossil fuel use and greenhouse gas emissions. In New Hampshire, the energy used for space heating, hot water, and process conditioning makes up about one-third of total energy consumption. This proposal would provide incentives and attractive financing for the use of cost-effective, renewable energy resources and high-efficiency/low-CO_2-emitting thermal systems. The incentive levels and financing would be directly tied to the magnitude of the efficiency improvements and energy savings. Other considerations would include the potential of particular new systems for market transformation and peak demand reduction.

Overall Implementation:

- Identify new thermal energy systems worthy of special consideration in this program.
- Evaluate potential current and new funding sources to support incentives and project financing.
- Develop incentive program details and create sustainable funding mechanisms.
- Legislation likely needed to establish stable funding streams.

Timeframe:

- Program could start ramping up in 2009.
- Incentives and financing could continue until maximum penetration of thermal renewable systems is achieved.

◆ ***Address Barriers to Low- and Non-CO_2-Emitting Electric Generation (EGU Action 2.4)***

Identify and remove obstacles to siting and constructing low- and non-CO_2-emitting energy facilities and transmission infrastructure in the state. These actions would better facilitate the development of new low- and non-CO_2-emitting facilities in the state, to enable the state to move away from carbon-based supply-side resources (i.e., fossil-fuel-fired power plants) while offsetting the impact of any potential load growth. The development of the new low-and non-CO_2-emitting facilities could enable older high-CO_2-emitting facilities to be gradually retired and facilitate the achievement of New Hampshire's Renewable Portfolio Standard targets and the goal to meet 25 percent of the state's energy from renewable power by 2025. However, to do so it is imperative that electrical transmission capability within the state also be enhanced to enable power to be exported from those areas where hydro, solar photovoltaic, wind, geothermal, tidal and biomass technologies could best be deployed in order to serve

the New England load. These two goals could be accomplished by seeking methods to expedite the ISO-NE interconnection application review and approval for these types of facilities, and by establishing appropriately streamlined state and local permitting processes. In addition, New Hampshire's planning efforts cannot stand in isolation and should be coordinated with other states and Canada.

Overall Implementation:

- Influence ISO-NE to expedite interconnection application review and approval for these types of facilities.
- Establish streamlined state and local permitting processes.
- Include siting standards to protect environmental quality and siting procedures that provide for appropriate public participation in state process.

Timeframe:

- Policy development could begin in 2009

◆ ***Identify and Deploy the Next Generation of Electric Grid Technologies (EGU Action 2.8)***

Work at the state and Regional level to facilitate the adoption of the next generation of electric grid standards, technologies, and practices through a *phased-in approach* in order to increase the efficiency of the grid and expand the integration of renewable distributed power generation to reduce total greenhouse gas emissions from the electric generation. This transition will include the modernization of the electricity transmission and distribution system to incorporate digital information and controls technology, deployment of energy storage devices, and sharing of real-time pricing information with electricity customers and "smart" technologies in homes and businesses. Deployment of the technology and adoption of standards would occur in a step-wise fashion in which initial investments would first exploit the current most cost-effective technologies while more advanced technologies would be employed as they become more cost-effective. This transition would occur across New Hampshire and the entire ISO-NE grid to the point of general adoption and ongoing market support in the electric generation sector. Such action would lead to the creation of a self-monitoring, adaptive system capable of semi-automated restoration and higher energy efficiency through reduced line losses and better integration of renewable resources through energy storage capacity and the deployment of end use technologies that are able to shift electric use to times when renewable generation is greatest.

Overall Implementation:

- Coordinate efforts at the state and regional levels to facilitate the adoption of smart grid standards, technologies, and practices.
- Assess the current state of smart grid technology market penetration and any obstacles to smart grid development.
- Identify needed legislation, NH Public Utilities Commission orders, and incentives to initiate smart grid development.
- Identify sustainable funding mechanisms.
- Require that electric utility rates be aligned with incentives for the delivery of cost-effective energy efficiency (i.e., consider rate decoupling to promote energy efficiency).
- Require electric utilities, before investing in conventional grid technologies, to demonstrate that investments in advanced grid technologies have been considered.
- Require electric utilities to provide customers with direct access to daily information regarding prices, usage, intervals and projections, and sources.
- Perform demonstration projects using advanced technologies for the power grid, including integration of demand-side resources into grid management.
- Address transmission infrastructure limitations.

Timeframe:

- The required technology already exists and could be deployed within a year.

◆ ***Promote Low- and Non-CO_2-Emitting Distributed Generation (EGU Action 2.9)***

Encourage the development of customer-sited low- and non-CO_2-emitting distributed generation (DG) through a combination of regulatory changes and incentives as begun with the passage of Senate Bill 451 (SB 451) in the 2008 Session. These distributed generation resources can include renewable power sources such as solar photovoltaic systems, wind power systems, biogas and landfill gas-fired systems, geothermal generation systems, and systems fueled with biomass, as well as extremely efficient fossil fuel fired cogeneration or combined heat and power. The distributed electricity generating systems provide electricity system benefits such as avoided capital investment and avoided transmission and distribution losses, while also displacing fossil-fueled generation and thus reducing greenhouse gas emissions. SB 451 authorizes rate

recovery for electric public utilities investments in distributed energy resources located on the premises of a retail customer of the electric public utility. Additional policies designed to encourage and accelerate the implementation of customer-sited renewable distributed generation could include direct incentives for system purchase, market incentives, including "net metering," education and training, state goals or directives, and favorable rules for interconnecting renewable generation systems with the electricity grid.

Overall Implementation:

- Assess the current state of renewable distributed generation in New Hampshire.
- Identify regulatory and institutional opportunities and obstacles affecting expansion of this network.
- Develop appropriate legislation and rules to expand the use of renewable distributed generation.
- Develop an outreach and education program with provisions for technical assistance.
- Develop a financial incentive program.
- Provide sustainable funding mechanisms.

Timeframe:

- The required technology already exists and is currently being implemented. More widespread implementation would occur once the necessary regulations, programs, and incentives have been put into place.

◆ ***Encourage the Use of Biogenic Waste Sources for Energy Generation (AFW Action 2.4)***

Create incentives for the development of facilities and processes that utilize biogenic waste streams as energy sources to reduce New Hampshire's reliance on fossil fuels. These wastes, which may be generated in municipal, residential, agricultural, institutional, or industrial settings, can provide heat, power, and fuel through any number of applications. Examples include: anaerobic digesters, microbial fuel cells, and direct conversion of organic wastes to fuel. Among the possible energy sources are sludge, septage, municipal and industrial wastewater, brown grease, residential and institutional food waste, leaf and yard waste, and manure. Development incentives could be provided by means of 1) a loan program to assist livestock and industrial operations, and 2) modification of existing municipal funding mechanisms to cover the higher initial costs of these projects, to be offset by long-term reductions in operating costs and fossil fuel consumption.

Overall Implementation:

- Assess the viability of a regional approach to biogenic waste-to-energy projects and the attendant economies of scale.
- Develop incentive program details and create sustainable funding mechanisms.
- Legislation likely needed to enact these measures.

Timeframe:

- Program development can begin immediately.
- Implementation could begin as early as 2010.

Actions recommended by the Task Force with majority support:

◆ ***Implement Regional Greenhouse Gas Initiative (RGGI) (EGU Action 2.2)***

Implement the Regional Greenhouse Gas Initiative, beginning in 2009, to stabilize CO_2 emissions from power plants at 188,076,976 tons (regional three-year average) through 2014. Reduce CO_2 emissions by an additional 2.5 percent per year for four years (10 percent total) through 2018. In 2012, evaluate the feasibility of further reductions after 2018.

Overall Implementation:

- Complete RGGI rulemaking process.
- Continue to participate on regional implementation workgroup with other states.
- Continue to implement program.

Timeframe:

- Implementation is on-going.

◆ ***Enable Importation of Canadian Hydro and Wind Generation (EGU Action 2.6)***

To the extent that it reduces or does not raise electricity rates to the consumer, high voltage transmission lines should be built to import clean power generated from Canadian hydro and wind sources as a complementary policy to developing non-CO_2-emitting generation in New Hampshire. Canada is developing vast new hydro and wind generation resources, which are greater than their local needs. This creates an opportunity for New Hampshire and the entire Northeast to obtain clean power. This could provide new power sources to offset future local and regional growth and facilitate retiring or curtailing the operation of fossil fuel-fired plants in New England. Contracts made for this renewable energy should be developed with consideration for the broader environmental

impacts of the power sources as well as the impacts that this imported power would have on the development of in-state renewable resources.

Overall Implementation:

- Begin administrative and legislative procedures to clarify issues and enable construction of a new transmission system.
- Identify program developers to find and align potential sellers and buyers for clean Canadian power. A positive regulatory or legislative signal would be essential.

Timeframe:

- This action could be implemented soon after 2012, following necessary review and approval.

◆ ***Allow Regulated Utilities to Build Renewable Generation (EGU Action 2.7)***

To the extent that it increases New Hampshire's overall renewable energy capacity and the rate at which those resources are brought online and helps to reduce CO_2 emissions, regulated utilities should be provided with limited authority to construct and/or acquire renewable generating assets. The only regulated electric utility that currently owns generation is Public Service of New Hampshire (PSNH), and under existing law PSNH and other utilities* are only specifically authorized to invest in or own new small-scale distributed generation under a new 2008 law. As noted in the summary below, this issue has been an area of intense debate within the Legislature and a wide range of opinions exist among the various stakeholder groups across the state. However, in the interest of reducing greenhouse gas emissions and reducing vulnerability to global energy price volatility, New Hampshire's energy planning efforts should consider the significant resources and experiences that utilities can provide in the development of new renewable generation, in conjunction with a strategy of aggressively encouraging new low-CO_2 generation sources so that ultimately less fossil fuel generation plants are needed in New England. The key element to achieve the greenhouse gas reductions is to adopt legislation that gives regulated utilities the authority to construct and/or acquire renewable generating assets. This authority should be provided with consideration to the impact that it will have on the benefits of market competition provided by non-utility owned merchant generating plants.

Overall Implementation:

- Establish clear legislation authorizing regulated utilities to construct or acquire generation facilities that are based exclusively on renewable energy resources.
- Address obstacles to speedy and efficient project review at the state and local levels by:
  - o Considering an expedited permit process for smaller generation facilities using renewable resources.
  - o Providing for an expedited PUC proceeding schedule so that project review may begin prior to project commencement.
- Address transmission infrastructure limitations, including the Coos County loop in northern New Hampshire.

Timeframe:

- This action can be implemented during the 2008-2009 legislative session.

OVERARCHING STRATEGY 3: SUPPORT REGIONAL AND NATIONAL ACTIONS TO REDUCE GREENHOUSE GAS EMISSIONS

Actions recommended by the Task Force:

◆ ***Support Stricter Corporate Average Fuel Economy Standards (TLU Action 1.A.1)***

Support more stringent, near-term Corporate Average Fuel Economy (CAFE) standards for all passenger vehicles and light trucks up to 10,000 lbs. gross vehicle weight rating (GVWR). CAFE is the sales-weighted average fuel economy, in miles per gallon, of a manufacturer's light-duty vehicles and light-duty trucks. Current standards apply to vehicles manufactured for sale in the United States with a GVWR of 8,500 lbs. or less. The higher limit would allow for inclusion of large sport utility vehicles and pick up trucks in these standards. In addition, the state should support the adoption of CAFE standards for vehicles greater than 10,000 lbs. GVWR in the near term. New standards recently proposed by the National Highway Traffic Safety Administration (NHTSA)[2] would raise the required corporate average to 35 mpg by model year 2020, up from the current 27.5 mpg for light cars and 22.2 mpg for light trucks. Existing analyses indicate that higher fuel economy is achievable with currently available technology and that significant improvements could be made by model year 2015.

* This excludes the New Hampshire Electric Cooperative and municipal electric utilities, which are not subject to the restrictions placed on other utilities in the state.

Overall Implementation:

- Support more stringent fuel efficiency standards through New Hampshire's Congressional Delegation. (Fuel economy standards may be established only by the federal government.)
- Continue public outreach and education to build public support for more fuel-efficient vehicles.
- A legislative resolution could be passed to demonstrate support.

Timeframe:

- Immediate efforts are needed as, under current rules, manufacturers would be required to meet the new standards within three years after their adoption.
- NHSTA is required to review the existing standards periodically. As new technology is developed, the standards should be made increasingly stringent.

◆ ***Support Fuel Economy Standards for Heavy-Duty Vehicles (TLU Action 1.A.2)***

Support fuel economy standards for all new vehicles greater than 8,500 lbs. gross vehicle weight rating (GVWR) to achieve greater CO_2 reductions from future vehicles. Also, support programs such as EPA's SmartWay Transport Partnership program to increase the fuel economy of existing heavy-duty vehicles. Tractor-trailers consume about two-thirds of all truck fuel consumed in the U.S. today. Tougher fuel economy standards for new trucks would have a significant impact on fuel consumption, but those standards are probably 10 or more years away from implementation. On the other hand, using available technology to improve the fuel economy of existing trucks would have an immediate impact. The current truck fleet can be made more fuel-efficient through aerodynamic retrofits, low-rolling-resistance tires, and idling reduction technology. Actions taken to improve the fuel economy of existing and future trucks would provide both short- and long-term CO_2 emission reductions.

Overall Implementation:

- Support more stringent fuel efficiency standards through New Hampshire's Congressional Delegation. (Fuel economy standards may be established only by the federal government.)
- A legislative resolution could be passed to demonstrate support.
- Consider legislative action to initiate an EPA SmartWay Transport partnership/financing program.
- Identify potential funding sources and staffing requirements for such a program.

Timeframe:

- Retrofit improvements to the existing fleet can begin immediately.
- Federal Fuel Economy Standards would require10 or more years to implement.

◆ ***Adopt a Low-Carbon Fuel Standard (TLU Action 1.C.1)***

Adopt a Low-Carbon Fuel Standard (LCFS) to reduce vehicular greenhouse gas emissions. This action would establish an emission standard measured in CO_2-equivalent mass per unit of fuel energy sold. The standard would be based on lifecycle analysis to account for all emissions deriving from fuel production, distribution, and consumption. This approach recognizes that the "upstream" emissions associated with production and distribution – not just those from fuel combustion – are significant contributors to the overall climate impact of transportation fuels.

Overall Implementation:

- Work with Northeast states and eastern Canadian provinces to develop a regional standard.
- Adopt the regional standard by legislation or executive order.
- Identify potential funding sources and staffing requirements to enable participation in planning, administration, and enforcement of the fuel standard.

Timeframe:

- Work should begin now to ensure that a standard is available for adoption by the region in the next 3 to 5 years.
- Phase-in of the standard would occur over the next 10 to 15 years.

◆ ***Promote Alternative Fuel and Advanced Technology Vehicles and Supporting Infrastructure (TLU Action 1.C.2)***

Promote development and deployment of alternative fuel vehicles, advanced technology vehicles, and associated fueling and powering infrastructure in order to speed market penetration of such vehicles and reduce transportation related greenhouse gas emissions. Alternative fuel vehicles (AFV), which will require adequate fueling infrastructure, include vehicles powered by fuels such as natural gas, propane, ethanol and biodiesel. Advanced technology vehicles, such as hybrid elec-

tric vehicles (HEV), plug-in hybrids (PHEV), advanced electric vehicles, and fuel cell vehicles (FCV), will require infrastructure in the form of electric plug-in ports, pricing and load signals from the grid. While these technologies promise dramatic reductions in greenhouse gas emissions associated with the transportation sector, planning across energy sectors will be needed to ensure that emission reductions in the transportation sector are not offset by increases elsewhere. For example, plug-in hybrid vehicles could increase peak electrical loads that draw from high-CO_2-emitting generators. Use of "Smart Grid" technology would allow plug-in hybrids to be recharged at optimal times. Although government is well positioned to promote the use of alternative fuel and advanced technology vehicles, the demand for these vehicles will continue to be driven at least in part by the economy. New Hampshire can hasten their deployment by investing in research and development where needed, seeking early adoption for state vehicle fleets, and providing financial resources and incentives to develop the required refueling infrastructure.

Overall Implementation:

- Seek federal funding to support infrastructure development.
- Commit the state fleet to new technology.
- Develop and deploy smart-grid technology.
- Continue to work with stakeholders and regional entities to develop market.

Timeframe:

- The Granite State Clean Cities Coalition has been promoting these vehicles and fuels since 2002, with growing interest each year.
- The timing of public acceptance and demand will be affected by market forces.
- PHEVs are expected to be on the market in 2010 to 2012.
- The timing for FCVs is unknown and would occur against stiff competition from PHEVs.

◆ ***Support Strong Climate Action at the Federal Level (GLA 1.6)***

The Task Force endorses strong national climate legislation to complement state efforts to reduce greenhouse gas emissions and prepare for the projected impacts of climate change. Such action could include increased vehicle fuel economy standards, appliance energy efficiency standards, investment in regional transportation networks and a national cap and trade mechanism for greenhouse gases. The national legislation should also support comprehensive adaptation planning that integrates the enhancement of the state's significant existing built and natural infrastructure. In the event that legislation results in a cap and trade program, the national program should return a significant portion of any collected pollution allowance revenues to New Hampshire to fund the emission reduction, clean energy, energy efficiency, and adaptation priorities contained in this Climate Action Plan. Adaptation priorities would include protecting natural systems, which provide significant ecosystem services to the state, as well as maintaining and enhancing built infrastructure affected by extreme storm events. Properly structured national climate legislation could provide the needed funding to implement many of the capital-intensive, higher-impact priorities identified in this plan. Funds generated by passage and enactment of a national climate law could drive the large emissions reductions needed while growing the New Hampshire economy if directly returned to the states and properly targeted.

Overall Implementation:

- Pass a legislative resolution to support efforts by the New Hampshire congressional delegation to encourage passage of a national climate bill that would:
  - o Complement efforts at the state level.
  - o Return generated revenue to the states in order to support the implementation of state Climate Action Plans.
- State level funding resulting from national legislation should be directed towards:
  - o Tax credits to support residential and business investment in measures consistent with this Plan.
  - o State and local government, non-governmental organizations, and privately-administered matching grant and loan funds.
  - o Direct grants or tax rebates to low-income households least able to adjust to potentially higher energy prices and designed to migrate participants as rapidly as possible to greater energy efficiency.
  - o Loans and grants for student and worker green jobs training.

Timeframe:

- A legislative resolution could be passed in the 2009 session.
- It is anticipated that a national climate bill will be intro-

duced in Congress in the 2009 Legislative session with passage likely in the next two years. The incoming Obama administration has made a national climate bill one of its top priorities.

OVERARCHING STRATEGY 4: REDUCE VEHICLE EMISSIONS THROUGH STATE ACTIONS

Actions recommended by the Task Force:

◆ ***Adopt California Low Emission Vehicle (CALEV) Standards (TLU Action 1.A.3)***

Adopt California Low-Emission Vehicle (CALEV) standards, including the tailpipe greenhouse gas emissions standards. Under the Clean Air Act, Section 209, states may not develop their own vehicle emission standards. The exception to that rule is the state of California, which may set its own standards provided they are at least as stringent as federal standards. California standards are typically more stringent than federal standards. The remaining 49 states have the option of either following federal emission standards or adopting the CALEV standards. The CALEV requirements include a tailpipe greenhouse gas emission standard that does not exist for federal emission standards. CALEV also includes a zero-emission-vehicle requirement (e.g., electric vehicles). States that adopt CALEV standards may choose to include the greenhouse gas and zero-emission-vehicle requirements or not. CALEV states allow only the sale of vehicles certified to CALEV standards. Unlike states that operate under federal vehicle emission standards, where the standards are enforced by EPA, any state that adopts CALEV is responsible for enforcing the program provisions by itself.

Overall Implementation:

- Draft and pass legislation to adopt CALEV standards.
- Provide funding for economic and air quality analyses to support legislative action.
- Allocate staffing and financial resources to develop, implement, and administer the program.

Timeframe:

- Approximately three years would be required to pass legislation and an additional one to two years to develop and implement the state program.
- Fleet saturation with CALEV vehicles would occur in about 10 years.

◆ ***Create a Point-of-Sale Financial Incentive for High-Efficiency Vehicles (TLU Action 1.B.1)***

Create a new vehicle point-of-sale "feebate," which would provide financial incentives to purchase vehicles that are high in fuel-efficiency and low in greenhouse gases emissions, accompanied by financial disincentives to purchase low-efficiency, high-CO_2-emitting vehicles. A buyer of a new high-efficiency vehicle would be rewarded with a rebate, but a buyer of a low-efficiency vehicle would have to pay a fee or surcharge (hence the name "feebate"). An effective feebate would be about 5 percent of the vehicle price. The feebate could be administered in either of two ways: 1) at the point of sale (e.g., at the automobile retailer), or 2) at the initial vehicle registration. The program could be made virtually revenue-neutral by using the surcharges paid on low-efficiency vehicles to cover the rebates on high-efficiency vehicles.

Overall Implementation:

- Pass legislative amendment to RSA 261 (Registration of Vehicles).
- Revise NH Department of Safety Rules pertaining to registration (Chapter Saf-C 500 Vehicle Registration Rules).
- Provide resources to support program administration.
- Provide outreach and education before and during program rollout.

Timeframe:

- The feebate program would require one year to pass legislation, followed by six to 12 months to begin program implementation.
- Full benefits of emission reductions would be realized in about 10 years.

◆ ***Install Retrofits to Address Black Carbon Emissions (TLU Action 1.C.3)***

Install retrofit technologies on diesel trucks with a model year of 2006 and older, or retire diesel trucks and replace them with new technology and cleaner operating engines for the purpose of reducing black carbon particulate matter (PM). Similarly, install retrofit technologies on diesel non-road equipment, including construction equipment, diesel generators, and the like. Black carbon is formed through the incomplete combustion of organic fuels and is a major component of PM, or soot, produced by diesel engines. This substance has been identified as having a large and fast-acting warming effect on

the atmosphere. Diesel trucks built after model year 2006 include technology that dramatically reduces PM emissions and do not need retrofitting.

Overall Implementation:

- Establish executive order to require retrofits for all state vehicles and for all equipment working on state contracts, as feasible.
- Provide outreach and education to promote voluntary retirement or retrofits of other pre-2007 diesel trucks and non-road equipment.
- Provide funding to implement program.

Timeframe:

- This action can begin immediately using available diesel retrofit technologies and funding.
- Emission reduction benefits will accrue through 2025, by which time most of the pre-2007 diesel truck fleet will have been retired.

◆ ***Implement Commuter Trip Reduction Initiative (TLU Action 2.A.1)***

Establish a state-supported initiative to increase the number of employers implementing commuter trip reduction programs. These programs use a variety of strategies to promote commuting and work options that reduce greenhouse gas emissions in comparison with single-occupancy-vehicle travel. Possible strategies include parking "cash-out," car/van pooling, flex time, and telecommuting. The proposed state initiative would use mechanisms such as targeted education and outreach, awards and recognition, and business tax incentives to promote more widespread availability of commuter trip reduction programs.

Overall Implementation:

- Provide resources to develop informational materials and market the program.
- Evaluate obstacles to implementation, especially lack of alternative travel options.
- Consider possible tax credits for participating businesses.

Timeframe:

- Commuter trip reduction programs could be implemented immediately.

◆ ***Increase Highway Automobile Efficiency (TLU Action 1.D.1)***

Explore ways to maximize efficiency in highway vehicle travel, including mechanisms to reduce average travel speeds on state and interstate highways and to improve driving habits to improve overall vehicle fuel efficiency. This could occur through enforcement of existing speed limits and through driver education programs to increase driver awareness of the potential fuel savings from changes in driving behavior. Evaluation of a lower speed limit should also be conducted.

Overall Implementation:

- Establish and implement driver education programs.
- Increased enforcement of speed limits.
- Evaluate attitudes and impacts of a lower speed limit.

Timeframe:

- Development and implementation of driver education programs could begin immediately.
- Increased enforcement is dependent on state resources.

◆ ***Address Vehicle Idling (TLU Action 1.D.2)***

Implement a robust idling reduction program for all motor vehicles. Vehicle idling wastes fuel, damages engines, and results in excessive emissions. The program would set an overall idling reduction target of 80 percent by 2010 for all vehicle classes, but a specific idling reduction target of 100 percent by 2020 for heavy trucks. Anti-idling program options for cars and light-duty vehicles include public education, fines for unnecessary idling, and targeted enforcement in designated areas or locations. Program options for freight haulers and other heavy-duty vehicles include outreach, technology retrofits to the existing fleet, and fines based on vehicle type. Special consideration would be given to truckers who sometimes need to run their engines to maintain comfortable cabin conditions during work breaks or to keep refrigerated cargo cold.

Overall Implementation:

- Pass legislation to establish an anti-idling program.
- Develop program details and issue anti-idling program regulations.
- Provide outreach and education to promote the program.
- Provide staff and financial resources to implement the program, including funds for enforcement and possible loans or incentives to assist with the necessary vehicle retrofits.

Timeframe:

- An anti-idling program can be implemented immediately for light-duty vehicles.
- A reasonable time limit should be imposed for heavy-duty

trucks requiring retrofit technology to reduce idling.

◆ ***Improve Traffic Flow (TLU Action 1.D.3)***

Revise state guidance and policies to promote the use of appropriate measures to reduce congestion, improve traffic flow, and reduce greenhouse gas emissions associated with motor vehicle travel. Although the New Hampshire Department of Transportation and local municipalities have control of intersection design and coordination, the public maintains a vital role in the development of traffic management solutions. Practical measures could include modern roundabouts at intersections, coordination of signalized intersections, and reduction of access points through improved access management. Policy options available to the state to promote improved traffic flow include outreach and education, issuance of technical guidance documents, and provision of funding assistance for the best examples of publicly supported projects. Selected actions would be developed with input from the professional planning/design community.

Overall Implementation:

- Provide outreach and education to the general public to explain modern design concepts for improved traffic flow and to foster community involvement in project planning.
- Revise state guidance on best traffic management and design practices; disseminate this information to planning/design professionals and municipal officials.
- Provide staff and financial resources to implement outreach, education, and technical support.
- Consider funding assistance for qualified traffic flow improvement projects.

Timeframe:

- Outreach and education can begin immediately.
- On average, intersection/signal coordination projects require two to three years to design, approve, and construct.
- On average, four to five traffic signalization projects on state roads are constructed each year. Most new signalized intersections are the result of new commercial development projects.

OVERARCHING STRATEGY 5: ENCOURAGE APPROPRIATE LAND USE PATTERNS THAT REDUCE VEHICLE-MILES TRAVELED

Actions recommended by the Task Force:

◆ ***Assess Greenhouse Gas Emission Impact Fees (TLU Action 2.C.1.a)***

For any new development project seeking a state permit, assess a state impact fee based on the estimated greenhouse gas impact of the project, and/or enable municipalities to adopt similar programs. The size of the impact fee would be determined from the estimated transportation demand generated by the project and would be administered through a statewide permit program. The new impact fees would encourage development that has lower greenhouse gas impacts, e.g., projects designed around compact, mixed-use, walkable environments in existing community centers. Funds raised through impact fees could be used to support public transit or promote other greenhouse offsets with the goal of achieving "carbon neutrality" or, at the very least, reduced carbon footprints for new state-permitted development projects.

Overall Implementation:

- Conduct feasibility study.
- Pass enabling legislation to require a transportation-based greenhouse gas emission permit for projects that will generate above a certain vehicle-miles-traveled threshold.
- Develop rules to establish greenhouse gas emission impact fees and to determine how the revenues may be used.
- Make appropriate revision to RSA 674:21, if impact fees are to be reduced or waived for developments within existing community centers.
- Provide funding for development and initial implementation of the program - After setup, the program would be self-funded through permit fees.

Timeframe:

- Appropriate legislation could be introduced in the next legislative session.
- Rulemaking, permit program setup, and project implementation could begin by 2010.
- Municipalities would be expected to take appropriate actions within 2 to 5 years thereafter.

◆ ***Streamline Approvals for Low-Greenhouse-Gas Development Projects (TLU Action 2.C.1.b)***

Adopt new policies to streamline permit review processes, apply alternative requirements, or otherwise reduce barriers

for development projects in *existing* community centers with low-greenhouse-gas footprints. Conduct a broad evaluation of state permit processes and requirements to identify barriers that now deter development from locating in low-greenhouse-gas impact areas – including existing downtowns and community centers – and develop practical solutions to removing such barriers. Encourage municipalities to adopt similar strategies in their development ordinances and permit processes.

Overall Implementation:

- Pass legislation to establish a greenhouse gas program within the NH Office of Energy and Planning or the NH Department of Environmental Services to coordinate with existing permit programs and create rules for the new permit review process.
- Revise applicable state agency administrative rules to allow expedited permit review under the new program.
- Conduct a broad evaluation of state permit processes and requirements to identify barriers that now deter development from locating in low-greenhouse-gas impact areas.
- Provide funding for development and initial implementation of the program. After setup, the program would be self-funded through permit fees.

Timeframe:

- Appropriate legislation could be introduced in the next legislative session.
- Rulemaking, permit program setup, and project implementation could begin by 2010.
- Municipalities would be expected to take appropriate actions within two to five years thereafter.

◆ ***Develop Model Zoning to Support Bus/Rail Transit (TLU Action 2.C.2)***

Develop a model zoning ordinance governing land use around bus/rail service access points to promote ridership and reduce greenhouse gas emissions. Encourage, assist, or require municipalities to adopt and implement this zoning around bus/rail stations. The model language would define criteria for minimum development density; mix of land uses; and interconnected, walkable street patterns. Grants for specific technical assistance to support implementation of the model zoning ordinance could be awarded to communities, and/or incentives could be provided to encourage adoption.

Overall Implementation:

- Prepare a model zoning ordinance under the direction of the NH Office of Energy and Planning or the NH Department of Environmental Services, with input from other entities.
- For a voluntary program: Begin outreach and education to promote the model ordinance; consider grants and financial incentives.
- For a mandatory program: Issue an executive order or pass legislation requiring adoption of the model ordinance; this action would be tied to investment in rail and bus service extensions.
- Provide resources to develop the model zoning ordinance and implement the program.

Note: The mandatory program would also require capital and operating funds to implement an expanded rail and bus system as a separate action.

Timeframe:

- A model zoning ordinance could be developed within one year.

◆ ***Develop Model Zoning for Higher-Density, Mixed-Use Development (TLU Action 2.C.3)***

Develop a model zoning ordinance to promote and facilitate higher-density, mixed-use, walkable development (including affordable housing) in designated areas of a community. Encourage, assist, or require municipalities to adapt and implement the model zoning. The model ordinance would specify what "smart growth" means to the state and would provide for the designation of compact "growth centers," which have lower greenhouse gas impacts than other forms of development. A growth center program could be either 1) a voluntary program with incentives to encourage designation of municipal growth centers at locations deemed to be desirable, or 2) a mandatory state-legislated process requiring that communities (perhaps of a certain minimum size) designate municipal growth centers. Grants for specific technical assistance to support implementation of the model zoning ordinance could be awarded to communities, and/or incentives could be provided to encourage adoption.

Overall Implementation:

- Prepare a model zoning ordinance under the direction of the NH Office of Energy and Planning and the NH Department of Environmental Services, with input from other

entities.

- For a voluntary program: Begin outreach and education to promote the model ordinance; consider grants and financial incentives.
- For a mandatory program: Issue an executive order or pass legislation requiring adoption of the model ordinance.
- Provide resources to develop the model zoning ordinance and implement the program.

Timeframe:

- A model zoning ordinance could be developed within one year.
- For a mandatory program, the necessary legislation, associated rulemaking, and initial program implementation would take two to three years.

◆ ***Continue/Expand Funding, Education, and Technical Assistance to Municipalities (TLU Action 2.C.8)***

Support/expand technical assistance and funding made available through existing programs to promote: 1) coordinated local planning for land use, transportation, and the environment; and 2) associated policy changes that result in reduced greenhouse gas impacts. This action would include updating existing publications to incorporate greenhouse gas considerations and preparation of new materials as appropriate. This action would also provide increased coordination among, and expansion of, existing programs now implemented by various government agencies such as the NH Office of Energy and Planning, the NH Department of Environmental Services, the University of New Hampshire Cooperative Extension, the Regional Planning Organizations, and other organizations such as the New Hampshire Planners Association, the Local Government Center, and Clean Air-Cool Planet.

Overall Implementation:

- Establish a clearinghouse of available resources including, but not limited to, publications, fact sheets, planning tools, model ordinances, geographic information system (GIS) data, grant programs, and educational programs.
- Develop a system to facilitate easy access to this information.
- Continue/expand outreach and education on the connections among land use, transportation, and environmental planning; begin targeted outreach designed to jump start local greenhouse gas planning initiatives.
- Legislation likely needed to enact these measures.

Timeframe:

- It will take one to two years to evaluate existing resource materials, educational opportunities, and grant programs; identify needed changes; and implement those changes.

OVERARCHING STRATEGY 6: REDUCE VEHICLE-MILES TRAVELED THROUGH AN INTEGRATED MULTI-MODAL TRANSPORTATION SYSTEM

Actions recommended by the Task Force:

◆ **Improve Existing Local/Intra-Regional Transit (Bus) Service (TLU Action 2.B.1.b)**

Improve local bus service within New Hampshire on *existing* routes by providing more frequent service, better passenger amenities and facilities, and increased marketing to expand ridership. This action would 1) increase the frequency of service on *existing routes* to reduce wait times and provide greater flexibility for passenger travel; 2) provide additional passenger amenities; and 3) expand marketing and provide easier access to schedules and service information to attract additional ridership.

Overall Implementation:

- Identify and implement service improvements and education/outreach efforts likely to increase ridership most significantly.
- Develop outreach/ marketing plan.
- Coordinate assistance and grant funding.
- Legislative action is likely required to provide for increased funding.

Timeframe:

- Outreach and education efforts could begin immediately.
- Improved services and amenities could be phased in over time beginning in 2010-2012 as state/local funding becomes available with an initial focus on increasing/ improving service for higher-population areas (e.g., Manchester, Nashua, and Seacoast).

◆ ***Expand Local/Intra-Regional Transit (Bus) Service (TLU Action 2.B.1.a)***

Expand the service areas of existing local and intra-regional transit (bus) systems and create new systems to: 1) provide

service for all communities with 20,000 or more population; 2) provide service connections for all communities having 10,000 or more population *and* a defined, walkable, mixed-use central area (of at least 100 acres); 3) provide connections to smaller satellite communities by extending existing local/intra-regional transit systems serving New Hampshire's largest cities and population centers (Manchester, Nashua, Concord and Seacoast); and 4) identify and implement additional local transit options over time.

Overall Implementation:

- Create a task force, under the guidance of the NH Department of Transportation, to investigate opportunities and develop recommendations for expanded local and intra-regional bus service.
- Quantify potential capital and operating costs of expanded service and identify sustainable funding mechanisms (with the realization that any system is likely to require public subsidies).
- Provide resources for initial planning studies and technical assistance to local communities.

Timeframe:

- Expanded service could be phased in, starting in 2010-2012, as funding becomes available; initial focus would be directed toward higher-population areas that currently lack fixed-route transit (especially the Salem-Derry area and the regions surrounding Manchester and Nashua).

◆ ***Improve Existing Inter-City Bus Service (TLU Action 2.B.2.h)***

Improve the quality of facilities and increase the frequency of service on current inter-city bus routes in New Hampshire to increase ridership levels and reduce vehicle-related carbon emissions. Enhancements would include 1) higher-quality bus stops and terminals with additional services and amenities; 2) improved and additional public intermodal facilities, shared by local and inter-city transit providers to facilitate connections; 3) increased frequency of service; and (4) better connections to surrounding areas through improved walkability and easier access to local transit.

Overall Implementation:

- In a collaborative effort of the NH Department of Transportation and commercial bus companies, investigate opportunities and develop recommendations for expanded local and inter-city bus service.
- Quantify potential capital and operating costs of expanded service and identify sustainable funding mechanisms.
- Provide resources for initial planning studies.

Timeframe:

- Expanded service could be phased in, starting in 2010-2012, as funding becomes available; initial focus would be directed toward higher-population areas that currently lack fixed-route transit (especially the Salem-Derry area and the regions surrounding Manchester and Nashua).

◆ ***Expand and Improve Bicycle and Pedestrian Infrastructure (TLU Action 2.B.1.c)***

Improve and expand bicycle and pedestrian infrastructure to increase the viability of these travel modes as options for shorter-distance local trips, particularly within existing community centers, around transit-access points, and in other areas of higher-density, compact, mixed-use development. Improving the availability of biking and walking as a viable travel option would help reduce single-occupancy vehicle use and total vehicle miles traveled, particularly for short-distance, local trips within compact areas and around transit-access points.

Overall Implementation:

- Expand existing bike-ped program, along with implementing "complete streets" approaches that ensure that all modes of travel are accommodated and supported.
- Assistance and grant funding could be coordinated by the Metropolitan Planning Organizations (MPOs) or Regional Planning Commissions (RPCs), together with NHDOT.
- Legislative action is likely required to provide for increased funding and technical assistance to identify and implement appropriate actions.

Timeframe:

- On-going beginning in 2010-2012 as state/local funding becomes available with an initial focus on increasing facilities in higher-population areas (e.g., community centers within southern New Hampshire) and where roadway/streetscape improvements are planned.

◆ ***Maintain and Expand Passenger Rail Service (TLU Action 2.B.2.a)***

Maintain and expand passenger rail service within New Hampshire as part of a balanced, state-wide, multi-modal transportation system that keeps the state competitive with

and accessible to the region. Initial actions would focus on sustaining and improving existing passenger rail service. Near- to mid-term actions would focus on improving and expanding New Hampshire's primary travel corridors (I-93 from Salem through Manchester to Concord, and the full traverse of I-95 on the Seacoast). Long-term actions would address the goal of expanding passenger rail service throughout New Hampshire.

Overall Implementation:

- Sustain and improve existing passenger rail service and plan for future service immediately through dedicated, long-term financial support, strategic improvements to service, and protection of active/inactive rail corridors.
- Study and implement additional extensions and restorations of service with the goal of establishing a state-wide passenger rail system.
- Improve/restore lost rail connections to support both freight and passenger service to Canada.
- Develop the legislation, zoning ordinance changes and regional coordination necessary to develop a regionally integrated rail system.

Timeframe:

- Immediate actions can be taken to sustain and improve existing service.
- Service extensions now under study can/should be implemented within 10-20 years.
- State-wide passenger service will take 20-30 years to restore.

◆ ***Maintain and Expand Freight Rail Service (TLU Action 2.B.2.b)***

Maintain and expand freight rail service within New Hampshire as part of a balanced, state-wide, multi-modal transportation system that keeps the state competitive with and accessible to the rest of the region. Initial actions would focus on sustaining and improving existing freight rail service. Near- to mid-term actions would include strategic improvements and expansions to increase freight rail usage – for example, track upgrades and restoration of lost rail connections to Canada, New Hampshire's major trading partner. Long-term actions would address the goal of expanding freight rail service throughout the state. Because any substantial improvements to rail service will almost certainly require expenditure of public monies, attention to sustainable funding sources will be a priority.

Overall Implementation:

- Protect active/inactive rail corridors.
- Provide resources for initial planning studies and consider options for long-term financial support.
- Conduct an economic study for expanded rail service (consider a 10-year rail investment plan).
- Make strategic improvements to existing service, e.g., increase tunnel clearances for freight passage, improve intermodal facilities, and make track upgrades to support higher speeds.

Timeframe:

- Improvements to freight rail service could begin immediately and be expanded over time.

◆ ***Implement a Stable Funding Stream to Support Public Transportation (TLU Action 2.B.2.c)***

Identify and implement a stable funding stream to support significant expansion of public transportation in New Hampshire. Public transportation is essential to establishing a balanced, less carbon-intensive transportation system within the state. Public transportation also complements, promotes, and supports low-greenhouse-gas-impact development. However, the current lack of adequate funding is a major impediment to the expansion and operation of public transportation. A dedicated funding stream to support this purpose could be established by implementing or enabling one or more of several possible funding mechanisms. Options include an increase in the state gasoline tax, local gasoline taxes dedicated to public transportation, increases in vehicle registration fees, and revenues from a statewide feebate program or a carbon fuel surcharge. Any of these actions would require legislative action. An amendment to Article 6-a of the New Hampshire Constitution would be required to remove current restrictions on the use of gas tax revenues for public transportation.

Overall Implementation:

- Conduct a study to identify and evaluate possible mechanisms for dedicated funding.
- Initiate legislative action, if indicated, to establish a dedicated funding stream or to amend Article 6-a.
- Provide resources to support the required studies and legislative action.

Timeframe:

- The timeframe for implementation will be tied to the

legislative process.

- Legislation for a study could be introduced in the next legislative process.

◆ ***Expand Park-and-Ride Infrastructure (TLU Action 2.B.2.e)***

Expand and improve New Hampshire's park-and-ride infrastructure to support public bus transit and carpooling. In our rural/suburban state, park-and-ride lots are essential to providing effective inter-city bus service and increasing the incidence of car/van pooling to reduce the number of single-occupancy vehicle trips. The proposed action would 1) create park-and-ride lots in new locations, 2) expand existing facilities nearing capacity, 3) improve the services provided at these facilities (e.g., better shelters and restroom facilities, greater security, walkable connections to adjoining developed land uses), and 4) strengthen education and outreach efforts to increase the use of park-and-ride facilities.

Overall Implementation:

- Expand education and outreach activities to increase the use of underutilized park-and-ride lots.
- Conduct a study to identify and evaluate locations for new and expanded park-and-ride facilities.
- Provide funding to support the site studies and promotional efforts.
- Consider potential funding sources for an expanded park-and-ride program.

Timeframe:

- Education and outreach activities can commence immediately.
- Improvements to existing park-and-ride facilities and the addition of new park-and-ride lots could begin in 2010-2012 as funding becomes available.

OVERARCHING STRATEGY 7: PROTECT NATURAL RESOURCES (LAND, WATER, AND WILDLIFE) TO MAINTAIN THE AMOUNT OF CARBON FIXED AND SEQUESTERED

Actions recommended by the Task Force:

◆ ***Invest in Forests to Maximize Carbon Storage and to Avoid Net Forest Land Conversion (AFW Action 1.2)***

Sustain the natural carbon sink provided by forests and their capacity to remove CO_2 from the atmosphere. Through photosynthesis, New Hampshire's forests take up the equivalent of 25 percent of the state's manmade CO_2 emissions annually[†] . Minimizing forest land conversion to non-forested uses will be a key component of any successful emission reduction strategy. Note that 20 percent of global manmade CO_2 emissions are caused by conversion of forest land to non-forested uses. Public policy objectives should include encouraging forest land owners to manage their forests sustainably for the dual purposes of producing forest products and maximizing carbon storage. Available tools include conservation easements, carbon easements and leases, new forest management strategies, and land use regulation. New Hampshire has had considerable success in conserving large blocks of contiguous forest land through perpetual easements – an important tool in maintaining the carbon sink that New Hampshire's forests presently provide and one which should be aggressively promoted in the presence of growing, competing land use pressures.

Overall Implementation:

- Create a new state initiative to invest public financial resources to protect the carbon storage capacity of New Hampshire forests with perpetual conservation easements.
- Create new incentives for forest landowners to enroll in market certification programs to promote sustainable forestry and to assure access to carbon credit markets.
- Evaluate the benefit of enrolling state forests in a market certification program to facilitate state participation in the carbon credit markets.
- Create a pilot program within the NH Department of Treasury to test the marketability of leases on privately owned forestland with the primary objective of sustaining and expanding the carbon storage capacity of working forests.
- Create new incentives to forest landowners to manage commercial timber over longer rotations.
- Develop a carbon-friendly model zoning ordinance and provide municipalities with statutory incentives to adopt this ordinance.
- Develop sustainable funding sources for these efforts.

Timeframe:

- All program aspects can commence immediately, would be continuous, and could be expanded as funding allows.

[†] EPA State Inventory Tool output using default values for state emissions.

- Develop sustainable funding sources for these efforts.

◆ ***Optimize Availability of Biomass for Electricity and Heating within Sustainable Limits (AFW Action 2.2)***

Develop and maintain the policies and infrastructure necessary to sustainably manage the state's forests as an essential carbon sink, for energy and timber supply, for its recreational value, and for the provision of irreplaceable ecosystem services. The forest industry has long been one of the cornerstones of New Hampshire's economy. Relatively new end-uses, such as the production of electricity from wood chips and the production of wood pellets for heating residential and public buildings, are providing the need for low-grade wood and improved logging infrastructure. It is important to note, the biomass stock necessary to support a growing demand is not unlimited and intact tracts of forest are better able to sustain biological diversity and play a role in the provision of ecosystem goods and services such as water supply. Planners, loggers, timber owners, investors, government officials and regulators, and consumers need a strong understanding of sustainable forest management principles as well as the underlying state of the forests, including growing conditions, soil productivity, tree species composition, and forest age, to make good decisions about the efficient use of the available resource for traditional and new forest products in order to sustainably manage this critical economic and ecological resource.

Overall Implementation:

- Review policies, laws and rules relative forestry practices and revise as needed.
- Inventory of forest resources.
- Develop education and outreach strategies.
- Review wood supply studies and establish state policy.
- Promote third-party green certification.
- Promote voluntary forest management practice.

Timeframe:

- Work in several areas could begin immediately. Inventory of forest resources would be dependent on resources.

◆ ***Promote Durable Wood Products (AFW Action 1.3)***

Create a program to develop a market for durable wood products. When wood is used to make products that have lasting value and are held for long periods of time, carbon is stored and not released into the atmosphere. Consumers often have a choice between a product made from petroleum or mineral base and one made from wood. The purchase decision is often formed around price and a short-term, throw-away mentality. An effective education campaign could be mounted to change consumer thinking that favors durable wood products over other materials when buying homes, building materials, furniture, and other accoutrements of modern living. Durable wood products are often more economical in the long run – if not initially – and, unlike petroleum- or mineral-based products, are environmentally sustainable. The proposed program would provide additional benefits to New Hampshire's economy while improving product manufacturing and transportation efficiency.

Overall Implementation:

- Design a well-researched program to promote the use of locally made wood products.
- Initiate a promotional campaign led by a collaboration of state government and private interests.
- Provide funding for program development and promotional activities.

Timeframe:

- This action can be implemented immediately and continue over time.

◆ ***Protect Agricultural Land (AFW Action 1.1.3)***

Promote policies and practices that preserve existing agricultural land. The conversion of agricultural land to developed land affects its carbon absorption capacity. New Hampshire should place greater emphasis on applying policies and practices that avoid releases of carbon stored in soils, preserve the carbon absorption capacity of existing agricultural lands, and enable continued carbon sequestration from the atmosphere. Available measures include acquiring and preserving open space, reducing sprawl through smart growth measures, and encouraging the reuse of existing infrastructure.

Overall Implementation:

- Continue to fund the New Hampshire Land and Community Heritage Investment Program (LCHIP) and consider increasing the acreage of agricultural land protected biannually through this program.
- Provide education and outreach directed toward preserving existing land as a means to reduce sprawl, encourage smart growth, and reuse infrastructure.
- Develop sustainable funding sources for these efforts.

Timeframe:

- Promotional activities and LCHIP expansion can commence immediately as funding allows.

◆ ***Maximize Source Reduction, Reuse and Recycling (AFW Action 3.1)***

Establish a state-operated revolving loan fund to increase commercial and residential source reduction and recycling programs in New Hampshire municipalities. Source reduction and recycling reduce greenhouse gas emissions by recapturing a high percentage of the embodied energy‡ content of the solid waste stream. A net reduction in emissions occurs when reused or recycled materials displace virgin raw materials in the manufacturing process and when solid waste is diverted from disposal. The current recycling rate in New Hampshire is less than 21 percent, well below the national average of 32 percent. However, for most households, the amount of waste that can be reduced, reused, recycled, or composted is a major portion of the original total waste volume. The revolving loan fund would help to rectify the current imbalance in solid waste practices by providing financing for the initial capital costs of public source reduction and recycling programs. Mechanisms available to communities wishing to increase their reuse/recycling rates include pay-as-you throw (PAYT) programs, resource management contracting with waste haulers, joint municipal ventures for transfer and recycling centers, salvage of reusable building materials, and commercial/municipal composting.

Overall Implementation:

- Conduct outreach and education to promote source reduction and recycling programs in New Hampshire.
- Provide technical assistance to municipalities to establish or expand their own programs. (Some programs and funding arrangements could be established through local ordinances while others would require state-level involvement and legislative action.)
- Create and pass legislation to establish a revolving loan fund for municipal source reduction and recycling programs.
- Revenue for the revolving loan program could be generated from mechanisms such as a one-cent fee on all bottles sold in the state.
- Provide staffing and financial support for outreach/education and technical assistance.

Timeframe:

- Education, outreach, and technical assistance can begin immediately.
- The revolving loan fund and source of monies can be established in the next legislative session.
- Municipalities would follow their own timetables for adopting ordinances and setting up local programs.

‡ Embodied energy in this case refers to the energy that is required to extract, process, package, transport, install, and recycle or dispose of materials and products.

OVERARCHING STRATEGY 8: LEAD BY EXAMPLE IN GOVERNMENT OPERATIONS

Actions recommended by the Task Force:

◆ **Establish an Energy Management Unit to Address State Energy Consumption and Greenhouse Gas Emissions (GLA Action 1.1)**

Form an Energy Management Unit within state government to implement and oversee the recommended actions of the Climate Change Policy Task Force as well as the Governor's Energy Efficiency Initiative. This entity would be responsible for tracking state government efforts to reduce energy use and costs, reduce greenhouse gas emissions, achieve state energy reduction/climate change goals, and provide assistance on energy efficiency matters to local and regional government entities. In addition to the existing State Energy Manager, the proposed Energy Management Unit would consist of a project manager, a data manager, a fleet manager, and an energy education and outreach specialist. This action would also require that the state adopt and implement consistent document and reporting procedures for energy purchases, equipment purchases, and energy usage.

Overall Implementation:

- Establish a project manager position as the highest priority; phase in other positions as resources allow.
- Develop consistent procedures for documentation and reporting of energy purchases, equipment purchases, and energy usage.
- Work plan to include remainder of GLA Actions that were retained for further consideration (Appendix 4.8).
- Legislation likely needed to enact these measures.

Timeframe:

- The establishment of this unit can be taken up in the next

Legislative Session.

◆ ***Establish an Energy Consumption and Greenhouse Gas Emissions Baseline Inventory for State Government (GLA Action 1.2)***

Establish a baseline inventory of energy consumption and greenhouse gas emissions for state government for the year 2005 or other year if more appropriate. The inventory would profile the specific types and sources of energy used and would quantify the amounts of energy consumed and emissions released on a quarterly and annual basis. This baseline inventory would assist in identifying opportunities having the greatest potential to reduce state government's energy consumption and greenhouse gas emissions and would serve as a benchmark by which to track progress in specific energy efficiency and renewable energy projects. The baseline inventory and subsequent updates would be the responsibility of the new Energy Management Unit.

Overall Implementation:

- Design a uniform data collection and reporting protocol for all state agencies to use in tracking energy consumption.
- Provide staffing and financial resources to collect the data, perform quality assurance, undertake the necessary analyses, and generate regular reports.

Timeframe:

- This action can be implemented immediately.

◆ ***Establish a Self-Sustaining Fund for Energy Efficiency Projects in State Government (GLA Action 1.3)***

Create a non-lapsing Energy Efficiency Fund, overseen by the Director of Plant and Property Management and the State Energy Manager (unless or until an Energy Management Unit is formed and becomes operational). State agencies could request monies from this fund to cover the costs of their energy efficiency projects. The fund would be financed and replenished with monies equal to 2 percent of each agency's utility budget from the previous year. Monies would be distributed to subsidize requested energy efficiency projects using technologies shown to reduce energy consumption. The Energy Efficiency Fund would boost the efforts of state agencies to find ways to conserve energy and lower their utility bills. By charging a single entity to administer the distribution of these funds, consistent procedures could be maintained for the benefit of small and large agencies alike.

Overall Implementation:

- Prepare and adopt legislation for the Energy Efficiency Fund.
- Develop criteria for allocation and application of funds.
- Prepare administrative and technical guidelines (e.g., calculation of emission reductions and project payback) for fund applications.
- Provide staffing and financial resources to develop and administer the funding program.

Timeframe:

- This action can be implemented during the 2008-2009 Legislative Session.

◆ ***Support the Establishment of Local Energy Commissions (GLA Action 1.4)***

Support the newly forming Local Energy Committees by providing the statutory and programmatic resources needed to make these committees a working part of municipal governance. In March 2007, 164 New Hampshire municipalities passed a historic Climate Resolution that called on state and federal elected officials to address climate change. The resolution also called for the establishment of Local Energy Committees to address greenhouse gas emissions associated with municipalities' activities. Since then, nearly 100 cities and towns have established Local Energy Committees. New Hampshire can support this groundswell of civic action by 1) passing legislation that authorizes municipalities to establish Local Energy Commissions with specific powers, thus formalizing their role and mission; and 2) providing resources to regional planning commissions and state agencies to assist municipalities in setting up Local Energy Commissions.

Overall Implementation:

- Pass legislation to amend RSA 674 to grant New Hampshire towns the authority to establish formal energy committees with specific authority.
- Provide staffing and financial resources to regional planning commissions and designated state agency(ies) to assist municipalities in forming Local Energy Commissions.

Timeframe:

- This action can be implemented during the 2008-2009 Legislative Session.

◆ ***Include Climate Change Adaptation and Mitigation in Programs and Planning (GLA Action 1.5)***

Establish a policy requiring that climate change adaptation and mitigation be considered in all planning and programmatic activities of state government agencies. Climate change has impacts that could affect the entire spectrum of activities (e.g., economic, recreational, agricultural) within the state. Likewise, the vast majority of activities are contributing to climate change in large and small ways. Because New Hampshire state government has the capacity to influence these activities regardless of origin – governmental, residential, commercial, or industrial – all state agencies should take the initiative in seeking solutions to climate change. A logical starting point is to incorporate consideration of climate change into all state planning and programming functions. The state's proactive response to climate change will help to engender climate change action as a necessary and normal part of life in New Hampshire.

Overall Implementation:

- Issue an executive order to require consideration of climate change in all government planning and programs.
- Begin outreach/education activities to build greater understanding of the science of climate change within the ranks of state government and to assist state employees in shaping an effective response to climate change.
- Provide resources to support internal outreach/education efforts.
- Publicize the state initiative to the population at large.

Timeframe:

- This action can be implemented immediately.

◆ ***Promote Public School Siting and Building Aid to Reduce Energy Use (GLA Action 2.6)***

Revise state public school siting and building aid policies to more effectively and cogently encourage the renovation of existing schools and the creation of high performance schools (through renovation or new construction) that both meet current educational standards and further the goals of RSA 9B and similar local and regional smart growth objectives. New emphasis on renovation through comprehensive feasibility studies, meaningful coordination between affected municipal bodies, adequate maintenance, and effective disposition processes can reinforce existing trends, take advantage of new opportunities for energy efficiency upgrades, and help alleviate conflicts in local school construction decision-making. For high performance schools, an additional funding bonus of up to 2 percent (resulting in a total bonus of up to 5 percent) may also entice more school districts into pursuing energy efficiency improvements that are part of major renovation projects or new construction.

Overall Implementation:

- Review existing school siting policies to identify opportunities to strengthen emphasis on renovation.
- Develop resources and support for coordinated planning and feasibility studies to support school construction decision making.
- Pass legislation necessary to expand the CHPS funding bonus.
- Develop the education and outreach necessary to increase awareness of the CHPS program and the expanded funding benefit in order to increase participation.

Timeframe:

- This action can be implemented immediately.

OVERARCHING STRATEGY 9: PLAN FOR HOW TO ADDRESS EXISTING AND POTENTIAL CLIMATE CHANGE IMPACTS

Actions recommended by the Task Force:

◆ ***Develop a Climate Change Adaptation Plan for the State of New Hampshire (ADP Action 8)***

Develop a Climate Change Adaptation Plan to support public and private partners and state agencies in the planning and preparation for the episodic and chronic events in New Hampshire that are projected to result from climate change. This Plan should identify actions that proactively prepare for these incidents and minimize their impacts on human health, the natural environment and the built environment (e.g., homes, businesses, roads, bridges, dams). The Plan should include the methodologies for making sure all necessary data are available to decision makers. There is a general lack of urgency for planning for adaptation to climate change. This Plan should provide the necessary education and information to keep New Hampshire moving in a proactive manner as we continue to face developing climate change impacts. The Plan will help our state and our decision makers identify and implement additional critical adaptation strategies.

Overall Implementation:

- Issue an executive order to establish the necessary body and define the scope of their responsibilities.
- Assemble the necessary bodies to develop the Adaptation Plan including members from various interests including, but not limited to, environmental, natural resources, public health, municipal and regional governance, built infrastructure, academia (UNH) as well as groups gathering data necessary for decision makers.
- Identify data gaps and explore ways to fill those gaps.
- Ensure that the plan is a living document that can change as needed.

Timeframe:

- Development of the Adaptation Action Plan can begin immediately.
- Allow six months for the Plan's development.
- Once completed implementation can occur in a phased-in approach.

◆ ***Develop and Distribute Critical Information on Climate Change (ADP Action 1)***

Invest in the analysis and dissemination of accurate and understandable information about the economic, environmental, and social impacts of climate change to policy makers and decision makers in the public and private sectors. Desired outcomes are policies and decisions that are fact-based, easy to achieve, and effective. This action is critical because of the complexity and volume of the information involved and the need to synthesize and graphically illustrate key concepts and facts to make them understandable and relevant. The action would be implemented through a broadly representative collaboration of public and private entities. Their charge would be to assess existing sources of information to identify data gaps and develop a strategic plan to address those gaps, with a focus on getting the information into the hands of persons responsible for protecting public safety and environmental integrity. Outputs would include maps, reports, modeling tools, data sets, fact sheets, and other information useful to planners, decision makers, and the public.

Overall Implementation:

- Develop a memorandum of understanding among affected interests within and outside government. (The governor could issue an executive order relative to participation of state officials).
- Identify and make available financial and staff resources to support initial efforts.
- Develop and obtain commitments for a sustained program.

Timeframe:

- This action can be implemented over the next one to two years.

◆ ***Promote Policies and Actions to Help Populations Most at Risk (ADP Action 2)***

Target policies and actions to help prepare populations that are most at-risk from the adverse impacts of climate change and related social effects – especially the elderly, low-income, chronically ill, and families with small children. What is currently difficult for at-risk populations is likely to become even more difficult under climate change conditions. Many of these people live in the most vulnerable areas; some will have limited access to communications networks or will be non-English-speaking. Impacts may be associated with the costs and availability of commuting/transportation, energy for heating and cooling homes, "cool shelters," food and potable water, health care, and the need for relocation. The NH Division of Public Health Services and NH Homeland Security and Emergency Management should work together and participate in climate change discussions. The NH Department of Environmental Services should continue its work in the areas of public health outreach and health-related impacts deriving from changes in air quality. Public health agencies at all levels should continue to identify individuals at risk and coordinate their efforts.

Overall Implementation:

- Develop partnership agreements among state and local public health officials, environmental officials, emergency planning officials, and organizations that work with at-risk populations.
- Develop a comprehensive public outreach and education program for at-risk populations.
- Assess the strength of state and local emergency response, recovery plans, and mitigation plans.
- Assess the capacity of the public/private health system to respond to the effects of climate change.
- Assess the mental health consequences and sociological effects of climate change.
- Provide financial and staff resources to support initial efforts.

Timeframe:

- This action can be implemented over the next one to two years.

◆ ***Charge and Empower Public Health Officials to Prepare for Climate Change (ADP Action 3)***

Provide direction and authority to public health officials to increase the state's preparedness against existing and emerging infectious diseases and other health-related conditions as climate change advances. Scientists project a higher incidence of certain diseases and other health affects associated with global warming in the decades ahead. Topics requiring public health action include 1) vector borne infectious diseases, 2) heat-related injuries, and 3) respiratory illnesses. In particular, public health officials need better data/analysis for vector-borne infectious disease forecasting and an understanding of what indicators to track (e.g., weather patterns, mosquito pools, tick populations).

Overall Implementation:

- Create a coalition of state agencies to develop, update, consolidate, and/or integrate, data collection systems for health facts and indicators, health and disease surveillance, demographics, population vulnerability, and resilience.
- Strengthen the ability of local emergency services to respond to heat waves, temperature extremes, and air quality action days.
- Develop an outreach/education program via mass media to prepare the public for climate-related events and provide information on response options.
- Provide financial and staff resources to support initial efforts.

Timeframe:

- This action can be implemented over the next one to two years.

◆ **Strengthen Protection of New Hampshire's Natural Systems (ADP Action 4)**

Strengthen state and local protection of New Hampshire's natural resources to improve resilience to climate change, with particular attention to preservation of agricultural soils, floodplains, wetlands, drinking water supplies, and wildlife habitat connectivity. To help achieve this goal, new development should be directed toward already-built areas, at possibly higher densities, so as to avoid stresses on undisturbed natural areas. Actions items include 1) identification of ecological hubs and corridors, 2) prioritization of places to protect or restore, 3) region-wide examination of the fragmentation of aquatic systems, 4) improved management of groundwater resources and potable water supplies, 5) more comprehensive monitoring to detect environmental responses to climate change, and 6) specific measures to reduce environmental stressors. Implementation of this action would necessitate a greater emphasis on regional planning and development strategies than currently exists.

Overall Implementation:

- Assemble a statewide database inventory of natural systems and resources; develop a method for prioritizing which systems and resources to protect or restore.
- Consider legislation to allow or require changes in environmental and land use regulations as necessary.
- Require climate change impacts to be considered in all state and local planning, zoning, and facility siting.
- Identify and allocate resources to support planning and monitoring activities.

Timeframe:

- This action can be implemented within one to four years.

◆ ***Increase Resilience to Extreme Weather Events (ADP Action 5)***

Begin measures to increase the state's resilience to extreme weather events. Because climate change forecasts include more frequent drought punctuated by more intense precipitation events and rising sea level, our built environment may be at increased risk of inland and coastal flooding. More succinctly, today's weather-related problems will be made worse by a changing climate. Future development could put more people and property at risk and could exacerbate the problem if sited in the wrong locations. Consequently, adaptation policies should be established that 1) steer future development away from the most vulnerable flood-prone areas, 2) render the existing built environment more resilient to weather-related impacts, and 3) move existing development out of harm's way where feasible. Mechanisms to accomplish these outcomes focus on municipal ordinances, building codes, land use practices, infrastructure planning, and incentives. Costs of inaction are potential loss of life, property, and economic activity – especially in flood-prone inland and coastal areas.

Overall Implementation:

- Create a legislative commission to study the issue of resilience to climate change and make recommendations.
- Prepare and pass legislation, as necessary, to:
  - o Prohibit development in vulnerable areas.
  - o Improve existing flood plain maps.
  - o Tighten existing regulations regarding floodplains.
  - o Assist communities in creating and enforcing tougher land use requirements and building codes.
- Provide financial and staff resources to support initial efforts.

Timeframe:

- This action can be implemented over the next one to two years.

◆ ***Strengthen the Adaptability of New Hampshire's Economy to Climate Change (ADP Action 6)***

Create policies to support economic development that will reduce or mitigate greenhouse gas emissions, introduce climate considerations into the economic growth model, and attract environmentally responsible employers. The proposed action would help businesses and agricultural interests prepare for and adapt to the impacts of climate change and the potential impacts of its solutions. Sample measures include anticipating the effects of climate change on important current industries (e.g., skiing, tourism, agricultural); assisting businesses with reducing their energy costs, developing "green collar" training and education programs; and attracting alternative energy and other "clean-tech" industries. New Hampshire should embrace this task proactively by taking advantage of any new economic opportunities where the state might create a niche for itself in sustainable economic development. Implementation may require improvements to infrastructure and creation of appropriate tax incentives to support businesses adapting to climate change. Additionally, New Hampshire may need to develop disaster recovery plans in advance of anticipated climate-related events to ensure that assistance will be available throughout the recovery phases of increasingly frequent extrem

Overall Implementation:

- Consider tax incentives to businesses for installation of energy reducing features.
- Consider tax incentives to attract "green" industry involved in the production of environmentally friendly products and climate-change-related goods and services.
- Provide technical assistance to help existing businesses adapt to climate change.
- Provide technical assistance to businesses implementing proven technologies that reduce energy use and greenhouse gas emissions (free energy audits, training, etc.).
- Expand higher education curricula on sustainable development and green energy technologies.
- Provide financial and staff resources to support initial efforts.

Timeframe:

- This action can be implemented over the next two to four years.

OVERARCHING STRATEGY 10: DEVELOP AN INTEGRATED EDUCATION, OUTREACH, AND WORKFORCE TRAINING PROGRAM

Actions recommended by the Task Force:

◆ ***Develop an Overarching Outreach and Education Plan (RCI Action 4.6)***

Implement a comprehensive climate change outreach and education program that elevates the awareness, knowledge and skill in the state in order to support action at all levels and in all sectors. This program would coordinate and develop educational programs in New Hampshire in order to engage residents, students, businesses and industry to take action now, while simultaneously expanding the capacity of the state to develop and implement advanced mitigation and adaptation solutions in a phased-in approach in the future. This broad education program must rely upon, and build partnerships with, existing educational and outreach organizations including, but not necessarily limited to, K-12 schools, colleges and universities, museums and science centers, environmental and climate change focused not-for-profits, state programs, and professional associations and groups (e.g., architects, planners, builders). Critical to this effort would be marketing the existing Climate Action Plan in order to foster the support necessary for wide-spread implementation.

Overall Implementation:

- Inventory existing climate and energy related educational/outreach/training programs and success of those programs.
- Identify working group to consult with responsible parties and develop plan for overall program and integration.
- Invest and enhance existing educational programs that are working (e.g., NH Carbon Challenge, Clean Air-Cool Planet, Local Energy Committees, UNH Cooperative Extension Energy Answers program).
- Collaborate with professional associations to enhance/grow existing professional training programs.
- Identify and pursue resources to support broader, integrated program.

Timeframe:

- Identification of working group should begin immediately.
- Plan framework and development over the next year and initiate implementation in 2010.

◆ ***Include Energy Efficiency and Conservation in School Curricula (RCI Action 4.1)***

Revise New Hampshire's K-12 school curriculum standards to promote development of a citizenry that has a comprehensive understanding of climate change and the opportunities to engage in energy efficiency and conservation measures. Goals would be developed from a multi-disciplinary perspective, including topics in science, mathematics, and social studies. As a short-term goal, partnerships between educators and experts on energy and the environment would be created to develop educator workshops to train New Hampshire teachers in the nuances of climate change and energy efficiency. The long-term goal would be to amend the New Hampshire Curriculum Frameworks at all grade levels with particular emphasis on curricula for grades 9 through 12, including both open enrollment and advanced studies. Greenhouse gas emission reductions would be achieved as students carry their growing knowledge of climate change and sustainable behaviors back to their families and communities. Sustainable behaviors can happen as part of daily habits, life-long decisions, individual advocacy, and community involvement.

Overall Implementation:

- Provide resources to support outreach/education efforts.
- Establish partnerships, assemble resource materials, and develop educator training program. Look to existing programs in other states for guidance in the design of multi-disciplinary teaching modules/workshops on climate change and energy efficiency.
- Begin educator workshops in targeted communities/school districts and extend these workshops to different communities each year. Provide continuing professional development credits to teachers who complete the workshops.
- Create a diverse committee of educators to begin the task of revising the K-12 curricula.
- Provide resources to support program development and curriculum revision.

Timeframe:

- Teaching modules/workshops for educators could be developed by a suggested target date of June 2010. Training in targeted communities/school districts would begin thereafter.
- Amendment of the New Hampshire Curriculum Frameworks and new teacher certification requirements would be longer-term, with a suggested target date of 2015.

◆ ***Increase Energy Efficiency through Building Management Education Programs (RCI Action 4.2)***

Continue and expand energy efficiency education for building maintenance and energy management staff. The industrial, commercial, and government sectors should make use of the many training opportunities provided by utilities, energy companies (e.g., oil and propane distributors), and private consulting firms. Training should focus on energy audits as a proven method for identifying energy efficiency opportunities to minimize or eliminate net CO_2 output in existing buildings. For new construction, "beyond code" certification would assure that buildings produce the lowest possible environmental impacts.

In addition, encourage the creation of building energy manager positions within organizations that are still without these positions. The concept of placing one person in charge of energy efficiency within an organization should be promoted even for small businesses. This action would result in regular reviews of energy use and identification of energy saving opportunities. Building energy managers should be given the responsibility and budgetary tools to implement energy saving measures as they are identified.

Overall Implementation:

- Direct the NH Office of Energy and Planning (or other

state agency) to create, perhaps in conjunction with the energy utilities, an initiative to 1) promote energy efficiency education to facilities management staff and 2) encourage the establishment of building energy managers in government and business.

- Coordinate efforts with the NH Public Utilities Commission and the NH Energy Efficiency and Sustainable Energy Board to investigate funding opportunities to support the program.

Timeframe:

- Action to create initiative can occur immediately.
- Implementation of the initiative would be ongoing.

◆ ***Reduce Residential Energy Demand through Education and Outreach (RCI Action 4.3)***

Develop a community-based outreach and education program aimed at reducing greenhouse gas emissions in the residential sector. Because residential greenhouse gas emissions account for roughly half of all such emissions (when personal vehicles are included), an organized effort to engage residents in voluntary reductions of their household energy use would be effective. This program would provide the needed information, tools, and support to help residents understand how they use energy and how to map out strategies that would reduce their household energy consumption and energy costs. The program should make use of existing networks and communities (e.g., towns, neighborhoods, civic groups, faith-based organizations, businesses, environmental organizations) to maximize participation. Research-based behavioral change strategies targeting the root causes of climate change inaction should be employed through outreach activities that strengthen communities and do not rely solely on information-based campaigns.

Overall Implementation:

- Develop program details; consider adopting the New Hampshire Carbon Challenge. (http://nhcarbonchal-lenge.org) as a platform to reduce residential energy consumption.
- Consider an executive order to encourage all state employees and all New Hampshire citizens to take the challenge.
- Create a database to quantify emission reductions and chart participation rates and progress toward emission reduction goals.
- Publicize progress at the community and state levels.
- Provide resources to support the program.

Timeframe:

- This action can be implemented immediately and would be ongoing.

◆ ***Establish a Comprehensive Energy Efficiency and Renewable Energy Education Program (RCI Action 4.4)***

Establish a comprehensive education program on energy efficiency and renewable energy to help close the tremendous gap that exists between knowledge and practice. It is estimated that just by using current technology correctly and efficiently we could cut building energy consumption and associated greenhouse gas emissions by 30 percent. In the proposed action, state government, utility companies, colleges, professional and building trade organizations, would sponsor ongoing training and offer demonstration sites for energy-efficient and renewable energy practices. The program would provide accessible resources and educational opportunities to any individuals and organizations that design, build, evaluate/rate, maintain, sell, own, and occupy buildings. It would be of particular value to contractors, code officials, and energy raters, and would establish working groups for building managers and real estate agents. The program would be established and administered at various settings throughout the state, including demonstration centers, community colleges, training seminars.

Overall Implementation:

- Create partnership agreements to develop and administer the education program.
- Evaluate existing resources and possible training locations.
- Design the program by building upon existing training programs and/or using successful programs as models. (Experience with the CORE Efficiency Programs could prove useful.)
- Publicize and roll out the program at a limited number of settings; expand and adjust the program as resources become available and experience is gained.
- Develop a sustainable funding mechanism.

Timeframe:

- This action can be implemented immediately and would be ongoing.

◆ ***Create an Energy Efficiency and Sustainable Energy Systems Web Portal (RCI Action 4.5)***

Develop a searchable, web-based clearinghouse to hasten

the adoption of energy efficiency and sustainable energy products and technologies. The portal would serve a range of specific New Hampshire audiences, including local energy committees, city and town managers, business owners, industrial and commercial facility managers, and residents. The portal would provide each specific target audience with the resources needed to make informed decisions concerning the available options to reduce their greenhouse gas emissions (e.g., currently available products/services/technologies, costs, projected savings, installers or contractors, online calculators, and tax and/or rebate incentives). Although numerous websites give information of this sort, there is currently no web-based clearinghouse for those who are evaluating purchasing sustainable energy products and technologies or have decided to buy products or services and need additional information.

Overall Implementation:

- Designate a state agency and a program coordinator within the agency to lead this action. The program coordinator would be responsible for development and maintenance of the portal with assistance from internal and external experts in energy efficiency and sustainable energy systems.
- Issue a request for proposals to create a searchable, web-based clearinghouse for energy-efficient and renewable products and services.
- Publicize the existence of the web portal when ready.
- Provide resources to support development and maintenance of the web portal.

Timeframe:

- This action can be implemented immediately.

Chapter 6: Moving the Plan Forward

The NH Energy & Climate Collaborative

The New Hampshire Climate Action Plan will not be successful unless it is well implemented. Accordingly, the Task Force identified the development of an implementation plan as a critical component of its work. Implementation of this Climate Action Plan must occur at multiple levels across all sectors of society, and in an ongoing fashion. It will require a high degree of coordination and integration, as well as flexibility, accountability, transparency, communication, and ongoing assessment and reporting.

To accomplish those goals, the Task Force recommends formation of a public/private partnership, the **New Hampshire Energy and Climate Collaborative**, to oversee and guide implementation of the NH Climate Action Plan. Effectively, the Collaborative will be "the keeper of the Plan."

PURPOSE

The primary purpose of the Collaborative will be to track and facilitate implementation of the Climate Action Plan's recommendations, and to report to the Governor, Legislature, and general public on progress toward achieving the desired outcomes. Activities and responsibilities would include:

- Inventory the activities already occurring in the state relative to the recommendations.
- Identify barriers and gaps to the successful implementation of specific recommendations and ways to remove or fill them.
- Guide efforts toward implementation.
- Serve as a clearing house of actions, including helping to facilitate communications among and between implementing partners and working groups in New Hampshire.
- Track and report annually on progress meeting the Plan's recommendations.
- Interact and coordinate with other states, especially in the New England region, as time allows.

As previously described in this Climate Action Plan, all potential actions were retained to be reconsidered over time as

economics, technologies or public policies change. However, the initial primary mission of the Collaborative will be to focus on prioritizing and facilitating the implemention of the 67 recommendations of the Task Force and not to re-evaluate or revisit the year-long process the Task Force just completed or to revise the Task Force's recommendations. The Collaborative will likely hold at least four meetings a year, each of which will also provide time for the public to provide input into the process. The Collaborative will produce an annual report and hold an annual summit to report on progress and bring key stakeholders together.

PROPOSED MEMBERSHIP

Implementation will require continued cooperation and leadership from the public, business, educational institutions, and the nonprofit sectors. Accordingly, the Collaborative will consist of major institutions and leading individuals representing:

- Six members from the business community.
- Six members from the public sector.
- Six members from the education and nonprofit sectors.

Due to the need for continuity with the previous Task Force process, the founding chairman will be the Commissioner of the Department of Environmental Services. Leading roles are also envisioned for: the University of New Hampshire/Carbon Solutions New England; the New Hampshire Charitable Foundation; and a leading business organization or individual. An executive committee of these four key partners will be formed to manage and facilitate activities in between Collaborative meetings.

STAFF

It is anticipated that, contingent on obtaining funding, four staff members would support the initial phase of the Collaborative: a part-time director, provided by NH Department of Environmental Services; a full-time technical coordinator; a part-time CSNE manager, provided by UNH/CSNE; and a full-time technical analyst at UNH/Carbon Solutions New England.

The director will be responsible for the following:

- Communicating with the executive committee and the full Collaborative. Providing day-to-day supervision of the technical coordinator.
- Directing the priorities and scope of work provided by the technical analyst.
- Reviewing communications.

The technical coordinator will be responsible for a range of activities, such as:

- Preparing an inventory of actions relative to implementation of the Climate Action Plan.
- Identifying and interfacing with existing organizations who could serve as implementing partners or working groups.
- Identifying gaps in implementation for consideration by the Collaborative.
- Maintaining and administering the clearinghouse of actions to facilitate communications among and between implementing partners and working groups.
- Planning for and preparing materials for Collaborative meetings.
- Planning the annual summit.
- Preparing a draft of the annual report, including reporting on emissions tracking by CSNE, for Collaborative consideration.
- Developing a communications plan for review by the Collaborative.
- Tracking and preparing financial reports.
- Meeting any grant obligations.

The manager and technical analyst at Carbon Solutions New England will be responsible for a range of activities, such as:

- Tracking progress annually, by sector, against Task Force targets and providing an annual report and presentation on such progress to the Collaborative.
- Prioritizing potential technical support to implementing partners, including activities listed below, with the technical coordinator.
- Quantifying the reductions associated with work conducted by implementing partners working on the front lines to reduce greenhouse gas emissions.
- Developing case studies of organizations to document greenhouse gas emissions reductions and associated costs, including cost savings.
- Tracking and reporting on green jobs in New Hampshire and New England and training opportunities.

- Continuing to update the analyses conducted for the Climate Action Plan.

IMPLEMENTING PARTNERS

It is important to emphasize that the Collaborative will not be directly responsible for implementation of the Climate Action Plan; it is far too large an agenda for any one entity. Rather, the Collaborative's job is to facilitate, coordinate, and support the activities of dozens of implementing partners from the public, private, and nonprofit sectors. As opportunities are identified, Collaborative members would be expected to serve as chairs or leaders of working groups made up of these partners. At this time, it is not anticipated that there will be Collaborative staff support to assist the Collaborative members in this role.

For illustrative purposes only, a partial list of implementing partners might include:

- *Business Council(s)* – to help direct the implementation of the plan toward maximizing economic development.
- *Regional Planning Commissions* – to assist in the implementation of actions at the regional and local levels.
- *Local Energy Committees and Regional Coalitions* – to assist in implementation at the community level.
- *Energy Efficiency and Sustainable Energy Board* – to ensure the coordination of energy efficiency, demand response, and sustainable energy programs in the state.
- *Educational Institutions* – Colleges, universities, professional associations, and not-for-profits to ensure that broad based education, outreach and workforce training programs are developed and integrated.
- *Hospitals and health care organizations* – to implement adaptation measures for public health protection.
- *Interstate and Regional organizations (such as the New England Governors/Eastern Canadian Premiers)* – to ensure that New Hampshire's efforts are integrated with regional plans.
- *Municipal, state, and federal agencies.*
- *Private for-profit businesses and associations.*
- *Nonprofit organizations representing environmental expertise, low-income residents, energy efficiency, and related concerns.*

ESTABLISHING THE COLLABORATIVE

The Collaborative will be formed through a Memorandum of Understanding signed by all of the initial members. The Collaborative will also seek "endorsing members" who will actively support the activities of the Collaborative but will not serve as voting members. The procedural rules of the Collaborative will be provided in the Memorandum of Understanding.

It is estimated that approximately $200,000 to $250,000 will be needed to support the level of effort recommended for the Collaborative. The goal is to obtain roughly one-third of the funding from government sources (likely through in-kind services), one-third from private sources, and one-third from the business sector. A number of organizations have already expressed interest in providing financial support for this effort.

Climate Action Plan Glossary

AFW: The Agriculture, Forestry and Waste working group.

Biomass: When referring to fuel, means plant-derived fuel including clean and untreated wood such as brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips or pellets, shavings, sawdust and slash, agricultural crops, biogas, or liquid biofuels, but shall exclude any materials derived in whole or in part from construction and demolition debris.

CAFE: The federal Corporate Average Fuel Economy program, which sets minimum fuel economy for cars and light trucks, including sport utility vehicles.

Capacity: The maximum power capability of a system.

Carbon Dioxide (CO_2): The major heat-trapping gas whose concentration is being increased by human activities. It also serves as the yardstick for all other greenhouse gases. The major source of CO_2 emissions is fossil fuel combustion. Carbon dioxide emissions also result from clearing forests and burning biomass. Atmospheric concentrations of CO_2 have been increasing at a rate of about 0.5 percent a year, and are now more than 30 percent above pre-industrial levels.

Carbon Sequestration: The uptake and storage of carbon. Trees and other plants, for example, absorb CO_2 then release the oxygen while storing the carbon.

Carbon Sinks: The processes or ecological systems that take in and store more carbon than they release. This process is called carbon sequestration. Forests and oceans are large carbon sinks.

CCPTF: Climate Change Policy Task Force.

Climate Change: A significant change from one climatic condition to another, often used in reference to climate changes caused by increase in heat-trapping gases since the end of the 19th century.

Climate: The average state of the atmosphere, including typical weather patterns for a particular region and time period (usually 30 years). Climate is not the same as weather, but rather the average pattern of weather for a particular region. Weather describes the short-term state of the atmosphere; climate is longer-term. Climatic elements include average precipitation, temperature, wind, and seasonal phenomena such as length of the growing season among others.

CO_2e: Carbon dioxide equivalent, a measure that is used to express the concentration of all heat-trapping gases in terms of CO_2.

Combined Heat and Power: Also referred to as cogeneration is the process by which two different and useful forms of energy are produced at the same time. For example, water may be boiled to generate electricity in a turbine, with the leftover steam used to drive industrial processes or captured for space heating.

CSNE: Carbon Solutions New England.

DES: New Hampshire Department of Environmental Services; the state agency with primary responsibility for environmental permitting and enforcement.

DOT: New Hampshire Department of Transportation; the state agency with the responsibility to construct and maintain the transportation system and facilities in the state.

DSM: Demand-side management includes end-use measures that conserve electricity. They include energy efficient products and design, and load management strategies.

EGU: The electric generation working group.

EIA: United States Energy Information Administration, a division of the United States Department of Energy that focuses on data collection and analysis.

Embodied Energy: The total expenditure of energy involved in the creation of the building and its constituent materials. In terms of a full lifecycle of a product, it can also refer to the energy that is required to extract, process, package, transport, install, and recycle or dispose of materials and products.

EPA: United States Environmental Protection Agency.

Executive Order 2007-3: Order signed in 2007 by Governor John Lynch establishing the Climate Change Action Plan and charging that body to develop climate change goals and a plan for the state.

FHWA: The Federal Highway Administration is a major agency of the United States Department of Transportation and is charged with the broad responsibility of ensuring that America's roads and highways continue to be the safest and most technologically up-to-date.

FIA: The Forest Inventory and Analysis Program of the United States Forest Service provides the information needed to assess America's forests.

Fossil Fuel: A general term for combustible geologic deposits of carbon in reduced (organic) form. Fossil fuels are of biological origin, and include coal, oil, natural gas, oil shales and tar sands. A major concern is that they emit CO_2 when burned, significantly contributing to the enhanced greenhouse effect.

Generation: The process of making electricity. The term may also refer to energy supply.

Greenhouse Effect: The thermal effect that results from heat-trapping gases allowing incoming solar radiation to pass through the Earth's atmosphere, but preventing most of the outgoing infrared radiation from the surface and lower atmosphere from escaping into outer space.

Greenhouse Gas: Any gas that absorbs infrared radiation (traps heat) in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide, (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs).

GWh: Gigawatt-hours (1 million kilowatt-hours).

HFC: Hydrofluorocarbon compounds; a man-made greenhouse gas generated by industrial processes.

ICLEI: International Council for Local Environmental Initiatives, a nonprofit organization that partners with local governments on environmental and sustainable development projects, particularly climate change.

IPCC: Intergovernmental Panel on Climate Change. Established in 1988, the IPCC assesses information in the scientific and technical literature related to all significant components of the issue of climate change. It draws on hundreds of the world's leading scientists to serve as authors, and thousands as reviewers. Key experts on climate change and the environmental, social and economic sciences from some 60 nations have helped the IPCC prepare periodic assessments of the scientific underpinnings of global climate change and its consequences.

KWh: Kilowatt-hour.

LEED: The Leadership in Energy and Environmental Design program of the United States Green Building Council.

Methane (CH_4): A hydrocarbon that is a heat-trapping gas carrying a global warming potential recently estimated at 24.5. Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and oil, coal production and incomplete fossil fuel combustion.

MMtCO_2e: Million metric tons of CO_2 equivalent.

Mt: A metric ton equivalent to 1.102 short tons (2000 lbs.)

MW: Megawatt, A measure of electricity capacity. One MW is sufficient to provide power to 700 to 1,000 homes.

MWh: Megawatt-hours (1 thousand kilowatt-hours).

NEG/ECP: New England Governors/Eastern Canadian Premiers, the regional inter-governmental organization responsible for releasing the NEG/ECP Climate Change Action Plan in 2001.

NESCAUM: Northeast States for Coordinated Air Use Management, a nonprofit regional air quality policy organization whose directors are the top air pollution control officials in all six New England states, New York and New Jersey.

Nitrous Oxide (N_2O): A powerful greenhouse gas with a global warming potential of 310. Major sources of nitrous oxide include soil cultivation – especially from use of commercial and organic fertilizers – fossil fuel combustion in vehicles, nitric acid production and the combustion of biomass.

NO_x: Oxides of nitrogen, both nitric oxide (NO) and nitrogen dioxide (NO_2). They are key in forming ground-level ozone smog, and contribute to acid rain and particulate pollution.

OEP: New Hampshire Office of Energy and Planning; this is an executive-level office that is responsible for guiding the state's future growth through public policy development, education, research, and partnership building.

PFCs: Perfluorocarbons; a man-made greenhouse gas generated by industrial processes.

PPM: Parts per million.

PUC: The Public Utilities Commission, whose mission it is to ensure that customers of regulated utilities receive safe, ad-

equate and reliable service at just and reasonable rates.

PV: Photovoltaic; a treated semiconductor material that converts sunlight to electricity.

RCI: The residential, commercial and industrial working group.

REC: Renewable energy certificates which are marketable/tradable entities that represents one megawatt hour (1,000 kWh) of power generation from a renewable energy source.

RPS: Renewable Portfolio Standard; a policy designed to influence the development of renewable resources and technologies by requiring electricity providers to obtain a minimum percentage of the power they supply to their customers from renewable energy resources by a certain date.

SBC: System benefit charge; a charge on a consumer's bill from an electric distribution company to pay for the costs of certain public benefits such as low-income assistance and energy efficiency.

SF_6: Sulfur hexafluoride; a man-made greenhouse gas generated by industrial processes.

Sink: Removals of carbon from the atmosphere, with the carbon stored in forests, soils, landfills, wood structures, or other biomass-related products.

SIT: USEPA State Greenhouse Gas Inventory Tool.

Source: Any process or activity that releases into the atmosphere a greenhouse gas, an aerosol or a precursor to a greenhouse gas.

SUV: Sports utility vehicle, considered under federal gas mileage standards to be a light-duty truck, and subject to a lower average mile per gallon requirement: 20.7 mpg.

TLU: Transportation and land use working group.

UNH: University of New Hampshire

VMT: Vehicle-miles traveled.

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