MASSACHUSETTS CLIMATE PROTECTION PLAN

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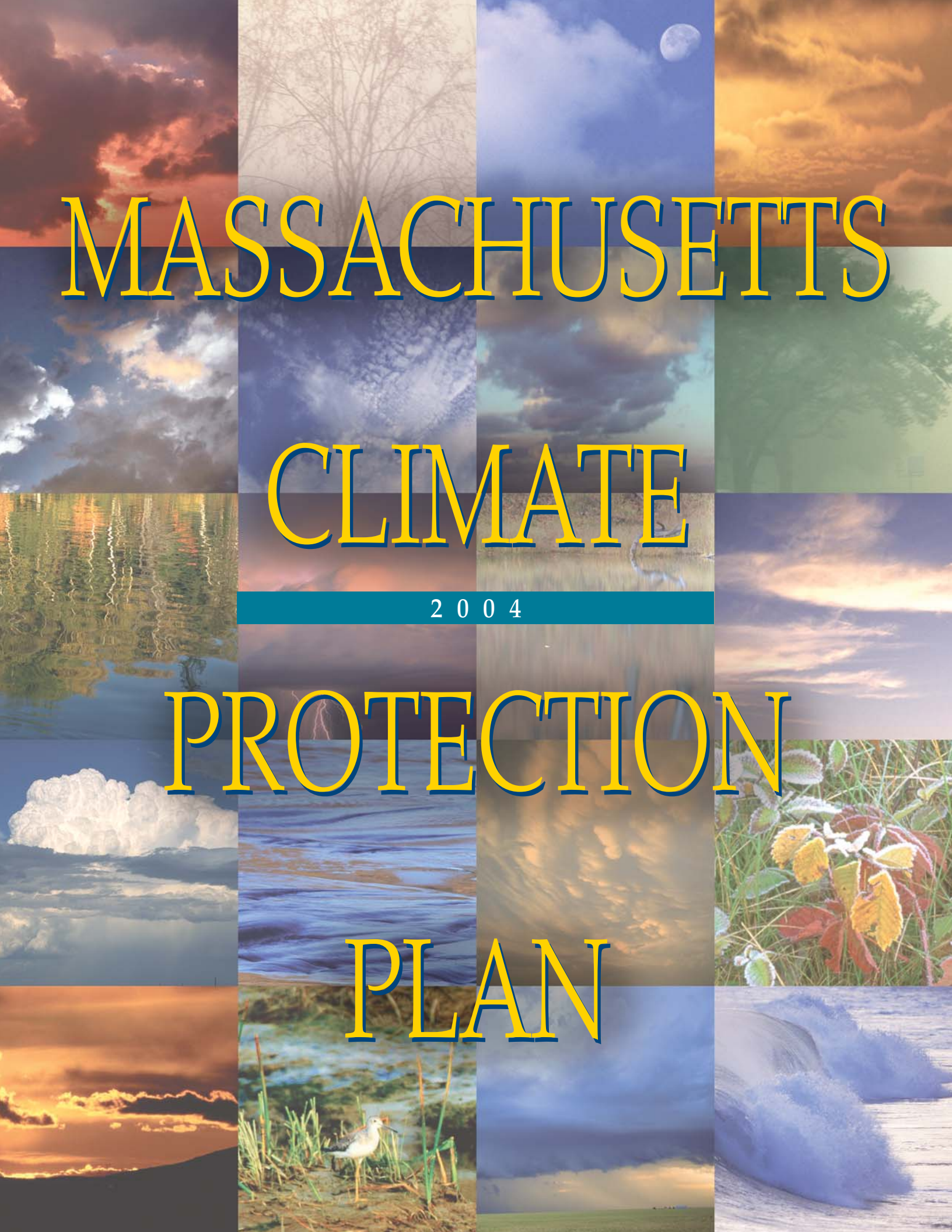

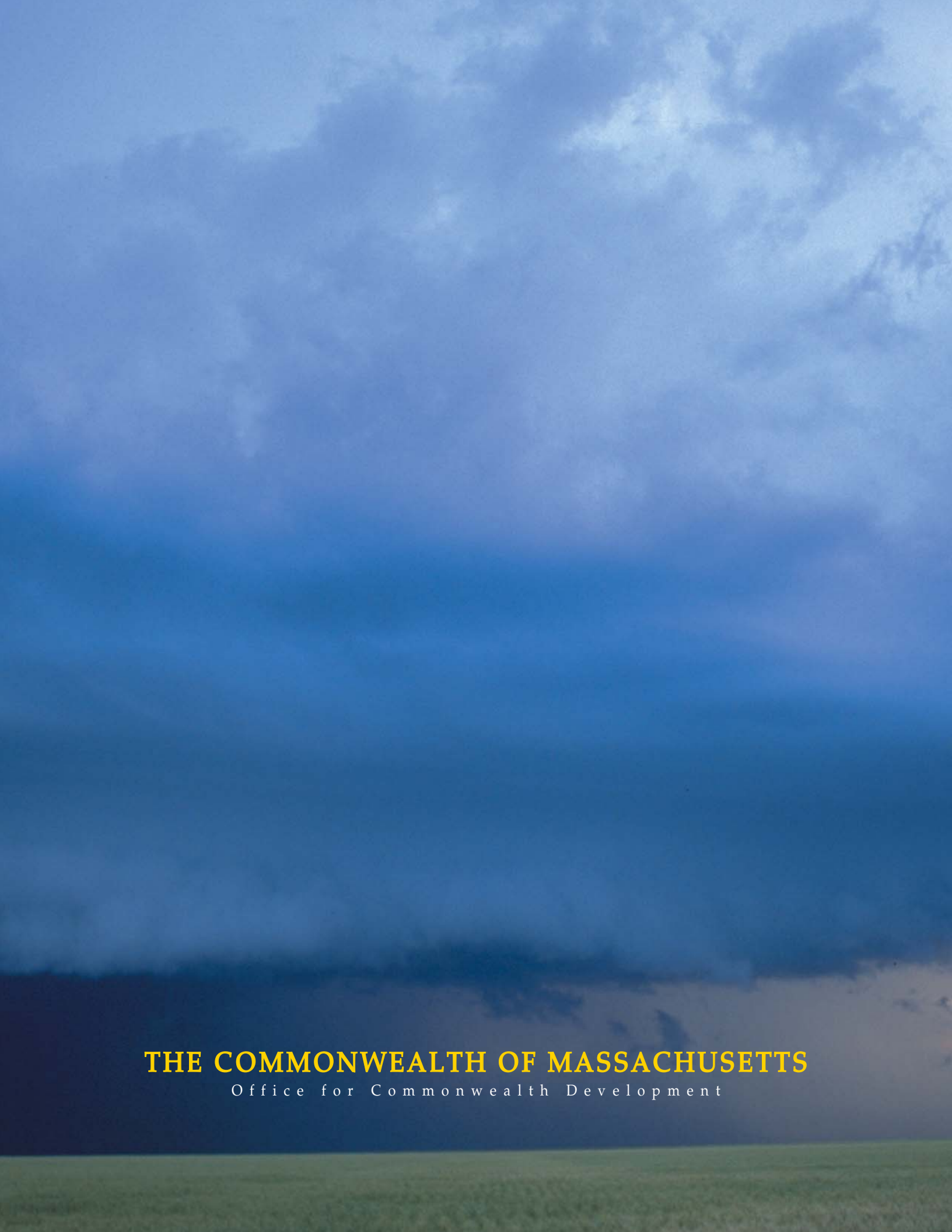

THE COMMONWEALTH OF MASSACHUSETTS

Office for Commonwealth Development

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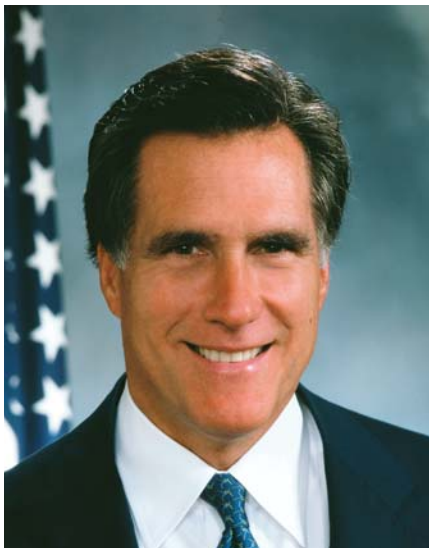

DEAR FELLOW CITIZEN OF THE COMMONWEALTH:

I am proud to announce the Massachusetts Climate Protection Plan, the first in the history of the Commonwealth and among the strongest in our nation. Since taking office in January 2003, this Administration has embarked on a "no regrets" policy towards climate change. Rather than focusing our energy on the debate over the causes of global warming and the impact of human activity on climate, we have chosen to put our emphasis on actions, not discourse. If climate change is happening, the actions we take will help. If climate change is largely caused by human actions, this will really help. If we learn decades from now that climate change isn't happening, these actions will still help our economy, our quality of life and the quality of our environment.

The same policies that protect the climate also promote energy efficiency, smart business practices, and improve the environment in which our citizens live and work. For Massachusetts, promoting climate protection in the Commonwealth and throughout our nation also promotes Massachusetts businesses that are at the forefront of the new markets for renewable energy technologies. Just as the brainpower of this state has been put to work by the nation and the world to develop the high-tech and biotech industries, we can also lead the nation in new energy technologies.

The actions in this Climate Protection Plan will have a significant impact on the future of our state. Although many of the policies will not be easy to implement, the benefits will be long-lasting and enormous – benefits to our health, our economy, our quality of life, our very landscape. These are actions we can and must take now if we are to have "no regrets" when we transfer our temporary stewardship of this earth to the next generation.

Sincerely,

Mitt Romney
Governor

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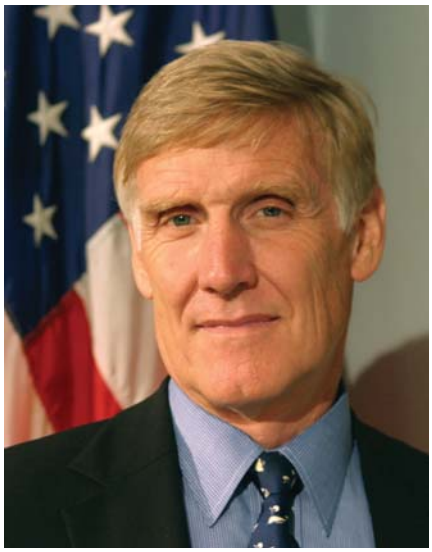


DEAR READER:

The Office for Commonwealth Development is dedicated to wise investment in our public infrastructure, careful stewardship of our natural resources, and the protection and enhancement of our wonderful towns and cities. As our state's needs for housing, transportation, and energy increase, we must carefully consider and manage the environmental impacts of growth. The choices we make today will affect not only our lives, but the lives of Massachusetts residents for generations to come.

Nowhere are the competing demands of the built and natural environments more apparent, or more important, than around the issue of climate change. As this report makes clear, the world's dramatically shifting weather patterns are in part attributable to the often-heedless development patterns of the past. Our houses, schools, shops, industry, cars and transit vehicles all consume energy and generate emissions, which too often have taken a disturbing cumulative toll on our fragile and finite natural resources.

Fortunately, these impacts are controllable, and reversible. While climate change is, by definition, a worldwide problem, it is essential that Massachusetts begin to address its local contribution and impacts. The challenge is twofold: we must acknowledge and repair the damage we have already caused, and we must change our policies and actions to minimize future damage.

Governor Romney created the Office for Commonwealth Development to forge coordinated policies and programs between the state's energy, environment, housing, and transportation agencies. This Climate Protection Plan represents a comprehensive effort by those four agencies, working in concert with a number of other agencies in the Commonwealth, to fashion a strategic plan for action. The Plan combines requirements with incentives, existing programs with new initiatives, regulatory streamlining with tougher performance standards, market tools with demonstration projects. And it pledges the state to lead by example – in the vehicles we use, the buildings we construct, and the growth that we lead.

All of the measures outlined in this Plan bring with them multiple benefits. Many will result in long-term cost savings and increased competitive advantages. They build on the Commonwealth's leadership in the innovation economy. Taken together, they will significantly improve public health, environmental safety and stability, and the overall quality of life in Massachusetts. They will prepare the way for our state to prosper in the twenty-first century. And they will serve as an active reminder that successful growth and responsible stewardship can – and must – go hand in hand.

Sincerely,

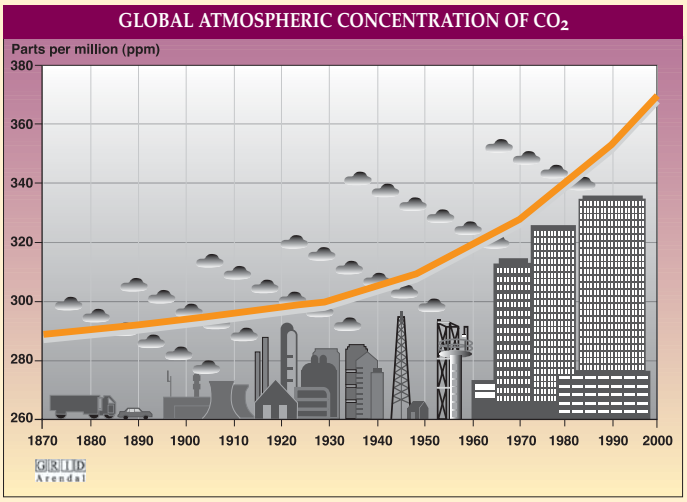
Douglas I. Foy
Secretary

THE NEED FOR ACTION NOW

The Massachusetts Climate Protection Plan (the Plan) is an initial step in a coordinated effort to reduce emissions of greenhouse gases (GHGs) and improve energy efficiency in the Commonwealth – two inseparably linked goals. It presents a comprehensive set of near-term actions that will protect the climate, reduce pollution, cut energy demand, and nurture job growth through the development of sustainable energy resources and advanced technologies.

Interestingly, what has often been missing from the climate change debate in recent years is a recognition that many of the protection measures one would take to alleviate climate impacts also bring with them significant other benefits. Whether you believe that the climate is changing or not, this plan makes sense. The actions outlined here will help our economy, protect our natural resources, and preserve the quality of life in the Commonwealth. They will not only reduce climate impacts, they will advance Romney administration efforts to promote smart growth, increase the resources dedicated to the maintenance of existing infrastructure ("Fix It First"), and save taxpayer dollars through better management of state operations and services.

Resources needed to implement the Plan have already been identified, relying heavily on existing programs that manage state agency buildings and purchasing, promote energy efficiency, and support the development of renewable energy supplies. Rather than build new barriers to sound economic growth, the Plan calls for more efficient and lean permitting and acts to spur the competitive and innovative strengths of our business, scientific, research and education communities. For these reasons, this plan should enjoy the support of all our citizens no matter what they believe about climate change.



The Plan represents Massachusetts' commitment to implementing the regional climate change plan adopted by the New England Governors and Eastern Canadian Premiers (NEG/ECP) in August 2001. It is a joint effort of more than 15 agencies, spearheaded by the Office for Commonwealth Development. The Plan was made possible by the technical support of the Northeast States for Coordinated Air Use Management (NESCAUM), an interstate organization that promotes air quality, and the support of the Center for Clean Air Policy, the Massachusetts Technology Collaborative's Renewable Energy Trust, and the U.S. Environmental Protection Agency (EPA). Hundreds of interested citizens helped to inform the development of the Plan. Their guidance and continued enthusiasm are critical to its successful implementation.

WHAT IS CLIMATE CHANGE?

Climate change refers to unstable weather patterns caused by increases in the average global temperature. There is a consensus among climate scientists that these changes result from atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and other heat-trapping gases. These greenhouse gases form a blanket of pollution that stays in the atmosphere and may be the fundamental cause of climate instability characterized by severe weather events such as storms, droughts, floods, heat waves, and sea level rise.

IS CLIMATE CHANGE REAL?

Atmospheric concentrations of carbon dioxide are the highest they have been in 140,000 years, with concentrations going from 290 parts per million (ppm) in 1870 to 373 ppm today. A consensus of climate change scientists agrees that the increasing concentrations of GHGs are causing a rise in average global temperatures. Whether or not this rise in temperature is fully human-induced, temperature records are being broken frequently. For example, 2003 was the third warmest year on record, following 2002, while 1998 remains the warmest year ever recorded. The International Panel for

Climate Change (IPCC), a group sponsored by the United Nations and the World Meteorological Organization, representing more than 2,000 leading climate scientists, predicts an average temperature increase of 5-9°F by 2100, although a wider range of outcomes is possible. To put this number in perspective, only about 9°F separates the world at the beginning of the twenty-first century from the world at the end of the last Ice Age, more than 10,000 years ago.

WHAT COULD BE THE IMPACTS OF CLIMATE CHANGE ON MASSACHUSETTS?

We are concerned about climate change worldwide because, if it continues, it will bring significant humanitarian, environmental and economic impacts globally. While there is some scientific uncertainty as to the magnitude of these potential changes, there is broad agreement that such change would affect many aspects of our daily lives.

There would also be impacts within the Commonwealth. For example, the New England Regional Assessment (NERA) predicts that if climate trends continue as projected, the weather patterns in Boston at the end of this century would look more like those now found in Richmond, Virginia or Atlanta, Georgia. Climate change on this scale would have wide-ranging consequences for the Commonwealth.

WEATHER EVENTS: Weather extremes, already a characteristic of New England, are likely to become more frequent and cause more damage under a changing climate. While no one storm is directly attributable to climate change, an increasing number of such events could become more commonplace, severely interrupting Bay State life and economic activity. For example, downed power lines, overburdened septic systems, and travel delays are all costs that would have to be borne by our citizens.

COASTAL IMPACTS: Massachusetts and all coastal states would lose beachfront in the coming years as climate change causes rising sea levels and stronger coastal storms. By 2100, a 5-9°F increase in global temperatures is forecast to double the rate of sea-level rise from 11 inches over the last century to 22 inches in this century.

ECONOMIC IMPACTS: Climate change would have impacts on important Massachusetts industries such as tourism and agriculture, which rely on the strength and vitality of our natural resources.

WATER RESOURCES: Higher temperatures would accelerate evaporation and cause drier conditions and droughts, placing pressure on our water resources, which are already stressed by regional growth. Water shortages would, in turn, alter the natural fish populations in our rivers, streams, lakes, and ponds, and saltwater could intrude in our coastal fresh water supplies.

FISH AND OCEAN IMPACTS: A warmer, saltier ocean and changing coastal currents would alter coastal and marine ecosystems, affecting the distribution, growth rate, and survival of our commercial fish, shellfish, and lobster stocks.

HUMAN HEALTH AND COMFORT: While CO_2 itself is non-toxic, its warming effects cause hotter weather with more frequent and severe heat waves, posing multiple health risks that include a rise in heat-related illness, more frequent periods of harmful outdoor air quality, and the spread of certain diseases.

Checkerspot Butterfly (Photo Credit to Bill Byrne, MassWildlife)

NATURAL RESOURCES: Climate change could have serious impacts on the state's diverse ecosystems and native species, and may encourage the spread of non-native species. It would also likely alter the natural range of many different plants and animals. Over the long term, warming could intensify droughts and damage forest ecosystems.

WHAT CAN MASSACHUSETTS DO TO ADDRESS CLIMATE CHANGE?

There is growing scientific concern regarding the contribution of human activity to climate change. For example, the IPCC states in its Third Assessment Report that "there is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities." The panel also concludes that if no action is taken, average rates of warming by the year 2100 will "be greater than any seen in the last 10,000 years." The NERA report asserts that, "There is growing evidence that much of the climate change experienced over the past half of the twentieth century is attributable to human factors."

But we need not resolve this scientific debate in order to fashion a thoughtful Climate Protection Plan. We know that a wide range of human activities generate greenhouse gases, including the burning of fossil fuels for electricity generation, the operation of our transportation systems, and the manufacture of goods. Even forestry and agricultural practices, and the way we dispose of solid waste, add climate pollutants to the atmosphere.

There are, fortunately, a broad range of opportunities to slow down these GHG releases through common sense, cost-effective actions that also advance other important state objectives, including sustainable economic development, job creation, energy independence, and cleaner air. Carbon dioxide emissions per capita in Massachusetts may be lower than the national average, with the state emitting 1.9% of the total CO_2 emitted in the U.S. while housing 2.4% of the population, but it is still a comparatively large amount of the world's GHG emissions. In fact, the Commonwealth emits about the same quantity of greenhouse gases as Portugal, Austria, or Greece, and emits considerably more than Sweden, Ireland, Switzerland, or Denmark. The impact of efforts to reduce GHG emissions here in Massachusetts should not be underestimated. Nor should the example our state actions can set for other political jurisdictions. Other states like Illinois, New York, Connecticut, and New Jersey have already adopted climate change plans, and many more states are in the planning stages. Massachusetts has learned from the experiences of other states and has already committed to starting programs that can and should be implemented on a multi-state or regional basis.

ACTIONS CALLED FOR IN THE PLAN

The Plan focuses on a range of strategies to achieve significant near-term reductions in GHG emissions. These strategies give priority to pollution reductions that are compatible with economic growth – measures which ease the transition to cleaner and less expensive energy resources, and which retain a higher proportion of the state's energy dollars within Massachusetts. These strategies encourage public agencies, businesses, industries, and citizens to take cost-effective, common sense steps toward reducing GHG emissions in ways that also advance other important state policies and objectives.

The Plan is divided into ten focus areas with associated action steps, as summarized on the following pages.

TOUGH BUT REALISTIC TARGETS

The Plan establishes the following goals to benchmark progress and to allow necessary adjustments ensuring short-term and long-term success. These goals are consistent with those established in the NEG/ECP regional climate change plan.

SHORT-TERM: Reduce GHG emissions to 1990 levels by the year 2010.

MEDIUM-TERM: Reduce GHG emissions 10% below 1990 levels by the year 2020.

LONG-TERM: Reduce GHG emissions sufficiently to eliminate any dangerous threat to the climate; current science suggests this will require reductions as much as 75-85% below current levels. Success in meeting this long-term goal will require major scientific and technological advances – advances that will take decades to achieve, requiring action to begin now.

ASSESSING AND COMMUNICATING EMISSIONS TRENDS

By gathering more information on the emissions of GHGs, including new efforts to require large facilities and large public projects to calculate and report CO_2 emissions, the state will establish a baseline of more accurate, detailed information from which future changes can be tracked, without increasing unnecessary costs, paperwork burdens, or timelines for environmental review and permitting. The Plan expands the state's commitment to the public dissemination of such information through education and outreach, seeking to build a constituency that understands the need for climate change action.

Action includes efforts to:

- Develop statewide greenhouse gas inventory, tracking, and reporting
- Enhance pollution reporting to include CO_2 emissions
- Require reporting of CO_2 impacts in the MEPA review process for large public projects
- Educate the public about greenhouse gas impacts of electricity generation
- Implement a coordinated outreach program and measure its effectiveness

STATE SUSTAINABILITY: LEADERSHIP BY EXAMPLE

The Massachusetts State Sustainability Program, established by Executive Order (EO) 438, calls on state agencies to incorporate environmentally sustainable practices into their daily operations. Reducing state government's impacts on climate change is a major focus of the Program. The Plan identifies a number of actions relating to state government that are specifically designed to be consistent with the goals of EO 438. Implementation of these actions will be overseen by the State Sustainability Program. Significantly, the state has committed to an expenditure of up to $17 million to purchase renewable energy. By greatly reducing GHG emissions associated with government activity, and coordinating climate change reduction strategies with policies that promote the state's long-term economic prosperity, the actions outlined here send a clear leadership message to business, institutions, and citizens across the Commonwealth and around the country.

Action includes efforts to:

- Review agency policies, programs, and operations to lessen state government's impacts on the environment
- Develop and maintain a greenhouse gas inventory for state facilities and fleets
- Acquire clean, fuel-efficient vehicles for the state fleet
- Consider employing sustainable, efficient design and construction standards for each state facility
- Improve energy efficiency for existing buildings
- Expand state role in long-term contracts for renewable energy purchases
- Promote greater waste prevention and recycling at state facilities
- Incorporate a longer timeframe for analysis of energy savings for state purchases
- Stimulate the market for environmentally preferable products
- Promote water conservation in state buildings to reduce electricity and heating costs

CITIES AND TOWNS AS CLIMATE PROTECTION PARTNERS

The Plan reflects the Romney administration's strategy of working closely with regional planning associations and their constituent cities and towns; the goal is to encourage living and working patterns that can be served by clean transportation options. Local cities and towns play a pivotal role in planning for growth, and they are on the front line in efforts to protect the state's public water supplies and natural aquifers, forests, farmlands, and other green spaces. Many communities have already pledged to address climate change issues and to lower their GHG emissions by reducing their generation of solid waste. The Plan outlines steps to support and expand local climate change efforts.

Action includes efforts to:

- Create a climate change resource roundtable for local officials
- Encourage municipalities to purchase renewable energy
- Guide municipalities to think and act regionally
- Urge communities to join the Cities for Climate Protection™ campaign
- Encourage municipalities to participate in community tree-planting programs
- Promote local and regional waste management tools
- Promote Project Greenlights: low energy traffic signals and more efficient night lighting

BUSINESS, INDUSTRY, AND INSTITUTIONS AS CLIMATE PROTECTION PARTNERS

The Plan promotes the goals of reducing GHG emissions and enhancing business competitiveness through energy efficiency, as well as the efforts to grow the many Massachusetts businesses whose products reduce GHG emissions. The Plan encourages business, industry, and non-profit sector leaders to set and achieve targets through focused strategies that promote new technologies, reduce demand for fossil fuels, cut carbon emissions, and create new jobs.

Action includes efforts to:

- Implement existing regulations to reduce greenhouse gases and other pollutants emitted by older power plants
- Create a CO_2 registry with other states
- Create an emissions banking and trading program
- Facilitate a climate change business leaders roundtable
- Initiate a Governor's Climate Change Challenge for businesses and institutions
- Provide technical assistance to the business community
- Implement a program to reduce the emissions of highly warming specialty gases
- Promote distributed generation, combined heat and power, and renewable energy at companies and institutions
- Ensure the efficient distribution of natural gas

CLEAN AND RELIABLE ENERGY

More efforts need to be undertaken to increase energy efficiency and renewable energy development. The Plan identifies a number of ways to decrease the amount of fuel burned in power plants and other industries, in commercial buildings, and in homes. Getting access to cleaner energy supplies, including the building of renewable and green resources – from photovoltaic panels and wind generators to ultra-clean fuel cells – represents an important way to meet future energy needs while dramatically cutting carbon emissions.

Action includes efforts to:

- Continue to build support and provide incentives for energy efficiency
- Promote renewable energy through the implementation of the statewide Renewable Portfolio Standard
- Participate in and support the Regional Greenhouse Gas Initiative

- Bring new renewable energy technologies and systems to the market through the Massachusetts Technology Collaborative's Renewable Energy Trust ("the Trust")
- Reduce barriers to renewable energy development
- Launch a partnership between the Office for Commonwealth Development and the Trust to fund climate change initiatives
- Encourage regulatory policies that will make it easier to site small-scale energy efficiency and renewables projects
- Work with utilities to promote residential energy efficiency
- Design an enhanced incentive program to improve the efficiency of residential oil use
- Implement new appliance energy-efficiency standards

MORE EFFICIENT BUILDINGS: REDUCING POLLUTION THROUGH SUSTAINABLE DESIGN AND CONSTRUCTION

By reducing the energy demanded by homes, offices, and industries – and particularly government buildings – Massachusetts can save energy; reduce stresses on power systems, lessening the likelihood of outages; and reduce the impact of price volatility. New and more environmentally sound and efficient construction practices are emphasized in the Plan. These practices often represent the most cost-effective way to lower environmental impacts.

Action includes efforts to:

- Continue the implementation of a comprehensive sustainable design initiative for state buildings
- Initiate a sustainable building design roundtable
- Promote sustainable design among construction professionals
- Work collaboratively with the Trust's Green Buildings Program
- Support the Trust's partnership with the Massachusetts Department of Education's Green Schools Program
- Incorporate sustainable design approaches into MEPA projects

TRANSPORTATION AND SUSTAINABLE DEVELOPMENT: INCREASING CHOICES, REDUCING EMISSIONS

Transportation – including cars, trucks, buses, and trains – is the source of more than 30% of the state's GHG emissions. We need to develop an efficient transportation system that both stops the anticipated growth of GHG emissions and reduces current emissions. Consistent with the Romney administration's Fix It First policy, the state is committed to aligning spending decisions with policies that encourage sustainable development by investing in areas where infrastructure already exists, focusing resources on the state's existing roads and bridges, and encouraging people to travel in more climate friendly ways, especially via mass transit.

Action includes efforts to:

- Use Sustainable Development Principles to integrate transportation and land use
- Favor transit-oriented development around MBTA stations
- Include energy use and GHG emissions data as criteria in transportation decisions
- Maintain and update public transit services
- Increase parking at train stations to encourage use of public transit
- Improve the efficiency of transit vehicle movement
- Develop new bicycle and pedestrian policies, programs, and facilities
- Expand programs to promote efficient travel
- Seek opportunities to reduce emissions at Logan Airport
- Improve aircraft movement efficiency
- Evaluate the benefits of expanded rail and water opportunities

VEHICLES: SUPPORTING CLEAN, EFFICIENT NEW TECHNOLOGIES

Cars, buses, and trucks that are more fuel-efficient and/or use cleaner alternative fuels emit less CO_2. The Plan features a wide range of strategies designed to encourage the demand for and sale of hybrid cars and other efficient clean vehicles.

Action includes efforts to:

- Provide incentives to purchase fuel-efficient vehicles
- Support HOV lane access for clean vehicles
- Implement stronger vehicle emissions standards
- Promote the use of cleaner vehicles and fuels in public transit fleets
- Clean up the existing transit fleet with less polluting fuels
- Continue to promote the use of cleaner diesel equipment on state-funded construction projects
- Eliminate unnecessary idling of buses
- Use cleaner train engine technology to reduce diesel soot
- Advocate for aircraft efficiency at a regional and national level

NATURAL RESOURCE PROTECTION AS A CLIMATE STRATEGY

Forests act as beneficial "carbon sinks" by temporarily removing and storing carbon dioxide. This keeps CO_2 out of the atmosphere where it causes warming, which in turn threatens the long-term survival of the forest. The Plan sets out a strategy to maintain and enhance important resources through forest management and protection. In addition, strategies are included to help citizens working in tourism, agriculture, commercial fishing, aquaculture, the wood products industry, water supply protection, and other natural resource-based enterprises, to adapt to the growing impacts of climate change. The Plan sets a course for the state to continue stewardship of its natural resources, ensuring that Massachusetts can successfully adapt to and withstand the projected impacts of climate change from CO_2 emissions already in the atmosphere.

Action includes efforts to:

- Host workshops on potential impacts of climate change on natural resources and land management
- Promote coastal planning programs that respond to climate change and help preserve wetlands
- Promote a new forest vision that integrates carbon resource management with other natural resource goals
- Promote municipal strategies that preserve trees
- Continue aggressive open space protection efforts
- Develop and implement a comprehensive biomass policy
- Make our farms full partners in climate protection and mitigation

MASSACHUSETTS CLIMATE PROTECTION PLAN

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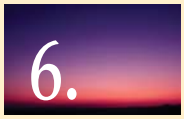
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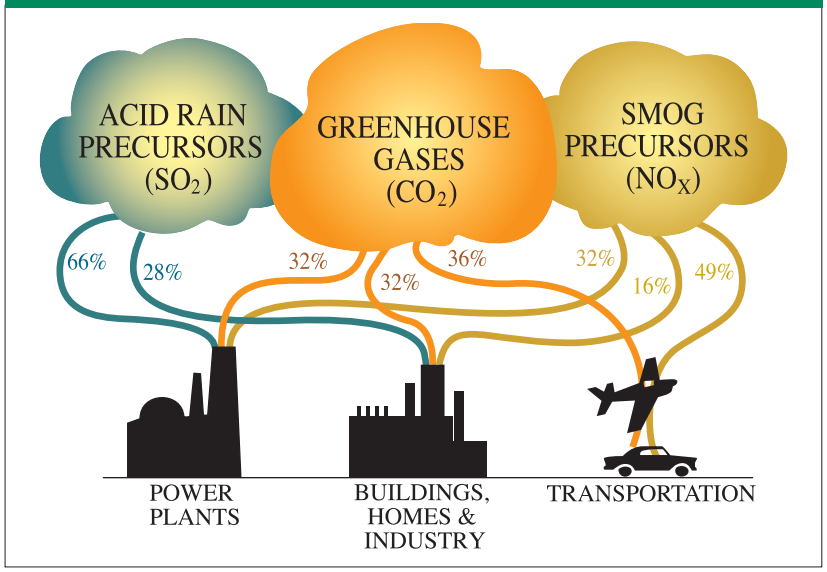
TOUGH BUT REALISTIC TARGETS

In August 2001, the Commonwealth joined the other New England states and the Eastern Canadian provinces to unveil a regional Climate Change Action Plan. This regional plan is designed to reduce greenhouse gas emissions to 1990 levels by the year 2010, with a further 10% reduction by 2020. The Governors and Premiers also recognized the importance of achieving overall reductions sufficient to eliminate the longer-term threat that greenhouses gases pose to the climate. To achieve these goals, strong action involving every sector of our economy needs to begin now.

MASSACHUSETTS SOURCES OF GREENHOUSE GASES, ACID RAIN, AND SMOG



The Massachusetts Climate Protection Plan (the Plan) represents Massachusetts' commitment to achieve the goals established in the New England Governors and Eastern Canadian Premiers Regional Climate Change Action Plan. These goals embody Massachusetts' pledge to take responsibility for its contributions to climate change and to work to minimize the damage that a changing climate will cause in the future. Massachusetts will attempt to exceed the regional emissions targets.

In 1990, Massachusetts' emissions were estimated to be 115,632,000 tons of CO_2 equivalent (including CO_2, methane, and N_2O). At the same time, forest and biomass-related carbon uptake was estimated at a mere 8,857,000 tons of CO_2 equivalent or about 7.6% of the total emitted. The resulting net emissions are estimated to be 106,775,000 tons. In 2001, Massachusetts released approximately 7% above 1990 emissions, or 123,726,240 tons. Biomass uptake is just slightly less than it was in 1990. The Plan sets a target of returning to the 1990 emission levels by 2010 and to emit no more than 96,000,000 tons of CO_2 equivalent tons by the year 2020. The remainder of this plan lays out the Massachusetts approach to meeting these goals.

OVERALL GOALS FOR MASSACHUSETTS

In support of the New England Governors and Eastern Canadian Premiers, Massachusetts has committed to making the following reductions in its greenhouse gas (GHG) emissions:

SHORT-TERM: Reduce GHG emissions to 1990 levels by the year 2010.

MEDIUM-TERM: Reduce GHG emissions 10% below 1990 levels by the year 2020.

LONG-TERM: Reduce GHG emissions sufficiently to eliminate any dangerous threat to the climate; current science suggests this will require reductions as much as 75-85% below current levels.

While this plan outlines a wealth of reasonable, achievable and meaningful commitments to make progress towards these short- and mid-term goals, it must be recognized that success in meeting this long-term goal will require major scientific and technological advances – advances that will take decades to achieve. To begin this challenge, Massachusetts is calling on the public and private sectors, as well as our residents, to take action now. Given Massachusetts' world-renowned educational institutions and research facilities, entrepreneurial business climate, and rich history of innovation, this challenge is an economic opportunity.

2. ASSESSING AND COMMUNICATING EMISSIONS TRENDS

If we are to succeed in meeting these climate change goals, accurate and detailed information needs to be gathered and clearly communicated to the public. Massachusetts companies will begin to understand their own emission profiles, and private citizens will need to understand how their actions contribute to the emission of greenhouse gases, and how they can change their behavior to reduce emissions. Education and outreach can show citizens how ordinary, daily decisions on matters such as driving and fuel consumption affect greenhouse gas emissions. Public disclosure of greenhouse gas emissions will establish a current baseline and help track progress toward meeting the goals of this Plan.

GOAL

By 2005, all Massachusetts citizens will be aware of climate change and consider ways in which they can help to reduce climate impacts. They will have access to a list of GHG emissions sources, and they will understand what actions they can take at home and at work to reduce the release of heat-trapping gases. The state will seek stakeholder input to develop workable methods of regular coordinated emissions reporting for Massachusetts companies. In addition, state agencies will also consider how state policies and programs affect climate change behavior.

ACTIONS

DEVELOP STATEWIDE GREENHOUSE GAS INVENTORY, TRACKING, AND REPORTING

Consistent with the New England Governors' and Eastern Canadian Premiers' (NEG/ECP) Plan, the Division of Energy Resources (DOER) is working with the Department of Environmental Protection (DEP) and the Northeast States for Coordinated Air Use Management (NESCAUM) to collect and analyze data on GHG emissions in Massachusetts. Based on that inventory, including DEP's data for its regulated sources, DOER will report every three years on progress achieved in reducing GHG emissions, and will help refine the state's plans for reducing greenhouse gas emissions and conserving energy.

ENHANCE POLLUTION REPORTING TO INCLUDE CO_2 EMISSIONS

In order to make progress in greenhouse gas reduction, we in the Commonwealth need to better understand where and how much CO_2 emissions are being generated. While all vehicles and buildings that burn fossil fuel generate GHGs, data is readily available from some sources and that data could and should be better tracked and monitored as an indicator of the state's efforts to reduce GHG emissions, just as we collect and track data on other air emissions. Currently CO_2 data is available for power plants and electricity suppliers, but there is no similar method of tracking annual GHG emissions from other facilities.

The state will now work to better track and report the CO_2 information currently reported from the power sector. In addition, we will seek stakeholder input on the design, initial implementation, and ongoing management of a system to expand the range of current reporting for CO_2 emissions to include large and medium facilities that currently report other air emissions data. This reporting system must be designed to maximize ease of reporting and minimize unnecessary costs through the use of standardized protocols, consistent with other on-going administrative efforts to streamline environmental review and permitting. Massachusetts will also work with other northeast states to ensure that the system is designed to align with other similar regional and multi-state programs to set the stage for reporters to easily access the new GHG cap and trade programs described below.

Similar requirements have recently been introduced in other states, such as New Jersey and Wisconsin. This new reporting would provide regular, consistent, verifiable, and timely information to help ensure that the state's periodic GHG inventory is accurate and complete.

REQUIRE REPORTING OF CO_2 IMPACTS IN THE MEPA REVIEW PROCESS FOR LARGE PUBLIC PROJECTS

The Massachusetts Environmental Policy Act (MEPA) requires that proponents of projects above a certain size that involve state agency action must assess the project's environmental impact and take all feasible measures to avoid, minimize, and mitigate damage to the environment. Currently, the MEPA process requires the reporting of greenhouse gas impacts for energy facilities. This requirement will now be extended to all large public projects subject to MEPA review, for informational purposes. As a result, significant state agency projects will be examined for their greenhouse gas impacts to enhance state decision-making.

EDUCATE THE PUBLIC ABOUT THE GREENHOUSE GAS IMPACTS OF ELECTRICITY GENERATION

Retail consumers need to know more about the fuel mix used by electric companies to generate power, and the extent to which this mix leads to the emission of greenhouse gases. To this end, a utility disclosure statement is currently provided to consumers on a periodic basis, identifying the carbon intensity of the resources used to generate the purchased electricity, compared with the carbon intensity of the regional power grid. The Commonwealth will continue to foster cleaner electricity choices for consumers and help them make informed environmental choices about their electricity providers.

IMPLEMENT A COORDINATED OUTREACH PROGRAM

The Office for Commonwealth Development will develop a coordinated and detailed education and outreach program to explain what individuals, businesses and organizations can do to reduce the risks and impacts of climate change including the creation of a web page to serve as a clearinghouse for information on greenhouse gas emissions.

In support of the New England Governors' regional plan, and as part of its three-year review, the Commonwealth will assess the effectiveness of efforts to educate the public on the significance of the climate change issue, and make adjustments in messages to ensure that they remain effective.

JANE BRIGHT HEALTHLINK, SALEM

The HealthLink campaign to clean up a local power plant led by Jane Bright and the other members of Salem's HealthLink grew out of concerns over the impacts of older power plants on the health of local residents. The effort soon expanded to consider the broader impacts of coal-fired power generation on the health of the planet.

Jane Bright and HealthLink have been steadfast in their fight for power plant clean-up, demanding that heat-trapping carbon dioxide be regulated along with other pollutants from the older power plants. With their strong advocacy and support, Massachusetts became the first state in the nation to finalize four-pollutant ("4P") regulations in 2001, requiring reductions in nitrogen oxides, sulfur dioxides, mercury, and carbon dioxide for our older power plants. These regulations will result in cleaner air for the Commonwealth and lower greenhouse gas pollution for the planet.

3. STATE SUSTAINABILITY: LEADERSHIP BY EXAMPLE

Massachusetts state government oversees more than 5,000 buildings and manages an annual average of $200 million in new construction and renovation projects. Each year the state purchases hundreds of vehicles, and maintains an existing fleet of 9,000 cars and trucks, which travel more than 110 million miles a year. Collectively, GHG emissions from state government energy consumption totaled over 842,000 tons in 2002.

In recognition of state government's significant potential impact on reductions in GHG emissions, and to demonstrate state leadership on this issue, Executive Order 438, signed in July 2002, established the Massachusetts State Sustainability Program. The primary goal of the Program is to help agencies to incorporate environmentally sustainable practices into their operations, focusing on three top priorities: waste reduction, mercury elimination, and reduction of greenhouse gas emissions. A Coordinating Council, made up of representatives from 15 key state agencies and offices, is responsible for guiding the Program, setting long-range targets, and developing and implementing effective strategies to help agencies meet Program goals.

GOAL

Consistent with the New England Governors' and Eastern Canadian Premiers' Regional Climate Change Action Plan, and Executive Order 438, state agencies will strive to reduce greenhouse gas emissions from state operations by 25% by 2012. These reductions will be achieved by improving energy efficiency, adding renewable resources, acquiring energy-efficient vehicles, and using lower-carbon fuels. These changes will be made without compromising government services or working conditions.

ACTIONS

REVIEW AGENCY POLICIES, PROGRAMS, AND OPERATIONS TO LESSEN STATE GOVERNMENT'S IMPACTS ON THE ENVIRONMENT

Every agency will assess the ways in which its policies, programs, and operations contribute to greenhouse gas emissions, and will develop a plan for reducing emissions to help meet the overall climate protection goal. Each agency will create a sustainability team, developing a sustainability plan by October 2004 that identifies and prioritizes strategies to reduce agency-wide environmental impacts. All plans shall be submitted to the Coordinating Council for review. To aid in this process, the Executive Office for Environmental Affairs will send a program implementation guide to all agencies.

DEVELOP AND MAINTAIN A GREENHOUSE GAS INVENTORY FOR STATE FACILITIES AND FLEETS

The State Sustainability Program has developed the state's first greenhouse gas inventory that measures the level of greenhouse gas emissions from state agency activities. This inventory will be updated annually and will be used to track progress in meeting the GHG reduction goals, and to help establish interim targets and set priorities. The State Sustainability Program will review progress toward meeting the 25% reduction goal and will submit annual updates to the Governor.

ACQUIRE CLEAN, FUEL-EFFICIENT VEHICLES FOR THE STATE FLEET

The Governor's Office of Administration and Finance recently implemented guidelines to ensure that fuel economy, and air quality concerns are fully incorporated into fleet purchasing decisions, encouraging the purchase of low-GHG emitting vehicles in public and private fleets. Under these guidelines, the Operational Services Division will work to ensure that vehicles purchased for the state meet high efficiency requirements, while also meeting the needs of the state employees who rely upon them. In particular, the purchase of SUVs will only be permitted when absolutely required to fill emergency response and off-road needs. Such purchases will require approval from the Governor's Administration and Finance Office. Agencies will be required to purchase the most economical, fuel-efficient, and low-emission vehicle appropriate to the missions, with the goal of all new state vehicles meeting Ultra Low Emissions Vehicle (ULEV) standards,

with fuel efficiencies of no less than 20 MPG. Agencies will be encouraged to consider alternative fuel vehicles and hybrids where practical.

By buying more efficient cars and trucks, and increasing use of lower-carbon fuels, the state will assemble a cleaner fleet, save money on energy, and demonstrate a commitment to reducing the impacts of state vehicles on air quality and climate change. The state will also encourage municipalities, independent authorities, and the state university system to follow similar guidelines.

In addition, the state will work to develop a cleaner fleet of watercraft, using new outboard motors that consume up to 30% less fuel and release less oil into the water. Municipalities will be strongly encouraged to adopt this policy.

The Operational Services Division, in collaboration with the State Sustainability Program, DOER, and other appropriate agencies, will develop and maintain statewide contracts for alternative fuels (e.g. low-sulfur diesel, biodiesel, compressed natural gas, etc.) and more efficient vehicles and engines. This will enable fleet managers to purchase efficient vehicles and engines directly from a statewide contract, with beneficial cost reductions resulting from the state's large purchasing power. In addition, agencies will cooperate to assure that fueling facilities are available for state fleet vehicles powered with alternative fuels.

CONSIDER EMPLOYING SUSTAINABLE, EFFICIENT DESIGN AND CONSTRUCTION STANDARDS FOR EACH STATE FACILITY

Currently, energy use in government buildings accounts for over 90% of state government's GHG emissions. By employing sustainable design and construction practices in all new construction and significant renovations to state properties, the state can significantly reduce GHG emissions – and at the same time save taxpayers' dollars by reducing energy costs.

To signal the Commonwealth's commitment to sustainable design, EOEA will collaborate with the Executive Office of Administration and Finance and its Division of Capital Asset Management (DCAM) to make sustainable design practices the norm for state construction projects. To achieve a comprehensive sustainable design program, DCAM shall consider seeking U.S. Green Buildings Council LEED™ certification for each appropriate construction project, unless such certification is not technically or economically feasible. Adhering to LEED™ standards will provide the public with facilities that are comfortable, clean, and environmentally responsible.

IMPROVE ENERGY EFFICIENCY FOR EXISTING BUILDINGS

For existing properties where no significant renovation plan exists, the State Sustainability Program will work with DCAM and state agencies to conduct energy audits, especially in buildings that have not been audited within the past ten years. To facilitate any retrofit, the State Sustainability Program, in collaboration with DCAM, will review current methods for financing energy efficiency efforts.

Agencies will also investigate the possibility of obtaining EnergyStar™ labels for existing buildings to identify and prioritize opportunities for energy efficiency, and to gain access to best energy practices across the country.

In addition, DCAM is examining sustainable design guidelines for its leased facilities.

EXPAND STATE ROLE IN LONG-TERM CONTRACTS FOR RENEWABLE ENERGY PURCHASES

The use of renewable energy can be a significant factor in reducing greenhouse gas emissions. State agencies can promote renewable energy by procuring it as it becomes available and/or by identifying opportunities for clean distributed generation at state facilities. In an agreement reached in 2003, the Massachusetts Renewable Energy Trust

has pledged $17 million to the Commonwealth, to be used for renewable energy investment. For its part, the Commonwealth pledges to invest at least this amount in long-term contracts for renewable electricity, in quantities greater than required by the Renewable Portfolio Standard (RPS).

The State Sustainability Coordinating Council, Massachusetts Technology Collaborative, DOER, and Operational Services Division are working together to develop a statewide long-term contract for the procurement of renewable energy by state facilities. Such efforts will include reaching out to municipalities and other quasi-public agencies to increase the state's renewable purchasing power. In addition, this coalition will conduct and release a study on distributed generation opportunities at state facilities, with recommendations on where and how to prioritize such opportunities.

PROMOTE GREATER WASTE PREVENTION AND RECYCLING AT STATE FACILITIES

Reducing the overall generation of solid waste by agencies, and recycling waste from state facilities, can have a significant impact on climate change (see sidebar, p. 22). To reduce these emissions, state agencies will continue to administer recycling programs to meet the goals of the Beyond 2000 Solid Waste Master Plan, developed by EOEA and DEP. More specifically, agencies will identify opportunities for waste prevention and take steps to achieve a 50% recycling rate by 2010.

INCORPORATE A LONGER TIMEFRAME FOR ANALYSIS OF ENERGY SAVINGS FOR STATE PURCHASES

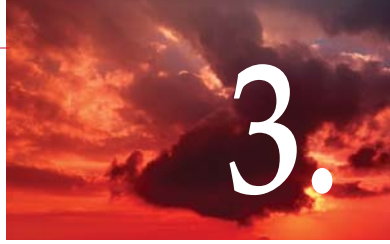
In order to increase the breadth of cost-effective energy efficient options open for government consideration, the state will provide greater flexibility in its expenditure guidelines to allow consideration of full life cycle costs, including when appropriate and cost-effective, energy efficiency expenditures that require longer than currently acceptable payback periods. This action could translate into lowering rate of return hurdles from the current 25% to as low as 10%, with payback periods extending from 3 years to up to 10 years. This decision represents an innovative stance by the Romney administration to better align capital and operating budget decisions and to take a much longer view of future energy savings and environmental improvements. This policy will establish an effective benchmark for the acquisition of energy-efficient equipment and conservation measures. And it will cut the cost of government operations for years to come.

STIMULATE THE MARKET FOR ENVIRONMENTALLY PREFERABLE PRODUCTS

Environmentally Preferable Products (EPPs) are products that contain recycled materials, as well as those that reduce energy consumption, minimize the release of toxic materials, consume less water, and/or otherwise minimize environmental impacts in their creation and use. These environmental benefits reduce greenhouse gas emissions. Through the Operational Services Division (OSD), Massachusetts is a nationwide leader in EPP purchasing. With EOEA's support, OSD will continue to ensure that clean products are given appropriate preference in government purchases of commodities and services.

Agencies will also seek to incorporate the following strategies into their operations:

- Ensure that all office equipment, appliances, and other energy-consuming devices meet EnergyStar™ standards, and that all such equipment, where appropriate, has the EnergyStar™ feature enabled at the time of initial use
- Purchase energy-efficient lighting, exit signs, and other building devices when existing products need replacement
- Purchase and install low-cost energy-saving devices



PROMOTE WATER CONSERVATION IN STATE BUILDINGS TO REDUCE ELECTRICITY AND HEATING COSTS

Conserving water can often have a significant impact on GHG emissions through reduced hot water demand and lower pumping requirements, both of which reduce energy consumption. Therefore, by 2010, agencies will seek to reduce water consumption by 15% by taking cost-effective steps such as:

- Reducing outdoor water use through green landscaping techniques (e.g. native species, rain sensors, appropriate watering procedures) for new construction and, where feasible, for existing grounds
- Replacing old fixtures to meet or exceed Massachusetts flow standards
- Inspecting and repairing leaks in facility piping, pools, and other water-using equipment
- Identifying possible sites where reclaimed water can be used for landscaping, plumbing, and other approved uses

EXAMPLES OF ENERGY SAVING PROJECTS AT STATE FACILITIES

UNIVERSITY OF MASSACHUSETTS MEDICAL SCHOOL
$27.2 million investment
$3,563,256 guaranteed annual savings

Energy Saving Measures

- Cogeneration equipment
- Energy efficient high-pressure boilers
- Efficient lighting retrofit
- Energy management system upgrade
- Domestic/process water conservation

UNIVERSITY OF MASSACHUSETTS BOSTON
$13.4 million project
$1.9 million guaranteed annual savings upon completion

Energy Saving Measures

- Convert from electric heat and hot water to natural gas
- Lighting retrofits
- Expanded energy management system
- Water conservation measures
- Kitchen appliance retrofit
- Lab fume hood replacement
- Motor replacement

WRENTHAM DEVELOPMENTAL CENTER
$1.6 million investment
$210,000 annual guaranteed savings

Energy Saving Measures

- Boiler plant optimization
- Efficient lighting retrofit
- Steam trap repairs
- Motor replacement
- Pool cover installation

TOTAL SAVINGS FROM EXISTING MASSACHUSETTS CONSERVATION PROJECTS

	# of Projects	*Total Project Cost*	*Annual Savings*	*Savings to Date*	*CO_2 (tons)*	*SO_2 (tons)*	*NO_x (tons)*
Total Conservation Projects	194	$118,894,467	$20,352,787	$152,314,094	1,244,913	6,581	2,692

4. CITIES AND TOWNS AS CLIMATE PROTECTION PARTNERS

The Commonwealth's ability to address climate change depends, to some degree, on harnessing the energy and talents in the state's 351 cities and towns. Fortunately, many of the measures that reduce greenhouse gas emissions are consistent with local priorities such as reducing energy costs, curbing traffic congestion, increasing recycling rates, creating attractive streetscapes, and improving air quality.

Communities can assist in climate protection by making decisions about transportation, land use, and infrastructure construction based on sustainability and efficiency principles. In addition, communities can make a real difference by becoming more energy efficient in their delivery of municipal services and management of municipal buildings.

Many Massachusetts cities and towns are already taking action to reduce their greenhouse gas emissions. The International Council for Local Environmental Initiatives (ICLEI) – an association of local governments dedicated to working on environmental problems through local action – has mounted the Cities for Climate Protection™ Campaign. This campaign is making efforts to slow climate change, improve air quality, and enhance the quality of urban life. Massachusetts CCP members include at least 20 cities and towns, including Amherst, Arlington, Barnstable, Boston, Brookline, Cambridge, Falmouth, Gloucester, Lenox, Lynn, Medford, Newton, Northampton, Salem, Shutesbury, Somerville, Springfield, Watertown, Williamstown, and Worcester.

GOAL

Massachusetts will encourage local efforts to reduce greenhouse gas emissions by working jointly with communities to assist local efforts and establishing action targets that are aggressive and achievable.

ACTIONS

CREATE A CLIMATE CHANGE RESOURCE ROUNDTABLE FOR LOCAL OFFICIALS

Massachusetts will help to develop and implement local programs that support the overall goals of this Plan. To facilitate the sharing of resources and expertise across communities, the state will convene elected municipal officials who are interested in or already addressing climate change issues at the local level. The state will develop a clearinghouse for Best Management Practices for energy-efficient municipal operations.

ENCOURAGE MUNICIPALITIES TO PURCHASE RENEWABLE ENERGY

The state will encourage municipalities to purchase energy from renewable sources. Massachusetts programs in which municipalities have purchased renewable power, or generated their own renewable energy (Hull is a good example) have been extraordinarily successful.

GUIDE MUNICIPALITIES TO THINK AND ACT REGIONALLY

Each of the Commonwealth's 351 cities and towns will be encouraged to tally and take account of the impacts that infrastructure – roads, sewer lines, water mains, utility lines, and so forth – has on that community's climate change profile. The state will provide tools to help regional planning agencies evaluate energy conservation as part of the planning and environmental review process for municipal programs. EOEA and DOER will work with transportation agencies, regional planning bodies, and cities and towns to ensure that the energy-use effects of land use and transportation decisions are appropriately disclosed on a project-by-project basis. For example, CO_2 has been proposed by EOTC to be part of the evaluation criteria for transportation project funding.

MALCOLM BROWN, MUNICIPAL LIGHT BOARD HULL, MASSACHUSETTS

Concerned citizens in Hull, Massachusetts are making a real difference in meeting climate change head-on by including clean, carbon-free electricity in their municipal energy supply.

In late 1998, a group of Hull citizens, including Malcolm Brown, petitioned the Hull Municipal Light District to add renewable energy to their energy mix at the Hull Municipal Light Plant. With assistance from the Massachusetts Division of Energy Resources, an engineering survey and report was completed, leading to the installation of a wind turbine to power the town's streetlights and other town energy needs. Today, it has become a local attraction as a steady stream of visitors stop by to look at the graceful turbine. Malcolm Brown is a tireless cheerleader for this project that has been producing energy for over a year and has already delivered millions of kilowatts of clean, carbon dioxide-free, renewable energy.

The Massachusetts Technology Collaborative's Renewable Energy Trust ("the Trust") has identified numerous communities with excellent wind resources on municipally owned land that may provide an opportunity for small economically viable wind projects.

URGE COMMUNITIES TO JOIN THE CITIES FOR CLIMATE PROTECTION™ CAMPAIGN

The state will encourage communities to join the Cities for Climate Protection™ Campaign. There are currently at least 20 Massachusetts communities participating in this program and over 110 nationally.

Technical support will be provided to communities as they inventory greenhouse gas emissions, develop action plans, and implement reduction measures.

ENCOURAGE MUNICIPALITIES TO PARTICIPATE IN COMMUNITY TREE-PLANTING PROGRAMS

Community tree-planting programs are not only a way for municipalities to beautify their communities and improve the value of real estate, they benefit the global climate in a number of ways. Besides the carbon that trees inherently sequester as they grow, trees provide shade that helps reduce the "heat-island" effect of developed areas, in turn reducing the need for air-conditioning and the electricity it requires. Trees also help to moderate cold winds in winter, lessening the need for the fossil fuel used in heating.

PROMOTE LOCAL AND REGIONAL WASTE MANAGEMENT GOALS

Although tough economic times have reduced the funds available for recycling programs, Massachusetts will continue to work with cities and towns to cut down on their generation of solid waste – one of the most important steps local governments can take to address climate change. Reducing waste, reusing products and materials, and recycling, cut greenhouse gas emissions in three important ways: first, by reducing the need for raw materials and energy throughout a product's lifecycle; second, by substituting recycled materials in manufacturing processes; and, third, by decreasing the amount of waste sent to landfills where methane is emitted as wastes decompose. The state will make efforts to help municipalities achieve the ambitious goals set in the Beyond 2000 Solid Waste Master Plan. In addition, DEP will work with municipalities and the waste management and energy industries to improve, wherever feasible, their techniques for methane recapture and use.

PROMOTE PROJECT GREENLIGHTS: LOW ENERGY TRAFFIC SIGNALS AND MORE EFFICIENT NIGHT LIGHTING

Lighting accounts for 20 to 25% of all electricity consumed in the U.S. The average household dedicates 5 to 10% of its energy budget to household lighting - and for the state and municipalities, the percentage rises to between 20 to 30% of the total energy budget. In lighting installation, 50% or more of the energy is wasted by obsolete equipment, inadequate maintenance, or inefficient use. Lighting offers a significant opportunity for the state and for municipalities to save energy and money.

To that end, the state is working with other states to assist municipal officials to encourage the use of Light Emitting Diodes (LEDs), high-efficiency street lighting, or other energy-saving lighting technologies. For example, LEDs are 80 to 90% more efficient than ordinary lights, they last ten times longer, and their payback period can be less than two years. A goal of the larger Regional Climate Action Plan is for all traffic lights from northern Quebec to southern Connecticut to be converted to LEDs over the next several years. The switch from regular traffic lights to LEDs is already occurring in Massachusetts, with the purchase of 15,540 LEDs. Examples where the changeover has already occurred include the towns of Framingham, Arlington, and Somerville; and all new and replacement traffic lights on roads owned by the Massachusetts Highway Department.

The state will also undertake a new initiative to reduce the energy wasted through night lighting, working with cities and towns to improve the energy efficiency of municipal lighting. Using state purchasing power and blanket contracting, the state will seek to improve the standards of the lighting purchased for outdoor installation. Mass Highway has already begun phasing out all old mercury vapor fixtures, and will now require in most locations the use of high-pressure sodium fixtures, which are more efficient and contain no mercury.

POLICY HIGHLIGHT

WASTE PREVENTION AND RECYCLING PROGRESS IN MASSACHUSETTS

One of the most important steps local governments can take to address climate change is to reduce their generation of solid waste. Reducing waste, reusing products and materials, and recycling can cut greenhouse gas emissions in three important ways. First, preventing waste at the source and reducing extraneous materials like packaging can reduce the need for raw materials and energy throughout a product's lifecycle – its manufacture, delivery, reuse, and final disposal. Second, using recycled materials in manufacturing processes, rather than so-called virgin materials, can often significantly cut energy consumption. Third, decreasing the amount of waste sent to landfills can reduce emissions of methane, which is emitted as landfilled waste decomposes. Methane is a greenhouse gas that is nearly 25 times more potent than carbon dioxide.

In 2000 alone, Massachusetts municipalities recycled or composted 2.7 million tons of municipal solid waste. As a result of this achievement, Massachusetts:

- Reduced greenhouse gas emissions by 800,000 tons of carbon equivalent per year, equal to 14% of the state's industrial carbon dioxide emissions

- Conserved the equivalent of 350,000 tons of iron ore, 200,000 tons of coal and 17,000 tons of limestone, reducing the need to mine these raw materials

- Saved 22 trillion BTUs of energy – enough to power nearly 120,000 homes for a year

BUSINESS, INDUSTRY, AND INSTITUTIONS AS CLIMATE PROTECTION PARTNERS

The need for reductions in climate change emissions poses both a challenge and an opportunity to business and industry. It challenges those industries that are major emitters of greenhouse gases to implement the most economically efficient means of reducing their emissions, as a way to encourage continued economic growth. The Commonwealth, working with other states and provinces, will enlist the assistance and talents of the private sector by taking a sensible, balanced approach to greenhouse gas reductions, focusing on innovative market-based methods. A number of Massachusetts companies have already asked the state to address climate change through regulatory and incentive policies that would grant them greater certainty in their business planning while supporting their goal of being environmentally responsible. The state will be responsive to such concerns. The state will also encourage all Massachusetts businesses to see climate change as a business opportunity, focusing on those businesses that could offer new technologies and products that lower demand for fossil fuels, cut carbon emissions, and create new jobs, particularly in the energy efficiency and renewable energy sectors.

Massachusetts also has many institutions: universities, hospitals, museums, faith-based organizations, and other non-profits. The Commonwealth will work with these diverse entities to reduce their climate change emissions.

GOAL

The state will work with the business community and institutions to set reasonable but aggressive energy savings and emissions reduction targets, and to help the state's environmental business sector grow.

ACTIONS

IMPLEMENT EXISTING REGULATIONS TO REDUCE GREENHOUSE GASES AND OTHER POLLUTANTS EMITTED BY OLDER POWER PLANTS

Massachusetts has begun the bold step of regulating carbon dioxide emissions from older, polluting power plants in a comprehensive way, while at the same time controlling other serious air pollutants – nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury. As the first state in the nation to regulate CO_2 from older plants, the Commonwealth has broken new ground, and is now moving toward the development of rules governing CO_2 emission reductions and a trading program to encourage early reductions, offsets, and least-cost compliance. Carbon dioxide reductions are now required as part of the overall cleanup of older plants. As a result, by 2008 these plants will have cut their rate of greenhouse gas emissions by 10% or will have purchased equivalent offsets.

CREATE A CO_2 REGISTRY WITH OTHER STATES

The DEP is currently working with other states to create a CO_2 registry, which will provide a uniform, coordinated starting point for companies and institutions to disclose their greenhouse gas emissions inventories and reduction programs. The registry will furnish technical guidelines and allow for public recognition of registrants who make early reductions. It will also assist the state in achieving broad participation by recruiting firms, institutions, and organizations from all economic sectors and regions of Massachusetts. Through the registry, economic incentives for the reduction of greenhouse gas emissions can be realized, and a variety of compliance options can be offered. By recording emissions and reductions in a consistent format, the registry will ensure that Massachusetts' sources receive all appropriate consideration for verified emissions reductions under any existing or future greenhouse gas regulatory regime (see policy highlight on emissions trading, p. 26).

CREATE AN EMISSIONS BANKING AND TRADING PROGRAM

In addition to a CO_2 registry, DEP is developing provisions to govern the banking and trading of greenhouse gas emission reduction credits. To add CO_2 to the state's emissions trading program, the DEP has convened a stakeholder

THE STOP & SHOP CORPORATION

The Stop & Shop Corporation's new Foxboro Superstore is a leap forward toward climate sustainability. Designed with climate in mind, the building utilizes 30% less energy than other stores its size and saves the store money in the process. Stop & Shop has proven that "design for the environment" is not just a theoretical exercise; it can produce results that meet rigorous financial and performance standards.

The low energy Superstore was opened in November 2001. It has numerous innovative energy-saving features such as skylights to maximize the use of natural daylight, dimming controls, and high efficiency lighting. These simple features cut the energy needed for interior and exterior lighting by 50% and reduce the amount of heat produced, resulting in lower air conditioning loads – all the while creating a pleasant atmosphere for customers and associates. Efficient refrigeration systems were installed, as well as insulation and reflective roof coverings, reducing energy consumption for cooling and heating by a projected 26%. In addition, construction materials were selected for environmental performance and recycled content. The project has exceeded its design target of 30% energy savings, and the project team is currently documenting and distributing the findings to Stop & Shop for use at other locations.

group to discuss CO_2 emissions credits and credit trading. The DEP has solicited broad input on the development of GHG banking and trading rules. In addition, the group has examined a wide range of technical issues and policy options, including which specific greenhouse gases are eligible for banking, the categories of action that can generate reduction credits, acceptable protocols for quantifying reductions, quantification challenges, the timing of eligible reductions, and the geographic area over which credits may be generated and traded.

DEP will continue to coordinate with other states, the Eastern Canadian provinces, federal governments (U.S. and Canadian), business entities, non-governmental organizations, and other relevant stakeholders to ensure that a sufficient and consistent regulatory framework is in place to implement the above programs.

FACILITATE A CLIMATE CHANGE BUSINESS LEADERS ROUNDTABLE

Working with organizations such as CERES and the New England Council, the state will facilitate a meeting of Massachusetts business and institutional leaders interested in reducing global climate change. The Climate Change Business Leaders Roundtable will establish reduction goals, solicit climate change partners among the business community and institutions, and assist the state in measuring progress and adjusting the action plan as needed.

INITIATE A GOVERNOR'S CLIMATE CHANGE CHALLENGE FOR BUSINESSES AND INSTITUTIONS

The Secretary of Economic Development, working with the Climate Change Business Leaders Roundtable, will initiate a Governor's Challenge to publicly recognize members of the business and institutional community who find innovative ways to reduce climate change emissions below specific target levels.

Governor Romney, along with the other New England Governors and Eastern Canadian Premiers, supports the New England Board of Higher Education (NEBHE) in uniting colleges and universities to tackle climate change issues. As a first step, the state invited college and university presidents to launch a Climate Action Challenge for their institutions. The effort will emphasize energy improvements on campuses in support of the goals of this Climate Action Plan. Participating schools are considering teaching climate change in their curricula and initiating research on climate-friendly technologies.

PROVIDE TECHNICAL ASSISTANCE TO THE BUSINESS COMMUNITY

The Commonwealth will create a special technical outreach team to assist companies and institutions that seek to play a leadership role.

Climate leaders who demonstrate creativity and initiative in making greenhouse gas reductions will have access to customized advice from the EOEA Office of Technical Assistance, the Strategic Envirotechnology Partnership, and the Division of Energy Resources. The goal will be to work together to reduce each company's energy use, increase its reliance on renewable resources, and otherwise cut its total CO_2 and other climate-related emissions.

IMPLEMENT A PROGRAM TO REDUCE THE EMISSIONS OF HIGHLY WARMING SPECIALTY GASES

Certain of the specialty gases used in cooling systems have the potential to warm the atmosphere at rates thousands of times greater than CO_2. While the total amounts of these gases are small, their potency makes controlling them vitally important. The DEP along with EOEA's Office of Technical Assistance will develop new partnerships to reduce the leakage of extremely warming specialty gases from commercial-scale refrigeration and air conditioning systems, a sector responsible for a growing share of greenhouse gas emissions. As a first step, the state will work with large refrigeration and air conditioning users to assess current leakage levels and identify best management approaches to reduce these emissions. Based on the results, the state will discuss broader implementation of cost-effective greenhouse gas control measures. These new industry partnerships provide a win-win opportunity to achieve near-term climate actions and emissions reductions in Massachusetts, while better positioning the commercial sector to meet future climate change goals.

PROMOTE DISTRIBUTED GENERATION, COMBINED HEAT AND POWER, AND RENEWABLE ENERGY AT COMPANIES AND INSTITUTIONS

Changing how and where energy is generated, and what is done with the resulting waste heat, can provide significant opportunities for efficient energy use. In combined heat and power systems, fuel is used to generate electricity. The resulting waste heat is used for heating buildings, heating water, process heating, etc. Where standard centralized power plants use roughly 40% of the fuel they burn to produce electricity, combined heat and power systems use up to 80% to produce electricity and heat. Another way of improving efficiency is to move the generation of electricity closer to where it will be used, avoiding losses during transmission. Finally, the incorporation of renewable energy into new and renovated buildings is another way to bring power closer to the end user, saving transmission losses and generating heat or electricity with little or no fuel use. The state will encourage the installation of combined heat and power applications, other forms of clean distributed generation, and the installation of new renewable energy sources through such measures as streamlined permitting and interconnection standards.

TUFTS CLIMATE INITIATIVE (TCI)

WILLIAM MOOMAW
Director of the TCI and Professor at the Fletcher School of Law and Diplomacy

SARAH HAMMOND CREIGHTON
Manager of TCI

ROBERT W. BERTRAM
Tufts Director of Facilities

ELIZABETH ISENSTEIN
Tufts Energy Manager

Tufts University is a pioneer in the higher education community, having made a serious commitment to reducing university-related greenhouse gas emissions. The university has adopted the goals of the Kyoto Protocol – approximately a 30% emissions reduction (after considering growth) by 2012.

The Tufts Climate Initiative (TCI), an effort involving faculty, students, and facilities and maintenance staff, is saving energy, reducing university energy bills, and improving public understanding of climate issues. Partly as a result of TCI, Tufts has become one of the country's centers of climate research, attracting committed students into research in engineering, science, economics, and other climate-related studies. TCI is a catalyst and resource, creating new initiatives and providing additional resources to ongoing climate change-related efforts around the university. Today, a growing number of colleges around the country are following Tufts' lead and setting up their own university climate initiatives.

ENSURE THE EFFICIENT DISTRIBUTION OF NATURAL GAS

Natural gas, or methane (CH_4), is a powerful climate change gas that, according to current scientific calculations, warms the atmosphere at a rate some 24.5 times that of carbon dioxide, although it doesn't reside in the atmosphere as long. In some parts of the state, older gas pipelines experience significant methane loss through seepage and leaking. While these leaks do not all pose a safety hazard, they nevertheless contribute to climate change. Currently, gas companies can recoup a portion of the cost of their lost methane by conducting a waste study, and then seeking permission to incorporate that loss into consumer rates. Over time this should change. The DOER, in cooperation with the DTE, will assess the rate of methane leakage in the Commonwealth and identify opportunities where incentives might help this leakage to be addressed more aggressively.

POLICY HIGHLIGHT

EMISSIONS TRADING: USING THE MARKET TO PROFIT FROM INNOVATION IN ENERGY SAVINGS

Massachusetts was among the first states in the nation to adopt a statewide emissions trading program for airborne hydrocarbons and nitrogen oxides (NO_x). This program has provided the state with the expertise needed to build a new emission credit registry for the reduction of the chief greenhouse gas, carbon dioxide. By building the infrastructure for a CO_2 emission reduction credits (ERCs) program, Massachusetts can offer official recognition of greenhouse gas emission reductions that the state's sources achieve voluntarily or ahead of schedule.

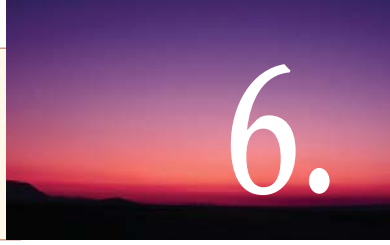
Many corporate leaders have come to believe that CO_2 and other greenhouse emissions will ultimately be regulated, capped, and potentially taxed – probably through an international system. To prepare for this and to serve as models of environmental citizenship, a number of companies already monitor their greenhouse gas emissions. They have set reduction targets and established the programs needed to achieve those targets.

The evidence so far suggests that early action has been a smart move. For example, many of the 535 companies enrolled in EPA's Climate Wise Program have reported cost savings, higher profitability, and competitive marketplace advantages as a result of the leadership position they have taken in the reduction of greenhouse gas emissions. Moreover, the advantages accrue not only to individual firms, but also to the state economy at large – and to the environment.

Some companies have publicly expressed concern that they might later find themselves at a disadvantage if they take prudent actions now to reduce their greenhouse gas emissions. If future regulations do not take account of actual reductions companies make in the years before the regulations go into effect, early actors could find that their pioneering work simply results in a tougher baseline. In the face of a percentage emission reduction requirement applicable to all emitters in a given industry, the argument goes, early adopters could be at a disadvantage compared to competitors who sat back and waited.

A carbon registry would help to address that concern by crediting companies for their measurable greenhouse gas reductions, and converting those reductions into credits that can be traded on a market, or saved for later. Market trades could involve CO_2 or carbon equivalents, that is, other greenhouse gases like methane expressed in units of carbon based on their global warming potential (GWP). The system would allow participants – companies or even countries – flexibility in choosing the least-cost means of investing in greenhouse gas mitigation. Some participants may wish to sell the reductions they make prior to the advent of formal reduction requirements, while others may seek to purchase such credits, allowing them to defer efficiency improvements until a more advantageous moment. At any given time, market participants can be expected to decide between cutting emissions and buying additional credits – depending on which is cheapest.

CLEAN AND RELIABLE ENERGY



The Massachusetts Electricity Restructuring Act of 1997 was a major step forward toward a more diverse and reliable energy supply. The Act established the Renewable Portfolio Standard, which ensures that a growing portion of the state's electricity must come from renewable sources: solar power, wind power, and energy generated by biomass and landfill gas. A further provision of the Act was the establishment of the Massachusetts Technology Collaborative's Renewable Energy Trust ("the Trust"), which funds development and education efforts relating to clean, reliable, renewable energy.

Massachusetts will continue to build on the Electricity Restructuring Act of 1997 to support new renewable energy markets and increase energy system reliability. New energy technologies will offer economic opportunities and encourage innovations and new capabilities – creating new jobs and business opportunities. Massachusetts is currently home to many clean energy technology companies whose regional and global markets will expand as energy savings and greenhouse gas reductions become important business activities over the coming years.

GOAL

Consistent with the New England Governors' and Eastern Canadian Premiers' goal of reducing the carbon emitted per unit of power 20% by 2025 and the RPS aim of a steady and reasonable rate for the introduction of new renewable sources, the state will continue to include requirements and incentives for energy efficiency, renewable energy and cleaner generation sources as it oversees electricity restructuring to reduce the environmental impacts of energy generation.

ACTIONS

CONTINUE TO BUILD SUPPORT AND PROVIDE INCENTIVES FOR ENERGY EFFICIENCY

The Commonwealth is committed to energy efficiency as a central way to achieve GHG emissions reductions, both now and in the future. Energy-efficiency measures can be thought of as a zero-emission source of electricity that will yield cost savings as it reduces energy use, benefiting both the environment and the bottom line of the company or facility paying the energy bills. To this end, the Division of Energy Resources will continue to support incentives and other means to promote energy efficiency investments and design practices in customer facilities and homes. One energy-efficiency program is the Massachusetts Energy Efficiency Partnership (MAEEP), which is a partnership between the University of Massachusetts Amherst, US Department of Energy (DOE), EOEA, DOER, gas and electric utilities, and trade associations. MAEEP provides coordinated delivery of energy-efficiency best practices training and technical support, technology deployment, research, and energy-efficiency implementation programs. DOER will also encourage strategic approaches to increase the overall efficiency of new and renovated buildings and products, including improved codes and product standards.

RWE SCHOTT SOLAR, Billerica, MA

Creating Jobs, Protecting the Climate

RWE Schott Solar is expanding the Massachusetts economy and creating new jobs in the production of solar panels here in our state.

RWE Schott Solar manufactures and markets high-performing solar electric wafers, cells, and modules, and integrated technical systems in its rapidly growing Billerica facility. Because solar cells produce no CO_2, they are a wonderful solution for energy production in many applications. And RWE Schott Solar just finished building the third phase of a state-of-the-art solar electric cell manufacturing line in Massachusetts. Having companies like RWE Schott Solar with their nearly 300 high-tech jobs and growing work force is good news for the Commonwealth environment and economy.

SELECTED PROGRAMS OF THE MASS RENEWABLE ENERGY TRUST

COMMUNITY WIND PROJECT

The Massachusetts Renewable Energy Trust has recently launched the Community Wind Collaborative to help communities across the state to develop wind projects. Community-based wind power that is economically viable, provides a clean source of power and new source of revenue for the host community, while reducing greenhouse gas emissions.

SOLAR FOR HOMEOWNERS

Another program run by the Trust helps owners of homes, small businesses, or other similarly sized facilities to finance the installation costs of solar systems. Through the program, awardees can cut by half the costs of installing a solar PV system, putting solar energy within the financial reach of more households

CLIMATE CHANGE AND RENEWABLE ENERGY EDUCATION

As part of a statewide education effort about the possibilities and benefits of renewable energy, the Trust hosts a series of Content Institutes for teachers every year. Beginning next year, the Trust will also run similar programs for teachers on climate change. The Institutes will inform Massachusetts teachers about climate change and renewables opportunities for their schools, as well as suggesting fun, valuable classroom projects.

PROMOTE RENEWABLE ENERGY THROUGH THE STATEWIDE RENEWABLE PORTFOLIO STANDARD

In April 2002, the state Division of Energy Resources (DOER) released final regulations to implement the Renewable Portfolio Standard (RPS), which requires that a portion of the sales of all retail electricity suppliers in the state come from new renewable sources starting in 2003. Currently DOER is evaluating the fulfillment of the first goal of the RPS – to have at least 1% of electricity sales come from new renewable sources by the end of 2003. This first 1% equals about 100 megawatts of new renewable capacity, generated through projects like wind turbines, photovoltaic arrays, generators driven by landfill gas or biomass, and fuel cells that use renewable fuels.

Yearly from 2003 through 2009, Massachusetts will take steps to add 0.5% of electricity sales to the RPS minimum standard, totaling 4% by 2009 or approximately 600 megawatts of new renewable energy generating capacity. After 2009, the RPS standard is due to accelerate its rise to 1% per year, unless modified by DOER. The state will bring renewable energy into the marketplace by making sure that all retail electricity suppliers make active provisions to secure energy resources that meet the definition of new renewable energy. The state will also work with generators, distributors, and municipalities to reduce barriers to the installation and use of renewable electricity generation, as well as the long-term financing for project construction. Massachusetts will also continue to inform consumers of their ability to purchase electricity generated by renewable resources and assist them in making that choice.

PARTICIPATE IN AND SUPPORT THE REGIONAL GREENHOUSE GAS INITIATIVE

Massachusetts is committed to active participation in the effort to develop a multi-state cap and trade program covering greenhouse gases (GHG) emissions. At the invitation of New York Governor George Pataki, Governor Romney has joined the initiative to reduce regional greenhouse gas emissions through a CO_2 cap and trade program, starting with the electrical power sector. The Governors of Maine, Vermont, New Hampshire, Rhode Island, Connecticut, New Jersey, and Delaware have also signed on to this effort and are all represented in a working group to develop a model rule which all states will then seek to implement. Pennsylvania and Maryland are also participating as observers.

This effort, now called the Regional Greenhouse Gas Initiative (RGGI), will establish a goal for emissions reductions, allowing those required reductions to be made either directly or through the trading of emission credits. Currently, the states will jointly develop a program to require the reduction of carbon dioxide emissions from power plants in participating states, while maintaining energy affordability and reliability, and accommodating, to the extent feasible, the diversity of policies and programs in the individual states. The approach is noteworthy because it is being designed to effect change in the most cost-effective way possible.

The initiative targets the release of a model rule by April 2005.

The state, through the Office for Commonwealth Development, the Department of Environmental Protection, and the Division of Energy Resources, is participating actively in this groundbreaking work in an effort to reach a regional consensus and to launch a robust program that makes environmental and economic sense for Massachusetts.

BRING NEW RENEWABLE ENERGY TECHNOLOGIES AND SYSTEMS TO THE MARKET THROUGH THE MASSACHUSETTS RENEWABLE ENERGY TRUST

The Massachusetts Technology Collaborative's Renewable Energy Trust ("the Trust") was created by the Electricity Restructuring Act to maximize the environmental and economic benefits of renewable energy. The revenue for the Trust is generated by a customer-paid systems benefit charge. The Trust's activities are currently organized into five areas: Green Power; Green Buildings and Infrastructure; Industry Support; Education and Public Awareness; and Policy (see chart on following page for summary of this work).

REDUCE BARRIERS TO RENEWABLE ENERGY DEVELOPMENT

DTE, DOER, and the Massachusetts Technology Collaborative's Renewable Energy Trust ("the Trust") will work together to identify and reduce remaining barriers to development of economically viable and reliable renewable energy. DOER will work with the Trust and others to develop financing strategies for renewable energy projects through long-term contracts and other mechanisms required by the investment community. In addition, DOER, in conjunction with the Department of Telecommunications and Energy (DTE), will work to facilitate low-cost interconnection to the electricity grid for renewable electricity resources. The Office for Commonwealth Development and DOER will work with other state agencies to develop wind energy projects on appropriate state lands.

LAUNCH A PARTNERSHIP BETWEEN THE OFFICE FOR COMMONWEALTH DEVELOPMENT AND THE TRUST TO FUND CLIMATE CHANGE INITIATIVES

Massachusetts has recently established a Partnership between the Office for Commonwealth Development and the Massachusetts Technology Collaborative's Renewable Energy Trust to provide financial support for renewable energy projects that are economically viable and advance the goals of the Plan. This $3 million fund (with the possibility of a further $6 million in several years) represents an unprecedented opportunity to strongly administer policies and procedures that reduce the impacts of climate change and promote clean energy.

ENCOURAGE REGULATORY POLICIES THAT WILL MAKE IT EASIER TO SITE SMALL-SCALE ENERGY EFFICIENCY AND RENEWABLES PROJECTS

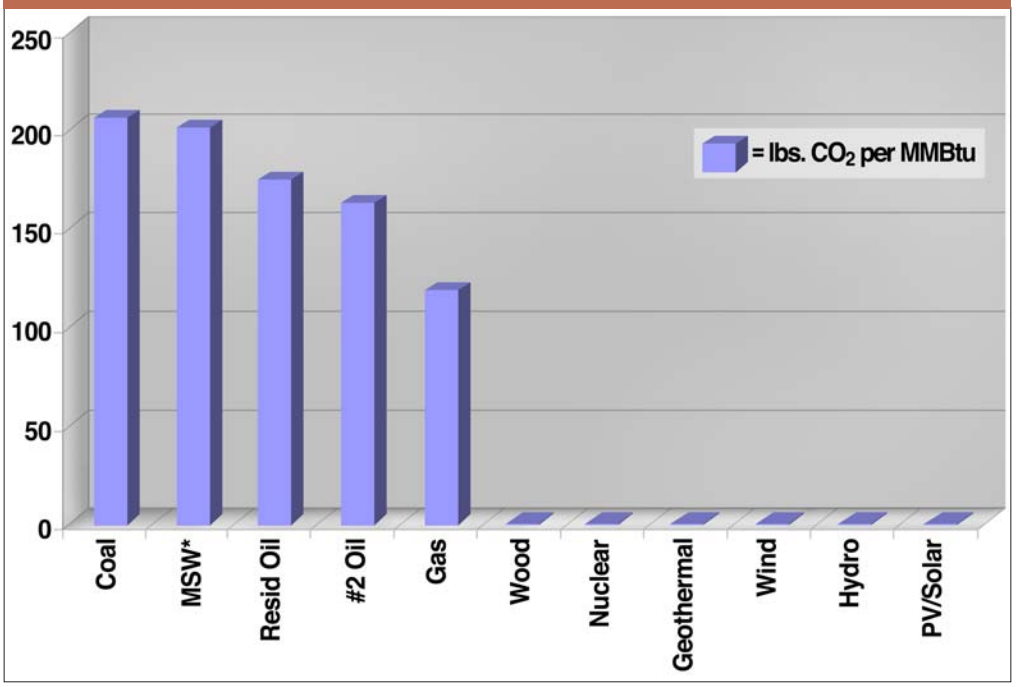
Currently existing requirements may be inappropriate for today's new clean energy technologies. For example, the state currently requires facilities such as hospitals to have back-up diesel generators even though much cleaner options exist for reliable back-up power. An 1899 law mandates that facilities with large steam turbines have a licensed operator present on-site, 24 hours a day. Today, mass-produced backpressure turbines with computer controls are safe and efficient and, in 49 states, are permitted to run without a full-time operator. They save money and fuel, but current restrictions put them at an economic disadvantage. The Division of Energy Resources and the Department of Environmental Protection, in cooperation with the Department of Telecommunications and Energy, and the State Office of Building Standards, will be asked to review our existing laws and regulatory policies, and make recommendations that facilitate the introduction of distributed energy sources, giving special attention to interconnection standards for fuel cells, combined heat and power, standby rates, air emission standards, and renewables. Recommendations for future legislation and regulatory streamlining are the expected outcomes of this action step.

PROGRAM	SELECTED ACTIVITIES	BENEFITS
GREEN POWER • *Facilitate the development of new renewable generation* • *Stimulate the demand for renewable electricity* • *Offer tools and resources to municipalities to build community-based generation and support for clean energy*	• Provide technical and financial support for new renewable energy development • Fund feasibility studies and predevelopment activities for projects • Support demonstrations of emerging renewables technologies • Provide funding to enhance local renewable energy planning • Help provide accurate information to communities and individuals about renewable projects	• Increased generation of renewable energy • Sustainable supply of green power • Reduction of costs for and other barriers to renewable generation • New jobs in the clean energy sector • Broad-based support for renewable energy across Massachusetts • Availability of reliable information to empower communities to make thoughtful decisions on project siting
GREEN BUILDINGS AND INFRASTRUCTURE • *Increase the supply of buildings that incorporate renewable energy distributed generation (renewable DG) as well as green building and/or energy efficiency measures* • *Increase the demand for renewable DG among building owners/occupiers* • *Fund demonstration projects that will advance policies to support renewable DG*	• Provide funding and related services directly to public entities for high performance building projects • Provide funding for renewable DG installation, and funding for education and outreach activities related to renewable DG	• Increased knowledge and experience of renewable DG and green design among building professionals • Collected data to be disseminated through case studies on the costs, benefits, challenges, and successes of incorporating renewable DG • Highly visible and accessible demonstration projects
INDUSTRY SUPPORT • *Offer comprehensive support enabling renewable energy companies to thrive and create new green jobs in Massachusetts*	• Provide investment capital to Massachusetts renewable energy companies • Partner with Massachusetts universities to build viable new markets, nourishing existing companies and attracting new ones to locate here	• Creation of new jobs in a growing Massachusetts energy technology cluster
EDUCATION AND PUBLIC AWARENESS • *Increase understanding and support for renewable energy on the part of citizens, businesses, and institutions*	• Fund exhibits and displays on renewable energy at museums, environmental education centers, and public buildings • Offer teacher training and educational materials that help educators teach their students about renewable energy • Provide objective, impartial information that helps citizens decide whether and how to support clean energy • Fund targeted training projects that produce a trained workforce and future leaders for renewable-energy jobs	• Greater public understanding of how renewable energy can meet Massachusetts' economic, environmental, and security needs • Broad-based support for the use of renewable energy in Massachusetts communities • Improved and increased renewable energy education in Massachusetts schools
POLICY • *Analyze, develop, and collaborate on regulatory and other public policy issues supporting renewable energy*	• Help other government agencies improve their regulations and policies to support renewable energy • Bring together industry and non-profit leaders to develop consensus supporting responsible energy policies	• Advancement of renewable energy in state and federal policies • Increased penetration of renewable energy in key markets

WORK WITH UTILITIES TO PROMOTE RESIDENTIAL ENERGY EFFICIENCY

There are many state, regional, and national programs to encourage residential energy efficiency, including rebates for energy- efficient appliances, installation of insulation, and tax credits for use of on-site renewable energy. DOER will continue to work with Massachusetts' utilities and municipal aggregators to identify and promote energy efficiency programs to residential homeowners.

POTENTIAL CO_2 EMISSION RATES FROM PRIMARY ENERGY SOURCES

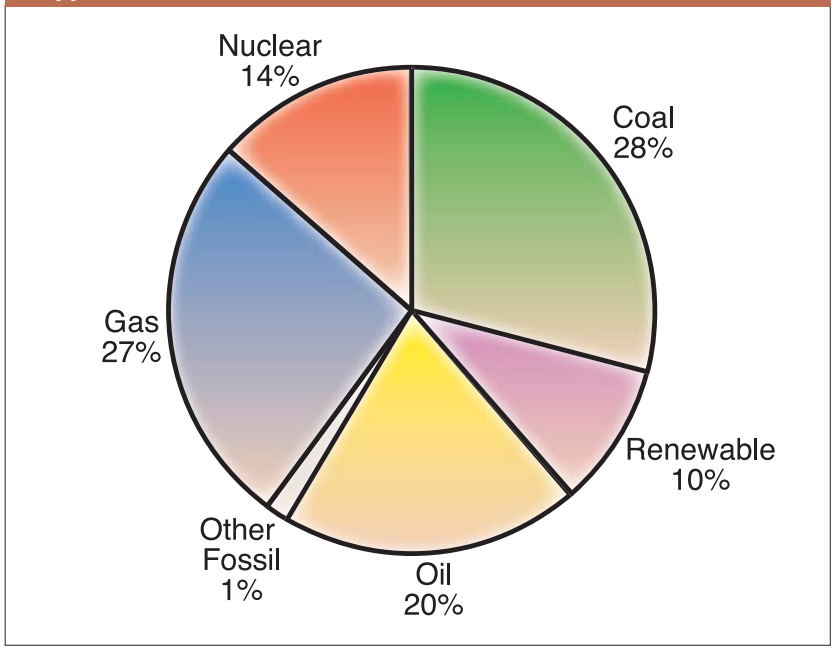


Source: State Inventory
**Includes landfill methane*
***CO_2 emissions offset by carbon sequestration during biomass growth*

DESIGN AN ENHANCED INCENTIVE PROGRAM TO IMPROVE THE EFFICIENCY OF RESIDENTIAL OIL USE

It is estimated that the average efficiency of a typical older oil-fired heating system is only 60%, compared to the 85% efficiency that new oil technology can achieve. Proper maintenance of heating systems and the retrofitting or replacement of inefficient oil-fired heating or hot water systems can significantly improve the efficiency of oil use, lower heating bills, and reduce greenhouse gas emissions. While regional electric and gas utilities offer services and incentives for homes heated with electricity and gas, respectively, to improve their energy efficiency, and offer fuel-blind services for energy audits and building shell improvements (e.g., insulation), they have only recently begun to offer assistance to the residents who live in the more than one-third of Massachusetts homes that are heated with oil.

1990 MASSACHUSETTS ELECTRICITY GENERATION FUEL MIX



Currently, there are a number of diverse programs that work to improve the efficiency of oil heating systems across the state, but a larger, more comprehensive program is needed to achieve the emissions reductions the state is seeking. Therefore, DOER will work with the administrators of energy-efficiency funds to evaluate options for a new education and incentive program to encourage homeowners to properly maintain their heating systems

and to replace old oil heating systems with new, efficient oil heating systems. In consultation with interested parties, DOER will investigate the economic viability and cost-effectiveness of a variety of options, including an expanded oil heating system rebate program, the establishment of industry partnerships or charges, use of long-term investments, and shared savings programs.

DEP is also planning to consider lowering the sulfur content of home heating oil in the next few years as part of a particulate reduction strategy.

IMPLEMENT NEW APPLIANCE ENERGY-EFFICIENCY STANDARDS

Over the last few decades, federal and state energy-efficiency standards have saved Massachusetts ratepayers hundreds of millions of dollars. Now, however, technological progress is providing many new opportunities for energy savings that surpass existing government policy.

Working with other states, the Commonwealth will promote technological innovation through new state-level efficiency standards for a variety of equipment and appliances. Further, the state will continue on-going efforts to work with neighboring states through the Regional Climate Plan to enhance efficiency in a wide range of products sold in New England. The Commonwealth will work in conjunction with other states to foster legislation and other approaches that encourage new appliance efficiency standards on products such as:

- Digital cable boxes
- Ceiling fans
- Torchiere lighting
- Large packaged HVAC systems
- Exit signs
- Traffic signals
- Unit and duct heaters
- Commercial clothes washers
- Commercial refrigerators and freezers

SHEILA LYNCH-BENTTINEN AND PETER BENTTINEN

Moving Toward Energy Independence

Sheila and Peter are living out their personal principles by applying an engineering systems approach to their home in Duxbury. They installed energy-efficient home appliances (refrigerator, washer and dryer), lights, and storm windows, all readily available and purchased from local stores. They wrapped their hot water heater, installed insulation, chose an Energy Star™ big screen TV and computer, and purchased an electric vehicle. They also purchased a new high efficiency hot air CNG furnace to heat their home. But they didn't stop there.

They installed a photovoltaic system that generates nearly enough electricity to run their home and even power their car! As a result of these efforts, Sheila and Peter now sell energy back to their power company during some months, bringing their net energy costs to a level most of us could only imagine.

The Benttinens in front of their PV-paneled tool shed and electric vehicle

MORE EFFICIENT BUILDINGS: REDUCING POLLUTION THROUGH SUSTAINABLE DESIGN AND CONSTRUCTION

The energy used to light, heat, and cool our buildings contributes significantly to greenhouse gas emissions. Some 30% of all GHG emissions result directly from residential and commercial building energy consumption. Additionally, the demolition and landfilling of building materials, the use of natural resources in building materials, and the destruction of natural habitats for building sites, all generate significant greenhouse gas emissions.

Sustainable design, construction, and renovation practices have the potential to reduce energy use and consumption, as well as greenhouse gas emissions. Sustainable design embodies a multi-disciplinary, integrated approach to building projects that uses material, energy, and water resources efficiently, minimizes site impacts, addresses health issues relating to construction and indoor environments, and supports the use of local products.

Since 1984, the state has completed nearly 200 energy and water conservation projects, via performance contracts, utility incentives, and bond-funded design and construction, which have resulted in over $152 million in energy and water reductions. Given these past successes, the state will seek to expand these activities and encourage similar efforts within the residential sector and private construction projects.

GOAL

Incorporate appropriate sustainable design techniques and approaches into all renovation and construction projects at state agencies and authorities. Promote such strategies in other public and private construction projects.

ACTIONS

CONTINUE THE IMPLEMENTATION OF A COMPREHENSIVE SUSTAINABLE DESIGN INITIATIVE FOR STATE BUILDINGS

The Division of Capital Asset Management (DCAM) will continue its existing sustainable design efforts to develop a comprehensive program that looks to incorporate appropriate sustainable design practices into all state projects. DCAM will rely on its own expertise, as well as that of other appropriate state agencies and non-governmental entities. A sustainable design program will include the following elements:

- DCAM shall seek to attain LEED™ certification for all new construction and major renovation projects for state buildings when cost-effective and feasible
- Lifecycle cost analyses for sustainable options will be conducted for major building systems
- Continued implementation of the ongoing, privately financed energy/water conservation retrofit program in state facilities
- Continuation of a commissioning program to ensure that project design criteria for efficiency and indoor environmental quality are met

THE ERIE-ELLINGTON NEIGHBORHOOD

Massachusetts is in need of more affordable housing, particularly in cities like Boston with low vacancy rates and high housing costs. This demand, along with growing community interest in the environment, gives rise to many opportunities for climate-friendly construction and renovations.

The Erie-Ellington housing development in Boston's Dorchester area has 50 affordable homes and a community center, all constructed to maximize energy efficiency. As a result, they use 60% less energy, 40% less water, and emit 50% fewer air pollutants than comparable conventional homes. Built by the Green Village Company and the Hickory Consortium, these units cost $97 per square foot for construction. That's 25% less than comparable city projects. They are not only affordable to buy; their energy efficiency makes them affordable to live in.

Residents of the Erie - Ellington Neighborhood

INITIATE A SUSTAINABLE BUILDING DESIGN FORUM

To help foster discussion and dialogue about the many opportunities for sustainable design in Massachusetts, the Executive Office of Environmental Affairs (EOEA) has initiated a roundtable designed to identify and promote sustainable design practices among architects, designers, engineers, and construction firms, as well as at appropriate state agencies. This roundtable will continue to meet periodically to review sustainable design policies and programs, identify new and innovative design and construction techniques, improve communication between the design and construction community and state government, and make recommendations on how to improve and advance sustainable design efforts in Massachusetts. EOEA and DCAM will continue to lead this roundtable, in collaboration with the Massachusetts Technology Collaborative's Renewable Energy Trust ("the Trust") and other identified parties.

PROMOTE SUSTAINABLE DESIGN AMONG CONSTRUCTION PROFESSIONALS

To bring sustainable design strategies into the mainstream, it will be necessary to promote such approaches through statewide training efforts. DCAM, in collaboration with other appropriate state agencies, will investigate opportunities to promote sustainable development techniques for designers, architects, construction firms, engineers, inspectors, clients, building managers, lighting and appliance retailers, and HVAC contractors.

WORK COLLABORATIVELY WITH THE TRUST'S GREEN BUILDINGS PROGRAM

The state will support the efforts of the Trust by continuing to identify and promote funding opportunities for public and private projects that are innovative and advance the goals of greenhouse gas reductions. The Trust is funding 40 feasibility studies and 50 design and construction awards, helping to integrate the goal of energy conservation with renewable energy technology.

SUPPORT THE TRUST'S PARTNERSHIP WITH THE MASSACHUSETTS DEPARTMENT OF EDUCATION'S GREEN SCHOOLS PROGRAM

The Massachusetts Green Schools Initiative is a program fostering the design and construction of a new generation of energy-efficient, high performance "green" school buildings. The Initiative is a cooperative effort between the Trust and the Massachusetts Department of Education School Building Assistance program. Currently, the Green Schools Program is supporting energy conservation and renewable energy technology in 16 pilot program schools, with the Trust funding initial activities. In the near future, the Trust plans to track improvements in student and staff health and productivity due to healthier buildings and increased daylight as well as energy performance of the pilot green schools.

INCORPORATE SUSTAINABLE DESIGN APPROACHES INTO MEPA PROJECTS

The MEPA office will develop sustainable design guidance for projects to promote appropriate measures to incorporate into project design.

POLICY HIGHLIGHT

SUSTAINABLE DESIGN

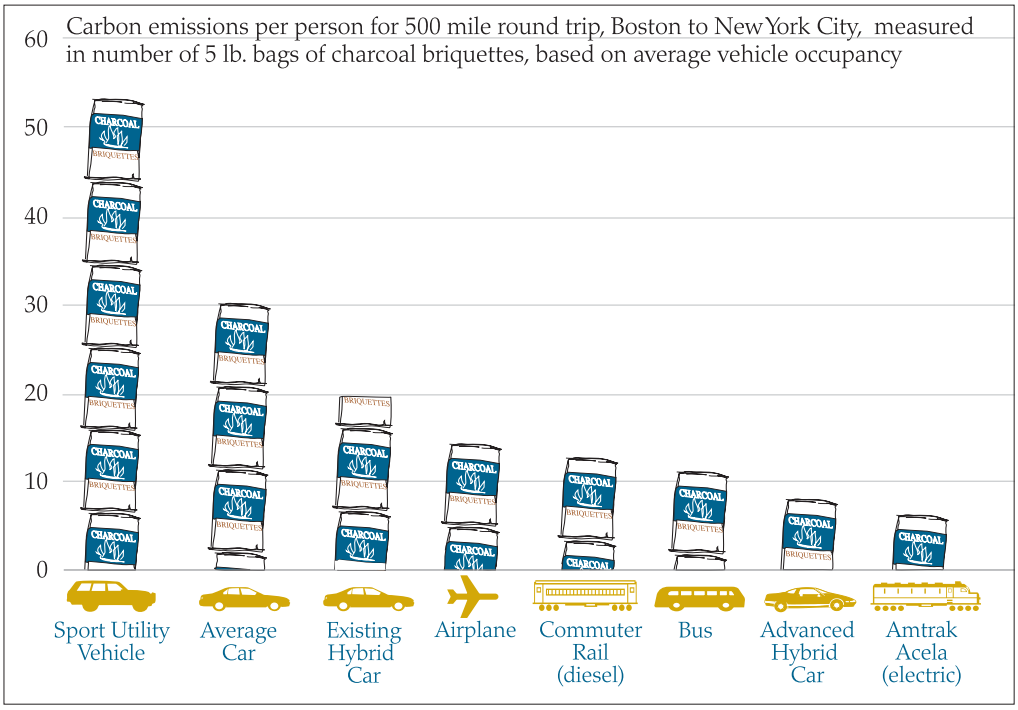
Sustainable Design is a new and growing field that will continue to demonstrate value in reducing the generation of greenhouse gases. Some current examples of sustainable design practices include:

- Installation and use of energy-efficient materials, technologies, mechanical equipment, lighting, and appliances.
- Use of sustainable, recycled, more durable, and less toxic materials.
- Day-lighting and active and passive solar design and technologies.
- Use of cleaner, lower-carbon fuels and renewable energy technologies to provide heat and hot water.
- Use of water-efficient plumbing systems, appliances, and water re-use techniques.
- Use of efficient HVAC systems and materials that protect indoor air quality and the health of building occupants.
- Incorporation of the transit and recycling needs of building occupants into building siting and design.
- Protection of natural surroundings, sensitive ecological areas, and plantings of native species to reduce water and energy demand.
- Recycling of construction and demolition debris.

TRANSPORTATION AND SUSTAINABLE DEVELOPMENT: INCREASING CHOICES, REDUCING EMISSIONS

8.

Transportation accounts for about 32% of national carbon dioxide emissions; and approximately 98% of the fuel used is petroleum. Greenhouse gas emissions are a direct result of the type of fuel consumed, and reducing greenhouse gas emissions requires either reducing fuel consumption or switching to lower-carbon fuels. Despite dramatic reductions in the traditional pollution rates of individual vehicles over the past 20 years, transportation remains an increasing source of CO_2. As long as the average miles-per-gallon fuel consumption remains stagnant and the amount of vehicular travel grows, greenhouse gas emissions will continue to increase. Between 1990 and 1998, annual vehicle miles traveled (VMT) in Massachusetts rose 13%, from 45 billion miles to 51 billion miles. Massachusetts anticipates a 33% overall increase in CO_2 from the transportation sector between 1990 and 2020 based on the increasing numbers of heavier and less fuel efficient vehicles.



Inefficient patterns of land development have contributed significantly to the continuing rise in VMT. For roughly 50 years, land use in Massachusetts has been dominated by sprawl: low density, single-use developments that rely solely on automobiles for transportation. In order to effectively address climate change, the Commonwealth must address land-use patterns as well. Land-use policies that promote higher density and mixed-use development can reduce the need for people to make trips by car, allowing them to combine several errands in one short trip. Sustainable development planning also enhances the efficiency and economics of public transportation, and helps to preserve open space.

Although most land-use decisions are made at the local level, state government can encourage sustainable development through its laws, policies, and spending. Policies that promote higher densities and mixed-use development can reduce GHG emissions by supporting transit, ridesharing, walking, and bicycling as alternatives to driving.

In addition to cars and light-duty trucks, emissions from the other major modes of transportation like heavy-duty trucks, rail, air, and shipping present opportunities for significant technological innovation. No fuel economy requirements currently apply to these modes of transportation, and states do not have unilateral authority to initiate them. Reducing global warming potential from air transportation poses even greater challenges, given its international scope. While the freight and air travel industries have steadily increased fuel efficiency on their own to lower operating cost, these gains in fuel efficiency are more than offset by increased passenger and freight air travel. In fact, the federal government predicts that combined consumption of fuel for transportation uses in New England will continue to increase. Passenger activity at Logan International Airport, New England's largest air traffic center, rose by more than 15% from 1990 to 2000, and in the long run is predicted to keep growing. Given the interstate nature of much freight transport, freight programs will succeed best with interstate cooperation.

8.

TRANSPORTATION AND SUSTAINABLE DEVELOPMENT: INCREASING CHOICES, REDUCING EMISSIONS

GOAL

The state is committed to curbing sprawl by adhering to the Sustainable Development Principles put forth by the Office for Commonwealth Development. Further, state agencies will work cooperatively to continue increasing efficient transportation choices for Massachusetts citizens. In taking these actions the state will be establishing a firm foundation for deeper, longer-term emissions reductions while using state tax dollars more efficiently and spurring opportunities for housing development and employment growth.

ACTIONS

USE SUSTAINABLE DEVELOPMENT PRINCIPLES TO INTEGRATE TRANSPORTATION AND LAND USE

State spending on programs that affect land use will be guided by the Commonwealth's Sustainable Development Principles (see sidebar at right). Major state investments, including water and sewer systems and state buildings, will seek to support projects in existing town centers and developed areas around transit stations. The Romney administration has committed to a goal of doubling new housing starts. Concentrating these new residences in developed locations will increase transit use and walking, reducing dependence on cars and therefore reducing GHG emissions. In other words, the goal is to increase development in areas where it takes less energy to maintain it. Through the Office for Commonwealth Development's Commonwealth Capital Initiative, a wide range of state spending programs will be coordinated to carry out the Sustainable Development Principles. This will give municipalities, landowners, developers, and lenders strong incentives to foster development in these locations.

FAVOR TRANSIT-ORIENTED DEVELOPMENT AROUND MBTA STATIONS

The MBTA is committed to promoting higher-density mixed-use development at transit stations. Working with local communities, the Office for Commonwealth Development and the MBTA have brought technical expertise in planning and real estate development into a joint planning process. These plans will result in the issuance of RFPs for the development of key state-owned parcels of land, consistent with the Sustainable Development Principles.

INCLUDE ENERGY USE AND GHG EMISSIONS DATA AS CRITERIA IN TRANSPORTATION DECISIONS

Considering greenhouse gas emissions when making transportation planning and funding decisions will be a powerful tool in state efforts to reduce transportation's harmful impacts on the environment. There are many opportunities to curb growing GHG emissions through the transportation planning process, but traditionally these have not been considered. EOTC has recently proposed that its transportation agencies, in cooperation with regional planning groups and local officials, include climate as a criterion when making decisions on transportation projects.

SUSTAINABLE DEVELOPMENT PRINCIPLES

The Office for Commonwealth Development is dedicated to careful stewardship of our natural resources, wise investment in public infrastructure, and the expansion of opportunity for all our residents. Future growth is inevitable and desirable – but we need to plan for it in a responsible manner. Our choices today must create value and opportunity for all our residents now and in the future. Careful, sustainable development decisions will foster continued economic growth in Massachusetts, while mitigating the environmental impacts of our past and minimizing those of the future.

To this end, the Office for Commonwealth Development has adopted the following Sustainable Development Principles. A more detailed description of these principles can be found on the web at www.mass.gov/ocd.

1. Redevelop first.
2. Concentrate development.
3. Be fair.
4. Restore and enhance the environment.
5. Conserve natural resources.
6. Expand housing opportunities.
7. Provide transportation choice.
8. Increase job opportunities.
9. Foster sustainable businesses.
10. Plan regionally.

In addition, through Mass Highway, the Executive Office of Transportation and Construction (EOTC) will work with the New England Governors' Conference to provide training to the Regional Planning Agencies and local transportation planners on the assessment of CO_2 emissions from transportation projects and ensure that the energy intensity of projects is disclosed, including the secondary impacts of such projects. Having this information will help the state, regional planning agencies, and cities and towns to make informed decisions about the relative impacts, both in the short and long term, of transportation decisions on infrastructure, efficiency, and the environment.

MAINTAIN AND UPDATE PUBLIC TRANSIT SERVICES

EOTC and the Massachusetts Bay Transit Authority (MBTA) will continue their efforts to find new and innovative ways to maintain and augment public transit infrastructure, optimize existing services, and increase overall public transit ridership. By moving people to transit services for as many trips as possible, Massachusetts will reduce energy use across the state, and lower CO_2 emissions.

INCREASE PARKING AT TRAIN STATIONS TO ENCOURAGE USE OF PUBLIC TRANSIT

The MBTA will review rail stations with inadequate parking and work to increase parking, consistent with sustainable development goals, in order to encourage ridership.

IMPROVE THE EFFICIENCY OF TRANSIT VEHICLE MOVEMENT

As the MBTA reviews the location and use of its maintenance and layover facilities, it will consider the efficiency and climate change impacts of its scheduling practices. This policy will encourage the choice of storage and maintenance facilities close to transit routes, thereby reducing or eliminating wasted travel. For example, by relocating a single existing bus maintenance facility closer to the bus routes, the MBTA can eliminate hundreds of miles of unnecessary travel every day, reducing fuel use, labor costs, air pollution, and congestion. The MBTA will continue to review changes in routes and service plans to reduce unproductive travel, while seeking facility sites that create the least disturbance to existing neighborhoods.

DEVELOP NEW BICYCLE AND PEDESTRIAN POLICIES, PROGRAMS, AND FACILITIES

EOTC's Bureau of Transportation Planning and Development will improve bicycling conditions by developing a new bike plan that will guide efforts to expand, improve, and link much of the state's on- and off-road network of bike paths. For example, the state will explore ways to connect the Pioneer Valley's Norwottuck and Manhan Trails and thereby create

THE CENTRAL ARTERY – MORE THAN JUST THE BIG DIG

The Commonwealth has implemented a number of measures to offer citizens alternatives to driving, and especially to discourage solo commuting.

The purpose of these measures is to prevent, in the long term, emissions increases once the Central Artery/Tunnel Project is complete and traffic is flowing freely. Examples of Central Artery Environmental Mitigation projects, many of which have been incorporated into the state's plan to comply with the federal Clean Air Act and are already completed, include:

- Extension of commuter rail service to Worcester, Newburyport, the South Shore, and T.F. Green Airport in Rhode Island.
- Construction of 20,000 new parking spaces at public transit stations.
- Continued implementation of parking freezes in downtown Boston, South Boston, East Boston, and Logan Airport.
- Development and expansion of commuter boat services.
- Planning and environmental review of major transit initiatives like the MBTA's Urban Ring, a circumferential transit system that will connect Chelsea, Everett, Somerville, Cambridge, Brookline, and Boston.
- Initiation of programs in which employers help workers pay for public transit, private buses, and paratransit.
- Operation of SmarTraveler™, a communication system that provides commuters with real-time, on-demand traffic and transit information in eastern Massachusetts.

POLICY HIGHLIGHT

IN THE TRANSPORTATION SECTOR, MANY PATHS LEAD HOME

Massachusetts supports many programs that offer alternatives to solo driving, and reduce associated air pollution and greenhouse gases. The state's primary transit strategies include maintaining, expanding, and enhancing public transit systems; increasing public awareness and acceptance of transit; and helping to pay the cost of transit use. These approaches work best when integrated with land-use policies that promote high-density, mixed-use development near transit stations, and parking policies that encourage commuters to use transit rather than cars.

In fact, research shows that communities near transit stations, as well as the vast majority served by commuter rail, have lower per capita levels of vehicle ownership. In other words, the availability of a solid transportation alternative makes it possible for residents of these communities to avoid having to keep several cars on the road, or even one. For people on a fixed income, who cannot afford the high cost of vehicle ownership, this access is not a luxury, but a necessity.

The MBTA, the sixth largest transit provider in the country, along with Massachusetts' 14 other regional transit authorities, plays an important role in offering transportation choices that help address climate change. The state will continue to support this commitment to provide Massachusetts citizens with efficient options.

a major non-motorized circulation system serving numerous academic, commercial, and residential districts. In addition, the state will undertake new efforts to educate the public about the collective impacts citizens can have on greenhouse gas reduction when they choose to walk or bike rather than drive.

EXPAND PROGRAMS TO PROMOTE EFFICIENT TRAVEL

In addition to DEP's full implementation and enforcement of the state's existing ridesharing program, Mass Highway, through the MassRIDES Travel Options Program, will expand its programs to address the needs of all travelers, including commuters, school children, people attending conventions and other large-scale events, tourists, senior citizens, and people in rural areas. Within the next year, Mass Highway will:

- Implement an on-line GIS-based ride-matching service
- Form new vanpools
- Conduct a minimum of 200 on-site meetings with employers
- Seek to register at least 2000 new carpoolers
- Initiate a Commuter Pilot Program for state transportation employees, encouraging the use of efficient transportation modes to and from work

For its part, EOEA will participate actively in a partnership with EPA to recognize companies that offer incentives for ridesharing and promote other policies to improve travel efficiency. This program has already signed up nearly 60 Massachusetts companies, with an estimated total of 72,000 employees.

SEEK OPPORTUNITIES TO REDUCE EMISSIONS AT LOGAN AIRPORT

In early 2001, Massport agreed to implement a slate of emissions reduction programs at Logan in an effort to improve air quality, both locally and throughout the region. While not reducing CO_2 directly, the Air Quality Initiative (AQI) for Logan International Airport covers NO_X (which in the upper atmosphere is a warming gas), and this program serves as the blueprint for managing and offsetting air quality impacts stemming from airport operations. In addition, Massport has recently taken a lead in considering energy efficiency for new airport terminals and will continue to report and track the benefits of these changes in terms of their ongoing energy savings.

IMPROVE AIRCRAFT MOVEMENT EFFICIENCY

Recent studies have shown that aircraft cause significant warming when in the upper atmosphere (see sidebar, "Impacts of NO_X on the Upper Atmosphere" p. 39). As part of a proposed Airside Improvements Program at Logan Airport, Massport has identified a number of

POLICY HIGHLIGHT

IMPACT OF NO_X EMISSIONS IN THE UPPER ATMOSPHERE

Airplanes emit NO_X, a gas that converts to ozone under normal outdoor conditions. In the upper atmosphere, however, this conversion is magnified. Ozone created in the upper

atmosphere - where NO_X is released from cruising altitude airplanes - is up to 1,800 times more warming than CO_2. This means that areas with high concentrations of flight activity, such as the northeast US, receive a large proportion of warming. IPCC estimated that ozone levels in high-flight-traffic areas had, by 1992, risen 6% compared with a theoretical air-travel-free atmosphere. They expect these levels to rise to 13% by 2050. Taking action to reduce NO_X emissions as a state is thus all the more important because of the emissions' direct consequences to our environment.

planned actions to improve the energy efficiency of the movement of aircraft. These opportunities include construction of a new runway, taxiway improvements and demand management measures including Peak Period Pricing. Together these actions will reduce the total amount of fuel wasted by aircraft circling in the air and idling on the ground. In addition to reducing fuel waste, the improvements will save the economy over $115 million annually.

The state will also look for ways to encourage and support national and international efforts to modernize and streamline the movement and routing of aircraft to minimize CO_2 and NO_X emissions both at the ground level and in the upper atmosphere. The state will continue to participate in national stakeholders' meetings seeking to reduce the environmental impacts of the aviation industry.

EVALUATE THE BENEFITS OF EXPANDED RAIL AND WATER OPPORTUNITIES

Diesel fuel is a major source of greenhouse gas emissions in Massachusetts. Current projections show diesel fuel consumption growing 14% from 1997 to 2010, which represents an increase of more than 40% above 1990 levels. Although modest efficiency gains in all forms of freight transportation are expected over the next decade, they will be offset by increased freight travel. Vehicle miles traveled by heavy-duty trucks are expected to increase by nearly 24% from 1998 to 2010, according to national projections from the U.S. Energy Information Administration.

Massachusetts will seek a better understanding of the environmental impacts of freight transport and will, through effective planning, work to retain the necessary infrastructure to move goods across the Northeast by rail, water, and other efficient means of transportation. EOTC will incorporate climate change into its concerns as it updates the Massachusetts statewide rail plan, seeking to identify opportunities for efficient partnerships with the freight rail industry.

POLICY HIGHLIGHT

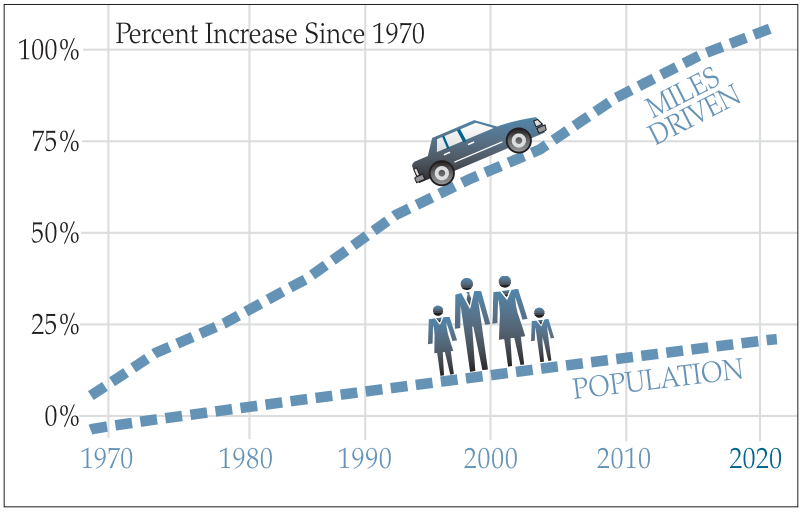
DRIVE LESS, PAY LESS: EXPLORE A MILEAGE-BASED INSURANCE OPTION

Mileage-based automobile insurance can prove an excellent incentive to promote more sustainable driving practices. Under this new consumer option, the amount that consumers pay for automobile insurance coverage is determined in part by how much they drive.

Major insurance companies in Europe are developing mileage-based insurance for car owners, and demonstration projects are currently underway in several U.S. states. Massachusetts has been exploring opportunities for a similar program here to complement its existing low mileage insurance discount. A mileage-based insurance option could result in a projected overall driving reduction of as much as 10%, which would bring about comparable reductions in highway maintenance costs, air pollution, and greenhouse gas emissions. It would make affordable insurance more widely available, since consumers can choose to lower their own rates by driving less.

9. VEHICLES: SUPPORTING CLEAN, EFFICIENT NEW TECHNOLOGIES

Clean vehicle technology has been a priority in Massachusetts since 1990. By adhering to California's stringent emissions standards, we have had enormous success in reducing conventional pollutants such as hydrocarbons and nitrogen oxides in cars sold in the Commonwealth. However, stringent as those standards have been, they have not regulated greenhouse gas emissions, and the growing number of vehicles on Massachusetts' roads – many of them fuel-inefficient SUVs – has contributed to a significant growth in carbon emissions.



By any measure, whether it is vehicle miles traveled (VMT), average fuel efficiency, or overall use of transportation energy, greenhouse gas emissions from the transportation sector are growing rapidly. The Center for Clean Air Policy projects that, if we fail to take action, transportation CO_2 emissions in the Commonwealth will be 33% higher in 2020 than in base year 1990, due in part to VMT increases, but even more directly attributable to increased sales of inefficient vehicles.

Slowing the growth of emissions in the transportation sector is critically important, and it presents one of the most significant challenges to overall climate change mitigation efforts. Basically, we need to use less fuel, use fuel that is less carbon-intensive, place a high value on fuel-efficiency in car-buying decisions, and actively support new vehicle technologies (such as hybrid and/or electric motors, fuel cells, and hydrogen).

In addition to CO_2 emissions, scientists have recently identified black carbon (soot) as having a large and fast-warming impact on the atmosphere. Diesel vehicles contribute hugely to soot emission, which may be carcinogenic and certainly causes respiratory ailments in children, the elderly, and people with pre-existing heart and lung problems. The state, therefore, continues to adhere to California's strict diesel vehicle emission standards, and intends to focus urgently on diesel clean-up in the near future.

WARREN LEON AND CYNTHIA ROBINSON

CHOOSING CLEAN CARS

Transportation is one of the largest contributors to climate change. And – as this Acton couple demonstrates – if you drive a car, you can make a difference. When Warren Leon and Cynthia Robinson needed to replace their aging car, they

thought about the impacts that their choice would have on climate change. Today, they both drive the cleanest cars available – hybrid vehicles that run on both gasoline and electricity.

The Leon/Robinson family goes everywhere in their Toyota Prius and their Honda Civic Hybrid. These hybrid vehicles meet all their family needs. They get more than 50 miles to a gallon on their cars, saving them an average of more than $500 per year in gas for each vehicle. And the family couldn't be happier with their environmental results. Each car is reducing their family's climate change emissions by over 6,500 pounds of CO_2 annually.

As people committed to a clean environment and as consumers interested in sending a signal to companies to make environmentally responsible products, Warren and Cynthia are making sensible choices for themselves and for our environment.

GOAL

Through the judicious use of regulations, incentives for cleaner and more efficient vehicles, and public education on the impacts of vehicle choices, the state will encourage Massachusetts drivers and fleet owners to shift to cleaner, higher-efficiency vehicles, lower-carbon fuels, and advanced technologies. The state will seek improvements in all transportation sectors, with a focus on vehicles and transportation systems that have not traditionally been part of clean-up efforts – such as airplanes, marine vehicles, heavy-duty trucks, and off-road equipment. A comprehensive clean-up of diesel vehicles, targeting soot reductions, will also be an important strategy for reducing the climate impacts of the transportation sector and improving public health.

ACTIONS

PROVIDE INCENTIVES TO PURCHASE FUEL-EFFICIENT VEHICLES

The state will promote the use of clean and energy-efficient vehicles by providing incentives for their purchase and use. The state will propose rebates and/or reductions in fees and existing taxes for purchasers of new fuel-efficient and clean vehicles. These measures will prompt people to consider the environment and fuel efficiency when making purchasing decisions. They will steer individuals and corporations toward the cleanest and most fuel-efficient vehicles, including those using hybrid, fuel cell, electric, compressed natural gas, and other clean alternative fuel technologies. Development of adequate fueling infrastructure will be important to the acceptance and utility of such alternative fuel vehicles. Consideration will also be given to coordinating this program with other states.

SUPPORT HOV LANE ACCESS FOR CLEAN VEHICLES

Clean vehicles will be granted access to existing and any new High-Occupancy Vehicle (HOV) lanes, regardless of the number of passengers in the vehicle, to the extent that such access does not degrade the operation of the HOV lanes.

IMPLEMENT STRONGER VEHICLE EMISSIONS STANDARDS

Massachusetts will adopt GHG emissions standards for new light-duty vehicles. Under Section 177 of the Clean Air Act, work will begin as soon as California finalizes its standards. Starting immediately, the Commonwealth will undertake the necessary work to facilitate adoption of the new California standards as soon as they are adopted. In addition, the Commonwealth will work cooperatively with New York, Vermont, Maine, New Jersey, Connecticut, and other states to implement these rules and to seek regional approaches to reduce GHGs from the regional vehicle fleet wherever feasible.

PROMOTE THE USE OF CLEANER VEHICLES AND FUELS IN OUR PUBLIC TRANSIT FLEETS

The state will encourage its transit authorities to purchase only public transit vehicles that use lower carbon fuels and advanced vehicle technologies. For example, the MBTA has already purchased 358 new buses that run on natural gas, and has committed to replace about a

POLICY HIGHLIGHT

THE LOW-EMISSION VEHICLE PROGRAM

The Clean Air Act Amendments of 1977 give states with air quality problems like Massachusetts the choice of either adopting California's strong tailpipe emissions standards, or defaulting to a less rigorous federal standard. Massachusetts chose to adopt the California Low Emission Vehicle (LEV) Program, since it is the more protective and farsighted option. As a result, new advanced technology vehicles (including hybrids and ultra-low emission vehicles) must be offered for sale in substantial numbers here. Some of these vehicles will provide significant greenhouse reduction benefits. The California standards also require that fleet-wide average tailpipe emissions decline steadily through the year 2010.

third of their existing bus fleet by the end of this year. These natural gas buses emit less CO_2 than the old buses, serving as an important bridge to cleaner hydrogen-fuel technologies in the future. These emissions may be soon be reduced a further 10-40% as hybrid electric buses become available.

CLEAN UP THE EXISTING TRANSIT FLEET WITH LESS POLLUTING FUELS

As outlined above, the state's goal is to switch over its public transit bus fleet to include only natural gas and cleaner vehicles. In the meantime, however, in order to reduce environmental impacts, including climate change effects, the MBTA is running all its current diesel buses, as well as its trucks and construction equipment on ultra-low sulfur diesel in advance of the 2006 federal requirements. The MBTA is also exploring the use of low sulfur diesel for the commuter rail network and expects to have all trains, traveling both north and south, to be operating on low sulfur diesel by July 1, 2004. The state will now promote the use of this cleaner fuel in other transit authorities and large public and private fleets, including long-haul fleets. MASCO (at the Longwood Medical area in Boston) is one example of a large private fleet that has undertaken retrofits and has already begun to use this fuel.

CONTINUE TO PROMOTE THE USE OF CLEAN DIESEL EQUIPMENT ON STATE-FUNDED CONSTRUCTION PROJECTS

For future construction projects undertaken using state funds, the state will encourage the use of heavy-duty diesel construction equipment that has been retrofitted with emission control devices, such as oxidation catalysts or particulate filters on the exhaust system, whenever appropriate. In addition, the state will encourage private projects to consider similar measures. Modeled on an approach taken in the construction of portions of the Central Artery, at DEP, and at the MBTA, this new measure represents an effort to more widely encourage the retrofitting of dirty diesel vehicles and construction equipment.

POLICY HIGHLIGHT

USING NEW TECHNOLOGY AND POLICIES TO AVOID UNNECESSARY TRUCK IDLING AND FUEL WASTE

Long-haul truck drivers typically idle their engines at truck stops or other locations to supply heating or cooling to sleeper cab compartments and run electrical appliances, such as televisions and microwave ovens. A typical long-haul truck idles an average of six hours per day in the Commonwealth, wasting large quantities of fuel and emitting significant amounts of diesel soot, greenhouse gases, and NO_X.

Thanks to new technology, truck drivers can now meet their electricity needs without polluting. Truck Stop Electrification (TSE) technology combined with on-board "shore power" electrical systems is becoming available. Installation of a TSE system typically pays for itself for in about three years, and for the trucker the cost of engine idling and associated maintenance suggests a strong potential for direct savings. Finally, TSE provides direct benefits to communities that currently suffer from fumes and noise of idling trucks.

The state will address the current truck idling problem at a number of levels, seeking to work with the trucking industry and the local enforcement agencies to develop a comprehensive approach. To encourage trucking companies and truck stop operators to reduce the amount of current emissions, the state will support increased enforcement of Massachusetts' anti-idling regulation. The state also supports the installation of facilities to enable long-haul truckers to meet their needs for power without leaving their engines running. In addition, MassHighway will fund the development of one or more TSE pilot projects at its service plazas and encourage private stops to install such systems; and propose that the I-95 Corridor Coalition work on such an effort corridor-wide.

Since 2001, the DEP (through its Clean Water and Drinking Water State Revolving Fund) has required that at least 50% of the construction equipment for every project be retrofitted with oxidation catalyst and/or particulate filters. In some cases, retrofitting of 100% of the equipment is required. A similar model developed for the MBTA in 2001 requires equipment retrofits for MBTA contracts. The MBTA also required all heavy-duty off-road construction equipment to have emission control devices installed, such as oxidation catalysts or particulate filters on the exhaust system side of the diesel combustion engine equipment.

Both models have worked very successfully at minimal cost to the Commonwealth. As a further environmental benefit, once a vehicle has been retrofitted, it stays cleaner in all of its future jobs, whether or not retrofitting is being required.

ELIMINATE UNNECESSARY IDLING OF BUSES

Idling of buses is a significant source of wasted fuel, noxious fumes, and greenhouse gas emissions. Therefore, new MBTA vehicles will feature new technology designed to ensure that vehicles do not idle unnecessarily. New buses will have an automatic shut-off system to turn the bus off if it is left idling (in park or neutral) longer than five minutes. In addition, all new MBTA buses will be equipped with preheaters so that vehicles can start readily in cold weather and not need to idle in order to warm up.

USE CLEANER TRAIN ENGINE TECHNOLOGY TO REDUCE DIESEL SOOT

The MBTA is retrofitting 12 commuter rail locomotives (15% of the MBTA fleet) so that they will now meet the new Tier 0 standards – that is, the cleanest and most advanced standard for trains. These parts of the fleet are being converted nearly ten years prior to EPA requirements. Based on the number of locomotives that the MBTA will retrofit, the MBTA anticipates reducing NO_X emissions by 152 tons per year and soot by approximately five tons per year. The MBTA is also working with the Environmental Protection Agency to secure funding sources to retrofit additional locomotives. All commuter rail lines traveling both north and south will begin using low sulfur diesel, a cleaner-burning fuel, by July 1, 2004.

ADVOCATE FOR AIRCRAFT EFFICIENCY AT A REGIONAL AND NATIONAL LEVEL

Through involvement in national working groups at the federal level, the state will encourage technological improvements in aircraft to increase fuel economy and reduce NO_X and hydrocarbon emissions.

POLICY HIGHLIGHT

CLOSING THE SUV LOOPHOLE: A MOVE THAT WILL HELP THE CLIMATE

When the Massachusetts legislature adopted the California Car Standards in 1990, trucks were a small part of the vehicle market and were not covered under these rigorous car pollutant standards. In the intervening years, an increased sale of larger and heavier vehicles has meant that more and more vehicles were slipping through this regulatory loophole. In 1999, Massachusetts adopted the LEV II standards, which began to require that the heavier Sport Utility Vehicles (SUVs) and Light Duty Trucks (LDTs) be as clean as cars being sold in the Commonwealth. This means that starting in model year 2004, these vehicles will be held to the same conventional pollutant requirements that apply to cars. While the LEV II standards do not cover greenhouse gases, many automakers will turn to advanced technology as a way to decrease the conventional pollutants emitted by SUVs and LDTs. The overall result will be a greater number of advanced technology vehicles, including hybrids – which will have the important benefit of significantly reducing greenhouse gas emissions in the Commonwealth. In fact, some hybrids cut greenhouse gas emissions by more than 50% compared to conventional vehicles. By 2010, the state's entire mix of advanced technology vehicles (zero emission vehicles, hybrids, and similar ultra-low emission vehicles) are forecast to prevent an additional 600,000 tons of carbon dioxide and equivalent greenhouse gases from reaching the atmosphere every year.

10. NATURAL RESOURCE PROTECTION AS A CLIMATE STRATEGY

Massachusetts is extraordinarily rich in coastal and inland natural resources, and a number of economic sectors – including tourism, farming, fishing, and forestry – rely on their continued health. Climate change threatens these resources directly, and the state can take actions to protect and enhance them against future potential impacts of climate change. Furthermore these resources – particularly forests and farmland – can be key components in an overall strategy to reduce our net statewide carbon emissions and conserve our carbon resource.

GOAL

Scientific research has shown that climate change poses a significant risk to our already stressed natural resources. Climate change can be significantly lessened by reducing greenhouse gas emissions through changes in agricultural and forestry management. Natural resource managers and land conservation advocates need to integrate these latest scientific findings into their planning processes and day-to-day management techniques. The state will nurture awareness of the connection between climate change, greenhouse gas pollution, and our forests, oceans, fisheries, and farms. The state will actively foster new ways to protect these resources while conserving carbon and reducing greenhouse gas emissions.

ACTIONS

HOST WORKSHOPS ON THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON NATURAL RESOURCES AND LAND MANAGEMENT

In March 2004, the state convened an interdisciplinary workshop to disseminate scientific information on the potential impacts of climate change on the natural resources of Massachusetts and the New England region, and the implications for resource management. The workshop drew upon the talents of traditional conservation organizations, land managers, universities and colleges, science centers and museums, oceanographers, natural resource-based industries, recreation industries, other non-governmental organizations and interested citizens. Follow-up workshops will continue to connect sound science with public and private managers and practitioners, to shape feasible, cost-effective solutions.

PROMOTE COASTAL PLANNING PROGRAMS THAT RESPOND TO CLIMATE CHANGE AND HELP PRESERVE WETLANDS

The Massachusetts Coastal Zone Management Office (CZM) will integrate climate change considerations into their policy-making and their planning and management of state-owned coastal areas. They will encourage coastal municipalities to institute adaptation measures to reduce climate impacts, assist state open space preservation programs in the identification of coastal lands in need of protection, and encourage coastal municipalities to consider development strategies that include protection measures such as bulkheads, dikes, and seawalls in critical areas.

PROMOTE A NEW FOREST VISION THAT INTEGRATES CARBON RESOURCE MANAGEMENT WITH OTHER NATURAL RESOURCE GOALS

The state will continue its efforts to maintain existing forests, increase land conservation areas, and give incentives for native (non-invasive) reforestation of previously forested area. The amount of carbon stored or sequestered by these activities will be measured and monitored over time to ensure that real carbon benefits accrue, and to better understand the long-term benefits of such programs. The state will focus on measures including:

- Tree selection that will both increase carbon storage and shepherd adaptation to climate change over time.
- Continued support for urban tree planting programs. Additional shade in certain urban areas mitigates the "heat island effect," and an urban tree-planting program can help lower energy demand by diminishing the need for air-conditioning. Reducing the size of the heat island has the additional benefit of reducing the formation of ground-level ozone smog in our cities.
- Including carbon resource management as one criterion in the management plan of state forests and other public lands. The state will encourage similar practices on private lands affected by conservation restrictions.
- Renewed research on the role of controlled and uncontrolled forest fires in returning carbon to the soil rather than emitting it into the atmosphere.

PROMOTE MUNICIPAL STRATEGIES THAT PRESERVE TREES

The state will encourage land and building development practices that preserve existing trees during construction, encourage the planting of native replacement trees, and emphasize reforestation of cleared land in and around developments. The state will meet its obligation to replace trees affected by state projects

POLICY HIGHLIGHT

PROTECTING OUR FORESTS: A NATURAL DEFENSE AGAINST CLIMATE CHANGE

Massachusetts is the third most densely populated state yet it has the eighth highest percentage of forest cover. Massachusetts has long recognized that the state's extensive forests furnish a broad array of benefits that support our quality of life. The state's forest ecosystems provide habitat for wildlife, a resource base for timber production, a wide range of opportunities for recreation, a natural filter to purify the air and water, and a vital source of aesthetic pleasure.

As development rates have outpaced population growth over the past four decades, the state has sought ways to ensure that forest resources are used in a sustainable manner. Today, however, an important ecosystem function waits to be fully integrated into this planning process – the beneficial role forests play in sequestering, storing, and emitting carbon dioxide.

Carbon is a key component of soil, the atmosphere, the ocean, plants, and animals, and constantly moves among and between these reservoirs through natural and human-caused processes. This network of flows is called the global carbon cycle. For example, when forests grow, or wood decays, or soils are tilled, carbon is exchanged between land and the atmosphere. Before the industrial revolution, levels of carbon dioxide and other greenhouse gases in the atmosphere were fairly constant: about the same amount of carbon was released to the atmosphere from the land or ocean as was returned to the land and ocean by other processes. However, human activities, including large-scale fossil fuel use and deforestation, have since perturbed this balance, causing carbon to accumulate in the atmosphere faster that it can be removed. A process that causes a net transfer of carbon to the atmosphere, such as burning coal, is called a carbon source. A process that causes a net removal of carbon from the atmosphere, such as when forests grow, is called a sink. Carbon resource conservation strives to encourage activities that remove or keep more carbon out of the atmosphere and discourage activities that release carbon into the atmosphere.

Massachusetts is studying the role of forests in climate change. Specifically, the state is promoting strategies to conserve and maintain working forests and their safe storage of carbon. Massachusetts will also seek to use forest carbon markets to encourage the retention of higher value-added products in the local timber industry, which currently exports much unfinished product out of state. Other strategies include the use of sustainably harvested biofuels to offset fossil fuel consumption, planting trees in urban areas to reduce the heating and cooling load of buildings, and the use of wood products instead of more emission-intensive materials like concrete, plastics, and steel.

The state's goal is to fully incorporate net greenhouse gas emissions impacts when making forest management and land use decisions.

POLICY HIGHLIGHT

RESOURCE PROTECTION AND GREENHOUSE GAS REDUCTION: NATURAL PARTNERS

Massachusetts is rich in natural resources, which offer a hedge against climate change, bolster our economy, and provide extraordinary aesthetic and recreational benefits. These include our forests and farms, wetlands and beaches, comprising thousands of acres protected for their ecological significance.

An area of more than a million acres – a fifth of the entire state – is protected in perpetuity for conservation and recreation. Half of this land is owned by the state itself. Cities and towns hold over 325,000 acres spread across more than 7,000 sites. The federal government owns 62,000 acres, half within the Cape Cod National Seashore. Nonprofit environmental organizations and land trusts protect more than 120,000 acres, or one-eighth of the total. These lands are protected by a variety of land-use arrangements, including outright ownership, restrictions on development, and conservation easements. Land protection targets key priorities – protecting water supply and biodiversity lands; preserving working farms and forests; establishing urban parks and outdoor recreation sites as well as historic landscapes; and expanding access to open space for Massachusetts citizens.

in cities and towns that have adopted replacement programs. In addition, state land conservation efforts will be broadened by encouraging participation in Chapter 61 (forest tax law) and "working forest" conservation restrictions to protect forest land and encourage forest management.

CONTINUE AGGRESSIVE OPEN SPACE PROTECTION EFFORTS

Open space preservation can help discourage sprawl, reducing transportation emissions and acting as an important greenhouse gas sink. Massachusetts will continue its efforts to acquire and protect open space. The state will encourage municipalities to protect land holdings that are currently unprotected; continue Self-Help and Urban Self-Help Program Funds for deserving projects in communities with open space and growth plans; enhance partnerships between the state and its municipalities as well as utility companies, large land owners, regional planning agencies, and other land protection groups; and continue to support MassReLeaf and other community tree programs. The state will continue efforts to complete forest stewardship management plans on targeted private forest areas to increase forest protection and implement sustainable forest management. Efforts will also continue to protect high quality forest resources via land conservation partnerships led by the state.

DEVELOP AND IMPLEMENT A COMPREHENSIVE BIOMASS POLICY

Carbon-based organic material, such as wastes from forestry, agriculture, and wood and food processing, can be used as a sustainable fuel supply. The Department of Energy Resources, in coordination with the environmental agencies and key stakeholders, will develop a comprehensive policy to promote the use and development of these biomass fuels as a climate-friendly energy resource. The policy will help meet various climate change, air quality, economic, forestry, and open space objectives by ensuring that:

- Biomass material is grown and harvested in an environmentally sound manner
- Strong air quality standards are maintained
- Low emissions and advanced biomass conversion technologies, as defined by the Massachusetts Renewable Portfolio Standard, are utilized for both heat and electricity
- State agencies provide incentives and work together to implement pilot biomass projects in various sectors (public and private applications) in rural regions

MAKE OUR FARMS FULL PARTNERS IN CLIMATE PROTECTION AND MITIGATION

The state will seek to create additional incentives for farming to advance the goals of this Plan, by working with farmers to promote farm practices that reduce greenhouse gases; by siting renewable energy projects including wind turbines on farmlands, where feasible; and by helping farmers create adaptation strategies to increasing climate change. The state will work to:

- Renew efforts to increase the amount of locally grown food. This will help preserve farmland and reduce transportation-related CO_2
- Use nitrogen fertilizers only when and where they are needed. Using less nitrogen fertilizer can decrease emissions of nitrous oxide, a powerful greenhouse gas
- Alter agricultural practices to reduce CO_2, methane, and nitrous oxide emissions through manure waste management on dairy farms, as well as through integrated pest management
- Site wind turbines and plant dedicated energy crops on agricultural land where feasible, in order to increase the economic viability of farms
- Increase the storage of carbon on agricultural lands through various methods including planting cover crops, installing permanently vegetated conservation buffer strips utilizing the federal Conservation Reserve Program, converting marginal agricultural land to forest where feasible, and adopting agro-forestry and organic farming practices

POLICY HIGHLIGHT

FARMING: ANOTHER WAY TO PRESERVE OPEN SPACE

Although most of the farms that shaped our landscape in the nineteenth century have disappeared, agriculture remains a significant part of the Massachusetts economy. At present, farmers own 570,000 acres of the state. Part of this land is actually forest land near their farm fields, not active agricultural land. Greenhouse gas emissions from the agricultural sector are a very small percentage of the state total, but farms and farmland represent a critical hedge against far larger emissions – those that follow when farmland is lost to uncontrolled development.

In addition, expanding the production of locally grown food can play a critical role in combating climate change. Typical ingredients in a family meal may have traveled thousands of miles before reaching the plate. Potatoes from Idaho, apples from Washington State, beans from California, and lamb from New Zealand are all common on Massachusetts tables, although these are all products that have been grown locally in the past. National data shows that a typical morsel of food journeys 1,400 miles before it reaches a mouth – 50 times farther than it did 20 years ago – changing hands at least six times along the way. It now takes between 10 and 15 units of energy to deliver one unit of food energy to a U.S. consumer. Furthermore, the food consumed by each US citizen takes the energy equivalent of 400 gallons of oil a year to produce, process, distribute, and prepare – 17% of the total energy supply.

Choosing locally grown produce, therefore, is important not just because it supports Massachusetts farms (four out of five of which are still family owned), but also because food that travels less pollutes less. Recognizing the huge long-term economic and environmental benefits of farming, the state will continue to focus on farmland preservation as part of an overall commitment to making farmland the vital strategic resource it once was in Massachusetts.

The Department of Agricultural Resources (DAR) is pursuing several different strategies to support the Massachusetts farmer. One of its efforts, the Agricultural Preservation Restriction Program, now protects more than 53,000 acres in 148 Massachusetts communities. DAR's Farm Viability Program uses 10-year "not-to-develop" covenants to preserve another 15,725 acres on 187 farms. The state will continue to support and expand these programs to encourage climate-friendly farming.

11. GLOSSARY & GUIDE TO ACRONYMS

APR: Agricultural Preservation Restriction, available through a farmland protection program managed by the state Department of Food & Agriculture.

Biomass: Organic, non-fossil material of biological origin. Trees and smaller plants or their residues are examples of biomass.

Biosphere: The region on land, in the oceans and in the atmosphere where living organisms are found.

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

Carbon Dioxide: 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. CO_2 emissions also result from clearing forests and burning biomass. Atmospheric concentrations of CO_2 have been increasing at a rate of about 0.5% a year, and are now more than 30% above pre-industrial levels.

CDE: Carbon Dioxide Equivalent, a metric measure used to compare the emissions from various heat-trapping gases based upon their global warming potential (GWP). The carbon dioxide equivalent of a gas is derived by multiplying its relative weight by its associated GWP.

Carbon Sequestration: The uptake and storage of carbon. Trees and other plants, for example, absorb carbon dioxide 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.

CH_4: see Methane.

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.

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.

CNG: Compressed Natural Gas, a fossil fuel stored under high pressure.

Cogeneration: 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.

CO: Carbon monoxide, a ground-level pollutant emitted mostly by vehicles.

CO_2: Carbon dioxide.

DEP: Massachusetts Department of Environmental Protection, the state agency with primary responsibility for environmental permitting and enforcement.

DOER: Massachusetts Division of Energy Resources, the state's energy office.

DOE: United States Department of Energy, the federal energy office.

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

EIA: U.S. Energy Information Administration, a division of the U.S. DOE that focuses on data collection and analysis.

EIR: Environmental Impact Report, a document describing the impacts of a major project reviewed by the MEPA process.

EOEA: Massachusetts Executive Office of Environmental Affairs, a cabinet-level office responsible for environmental policy.

EOTC: Executive Office of Transportation and Construction

EPA: U.S. Environmental Protection Agency.

EPP: Environmentally Preferable Product.

ERCs: Emission reduction credits. Under a market-based emissions reduction credit trading system, certified reductions in the emission of a pollutant or greenhouse gas that a given source achieves, which then may be sold or traded to another source as part of the latter's emission reduction requirement.

EV: Electric vehicle. At present, these are battery-powered.

Executive Order 388: Order signed in 1996 by then-Governor William Weld establishing targets for state procurement of alternative fuel vehicles.

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 carbon dioxide when burned, significantly contributing to the enhanced greenhouse effect.

FCCC: Framework Convention on Climate Change, the landmark international treaty unveiled at the United Nations Conference on Environment and Development (UNCED, also known as the "Rio Summit"), in June 1992. The U.S. was the first industrialized nation to ratify this accord, out of 155 countries to do so.

GHG: Greenhouse gas (used interchangeably here with heat-trapping gas). Any gas that traps radiant heat from the Earth causing climate change. The major greenhouse gases are water vapor, carbon dioxide (CO_2), Methane (CH_4), nitrous oxide (N_2O) and hydrochlorofluorocarbons (HCFCs), Ozone (O_3), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs).

GWP: Global Warming Potential, the scientific index used to translate the level of emissions of various gases into a common measure in order to compare the greenhouse impact of different gases without directly calculating the changes in atmospheric concentrations. The GWP of greenhouse gases is expressed in terms of "Carbon Dioxide Equivalent," or CDE.

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), perfluorinated carbons (PFCs) and hydrofluorocarbons (HFCs).

HOV lane: High-Occupancy Vehicle lanes, sometimes referred to as "carpool" lanes are special highway lanes designated for use by vehicles with more than one passenger. HOV lanes were created with the dual purpose of increasing air quality and reducing traffic congestion by reducing the number of vehicles on the road.

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.

ISTEA: The Intermodal Surface Transportation Equity Act of 1991, major legislation giving states more funding and flexibility in developing environmentally-sound transportation options.

Kyoto Protocol: An international agreement reached in 1997 in Kyoto, Japan, which extends the commitments of the FCCC. In particular, it sets targets for future emissions in developed countries.

LEED™: The Leadership in Energy & Environmental Design program of the U.S. Green Building Council.

LEV: Low-emission vehicle.

MassHighway: Massachusetts Highway Department

Massport: Massachusetts Port Authority, a public transportation agency that operates the maritime Port of Boston, Logan International Airport and several other facilities.

MBTA: Massachusetts Bay Transportation Authority, a public agency that operates the state's largest public transit system, centered in Boston. It is called the "T."

MEPA: Massachusetts Environmental Policy Act, which requires state review of major projects. MEPA is administered within EOEA and is headed by the Secretary of Environmental Affairs.

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. The atmospheric concentration of methane has been shown to be increasing at a rate of about 0.6% a year.

MSW: Municipal solid waste.

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

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.

NERA: New England Regional Assessment.

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 320. 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.

PAYT: Pay-As-You-Throw solid waste disposal program, designed to put a price on the amount of waste a household creates in an effort to encourage waste reduction.

PPM: Parts per million.

RFP: Request for Proposal, a proposal solicitation from state government.

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

SO_2: Sulfur dioxide, a major contributor to acid rain and particulate pollution.

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.

TDM: Transportation Demand Management, a policy strategy aimed at increasing demand for lower-impact means of transportation.

TEA-21: The Transportation Equity Act for the 21st Century, which reauthorizes ISTEA and reaffirms its commitment to environmentally sound transportation.

UMass: University of Massachusetts, the state university system with four campuses and a medical school.

VMT: Vehicle miles traveled.

VOC's: Volatile organic compounds, numerous complex chemicals that contribute to the formation of ground-level ozone smog. Sometimes also called hydrocarbons or non-methane organic compounds, although slight variations exist among these terms.

ZEV: Zero-emission vehicle. Right now, all ZEV's are battery-powered electric vehicles. They have no tailpipe emissions, although some fossil fuels are burned to provide the electricity that charges their batteries.

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