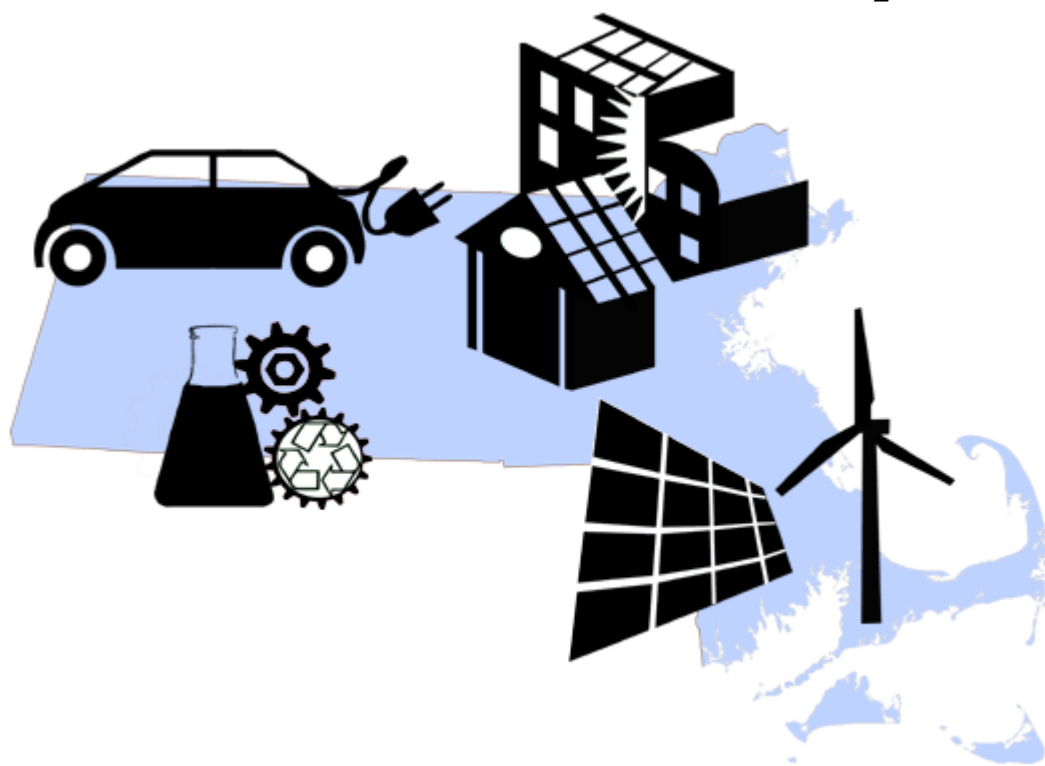


# ***Massachusetts Clean Energy and Climate Plan for 2020***

## **Executive Summary**



A report to the Great and General Court pursuant to the  
Global Warming Solutions Act  
(Chapter 298 of the Acts of 2008, and as codified at  
M.G.L. c. 21N)

Secretary of Energy and Environmental Affairs

Ian A. Bowles



December 29, 2010



## Executive Summary

### A Clean Energy Revolution

Between 2007 and the end of 2010, solar photovoltaic (PV) systems installed and scheduled for installation in Massachusetts increased 20-fold — with jobs in solar manufacturing, installation, and services nearly tripling — while installed wind energy increased 10-fold. In that same time period, Massachusetts launched the most aggressive energy efficiency program in the country, with estimated savings of over \$6 billion for residential, municipal, industrial and commercial customers and 4,500 jobs sustained or created.

This is not a vision of a possible future for Massachusetts. This is Massachusetts today.

It is in this context that the Executive Office of Energy and Environmental Affairs (EEA) presents the *Massachusetts Clean Energy and Climate Plan for 2020*. The Global Warming Solutions Act (GWSA, or the Act) of 2008 requires the Secretary of Energy and Environmental Affairs to establish a statewide limit on greenhouse gas (GHG) emissions of between 10 percent and 25 percent below 1990 levels for 2020 — on the way toward an 80 percent reduction in emissions by 2050 — along with a plan to achieve the 2020 target. Secretary Bowles has set that 2020 limit at 25 percent — and this Clean Energy and Climate Plan for 2020 contains the measures necessary to meet the limit.

Fulfilling that mandate will do much more than meet the requirements of the Act. It will allow the Commonwealth to address a number of challenges, only one of which is climate change. Most importantly, it will give powerful impetus to the clean energy revolution that has already begun.

**Energy Independence:** Massachusetts is at the end of the energy pipeline, figuratively

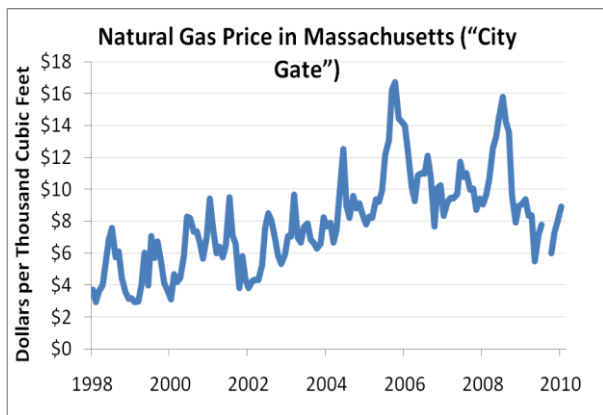
and literally. All of our fossil-based energy sources — oil, natural gas, and coal — are derived from other regions of the country (e.g., the Gulf Coast or Western states) and other parts of the world, many of them unstable or hostile to the United States, (e.g., countries in the Middle East and Venezuela). Thus, all spending on fossil fuel energy — whether to fuel power plants, buildings, or vehicles — flows out of state and fails to provide income to in-state businesses or employees. This exported economic value is significant, totaling almost \$22 billion in 2008.<sup>1</sup> In 2008, an average Massachusetts household spent about \$5,200 for energy costs, of which about \$1,700 was for heating (space and water), \$1,300 for electricity, and \$2,200 for gasoline. Almost all of these expenditures leave Massachusetts.



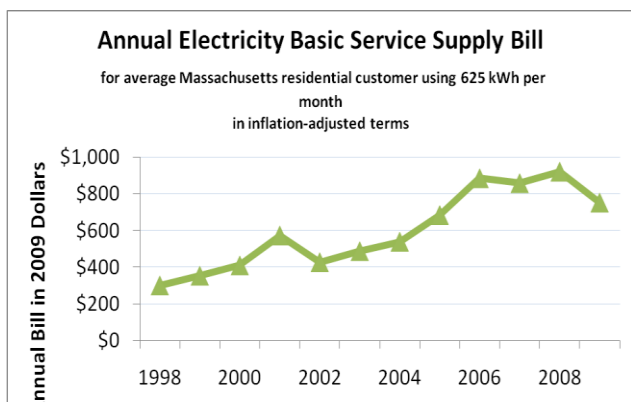
**Energy Costs and Volatility:** In addition to the economic drain represented by Massachusetts dollars flowing out of the state for energy resources, energy consumers have experienced wild price swings and long term energy price increases. The figures below show both steadily increasing and volatile prices for natural gas, electricity and gasoline.

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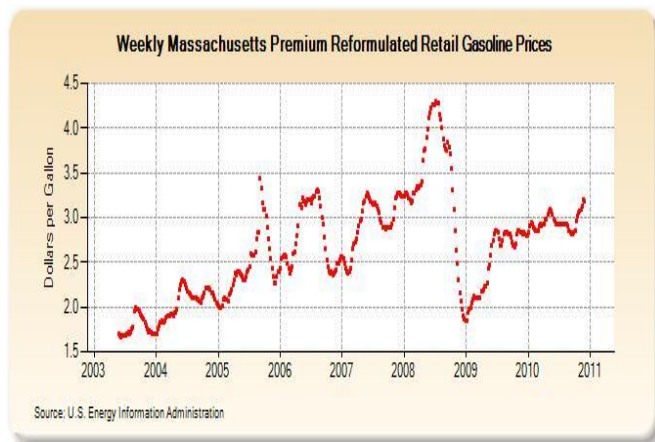
<sup>1</sup> Energy Price and Expenditure Estimates by Source, Selected Years, 1970-2008, Massachusetts, U.S. Energy Information Administration (EIA).  
[www.eia.doe.gov/states/sep\\_prices/total/pdf/pr\\_ma.pdf](http://www.eia.doe.gov/states/sep_prices/total/pdf/pr_ma.pdf)



**Figure ES-1. Increase and volatility in natural gas prices (source: DOER)**



**Figure ES-2. Increase and volatility in electricity prices (source: DOER)**



**Figure ES-3. Increase and volatility in gasoline prices (source: U.S. Energy Information Administration (EIA))**

**Economic Opportunity:** Along with the rest of the nation, Massachusetts is coming out of the most severe recession in half a century. In the transition to a clean energy economy, Massachusetts has many resources to bring to bear — and should be the disproportionate beneficiary as the economy becomes cleaner and greener. Clean Edge, Inc., has found that Massachusetts is the leading state on the East Coast for clean energy innovation, investment, deployment, and jobs.<sup>2</sup>

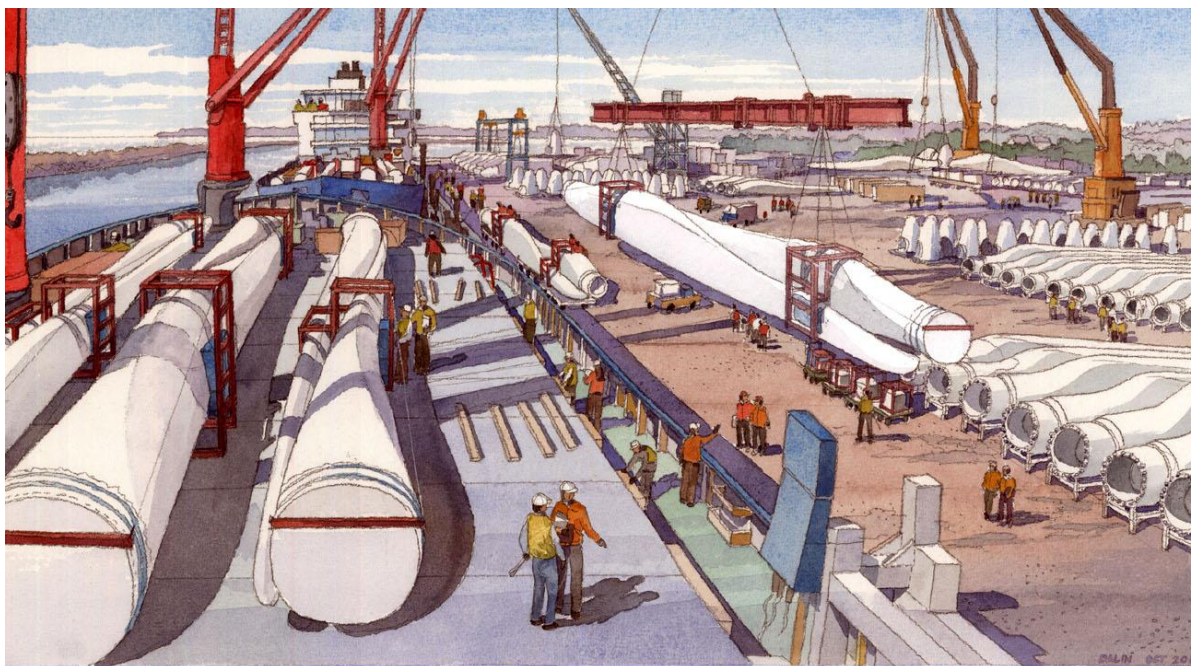
Massachusetts already has a core of companies and jobs in clean energy, and this industry has been growing even during challenging economic times. According to a Massachusetts Clean Energy Center (MassCEC) survey of 471 local companies, more than 11,000 people are employed in clean energy at the end of 2010, up 65 percent since 2007. Some 3,500 people are employed in manufacturing of energy efficiency products, with growth of 20 percent since 2007, and the fastest growth (67 percent) in energy storage, represented by such companies as A123 Systems, Inc., Beacon Power Corp., and Premium Power Corp.

Policies in this Plan will result in large reductions in fossil fuel use in buildings, electricity generation, and transportation. These include energy efficiency programs, advanced building codes, requirements for increased renewable electricity generation, federal vehicle efficiency standards, state incentives for purchasing more efficient vehicles, incentives to reduce vehicle miles traveled, and “smart growth” policies. Through both direct and indirect impacts, these policies will create an estimated 42,000 to 48,000 jobs in Massachusetts in 2020.

<sup>2</sup> A Future of Innovation and Growth: Advancing Massachusetts’ Clean Energy Leadership, Clean Edge, April 2010, Massachusetts Clean Energy Center.

<b>Table ES-1: Approximate Massachusetts job increases, direct and indirect, in 2020 due to Implementation of the Massachusetts Clean Energy and Climate Plan</b>	
Federal and California vehicle efficiency and GHG standards	6,000
Federal emissions and fuel efficiency standards for medium and heavy duty vehicles	1,000
Pay As You Drive auto insurance (PAYD)	3,000
Clean car consumer incentives	2,000
Smart growth policy package	1,000
subtotal — transportation	13,000
Electric efficiency programs	10,000
Natural gas, heating oil efficiency programs	9,000
Advanced building energy codes	3,000
Federal appliance & product standards	1,000
subtotal — buildings efficiency	23,000
Renewables (solar, wind, biomass, biofuels)	6,000 - 12,000 <sup>3</sup>
<b>Total</b>	<b>42,000 - 48,000</b>

*Note: see the methodological appendix for sources and description of how the employment gains were estimated.*



**Artist's rendering of proposed New Bedford Marine Commerce Terminal, staging area for offshore wind installation. (Courtesy of MassCEC)**

<sup>3</sup> The figure for renewables is given as a range, because most of the value added for renewables is in manufacturing, and the degree to which renewable components will be manufactured in the Commonwealth is fluid at this time, as is the degree to which the state's 2020 renewable energy requirements will be met from in-state sources.

**Climate Change:** The international consensus on climate released in 2007 by the Intergovernmental Panel on Climate Change (IPCC) found that the “warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.”<sup>4</sup>

Massachusetts is vulnerable to severe impacts from climate change. Impacts are expected to include increased coastal flooding from intense storms and permanent inundation of low-lying coastal areas; infrastructure and development located along the coast affected by storm surges, sea level rise, and saltwater intrusion; degraded water quality and quantity, habitat loss, and increased sedimentation and pollution of waterways due to changes in precipitation; increased number of extreme heat days, impacting those with respiratory and cardiovascular conditions; habitat for commercially important fish and shellfish species, such as cod and lobster, shifted northward; and for recreation areas, decreased average ski and snowboard seasons and increased need for artificial snow making.

**Local and Regional Air Pollution:** In addition to causing climate change, emissions from the combustion of fossil fuels result in a range of negative human health and ecosystem impacts. The U.S. Environmental Protection Agency (EPA) has established health-based National Ambient Air Quality Standards (NAAQS) for six pervasive pollutants that have well-documented health and environmental impacts: ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter (PM), lead, and carbon monoxide (CO<sub>2</sub>). Exposure

to each of these pollutants has been linked to adverse health effects. Ozone can also irritate the respiratory system, causing coughing, throat irritation, chest pain and reduced lung function. Ozone can also aggravate asthma, leading to more asthma attacks and increased hospital admissions and emergency room visits for respiratory problems. Fine PM is associated with aggravation of respiratory and cardiovascular disease resulting in increased hospital admissions, emergency room visits and premature mortality.

These pollutants also damage ecosystems. Acid rain is created when SO<sub>2</sub> and NO<sub>x</sub> emissions mix with water in the atmosphere. Acid rain lowers the pH levels of lakes, rivers, and soils, harming fish and invertebrates. Exposure to ozone is associated with a range of adverse impacts to vegetation, including impairment of tree growth and loss of agricultural crop yield. Ozone can increase the rate of water loss by trees causing forests to drain streams and soils of water, thus stressing natural ecosystems beyond the trees themselves.

### **Meeting Challenges, Seizing**

**Opportunities:** At roughly 2 percent of the U.S. economy and 1.3 percent of the nation’s GHG emissions, Massachusetts could not, on its own, stop global climate change even if it reduced statewide emissions to zero instantly. However, Massachusetts is in a position to show the way to a clean energy economy — and reap direct benefits in economic growth — through the development of smart, targeted policies that reduce emissions by promoting greater energy efficiency, developing renewable energy, and encouraging other alternatives to the combustion of fossil fuels. In the process, Massachusetts will also start to get off the fossil fuel rollercoaster, become more energy independent, and jump start its economy with new technologies, new companies, and new jobs.

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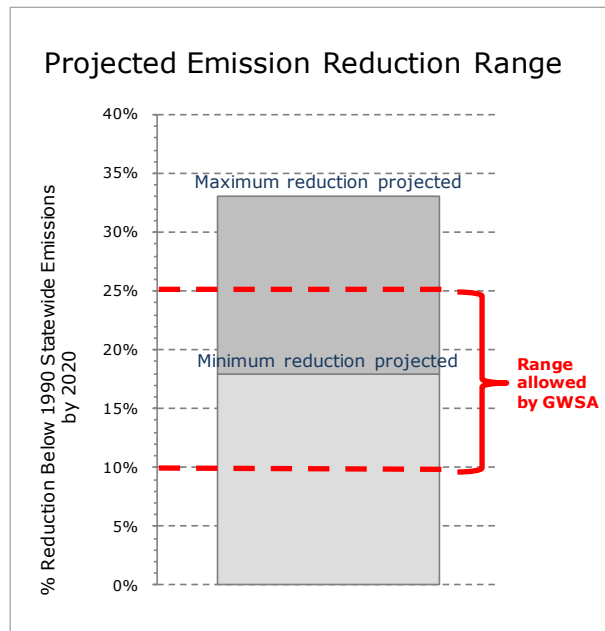
<sup>4</sup> 4<sup>th</sup> Assessment Report, Intergovernmental Panel on Climate Change, 2007.

The *Massachusetts Clean Energy and Climate Plan for 2020* will put Massachusetts on a path to meeting its statutory obligation to reduce GHG emissions, and on the road to a vibrant clean energy economy.

## Setting the 2020 Emissions Limit

The statewide GHG emissions limit set for 2020 was based on two years of analysis and public comment, and followed a process to determine the baseline Massachusetts 1990 emissions level and the predicted "Business as Usual" (BAU) emissions trajectory for 2020. The trend line of GHG emissions was found to be relatively stable since 1990 and projected as remaining relatively stable through 2020. Policies and programs implemented or initiated since the beginning of the Patrick-Murray Administration in 2007 — including the Green Communities Act and various state government executive actions, and federal government actions — are projected to result in GHG emissions reduction of roughly 18 percent — roughly the midpoint of the 10 percent to 25 percent range required by the GWSA.

Further analysis showed that it would be technically feasible to reduce emissions by up to 35 percent below 1990 levels by 2020 with additional policies that are cost-effective. In a series of eight public hearings held in June 2010, as required by the Act, nearly 200 individuals and organizations provided oral or written comment on the 2020 emissions reduction requirement and on policy measures to meet the requirement. The vast majority of commenters called for the Secretary to set the GHG limit at 25 percent below 1990 levels, the maximum allowed under the statute. The Secretary of EEA then directed state technical teams to conduct in-depth analyses of measures that satisfy criteria of cost-effectiveness and reducing GHG emissions.

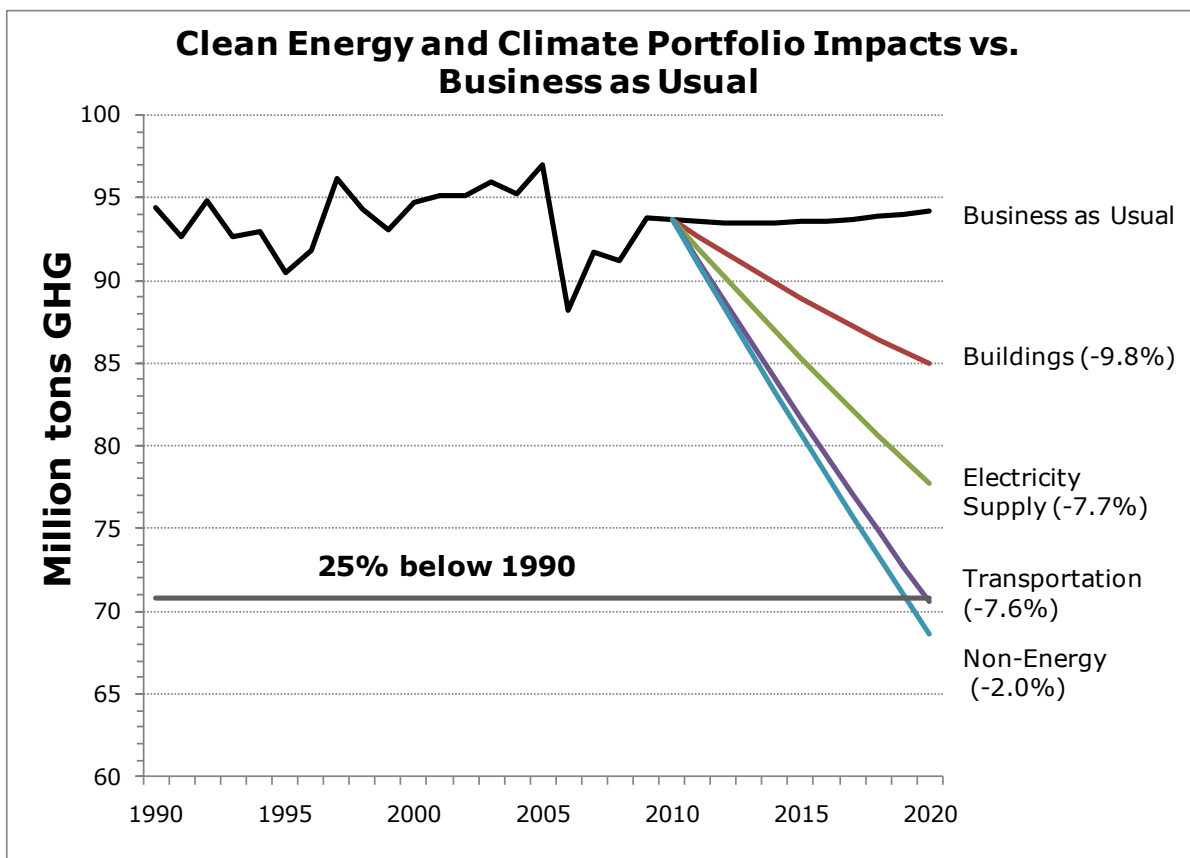


**Figure ES-4. Projected emission reduction range below 1990 by 2020. The range results from uncertainties in Business as Usual (BAU) emissions, policy designs, and impacts of individual policies.**

Table ES-2 (on page ES-6) displays the portfolio of policies incorporated in this *Clean Energy and Climate Plan for 2020*, and the associated potential contribution to GHG reduction below 1990 levels by 2020 for each policy. In aggregate, these policies, which include measures put in place since 2007 and new initiatives proposed in this Plan, are projected to achieve emissions reductions in the range of 18 percent to 33 percent by 2020 (see Figure ES-4). The lower end of this range represents a scenario in which Business as Usual (BAU) emissions are higher than projected and actual emissions reduction from the policies as implemented is at the low end of estimates. The higher end of the range represents a scenario in which BAU emissions are lower than projected and implementation success is relatively high. A mid-range estimate for the portfolio of policies results in GHG emissions approximately 27 percent below 1990 levels by 2020 (See Figure ES-5 on page ES-7).

<b>Table ES-2. The Portfolio of Policies</b>	<b>middle estimate % reduction below 1990</b>
<b>Buildings</b>	<b>9.8%</b>
All cost-effective energy efficiency/RGGI	7.1%
Advanced building energy codes	1.6%
Building energy rating and labeling	---
"Deep" energy efficiency improvements for buildings	0.2%
Expanding energy efficiency programs to C/I heating oil	0.1%
Developing a mature market for solar thermal water/space heating	0.1%
Tree retention and planting to reduce heating and cooling loads	0.1%
Federal appliance and product standards	0.6%
<b>Electricity</b>	<b>7.7%</b>
Expanded Renewable Portfolio Standard (RPS)	1.2%
More stringent EPA power plant rules	1.2%
Clean energy imports	5.4%
Clean energy performance standard (CPS)	---
<b>Transportation</b>	<b>7.6%</b>
Federal and California vehicle efficiency and GHG standards	2.6%
Federal emissions and fuel efficiency standards for medium and heavy duty vehicles	0.3%
Federal renewable fuel standard and regional low carbon fuel standard	1.6%
Clean car consumer incentives	0.5%
Pay As You Drive (PAYD) auto insurance (pilot program, possible expansion later)	1.1%
Sustainable Development Principles	0.1%
GreenDOT	1.2%
Smart growth policy package	0.4%
<b>Non-Energy Emissions</b>	<b>2.0%</b>
Reducing GHG emissions from motor vehicle air conditioning	0.3%
Stationary equipment refrigerant management	1.3%
Reducing SF <sub>6</sub> emissions from gas-insulated switchgear	0.2%
Reducing GHG emissions from plastics	0.3%
<b>Cross-cutting Policies</b>	---
MEPA GHG policy and protocol	---
Leading by Example	---
Green Communities Division	---
Consideration of GHG emissions in State permitting, licensing and administrative approvals	---
<b>Overall reductions versus 1990 (adjusted for uncertainty in Business as Usual (BAU) emissions, policy designs, and impacts of individual policies)</b>	
High BAU emissions and low policy impacts	<b>18%</b>
Middle BAU emissions and policy impacts	<b>27%</b>
Low BAU emissions and high policy impacts	<b>33%</b>

Note: the overall reduction is adjusted for overlap among policies, so is smaller than the sum of the individual policies. Individual lines may not sum to subtotals due to rounding.



**Figure ES-5. Emissions reductions by sector for the portfolio of policies, at the mid-range estimate of 27 percent below 1990 levels by 2020.**

Based on these analyses, input from the Climate Protection and Green Economy Advisory Committee created by the GWSA, and full consideration of the public comments received, EEA determined that a responsible and achievable GHG emissions reduction limit for 2020 that maximizes opportunities to realize energy cost savings, increase energy independence, and promote growth in clean energy jobs in Massachusetts is 25 percent. The limit is at the high end of the range for 2020 authorized by GWSA, but the middle of the range of possible outcomes for the policies incorporated in this Plan.

## An Integrated Portfolio of Policies

The GWSA provides broad authority to choose policy tools — from targeted and technology-specific policies to economy-wide and market-based mechanisms — to advance a clean energy economy while reducing GHG emissions. An integrated portfolio approach plays to Massachusetts strengths and, taken as a whole, has the greatest likelihood of reaching the goals of addressing energy costs, energy security and independence, and reducing GHG emissions.

In the last four years, Massachusetts has demonstrated the effectiveness of a portfolio approach. A combination of legislation, executive action and private sector entrepreneurship has aligned incentives and created opportunities for clean energy growth and GHG reductions.

The directive from the Secretary was to build on this portfolio — expanding existing programs where practical and developing



new complementary policies that could accelerate clean energy growth and lower GHG emissions. Each of the policies presented in this Plan — GHG reductions; cost-effectiveness; lowering energy costs for consumers and businesses; job growth; equity; implementability; and co-benefits — underwent rigorous analysis focusing on criteria established by the Act and input from the public hearings and Advisory Committee. Some policies can be put in place immediately; others will be tested first through pilot programs. Not every one of these policies must be implemented to its fullest extent in order to achieve the 2020 mandate. But these represent the suite of policies that the Patrick-Murray Administration is committed to pursuing over the next four years as we build on the foundation created in the past four years and work toward the 2020 emissions limit set by the Secretary.

This portfolio is divided into five categories: buildings, electricity supply, transportation, non-energy emissions, and cross-cutting policies.

## **BUILDINGS**

### **9.8 PERCENT REDUCTION OF GHG EMISSIONS**

Buildings consume over 50 percent of the energy used in Massachusetts and are therefore responsible for the greatest GHG emissions of any sector. Energy use in buildings comes from these two primary areas: 1) fuels for heating — primarily natural gas and heating oil, and 2) electricity for air conditioning, lighting, ventilation, appliances and equipment. The *Clean Energy and Climate Plan for 2020* takes into account Massachusetts nation-leading energy efficiency efforts mandated by the Green Communities Act (GCA) of 2008, which will produce substantial GHG reductions for 2020, and proposes additional measures that will contribute toward meeting the 2020 limit. This category is expected to yield GHG reductions of 9.8 percent.

- **All Cost-Effective Energy Efficiency**

- Existing Policy

- With the Governor’s signing of the GCA of 2008, Massachusetts embarked on a path to greatly increase investments in and return on investments from building energy improvements. From 2010 to 2012—the first three year plan approved by the Department of Public Utilities (DPU) under the GCA mandate to capture all cost-effective energy efficiency opportunities — the state will invest over \$2 billion, with an anticipated return of over \$6 billion in savings for customers, and creation of thousands of clean energy jobs that cannot be outsourced overseas.

- **Advanced Building Energy Codes**

- Expanded Policy

- Massachusetts has adopted a pathway to greater energy efficiency in building codes through a commitment in the GCA to adopt the latest IECC, as well as by creating a local-option “stretch” code that has been adopted by over 60 municipalities. This policy would complete the transition to performance-based codes by 2020 that go beyond the IECC code in terms of efficiency while reducing their complexity, giving developers flexibility and clear performance targets and creating “green” jobs.

- **Building Energy Rating and Labeling**

- New Policy

- The real estate market currently operates without explicit consideration of energy efficiency. This policy would address this market failure by introducing an energy rating program designed to facilitate “apples-to-apples” comparisons between buildings. Initially in a pilot form, this would be the buildings equivalent of the EPA miles-per-gallon (MPG) rating on cars and light trucks.

- **“Deep” Energy Efficiency Improvements for Buildings** New Policy  
To reach our 2050 GHG reduction requirement, energy use in existing buildings must fall dramatically. To accomplish this, it is necessary to begin retrofitting buildings with much higher levels of insulation, less air leakage, and better windows than are typically installed in the retrofit energy efficiency programs. This policy, begun with pilots with utilities, would make rebates and appropriate training and technical support widely available for “deeper” energy improvements for residential buildings.
- **Expanding Efficiency Programs to Commercial/Industrial Heating Oil** New Policy  
Currently, electric utility programs provide funding for heating-related efficiency measures in homes that use oil heat but not for commercial and industrial buildings that use fuel oil for heating. Expanding the programs to such customers would yield significant cuts in energy use and GHG emissions.
- **Developing a Market for Solar Thermal Water and Space Heating** New Policy  
A policy framework will be established to develop a mature and self-sustaining market for solar thermal water and space heating in both residential and commercial buildings as part of a broader effort to support renewable heating technologies (such as clean biomass heating and efficient heat pumps) for low-grade heating needs and spur job and business growth in renewable thermal.
- **Tree Retention and Planting to Reduce Heating and Cooling Loads** New Policy  
Trees help to reduce heating and cooling loads in buildings. This policy would provide incentives to plant new trees around

existing housing, and retain trees within new housing developments. This pilot program might be feasible within current utility efficiency programs, or might require new funding and/or regulatory authority.

- **Federal Appliance and Product Standards** Existing Policy  
The federal government sets energy efficiency standards for appliances, electronics, and other products. Under President Obama, the DOE has planned an accelerated schedule for setting new standards between 2009 and 2013. Nationwide these are expected to yield major savings in electricity (11.5 percent of total consumption in 2020), fuel, costs to homeowners and businesses, and carbon dioxide emissions, with Massachusetts getting its proportional share.

## ELECTRICITY SUPPLY

### 7.7 PERCENT REDUCTION OF GHG EMISSIONS

The vast majority of existing power plants burn fossil fuels to generate electricity, producing millions of tons of pollution. Non-fossil fuel electricity generation technologies include nuclear, hydro, wind, solar, and eligible biomass and anaerobic digestion, which vary in their emissions profiles. The character of the electric power sector as a whole is determined by three key factors: the demand for electricity overall, existing generation capacity by technology type, and how much of each type of existing capacity is utilized to meet demand. The *Clean Energy and Climate Plan for 2020* relies on progress in each of these areas made since 2007, along with proposed new measures to move toward a cleaner electricity supply.

- **Renewable and Alternative Portfolio Standards (RPS, APS)** Existing Policy  
The RPS was created as part of electricity restructuring in Massachusetts in 1997 and then expanded in the GCA. The

Portfolio Standards require retail electricity suppliers—both distribution companies and other retail suppliers—to buy a growing percentage of their electricity sales from eligible resources. The RPS classes I and II will require 22 percent of electricity supply to be from new and existing renewable sources by 2020, with an additional 5 percent from other eligible sources under the APS.

- **Regional Greenhouse Gas Initiative (RGGI)** Existing Policy

Massachusetts is one of the 10 Northeast and Mid-Atlantic states participating in a regional effort to limit carbon dioxide emissions from electric generating units. The program, which began in January of 2009, establishes a region-wide cap on CO<sub>2</sub> emissions from fossil fuel-fired power plants that will remain at the initial level for six years then decrease 2.5 percent per year for the next four years, for a total reduction of 10 percent by 2018. Allowances are made available for purchase in quarterly auctions. Massachusetts is investing over 80 percent of its auction proceeds in energy efficiency, with smaller amounts for renewable energy and other consumer benefit programs.

- **More Stringent EPA Power Plant Rules** New Policy

The EPA is in the midst of proposing and implementing a variety of regulations that will affect allowable water and air emissions of the nation's power plant fleet. The owners of some older, smaller power plants may find it is not economical to retrofit their plants to meet EPA's new regulations, and will instead choose to shut down the plants. In Massachusetts, The Somerset Power Station last ran in January 2010, and its permits will eventually expire if it is not restarted, and the owner of the Salem Harbor Station has indicated that it expects the plant to close within five years.

- **Clean Energy Imports** Expanded Policy

Canada has substantial hydro-electric resources, which have very low emissions, and are available at relatively low cost and with no need for renewable energy subsidies (see RPS above). A new transmission line being developed by two Massachusetts utilities, NSTAR and Northeast Utilities Service Co., in partnership with Hydro Quebec (HQ) and with the support of the Patrick-Murray Administration would tap more of these resources. When this power line is completed, at HQ's expense, it will bring to New England enough clean power to serve up to 15 percent of Massachusetts present electricity demand. Additional transmission lines may also be possible.

- **Clean Energy Performance Standard (CPS)** New Policy

A market-based framework is needed to provide a clear signal to the electricity market to improve upon the cleaner energy portfolios of the last few years. One approach to be considered is a CPS, which would require electricity suppliers to favor lower- and no-emissions sources in the mix of electricity delivered to their customers.

## TRANSPORTATION

### 7.6 PERCENT GHG EMISSION REDUCTION

Transportation is second only to buildings in responsibility for GHG emissions in Massachusetts. The *Clean Energy and Climate Plan for 2020* takes into account state and federal measures to improve vehicle efficiency, reduce vehicle miles traveled (VMT), and increase use of lower-carbon fuels; and proposes additional measures that will contribute toward meeting the 2020 limit.

- **Federal and California Light Vehicle Efficiency and GHG Standards**

Existing Policy

The EPA and the National Highway Traffic

Safety Administration (NHTSA) have set harmonized standards for light-duty MPG and GHG emissions; raising the fuel efficiency standard from 27.5 MPG at present to 35.5 MPG for model year 2016. California is expected to propose stricter standards for model year 2017-2020 vehicles, and Massachusetts law requires the Commonwealth to adopt the California standards. In combination, the federal and California standards are forecasted to yield a 17 percent reduction in GHG emissions in 2020 (primarily from lower gasoline consumption, but also some reduced emissions from vehicle air conditioning systems).

- **Federal GHG Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles** Existing Policy

The EPA and the U.S. Department of Transportation (DOT) have announced complementary programs to reduce GHG emissions and improve fuel efficiency, for medium- and heavy-duty vehicles, such as the largest pickup trucks and vans, combination tractors (semis), and all types and sizes of work trucks and buses for model years 2014-2018.

- **Federal Renewable Fuel Standard and Regional Low Carbon Fuel Standard (LCFS)** Existing Policy

Title II of the federal Energy Independence and Security Act of 2007 creates a “renewable fuel standard,” which requires an increase in the volume of renewable fuels used in the U.S. Massachusetts biofuels law, passed in 2008, instructs the state to pursue development of a LCFS on a regional basis throughout the Northeast. The LCFS (first developed by California) would require that the average carbon intensity of vehicle fuels falls by a specific percentage compared to petroleum fuels.

- **Clean Car Consumer Incentives** New Policy

There are various means by which the Commonwealth could provide incentives

for consumers to shift their vehicle purchases to more fuel-efficient (or lower GHG) models. This includes varying the rates on new car sales taxes, annual auto excise (property) taxes, and registration fees, with rates raised on low-MPG vehicles and reduced on high-MPG ones. The change could be designed to be revenue-neutral to consumers as a whole and to the state. EEA and MassDOT will conduct a study to examine critical implementation challenges and possible regulatory or legislative paths for this policy.

- **Pay As You Drive (PAYD) Auto Insurance Pilot** New Policy

PAYD would convert a large fixed annual premium into a variable cost based on miles traveled, creating a major incentive to reduce discretionary driving, while cutting the overall cost of insurance due to fewer accidents. Miles driven would fall substantially, along with CO<sub>2</sub> emissions and costs for gasoline, accidents, and congestion. The Commonwealth plans to conduct a PAYD pilot program initially, and, depending on results, work with the insurance industry to make this payment method more widely available.

- **Sustainable Development Principles** Existing Policy

In 2007, the Patrick-Murray Administration updated the Massachusetts *Sustainable Development Principles*. Making state investments consistent with the *Principles* increases the amount of growth that takes place in locations and densities that reduce VMT and GHG emissions and have other clean energy benefits.

- **GreenDOT** New Policy

GreenDOT is MassDOT’s sustainability initiative, announced through a Policy Directive by the Secretary of Transportation in June 2010. GreenDOT is focused on three related goals: reducing GHG emissions; promoting the healthy

transportation modes of walking, bicycling, and public transit; and supporting smart growth development.

- **Smart Growth Policy Package**

- **Expanded Policy**

- Additional “smart growth” would make it easier for households and businesses to decrease the number and distance of vehicle trips, reducing VMT and related emissions. Massachusetts already has several policies promoting smart growth, but new, complementary policies are necessary to achieve our smart growth targets. Such policies would focus on influencing infrastructure investments by state agencies and planning decisions made by local governments.

## NON-ENERGY EMISSIONS

### 2.0 PERCENT GHG EMISSIONS REDUCTION

Greenhouse gas emissions not related to energy use represent a small but important part of statewide GHG emissions. Although these sources currently represent only 7 percent of total emissions, many of the gases emitted by these processes have high global warming potential (GWP) — thousands of times greater than CO<sub>2</sub>. The *Massachusetts Clean Energy and Climate Plan for 2020* addresses a number of non-energy sources of GHG emissions.

- **Reducing GHG Emissions from Motor Vehicle Air Conditioning** New Policy

- Massachusetts law requires adoption of California’s emissions standards for new motor vehicles, and the California Air Resources Board (CARB) is developing regulations to reduce emissions associated with motor vehicle air conditioning (MVAC). CARB’s standard aims to minimize emissions by reducing direct GHG emissions from MVAC systems, by using low GWP refrigerants and reducing leaks, as well as improvement in the efficiency of the AC system (e.g., more efficient compressors, fans and motors; systems that avoid over-chilling and

reheating; and technologies to reduce heat gain in the passenger cabin).

- **Stationary Equipment Refrigerant Management** New Policy

- This policy aims to minimize emissions of high GWP refrigerants used in non-residential refrigerating equipment through: facility registration, leak detection and monitoring, leak repair, system retrofit and retirement, required service practices, recordkeeping and reporting, and eventual replacement with equipment using no-GWP or lower GWP substances, where such alternatives are available and practical. The policy would affect facilities with refrigeration units containing at least 50 pounds of refrigerant, beginning with a voluntary pilot program focused on leak detection and repair.

- **Reducing SF<sub>6</sub> Emissions from Gas-Insulated Switchgear**

- **New Policy**

- Through a pilot program, followed by possible regulatory action, this policy aims to minimize emissions of sulfur hexafluoride (SF<sub>6</sub>), a high GWP substance, from leakage of gas insulated switchgear (GIS) used in electricity transmission and distribution systems by setting limits on leakage rates and implementing best management practices for the recovery and handling of SF<sub>6</sub>.

- **Reducing GHG Emissions from Plastics** Expanded Policy

- Diverting plastics from the waste stream under this Plan will result in materials with a lower carbon content being combusted at Massachusetts’ municipal waste-to-energy facilities, reducing emissions of CO<sub>2</sub>.

## CROSS-CUTTING POLICIES

Several policies pursued under the *Clean Energy and Climate Plan for 2020* do not neatly fit in the categories of buildings, electricity supply, transportation or non-energy emissions, but involve state actions that drive clean energy adoption across all of these domains.

- **MEPA GHG Policy and Protocol**

Expanded Policy

MEPA requires that all major projects proposed in the Commonwealth that have state involvement (in the form of state permits, land transfers or financial assistance, for example) undertake an assessment of project impacts and alternatives in an effort to avoid, minimize and mitigate damage to the environment to the maximum extent feasible. Building on this general requirement, the MEPA GHG Policy requires that certain projects undergoing review by the MEPA office quantify their GHG emissions and identify measures to avoid, minimize, and mitigate such emissions.

- **Leading by Example** Expanded Policy

The Leading by Example (LBE) Program, established in April 2007 by Governor Patrick's Executive Order No. 484, works to lower costs and reduce environmental impacts at all Executive Branch agencies, public colleges and universities and quasi-public authorities. The program oversees efforts to reduce energy use by the state's buildings and vehicles, expand recycling programs, cut water consumption, promote green procurement, facilitate the

construction of high performance state buildings, and reduce carbon emissions across state government. In addition, the Administration has proposed creation of a Commonwealth Energy Solutions program charged with managing and purchasing low-cost, clean energy across all public agencies, authorities, and facilities — providing an integrated strategy for energy procurement that capitalizes on economies of scale.

- **Green Communities Division**

Existing Policy

Created by the GCA, the Green Communities Division of the Department of Energy Resources (DOER) helps municipalities become more sustainable, control rising energy costs, and incubate the clean energy technologies and practices. Envisioned as a way to encourage municipalities to make greener energy decisions, the Division offer assistance to municipalities in order to be designated as "Green Communities" and qualify for grant funding.

- **Consideration of GHG Emissions in State Permitting, Licensing and Administrative Approvals** New Policy

The Global Warming Solutions Act requires all state agencies, departments, boards, commissions and authorities to consider climate change impacts, such as GHG emissions, when they issue permits, licenses and other administrative approvals in the context of environmental review. EEA, in collaboration with other state and quasi-public agencies, will develop a plan to implement this requirement in selected agency actions.

## The Road to 80 Percent Lower Emissions in 2050

The clean energy economy of 2050 will be very different than the fossil-fuel dominated economy of today. With many of the policies embodied in this Plan in place, 2050 would find a Massachusetts where energy costs are less volatile and comprise a smaller part of budgets. Businesses, households, municipalities and institutions are better able to manage their energy needs. Renewable and alternative sources of energy have largely displaced fossil-based sources, and a smart grid and advanced storage technologies release to the grid as needed electricity generated during the night by massive wind farms off the coast of the Northeast. Both small and large-scale solar installations are ubiquitous across the state. National security has been strengthened by an economy driven by homegrown sources of energy that no longer depend on fossil fuel from unstable regions or countries that do not share the interests of the U.S.

By 2050, the clean energy cluster in Massachusetts has matured, much as the biotechnology and health care sectors matured in the early part of the 21st century. Massachusetts plays a major role in the global market for technologies in offshore wind, solar PV and thermal, electricity storage and energy management. Massachusetts architects and engineers are leaders internationally in green building design and building energy management. Massachusetts companies that pioneered battery technology have robust partnerships with American, European, Indian and Chinese car and truck manufacturers.

And by law, in 2050, GHG emissions are 80 percent lower than in 1990 and the air cleaner.

Getting to this clean energy future will require significant innovation in policy, technology and business practices over the

next 40 years. Unlike the 2020 limit, which can be met with actions that we take here in Massachusetts, reaching 80 percent reductions below 1990 emission levels, as required by the Global Warming Solutions Act, will mean broad changes that are beyond the reach of Massachusetts alone. Between 2010 and 2050, much will change — in the economy, in federal regulation, and in technology — that will make possible GHG emission reductions that would be unthinkable today. But in imagining — and planning for — a path to the mandated GHG emissions reduction of 80 percent in 2050, it is important to ask now: How do we get there?

The *Clean Energy and Climate Plan for 2020* describes two scenarios — one based on maximum energy conservation, the other on widespread switching from fossil fuels to electricity for transportation, buildings, and industry, powered by an extremely clean electricity supply. While there are differences between the two scenarios — the former allows marginally greater use of conventional fuels for meeting the remaining energy needs after fundamental efficiency improvements, while the latter allows for marginally greater energy utilization, as long as the source is clean — but there is more that they have in common. Both require dramatic reductions in energy use to meet heating, cooling, lighting, transportation, and production needs, and both require dramatic shifts in where the energy we use comes from.

Although it could not, by itself, get Massachusetts to the mandated 2050 emissions levels, the Plan contains a number of policies that produce modest emissions reductions for 2020 but, if put in place under the Plan for 2020, will make substantial contributions to meeting the 2050 requirement. These include advanced

building codes and building energy rating and labeling, since building stock turns over slowly. The same is true for smart growth, which will take many years to reap emissions dividends in changed transportation patterns. Also vital will be reducing the carbon content of vehicle fuels through a low carbon fuel standard, which will require the development and widespread commercialization of advanced, truly low-carbon biofuels that are not yet in the marketplace, and/or the near universal installation of fueling infrastructure for electric vehicles, which will take time.

## Conclusion

Developed under the authority of the GWSA of 2008, the Commonwealth's *Clean Energy and Climate Plan for 2020* provides the means for meeting the Secretary's GHG emissions reduction requirement of 25 percent in 2020, putting the Commonwealth on track toward the GWSA's mandate of 80 percent reduction in 2050 — and accelerating the development of a clean energy economy for Massachusetts.

As this Plan is implemented, homeowners and businesses will discover new ways to save money on energy costs, make living and work spaces more comfortable, and make production processes cleaner and more efficient. The air we breathe will be cleaner, and we will be less dependent on energy from unstable parts of the world. Above all, we will be putting Massachusetts in a leadership position in the clean energy economy of the future.

Capitalizing on the state's advantages in academic resources, venture capital, and skilled resources, the measures advanced in this Plan will give rise to technological

innovation and commercialization, company formation, and job creation up and down the skill ladder. There will be clean energy jobs for scientists and engineers, construction workers and insulation installers, as Massachusetts develops the products and services not only needed here, but across the country and around the world. There will be opportunities for those displaced by economic change to retool for a new industry, and for those long disadvantaged in the mainstream economy to find a new point of entry.

Clean energy is an industry of the future, but for Massachusetts, the future is now.



**Deep retrofit with super-insulation.**  
(source: DOER)