



# FACTS

## MASSACHUSETTS

A M E R I C A N S E C U R I T Y P R O J E C T

## Pay Now, Pay Later: Massachusetts

"100-year" floods, the sort that led the president to declare Massachusetts a disaster area in the spring of 2010, may hit Boston every two or three years by mid-century, under lower or higher greenhouse gas emissions scenarios.<sup>1</sup>

Massachusetts' commercial seafood industry, one of the biggest in the country—its payroll is \$509 million annually—is in grave danger from warming waters.<sup>2</sup>

Alternative energy research, development, and manufacturing can yield benefits for Massachusetts. If 50,000 MW of new wind energy is created nationally, Massachusetts could see over a billion dollars and 3,200 jobs in investments and wind turbine manufacturing, respectively.<sup>3</sup>

According to a new study, a failure to mitigate the effects of climate change could begin to cause serious gross domestic product and job losses within the next several decades. Between 2010 and 2050, it could cost Massachusetts \$9 billion in GDP and nearly 38,000 jobs.\*

*\*GDP numbers are based on a 0% discount rate. Job losses are measured in labor years, or entire years of fulltime employment. Backus, George et al., "Assessing the Near-Term Risk of Climate Uncertainty: Interdependencies among the U.S. States," Sandia Report (Sandia National Laboratories, May 2010), 141. [https://cfwebprod.sandia.gov/cfdocs/CCIM/docs/Climate\\_Risk\\_Assessment.pdf](https://cfwebprod.sandia.gov/cfdocs/CCIM/docs/Climate_Risk_Assessment.pdf) (accessed March 23, 2011).*

Admittedly, the effects of climate change, a complex and intricate phenomenon, are difficult to predict with precision. Informed scientific and economic projections, as we have used in our research, however, allow us to see that Massachusetts faces significant losses crucial to its economy if no action is taken.

Moreover, data shows Massachusetts is poised to benefit from the research, development, and distribution of renewable energy technologies. Massachusetts could become a world leader in renewable energy technology research and development. Indeed, science and technology development is already a major part of Massachusetts' economy due to the concentration of world-renowned universities, hospitals, financial institutes, and high-tech industries in the state. Yet much of this

industry is still in its earliest stages, and a greater level of investment and numbers of incentives is needed to secure its place in the state's economy. Should we fail to take continued action against climate change, Massachusetts has much to lose.

## Pay Later: The Cost of Inaction

**Average temperatures in Massachusetts have risen more than 1.5°F since 1970. Winters are warming most quickly, with an increase of nearly 4°F occurring between 1970 and 2000.**<sup>4</sup> Average temperatures in the Northeast are expected to rise 8-12°F above historic levels in winter and 6-14°F in summer by late century under a high-emissions scenario,

causing Boston's climate to possibly feel like that of Memphis, Tennessee.<sup>5</sup> Massachusetts' cities can, furthermore, expect to see many more days over 100°F.<sup>6</sup> Winter precipitation in the Northeast is projected to increase by 20-30%, with more rain than snow.

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Global sea levels are projected to rise 10-24 inches by 2100 under a high-emissions scenario and 7-14 inches under a lower-emissions scenario.<sup>7</sup> Massachusetts' densely populated coastal region—home to one third of the state's population<sup>8</sup>—could see intensified coastal flooding and property damage. Major insurers have already refused to cover thousands of homeowners in the region.<sup>9</sup> Estuaries and saltwater marshes—known as the nurseries of the sea due to their place in the marine food chain as a habitat for important commercial fish and other creatures, and as critical feeding grounds for migrating birds—will

be especially vulnerable to the rise in sea level.<sup>10</sup> Heavy rains and flooding, which caused significant damage in 2006, 2007, and 2010, are expected to increase under either emissions scenario.<sup>11</sup>

## A Bay State Identity under Threat

**Rising water temperatures alter ocean habitats. Temperature affects, among other things, where sea creatures are able to live. In 2008, the state's cod industry was worth \$24 million.**<sup>12</sup> Water temperatures are already at the top of the cod's preferred range,<sup>13</sup> however, and further climate change may help to eliminate cod as a viable enterprise in Massachusetts by the end of the century. The sea scallop population, presently the most valuable fishery in Massachusetts with a 2008 value of more than \$190 million,<sup>14</sup> is also potentially threatened. Carbon dioxide (CO<sub>2</sub>), the primary greenhouse gas causing climate change, is absorbed by seawater; higher concentrations of CO<sub>2</sub> in the water can produce thinner scallops<sup>15</sup> and could devastate the industry.

The lobster industry in Massachusetts was worth \$44 million in 2008.<sup>16</sup> However, the southern New England lobster stock, which includes Cape Cod, is now critically depleted and may not recover.<sup>17</sup> Since 1999, the region has experienced, throughout inshore waters, a widespread increase in water temperatures above 68°F, both in terms of area affected and duration of the effect. Lobsters are susceptible to changes in temperature throughout their life cycle, and higher temperatures can reduce their numbers and their accessibility to fishermen as they move to deeper, cooler waters farther from shore.<sup>18</sup> If no action is taken to reduce emissions and lower the rate of warming, lobstering, as well

as cod fishing, both part of the Bay State's culture and economy, could become a thing of its past. If Massachusetts loses its cod and lobster industries, the annual economic loss could be more than twice the losses from the recent flooding caused by heavy spring rains.

## Losses on the Coast

**The coast of Massachusetts is home to one third of the state's total population,**<sup>19</sup> contributes about 37% of the gross state product annually,<sup>20</sup> and employs more than 1 in 3 people.<sup>21</sup> **Based on current rates of sea level rise, more than 5% of coastal communities in Massachusetts, such as Gloucester and Marshfield, will be underwater by the end of this century. Storm surges are expected to cost the Boston metro area \$20-96 billion over the next 100 years.**<sup>22</sup> Massachusetts' coastal economy is vitally important to the state, and may be profoundly affected by the consequences of climate change if nothing is done.

### Massachusetts Labor Force Projected to be Directly Affected



Source: Bureau of Economic Analysis<sup>23</sup>

## Costs to Recreation

**Coastal recreation, the biggest part of the coastal economy, will change as rising sea levels and increased winter storms result in a loss of beachfront property and the destruction of barrier islands. The costs of maintaining beach recreation areas would greatly increase.**<sup>24</sup>

Insect-borne diseases such as Lyme disease and malaria may increase in prevalence as the climate, particularly winters, warm and rainfall increases. The ski industry in Massachusetts may suffer severe contractions as snowfall decreases and snowmaking costs increase; much of this activity may migrate northward out of the state. The Berkshires could see a drop in the number of visitors, as fall foliage may change in intensity and duration.<sup>25</sup>

## An Agrarian History at Risk

**The state's maple syrup industry may disappear as the climate warms and the required cycle of freezing nights, warm days, and sustained cold temperatures in February and March no longer occur.**<sup>26</sup> The cranberry industry is already starting to shift to Canada as the crop in Massachusetts is already feeling the impact of erratic weather and drought.<sup>27</sup> Valued at more than \$138 million in 2008, Massachusetts provides over one-fourth of the nation's cranberry crop.<sup>28</sup>

## Pay Now: The Benefits of Taking Action

**In 2004, Massachusetts became one of the first states to enact a formal policy addressing the effects of climate change. Republican**

**Governor Mitt Romney signed the Massachusetts Climate Protection Plan, the first for the state and one of the most robust in the country, stating, “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.”**<sup>29</sup> This plan laid a foundation for the more recent 2008 Global Warming Solutions Act (GWSA), signed by Democratic Governor Deval Patrick. The GWSA requires emission reductions of 10-25% below 1990 levels by 2020. By 2050, GWSA requires reductions of 80% below 1990 levels. The state is a signatory to the Regional Greenhouse Gas Initiative (RGGI), a group which pledges to cap and reduce the amount of carbon its power plants emit 10% by 2018.<sup>30</sup>

Massachusetts has a highly educated and highly skilled labor force.<sup>31</sup> The state is already a national leader in technology research and development as well as in higher education. The transition to an economy based on non-carbon-producing energy sources could be very beneficial to Massachusetts. According to a joint study by the University of Massachusetts and the Center for American Progress, a federal green energy program, costing \$150 billion nationally, could have employed 38,000; for every \$1 million spent, 16.7 green economy jobs are created, but only 5.3 positions are created if this same amount is spent on the fossil fuel economy.<sup>32</sup> In addition, the Cape Wind Offshore Renewable Energy Project at Horseshoe Shoal, Nantucket Sound is projected to spend \$50 million on construction wages, benefiting the local economy via jobs, associated spending, and the purchase of supplies and materials.<sup>33</sup>

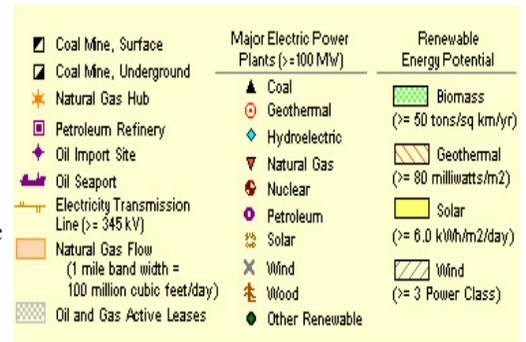
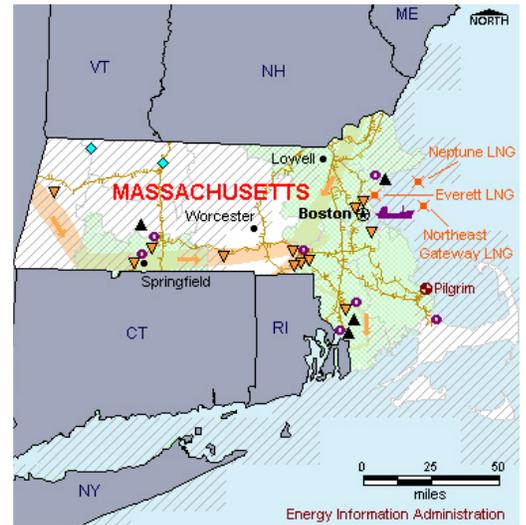
Massachusetts’ current energy consumption exceeds its in-state production. It has great potential, however, to compensate for this by developing its renewable energy capacity. If the state devoted just one square mile to concentrated solar power systems, it could power about 1,100 households annually. Massachusetts could also generate nearly 300 MW of electricity each year with the 1.4 million dry tons of biomass that it has annually available.<sup>34</sup> Moreover, Massachusetts currently is ranked 31<sup>st</sup> in the nation in wind power production, although the state is ranked 25<sup>th</sup> by the American Wind Energy Association in wind energy potential—a disparity that the recently approved Cape Wind Project should begin to remedy.<sup>35</sup> Recent studies show that the savings from greenhouse gas reduction measures will, in time, exceed the costs of their implementation. The high-efficiency Fidelity Bank building in Leominster, for instance, was built to use 31% less energy than other office buildings of the same size. Upgrades costing \$100,600 will pay for themselves in less than four years, with energy savings of \$27,600 per year.<sup>36</sup>

Addressing climate change in Massachusetts will protect the state’s economy and traditions—and create thousands of new jobs in the state.

## Conclusion

Massachusetts has begun to consider action on climate change not just in terms of cost, but also in terms of opportunities. If we continue to give Massachusetts’ population, businesses, and investors clear and consistent signals by properly offering initiatives and cultivating demand, investment and innovation in renewable technologies will follow.

**The people of Massachusetts will have to pay for the effects of climate change.** The only remaining question is whether they will pay now, or pay later, and risk paying significantly more.



(Endnotes)

- 1 Peter C. Frumhoff et al., *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions: Synthesis report of the Northeast Climate Impacts Assessment*, Union of Concerned Scientists, 2007, 18-19. <http://www.northeastclimateimpacts.org/pdf/confronting-climate-change-in-the-u-s-northeast.pdf> (accessed September 23, 2010).
- 2 Massachusetts Office of Coastal Zone Management, *An Assessment of the Coastal and Marine Economies of Massachusetts*, June 29, 2006, 6. [http://www.uhi.umb.edu/pdf\\_files/MA\\_coastal\\_marine\\_economy\\_1.pdf](http://www.uhi.umb.edu/pdf_files/MA_coastal_marine_economy_1.pdf) (accessed September 23, 2010).
- 3 National Wildlife Federation, *Charting a New Path for Massachusetts's Electricity Generation*, 2. [http://www.nwf.org/Global-Warming/-/media/PDFs/Global%20Warming/Clean%20Energy%20State%20Fact%20Sheets/MASSACHUSETTS\\_10-22-2.ashx](http://www.nwf.org/Global-Warming/-/media/PDFs/Global%20Warming/Clean%20Energy%20State%20Fact%20Sheets/MASSACHUSETTS_10-22-2.ashx) (accessed September 29, 2010).
- 4 Frumhoff et al., 1-2.
- 5 Frank Ackerman and Elizabeth A. Stanton, *The Cost of Climate Change: What We'll Pay if Global Warming Continues Unchecked*, Natural Resources Defense Council, May 2008, vi. [http://www.fao.org/fileadmin/user\\_upload/rome2007/docs/The%20Cost%20of%20Climate%20Change.pdf](http://www.fao.org/fileadmin/user_upload/rome2007/docs/The%20Cost%20of%20Climate%20Change.pdf) (accessed September 23, 2010).
- 6 Frumhoff et al., x.
- 7 *Ibid.*, 12.
- 8 Commonwealth of Massachusetts, *Trends in the Demographics of Human Population and the Massachusetts Marine Economy*. [http://www.mass.gov/czm/oceanmanagement/waves\\_of\\_change/pdf/trdemogecon.pdf](http://www.mass.gov/czm/oceanmanagement/waves_of_change/pdf/trdemogecon.pdf) (accessed September 28, 2010).
- 9 Frumhoff et al., 26.
- 10 *Ibid.*, 27-28.
- 11 *Ibid.*, 2.
- 12 Massachusetts Marine Fisheries, *Annual Report*, 2008, 41. [http://www.mass.gov/dfwele/dmf/publications/2008\\_dmf\\_annual\\_report.pdf](http://www.mass.gov/dfwele/dmf/publications/2008_dmf_annual_report.pdf) (accessed September 28, 2008).
- 13 New England Aquarium, *Climate Change Effects on Ocean Animals*. [http://www.neaq.org/conservation\\_and\\_research/climate\\_change/effects\\_on\\_ocean\\_animals.php](http://www.neaq.org/conservation_and_research/climate_change/effects_on_ocean_animals.php) (accessed July 4, 2010).
- 14 Massachusetts Marine Fisheries, 41.
- 15 See, for example, Stephanie C. Talmage and Christopher J. Gobler, "Effects of Past, Present and Future Ocean Carbon Dioxide Concentrations on the Growth and Survival of Larval Shellfish," *Proceedings of the National Academy of Sciences of the United States of America*, September 20, 2010. <http://www.pnas.org/content/early/2010/09/17/0913804107.abstract> (accessed September 28, 2010).
- 16 Massachusetts Marine Fisheries, 41.
- 17 American Lobster Technical Committee and Atlantic States Marine Fishery Commission, *Recruitment Failure in the Southern New England Lobster Stock*, April 17, 2010, 1. [http://www.asmf.org/speciesDocuments/lobster/minutesandmeetingsummaries/tc/2010/april2010\\_SNE\\_Recruitment\\_Failure\\_TCmemoB.pdf](http://www.asmf.org/speciesDocuments/lobster/minutesandmeetingsummaries/tc/2010/april2010_SNE_Recruitment_Failure_TCmemoB.pdf) (accessed September 28, 2010).
- 18 *Ibid.*, 3-4.
- 19 Commonwealth of Massachusetts, *Trends in the Demographics of Human Population and the Massachusetts Marine Economy*.
- 20 Massachusetts Office of Coastal Zone Management, 5.
- 21 *Ibid.*
- 22 Nature Conservancy, *Climate Change Impacts in Massachusetts*, 2. [http://www.nature.org/initiatives/climatechange/files/mass\\_facts\\_d2.pdf](http://www.nature.org/initiatives/climatechange/files/mass_facts_d2.pdf) (accessed September 28, 2010).
- 23 Includes those employed in the farming, fishing, hunting, and forestry sectors as well as the tourism and hospitality sectors. But this is a conservative projection considering the livelihoods of 1 in 3 people depend on the coastal economy. Bureau of Economic

- Analysis, *SA25N Total full-time and part-time employment by NAICS industry 1/ -- Massachusetts*, September 20, 2010. <http://www.bea.gov/regional/spi/default.cfm?selTable=SA25N&selSeries=NAICS> (accessed October 14, 2010).
- 24 Eric Barron, *Potential Consequences of Climate Variability and Change for the Northeastern United States*, 124-125. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/04NE.pdf> (September 28, 2010).
- 25 Nature Conservancy, 1-2.
- 26 Barron, 126.
- 27 Tony Azios, "Cranberries are headed north," *Christian Science Monitor*, November 21, 2007. <http://www.csmonitor.com/2007/1121/p13s01-wogi.html> (accessed July 5, 2010).
- 28 U.S. Department of Agriculture, New England Agricultural Statistics, *Cranberry Forecasts*, August 17, 2010. [http://www.nass.usda.gov/Statistics\\_by\\_State/New\\_England\\_includes/Publications/jancran.pdf](http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/jancran.pdf) (accessed September 28, 2010).
- 29 The Commonwealth of Massachusetts, *Climate Protection Plan*, Spring 2004, 3. <http://www.newamerica.net/files/MAClimate-ProtPlan0504.pdf> (accessed September 28, 2010).
- 30 Regional Greenhouse Gas Initiative, *Fact Sheet: The Regional Greenhouse Gas Initiative*, 1-2. [http://www.rggi.org/docs/RGGI\\_Fact\\_Sheet.pdf](http://www.rggi.org/docs/RGGI_Fact_Sheet.pdf) (accessed January 25, 2011).
- 31 U.S. Bureau of Labor Statistics, *The Prominence of Colleges and Universities in the Boston Metropolitan Area*, February 2009, 2. [http://www.bls.gov/opub/regional\\_reports/200902\\_colleges\\_boston.pdf](http://www.bls.gov/opub/regional_reports/200902_colleges_boston.pdf) (accessed September 29, 2010).
- 32 Robert Pollin, James Heintz, and Heidi Garrett-Peltier, *Clean-Energy Investments Create Jobs in Massachusetts*, Political Economy Research Institute, University of Massachusetts, Amherst and Center for American Progress, June 2009, 1. [http://www.peri.umass.edu/fileadmin/pdf/other\\_publication\\_types/green\\_economics/economic\\_benefits/cap\\_states/peri\\_ma.pdf](http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/cap_states/peri_ma.pdf) (accessed September 28, 2010).
- 33 U. S. Department of the Interior, Minerals Management Service, *Record of Decision: Cape Wind Energy Project, Horseshoe Shoal, Nantucket Sound*, April 2010, 22. <http://www.boemre.gov/offshore/renewableenergy/PDFs/CapeWindROD.pdf> (accessed September 29, 2010).
- 34 National Wildlife Federation, 2; U.S. Energy Information Administration, *Renewable Biomass*. [http://www.eia.doe.gov/kids/energy.cfm?page=biomass\\_home-basics](http://www.eia.doe.gov/kids/energy.cfm?page=biomass_home-basics) (accessed November 10, 2010). Burning wood for fuel is a centuries old practice, currently making up 2% of American total energy use. While wood pellet combustion does release carbon monoxide and other particulates, sometimes producing acid rain, it is still superior to the burning of fossil fuel, and clean-burning technology is available. The Environmental Protection Agency requires plants converting waste to energy to employ devices which scrub and/or filter emissions, removing pollutants. Oftentimes, the waste-to-energy process occurs at such high temperatures that the pollutants break down naturally, becoming less toxic.
- 35 National Wildlife Federation, 2.
- 36 National Grid, *Fidelity Bank Office and Branch Case Study*, 1. [http://www.nationalgridus.com/non\\_html/shared\\_FidelityTri-foldBrochure.pdf](http://www.nationalgridus.com/non_html/shared_FidelityTri-foldBrochure.pdf) (accessed October 1, 2010).