The Beacon Hill Institute

The High Cost of Green Energy Programs in Massachusetts

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Executive Summary

Massachusetts has attempted to lead the push for renewable energy and energy efficiency programs. The state currently offers over 25 unique mandates, programs and incentives to promote renewable energy and energy efficiency.[1] Since all of these mandates, programs and incentives attempt to influence the behavior of utilities, consumers and businesses they incur costs. Massachusetts ratepayers will continue to pay for these programs through higher electricity bills.

The Beacon Hill Institute at Suffolk University (BHI) has quantified the cost of 11 of the state green energy mandates, programs and incentives. We start with the major green energy costs today. From that baseline we use legislative mandates, third-party estimates and our own estimates to forecast how these individual costs will change over time. All dollar figures are in 2010 Net Present Values (NPV). Table 1 displays the cost to the state's ratepayers and the total costs of the policies.

Table 1: Cost of Selected Massachusetts Green Energy Mandates, Programs and Incentives (2010 NPV $)

Cost to Individual Rate Payer	2010	2020	2010-2020
Residential ratepayer ($)	78	159	1,582
Commercial ratepayer ($)	740	1,503	15,559
Industrial ratepayer ($)	7,017	14,255	141,255
Total Aggregate Cost ($ millions)	490	985	9,815

We find that that the major green energy mandates, programs and incentives will cost $490 million this year, more than $985 million in 2020 and more than $9.8 billion cumulatively over the next eleven years. By 2020, the total cost of these mandates, programs and incentives will amount to over 2.6 cents per kilowatt hour (kWh) of electricity. In 2020, that amounts to $159 per year for families consuming the state average for residential electricity, $1,503 per year for an average commercial business and $14,255 per year for an average industrial company. Over the eleven years, the average household ratepayers will incur $1,582 in higher electricity prices to fund these 11 mandates, programs and incentives, the average commercial ratepayer will spend $15,559 and the average industrial ratepayer $141,255. These figures do not include the cost incurred from the state's other 14 green energy mandates, programs and incentives.[2]

[1] Database of State Incentives for Renewables & Energy Efficiency, Massachusetts: Incentives/Polices for Renewables & Efficiency, Internet, available at http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=MA (accessed September 20, 2010).

[2] U.S. Energy Information Administration, "Average electricity consumption per residence in MA in 2008," (January 2010) "http://www.eia.doe.gov/cneaf/electricity/esr/table5.html, The 2008 consumption figures were inflated to 2010 using the increase in electricity demand from the ISO figure of 1.1% compound annual growth rate.

We choose these 11 mandates, programs and incentives because current data are readily available and quantifiable. Data is unavailable for the other 14 mandates, programs, and incentives, such as property and sales tax incentives, precluding the calculation of any reliable estimates. It is likely that the total cost of all the green energy mandates, programs and incentives in Massachusetts is significantly higher than we have found here and will continue to grow over the next decade.

In addition, we compare the number of mandates, programs and incentives and their costs, where possible, in Massachusetts with other states we identify as economic competitors.[3] The competitor states are highly ranked in both the BHI 2009 Competitiveness Index and Massachusetts Technology Collaborative *The Index of Innovation Economy, 2009.* Massachusetts imposes more green energy mandates, programs and incentives than its competitors.

As noted above, our cost estimates are only a fraction of the total costs of all 25 mandates, programs and incentives. As a result, Massachusetts electricity ratepayers will face skyrocketing electricity rates in this decade due to the state's green energy mandates, programs and incentives, unless policymakers reverse course and provide relief. Businesses that are large consumers of electricity will bear the greatest burden of the higher electricity rates, which will force some to close and others to seek locations with lower electricity costs. The burden threatens the long term competitiveness of Massachusetts.

[3] Compiled by authors based on Beacon Hill Institute *State Competitiveness Reports 2001-2009* and Massachusetts Technology Collaborative as enumerated in its *The Index of Innovation Economy, 2007.*

Introduction

The push for green energy in Massachusetts, like elsewhere, has opened a debate on green energy's economics. Green energy encompasses both renewable energy sources such as wind, solar and biomass, and technologies such as energy efficiency and information technology-driven products designed to save energy. Many environmentalists believe the transition from carbon-based to greener energy sources is not only earth-friendly but also economical. They promote a smooth transition to a "green economy" supporting "green jobs." Skeptics of the green economy contend that the individual projects fail any reliable cost-benefit analysis. The ongoing battle surrounding the Cape Wind project in Nantucket Sound is a prime illustration of the difficulties of trying to determine the real costs and benefits to both ratepayers and taxpayers.

Seeking to simplify the issue, Governor Deval Patrick claims that residential ratepayers will pay slightly less than the equivalent of a cup of coffee ($1.25) per month more for Cape Wind's electricity than conventional sources. At the other end, National Grid, the electric utility, estimates that customers will face substantially higher rates. Cape Wind is just one of many green energy initiatives Massachusetts is promoting in its effort to curb carbon emissions. But it is proving to be a costly investment, a fact that has emerged during the laborious state and federal regulatory processes imposed upon Cape Wind. However, most state green energy mandates, programs and incentives have not received the same level of review. If Massachusetts citizens intend to rationally debate the future of green energy programs they need viable and accurate cost projections.

According to the Database of State Incentives for Renewables & Efficiency (DSIRE), funded by the U.S. Department of Energy, Massachusetts offers over 25 unique mandates, programs and incentives to promote renewable energy and energy efficiency.[4] These programs incur costs by influencing the behavior of utilities, consumers and businesses. Massachusetts ratepayers will continue to pay for these programs through higher electricity bills.

The following sections provide a more detailed breakdown of our estimates and an explanation of the methodology and assumptions that went into constructing them.

[4] Database of State Incentives for Renewables & Energy Efficiency, Massachusetts: Incentives/Polices for Renewables & Efficiency, Internet, available at http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=MA (accessed September 20, 2010).

Growth of Existing Mandates, Programs and Incentives

Massachusetts ratepayers fund a number of mandates, programs and incentives to support green energy. The major sources of funds for green energy that we have identified are:

Renewable Energy: A surcharge of $0.0005 per kWh is levied on all electricity sold by private utilities. This money is used to finance the Massachusetts Clean Energy Center, a state authority that subsidizes various programs and incentives related to green energy.

Energy Conservation: A surcharge of $0.0025 per kWh is levied on all electricity sold by private utilities. This money is used by utilities to pay for energy efficiency measures, such as installing extra insulation in customers' homes.

RGGI: The Regional Greenhouse Gas Initiative, signed by 10 states including Massachusetts, calls for a permit system that captures the cost of carbon emissions. Permits must be purchased by electricity generators, while in Massachusetts 80 percent of the money raised from permit auctions is used to finance energy efficiency.

EERF: The "Energy Efficiency Reconciliation Factor" makes up for shortfalls in running energy efficiency programs. This fee is part of the distribution charge on electricity bills.[5]

"Outside": This is a speculative number included in the three-year plan of the Massachusetts Department of Public Utilities (DPU) representing an assumption that outside funds will materialize.[6] If outside funding is not found, the costs in this category will be added to the EERF. At this point we have no reason to expect outside funds to materialize.

Class I RECs: Currently, the 2010 RPS Class I requirement is five percent, and is set to increase by one percent each year. It is met through electricity production from qualified New Renewable Generation Units. New Renewable Generation Units are facilities that began commercial operation after 1997 and generate electricity using any of the following technologies: solar photovoltaic, solar thermal electric, wind energy, small hydropower, landfill methane and anaerobic digester gas, marine or hydrokinetic energy, geothermal energy and biomass fuel.

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[5] NStar, "Definition of EERF charges," (June 30, 2010) http://www.nstaronline.com/docs3/tariffs/107.pdf, (accessed September 22, 2010).
[6] Massachusetts Department of Public Utilities, under "DPU Order on Electric Three-Year Energy Efficiency Plans," (January 2010) http://www.env.state.ma.us/dpu/docs/electric/09-116/12810dpuord.pdf, (accessed September 15, 2010).

Class II RECs: RPS Class II mandates that a minimum percentage of electricity sales come from each of two sources, renewable energy and waste energy. The current RPS Class II Renewable Generation obligation is 3.6 percent, and the Waste Energy Generation obligation is 3.5 percent. The obligation does not increase annually. A supplier must comply with *both* the minimum percentage of Renewable and Waste Energy obligations.

Alternative Energy Certificates: Massachusetts requires utilities to purchase a percentage of electricity from providers of alternative energies, such as gasification and combined heat and power cogeneration facilities.

Solar Carve-out: On January 1st, 2010, new regulations were filed so that a specified and growing portion of the RPS Class I renewable energy requirement comes from solar photovoltaic (PV) energy. This carve-out supports distributed solar PV energy facilities including residential, commercial, public and non-profit projects, and is designed to help the Commonwealth achieve the installation of 400 MW of solar PV across the state.[7]

Smart Grid: Each utility is required to initiate a Smart Grid pilot program. A Smart Grid is an enhanced electricity delivery grid that allows electricity use to be monitored between meter readings. These pilot programs are financed through higher electricity rates to customers.

Net Metering: Net metering allows customers of an electric distribution company to generate their own electricity in order to offset their electricity usage. Net metering can lower a customer's electricity bill by reducing the amount of electricity the customer must buy from the distribution company. Net metering also allows customers to be compensated for any electricity they generate but do not use.

Long-term Contracts: The Green Community Act, which requires Massachusetts electric distribution companies to enter into 10 to 15-year contracts with renewable energy projects located within state boundaries, including state and adjacent federal waters.

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[7] Evolution Markets Inc., REC Markets – February 2010: Monthly Market Update, Class I REC prices (February 2010) http://new.evomarkets.com/scripts/getmmu.php?uid=web&mmu_id=509
SRECTrade.com, "Market price of Solar RECs," (August 2010), http://www.srectrade.com/blog/srec-markets/massachusetts/first-massachusetts-srec-auction-closes-q1-srecs-sell-for-500 (accessed October 2, 2010).

While the costs of these mandates, programs and incentives are already substantial, we expect them to rise dramatically in the coming years as an ever greater percentage of our electricity must be generated from renewable sources. As Table 2 illustrates, the added cost of these mandates, programs and incentives will more than double to over 2.6 cents per kWh, and nearly $1 billion annually by 2020. The cumulative cost over the period will be more than $9.8 billion.

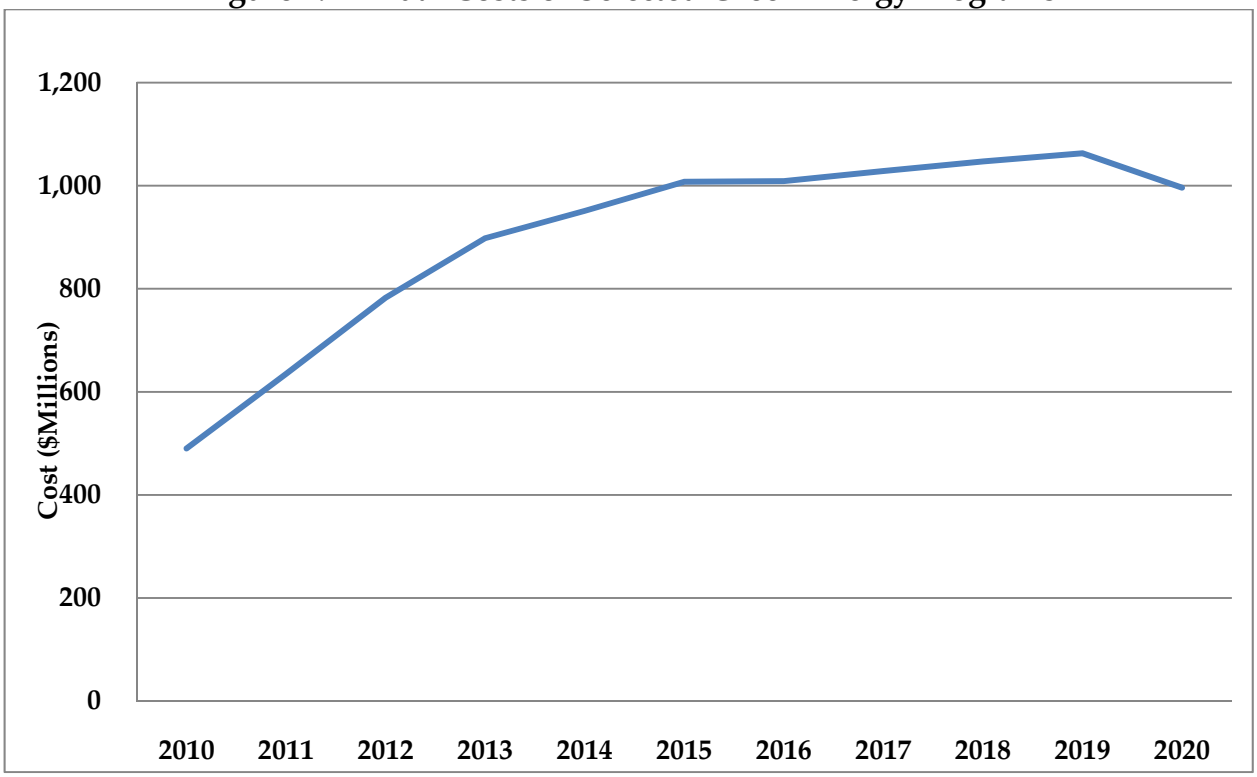
Table 2: Cost of Green Energy Mandates, programs and incentives (2010 NPV $)

Year	Total Cost ($ millions)	Cost per KWh ($)
2010	490	0.01035
2011	630	0.01382
2012	777	0.01726
2013	891	0.02006
2014	943	0.02150
2015	998	0.02304
2016	998	0.02334
2017	1,017	0.02406
2018	1,035	0.02478
2019	1,051	0.02546
2020	985	0.02622
Total	**9,815**	

Our complete methodology is described in the Appendix to this report, but one important point is worth noting. As Figure 1 illustrates, we forecast a more rapid increase in costs through 2012 and then a more moderate increase thereafter. This is driven by lack of data availability on the increase in the RGGI, EERF and "Outside" costs. The Massachusetts DPU estimated the increase in these costs through 2012.[8] Thereafter, we assume that the costs will grow at the rate of inflation. There is reason to believe that the costs of meeting the RPS will increase more rapidly due to EERF.

[8] Massachusetts Department of Public Utilities, under "DPU Order on Electric Three-Year Energy Efficiency Plans," (January 2010) http://www.env.state.ma.us/dpu/docs/electric/09-116/12810dpuord.pdf, (accessed September 15, 2010).

Figure 1: Annual Costs of Selected Green Energy Programs

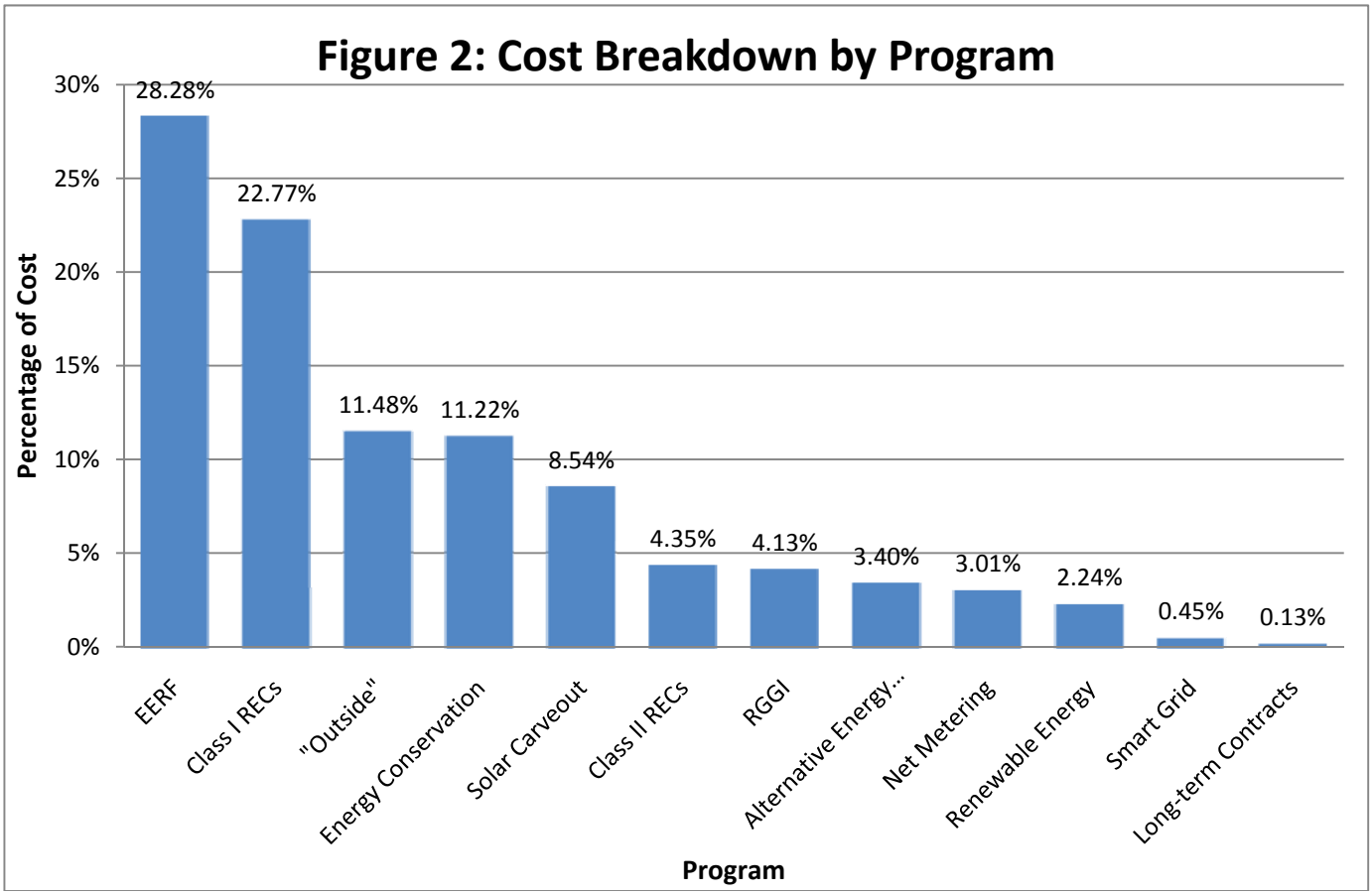


For example, the DPU estimates that the EERF payments will grow by a 51 percent compound annual growth rate between 2009 and 2012. The investments in energy efficiency using EERF and other funding, such as "Outside," are facing diminishing marginal returns. By 2020, all of the lower cost high return investments, such as replacing incandescent light bulbs with florescent bulbs will have been made. At that point, the more expensive investments, with a lower relative return, will be the only options available. In other words, it will take more dollars to squeeze the same quantity of energy savings from each new investment.

Theoretically, using the 51 percent compounded growth rate, EERF would cost over $8.5 billion in 2020 or 16 cents per kWh, and more than $24.5 billion over the entire period. This would be an overwhelming burden on Massachusetts electricity ratepayers.

Figure 2 and Table 3 break out the costs by individual program. The EERF is the largest at over 25 percent of total cost. This charge makes up for shortfalls in running energy efficiency programs and is contained in the distribution charge on electricity bills. As a result, most consumers will not be aware of its true cost. The EERF and "Outside" comprise over 36 percent of the total costs, which is astonishing considering the lack of transparency and accountability surrounding these programs.

Table 3: Total Cost of Individual Green Energy Mandates, Programs and Incentives 2010-2020	
Mandate, Program and Incentive	**Cost (2010 NPV $)**
EERF	2,803
Class I RECs	2,257
"Outside"	1,138
Energy Conservation	1,112
Solar Carve-out	846
Class II RECs	430
RGGI	409
Alternative Energy Certificates	337
Renewable Energy	222
Net Metering	198
Smart Grid	44
Long-term Contracts	13
Total	9,815



Massachusetts Compared to Competitor States

Table 4 lists the Bay State's renewable energy and energy efficiency subsidies, taxes, incentives and mandates along with competitor states.[9] We define competitor states as those that are in the top ten in the BHI *2009 Competitiveness Index* and the Massachusetts Technology Collaborative's *The Index of Innovation Economy, 2009.* The analysis indicates that, at 25, Massachusetts imposes the most renewable energy mandates, programs and incentives of the eight states. Massachusetts provides 15 financial incentives for renewable energy and energy efficiency, while Texas and Vermont provide 13, Utah and Minnesota provide seven, and New Hampshire provides eight. At 10, Massachusetts is second to Colorado in imposing non-financial regulations and policies for renewable energy and energy efficiency. Texas imposes only seven, while New Hampshire and Utah require eight. Of these states, Massachusetts has the highest average electric power rates and the 4th highest in the nation.

We conclude from this comparison that Massachusetts imposes more mandates, programs and incentives than other competitor states, which jeopardizes our competitiveness, especially in competition for manufacturing firms and other large consumers of electricity.

[9] Compiled by authors based on Beacon Hill Institute *State Competitiveness Reports 2001-2009* and Massachusetts Technology Collaborative as enumerated in its *The Index of Innovation Economy, 2008.*

Table 4: Massachusetts Programs for Renewable Energy and Energy Efficiency Compared to Competitor States

	Massachusetts	Utah	Minnesota	Colorado	Washington	New Hampshire	Vermont	Texas
Financial Incentives	**15**	**7**	**10**	**10**	**10**	**8**	**13**	**13**
Corporate Tax Deduction/Exemption	2	X					X	X
Green Building Incentive					X			
Industry Recruitment	X	X			X			X
Local Loan Program	X					X	X	X
Local Rebate Program	X			X				X
Local Grant Program				X	X			
PACE Financing	X		X	X		X	X	X
Performance Incentive	X		X		X		X	X
Personal Tax Credit	X	X					X	
Property Tax Incentive	X		X	X		X	X	X
Sales Tax Incentive	X	X	X	X	X		X	X
State & Non-Profit Grant Program	X		X	X	X		X	X
State Loan Program	X	X	X			X	X	X
State Rebate Program	X	X	X	X	X	X	X	X
Utility Grant Program			X	X	X	X	X	
Utility Loan Program	X		X	X	X	X	X	X
Utility Rebate Program	X	X	X	X	X	X	X	X
Regulations & Policies	**10**	**8**	**9**	**12**	**9**	**7**	**8**	**7**
Appliance Efficiency	X				X		X	
Building Energy Code	X	2	X	X	X	X	X	X
Standards for Public Buildings	X	X	X	X	X	X		X
Green Power Purchasing	X	X	X	X	X			X
Interconnection	X	X	X	X	X	X	X	X
Line Extension Analysis				X			X	X
Green Power Utility Option				X	X			
Net Metering	X	X	X	X	X	X	X	X
Public Benefits Fund	X		X	X		X	X	
Renewable Portfolio Standard	X	X	X	X	X	X	X	X
Solar Access Law/ Guideline	X	X		X	X	X		
Solar and Wind Access Law			X	X			X	
Solar/Wind Permitting	X			X				
Other Policy			X					
Total	**25**	**15**	**19**	**22**	**19**	**15**	**21**	**20**

Conclusion

Massachusetts joins many other states in the dash to achieve a green energy future. The state has laid out a roadmap to achieve this goal that is filled with aggressive renewable energy and efficiency mandates, programs and incentives. However, renewable energy sources such as solar, wind and biomass are much more expensive to electricity ratepayers than conventional sources of energy derived from fossil fuels.

The costs of the mandates, programs and incentives are already embedded in our monthly electric bills. In the next ten years, as the mandates begin increasing, these costs will soar. Electric utilities will have no choice but to pass costs onto their customers, the citizens and businesses of the Commonwealth. The Renewable Portfolio Standard and other polices will erode the state's competitiveness and hurt it's economy.

Massachusetts policymakers should relieve electricity ratepayers of these costly burdens and repeal many of the green energy mandates, programs and incentives that the state currently imposes.

Methodology

Prices: All dollar values are presented in 2010 Net Present Value (NPV) dollars, using a 5% discount rate.

Renewable Energy: This is the surcharge of $0.0005/kWh on all electricity. The total cost is the charge multiplied by the total load in kWhs.

Energy Conservation: This is the surcharge of $0.0025/kWh on all electricity. The total cost is the charge multiplied by the total load in kWhs.

RGGI: This estimate is from the DPU Order on Electric Three-Year Energy Efficiency Plans.[10] We estimated this cost by dividing the estimated total cost of RGGI by total electricity consumption for each year. Estimates for years beyond 2012 are based on an assumption that costs grow at the rate of inflation through 2020 (the 2010 cost estimate is $1.06/MWh).[11] There are no available forecasts of RGGI spending, although as the carbon limit drops RGGI allowances should increase in price. Our estimate is conservative and likely underestimates the cost of this program.

EERF: This estimate is from the DPU Order on Electric Three-Year Energy Efficiency Plans.[12] Our estimate was calculated by dividing the estimated total cost of EERF by total electricity consumption. Estimates for years beyond 2012 are based on the assumption that the costs grow at the rate of inflation through 2020, since there are no current forecasts available for future EERF spending.[13] Moreover, we base EERF on ISO of New England's 1.1 percent estimate for the growth of electricity consumption over the period, which includes the effects of the energy efficiency investments and electricity savings. Because the easiest projects will be pursued first, we should expect EERF costs to rise more rapidly as higher-cost/lower-benefit projects are pursued. If EERF grows at the same average annual rate that it does in the DPU plan (51 percent) it balloons to over $8 billion dollars in the year 2020 (and over $24 billion for the full 11 years).

[10] Massachusetts Department of Public Utilities, under "DPU Order on Electric Three-Year Energy Efficiency Plans," (January 2010) http://www.env.state.ma.us/dpu/docs/electric/09-116/12810dpuord.pdf, (accessed September 15, 2010).
[11] Ibid, 179.
[12] Ibid.
[13] The Congressional Budget Office, "Budget and Economic Outlook: An Update," under "Detailed Economic Projections," http://www.cbo.gov/doc.cfm?index=11705 (accessed October 20, 2010).

"Outside": This estimate is from the DPU Order on Electric Three-Year Energy Efficiency Plans.[14] The costs are based on a per MWh unit of measure. We estimate the cost by dividing the estimated total cost of "Outside" by total electricity consumption. Estimates for years beyond 2012 are based on the assumption that the costs grow at the rate of inflation through 2020 projected by the Congressional Budget Office.[15]

Class I RECs: This estimate is derived from the Renewable Portfolio Standard. The required proportion of electricity sales from Class I sources is multiplied by the total private electricity sales to find the required number of RECs. We then multiply the number of RECs by the forecasted price. There are forces we would expect to drive up the price of RECs (such as a reduced number of productive places to put wind power plants) as well as forces we might expect to drive down the price (improved energy technology). We utilize a private forecast of RECs from 2011 – 2020 under the assumption that the federal Production Tax Credit is extended and no federal cap and trade policy is enacted over the period.[16] The total cost of Class I RECs on the table does not include the impact of the solar carve-out, which are reported separately. For all RECs, we estimate a per MWh cost by dividing the total cost by the total energy demand. For example, the cost of Class I RECs is approximately $24.50 for 2010, but the average cost per MWh is $3.43, because it is averaged across all sources of energy. The reason for this is to show the impact of RECs on the average cost of electricity.

Class II RECs: The proportion of electricity that must be derived from Class II sources is fixed at 3.6 percent for certain renewable resources and 3.5 percent for waste energy. We find the required number of waste and non-waste Class II RECs, then multiply each by the cost of waste and non-waste Class II RECs (currently around $4.75 and $23.50 per MWh respectively). We assume the REC prices increase at the rate of inflation projected by the Congressional Budget Office.

Alternative Portfolio Standard (APS): The proportion of electricity that is required to be derived from alternative sources (other than renewable sources) is 1.5 percent in 2010. It is scheduled to expand by 0.5 percent each year until 2014. After 2014 it is scheduled to expand by 0.025 percent each year until 2020. The total cost is calculated by multiplying the number of Alternative Energy Credits (AECs) by the 2010 price of $18. We assume prices increase at the rate of inflation projected by the Congressional Budget Office.

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[14] DUP ,Three-Year Plan, 179.

[15] U.S. Congressional Budget Office, Budget and Economic Outlook: An Update August 2010, Internet, available at http://www.cbo.gov/doc.cfm?index=11705, (accessed October 20, 2010)

[16] We used a projection by Energy Ventures Analysis Inc. Inc., May 16, 2010.

Solar Carve-Out: This program is intended to replace some of the Class I RECs, so our cost estimate accounts for the reduction in Class I RECs. The level of required SRECs is found by increasing the annual growth rate from the previous two years by 30 percent (so that if the growth from the previous two years was 10 percent, the growth required for the year in question would be 13 percent, the growth for the next year would be 17 percent, and so on). We obtain the values for 2010 and 2011 from estimates on the Massachusetts Executive Office of Energy and Environmental Affairs website (Adjusted Mechanics to the Minimum Standard, Opt-In Term, and ACP Rate).[17] The level of solar RECs is multiplied by $411.10/MWh, the current market rate for SRECs.[18] We then multiply the number of SRECs by the price of Class I RECs and subtract that number from the cost of SRECs. We deflate the SREC cost by 3.5 percent per year to reflect the expected decline in installed costs of photovoltaic technology, using recent historical figures.[19]

Smart Grid: This estimate is based on three approved and one proposed smart-grid pilot projects. The estimated total cost for these four projects is $75,416,560. We assume $5 million annually to cover the cost of capital (and the cost of debt used to finance this capital) and maintenance. This is the approximate annual cost of amortizing the projects over 20 years. Because these are pilot projects, a continuation of this program could make this estimate significantly below actual costs.

Net Metering: Because there are no forecasts or publicly available numbers for this program, we estimate these numbers based on the assumption that other subsidies encouraging people and municipalities to generate electricity in a residential setting are effective. To gauge the total participation we assume that the level of net-metering grows at a constant rate from zero to the maximum level allowed (3 percent of total peak load) over ten years and is credited at retail electricity rates. We take this number and multiply it by the difference in cost between retail and wholesale electricity (we assume delivery costs will be negligible because the electricity is being generated very close to where it will be consumed). We assume that 30 percent of the 3 percent is sold back into the grid, and that the 3 percent maximum is reached in 2018.[20]

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[17] Executive Office of Energy and Environmental Affairs, "Adjusted Mechanics to the Minimum Standard, Opt-In Term, and ACP Rate," Internet, available at http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_adjusted-mechanics&csid=Eoeea (accessed October 1, 2010).

[18] Flettexchange, "Massachusetts SREC Prices," http://www.flettexchange.com/, (accessed October, 18, 2010).

[19] Ryan Riser, Galen Barbose, Carla Peterman, "Tracking the Sun: The Installed Cost of Photovoltaics in the US from 1998 to 2007," Lawrence Berkeley National Laboratory, (February 2009) http://eetd.lbl.gov/ea/ems/reports/lbnl-1516e.pdf,

[20] Yih-huei Wan, "Net Metering Programs," National Renewable Energy Laboratory, (Oak Ridge, TN: February 1997) 2.

Long term Contracts: Green Community Act, which requires Massachusetts electric distribution companies to enter into 10- to 15-year contracts with renewable energy projects located within state boundaries, including state and adjacent federal waters.

To calculate the cost of renewable energy under the RPS and other mandates, programs and incentives, BHI utilized data from the Energy Information Agency (EIA). We collected data on total retail of electricity (in megawatt hours) from the Massachusetts Electricity Profile for 2008.[21] We reduce the projected net energy for load by 13 percent to account for municipal utilities, which are not obligated to meet the RPS.[22] These net figures are then inflated through 2020 using the ISO projections for the growth of electricity demand in Massachusetts (1.1 percent compound annual growth rate).[23] Table 5 displays the results.

Table 5: Projected Massachusetts Electricity Demand and Amount Required by the RPS Components

Year	Projected RPS Electricity Demand MWhs	Class 1 MWhs	Class 2 (Old Renewable) MWhs	Class 2 (Waste to energy) MWhs	Solar Carve-Out MWhs	APS MWhs	Total RPS MWhs
2010	47,359,215	2,334,313	1,704,932	1,657,573	33,648	710,388	6,440,853
2011	47,880,167	2,795,385	1,723,686	1,675,806	77,425	957,603	7,229,905
2012	48,406,848	3,254,664	1,742,647	1,694,240	133,816	1,210,171	8,035,537
2013	48,939,324	3,711,475	1,761,816	1,712,876	203,671	1,468,180	8,858,018
2014	49,477,656	4,160,789	1,781,196	1,731,718	292,200	1,731,718	9,697,621
2015	50,021,911	4,597,623	1,800,789	1,750,767	404,568	1,875,822	10,429,568
2016	50,572,152	5,147,859	1,820,597	1,770,025	415,077	2,022,886	11,176,445
2017	51,128,445	5,727,993	1,840,624	1,789,496	407,420	2,172,959	11,938,492
2018	51,690,858	6,319,907	1,860,871	1,809,180	399,905	2,326,089	12,715,951
2019	52,259,458	6,923,796	1,881,340	1,829,081	392,528	2,482,324	13,509,070
2020	52,834,312	7,539,859	1,902,035	1,849,201	385,287	2,641,716	14,318,098
Total	**550,570,345**	**52,513,663**	**19,820,532**	**19,269,962**	**3,145,545**	**19,599,856**	**114,349,559**

[21] U.S. Department of Energy, Energy Information Agency, "Electricity, State Electricity Profiles," Massachusetts Electricity Profile, 2008 edition, http://www.eia.doe.gov/cneaf/electricity/st_profiles/massachusetts.html,. (accessed September 15, 2010).
[22] Commonwealth of Massachusetts Department of Energy Resources, Massachusetts Renewable Portfolio Standard Annual Compliance Report for 2007, (July 29, 2010):16, http://www.mass.gov/Eoeea/docs/doer/rps/rps-2007annual-rpt.pdf, (accessed September 15, 2010).
[19] ISO, 22.

To these totals, we apply the percentage of renewable sales prescribed by the Massachusetts RPS. For example, 6 percent of total electricity demand in Massachusetts must be from new renewable sources (Class I) by the end of 2011. We repeat this process for each year from 2010 through 2020. In 2020, Massachusetts requires that 15 percent of electricity sales be sourced from new renewable sources (Class I) minus 0.73 percent for the solar carve-out, 3.5 percent of sales from old renewable sources (Class II) and 3.6% of sales from waste-to-energy projects (Class II), and 5 percent from the Alternative Portfolio Standard technologies (Combined Heat and Power, flywheel storage, coal gasification and efficient steam technologies). By 2020, renewable energy sources must account for 27.1 percent of total electricity sales in Massachusetts.

Sources:

Commonwealth of Massachusetts. General Court, 186th Sess., "Cost of Energy Efficiency Surcharge." http://www.malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter25/Section20. See also Database of State Incentives for Renewables & Efficiency, (June 2010). http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA07R&re=1&ee=1.

The Congressional Budget Office, Budget and Economic Outlook: An Update", Detailed Economic Projections, (August 2010) http://www.cbo.gov/doc.cfm?index=11705.

Evolution Markets Inc. 2010. "REC Markets – February 2010: Monthly Market Update, Class I REC prices." (February). http://new.evomarkets.com/scripts/getmmu.php?uid=web&mmu_id=509.

Evolution Markets, Inc. 2010. "Maximum price of Alternative Energy Credits (AECs): Monthly Market Update." (February). http://new.evomarkets.com/pdf_documents/February%20REC%20Market%20Update.pdf.

Executive Office of Energy and Environmental Affairs. 2010. "Adjusted Mechanics to the Minimum Standard, Opt-In Term, and ACP Rate." http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_adjusted-mechanics&csid=Eoeea.

_____. 2009. "Alternative Portfolio Standard Requirements by Year," March. , http://www.mass.gov/Eoeea/docs/doer/rps/rps-225-cmr16-mar-12-2009.pdf.

_____. "Class II RPS generation requirements." http://www.mass.gov/?pageID=eoeeaterminal&L=4&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Renewable+Energy+Portfolio+Standard+%26+Alternative+Energy+Portfolio+Standard+Programs&sid=Eoeea&b=terminalcontent&f=doer_rps_aps_program_sum&csid=Eoeea.

_____. "Minimum price of Solar RECs."

http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_solar-credit&csid=Eoeea.

_____. "Price Ceiling of Solar RECs, and SREC requirements for 2010 and 2011." http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_current-parameters&csid=Eoeea.

_____. 2010. Renewable Portfolio Standard: "Class I RPS generation requirements," (January) http://www.mass.gov/Eoeea/docs/doer/renewables/solar/225CMR1400Jan8-2010.pdf.

_____. . "Solar Credit Clearinghouse Auction." http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_solar-credit&csid=Eoeea.

_____. "13% capacity factor," 5, http://www.mass.gov/Eoeea/docs/doer/renewables/solar/Questions%20on%20SREC.pdf.

Flettexchange, "Massachusetts SREC Prices," http://www.flettexchange.com/.

Industrial Wind Action Group. "Class II REC prices: ICAP – REC Recap – Sept 10, 2010." E-mail correspondence with the Industrial Wind Action Group.

ISO New England Inc., Regional System Plan: Third Draft, (Holyoke, MA: September 8, 2010).

Massachusetts Department of Public Utilities. 2010. "DPU Order on Electric Three-Year Energy Efficiency Plans," (January). http://www.env.state.ma.us/dpu/docs/electric/09-116/12810dpuord.pdf.

Nstar. 2003. "Cost of renewable energy surcharge." (January). http://www.nstaronline.com/docs3/tariffs/108.pdf.

Nstar. 2010. "Definition of EERF charges" (June). http://www.nstaronline.com/docs3/tariffs/107.pdf.

Riser Ryan, Galen Barbose, Carla Peterman. 2009. "Tracking the sun: The Installed Cost of Photovoltaics in the US from 1998 to 2007." Lawrence Berkeley National Laboratory. (February). http://eetd.lbl.gov/ea/ems/reports/lbnl-1516e.pdf.

SRECTrade.com. 2010. "Market price of Solar RECs." (August). http://www.srectrade.com/blog/srec-markets/massachusetts/first-massachusetts-srec-auction-closes-q1-srecs-sell-for-500.

U.S. Energy Information Administration. 2010. "Average electricity consumption per residence in MA in 2008." (January). http://www.eia.doe.gov/cneaf/electricity/esr/table5.html.

_____. 2010. "Cost of wholesale electricity."(October). http://www.eia.doe.gov/cneaf/electricity/wholesale/wholesale.html. Our conservative estimate is based on the numbers available on this spreadsheet: http://www.eia.doe.gov/cneaf/electricity/wholesale/nepool10.xls.

_____. 2010." Levelized Cost of New Generation Resources from the *Annual Energy Outlook 2010"* http://www.eia.doe.gov/oiaf/aeo/electricity_generation.html.

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The Beacon Hill Institute at Suffolk University in Boston focuses on federal, state and local economic policies as they affect citizens and businesses. The Institute conducts research and educational mandates, programs and incentives to provide timely, concise and readable analyses that help voters, policymakers and opinion leaders understand today's leading public policy issues.

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