Potential for Renewable Energy Development in Massachusetts

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Over the last several years, Massachusetts has become increasingly dependent on natural gas for electricity and vulnerable to swings in fuel prices. Renewable electricity generation, once built, is not influenced significantly by fuel prices. The development of renewable resources for electricity offers an opportunity to both diversify the state's energy portfolio in the face of volatile fossil fuel prices and to reduce the emissions that contribute to global warming from the state's energy portfolio.

In the past, the development of renewable resources has been limited by uncertainty about long-term demand for renewable electricity, difficulty in siting, and a number of other obstacles. As of 2006, Massachusetts generated 0.23 million megawatt hours (MWh) of renewable electricity annually that qualified for the state's Renewable Portfolio Standard (RPS), or about 0.5% of retail electricity sales of about 50 million MWh from suppliers not exempt from the RPS. The remainder of the 2006 RPS obligation, of 2% of non-exempt retail sales, was met through renewable electricity from other states and through alternative compliance payments in lieu of renewable electricity.

The Green Communities Act significantly changes our energy future. It stimulates substantial demand for new renewable electricity into the future with an RPS requirement that grows by 1% per year to 15% of non-exempt retail sales in 2020, or about 7.5 million MWh at current load levels. Projects in Massachusetts currently under construction, design, or consideration, if approved and developed, would generate 3.7 million MWh, of which 2.2 million MWh is from 670 MW of offshore wind at four proposed sites, 0.2 million MWh is from 100 MW of onshore wind, 1.0 million MWh is from 140 MW of biomass projects, and up to 0.3 million MWh from the commitment of the Commonwealth to 250 MW of solar. Completion of these projects would meet roughly half of the RPS obligation, leaving an additional 3.8 MWh to be met from other renewable sources.

In order to assess what additional renewable generation is feasible in Massachusetts, the Department of Energy Resources (DOER) and the Massachusetts Renewable Energy Trust (MRET) commissioned a study of in-state resources and the economics associated with their development. The study was conducted by Navigant Consulting, Inc., an organization with substantial experience in the assessment of renewable energy across several states and over many years.

The study focused on renewable electricity generated from five resources—solar, wind, biomass, river, and ocean—and nine technologies, recognizing that there are additional opportunities for developing renewable resources in Massachusetts, using other resources and technologies and making use of renewables for heat in addition to electricity. For each resource, the study determined the potential from several perspectives: the total renewable resources in Massachusetts (theoretical potential); the accessible resources not excluded from development because of land use restrictions, shipping lanes, protected habitats, etc. (technical potential); and the accessible resources that could be developed at costs lower than electricity prices or projects that are already in the pipeline (economic potential). The economic potential changes over time

as technology costs and the market price for electricity evolve. For technologies such as utility-scale wind farms and biomass plants, the cost of generating renewable electricity is compared to wholesale prices, while for technologies such as community scale wind and rooftop solar, it is compared to retail prices.

One of the primary findings of the study is that there is substantial potential for renewable electricity in Massachusetts. The following table summarizes the various types of potential for each renewable resource:

Renewable Potential in Massachusetts (in MW)			
	Theoretical	Technical	Economic (by 2020)*
Wind	25,200	7,800	3,000**
Biomass	1,100	240	240
River	280	30	15
Ocean	***	180	24
Solar	41,900	8,700-12,900****	> 250*****

Source: Navigant Consulting 2008

* The economic potential shown here is for the year 2020 in one of the scenarios analyzed. The scenario had the following assumptions. Wholesale electricity prices rise at an average annual rate of about 6% between 2009-2020. Renewables become more competitive with grid prices, REC prices decline at an average annual rate of about 2% in this time period, and Federal tax credits for renewables are not renewed.

** No entity has *comprehensively* mapped offshore wind sites that could be developed. Of the 6,300 MW of technical potential for offshore wind, over 4000 MW are excluded from being economic because they are not currently associated with specific sites. Once a comprehensive analysis of sites is completed, some part of the 4000 MW could be added to the economic potential.

*** No primary study of the theoretical potential has been conducted to date.

**** Unlike the other resources, the technical potential for solar increases over time as rooftop space increases.

***** Because of the existing policy commitment to 250 MW of solar PV by 2017, this was treated as the minimum economic potential for this technology.

The theoretical potential for all resources is significant, with enormous amounts of offshore wind and solar PV. Somewhat more useful than the theoretical potential is the technical potential, which includes only accessible resources and provides a more realistic picture of resource potential. Wind, both on- and offshore, and solar have the largest technical potential.

A yet more useful measure of potential is the economic potential. The total economic potential in 2020 in the scenario shown in the table is a capacity of about 3500 MW and annual generation of about 10 million MWh, more than sufficient to meet our RPS requirements in 2020 at current loads. In fact, by 2012, the economic potential is already half of this amount or about 5 million MWh, with the largest early-stage potential in community scale wind and biomass. In the longer-term, offshore wind, and potentially solar, offer the largest economic potential as costs of these technologies drop below market prices.

Since the economic potential depends on several uncertain factors, primarily electricity prices, the market price of renewable energy certificates (RECs), and Federal tax credits, several hypothetical future scenarios for the electricity market and Federal policy were considered. The economic potential shown in the table above is for the year 2020 from one of these scenarios that is particularly helpful for planning. The scenario has wholesale electricity prices rising at an average annual rate of about 6% between 2009 and 2020, similar to price increases over the last few years. As renewables become more competitive with grid prices, REC prices are assumed to decline at an average annual rate of 2% during this time period and Federal tax credits are

assumed to expire. By explicitly considering the possibility of steadily increasing electricity prices, this scenario helps identify opportunities to mitigate risk by diversifying our portfolio of energy sources, as well as demonstrates the potential for market development of renewable energy resources as fossil-fuel prices rise.

In addition to this scenario, the study considered two other scenarios. In one of the additional scenarios, electricity prices increase, as in the first scenario, but REC prices remain at their current level and Federal tax credits are renewed. The higher incentive levels result in lower cost of renewable electricity and faster growth in the economic potential. The third and final scenario pairs the higher incentives in the second scenario with wholesale electricity prices that *decrease* by an average annual rate of 4% between 2009 and 2015 and return to 2009 levels by 2020.

While the second and third scenarios are helpful in understanding the possible futures for renewable energy development, they do not provide distinct insight for public policy. The second scenario is qualitatively similar to the first scenario, driven by high electricity prices. The third scenario has decreasing electricity prices, which if actually materialize, would be welcome, even if they made renewable energy less cost competitive in the short run.

Realizing the economic potential identified in this study, of both the projects in the pipeline and the additional untapped renewable resources in Massachusetts, will require significant effort by all stakeholders to overcome barriers. The study team interviewed project developers to identify common barriers. The following themes emerged:

- Massachusetts has had a complicated permitting process involving multiple sequential reviews by different agencies and levels of government with no enforceable timeline.
- Opposition to renewable energy projects, even if voiced by small numbers of residents, is a powerful obstacle, particularly on the local level.
- Renewable suppliers have found it difficult to secure financing without the financial certainty of long-term contracts with utilities.
- The rules for selling excess electricity generated at or near a customer site back to the utility have limited the economic appeal of on-site and community-scale projects.

The Green Communities Act, signed by Governor Patrick and developed in close collaboration with legislative leaders, comprehensively reforms the rules around renewable electricity. Now in the process of implementation, the Green Community Act will help the Commonwealth overcome many of these barriers:

- It increases demand for renewables by expanding the Renewable Portfolio Standard (RPS) by 1% per year to 15% in 2020.
- It creates financial certainty for renewables projects by requiring utilities, for a pilot period of 5 years, to enter into long-term contracts of 10 to 15 years in length for up to 3% of their total load and providing an incentive of 4% of annual contract payments for taking on these long-term contracts.
- It rationalizes the pricing of distributed renewable generation, such as rooftop solar and community-scale wind, through changes in the rules governing “net metering.” Net metering requires utilities to credit a customer for net excess generation of renewable and alternative energy at the customer’s site that’s supplied to the grid. In the past, customers were credited based on the average monthly *wholesale* price and were limited to a

generating capacity up to 60 kilowatts. The new law requires the utility to purchase the excess power at the retail price rather than the wholesale price and increases the cap to 2 MW. It also allows "neighborhood net metering" for facilities that serve a group of 10 or more residential customers in a single neighborhood within a single utility service territory.

- It creates demand for solar PV and helps develop the infrastructure for accelerated deployment of solar in the future by allowing each of the major investor-owned utilities in Massachusetts to own up to 50 MW of solar PV by 2010, sharing the costs and benefits across their customer base. Along with the existing Commonwealth Solar rebate program, this provision will help realize the Governor's goal of 250 MW of solar PV by 2017.
- It creates familiarity with and demand for renewables at the municipal level through the new Green Communities Program. The program also provides incentives for towns to streamline the permitting process for new renewable projects.
- Finally, it creates a commission to study the siting of energy facilities in the state and to recommend ways to streamline the permitting system.

In addition to the Green Communities Act, the Governor and the legislature approved other pieces of legislation that facilitate the development of renewable energy:

- The Oceans Act mandates the creation of a comprehensive plan to manage development in state waters, balancing natural resource preservation with traditional and new uses, including renewable energy from offshore wind and tidal and wave resources.
- The Green Jobs Act accelerates the development of a "green collar" workforce in the Commonwealth necessary to design and construct the large number of renewable projects possible in the state.

The study commissioned by DOER and MRET has established the significant renewable potential that exists in Massachusetts and that could be tapped economically in the near-term. The reforms in the Green Communities Act and other legislation completed this summer help move the Commonwealth towards realizing this enormous potential. With ongoing commitment by all stakeholders, a greener energy future awaits Massachusetts.