Renewable Energy Results for Massachusetts

A Report on the Renewable Energy Trust Fund 1998–2008

The Massachusetts Technology Collaborative (MTC) is a public economic development agency chartered by the Commonwealth to promote new economic opportunity and foster a more favorable environment for the formation, retention, and expansion of technology-related enterprises in Massachusetts.

MTC serves as a catalyst in growing the knowledge- and technology-based industries that comprise the state's innovation economy. It is working with major healthcare organizations to implement e-health solutions that save lives and reduce costs.

The agency is leveraging more than $70 million in federal funding for economic development in Massachusetts through the American Recovery and Reinvestment Act of 2009. MTC's proven track record of successfully managing complex projects that involve significant public and private investment has positioned the agency to serve as an important conduit for infusions of funding into the Commonwealth.

Working through its major divisions—the John Adams Innovation Institute, the Massachusetts e-Health Institute, and the Massachusetts Broadband Institute—the agency is strengthening the innovation economy, improving the healthcare system and creating new opportunities for citizens throughout the Commonwealth.

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During the decade between 1998 and 2008, the Massachusetts Technology Collaborative (MTC) was responsible for directing and administering the Renewable Energy Trust, a fund created by the Commonwealth to provide the Commonwealth and its electricity ratepayers with economic and environmental benefits from renewable energy. This paper describes the origins and purposes of the Trust, explains MTC's implementation strategies, and highlights what MTC accomplished during the years it administered the Trust.

Origins and Purpose of the Renewable Energy Trust

In 1997, Massachusetts enacted legislation that restructured the electric utility industry with the goal of using competitive market forces to reduce electricity prices and provide retail customers with a choice of electricity supplier.[1] As part of that legislation, the Massachusetts Renewable Energy Trust Fund was created to ensure that certain public policy goals related to renewable energy were achieved even though decisions about new electricity generation would be made through the competitive market rather than a regulatory process. The Trust Fund was funded through an excise tax on retail electricity sales to Massachusetts customers of investor-owned utilities.[2]

The idea of a state renewable energy fund supported by an excise tax on electricity sales was not unique to Massachusetts, but was instead being adopted in Connecticut, New Jersey, and several other states that were restructuring their electric utilities. However, the Massachusetts legislators could not simply copy a successful model from elsewhere, because those other states were either still developing their own legislation or in the very early phases of implementation.

The legislation gave the Massachusetts Technology Collaborative (MTC) responsibility for managing the fund in a way that produced "the maximum economic and environmental benefits over time from renewable energy to the ratepayers of the Commonwealth." MTC was told to create "a series of initiatives… promoting the increased availability, use, and affordability of renewable energy and… fostering the formation, growth, expansion, and retention within the Commonwealth of preeminent clusters" of renewable energy-related businesses and institutions.[3] MTC was therefore charged with considering the economy as well as the environment, and with building a renewable energy business cluster as well as expanding renewable energy generation.

The legislation did not prescribe or require specific programs but instead granted MTC wide latitude in determining how the money in the Trust Fund would be expended. Because the excise tax was linked to the sale of electricity through the electricity grid, the use of the Fund was limited to renewable energy applications that involved grid-tied electricity generation. The legislation also specified that the Fund would be restricted to the following technologies: solar energy (photovoltaic and solar thermal electric); wind energy; ocean energy (thermal, wave, and tidal); landfill gas; waste-to-energy; naturally flowing water and hydroelectric; low-emission, advanced biomass power conversion; fuel cells; and storage and conversion technologies connected to qualifying generation projects.

1 General Laws of Massachusetts, Chapter 164 of the Acts of 1997: "An Act Relative to Restructuring the Electric Utility Industry in the Commonwealth, Regulating the Provision of Electricity and Other Services, and Promoting Enhanced Consumer Protections Therein." Also Chapter 40J, Section 4E of the General Laws of 1997.

2 For the years starting in 2003, the tax was.05 cents per kilowatt hour. Before 2003, the tax was higher (.075-.125 cents per kilowatt hour). The additional money collected during the early years was designated by the Legislature for a purpose distinct from the main purposes of the Renewable Energy Trust Fund. It was earmarked to help Massachusetts municipalities and other governmental bodies meet the financial obligations associated with retrofitting or closing existing waste-to-energy facilities in the Commonwealth. MTC administered a program that distributed approximately $54 million for that purpose.

3 Chapter 164 of the Acts of 1997, Section 37

How MTC Prepared for the Launch of the Renewable Energy Trust

Although MTC had experience working on economic development matters related to the state's innovation economy, the agency had not worked on energy issues at the time it was selected to administer the Renewable Energy Trust Fund. The Legislature in part gave MTC the assignment because it wanted a fresh, independent approach to renewable energy that would not be constrained by past alliances with particular stakeholders—whether they be utilities, environmental groups, or electricity generators. And the Legislature wanted to ensure that strong consideration would be given to the economic development potential of renewable energy.

Because of the Renewable Energy Trust's wide-ranging mandate, the lack of successful models elsewhere, and MTC's general modus operandi which emphasized careful planning and consultation with diverse stakeholders, MTC embarked on a multi-faceted effort to determine the best strategy for the Trust. While MTC was pre-disposed to such a deliberative, structured planning process, a quick roll-out of Renewable Energy Trust programs and activities was not an option, because of a lawsuit filed by ten ratepayers challenging the constitutionality of the excise tax funding the Trust Fund. This made it difficult for MTC to spend any of the money in the Fund until after the resolution of the lawsuit in April 2000, when the Supreme Judicial Court ruled that the legislation was indeed constitutional.[4]

In the meantime, MTC conducted extensive discussions with government agencies, power generators, distribution companies, aggregators, renewable energy companies, consumer groups, and others. It hired several consulting firms to research renewable energy technologies, implementation strategies, and potential partners. In October 1998, Arthur D. Little, Inc. issued *Profiles of Leading Renewable Energy Technologies*, a report which made recommendations about which technologies MTC should focus on and the strategies it should use.[5] Bain and Company and Nexus Associates conducted a separate project that examined existing and potential market opportunities for renewable energy.

MTC's General Approach and Strategy

In October 2000, MTC released a detailed plan for the Trust, including a *Statement of Strategic Direction*.[6] That document embodied the general approach that MTC would use over the entire time it administered the Trust Fund. In particular:

- *MTC would focus on using the Fund to benefit the public as a whole, especially ratepayers, rather than any special interests.* As MTC indicated in the *Statement of Strategic Direction*, "We have a fiduciary responsibility to ensure that the fund is invested in ways that further the public purpose. Every action taken by MTPC should and will be considered within this context."[7] Effective administrative systems and controls were seen as important to demonstrate that the Fund was being fairly, impartially, and efficiently managed.
- *MTC would "emphasize learning by doing."*[8] It was unclear how renewable energy markets would develop within the new, restructured electric utility environment and there was considerable uncertainty about the best path to a future with more renewable energy. It therefore made sense to develop assumptions and then test them in order to learn from actual experience. This would be more than just trial

4 Supreme Judicial Court for the Commonwealth of Massachusetts, William E. Shea & others vs. Boston Edison Company & others, April 19, 2000.
5 Arthur D. Little, Inc. *Profiles of Leading Renewable Energy Technologies for the Massachusetts Renewable Energy Trust Fund* (Cambridge: Arthur D. Little. Inc., 1998).
6 Massachusetts Renewable Energy Trust, *Detailed Plan of the Massachusetts Renewable Energy Trust Fund. Part One: Statement of Strategic Direction* (Westborough: Massachusetts Technology Collaborative, 2000).
7 Ibid., p. 1.
8 Ibid. The quotations in this and the subsequent four paragraphs can be found on pp. 44-47.

and error, but would instead reflect experimentation based on "well-articulated hypotheses, clear designs, documented processes and sound analysis."

- *MTC would "avoid committing the Trust to a single course too quickly."* This seemed prudent given that there was no obvious one technology or single silver-bullet strategy that would quickly achieve the goals set out by the legislation. It would be important to conserve resources so that MTC could modify its strategy as it learned from experimentation and as markets evolved.
- *MTC would have "a diverse portfolio of initiatives and programs."* This was essential given the multiple goals laid out in the legislation, the many renewable energy technologies, and the need to experiment with alternative models in order to find the most effective ones.
- *The Renewable Energy Trust's grants and other awards would be "subject to systematic review based on explicit criteria."* MTC perceived this to be essential to making fair, sound decisions. There would be a formal approval process that included review by knowledgeable experts who were not on the MTC staff and did not have a personal stake in the outcome of a decision.
- *MTC would leverage the Trust's resources "with investments by other private and public organizations."* To increase the impact of the Trust and to ensure that relevant parties were committed to its initiatives, MTC would avoid using Trust funds as the only source of funding for an activity, but instead seek to add its funding to that provided by consumers, investors, power suppliers, renewable energy companies, local agencies, the federal government, and others.

The Statement of Strategic Direction also outlined some specific initial initiatives. Although the actual initiatives ultimately varied over time, they always revolved around three general areas outlined in the legislation:

1. Increasing the amount of electricity generated from renewable energy resources.
2. Helping individual ratepayers benefit from the onsite use of renewable energy technologies and related energy-efficiency measures.
3. Building a leading clean energy industry cluster in order to create and sustain jobs in the Commonwealth.

Benefits and Limitations of MTC's Approach

The approach taken by MTC had significant advantages. Most notably, the strong emphasis on the public interest, on formal award approvals processes, and on well-designed systems of financial control ensured that the large sums of money that were generated by the excise tax and flowed through the Renewable Energy Trust—$287 million over more than ten years—were all accounted for and deployed for the public purposes of the Trust. From 2000 to 2008, thousands of grants and loans were awarded; detailed contracts were written and signed clarifying the rights and responsibilities of all parties; and milestones were monitored before public funds were paid to award recipients.

Audit reports by the State Auditor in 2004 and 2007 recognized MTC's strong quality control systems and gave the agency a clean bill of health with zero adverse findings.[9] The emphasis on financial controls and methodical proposal review processes, including expert peer review panels, ensured that the Renewable Energy Trust Fund was not vulnerable to criticism of corruption or mismanagement of funds, even though large sums of money were being managed and public funding was being awarded to private businesses and individuals.

9 Auditor of the Commonwealth, *Independent State Auditor's Report on Certain Activities of the Massachusetts Technology Park Corporation, July 1, 2000 to June 30, 2003* (Boston, Commonwealth of Massachusetts, 2007), and *Independent State Auditor's Report on Certain Activities of the Massachusetts Technology Collaborative, July 1, 2004 to September 30, 2006* (Boston, Commonwealth of Massachusetts, 2007).

In addition, MTC's careful, deliberate approach and emphasis on step-by-step experimentation ensured that the money in the Fund was not squandered. At the outset, various stakeholders advocated loudly for large grants for their favorite projects, some of which would have used a significant share of the available money for unproven activities with a low probability of success. MTC resisted those entreaties and instead proceeded in its planned, systematic way, which left sufficient funding for later projects with a higher likelihood of having a significant impact.

MTC's successful investment of unexpended funds pending disbursement yielded a high rate of return and meant that more money was available when it was ultimately needed. Investment income through August 2008 totaled an impressive $60 million, which allowed MTC to increase the public impact of the Trust.

But MTC's deliberate approach also had a downside as the agency left itself vulnerable to criticism for being slow and bureaucratic. The lawsuit that delayed the launch of the Trust made some stakeholders especially anxious for quick action and they loudly criticized the agency's processes and approach. It was difficult for MTC to diffuse the criticism, in part because the state Administration at the time was not sufficiently focused on renewable energy to address the criticism or defend MTC.

Unsurprisingly, some of the most vocal critics of the complexity of MTC's review processes and the speed of spending were those who had been turned down for funding or had received tough messages from the agency's peer review panels and advisory committees. MTC rightly believed that the bar should be set high for receiving public subsidies in order to weed out inferior projects. But there were times, especially in the first few years, when MTC could have moved more quickly to distribute awards, and without as much focus on process. Over time, most initiatives were able to operate quickly with little bureaucracy, yet MTC always believed that it was important to strike an appropriate balance between rapid action and protecting public funds.

Most Notable Initiatives

Although MTC developed and implemented many successful initiatives, the Massachusetts Green Power Partnership and the Green Schools Initiative stand out for their especially large impact, not just within Massachusetts but on other states as well.

The Green Schools Initiative led to the incorporation of green building practices in state regulations governing the construction of schools, thereby saving communities across the Commonwealth significant money on their future energy bills and giving them better school buildings. The initiative also increased school architects' and local school committees' understanding of and commitment to green building techniques. Every step of the way leading to these happy conclusions followed MTC's collaborative, experimental, learning-by-doing model.

The initiative started at a time when environmentally conscious architects and engineers were advocating for incorporating a wide range of energy-efficiency, renewable energy, and other environmental measures into school buildings. But there was little experience trying to build so-called "green" schools in Massachusetts, so it was unclear which technologies and practices would turn out to be cost-effective and it was uncertain whether it would be possible to adjust school building planning processes to accommodate

Turners Falls High School
Montague, Massachusetts

new concerns about energy and the environment.

In 2001, MTC entered into a close partnership with the Department of Education—and later its successor school construction agency, the Massachusetts School Building Authority (MSBA)—to test and refine the green schools concept. One of the first activities of this partnership was a series of workshops for local school officials, architects, and other interested parties. MTC then awarded small feasibility study grants to 38 schools so that they could explore the green schools concept as they embarked on planning a new school or major renovation. In addition, and more importantly, MTC awarded design and construction grants averaging approximately $600,000 to 20 schools to help them cover some of the added costs associated with constructing a green school. The grants were necessary because the financial benefits of those extra initial costs were not yet known and MTC wanted to encourage the schools to experiment with unproven technologies.

To give the school systems expert advice and to make sure that their designs were headed in appropriate directions, MTC worked with the California-based Collaborative for High Performance Schools to create the Massachusetts Collaborative for High Performance Schools (MA-CHPS), a manual and a rating system for verifying whether a design met the emerging green schools standard.[10]

MTC then embarked on a careful process of evaluating the results of the initial experimental green school projects. Most notably, it funded two major studies that proved influential in convincing MSBA that green schools could indeed make good financial and educational sense if implemented appropriately. The first study, conducted by HMFH Architects and the Vermont Energy Investment Corporation in 2005, was titled *The Incremental Costs and Benefits of Green Schools in Massachusetts*,[11] and it analyzed the designs of eight of the Trust-funded model green schools. It found that the financial benefits of those schools would exceed their incremental costs by eight times over the 20-year bonding period of the projects. It identified the specific technologies and measures that had turned out to be most cost-effective. It also identified those measures that should not be replicated in future school projects, either because they did not work effectively or they turned out to have an excessively long payback period.

For the second study, funding from the Trust helped convince the prestigious National Research Council of the National Academy of Sciences to assess the health benefits of green schools. The resulting report, which received considerable attention in the educational community across the country, concluded that a "robust body of scientific evidence indicates that the health of children and adults can be affected by indoor air quality. A growing body of evidence suggests that teacher productivity and student learning may also be affected by indoor air quality."[12]

The evidence from these two studies, as well as the careful, even-handed way in which MTC had approached the Green Schools Initiative, gave MSBA the confidence to incorporate greater energy efficiency and other green school measures into its 2006 guidelines and funding incentives for all future construction projects. MSBA required all schools to meet 20 of the 27 "prerequisites" from the MA-CHPS rating system, including 14 pertaining to indoor environmental quality, three related to energy efficiency, and three that dealt with other green building practices. In addition, schools were able to earn an additional state reimbursement of up to two percent of the total cost of the construction project if the school is actually certified as a high-performance green school through MA-CHPS.

10 Collaborative for High Performance Schools, *Massachusetts High Performance Green School Guidelines: Criteria. Version 1.0* (Westborough: Massachusetts Technology Collaborative, 2006). The manual was based on an earlier one that had been developed for California.

11 HMFH Architects, Inc. and Vermont Energy Investment Corporation, *The Incremental Costs and Benefits of Green Schools in Massachusetts* (Cambridge: HMFH Architects, Inc., 2005).

12 National Research Council, *Green Schools: Attributes for Health and Learning* (Washington: National Academies Press, 2006), p. 6.

After the adoption of the new standards, MTC continued to provide advice and support to MSBA's green school efforts. As part of that ongoing role, MTC sought to extract additional useful information from the experience of the initial green schools. MTC therefore funded another major study, *Massachusetts Green Schools: Post-Occupancy Study of Energy Efficiency*, by the Cadmus Group and RLW Analytics.[13] Completed in 2009 and based on the actual performance of the completed model school buildings, it not only quantified the extent to which green schools were outperforming their conventional counterparts but it identified ways in which inadequate monitoring, insufficient training of facilities personnel, and the introduction of unnecessary plug loads were preventing the schools from achieving their energy-saving potential. The report included energy-savings tips that many of the schools have since adopted.

The Massachusetts Green Power Partnership (MGPP) was created to help developers of large renewable energy projects secure financing for those projects and to overcome the limitations of the state's renewable portfolio standard (RPS). In the 1997 electric industry restructuring legislation, an RPS was established requiring electricity suppliers to get an increasing share of their electricity from renewable energy generators. Legislators and the policy analysts who developed the RPS assumed that this mechanism alone would be sufficient to bring the least-cost renewable energy generation online. The Renewable Energy Trust was envisioned as concentrating on other goals of the legislation.

The RPS did not function in this way because project developers had great difficulty securing financing for their projects. Revenue from the sale of renewable energy certificates (RECs) under the RPS was essential to the financial viability of renewable energy projects, but developers could not assure financiers that they would actually receive that money. A main part of the problem was that the Legislature and Executive Branch had the ability to revise or repeal the RPS at any time. In addition, even if the law remained unchanged, it was impossible to accurately predict future REC prices. MTC stepped in with MGPP to compensate for these weaknesses in the RPS.

Through long-term REC-purchasing agreements, MGPP guaranteed project developers a specified price for their RECs for a term up to ten years. Based on solicitations in 2003 and 2005, MTC approved 13 awards, representing a total obligation of $73.4 million (nominal). Although some of the projects were later cancelled or were subsequently able to find an alternative financing route, the MGPP awards were essential to the completion of seven projects with a total capacity of 99 megawatts.

An innovative and desirable feature of MGPP was that the Renewable Energy Trust Fund did not need to pay out any money unless and until a project was actually completed. This was especially important, because it was clear that the lack of project financing was not the only problem that could derail a proposed renewable energy project. The

Brockton Brightfields
Brockton, Massachusetts

13 Cadmus Group and RLW Analytics, *Massachusetts Green Schools: Post-Occupancy Study of Energy Efficiency* (Westborough: Renewable Energy Trust, 2009).

way MGPP was structured avoided the risk of spending public funds without achieving the intended public purpose. Moreover, as long as RECs retained some value, the Trust Fund would get much or all of its money back by reselling the RECs it received from the projects. In fact, in the case of the first MGPP project for which RECs were received—the Schiller Station biomass facility—the RECs were sold at a profit of several million dollars, thereby generating additional funding for other Trust activities.

MGPP influenced the thinking of policymakers in other states, some of whom adapted the model for their purposes. Discussion of the initiative in policy circles brought considerable attention to the under-recognized problem of how to secure long-term financing for renewable energy projects in restructured electricity markets.

Other Successful Initiatives

Many other initiatives and activities of the Renewable Energy Trust produced benefits for the Commonwealth. The following deserve special notice:

Cluster Development Activities. MTC developed and carried out a wide-ranging strategy to build a cluster of clean energy businesses in the state. The involvement of MTC and support from the Trust Fund were especially important in the early to mid-2000s, before the blossoming of global investor interest in the cleantech sector. MTC helped maintain momentum for the industry through those lean years and made it clear that Massachusetts was an important center of clean energy business activity. To ensure that MTC's investments in individual companies would be based on objective information about the companies' financial prospects and their potential importance to the Massachusetts economy, the agency relied on review input from a distinguished Industry Support Investment Committee. Here are some of the particularly noteworthy results:

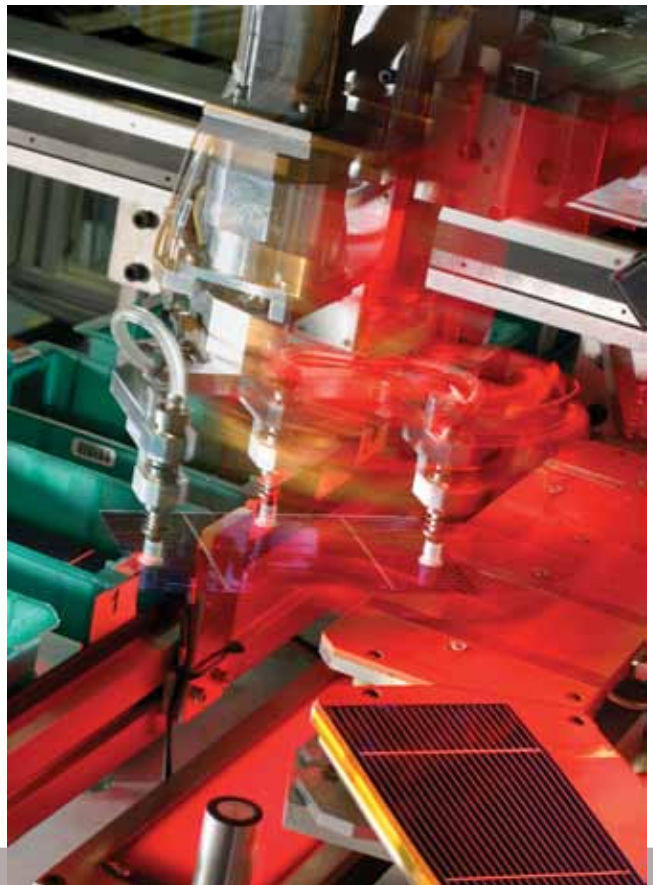
- The SEED program provided loans to 14 small start-up companies that helped them to survive and advance to the stage where they were able to attract significant funding from private investors. Given that these were inherently risky, early-stage companies, it is a testament to MTC's ability to make sound investments for the Commonwealth that virtually all the companies still remain in business in Massachusetts, as of this writing, and the vast majority of them have secured additional investment. As one example, FloDesign Wind Turbine Corp., the recipient of an MTC $500,000 SEED loan, recently closed on $34.5 million in Series B financing and also received a major $8.3 million grant from the US Department of Energy.
- MTC helped build the emerging cluster's infrastructure by supporting two nascent industry associations, the Solar Energy Business Association of New England (SEBANE) and the Hydrogen Coalition.
- MTC's involvement with the Northeast Sustainable Energy Association's Building Energy conference was essential to expanding its size and making Boston the permanent home for this largest of regional green building conferences. Thousands of people came to Massachusetts annually from across the region, helping to solidify the image of the state as the regional center of green building and clean energy activity.
- A 2003 investment by MTC in Evergreen Solar was important to that company securing major equity investments that allowed it to survive a difficult period in its development.
- MTC was instrumental in inducing the world-renowned Fraunhofer Society to establish its US energy research center in Massachusetts. The Fraunhofer Center for Sustainable Energy Systems is now up and running in Cambridge, carrying out a wide range of contract research for industry.
- MTC created an innovative, professionally managed venture capital fund, the Massachusetts Green Energy Fund. That

fund combined $15 million from the Renewable Energy Trust with $2.1 million from private investors to make equity investments in early-stage Massachusetts companies, both helping those companies and inducing them to retain their headquarters and other activities in Massachusetts.

- In total, more than 30 companies received loans or other investments. Those investments have had an outstanding track record.
- An MTC-initiated and Trust-funded *Massachusetts Clean Energy Industry Census* in 2007 identified more than 556 entities focused on renewable energy and energy efficiency, employing 14,400 people.[14] This report gave much increased visibility, both locally and nationally, to the state's clean energy industry cluster.

DG Collaborative. MTC assumed responsibility for organizing and facilitating a Massachusetts Distributed Generation (DG) Collaborative after the state's Department of Telecommunications and Energy (DTE) called for the formation of such a group in order to develop uniform state standards for grid interconnection of solar and other distributed generating systems. This multi-stakeholder effort, involving the utilities, renewable energy companies, environmental organizations, consumer advocates, and public interest groups addressed arcane matters that were nevertheless important for installations of renewable energy to proceed smoothly. DTE used the DG Collaborative's recommendations as the basis for standardizing the technical requirements, administrative procedures, and tariffs for tying DG systems into the grid.

Evergreen Solar
Marlborough, Massachusetts



Clean Energy Choice. Back in 1997, both the local and national proponents of electric utility restructuring assumed that the Massachusetts restructuring legislation would lead quickly to a vibrant retail electricity market with many choices for consumers, including the option of paying a little extra for so-called "green" electricity generated from renewable energy. Because some of the initially proposed green offerings would have done little to support the creation and operation of additional renewable energy facilities, MTC stepped in to make sure that consumers had choices that would indeed create more renewable energy with their payments. With the Clean Energy Choice initiative, MTC played a valuable certification function, sanctioning only those offerings that met higher standards. In addition, because consumers' voluntary payments did not provide them with any personal benefits but instead contributed to the public good of advancing renewable energy, MTC made the argument to the US Internal Revenue Service that the payments constituted a charitable contribution and should be eligible for a tax deduction. MTC was the first in the nation to make this argument to the IRS and the IRS agreed with it. Although the voluntary green electricity market remained small and did not develop as anticipated in either Massachusetts or elsewhere, Clean Energy Choice accomplished several valuable purposes:

- Many consumers were saved from paying for ineffective green electricity options, because Clean Energy Choice either

14 Global Insights Inc., *Massachusetts Clean Energy Industry Census* (Westborough: Massachusetts Technology Collaborative, 2007).

discouraged those options from being offered in Massachusetts or consumers were discouraged from purchasing them if they were offered.

- Consumers who paid for Clean Energy Choice offerings saved money by qualifying for a tax deduction on their purchases.
- Through a matching grant program that was linked to Clean Energy Choice, many municipalities qualified for grants that paid for renewable energy installations and energy-efficiency improvements at municipal buildings. This matching grant program unleashed considerable grassroots activism in support of renewable energy and led to widespread media coverage of local clean energy projects.

Cape and Islands Offshore Wind Stakeholder Process. At a crucial point in the long, contentious history of the proposed Cape Wind project, MTC stepped in to conduct a six-month stakeholder group process, as well as follow-on public meetings that examined the issues related to this unprecedented project. MTC began the initiative after concluding that there was a need for contextual and project-specific information to be presented in a neutral setting that would promote exchange among stakeholders with varying viewpoints. MTC played the role of honest broker, identifying information necessary for informed decision-making and facilitating discussion among representatives of local organizations, elected officials, and other interested parties. The goal was not to achieve consensus, but rather to discover and communicate project-related objective information that would help decisionmakers and average citizens participate in the permitting process in an informed and constructive manner. Although MTC's stakeholder process clearly did not end the acrimonious debate or controversy over Cape Wind, it focused attention on sound information and meaningful issues rather than on non-issues. It helped many people in the Cape and Islands region better understand the Cape Wind project and develop an informed opinion about it. MTC's work was also useful to the federal Army Corps of Engineers and Minerals Management Service as they carried out the federal permitting process. In retrospect, MTC's initiative helped to keep the Cape Wind project alive and made the emotional public discussion of it more fact-based than it would otherwise have been.

Green Affordable Housing Initiative. MTC believed that it was in the public interest for affordable housing projects to be less expensive to operate and healthier for occupants. Green building practices could accomplish those objectives, but Massachusetts's affordable housing community needed guidance and financial support to help them move towards a new way of designing, building, and assessing major construction and renovation projects. The Renewable Energy Trust's Green Affordable Housing Initiative provided major partnership grants to eight key public housing agencies and developers of affordable housing. The grant recipients used Trust funding for the incremental costs of green building designs and renewable energy systems, but they also developed strategies for how to continue to build green after the grants ended. Under MTC leadership, the eight organizations exchanged ideas, results, and lessons learned. As a result of the initiative, MassHousing, the Massachusetts Department of Housing and Community Development, the City of Boston Department of Neighborhood Development, and the other five initiative partners became committed to increasing

Jiminy Peak Resort
Hancock, Massachusetts

Private residence

energy efficiency and the use of renewable energy in affordable housing projects in the Commonwealth.

Renewable Energy and Energy Efficiency for Businesses and Institutions. Several initiatives, including the Large Onsite Renewables Initiative and the Green Buildings Initiative, helped businesses, universities, and other organizations install medium-sized renewable energy systems. Jiminy Peak Resort, Mass Maritime Academy, and other organizations installed wind turbines in order to reduce their energy costs, while the Massachusetts Museum of Contemporary Art and many others installed large solar electricity systems. Through the Green Buildings Initiative, 55 organizations received grants for either feasibility studies or design and construction. They used that funding for renewable energy systems and to reduce the cost of various energy efficiency measures, including ground source heat pumps, energy monitoring and control systems, high-performance windows, energy-efficient lighting, reflective wall panels, and additional insulation. Funding from the Trust contributed to the success of some of the state's most iconic award-winning green buildings, including the Genzyme headquarters, the Trustees of Reservations Doyle Conservation Center, and the Woods Hole Research Center.

Small Solar Projects. MTC experimented with several initiatives to help homeowners, businesses, and institutions install small solar electricity systems with a retail cost under $50,000. Many individuals and organizations wanted to purchase such photovoltaic (PV) systems for environmental reasons and because they wanted to do something personal and visible to encourage energy independence and mitigate global warming. Given the high cost of PV compared to other electricity-generating technologies, the challenge was to design initiatives that did not use large amounts of public funds for limited public benefits and that encouraged ratepayers to tackle more cost-effective, energy-efficiency projects before installing PV. In 2005 MTC rolled out the highly successful Small Renewables Initiative. This simple, well-designed rebate program incorporated what MTC had learned from its previous solar initiatives, as well as from extensive input from the solar industry and other stakeholders. It provided grants to many hundreds of Massachusetts ratepayers. Rebate levels were changed over time in response to PV prices in order to provide the smallest public subsidy needed to induce increasing market penetration by the technology. In the interest of equity, rebate levels reflected the purchasers' ability to pay. This well-regarded initiative provided the intellectual underpinnings and a strong starting point for Governor Patrick's Commonwealth Solar Initiative.

US Offshore Wind Collaborative. The idea of installing large wind turbines in deep water far from shore has considerable appeal. Wind speeds are high there and there would be little public opposition since the wind turbines could not be seen easily from land. However, significant technical, regulatory, and logistical challenges must be overcome before deep-water wind projects are practical. MTC therefore started the Offshore Wind Energy Collaborative (later called the US Offshore Wind Collaborative), an initiative that brought together representatives of industry, academia, and government to explore joining together to advance the prospects of deep-water wind projects. The initiative increased communication among the many US organizations, companies, and governments potentially interested in offshore wind, especially along the Atlantic Coast. In addition to funding from MTC, the initiative received early temporary funding from the US Department of Energy and GE, the nation's largest wind turbine manufacturer. The initial efforts ultimately led to the recent establishment of the US Offshore Wind Collaborative as an independent national membership organization with headquarters in Massachusetts and with close ties to the

Massachusetts Executive Office of Energy and Environmental Affairs. Collaborative members will now work together to tackle some of the issues related to offshore wind. Not only has this MTC-originated initiative served a valuable national function by building momentum for offshore wind, but it helped place Massachusetts in a leadership role and has increased the likelihood that companies related to offshore wind will ultimately want to have a presence in Massachusetts.

Massachusetts-NREL Wind Technology Testing Center. Massachusetts, in partnership with the US Department of Energy's National Renewable Energy Laboratory (NREL), is building the nation's primary large wind turbine blade testing center in Charlestown. The center will work with turbine manufacturers to provide certification tests for new blade designs and reliability tests for existing designs. After early major funding from the Renewable Energy Trust Fund, construction of the project is being supported by a $25 million grant from the federal government. Governor Patrick led a team from various state agencies and the University of Massachusetts that convinced the federal government to select Massachusetts as the location for the center and to award the funding for it. However, Massachusetts would not have been able to put together a competitive proposal or receive the support of the NREL staff during the selection process without the extensive early work done by MTC staff and the strong relationships developed between MTC and NREL.

Greening State Buildings. MTC worked with the state's Division of Capital Asset Management to help that agency explore how to adopt green building practices for the state's public building projects and to incorporate renewable energy installations into those projects. More than $2.5 million in Trust funds was used for this effort, leading to significant changes in DCAM's approach and specific practices.

The Massachusetts Water Resource Authority Deer Island Wind, Winthrop, MA

Limitations of the Renewable Energy Trust

Despite the many successes of the Renewable Energy Trust, MTC ran into four obstacles that made it difficult to implement renewable energy as fast as had been hoped when the Trust was established. Neither MTC nor any other single public agency had the ability to unilaterally eliminate these obstacles.

1. *Siting and Permitting Difficulties.* It was much more difficult than expected to site and permit large wind and biomass projects in Massachusetts. This significantly constrained the pace of renewable energy development, especially because wind and biomass are the two technologies with the greatest potential for large-scale, near-term deployment. Almost all large-scale development in Massachusetts is subject to a relatively slow permitting process, but wind and biomass projects have also faced special problems. For one thing, there are a limited number of good sites for large renewable energy projects, yet local opposition has emerged to building on many of those sites. In addition, the usual energy facility siting procedures have not been well matched to certain types of renewable energy projects. MTC took some steps to address siting and permitting, but the agency had limited ability to address the key issues. Governor Patrick's Administration has recognized that siting/permitting represents the largest obstacle to renewable energy development, and so has given considerable attention to it.

2. *Slow Progress for Certain Technologies.* From the mid-1990s through the mid-2000s, energy experts across the country were optimistic that fuel cell technology would make rapid progress and be able to be deployed cost-effectively and widely. For that reason, when the Renewable Energy Trust was established, the Legislature assumed that fuel cells would be one of the main focuses of the Trust. Indeed, the analyses of renewable energy technologies and markets that MTC commissioned from Arthur D. Little, Bain and Company, and Nexus Associates all concluded that fuel cells should receive significant near-term attention from the Trust. As a result, MTC early on rolled out several initiatives aimed in part at encouraging fuel cell installations. However, the technology has advanced much more slowly than the experts predicted and there are still relatively few fuel cell installations either in Massachusetts or elsewhere in the world. Similarly, other technologies have turned out to be more difficult than expected to implement in Massachusetts. For example, community wind projects have been much more labor intensive to develop than anticipated.

3. *Little Competition for Household Electricity Customers.* As noted earlier, proponents of electricity utility restructuring predicted that an active market would emerge with many companies competing to supply electricity to ratepayers. In response to that assumption, MTC gave considerable attention to encouraging consumer aggregation projects and the development of sound choices for consumers. But although an active market has developed for large business and institutional customers, active competition for households and small businesses never developed. Few of those ratepayers have shifted their service away from the standard offer provided by their electric distribution company. If there had been greater retail competition, some of MTC's initiatives would have been more successful, but the agency never had (nor professed to have) the ability single handedly to create such a vibrant retail market.

4. *Larger Market Forces Have Not Always Favored Renewables.* A variety of factors, including the high price of steel for wind turbines, shortage of silicon for photovoltaic panels, periodic low prices for natural gas, slower than anticipated

growth in electricity demand, and the inability of electric distribution companies to enter into long-term power purchasing agreements, have all slowed renewable energy development at one time or another. MTC through the Renewable Energy Trust was only able to advance renewables at a pace that made financial sense to investors, developers, suppliers, distributors, and customers.

Summing Up

During the more than ten years that the Massachusetts Technology Collaborative was responsible for administering the Renewable Energy Trust, the agency awarded $281 million in grants, loans, and contracts to municipalities, public agencies, nonprofit organizations, private companies and individuals.[15] Although it was more difficult to implement large-scale renewable energy generation projects than anticipated at the time that the Trust was established by the Legislature, MTC made significant progress on its three main goals: increasing the amount of electricity generated using renewable energy, helping individual ratepayers benefit from the onsite use of renewable energy and energy efficiency, and building a leading clean energy industry cluster.

MTC's careful financial management of the Renewable Energy Trust Fund is especially noteworthy. MTC did not squander public money on irrelevant or unpromising activities, and it invested unawarded funds in a way that produced additional funding for program activities. Perhaps the most remarkable indicator of MTC's successful financial stewardship of the Trust Fund was the positive return on those awards that were given out in the form of loans or equity or otherwise required repayment. Although these awards often involved uncertain new technologies and financially risky early-stage companies where one would expect a high rate of default and bankruptcy, MTC's investments in renewable energy companies and installations had achieved a positive gain of more than $12 million as of June 30, 2008.

When MTC transferred control of the Renewable Energy Trust Fund to a new Board under the Green Communities Act, there was an unawarded fund balance of $28 million for the new Board to use. Moreover, in the coming years, loans and other program-related investments by MTC will likely provide the new Massachusetts Clean Energy Center with additional tens of millions of dollars to use to advance renewable energy.

MTC learned a great deal from overseeing the Massachusetts Renewable Energy Trust Fund and now has considerable experience at managing a large technology-oriented fund or project in collaboration with the Commonwealth's Executive Branch. MTC has applied lessons learned to new projects, most notably the Massachusetts Broadband Institute and the Massachusetts eHealth Institute. The knowledge and know-how gained through the Renewable Energy Trust have helped MTC to work productively with the Executive Branch and the Legislature to get those two important new initiatives off to strong starts.

15 More detailed data on revenues and expenditures of the Renewable Energy Trust through December 31, 2007 is included in an independent evaluation that was carried out by Nexus Associates. See Nexus Associates, Inc., *Evaluation of the Renewable Energy Trust: Final Report* (Arlington: Nexus Associates, 2008). This evaluation also includes assessments of the impacts of the various initiatives of the Renewable Energy Trust.