GREEN RESERVE

The **American Recovery and Reinvestment Act (ARRA), Green Project Reserve** of 2009, through the State Revolving Fund, provided funding for a wide variety of qualifying projects in the categories of: ***green infrastructure***, ***energy efficiency, water efficiency, and other innovative projects***. For more information on ARRA, to find out if your current or future planned project meets the necessary criteria, and how to apply, visit **www.Recovery.gov**.

Massachusetts Energy Management Pilot Program for Drinking Water and Wastewater Case Study

Reducing energy costs, lowering greenhouse gas emissions, and saving communities money through the identification of energy-efficient opportunities at water treatment facilities.

PILOT PROGRAM BACKGROUND

For many drinking water and wastewater facilities across the United States, energy costs make up the majority of an annual operating budget, typically second only to labor costs. Energy costs have a direct impact on an area's economic health through inefficient energy use and high utility rates, as well as on the total of greenhouse gases emitted.

According to the U.S. Environmental Protection Agency (EPA), an estimated 3% of national energy consumption, equivalent to approximately 56 billion kilowatts (kW), or $4 billion, is used in providing drinking water and wastewater services each year. Assuming the average mix of energy sources throughout country, this equates to adding approximately 45 million tons of greenhouse gas to the atmosphere annually.

In the state of Massachusetts alone, cities and towns spend approximately $150 million per year in electrical costs to treat 662 billion gallons of wastewater and drinking water. As much as 35-40% of a treatment facility's operating budget involves the purchase of energy to treat drinking water or wastewater.

EXECUTIVE SUMMARY

In December of 2007, the Executive Office of Energy & Environmental Affairs (EOEEA) and Massachusetts Department of Environmental Protection (MassDEP) set out to identify how the state could achieve a higher level of energy efficiency at water and wastewater utilities, and the Massachusetts Energy Management Pilot for Drinking Water and Wastewater Treatment Facilities was launched. A total of 14 facilities across the state, seven wastewater treatment plants and seven drinking water treatment plants, are taking part in this innovative pilot program, which is designed to:

- reduce the amount of energy that municipal facilities use in treating the water that flows through the plant by 20%;
- reduce greenhouse gas emissions by 20%;
- and save communities money.

> ***"The results of this pilot demonstrate the power and benefits of building a public and private partnership. These facilities will reduce energy costs for the ratepayers, as well as provide significant greenhouse gas emission reductions in the decades to come."***
>
> ***Michael DiBara, Project Manager***
> ***Massachusetts Department of Environmental Protection***

The pilot program has brought together state and federal agencies, electric and gas utilities, and other partners to share resources and expertise in achieving the program's energy goals. Utilities and other state partners provided a total of $326,000 in-kind contributions in assessment activities for the initial phase of the program.

Steps taken at each participating utility in this pilot program include:

- Benchmarking each plant's current energy needs and performance and assigning a score based on EPA's ENERGYSTAR Portfolio Manger benchmarking tool
- Conducting facility energy audits
- Assessing each plant for its potential renewable and clean energy opportunities
- Offering support for the implementation of energy-related projects based on the assessments

Significant energy savings and renewable power generation opportunities have been identified. In total, over $3.7 million of potential annual energy savings, through energy efficient and renewables, were identified at the 14 facilities. Each facility varied in estimated potential savings, from 6-133% of annual energy costs, an average of 34%. A summary of these costs and potential savings is provided later in this case study.

SUCCESS THROUGH PARTNERSHIP

A primary driver for this pilot program was MassDEP's desire to increase the organization's efforts to provide information on the public and private resources available to assist drinking water and wastewater facilities in reducing their energy consumption and carbon footprint, while saving money. The establishment of a combined Energy and Environmental Affairs Secretary position under MA Governor Deval Patrick's administration and the office's high priority to advance energy-savings goals across the state was also a contributing factor to this collaborative environment.

With municipal energy savings a priority within the state, MassDEP was joined by the following strategic partners:

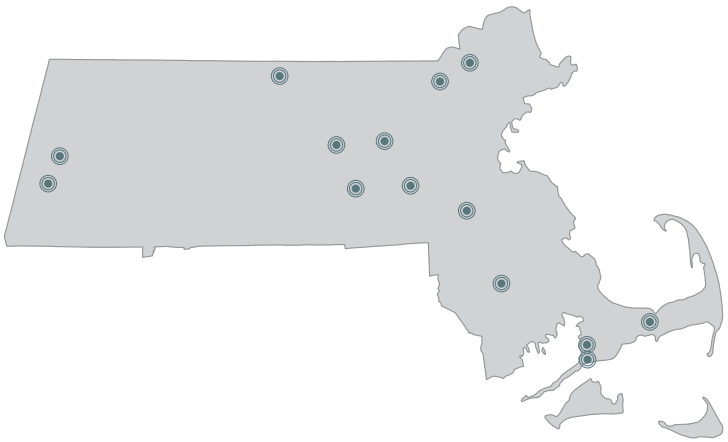
- U.S. Environmental Protection Agency (EPA Region 1)
- Massachusetts Department of Energy Resources (MA DOER)
- the University of Massachusetts-Amherst (U Mass)
- the Massachusetts Renewable Energy Trust
- the Consortium for Energy Efficiency
- Major electric and gas energy efficiency programs in the state: Cape Light Compact, National Grid, NSTAR, Western Massachusetts Electric, Unitil, and Bay State Gas

As a voluntary program, MassDEP reached out to a cross-section of 14 facilities, varying in size, employed technologies, geographic location, and level of utilization of energy management techniques.

> ***"The great success of the Energy Management Pilot Program can be attributed to the dedication, passion, and hard work of all those involved with the goal of making a positive impact within the state's largest area of municipal energy use. State and federal leadership, agency staff and my colleagues in other communities all pulled together as partners. Development of this national pilot program is inspiring for us, both personally and professionally."***
>
> *Bill Fitzgerald, Superintendent*
> *Town of Fairhaven, Board of Public Works*

The following facilities participated in the first phase of the pilot program:

- **Drinking Water Facilities:** Ashland, Easton, Falmouth, Lee, New Bedford, Townsend, and Worcester.
- **Wastewater Facilities:** Barnstable Wastewater Treatment; Charles River Pollution Control District (Bellingham, Dover, Franklin, Medway, Millis, Norfolk, Sherborn and Wrentham); Falmouth Wastewater Treatment; Greater Lawrence Sewer District (Andover, Lawrence, Methuen, North Andover, and Salem, NH); Lowell Regional Wastewater Utility (Chelmsford, Dracut, Lowell, Tewksbury and Tyngsboro); Pittsfield Wastewater Treatment; and Upper Blackstone Wastewater Pollution Control District (Auburn, Cherry Valley, Holden, Millbury, Rutland, West Boylston and Worcester).



STEPS TO INCREASED ENERGY EFFICIENCY

INITIATE ENERGY AUDITS & RENEWABLE OPPORTUNITIES ASSESSMENTS

MassDEP negotiated with five investor-owned electric and gas utilities and Cape Light Compact to provide audit assistance at all 14 facilities, with the goal of quantifying energy uses and costs, and identifying potential reductions or savings through conservation. These utility partners agreed to fund energy audits covering electric, natural gas, and fuel oil usage. Up to $10,000 was funded per facility, including a 50/50 cost share on additional funding required for a requested higher-level audit.

As part of the program, each facility will receive an EPA "ENERGY STAR Benchmarking" energy performance score. This will provide an initial screening of the facilities, as well as an ongoing tracking measure to compare their energy performance against similar facilities nationwide.

To address the pilot's renewable energy objectives, MassDEP also collaborated with the Massachusetts Technology Collaborative (MTC), which provided free preliminary screenings for renewable power generation opportunities in regard to pursuing wind power, bio-energy, solar, microturbines, or other sources of renewable energy at the pilot program facilities.

COLLABORATION WITH U.S. EPA

The Office of Wastewater Management and EPA Region 1 have been working with utilities in Massachusetts to promote development of energy management systems based on EPA's Energy Management Guidebook for Wastewater and Water Utilities developed in 2008. EPA sponsored two workshops in Massachusetts and Connecticut to introduce utilities to the steps outlined in the guidebook, which are based on the Plan-Do-Check-Act framework embodied in environmental management systems (EMS).

EPA, working with MassDEP, extended to all 14 facilities the opportunity to participate in an energy management roundtable with the goal of developing and implementing energy management plans based on EPA's Plan, Do, Check, Act framework.

An average of nine facilities and 20–25 staff attended five roundtable workshops throughout the year. The workshops were designed to provide technical information on energy efficiency, and allow operators to discuss application of EPA assessment tools, as well as share common problems and individual success stories. The Roundtable included site visits to map each facility's progress in developing an Energy Management Plan.

> ***"The roundtable discussions provided the Town of Easton with a variety of insights for operating our water supply more efficiently through discussions with our peers from the 14 pilot facilities. Our participation in this program has resulted in our receipt of a 50kw solar photovoltaic system at an Easton Water Division Facility, which will save our community hundreds of thousands of dollars in installation costs and thousands of dollars in energy savings for many years to come."***
>
> ***Wayne P. Southworth, Director***
> ***Town of Easton, Dept. of Public Works***

IDENTIFY FUNDING OPPORTUNITIES

The cost of implementing the first phase of this pilot program totals $326,000, with the funding coming from the utilities' energy efficiency incentive programs and the DOER Energy Audit program.

The pilot has also brought together sources of funds to support implementation of the identified conservation and renewable energy projects at these facilities, including MTC Renewable Energy Trust grants, State Revolving Fund/ARRA assistance, and energy efficiency incentive funds from participating electric and gas partners.

Through these sources, all original 14 pilot program projects, totalling $45.8 million, and an additional seven green infrastructure projects, $22.8 million, were fully funded. All projects are scheduled to begin by January 2010.

RESULTS

As part of Governor Patrick's Massachusetts Recovery Plan to secure the state's economic and clean energy future, the State Revolving Loan Fund will utilize federal American Recovery and Reinvestment Act (ARRA) funds to finance 21 "Green Infrastructure" drinking water and wastewater projects (14 pilot sites and 7 additional "green" sites).

In total, over $5.0 million of annual energy savings are anticipated to be achieved through energy efficiency ($2.2M) and on-site clean energy power generation ($2.8M). Over 29 million kilowatts are estimated to be saved annually through project implementation (equivalent to powering 3,450 average sized homes) and 22,000 tons of carbon dioxide emission reductions will result annually from these green infrastructure investments.

Once fully implemented, the renewable projects are anticipated to generate over 10,000 kilowatts (10 megawatts) of clean power to the water sector:

- Up to 5,175 kilowatts (5.175 megawatts) of new solar photovoltaic;
- Up to 4,860 kilowatts (4.860 megawatts) of new wind power at two wastewater treatment plants in Cape Cod and one large MWRA wastewater pumping station;
- Up to 344 kilowatts (.344 megawatts) of Combined Heat & Power (CHP) that will recapture methane biogas from wastewater sludge digestion to optimize on-site electric power generation and heat recovery; and
- Up to 255 kilowatts (.255 megawatts) of new hydroelectric power at three drinking water treatment plants.

RESULTS

MA Energy Pilot (Phase 1)—14 Sites
Facility Breakdown—(Annual Saving Estimates)

WASTEWATER

	Est. Costs	Total Cost Savings	Energy Efficiency Savings	Total kW Savings	Est. CO^2 Reductions (tons)	Green Power Generation (kW)
Barnstable Wastewater Treatment	$7,650,000	$128,939 (50%)	$35,000 (13%)	850,000	812	1,000 kW (solar & wind)
Charles River Pollution Control District	$895,000	$101,599 (22%)	$97,955 (21.5%)	705,300	558	Up to 20 kW (solar)
Falmouth Wastewater Treatment (*Wind I—Town Funded) (Wind II—ARRA Funded)	* $4,692,000 (Wind I) $5,300,000 (Wind II)	$508,000 (293%) $312,000 (133%) (Wind II)	$0 (Major facility upgrade in 2005)	4,235,000 2,600,000	3,131 (2 wind turbines—Wind I & II)	3,150 kW (2 wind turbines Wind I & II)
Greater Lawrence Sanitary District	$4,535,000	$1,473,270 (49%)	$1,417,470 (47%)	4,909,062	5,335	Up to 410 kW (solar)
Lowell Regional Wastewater	$4,669,500	$82,087 (6.5%)	$78,027 (6%)	567,444	415	Up to 30 kW (solar) Green Roofs (32,000 sq ft)
Pittsfield Wastewater Treatment	$14,650,000	$669,428 (84%)	$179,393 (25%)	4,255,737	3,252	1,770 kW (solar & biomass -CHP)
Upper Blackstone Water Pollution Control District	$2,053,000	$128,381 (6%)	$60,381 (3%)	831,615	636	Up to 400 kW (solar)
Totals	***$39,752,500**	**$3,403,904**	**$1,868,226 (55%)**	**18,954,158**	**14,159**	**6,780**

* Note: Wind Project "I" is town-funded; the estimated total costs of $4,692,000 is not included in the ARRA/SRF financial assistance totals.

DRINKING WATER

	Est. Costs	Total Cost Savings	Energy Efficiency Savings	Total kW Savings	Est. CO^2 Reductions (tons)	Green Power Generation (kW)
Ashland Howe Street Water Treatment	$486,353	$75,428 (62%)	$67,328 (55%)	194,464	229	Up to 45 kW (solar)
Easton Water Division	$350,000.00	$9,000 (6%)	$0	60,000	46	Up to 50 kW (solar)
Falmouth Long Pond Water Treatment	*$228,062	$52,352 (36%)	$49,652 (34%)	278,200	213	Up to 15 kW (solar)
Lee Water Treatment	$801,000	$34,177 (106%)	$7,926 (25%)	200,940	153	Up to 105 kW (solar & hydroelectric)
New Bedford—Quittacus Water Treatment	$2,590,000	$49,840 (9%)	$25,000 (4%)	165,000 / 1,783 MMBTU	165	Up to 138 kW (solar)
Townsend Water Treatment	$325,000	$13,658 (40%)	$5,000 (15%)	73,844	56	Up to 40 kW (solar)
Worcester Water Treatment	$1,434,000	$75,724 (25%)	$28,492 (9%)	553,152	423	Up to 160 kW (solar & hydroelectric)
Totals	**$6,091,353**	**$310,179**	**$183,398 (59%)**	**1,525,600**	**1,285**	**553**

Sub Totals: (14 sites) Wastewater & Water	**$45,843,853**	**$3,714,083**	**2,051,624 (55%)**	**20,479,758**	**15,444**	**7,333**

* Note: Includes $123,062 in energy efficiency upgrades (VFD retrofitting) funded by Cape Light Compact in 2006–2007.

RESULTS

MA SRF 2009 Additional Green Project Reserve Facilities—7 Sites
Facility Breakdown—(Annual Saving Estimates)

WASTEWATER

	Est. Costs	Total Cost Savings	Total kW Savings	Est. CO^2 Reductions (tons)	Green Power Generation (kW)
Fairhaven Wastewater Treatment	$7,876,000	$400,000	2,584,319	2,000	Up to 287 (solar, biomass—CHP, geothermal)
Newburyport Wastewater Treatment	$3,055,000	$144,200	628,000	589	Up to 65 kW (solar)
MWRA Deer Island Treatment Facility	1,119,000 ($735,000 ARRA funded)	$17,000	173,000	135	Up to 180 kW (solar)
MWRA DeLauri Pump Station (Charlestown MA)	$4,750,000	$500,000	3,000,000	2,294	1,500 kW (wind)
Totals	**$16,416,000***	**$1,061,200**	**6,385,319**	**5,018**	**2,032**

Note: Wind Project "I" is town-funded; the estimated total costs of $4,692,000 is not included in the ARRA/SRF financial assistance totals.
* A total of $735,000 of ARRA/SRF funds will be used to help subsidize the project.

DRINKING WATER

	Est. Costs	Total Cost Savings	Total kW Savings	Est. CO^2 Reductions (tons)	Green Power Generation (kW)
MWRA Loring Road	$1,525,000	$144,000	1,200,000	917	200 (hydroelectric)
MWRA John J. Carroll Water Treatment Plant	$2,200,000 ($1,050,000 ARRA funded)	$74,000	600,000	500	Up to 500 kW (solar)
Chelmsford Water District (Crooked Spring Road) Facility	$3,783,000	$84,000	498,560	280	Up to 469 kW (solar)
Totals	**$6,358,000***	**$302,000**	**2,298,560**	**1,697**	**1,169**

* Note: A total of $1,050,000 of ARRA/SRF funds will be used to help subsidize the project.

Sub Totals: (7 sites) Wastewater & Water	**$22,774,000**	**$1,363,200**	**8,683,879**	**6,715**	**3,201**

Grand Totals: (21 sites) Wastewater & Water	**$68,617,853**	**$5,077,283**	**29,163,637**	**22,159**	**10,534**

TAKING ACTION

According to MassDEP, the following projects identified by this pilot program are slated for development and implementation.

Solar: All participating facilities will potentially be installing new solar photovoltaic (PV) systems expecting to generate 5,100 kW of renewable power—increasing the state's current solar capacity by 40%.

Over 4,000 kW of solar energy will be installed through the Massachusetts Solar Stimulus (MaSS) Program—a new and innovative statewide procurement that will save communities money and help build the clean energy sector in Massachusetts.

Wind: A total of 3,360 kW of new wind power will be installed at two wastewater treatment plants in Cape Cod (Falmouth 3,150—two turbines 1,650 and 1,500 kW, and Barnstable up to 210 kW).

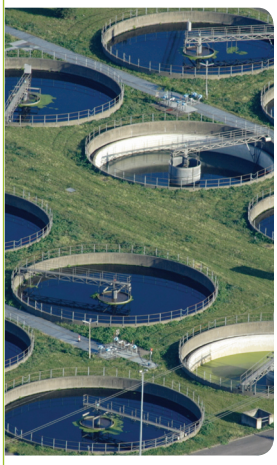
Other energy projects: Include installation of new hydropower, combined heat and power system, and $6 million of efficiency upgrades to these plants (e.g., installation of variable speed drives, premium motors, operational improvements, HVAC, lighting) expected to save approximately $2 million per year.

Clean Power: Anticipated annual energy savings and clean energy generation from these projects is equivalent to powering 3,450 homes.

Expected Savings and Green Power: The Pittsfield wastewater treatment plant expects to reduce annual electricity costs by 75-85%—saving nearly $700,000 annually. The Falmouth wastewater treatment plant will be using 100% wind power to clean its wastewater. In total, the two new wind turbines will offset 40% of Falmouth's municipal electricity costs. The Lee drinking water plant is expected to be "net zero"—producing 100% of its electric needs through on-site renewable power and maximizing energy efficiency.

If the targeted energy reductions of this pilot are achieved and expanded throughout the entire municipal wastewater and water utility sector in Massachussetts, the result would be a total annual reduction of approximately 200,000 tons of carbon dioxide (CO2), 380 tons of sulfur dioxide (SO2), and 125 tons of nitrogen oxide (NOx).

CONCLUSION



The Massachusetts Energy Management Pilot is an example of achieving fiscal, operational, and environmental benefits through evaluation of a community's municipal water and wastewater opportunities to save money and reduce environmental impacts through more sustainable energy management practices and projects. EPA believes the approach employed in this pilot project can be applied and replicated within drinking water and wastewater facilities across the country, helping to ensure a more efficient, sustainable, and resource-conscious future.

For more information on this pilot program and resources on identifying approaches to achieving greater utility energy efficiency in your community, please visit:

www.mass.gov/dep/water/wastewater/empilot.htm
Or contact MassDEP Project Manager, Michael DiBara, at (508) 767-2885 or email: Michael.dibara@state.ma.us

www.epa.gov/waterinfrastructure/bettermanagement_energy.html
Or contact Linda Darveau, EPA Region 1 contact, at (617) 918-1718 or email: darveau.linda@epa.gov

EPA-832-F-09-014 | December 2009