



GREEN RESERVE

The American Recovery and Reinvestment Act (ARRA), Green Project Reserve of 2009, through the Clean Water 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 projects that have been funded by the Green Project Reserve and for additional details, visit www.epa.gov/ow/eparecovery.

Achieving Zero-Net Energy at Drinking Water and Wastewater Facilities



Adopting zero-net energy principles to realize both cost savings and increased energy efficiency.



BACKGROUND

Providing safe drinking water and reliable wastewater treatment is extremely energy-intensive. An estimated 3% of total national energy consumption is used for drinking water and wastewater services.

By applying zero-net energy (or ZNE) principles, water and wastewater utilities can reduce their energy consumption, achieve greater energy independence, realize significant cost savings, and add to their bottom lines.

A zero-net energy facility is one that has greatly decreased its dependence on outside energy supplies moving toward a goal of total energy independence. Facilities striving to reach ZNE should first reduce the plant's total energy needs through investment in renewable technologies, reduced energy consumption equipment, and operational efficiencies using a variety of approaches, including those described in EPA's *Energy Management Guidebook for Wastewater and*

Water Utilities, available at www.epa.gov/waterinfrastructure/pdfs/guidebook_si_energymangement.pdf. Achieving ZNE is also an important element of effective utility management consistent with the Attributes of Effectively Managed Utilities supported by EPA and major water sector associations.

Once the total operational energy needs have been mitigated, alternative or "green" power sources can be used for on-site energy production. Through the use of low-cost, locally available, nonpolluting, renewable energy sources—such as solar cells, methane-powered microturbines, and wind turbines—a utility can generate enough renewable energy on site to equal or even exceed its annual energy use.

If the water and wastewater sector could reduce energy use by just 10%, collectively it would save about \$400 million annually.

ADVANCEMENT THROUGH STIMULUS FUNDING



Photo courtesy of Rose Forbes,
United States Air Force

Read about what three facilities in Massachusetts have done to reach zero- or close to zero-net energy through a combination of state and 2009 American Reinvestment and Recovery Act (ARRA) funding. These facilities also participated in a pilot program managed by the Massachusetts Department of Environmental

Protection to help utilities across the Commonwealth identify ways to improve their overall energy efficiency. For more information on this pilot program and its future expansion to all 370 Massachusetts water and wastewater treatment plants, visit www.mass.gov/dep/water/wastewater/empilot.htm.

TOWN OF FALMOUTH, MA: WASTEWATER TREATMENT FACILITY

The Town of Falmouth operates an advanced nutrient-removal system that processes approximately 0.4 million gallons of wastewater per day. The facility treats wastewater and domestic septage for the community.

Zero-Net Energy Upgrades:

- A town-funded (\$4,692,000) 1.65 MW wind turbine (installed in Nov. 2009 and operational by March 2010; is the Commonwealth's first utility-scale municipal wind turbine)
- An SRF/ARRA-funded (\$4,865,000) 1.65 MW wind turbine (currently under construction)

Anticipated Results:

- Approximately \$508,000 in annual energy savings

- Since installation, the town-funded wind turbine has generated 882,266 kW of clean energy or the equivalent of enough power an Average American Home for 79 years
- ARRA-funded wind turbine is projected to generate 3,624 MWh per year, thus reducing the Town's carbon emissions by 20%
- Achieve positive cash flow in first year by utilizing Massachusetts long-term Renewable Energy Credit incentives

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CITY OF PITTSFIELD, MA: WASTEWATER TREATMENT FACILITY

The City of Pittsfield operates an advanced nutrient-removal treatment facility that processes approximately 10.8 million gallons of wastewater per day. The facility treats municipal and industrial wastes from the City of Pittsfield and the surrounding communities.

Zero-Net Energy Upgrades:

- Upgrading the aeration system from a mechanical mixing system to a fine bubble mixing system
- Performing heating and lighting upgrades
- Upgrading the existing anaerobic biomass (sludge) digestion system by installing a 195 kW biomass cogeneration system for on-site electric power generation

- Installing a 1,575 kW solar photovoltaic system (ground-mounted)

Anticipated Results:

- Approximately \$647,000 in total annual energy savings
- 3,263,000 kWh of annual green power generation from solar photovoltaic and Combined Heat and Power [CHP] (approximately 69% total power generation)
- 3,252 tons of carbon dioxide emission reductions

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TOWN OF LEE, MA: DRINKING WATER TREATMENT FACILITY

The Town of Lee operates a surface water treatment plant that treats and distributes more than 308 million gallons of drinking water for 2,055 customers annually. The facility currently utilizes an 80 kW hydroelectric turbine at the plant that generates nearly 50% of its on-site electric power needs, saving the facility \$28,000 annually.

Zero-Net Energy Upgrades:

- Installing Variable Speed Drives (VSDs) and optimizing batching, premium motor, lighting, and heating upgrades
- Installing a 34 kW solar photovoltaic system on site
- Optimizing the existing 80 kW hydroelectric microturbine system to increase on-site renewable power generation

Anticipated Results:

- Over 90% production of the plant's electricity needs
- Approximately \$34,000 in annual energy savings
- 114 kW of green power generation
- 153 tons of carbon dioxide emission reductions annually

Although these upgrades were 100% funded by ARRA, the Town of Lee would have realized positive cash flow in the first year by combining its annual energy cost savings with Massachusetts' existing solar Renewable Energy Credit incentives.¹

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¹ Assumes financing the total upgrade costs at a 2% interest rate, REC revenue at \$0.285 per kWh for years 1-10 and \$0.06 per kWh for years 11-15.