SEPTEMBER 2013

HELPING MAINE MUNICIPALITIES

Case Studies in Energy Efficiency

efficiency MAINE

WELCOME

MUNICIPAL OFFICES DELIVER vitally important services to their communities, and today's municipalities have to do much more with much less. This challenge applies to municipalities' management of multiple facilities, including fire and police stations, athletic centers, public works garages, gyms, parks, and city streets, and requires planning and perseverance when dealing with the cost of energy at these facilities.

Towns operate like small businesses, with at least one major exception: municipalities are limited in how they can raise revenues. In recent years, municipalities have worked hard looking for ways to reduce operating costs. Many municipal facilities are often old and outdated, which further adds to the challenge. Reduced budgets have often resulted in delayed maintenance and upgrades to these buildings.

The timing of the Energy Efficiency and Conservation Block Grant Program was perfect. From 2009 to 2013, at the height of the economic downturn, Efficiency Maine administered $9.6 million in federal Recovery Act funds through the Department of Energy to help Maine's cities and towns (and a few large industrial customers) upgrade their energy infrastructure. The goals of the federal program were to reduce total energy use, improve energy efficiency, and reduce fossil fuel emissions.

From Aroostook to York Counties, more than 100 communities benefitted from these grants. These projects resulted in municipal facilities that were not only more energy efficient, but safer and more comfortable. Sometimes, improved energy efficiency helped reduce maintenance costs and improve processes, resulting in even greater savings. That was the case with a wastewater treatment facility in Bethel, where an energy-efficient variable frequency drive actually helped improve operations, specifically by improving the process of oxygen aeration.

In the case of electrical savings, the beneficiaries weren't only the municipalities that participated in the program, or the residents of those communities. Rather, these projects benefited everyone on the electric grid by reducing or deferring the need to build new and expensive transmission lines and substations.

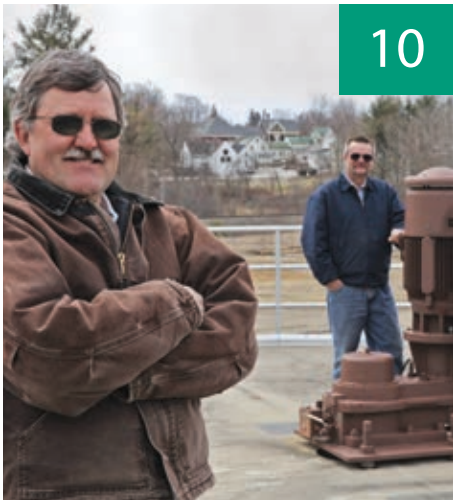
This report highlights several examples of towns that used these funds in various ways and were selected as examples of best practices that may be replicated elsewhere. Participants discovered that energy efficiency is the least cost energy resource.

The grant period is over, but Efficiency Maine offers a number of incentives and informational resources to help municipalities use energy more efficiently.

Regards,

MICHAEL STODDARD
Executive Director, Efficiency Maine

For more information on how your town can save energy and money through energy efficiency, visit www.efficiencymaine.com/municipal. While you're there, be sure to check out video testimonials from 12 communities statewide. These communities will continue to realize benefits year after year. So can yours.



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Introduction

IN 2009, EFFICIENCY MAINE WAS AWARDED $9,593,500 from the American Recovery and Reinvestment Act (the Recovery Act or ARRA) to help local governments promote, implement, and manage energy efficiency and conservation projects and programs designed to:

- Reduce fossil fuel emissions;
- Reduce total energy use;
- Improve energy efficiency; and
- Create and retain jobs.

These funds constituted Maine's share of the U.S. Department of Energy's nationwide program called the *Energy Efficiency & Conservation Block Grants* (EECBG). Efficiency Maine managed Maine's EECBG activities from November 2009 to May 2013, awarding more than 100 grants to municipalities across the state.

A number of municipalities used these grants to first develop energy management plans, conduct energy audits, and form energy committees. Leveraging grant resources with local matching funds, municipal leaders oversaw efficiency upgrades at various municipal buildings including town halls, community centers, fire and police stations, libraries, water treatment facilities, and other public buildings. A variety of thermal and electric measures were installed, from simple but essential lighting upgrades and insulation to more complex and technologically sophisticated equipment solutions including destratification fans, air exchange heating systems, and solar walls.

The intent of highlighting these profiles is to help municipalities – many of which are struggling with ever-shrinking budgets and increased costs –save money by making energy-efficient improvements that don't simply save taxpayer dollars on a one-time basis, but for the life of the installed measures.

In some instances, the stated energy and financial savings estimates were calculated by the town officials and their own impact from savings analyses such as comparing utility bills. In other cases, particularly in those where not enough time has passed to verify estimated savings, calculations are based on industry modeling assumptions.

Participants often realized additional benefits such as reduced maintenance cost and increased comfort of work spaces. Some community leaders said that the benefits they realized became the catalyst for making additional energy efficiency improvements – even helping local residents look for ways to save energy and money in their own homes. ▪

The Energy Audit and Planning Process

WITH MANY MUNICIPALITIES managing old, large, and outdated buildings, heating and powering these facilities is expensive. Many town offices have already taken steps to close off upper floors of their buildings to save energy, and are keeping thermostats as low as possible.

In some communities, such as Allagash and St. Francis, municipal officials knew that advances in energy efficiency technology could help them save considerable money on their heating and electric bills. However, they weren't sure where to begin or how to pay for the upgrades. Elsewhere, as in Alfred and Strong, town offices were located in beautiful, classic buildings on the National Register of Historic Places, and local officials were cautious about making changes that might affect the historic integrity of the structure.

In these cases, an energy audit played a vital role in guiding municipalities to make the right investments to maximize savings. Most participants profiled in this report say an energy audit – sometimes conducted at numerous facilities within a single municipality–served as the foundation and first step in the process of pursuing their EECBG projects. Municipalities, either through a local energy committee or local town officials, hired a professional energy assessor or contractor to conduct a detailed energy assessment outlining various cost-effective energy efficiency measures.

Most municipalities started the EECBG process with a detailed energy assessment and community energy plan, including the Town of Alfred. Pictured is Alfred Administrative Assistant Joyce Wood.

> "The most indispensable tool in all of this process was the energy audit."
>
> **DAVID POTTER**
> **Grant Writer/Consultant**

Audits also allowed towns to prioritize which measures to focus on in one or more community buildings. Through a detailed audit report, the contractor or assessor guided municipal officials on what critical first steps to take before making deeper investments. For example, replacing inefficient incandescent or halogen lights with more energy efficient lights was a common recommendation. So too were installing cellulose insulation, weatherizing attics, crawl spaces and basements, and sealing up cracks and holes that allow air leakage.

"The most indispensable tool in all of this process was the energy audit, because it keyed us in on the specific work that needed to be done," said David Potter, grant writer for the towns of Allagash and St. Francis. In the Allagash gym, it was a challenge to maintain a comfortable temperature given the high ceilings.

"We understood from the energy audit that there was an opportunity to better mix air by installing thermal destratification fans that created air columns and allowed the furnace to demand heat less often," added Potter.

In many instances, audit results provided unexpected information and recommendations.

For example, one common misconception was that if a structure was recently built – say within the last two decades – it must be energy efficient. Not so.

"I think that the biggest eye-opener for us throughout this project was that we were able to significantly reduce our energy use even though this is a fairly new facility and we thought when it was built that it was energy efficient," said John Fancy, Thomaston Superintendent, Pollution Control. "We were wrong."

Some municipalities used national resources such as the Environmental Protection Agency's Portfolio Manager, an interactive energy management tool (see related story).

"The select board, town clerk, and firemen were really wowed by the impact that this project had in terms of cost savings," said Potter. "And because they have a community energy plan as well, now they're looking at street lighting replacements on a regular schedule."

"What we were looking to solve with the grant was reducing or maintaining energy costs, and eliminating tax increases," said Tom Fullam of the Vassalboro Energy Committee. "If other municipalities want to achieve these results, they should start with what we call low-hanging fruit. Do the basic improvements to water heaters, insulating pipes, and air sealing, and with the savings from those improvements, they should then invest in the next level of deeper, more costly improvements." ▪

What is EPA's Portfolio Manager?

Portfolio Manager is an interactive energy management tool that allows property managers to track and assess energy and water consumption across a portfolio of buildings in a secure online environment. Portfolio Manager helps identify under-performing buildings, verify efficiency improvements, and even recognize superior energy performance. In addition, the EPA provides resources and assistance that can help an organization achieve energy-performance goals including publications, technical guidance, and visible recognition of achievements. **To learn more, visit the ENERGY STAR® web site (www.energystar.gov).**

Lighting

REPLACING INEFFICIENT LINEAR fluorescent lighting with more efficient T8 lamps is one of the most basic and cost-effective measures a municipality or business can undertake, offering maximum savings and a short return on investment. Because offices and large buildings often have numerous fixtures that are antiquated and left on for hours at a time, reducing energy costs per fixture is critical to an organization's bottom line.

Linear fluorescent lamps are the dominant type of interior lighting currently used in the kinds of buildings that municipalities operate. Recent advances in fluorescent lamps and electronic ballasts have created the opportunity for significant energy savings when replacing any prior generation of fluorescent lighting. Linear fluorescent lighting systems can be upgraded by installing High Performance T8 lamps and electronic ballasts in the existing fixtures or by installing new T5 or High Performance T8 lighting fixtures.

Replacing a standard, older, linear T12 fluorescent bulb with an energy efficient T-8 fixture can save as much as 50 percent a year to operate.

Another common lighting upgrade, particularly for outdoor lighting retrofits, is the installation of LEDs, which have the added benefit of a very long life, and reduced maintenance and replacement costs. Through the EECBG program, more than 30 communities chose to retrofit their lighting with more efficient lighting, such as T8 or LED lights. In Madison, for example, 40 street lights were converted to LED lights, for an estimated annual savings of nearly $6,000.

Caribou City Manager Austin Blees says new LED street lights have benefited the City of Caribou considerably by making streets look more attractive, helping residents feel safer, and helping storeowners increase visibility.

CARIBOU

Caribou's downtown area is modest, but vital to the municipality's character and tax revenues. The main downtown area, called the Downtown Mall, sees steady pedestrian traffic well into the evening. So it's critical that the area is brightly lit for safety and security reasons.

City officials knew that switching from high pressure sodium bulbs to LED bulbs would save energy and money and reduce maintenance costs. Besides being more efficient, the bulbs also cast a much crisper, whiter light.

"The citizens of Caribou have definitely complimented the city on the change," says City Manager Austin Blees. "They notice the difference and they appreciate the clear light that the downtown area offers."

One of the easiest and most cost-effective measures a municipality can pursue is energy-efficient lighting. Vassalboro is expected to save more than $5,000 a year on its electric bills, in part because of savings it will realize as a result of lighting improvements at the Vassalboro Library. Pictured is Dawn Thistle, Vassalboro's librarian.

Caribou also operates a small fixed-based operator airport with traffic from small private aircraft as well as emergency medical flights. Airport lights are required to be on for many hours, so energy efficiency is important to keep costs down.

Public Works staff used to service the airport three or four times a year conducting maintenance and replacing burnt bulbs on runway light fixtures. With LEDs, maintenance has been drastically reduced. Crews do an annual inspection and adjust any light fixtures that may have been knocked down from snow plowing the runway. "We've not had a light failure problem since installing the LEDs," says David Ouellette, Director of Public Works.

CARIBOU

Estimated Annual Savings:
$4,559 (plus $20,000 in maintenance costs over project life)

Simple Payback after Efficiency Maine Grant:
2 Years

"Energy efficiency definitely makes a big difference to a municipality's budget," says Blees. "We'll be saving tens of thousands of dollars over the life of the projects. When municipalities can save that much money, it allows you to run the city more efficiently, it allows you to provide better value to your taxpayers, and it allows you to keep the tax rate low so taxpayers get more bang for their buck."

VASSALBORO

In 2010, the Town of Vassalboro extended an open invitation to its 4,300-plus residents to serve on a newly formed Energy Committee. Its mission was to look for ways to reduce energy costs and save taxpayer dollars.

The committee toured town buildings, reviewed utility bills, and assessed heating and electric systems in order to prioritize goals.

"In order for a project to be viable, we considered cost and energy consumption," explains Tom Fullam, a member of the Vassalboro Energy Committee. Two candidates that rose to the top early in the process were the library, where lighting was the biggest expense to the facility's shrinking bottom line, and the town's fire stations, where heating a large space with high ceilings was a challenge.

"Lighting is so important to a library," says Dawn Thistle, Vassalboro Librarian. "You want to have enough light so you can see all the materials, and have a welcoming atmosphere. You also have to weigh whether there's too much glare, and too much direct light which might impact the preservation of your collection. You also want the lighting to look cozy rather than harsh, so that people stay and linger.

"Our previous lights also buzzed whenever they were on. We now have silent lights and a beautiful warm glow."

The committee also considered additional expenses such as maintenance and staffing. For example, high performance LED lighting in "Exit" signs and fixtures were identified as worthwhile candidates to save money on electric bills. Installing LEDs also eliminated the need to regularly replace bulbs, thus saving labor costs.

"A community has to take into consideration a facility's hours of use and its seasonality – lighting a baseball field used for one season vs. lighting a municipal building year-round, for example – and prioritize before determining a course of action," says Fullam. ▪

VASSALBORO

Estimated Annual Savings:
$5,367

Simple Payback after Efficiency Maine Grant:
3 Years, 2 months

What is a T8 light?

Fluorescent lamp diameters are measured in increments of 1/8 of an inch. This number follows the letter "T," which signifies a tubular lamp. Therefore a T8 lamp is a tubular lamp that measures 8/8" (or 1") in diameter. Over the last few years, T8 lamps have replaced T12s as the standard fluorescent lamp for commercial lighting, as well as some industrial lighting.

More advanced and efficient lighting is now in the marketplace, offering even more exciting alternatives to T8s. T5 systems are available in standard and high output versions, and are appropriate for high ceiling applications such as gymnasium and warehouse lighting. They also work very well in fixtures specially designed to spread light evenly across ceilings and/or throughout a space.

What is an LED light?

LED stands for light-emitting diode. LEDs are small light sources that become illuminated by the movement of electrons through a semiconductive material. LEDs can provide white and colored light. LEDs emit light in a specific direction, whereas an incandescent or fluorescent bulb emits light in all directions. For direct lighting applications LED lighting uses both light and energy more efficiently.

LED lighting uses up to 75 percent less energy than incandescent lighting, and lasts about 11 years – as much as 25 times longer than incandescent lighting or more than six times that of halogen lighting. Longer life also results in the added benefit of reduced maintenance costs from having to regularly replace bulbs.

Heating and Water Heating

RISING HEATING COSTS were a major concern for many of the municipalities applying to the grant program. For most municipalities, choosing space and water heating efficiency measures was guided by energy audit results, as well as the efficiency and age of the existing systems. Municipal heating projects funded through the grant program included: replacing inefficient systems, optimizing existing systems, matching production with demand, and providing supplemental heat.

For municipal buildings with inefficient older boilers or furnaces, replacing the entire system with an energy-efficient system had a relatively short payback and promised lower ongoing energy costs. These replacement systems, like the boiler at the Vassalboro Town Garage, operate more efficiently. The new boiler also has a cold-start feature, which allows the boiler to turn off while there is no call for heat, rather than staying on 24/7 to meet anticipated need. A number of municipalities took this efficiency upgrade opportunity to switch the fuel burned on-site. The towns of Strong and Perry, for example, replaced inefficient oil systems with pellet boilers, while Lisbon replaced an inefficient oil system with a higher-efficiency natural gas system.

New and existing systems were frequently optimized with controls and distribution upgrades. Adding controls was common in buildings with more recent heating systems, or in buildings where the investment in a new system required too much capital. The town of Allagash installed an outdoor temperature reset on its town hall boiler. Many towns also added programmable thermostats. These thermostats have been programmed to lower heat demand on weekends and evenings as well as prevent sporadic changes to interior temperatures in rooms used by the public. These optimizations are saving many grant participants as much as 10 percent on their heating costs.

Boiler controls like this one can be outfit with an outdoor temperature reset unit, which senses outside air temperature and re-adjusts the heating system's water temperature accordingly to satisfy the heat requirements of a building.

Strong's town hall includes a large community room and kitchen used for community events ranging from spaghetti suppers to weddings. One of the many measures Strong installed was an on-demand hot water heater. This propane-fueled system is located next to the kitchen and only fires when there is a call for hot water. Before the upgrade, domestic hot water was heated by the central boiler, which required the boiler to be kept hot year-round and stored a large amount of hot water whether or not the community room was in use. On-demand systems were installed in a number of other municipalities, especially in fire stations, where the call for water varies daily.

Grant writer David Potter and Patricia Pelletier, Town Manager, stand in the community gym, which was retrofitted with destratification fans.

A number of communities also installed supplemental or complementary heat or circulation systems to reduce demand on the primary heating system. The wastewater treatment facility in Orono added a heat recovery system that pre-heats incoming fresh air with the heat from air being exhausted. Thermal destratification fans were added to a number of fire stations, gymnasiums, and other high-ceiling spaces to re-circulate warm air. The destratification fans have reduced heating bills, and building users report that the fans have made these large spaces more comfortable!

ALLAGASH

Allagash, a small town of 215, is located at the confluence of the Allagash and St. John Rivers on the Canadian border. The town has one municipal building which serves as the heart of the community; it houses multiple resources from town offices and a sewing room to a gym and the fire station. The 10,000-square-foot building was once the local high school, and the repurposing of the building to serve so many municipal and community functions had resulted in a building that is expensive to maintain. A principal goal of participating in

the EECBG grant program was to stabilize municipal energy costs so that the town could afford to operate the building as a community hub well into the future.

The building's heating systems were recently installed but were not operating efficiently. Outdoor reset controls were added so that heat production could be modulated by outdoor temperatures. The heat distribution system was modified to eliminate excessive water storage, significantly reducing boiler run-times and unnecessary cycling. These changes to boiler controls and distribution were complemented by thermal destratification fans in the gymnasium. These fans mix internal air in a building to eliminate fluctuations of cool and warm air and achieve temperature equalization throughout a space. These fans redistribute the warm air that tends to rise – and is thus wasted – in buildings with high ceilings. This helps reduce the call for heat. Programmable thermostats have also reduced calls for heat overnight and have eliminated inadvertent changes to space heating through thermostat adjustments by staffers and community members.

ALLAGASH

Estimated Annual Savings:
$8,921

Simple Payback after Efficiency Maine Grant:
4 months

ST. FRANCIS

Like Allagash, the nearby town of St. Francis undertook an energy audit and comprehensive whole-building solutions for its three-story wood frame municipal building. This 100-year-old-building was originally a private residence and general store owned by the local lumber mill. When it transitioned to a public building with municipal offices and the fire station, it wasn't insulated and much of the original lighting remained in place.

The energy audit identified a number of measures that would reduce St. Francis's energy costs as well as make the building more usable. The renovation team focused a great deal of effort on improving the building envelope: air sealing and weather-stripping measures were installed, the attic and exterior walls were insulated, and inefficient windows were replaced with triple-glazed argon-filled models. In addition, inefficient fluorescent lighting was upgraded to more efficient models (T12s to T8s) and incandescent flood lights were replaced by compact fluorescent lamps. Heating and hot water controls were added to make existing systems more efficient. An outdoor air temperature reset control was installed, and a timer on the domestic hot water heater allows the tank to turn off when the building is unoccupied, rather than cycling through the night.

The St. Francis Fire Department installed destratification fans to heat its space more efficiently.

Deborah Jandreau spends most of her work day in her office at the St. Francis Municipal Center, which also houses the St. Francis Fire Station. She said since the building was weatherized, the office is less drafty and warmer in the winter.

Perhaps one of the most innovative aspects of the St. Francis project was the installation of thermal destratification fans in the fire truck bay. The fans are installed in the catch area where the doors retract, and they recirculate the warm air that collects at the top of the fire station. When the doors open for a call, the destratification fans produce a high volume of downward directed air flow to create an air curtain. This curtain prevents large volumes of warm interior air from escaping and has significantly reduced the heat loss associated with answering winter calls. In addition to saving money, the fire station is significantly more comfortable for the volunteer fire fighters who spend time there. ▪

ST. FRANCIS

Estimated Annual Savings:
$6,836

Simple Payback after Efficiency Maine Grant:
7 months

Water/Wastewater

ACCORDING TO THE US EPA, wastewater treatment accounts for 30-40 percent of a typical town's energy consumption. Water and wastewater treatment facilities require significant energy to power pumps, power aeration systems, exchange air, and control other operations.

A number of Maine towns tackled the energy-intensity of wastewater treatment through the EECBG grant program. Thomaston and Farmington used renewable energy to offset their high energy costs. Thomaston installed solar panels to meet some of the building's large electric demand to run pumps and its aeration system. Farmington reduced the heating demand of its treatment facility by using pre-heated solar air through the building's ventilation system.

BETHEL

The town of Bethel took a different approach and installed a variable-speed drive on a high-efficiency agitator. This new agitator has, in turn, been tied to an oxygen sensor. This variable-speed drive ramps-up or ramps-down power to the agitator depending on the volume of water being treated. And the link to the oxygen sensor ensures that the agitation and oxygen delivered to the water matches treatment requirements. Before the upgrade, the system was either on or off, too high or too low. Any excess oxygen and agitation did not improve the quality of the water, but added to the town's electric bill. Between 40-45 percent of Bethel's electric costs are from water treatment.

The new variable speed drive has reduced those energy costs by 10 percent, and the town has set aside these savings in a reserve fund for additional efficiency upgrades. What's more, the quality of the treated water released into the environment is more consistent – a powerful upside for a town that prides itself on its rivers and outdoor recreation opportunities. ▪

The Town of Bethel installed a variable speed drive on an agitator for its wastewater treatment facility, reducing its energy costs by about 10 percent.

Robert Gunderson, Superintendent, Bethel Wastewater Plant, says the energy-efficient improvements he made to the facility aren't just saving the town money and energy, but they're improving processes as well: the oxygen aeration process is better because of more precise agitator speed thanks to installation of a variable speed drive.

BETHEL

Estimated Annual Savings:
$2,883

Simple Payback after Efficiency Maine Grant:
8 months

Renewable Energy

AFTER REDUCING ENERGY waste and making systems more efficient, offsetting energy procurement by generating energy on-site may be another viable option. Many of the municipalities participating in the EECBG Program chose to complement efficiency projects with on-site renewable energy systems. These projects included wood pellet boilers, geothermal systems, solar thermal systems, solar hot air systems, and solar photovoltaic systems, and were selected based on the needs of the town and the opportunity for renewable energy.

For example, the town of Corinth required significant heating and cooling in its municipal building, and geothermal was a great fit to meet both demands. Meanwhile, the energy costs for the Cumberland Fire Station living quarters were driven by significant domestic hot water needs, so the town installed a solar thermal system to heat water with solar energy. Winthrop installed a solar photovoltaic system to offset a large electric bill and take advantage of a large roof with southern exposure.

In all of these cases, demand was paired with opportunity to make the renewable systems as cost-effective as possible. Two particularly interesting case studies are Thomaston and Farmington: both targeted the most energy-intensive facility in their building portfolios, the wastewater treatment facility.

THOMASTON

Thomaston constructed a new wastewater treatment facility in 1997. The facility was highly efficient at the time it was constructed, but was still the town's most costly operation. An energy audit revealed that significant efficiency opportunities remained, despite the fact that the building was newer than many others in town.

"We typically used 175,000 kilowatt hours per

"As a public utility, it is hard for us to justify raising the cost to the customer, and so we are continuing to look for ways to reduce our energy use."

JOHN FANCY
Superintendent of the Thomaston Wastewater Treatment Facility

The historic clock in downtown Thomaston serves as a local landmark.

year just to run the plant," said John Fancy, Thomaston Superintendent, Pollution Control. "To put that in perspective, that's the equivalent of almost 24 houses. This also added significantly to our cost. About 10 percent of our operating budget was spent buying the electricity just for this plant. And so we started looking for ways to reduce that cost to find a way to cut our electric bill. As a public utility, it is hard for us to justify raising the cost to the customer, and so we are continuing to look for ways to reduce our energy use and to keep the cost of handling the wastewater in Thomaston at a reasonable level."

THOMASTON

Estimated Annual Savings:
At least $3,500

Simple Payback after Efficiency Maine Grant:
1 Year

Thomaston added energy controls to its aerated lagoon system, replaced inefficient lamps with higher efficiency lamps, and added lighting controls. These efficiency upgrades were paired with 78 solar photovoltaic panels (solar electric systems or PV) placed on the roof of the building and funded through the grant. The 17 kilowatts of electricity these panels are generating reduces the amount required for purchase. Before installing the oxygen sensors, the panels produced 13 percent of the facility's electricity; now that all of the efficiency measures have been installed in the building, the facility manager expects that on-site generation will represent a far larger percentage of the electric load.

What is Solar PV?

Solar photovoltaic panels capture the sun's energy using photovoltaic (PV) cells. PV cells are made from layers of a semi-conductive material. When the sun shines on the cell, it creates an electric field across the layers. The cells don't need direct sunlight to work but the stronger the sunshine, the more electricity they produce. Groups of cells are mounted together in panels that are frequently mounted on southern-facing roofs, like at the Thomaston wastewater treatment facility.

What is Solar Hot Air?

Solar hot air systems capture the sun's heat to warm buildings. Dark, perforated plates are installed (typically on a southern wall) with an air space between the plates and the building. As the dark collectors absorb heat, warm air collects in the gap. A sensor reads the temperature in the solar wall and exchanges inside air with pre-heated solar air when it's reached a warm temperature.

The solar heated air is distributed throughout the building via the conventional ventilation system or dedicated fans and ducting. Solar hot air systems are good choices in buildings like the one in Farmington that require significant air exchange or have large volumes of air to heat.

Steve Moore, Farmington's Superintendent of Wastewater Treatment, stands in front of a SolarWall, a solar hot air system that captures the sun's heat to warm a building.

FARMINGTON

The town of Farmington chose to harness solar energy in a different way to mitigate the energy intensity of its wastewater treatment plant. The Farmington wastewater treatment facility has a large building that removes water from sludge. Because this process happens inside, large louvers exchange air between the inside and outside to release sulfur and the build-up of other gases. In the winter months, this required air exchange resulting in significant energy bills because indoor air temperatures had to be maintained for treatment quality and worker comfort, and large volumes of air had to be constantly heated by an oil-fired furnace.

Farmington had identified this building as its most energy intensive, and its heating costs as particularly significant. The water treatment team in Farmington, with the help of the Maine Rural Water Association, identified a SolarWall® (solar hot air system) as the most cost-effective solution to reduce these heating costs. The solar hot air system now delivers the majority of the facility's heat, and is supplemented by the original heating system. In the first year after its installation, the town saved 1,000 gallons of oil, further adding to the energy savings from the efficiency measures the town previously installed, including lighting upgrades and controls. ▪

FARMINGTON

Estimated Annual Savings:
At least $3,500

Simple Payback after Efficiency Maine Grant:
1 Year

Community Weatherization

A contractor caulks a window at a home in Unity.

UNITY

The town of Unity is home to Maine's Common Ground Fair, Unity College, and 2,000 residents who pride themselves on their commitment to community-building. It was this commitment that inspired the town's energy committee to apply for EECBG grant funds for a community weatherization project that would address energy costs experienced directly by Unity residents rather than energy costs in municipal buildings. The energy committee members were concerned about the rising cost of heating oil, and leveraged the local Neighbor Warming Neighbor program to connect Unity residents to resources for reducing heating consumption. The Unity Energy Committee, frequently in collaboration with volunteers from the college, offered workshops on air sealing, building homemade storm windows, and other weatherization strategies. The committee also offered a rebate for homeowners getting an energy audit in conjunction with air sealing. The program was a great success – 56 households in town participated in the rebate program and received an energy audit and air sealing from volunteer teams working with energy professionals. Air leakage was measured in participating households with a blower door before and after the air sealing projects. This data and the energy performance of the homes have been tracked by the Neighbor Warming Neighbor team, and participating households are saving an average of $900 per year.

Those annual savings are substantial and will provide savings benefits year after year, as will the energy audits, since those homeowners have a game plan for future energy reduction projects. For Energy Committee and Unity faculty member Doug Fox, the energy savings ripple out from those homes that participated directly in the program.

"Our goal was to find ways to make weatherization approachable for folks," says Fox. "Along the way, we were in over 50 homes and now we have testimonials from these homeowners. This program raised energy awareness for the whole town. I knew that we were successful when I was shopping at the local hardware store and heard two people discussing their blower door number."

Unity's success and the innovative combination of air sealing during an energy audit has had a far larger impact than simply benefiting the people of Unity. Efficiency Maine followed best practices from the Unity program and created a similar, statewide Air Sealing Promotion. Participating households begin saving on energy costs immediately thanks to six hours of air sealing work, and the energy audit conducted with that work provides homeowners with a plan to achieve deeper energy savings. ▪

What is a Blower Door?

A blower door is a device energy professionals use to quantify and pinpoint air leakage. A building can be pressurized or depressurized with a blower door, and the air pressure difference can reveal air sealing opportunities as well as determine the relative leakiness of the space.

"Our goal was to find ways to make weatherization approachable for folks. Along the way, we were in over 50 homes and now we have testimonials from these homeowners."

DOUG FOX

Unity College faculty member and member of the Unity Energy Committee

UNITY

Estimated Annual Savings:
At least $50,400

Simple Payback after Efficiency Maine Grant:
2 Months

Whole Building Solutions

TO SAVE ENERGY CONSISTENTLY and effectively, a municipality should look at its entire portfolio of buildings, and look at each building holistically. Energy management begins with a top-level commitment to continuous improvement in energy efficiency.

The industry best practice for saving energy costs when managing multiple municipal buildings is that "every organization should form an energy team that is responsible for overseeing the stated energy objectives and for performing periodic evaluations of energy use for all of the organization's major facilities and functions" (ENERGY STAR). Numerous municipalities used EECBG funds to make building envelope enhancements to their facilities. They ranged from Fort Kent and Freeport, who undertook air sealing and insulation projects to weatherize various community facilities, to New Gloucester and Oakland, who went deeper and installed heating system upgrades and heating controls, in addition to basic building envelope work. Stonington took another familiar approach: besides air sealing and insulation, they focused on lighting upgrades.

Following are examples of municipalities that made comprehensive upgrades to one or more community buildings.

ALFRED

The Town of Alfred is proud of its municipal building – a Greek Revival structure built in 1860 and listed on the National Register of Historic Places. Along with the charm, character and history of that building, however, comes hefty maintenance and utility costs.

Municipal leaders recognized they needed to reduce the cost of electricity and heating, particularly after several years of lower local and state revenues. First they conducted a thorough energy audit, prioritized next steps, and got to work.

They added dense-pack cellulose insulation throughout the building, including the crawl-space, exterior walls, and the attic scuttle; air sealed throughout the building; replaced the fire escape door on the second floor with an insulated steel door; and replaced 40 T12 lamps with 40 more efficient T8 lamps.

The Alfred Town Hall is on the National Register of Historic Places.


Insulation in the attic at the Alfred Municipal Building.

"The bulk of any building's heat escapes through the ceiling, so adding more insulation was just as important as upgrading the windows," said Glenn Charette, Alfred's Code Officer. "We kept more heat in the building by adding more insulation in the attic."

Because the crawl space in the building had a dirt floor, they used a moisture barrier to keep the floor dry.

"The crawlspace had a climate all its own," explains Charette. "The foundation is granite stacked on granite, and there were voids and hollows everywhere. The dirt floor was always damp, and dampness would permeate through the first floor. "

By sealing the dirt floor, and applying spray foam to the foundation, the entire building was made more comfortable. "We encapsulated the entire foundation and the crawlspace with spray

foam and that kept a uniform temperature and humidity level in that space, and the climate from outside was kept at bay," added Charette, who was also the contractor who worked on the building prior to his position with the town.

"My word, it's made a huge difference," he adds. "Before the crawlspace was done, in the summertime you could smell mustiness coming up through the floor. You can't do that now. Sealing that and insulating the attic had a big impact on our energy saving."

Town officials also wanted to replace the original 150-plus-year-old windows, some of which had broken panes, cracked frames, and very leaky sashes but they feared the new windows would detract from the historic character of the structure. So with guidance from the Maine Historic Preservation Commission, rather than replace the windows, they refurbished them. To the surprise of the energy team, the refurbished windows had an energy performance similar to replacement windows.

ALFRED

Estimated Annual Savings:
$1,696

Simple Payback after Efficiency Maine Grant:
8 years, 4 months

"The people who live in Alfred want this town hall to stay," says Charette. "They want it to be maintained, they want it to look good, and they want it to be efficient. These energy upgrades have inspired us to look at improving other measures, such as expanding the current heating system to the second floor."

STRONG

On June 25, 2010, the Town of Strong took a proactive step to save taxpayer dollars by creating a town policy to reduce energy costs. As one citizen described, it turned out to be "one of the smartest things we've done in a long time."

Local leaders decided to have a professional energy audit conducted on the Forster Memorial Building, which houses the town's municipal offices. The audit determined that the town's building envelope and heating systems were inefficient. Assessments were also conducted on the Town Garage and Fire Station, with recommendations for both.

The town adopted a policy to "aggressively pursue energy efficiency and fossil fuel reduction strategies for municipal facilities," with goals to significantly cut heating, hot water, and electricity costs. To accomplish this, Strong undertook an ambitious whole-building approach to energy efficiency.

What is an outdoor temperature reset?

Outdoor temperature resets (also called modulating aquastats) modulate the temperature of the water delivered from the boiler to the distribution system. These controls sense outside air temperature and re-adjust the heating system's water temperature to a minimum temperature to satisfy the heat requirements of the building: as the outside air temperature gets colder, the heating water gets warmer, and as the outside temperature gets warmer, the distribution system circulates water at a cooler temperature. For example, during the shoulder months, boiler temperatures can be lowered to meet the minimal temperature requirements of indoor spaces.

Outdoor temperature reset controls improve comfort by limiting indoor temperature swings, and maximize energy savings by minimizing distribution and boiler stack losses. On average, outdoor temperature reset controls reduce fuel consumption by 15 percent, and cost about $1,000 installed.

"When we first looked at the Forster Memorial Building, we found it needed a lot of work," said Frank Stevens, President of FE Builders, who did the contract work. "We found substantial heat loss, ice buildup on the eaves, cold air dropping back down in the administrative area -- and the insulation was thin and full of voids."

The project team started by air sealing and insulating the Forster Building attic, and repairing office windows with failed seals. Next, a contractor installed digital programmable thermostats, and an on-demand propane water heater to

Strong installed an energy-efficient water heater in its Forster Memorial Building.

reduce water heating costs. Strong also conducted an extensive lighting retrofit, replacing inefficient lighting with more efficient T-8 lights.

Similar lighting retrofits were conducted at the town garage and fire station, and insulation was also added to the fire station attic.

For energy upgrades in the public works building, Strong decided to heat using a wood pellet boiler. Conveniently, pellet manufacturer Geneva Energy Fuels was located directly across the street. The switch allowed Strong to upgrade to a more efficient system and to support a local business. Strong has a long history of wood product manufacturing, having been at one time the toothpick manufacturing capital of the world.

"I think the most significant benefits are going to be the tax savings to the residents of the town of Strong," said Milt Baston, Strong Energy Committee Member. "I think residents have been pleased with how we've made saving taxpayer dollars a priority." ▪

STRONG

Estimated Annual Savings:
$5,072

Simple Payback after Efficiency Maine Grant:
8 months

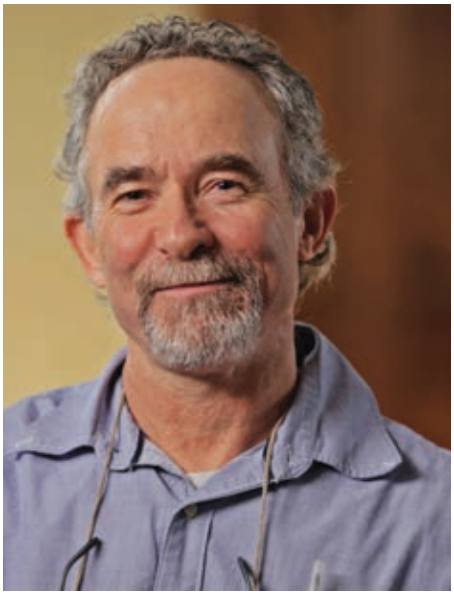
What is air sealing?

According to the Department of Energy, the recommended strategy in structures is to reduce air leakage as much as possible and to provide controlled ventilation (incorporating heat recovery, moisture control, or air filtering) as needed. Reducing air infiltration by sealing the holes and cracks throughout a building – called "air sealing" – can significantly cut annual heating and cooling costs, improve building durability, and create a healthier indoor environment.

Although windows, doors, and outside walls contribute to air leakage, the biggest holes are usually hidden from view and connect the structure to an attic, crawlspace, or basement. Usually, the process involves sealing all the big holes first, then the large cracks and penetrations, and finally the smaller cracks and seams.

Where air sealing is able to significantly reduce energy waste, there is the possibility of also reducing the size of heating and cooling equipment, which can save additional dollars.

SOURCE: U.S. DEPARTMENT OF ENERGY



As with many small municipal offices in the state, the Forster Memorial Building has deep historic roots and is the social center for many residents in Strong. Strong undertook a number of efficiency improvements, focusing on the building envelope and heating systems. They didn't stop there: they then went on to upgrade the Town Garage and Fire Station, thanks to the hard work of people like Milt Baston, Strong Energy Committee Member.

Air sealing up close in the Town of Strong.

THE STAGED APPROACH TO BUILDING UPGRADES

THE STAGED APPROACH recommended by ENERGY STAR accounts for the interactions among all the energy flows in a building. Each stage includes changes that will affect the upgrades performed in subsequent stages, thus setting the overall process up for the greatest energy and cost savings possible. The five stages recommended by the EPA are:

Retrocommissioning. Retrocommissioning is the first stage because it provides an understanding of how a facility is operating and how closely it comes to operating as intended. Specifically, it helps to identify improper equipment performance, equipment or systems that need to be replaced, and operational strategies for improving the performance of the various building systems.

Lighting. Lighting upgrades, which may include new light sources, fixtures, and controls, come early in the process because the lighting system has a significant impact on other building systems. Lighting affects heating and cooling loads and power quality.

Supplemental Load Reductions. Supplemental load sources, such as building occupants and electronic equipment, are secondary contributors to energy consumption in buildings. They can affect heating, cooling, and electric loads. With careful analysis of these sources and their interactions with HVAC systems, equipment size and upgrade costs can be reduced.

Air Distribution Systems. Air distribution systems bring conditioned air for heating or cooling to building occupants, and therefore directly affect both energy consumption and occupant comfort. Fan systems can be upgraded and adjusted to optimize the delivery of air in the most energy-efficient way.

Heating and Cooling Systems. If the steps outlined in the first four stages have been followed, cooling and heating loads are likely to have been reduced. That reduction, coupled with the fact that many existing HVAC systems are oversized to begin with, means that it may be possible to justify replacing an existing system with one that is properly sized or retrofitting a system so that it operates more efficiently. In addition to saving energy, proper sizing will likely reduce noise, lower the first costs for equipment, and optimize equipment operation, often leading to less required maintenance and longer equipment lifetimes. ▪

SOURCE: ENERGY STAR

A pellet silo located at the Forster Memorial Building.

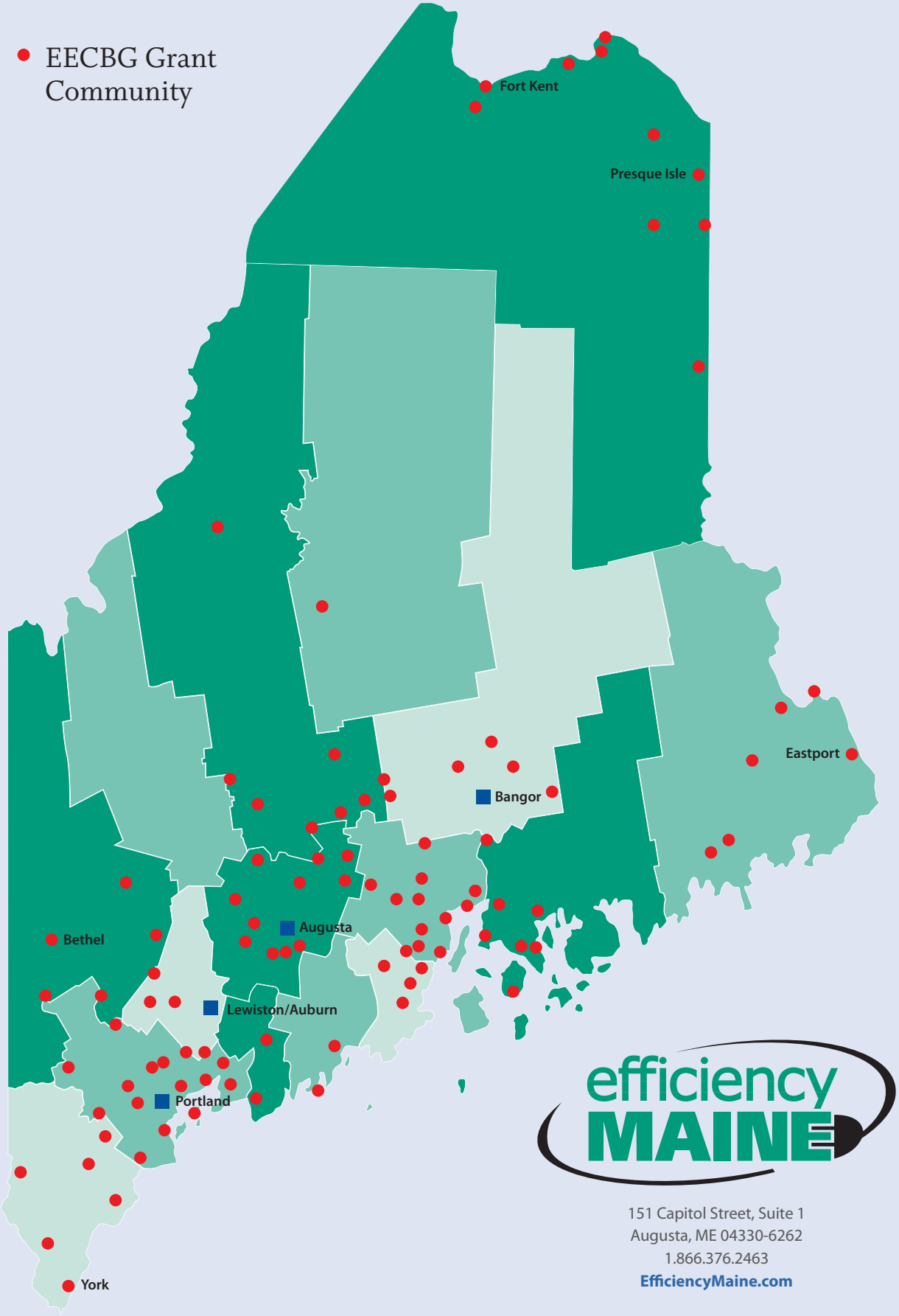
Orono's wastewater treatment facility.

Appendix A: Table with towns and project type

			ENVELOPE		LIGHTING				HEATING			RENEWABLES						
Grant Recipient	Grant Amount	Energy Audit/ Energy Plan	Air Sealing/ Building Envelope	Insulation	LED Lighting Retrofit	Lighting Upgrade (Typically T-12 to T-8)	Lighting Controls	Appliances	Heating or Hot Water Upgrades	Heat Controls	Heating Fans/ Destratification	Pellets	Solar Thermal/ Solar Air	Solar PV	Wind	Geothermal	Community	VFD/Equipment Efficeincy Upgrade
Addison	$76,842	✔			✔								✔		✔			
Alfred	$41,055		✔	✔		✔												
Allagash	$14,980		✔			✔	✔		✔	✔								
Anson	$34,776		✔	✔					✔									
Baileyville	$40,989		✔			✔			✔									
Bar Harbor	$10,000	✔																
Bath (Regional)	$532,037	✔	✔	✔		✔	✔		✔	✔							✔	✔
Belfast	$46,225	✔	✔	✔														
Belgrade	$29,600	✔	✔	✔					✔									
Berwick	$8,105	✔				✔												
Bethel	$20,550																	✔
Blue Hill	$42,190	✔				✔			✔									
Bowdoinham	$46,225	✔	✔	✔														
Brewer	$78,968		✔			✔			✔									
Brooklin	$10,000	✔		✔														
Brooks	$85,000																✔	
Brooksville	$40,512																✔	
Bucksport	$85,000								✔			✔						
Calais	$85,000		✔	✔														
Cape Elizabeth	$85,000					✔												
Caribou	$71,100				✔													
Casco (Regional)	$247,576		✔						✔									
Chebeague Island	$51,573	✔	✔	✔					✔									
China	$60,300			✔					✔			✔	✔					✔
Columbia	$18,569			✔					✔									✔
Columbia Falls	$34,650								✔	✔								
Corinth	$41,055		✔	✔					✔							✔		
Cumberland	$59,590								✔				✔					
Damariscotta	$82,000																✔	
Dayton	$73,656													✔				
Dixfield	$24,150		✔	✔		✔			✔	✔	✔							
Eliot	$7,842	✔																
Falmouth	$75,995	✔	✔										✔					
Farmingdale	$11,205								✔									
Farmington	$31,547												✔					
Fayette	$8,000									✔								
Fort Fairfield	$58,290				✔													
Fort Kent	$85,000		✔			✔												
Freeport	$80,847	✔	✔	✔		✔			✔		✔							
Frenchville	$54,020	✔	✔	✔		✔												
Gardiner	$17,500					✔												
Gorham	$78,573													✔				
Gray	$51,055	✔	✔				✔			✔								
Greenville	$66,801					✔							✔					
Hallowell	$37,061				✔													
Hampden	$84,146								✔									
Harrison	$10,000	✔																
Hiram	$38,082	✔	✔	✔					✔									
Houlton	$41,055					✔	✔											
Hudson	$41,055		✔	✔		✔			✔									
Kennebunk	$81,000			✔													✔	
Kennebunkport	$41,055		✔	✔	✔	✔			✔		✔							
Lisbon	$84,077		✔	✔					✔									
Madawaska	$41,055				✔													

			ENVELOPE		LIGHTING				HEATING			RENEWABLES						
Grant Recipient	Grant Amount	Energy Audit/ Energy Plan	Air Sealing/ Building Envelope	Insulation	LED Lighting Retrofit	Lighting Upgrade (Typically T-12 to T-8)	Lighting Controls	Appliances	Heating or Hot Water Upgrades	Heat Controls	Heating Fans/ Destratification	Pellets	Solar Thermal/ Solar Air	Solar PV	Wind	Geothermal	Community	VFD/Equipment Efficeincy Upgrade
Madison	$85,000			✔	✔													
Manchester	$41,055													✔				
Mars Hill	$24,150					✔			✔									
Mechanic Falls	$36,675	✔	✔	✔	✔		✔		✔	✔							✔	
Mercer	$41,055								✔			✔						
Monmouth	$2,725	✔																
Montville	$39,520	✔	✔	✔										✔				
New Gloucester	$46,118	✔	✔	✔	✔	✔	✔		✔	✔	✔							
North Yarmouth	$12,972	✔																
Norway	$85,000																	✔
Oakland	$46,817		✔	✔					✔									✔
Old Town	$82,826	✔			✔													
Orland	$41,055																	✔
Orono	$29,163								✔									
Palmyra	$29,250	✔		✔						✔								
Paris	$28,500		✔			✔			✔	✔								
Perry	$85,000	✔	✔			✔			✔			✔						
Phippsburg (A)	$10,000								✔									
Pittsfield	$84,425		✔	✔					✔				✔				✔	
Plantation of Grand Lake Stream	$35,000			✔		✔			✔									
Poland	$17,575					✔	✔											
Presque Isle	$62,409	✔															✔	
Raymond	$36,044			✔		✔												
Reed Plantation	$29,250			✔		✔			✔	✔								
Rockland Solid Waste Facility	$12,356	✔															✔	
Rockport	$46,225	✔	✔	✔														
Rumford	$10,000	✔				✔												
Saco	$85,000				✔		✔		✔					✔				
Saint Francis	$36,298	✔	✔			✔			✔	✔	✔							
Searsmont	$35,711													✔				
Sedgwick	$10,000																✔	
Skowhegan	$49,500					✔												
South Berwick	$510,000	✔															✔	
Stockton Springs	$10,000	✔		✔														
Stoneham	$10,000	✔		✔		✔	✔		✔	✔								
Stonington	$41,886		✔	✔		✔	✔											
Strong	$46,225	✔	✔	✔	✔	✔	✔		✔	✔		✔						
Thomaston	$76,650													✔				
Thorndike	$46,225	✔	✔	✔	✔	✔	✔		✔								✔	
Union	$45,692	✔	✔	✔	✔	✔		✔	✔	✔								
Unity	$82,500																✔	
Vassalboro	$46,225	✔			✔	✔	✔		✔	✔								
Veazie	$8,583		✔						✔									
Waldoboro	$36,675	✔	✔	✔						✔							✔	
Warren	$73,214		✔	✔														
Washington County	$9,000	✔																
Waterboro	$24,808	✔																
Waterville (Regional)	$170,000																✔	
Westbrook	$85,000								✔									
Windham	$46,225	✔	✔	✔	✔	✔			✔	✔								
Winthrop	$73,504													✔				
Yarmouth	$55,344																	✔
York	$10,000	✔	✔	✔														

Appendix B: Map with participating communities



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