



American Recovery and Reinvestment Act Funds Spur Clean Energy Projects in Vermont

A Final Report To the Vermont Public



Report Title:

**American Recovery and Reinvestment Act Funds
Spur Clean Energy Projects in Vermont:
A Final Report to the Vermont Public**

Published by the Vermont Public Service Department in June 2013

The [Vermont Public Service Department](#) (PSD) is an agency within the executive branch of Vermont state government, and is charged with representing the public interest in energy, telecommunications, water, and wastewater utility matters.

The mission of the PSD is to serve all citizens of Vermont through public advocacy, planning, programs, and other actions that meet the public's need for least cost, environmentally sound, efficient, reliable, secure, sustainable, and safe energy, telecommunications, and regulated utility systems in the state for the short and long term.

Cover Page Photos (from left top clockwise): Wood pellet silo at Fayston Town Hall, photo by Patti Lewis; New exterior wall insulation on Vermont Housing and Conservation Board dwelling, photo by PSD; Burke Mountain wind turbine photo by Burke Mountain Operating Group; Waste oil boiler at Corinth Town Garage, photo by Town of Corinth; Burlington multi-family housing retrofit by the All-Fuels Efficiency Program, photo by Sara Zaleski; Vermont Youth Conservation Corps solar tracker photo by U.S. Department of Energy.

Table of Contents

	Page
Introduction	3
Deploying ARRA Monies to Vermont Communities	5
ARRA Energy Efficiency Projects Save Vermonters Money	9
ARRA Renewable Generation Projects Produce Electricity and Heat from In-State Resources	13
Economic Impact of ARRA Funding	16
Case Studies	18
Energy Efficiency Projects by Towns and Schools	19
Energy Efficient Street and Parking Lights Installed by Schools and Towns	27
Improving Energy Efficiency for Public Serving Institutions and a Farm	29
Established Statewide Programs	32
Renewable Energy Projects	36
Business Development	40
Financing Programs for Energy Projects	41
The State of Vermont Leading By Example	45
Conclusion	49

Introduction

The American Recovery and Reinvestment Act (ARRA) was signed into law by President Obama in February 2009. Through the U.S. Department of Energy (DOE), the Vermont Public Service Department (PSD) was allocated \$31,592,500¹ in ARRA funds. The one-time federal stimulus presented substantial opportunity for the PSD to expand the scope and rate of energy efficiency improvements and renewable energy development in Vermont, an effort that will have lasting economic and environmental benefits.

In accordance with Vermont's clean energy goals and ARRA requirements, the PSD² distributed ARRA monies to 190 public and private organizations in over 100 Vermont municipalities. The energy efficiency projects funded have reduced the overall consumption of energy in Vermont. The renewable energy projects funded have augmented local energy generation through use of in-state renewable resources. All projects were carried out between August 2009 and March 2013.

Projects funded by Vermont's ARRA monies supported Vermont jobs and job training while making long term investments in Vermont's clean energy infrastructure, including energy efficient buildings and energy production from in-state renewable resources.

Approximately half of the ARRA funds, \$14,092,792 were awarded to energy efficiency projects and half, \$13,870,894, to renewable energy projects. An additional \$2,647,380 was distributed for projects involving a combination of efficiency, renewables, and planning. The PSD expended \$981,434, or 3% of the total ARRA funds, to administer the awards.

To complete projects, ARRA award recipients retained staff and contractors and/or hired anew. Vermonters with specific expertise in renewable energy and energy efficiency carried out the projects, including construction laborers, carpenters, electricians, plumbers, machine and software technicians, specialized equipment installers, heavy equipment operators, training instructors, and lawyers. Energy auditors, engineers, and design consultants conducted pre-project assessments and financing studies for projects. People such as financial managers, office administrators, executive directors, etc., were also funded by ARRA to oversee projects and manage reporting requirements.

¹ ARRA funds for Vermont Energy Programs originated from two sources through DOE 1) The Energy Efficiency and Conservation Block Grant program provided \$9,593,500 and 2) the State Energy Program provided \$21,999,000.

² Under the PSD, the Clean Energy Development Fund (CEDF) oversees the distribution of state and federal funds to develop clean energy resources in Vermont. CEDF is managed by the PSD under the guidance of a citizen board, whose members are appointed by the PSD Commissioner and State Legislators.

The ARRA energy projects add value to Vermont's economy in many ways. The benefits of job retention and creation, energy savings from efficiency projects, and in-state energy production from renewable energy installations are percolating through Vermont's economy. Here is an overview of preliminary results from Vermont's ARRA energy projects.

- The energy projects are infusing an average of \$4.7 million³ per year into Vermont's economy. This figure accounts for the economic multiplier effects of these projects.
- Energy efficiency projects are saving Vermont households and businesses over \$1.8 million annually.
- Installations of in-state renewable electric generators (such as solar arrays and wind turbines) account for 6MW in new generation capacity, yielding over 8,840 MWhs annually.⁴ This is enough energy to power 1,300 Vermont homes each year.
- New installations of renewably fueled heating systems (such as wood biomass burners, solar hot water, and geothermal heat pumps) account for 173 billion BTUs annually.⁵ This is enough energy to heat 1,500 Vermont homes each year.
- The energy savings and new renewable energy production combined reduce Vermont's greenhouse gas emissions by 13,537 metric tons annually (in CO₂ equivalents). This is comparable to removing 2,508 cars from Vermont's roads.
- The projects induced the equivalent of 527 full time jobs for a year (aka job-years) during the three year ARRA project cycle and will induce an additional 616 job-years through 2031.

This report offers the Vermont public an overview of energy projects funded with ARRA monies. All of the information presented in this report is based on the estimated impacts projected by the ARRA award recipients. Brief case studies highlight the breadth of energy projects which have benefited from ARRA funding.

³ This is a measure of change the Vermont Gross Domestic Product stated in 2013 dollars.

⁴ MW, megawatts or million watts, is a measure of the electrical system size. MWh, mega watt hours, is a measure of the volume of electricity produced or consumed each hour. The average Vermont home consumes seven MWhs in electricity a year.

⁵ BTU, British Thermal Units, is a measure of energy typically used for liquid fuels and wood. One gallon of #2 fuel oil is 138,200 BTUs. One cord of green wood is 22,000,000 BTUs.

Deploying ARRA Monies to Vermont Communities

Award Criteria

To swiftly stimulate the U.S. economy, State Energy Offices, like the PSD, were asked to quickly deploy ARRA funds into the state economy. Projects that could be “started and completed expeditiously” were favored. Entities applying for funds were required to estimate the number of jobs created or retained through the completion of their project. Energy efficiency applicants were required to project their annual energy savings, while renewable energy applicants projected their annual energy generation. All projects had to utilize proven energy technologies and build upon established programs.

Response to Funding Opportunities

Vermont citizens and businesses exhibit a growing awareness of clean energy initiatives. The PSD’s announcement of ARRA funding opportunities drew an unanticipated level of interest. Funding requests were well over what was available through ARRA. Hundreds of applicants representing communities, school districts, businesses, institutions, organizations, and individuals competed for—and many received—resources to support clean energy initiatives. The PSD selected projects that had evident long term economic benefits on communities and/or businesses.

The PSD’s goal was to stimulate the Vermont economy and to propel energy savings, greenhouse gas emissions reduction, new in-state renewable energy generation, job retention/creation, and to support Vermont’s clean energy industries.

Clean Energy Technologies and Project Outcomes

The PSD dispersed ARRA funds widely to have broad impact. In all, PSD gave out 220 ARRA awards to fund a variety of clean energy technologies. The ARRA funds supported a variety of projects.

A majority of the ARRA awards resulted in **energy installations**, including 155 for energy efficiency and 20 for renewable generation. These installation projects (such as building retrofits, solar and wind energy systems) have measureable long



Deep Energy Retrofit

Photo by S. Brett Humble, U.S. Department of Energy

term impacts, creating energy savings and/or new generation from local renewable energy resources.

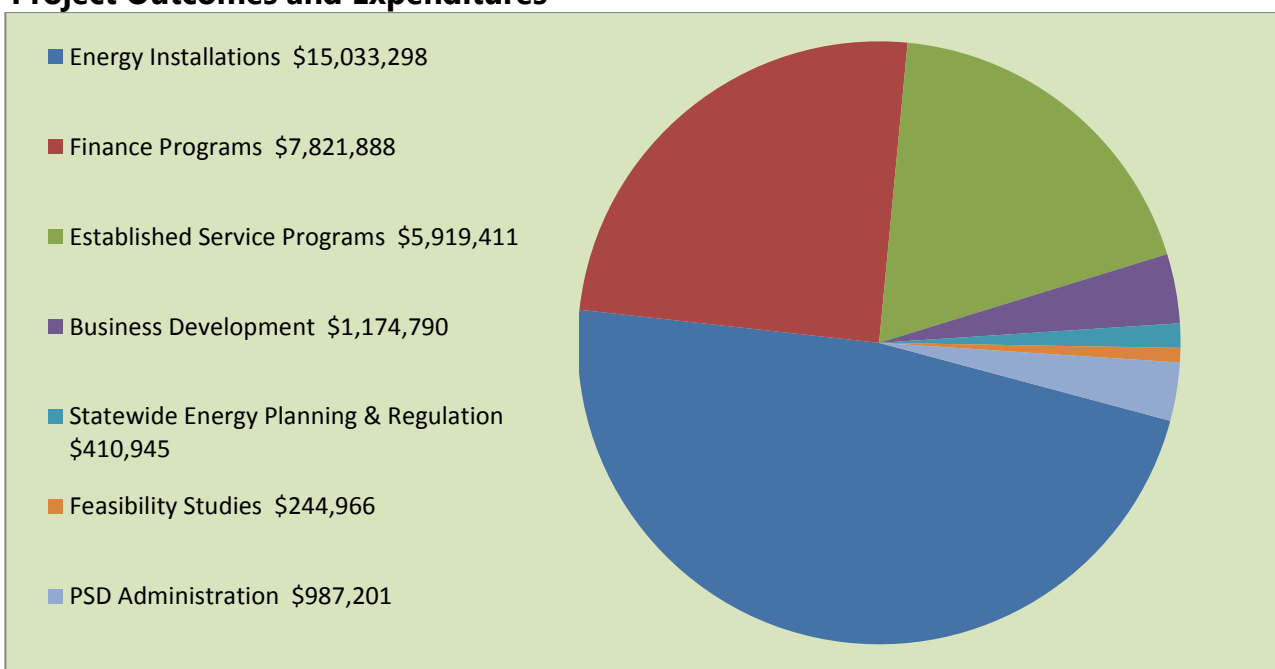
Eight awards funded **feasibility studies**, primarily for renewable installations that demonstrated community benefits, but were not yet ready for construction.

Nine awards funded **finance programs**, which then gave out sub-awards to local entities in the form of grants, loans, and cash rebates/incentives, primarily for energy installations. For instance, the Small Scale Renewable Incentive Program gave out 1,172 cash rebates to homeowners and businesses to install solar electric, solar hot water, and wind systems.

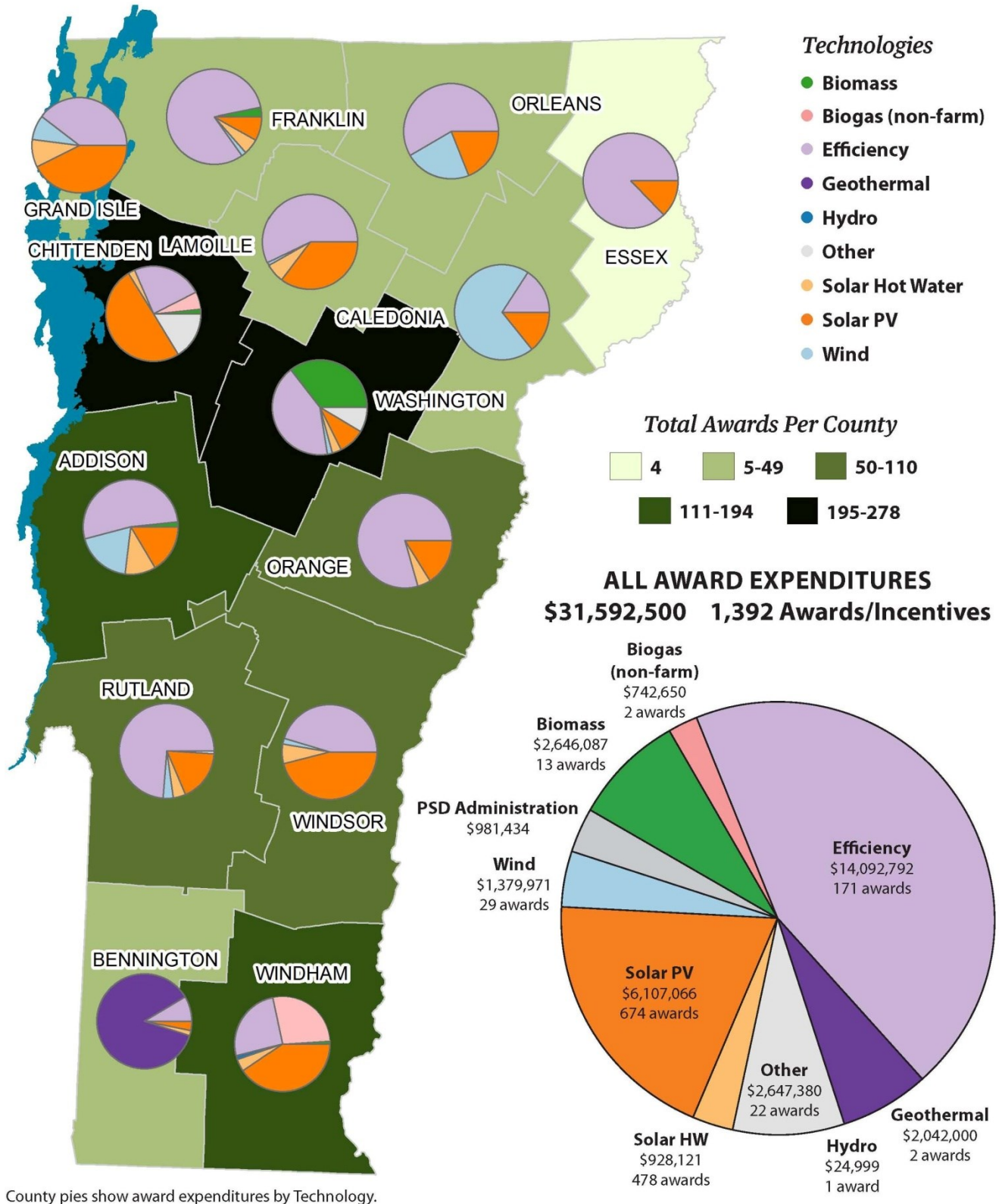
PSD issued 16 awards to statewide and regional entities that used ARRA funds to support **established service programs**, which in turn, funded multiple projects including energy installations, feasibility studies, planning, skills training, and financing programs for their service territory.

Three awards funded **business development** in emerging clean energy technologies, undertaken by established Vermont manufacturers. And, the PSD funded nine awards related to **statewide energy planning and regulation**.

Project Outcomes and Expenditures



All ARRA Awards and Small Scale Renewable Incentives

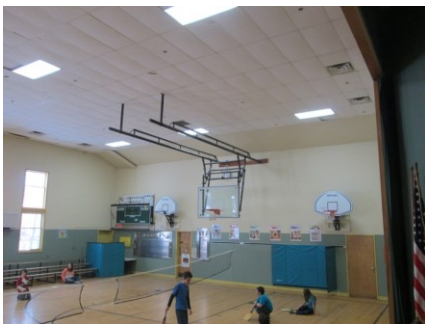


Vermont Counties Receiving Funding

Funds were awarded across each region in Vermont, reaching every county. The map on the opposite page shows the number of awards and incentives issued and the types of technologies per county.

Sectors of the Vermont Economy Receiving Funding

Under guidance from DOE and the Vermont legislature, the PSD directed ARRA funds to specific sectors of Vermont's economy. The PSD awarded funds to local governments, colleges and universities, K-12 schools, farms, businesses, Regional Planning Commissions, state facilities, other public serving institutions and non-profits, including those serving low income Vermonters.



*Troy School Gym's New Lighting
Photo by Troy School*



*The Highgate Library was weatherized
Photo by David Jescavage*



*Solar Trackers at Concept2
Photo by S. Brett Humble,
U.S. Department of Energy*

ARRA Energy Efficiency Projects Save Vermonters Money

There is an untapped interest in energy efficiency projects by Vermont towns and schools, indicating a widespread need to reduce energy costs. In response to a solicitation for a competitive grant program, over 300 applicants applied. The PSD had ARRA funding available for just over half of the applicants. The Vermont map on the following page shows the energy efficiency project awards distributed by county.

Energy efficiency projects were of three types: building retrofits, street/parking light replacements, and building energy code revision/training. Over \$14 million of ARRA funds spent on these projects was matched with over \$11 million in local funds. The completed projects are expected to save towns, schools, and other public entities more than \$1.8 million annually.



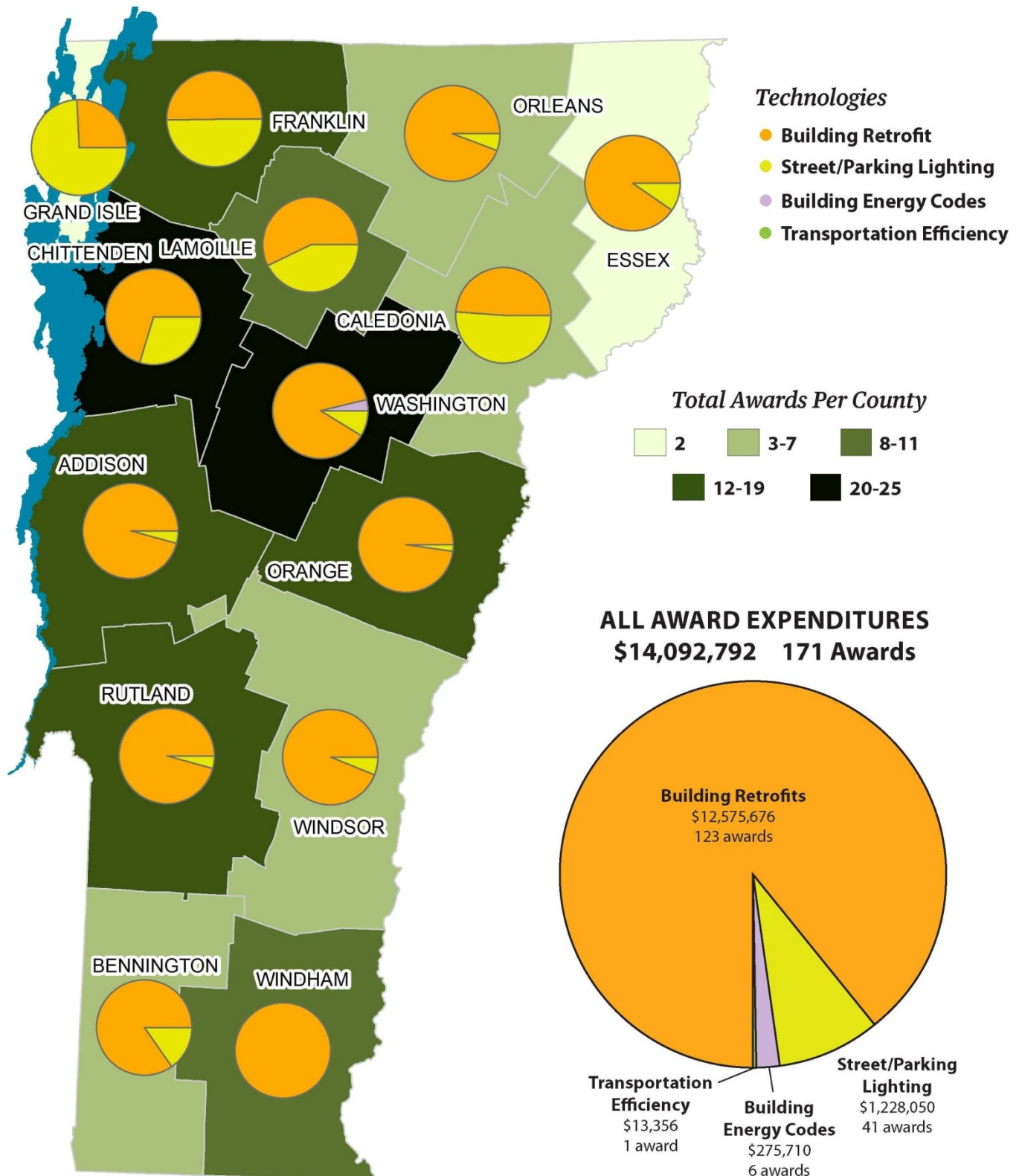
*Tinmouth Town Office
Photo by Cathy Reynolds*

*Vermont is home to nationally recognized experts
in the burgeoning field of building energy efficiency.*

Efficiency Vermont (EVT) collaborated with the PSD to provide cash rebates for many ARRA energy efficiency projects. These rebates helped recipients meet their award's requirements for local match funding. EVT also offered valuable technical expertise, helping ARRA recipients with design, the selection of efficient equipment, and realistic analyses of energy savings.

Educational programs were offered by several ARRA award recipients with expertise in this realm. Public how-to workshops helped homeowners and business owners learn weatherization techniques and navigate project financing. Professional seminars were held to relay information on new building energy technologies and regulations. Professional training supported the continued expansion of Vermont's energy efficiency industry. ARRA recipients reported that over 3,800 people attended training sessions.

ARRA Energy Efficiency Awards



County pies show award expenditures by Technology.

Building Retrofits

Using ARRA funds 344 buildings, totaling over 4 million square feet, were retrofitted. The structures are owned by schools, colleges, towns, the State, one farm, and several non-profits that service low-income housing. The buildings were retrofitted with state-of-the-art efficiency materials, equipment, and techniques.



*Burlington multi-family housing retrofit by
the All-Fuels Efficiency Program
Photo by Sara Zaleski*

A building retrofit is a renovation, which involves weatherization and the installation of programmable thermostats, efficient lighting, occupancy sensors, and efficient appliances such as heating and ventilation systems, water heaters, refrigerators, and dishwashers. Building weatherization projects lessen heat loss throughout the building by improving air sealing and insulation in wall floors and ceilings, from the basement to the attic. Historic buildings being retrofitted require approval from the Vermont Historic Preservation Office and receive specialized services to protect the historic features of the building.

New indoor and outdoor lighting technology has led to terrific improvements in the electric efficiency and the quality of illumination. In many buildings, all light fixtures are replaced with energy efficient lights, and occupancy sensors are added to turn lights off when a space is empty. The design phase of lighting projects often involves an analysis of the quality and quantity of lighting required for each particular environ. In many cases, the analysis concludes that fewer lighting fixtures are needed.

Each ARRA building retrofit project installed some or all of the measures described above. The results include a reduction in the electric and thermal (heat) energy consumed by the building. In addition, many recipients reported that the building occupants are more comfortable due to more consistent air flow and fewer drafts.

ARRA funded building retrofits are saving Vermonters approximately \$670,000 in electric costs and \$1,180,000 in heating costs each year.

The resulting annual costs savings make the buildings more viable for the long term. For communities across Vermont, the ARRA building retrofit projects have secured structures that are priceless icons of their history.



*Inadequate attic insulation prior to a retrofit
Photo by PSD*

Street/Parking Light Replacements

In the street lighting category, there were 41 projects. Twelve town projects replaced street and parking area lights, and in some cases, pedestrian lights. Twenty-eight public K-12 schools replaced parking and walkway lights. ARRA funded street/parking lighting projects are saving Vermonters \$172,000 annually. The outdoor lighting projects are saving energy costs and improving safety in school yards, around town greens, along major thoroughfares, and in public parking areas.

Building Energy Codes

Building energy codes define the standards which builders follow to ensure that new construction meets minimum energy efficiency standards. ARRA funds supported the PSD's work to update the statewide building energy codes for commercial and residential construction, to develop a plan for increasing compliance, and to conduct training workshops for all involved with the building trades.

Transportation Efficiency

One school used ARRA funds to install bus route optimization software to realize annual savings.

ARRA Renewable Generation Projects Produce Electricity and Heat from In-State Resources

ARRA funds increased the deployment of in-state renewable resources for the production of electricity and heat. Over \$13 million spent in ARRA funds on these projects was matched with over \$63 million in local funds. The Vermont map on the following page shows the distribution of ARRA renewable energy awards and incentives by county.

An energy resource is considered renewable if it can be collected at a rate that is less than or equal to the rate at which it is created. For example, wood used for heating is a renewable resource, if it is cut from a healthy forest that grows as much wood as is cut each year. The types of renewable energy technologies funded by ARRA are described below.

Biogas, also called methane, is a greenhouse gas that is released during the break down of organic matter, such as animal and food wastes. A **biogas digester** burns this byproduct to produce energy. Two award recipients installed biogas digesters to produce electricity and heat. One project captures biogas from a landfill and the other from a waste water treatment plant.

Thirteen ARRA awards to small towns and colleges funded **biomass** heating projects. Biomass furnaces burn organic matter such as wood and agricultural crops. A number of recipients installed a biomass district heating system; these connect multiple buildings to a central biomass furnace. Five recipients completed feasibility studies to assess the energy requirements and the cost options for biomass heating.

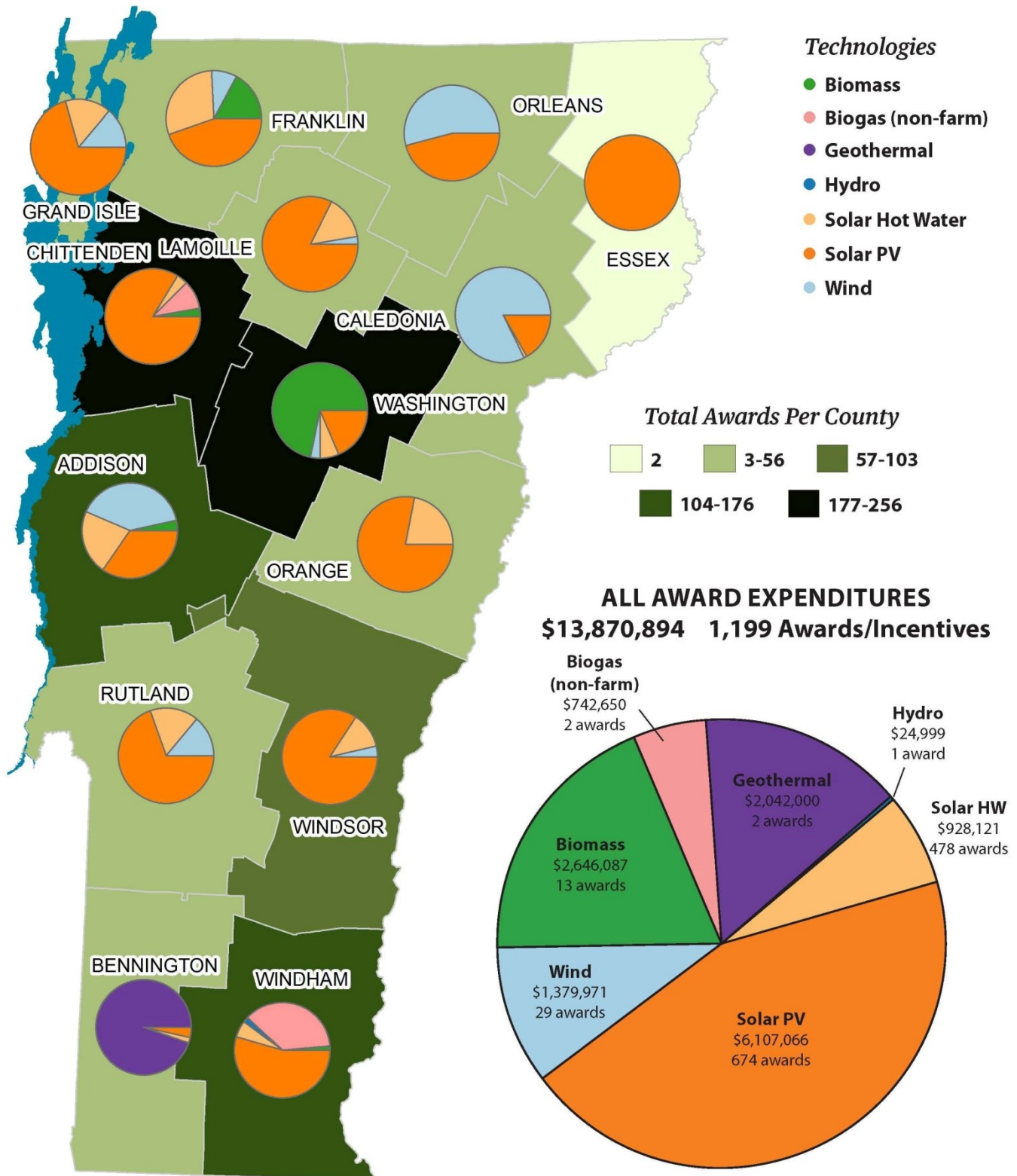


A state agency and a school installed **geothermal** systems to supply heat and air conditioning for their public facilities. Geothermal systems, also called ground source heat pumps, use the ambient temperature of the earth to heat or cool the building.⁶

Hydropower is created from the force of water flowing in a river or over a dam, this force can be converted to electricity. One award funded a study to determine the viability of creating a commercial hydroelectric plant at an existing dam site.

⁶ Although geothermal energy is renewable, heat pumps are now classified as energy efficiency measures.

ARRA Renewable Energy Awards and Small Scale Renewable Incentives



County pies show award expenditures by Technology.

Solar hot water systems capture radiant heat from the sun and transfer the heat to water. Cash rebates were given for 478 solar hot water installations at homes, schools, and municipal offices. In addition, two low income housing agencies that received ARRA energy efficiency awards, installed 32 solar hot water systems.

Energy from the sun can be converted to electricity using photovoltaic (PV) technology. This technology is also called **solar electric**. ARRA funds were used to install solar electric systems that are connected to the electric grid. ARRA awards and incentives funded 673 solar electric projects for low income housing units, a farm, a commercial electric producer, residences, municipal offices, farms, and businesses. Also, one project funded the creation of a guide describing legal structures under which multiple individuals and businesses can join together to invest in solar electric and other renewable energy projects, under Vermont's net metering law⁷.



Wind energy is captured by when wind rotates the blades of a wind turbine or windmill to generate electricity. Businesses, schools, and homes used ARRA funds to install wind systems. Twenty-seven of the projects were small scale, that is sized at 10 kilowatts or less, while two larger wind projects installed one 100 kilowatt turbine each.

The table below shows the total size or capacity of the renewable energy systems installed with ARRA funds.

<u>Technology</u>	<u>Capacity⁸</u>	<u>Units</u>
Biogas	615	kW AC
Biomass	330	kBTU/hour
Geothermal	88	tons
Solar Hot Water	43,481	kBTU/day
Solar PV	5,157	kW AC
Wind	400	kW AC

⁷ For a definition of net metering, refer to the case study in this report titled *Vermont Group Net Metering Information & Guidelines*.

⁸ The capacity of the system is the maximum energy the system can produce at a point in time.

Economic Impact of ARRA Funding⁹

The Public Service Department (PSD) studied the economic impacts across Vermont, resulting from energy related investments of over \$31 million from ARRA and \$77 million from local sources. Impacts were estimated over 20 years, from 2011 through 2031, though it is known that the impacts will continue beyond the study period. (All dollar figures are reported in 2013 dollars.) PSD's analysis assumed that the ARRA energy projects would not have been initiated without the infusion of ARRA monies.

The results of the PSD's economic analysis looking forward 20 years are described below.

Due to ARRA funding, virtually every sector of Vermont's economy will experience a positive effect from the completion of the ARRA energy projects. PSD estimates that Vermont's Gross Domestic Product (GDP) will increase an average of \$4.7 million per year¹⁰. The GDP increase benefits the household sector by \$2.3 million annually, with \$2.4 million annually for the commercial, industrial, and government sectors. In addition, PSD's analytic results predict that the Vermont population will increase somewhat, as job opportunities expand and the cost of living falls slightly.

Due to ARRA funding, PSD estimates that Vermont's total employment will increase by 1,143 job-years¹¹ through 2031, with nearly half the job impacts occurring during project construction and build-out in the first three years of ARRA spending. As expected, construction industry jobs account for over 40% of the total job-years. Service employment (such as lodging, food services, healthcare, retail trade) account for over 30% of the total job-years. Skilled service jobs (such as professional and scientific consulting, administration, management) account for almost 20% of ARRA induced jobs. The Utilities sector will experience modest job losses because energy efficiency projects reduce demand on Utility services.

The impacts on personal income and consumption are interesting. Across all Vermont households over the 20 year period, the average annual personal income will increase by \$2.9 million. Average annual household spending on utilities and fuels will decline by \$0.8 million. Household spending on all other items will increase by \$3.1 million.

⁹ The PSD used REMI, a modeling tool developed specifically for economic forecasting. The tool considers detailed inter-industry relationships and consumer expenditure categories that interact to predict how businesses and households adjust their behavior in response to changing prices and production.

¹⁰ Vermont's annual Gross Domestic Product is \$25 billion. An annual increase of \$4.7 million is small in comparison, yet has certain benefits.

¹¹ A job-year is one full time job for lasting for one year.

Case Studies

The PSD thoughtfully distributed \$31,592,500 in ARRA funds. The PSD divided the funds into a few subsets to target various sectors of Vermont's economy (towns, schools, businesses...) and different physical spaces (historic buildings, main streets, homes, offices...). On the following pages, particular case studies tell stories that provide a feel for how ARRA awards translated into real benefits for Vermont communities and organizations.

Towns Schools Businesses Farms Health Facilities Colleges
Historic Buildings Streetscapes Low Income Housing Office Complexes



*Geothermal Heating & Cooling
Champlain College*



*Weatherization
Westford Library*



*Wind Turbine Blade
Burke Mountain*



*Wood Pellet Silo
Fayston Town Hall*



*Energy Efficient Lighting
Fayston Town Hall*



*Waste Oil Boiler
Corinth Town Garage*

All energy and cost figures presented in this report are based on estimates projected by the ARRA award recipients.

Photos (from left top clockwise): Westford Library photo by Alison Pierce, Alison Pierce Photography; Champlain College photo by Champlain College; Burke Mountain photo supplied by Burke Mountain; Town of Fayston photos by Patti Lewis; Town of Corinth photo by Town of Corinth.

Energy Efficiency Projects by Towns and Schools

Towns and schools retrofitted public buildings, and replaced street and parking lights for long term energy savings. Fifty-six ARRA grants were awarded to towns and 66 were awarded to public schools. The maximum granted was \$50,000. Grantees were required to contribute at least \$5,000 or 10% in local funds to the project. Many contributed much more. In total, these projects are saving over \$600,000 annually.

Small Town Energy Efficiency – Weatherization

In 2009, when the **Town of Westford** resided its Library, a 1844 Greek Revival structure, they discovered that the building was essentially uninsulated. With ARRA funds, the town performed a full retrofit to reduce heating costs. The project had several surprises due to the historic nature of the building. Historic preservation necessitated additional measures to remove moisture damage and prevent future structural problems. This project drew tremendous support from dedicated townspeople who had not worked on a complex grant project before.



*Westford Library
Photo by Alison Pierce Photography*

*Air leakage in the building was reduced by 75%.
Library staff and patrons have noticed that the building is warmer and less drafty.
An unexpected benefit has been reduced noise from traffic on Route 128.*



*Cozy children's section in the Westford Library
Photo by Alison Pierce, Alison Pierce Photography*

Project Funding

ARRA	\$12,200
Town	\$7,858

Annual Energy Savings

Dollars	\$900
Fuel Oil	300 gallons

Small Town Energy Efficiency – Weatherization

The **Town of Townshend's** retrofit project entailed a total thermal transformation of the Town Hall, a culturally important 1921 Classical Revival building. The project was part of a larger effort to bring the Hall up to code and modernize the equipment. A contractor was chosen with specific expertise in historic building weatherization. To protect the building from unintended moisture damage, weatherization work in the basement was done in accordance with the Secretary of the Interior's Standards for Rehabilitation and the Vermont Historic Preservation requirements.

The town and the contractor stretched their resources to leverage ARRA funds. Old vermiculite insulation laced with asbestos was removed using local funds. Local funds also covered the repair of historic curtains which were removed and reinstalled to allow completion of the ceiling insulation. The town reported that this project supported three full time jobs during its duration.



*Townshend Town Hall
Photo provided by Rick Hege*

Project Funding

ARRA	\$45,000
Town	\$5,000

Annual Energy Savings

Dollars	\$5,764
Fuel Oil	1,572gallons

"Employees in the building have lowered thermostats and remain more comfortable in their offices. Citizens attending meetings and other functions also note that they are not hot and cold, in frequent close succession."

*Elizabeth (Tiz) Garfield,
Chair, Town Hall Renovations
Committee*

Small Town Energy Efficiency – Weatherization, Interior Lighting, Waste Oil Furnace

The **Town of Peacham's** project retrofitted their Town Hall (originally a Methodist church circa 1832) and the Town Garage. In both buildings, they upgraded interior and exterior lighting and added timers or motion sensors. The Town Hall was weatherized and the 40 year old furnace was replaced with one capable of burning waste oil , which the town collects from local individuals.

"The whole project has been highly visible and we feel sure that some citizens have gone home and improved their own home's energy efficiency as a result."
Selectboard Member Tim McKay



*Peacham Town Hall
Photo by Deborah Nobel.*

Project Funding

ARRA	\$22,422
Town	\$8,890

Annual Energy Savings

Dollars	\$4,502
Electricity	9,878 kWh
Fuel Oil	412 gallons
Propane	594 gallons

Small Town Energy Efficiency and Renewable Energy – Deep Retrofit, Biomass Heat

Through the leadership of municipal officials and town energy committee members, the **Town of Fayston** is enjoying energy and cost savings having completed a deep retrofit and installed a super efficient wood pellet boiler system. Fayston received two ARRA awards, one grant to renovate their poorly insulated Town Hall and upgrade to new energy efficient lighting, and a second grant to replace the Hall's 35 year old oil furnace with a wood pellet boiler. Local contractors provided all the design, labor, and materials.



*Wood Pellet Silo (left) and Fayston Town Hall
Photo by David Frank - SunWood Biomass*

The wood pellet boiler installed is rated in the top five internationally for its efficiency, reduced air emissions, and ease of use. The pellets are sourced from sustainably managed Vermont forests and are manufactured in Vermont.

"This is where energy efficiency measures combine with renewable energy pay back to the taxpayer while reducing our dependency on foreign oil"
David Frank, Town Energy Coordinator

Project Funding

ARRA	\$71,315
Town	\$11,162

Annual Energy Savings

Dollars	\$7,108
Electricity	2,167 kWh
Fuel Oil	1,875 gallons

New Renewable Generation

1 Wood Pellet Boiler	
Thermal Capacity	130 kBTU/hr

Public School Energy Efficiency – Weatherization

The **Orange Center School** is a historic building, built in the early 1900's, has a major addition completed in the early 1990's. The school's facility committee has prioritized energy efficiency since 2008 when they completed an initial energy assessment through the Vermont Superintendents Association's School Energy Management Program. Their ARRA award funded an extensive weatherization project throughout the 30,000 square foot building.

Their retrofit super insulated the attic spaces well above the minimum recommended for Vermont buildings per national building energy code standards. The annual energy savings from their ARRA project allowed the school to set aside funds for the school's next priority, which was to upgrade lighting throughout the school to new energy efficient fixtures.

"During the project we discovered exactly how under insulated the school really was and we are all very excited to be able to provide such a huge upgrade..."
Chris Locarno, Business Manager



*Project team for Orange Center School
Photo provided by Orange Center School*

Project Funding

ARRA	\$50,000
School	\$8,037

Annual Energy Savings

Dollars	\$6,946
Fuel Oil	3200 gallons

Public School Energy Efficiency – Interior Lighting

The **Mount Mansfield Union High School** replaced all interior lighting fixtures with high performance energy fixtures throughout the 150,000 square foot building. The preliminary school-wide lighting design followed protocols established by national engineering standards. The design recommended lower lighting levels in particular areas. As a result, 278 fewer fixtures were needed. Motion sensors installed also result in reduced energy usage because lights are off when a room is empty.

Other aspects of the project contribute to a significant reduction in electricity use and costs. The lights installed require less maintenance, and thus save future staff and equipment cost to replace bulbs and fixtures. These other savings are not valued below.



*Mount Mansfield Union High School
Photo by Mount Mansfield UHS*

Project Funding

ARRA	\$50,000
School District	\$54,900

Annual Energy Savings

Dollars	\$32,813
Electricity	209,784 kWh

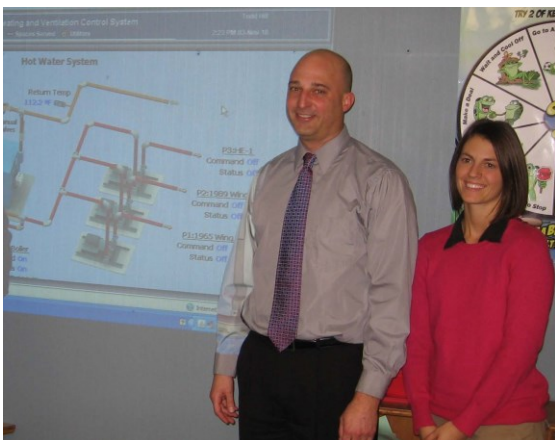
*Energy efficient improvements result in a better environment for all who inhabit the building.
High performance lighting fixtures enhance the quality of light in indoor spaces.*

Public School Energy Efficiency – Energy Management

Built in 1965, the **East Montpelier Elementary School** has been maintained with care throughout its life. Using ARRA funds, the school replaced their outdated energy control system for managing heat, ventilation, and air conditioning. The existing system, built in 1965, had been altered, expanded, and had parts decommissioned due to failure. Running 24/7 with antiquated electrical and mechanical controls, it was no longer efficient or effective. Every expert on energy efficiency assured the school that the control system's replacement would have the greatest impact on energy cost savings and environmental comfort. With the new system, the school estimates saving 10 to 15 percent per year in energy costs.

With project funds, the school purchased and installed a Direct Digital Control (DDC) Web-Based Energy Management System. The system has automated controls for the school's boilers, pumps, unit ventilators, gravity ventilators, unit heaters and various exhaust fans. These units are synchronized with the school calendar, building occupancy, and outdoor temperature. Web-based access allows remote monitoring and adjustment by school personnel, and issues an automatic alarm call when the system detects anomalies.

Facilities managers can control the system from home. This feature saves the school overtime pay for travel and mileage expenses when school is closed at night, on weekends, and during vacations. The personnel cost savings are not reflected in the energy cost savings stated below.



*Principal Roddy Cooke & Assistant Principal Alicia Lyford.
Photo by PSD*

Project Funding

ARRA	\$50,000
School	\$11,500

Annual Energy Savings

Dollars	\$5,824
Electricity	25,800 kWh
Fuel Oil	313 gallons

Public School Transportation Energy Efficiency – Bus Route Optimization

Otter Valley Union High School in Brandon serves seven towns in Rutland County. Using ARRA funds, the school district installed Bus Route Optimization Software in June 2011. The software resulted in \$7,000 in savings in fuel and other costs, in the first four months of its use.

The software had unanticipated advantages when Tropical Storm Irene ravaged the Rutland northeast region. The Neshobe River cut a gorge through the Town of Brandon. The Town of Mendon was divided, with roughly half of the town isolated. The school district employed the software to identify students who were blocked from bus routes due to a multitude of destroyed roads and bridges. This allowed the school district to expedite decisions and plans for how to transport the students safely.



Flood-damage on Route 4.



*Children transferring buses to get to school.
Photos provided by the Mendon Historical Society*

Project Funding

ARRA	\$13,356
School	\$2,684

Annual Energy Savings

Dollars	\$2,500
Diesel	675 gallons

Children walked through the woods on the "Woodchip Parkway", a temporary path which circumvented the break in Route 4. They were met by a small bus at the end of the path and then were transported to a larger parking area where they switched buses for the ride to school. A book by the Mendon Historical Society tells Mendon's story in the aftermath of Tropical Storm Irene. *"Irene Storms through Mendon: You CAN Get There from Here"*, is available at the Mendon Town Office. Call (802)-775-1662 or email mendonclerk@comcast.net.

Energy Efficient Street and Parking Lights Installed by Schools and Towns

Forty-one schools and towns received ARRA awards to replace street and parking lot lights with the newest LED fixtures. The design phase of these projects analyzed lighting needs and often recommended that some light poles be removed. In addition to cost savings from lower energy consumption, the long life of the new lights reduces maintenance costs.

City Parking Garage Energy Efficiency – Parking Lights

The **City of Winooski** replaced all 307 lights in their 110,000 square foot Winooski Parking Garage with LED fixtures. The resulting \$37,000 cost savings is a significant benefit for city taxpayers. Efficiency Vermont provided \$75,000 toward the City's matching funds.

Project Funding

ARRA	\$50,000
City	\$90,143

Annual Energy Savings

Dollars	\$37,100
Electricity	265,000 kWh

Small Town Energy Efficiency – Street Lights

The **Town of Thetford** replaced 23 street lights with LED fixtures. This project was part of an overall streetlight upgrade program which began seven years earlier. The town reviewed lighting requirements and determined that five, of the original 28 lights slated to be replaced, could be removed. The Town and the Sustainable Energy Resource Group, convinced CVPS to allow for town ownership of the new fixtures which are installed on street light poles owned by CVPS.

Project Funding

ARRA	\$23,282
Town	\$6,753

Annual Energy Savings

Dollars	\$1,656
Electricity	13,931 kWh

Public School District Energy Efficiency – Parking Lights, Weatherization, Interior Lighting

A number of school districts received multiple awards. Six schools in the **Addison Northeast Supervisory Union** completed eight energy efficiency projects. Mount Abraham Union High School and Robinson Elementary replaced parking and exterior building lights with high efficiency LED fixtures. Interior lighting retrofits were also completed in Mount Abraham and Robinson, as well as in Bristol Elementary, Lincoln Elementary, Monkton Elementary, and Beeman Elementary. In a couple of the schools, old furnaces and other heating system equipment were replaced with new high efficiency equipment.



*Lincoln Elementary
Photo supplied by
Addison Northeast Supervisory Union*

Project Funding

ARRA	\$297,617
School District	\$92,207

Annual Energy Savings

Dollars	\$41,600
Electricity	133,878 kWh
Fuel Oil	7,076 gallons

Improving Energy Efficiency for Pubic Serving Institutions and a Farm

Eight colleges, three health facilities, and a farm received ARRA funds to weatherize buildings, replace interior and exterior lights, and/or replace heating system components. Fifteen buildings were retrofitted totaling over 700,000 square feet. These organizations are saving an estimated \$228,000 annually.

Private College Energy Efficiency – Weatherization

With an ARRA grant, the **College of St Josephs** added an exterior insulation sheath for two dormitories - Roncalli Hall and Medaille Hall. Built in the late 1960's, both of the two-story buildings are walled with masonry blocks and concrete, and use electric heat. The buildings had issues with moisture in the first floor rooms, which led to mold and algae growth. The concrete walls were deteriorating and there was little insulation in the buildings. A certified contractor installed a new layer of four inch thick insulation over the exterior walls to remedy both the insulation and moisture problems.



Roncalli Hall
Photo by Cassandra Hotaling Hahn.

Project Funding

ARRA	\$122,749
College	\$122,749

Annual Energy Savings

Dollars	\$21,560
Electricity	154,000 kWh



Exterior sheath

Public Health Facility Energy Efficiency – Heating & Cooling System Upgrade, Energy Management

The **Richford Health Center**, (called the NOTCH) manages a 40,000 square foot building housing medical & dental offices, a pharmacy, and a grocery store. The building uses innovative air exchange technology which balances hot and cold areas throughout. When their utility costs sky-rocketed, the NOTCH collaborated with Efficiency Vermont, Housing Vermont, and an engineering firm to recommend system design improvements.

With their ARRA award, the NOTCH funded the installation of new metering and control equipment, and improved the functionality of existing equipment. The NOTCH is working with the grocery store to transfer tremendous amounts lost heat from the store's refrigeration systems into the building's main heating system. The Health Center and all tenants are benefiting from the energy savings already. The savings could increase another 20-50% once the grocery store heat transfer is completed.



*The NOTCH
Photo by Darlene Gregoire*

Project Funding

ARRA	\$72,500
Health Center	\$48,299

Annual Energy Savings

Dollars	\$19,330
Electricity	22,002 kWh
Fuel Oil	5,000 gallons

Commercial Organic Farm Energy Efficiency – Greenhouse Heating, Cooling, and Humidity Control

Long Wind Farm in East Thetford grows organic tomatoes for wholesale markets. The farmers have a deep commitment to environmental stewardship and profitability. Long Wind received an ARRA loan to retrofit a 83,000 square foot greenhouse by upgrading heat exchangers and a computerized control system. These air-to-air heat exchangers recover heat from air vented into and out of the greenhouse. This technology, along with new energy curtains for the ceiling, allow the farmers to intricately control the greenhouse air temperature and humidity to the liking of the tomatoes, while also saving energy.

"This synergistic system of curtains and air-to-air heat exchangers is projected by the Dutch engineers designing our system to save 30% of our energy use. These results are based on computer modeling, but the results have been confirmed by numerous installations in Holland in recent years." Long Wind Farm



Project Funding

ARRA	\$308,000
Farm	\$105,059

Annual Energy Savings

Dollars	\$54,945
Propane	27,473 gallons

*Greenhouse at Long Wind Farm
Photo by Jason Powers, U.S. Department of Energy*

Established Statewide Programs

ARRA awards were given to a number of established programs which work statewide to improve energy performance for low income housing units and schools. The ARRA funds provided a well-timed opportunity to continue or expand these programs and helped the PSD avoid costly efforts to create programs from scratch.

Statewide Program for Low Income Housing Energy Efficiency – Weatherization, Energy Management, Training

The **Vermont Fuel Efficiency Partnership** (VFEP), a statewide partnership of five Community Action Programs, is administered by the Central Vermont Community Action Council (CVCAC). The goal of VFEP is to weatherize low income housing units, with an emphasis on multi-family rentals. VFEP works closely with the Vermont Housing & Conservation Board and the Vermont Housing Finance Agency to prioritize which properties will be retrofitted. VFEP's energy services include building weatherization projects such as insulation and heating system upgrades, as well as consumer education and workforce training.

Over two million dollars in ARRA monies funded the continuation and expansion of VFEP. The majority of VFEP's ARRA award was directed to serve Vermonters who are over the eligible income levels for VFEP services. Families in the range of 60-80% of median income typically do not have the means to install efficiency measures.

To date, VFEP weatherized 53 buildings totaling 360,000 square feet, and performed audits in 187 buildings.

To further improve energy savings, VFEP supported training for multi-family building property managers and sponsored Do-It-Yourself Weatherization skillshops for homeowners. And 2,100 people participated in trainings.

Project Funding

ARRA	\$2,379,793
------	-------------

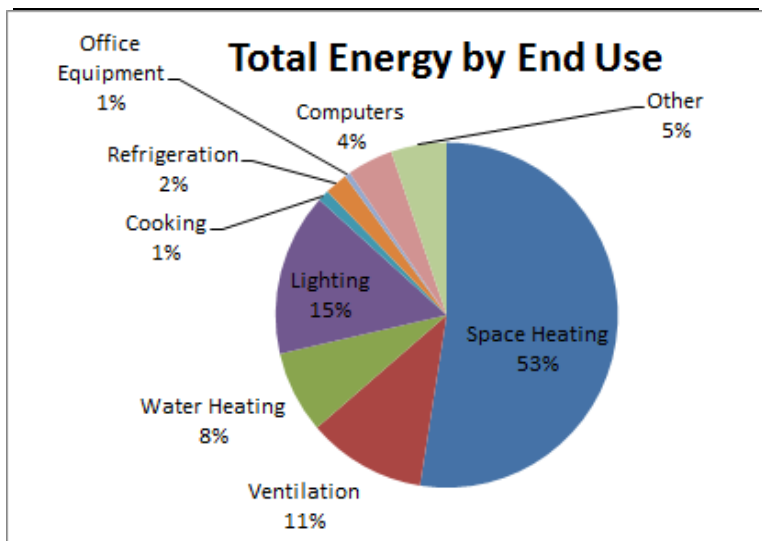
Annual Energy Savings

Dollars	\$118,784
Natural Gas	2 mil. cubic feet
Electricity	600,561 kWh
Fuel Oil	7,152 gallons

Statewide Program for Schools Energy Efficiency – Full Retrofits, Energy Management

The **Vermont School Energy Management Program** (SEMP), run by the Vermont Superintendents Association, received \$104,000 in ARRA funding. This funding augmented their existing program in K-12 schools. SEMP aims to achieve significant savings in annual energy costs by documenting building conditions, recommending cost-effective energy improvements, and helping schools implement equipment and behavioral improvements.

Using ARRA funds, SEMP reported completion of 67 energy audits, covering 2.6 million square feet in Vermont schools. Additionally, ARRA funds supported SEMP's evaluation of their work from 2005 to 2010, when they visited 245 of the 428 schools in Vermont. The evaluation found that SEMP advised and installed over 50,000 electric conservation measures to save \$1.5 million in annual electric costs for schools across Vermont. In 2011, SEMP schools consumed about 16% less electricity per square foot compared to schools that had not participated in SEMP.



Energy use by schools across Vermont.

Chart provided by Vermont Energy Investment Corporation.

On average,
schools that have implemented
SEMP recommendations
are saving
\$6,100 in electric costs and
\$2,300 in heating costs every year.

Project Funding

ARRA	\$104,000
------	-----------

"The primary goal of a school's energy using systems is to create an indoor environment that supports its educational and community purposes. Using energy in an efficient manner will achieve energy savings while complementing, not compromising the educational environment."

Norm Etkind, School Energy Management Program Director

Statewide Program for Low Income Housing Energy Efficiency – Weatherization, Solar Hot Water

The **Vermont Housing and Conservation Board** (VHCB) is a state-supported non-profit agency that provides grants, loans, and technical assistance for the development of affordable housing, and for the conservation of land and historic properties in Vermont.

With ARRA funds, VHCB completed building weatherization projects and installed solar hot water systems for low income homes that are normally not eligible for VHCB services. VHCB worked on 725 units, totaling 659,000 square feet, at 88 public housing buildings in 27 towns. Thirty solar domestic hot water systems were installed to service 390 units. The numbers are impressive. VHCB worked together with energy and housing development partners to achieve total energy savings of 40% or above.

"The [ARRA] funds were critical because they allowed us to address the energy needs of so many important projects in our portfolio, including many units in smaller buildings that have been a challenge from an energy perspective." Craig Peltier, VHCB Program Director

VHCB also created a tool that accurately accounts for the costs and benefits of specific renewable energy equipment and energy efficiency measures in multi-family dwellings. The program outcomes were recorded, analyzed, and shared with partners. With the tool, partners can more effectively plan projects that have the greatest energy and cost savings. Thus, the most successful efficiency strategies will be incorporated into all future projects.



*New exterior wall insulation
Photo by PSD*



*New interior wall insulation
Photo by PSD*

In addition to over \$432,000 in annual energy cost savings, Vermont building contractors benefitted economically as the project generated over 31,000 hours of work. Over 60 small businesses throughout the state were contracted on VHCB projects.



*Low Income Housing Property
Photo by VHCB*

Project Funding

ARRA	\$2,000,000
VHCB	\$7,739,454

Annual Energy Savings

Dollars	\$432,931
Natural Gas	2 mil. cubic feet
Electricity	487,156 kWh
Fuel Oil	97,455 gallons
Propane	11,276 gallons

New Renewable Generation

30 Solar Hot Water units	
Thermal Capacity	6,963 kBTU/day

"We wanted to give our residents more comfortable and sustainable homes. New windows, added insulation, better ventilation and lighting were made possible because of our participation in this valuable program."

Bob Hanson, Gilman Housing Trust Project Manager

Renewable Energy Projects

Nearly half of ARRA funding supported renewable energy installations and Vermont's wind and solar energy markets. The PSD awarded ARRA funds to install renewable energy generation at businesses and municipal facilities. Projects were selected based on their potential replicability at other commercial and public buildings, and their public visibility. These projects helped advance and promote sustainability initiatives in Vermont organizations due to the resulting positive environmental, economic, and societal impacts. The ARRA funds fostered market development in Vermont's renewable industry by spurring new public and private partnerships and linkages within supply chains.

Cooperative Food Market Renewable Energy – Rooftop Solar Electric

Using ARRA grant funds, Burlington's **City Market Onion River Co-op** installed a rooftop solar array consisting of 136 solar panels. City Market is a 16,000 square foot community-owned grocery, dedicated to sustainable agriculture and local development. City Market hired local businesses to design and install the solar electric system. Prior to the solar installation, City Market's monthly electric bill was approximately \$17,000, the bulk of which covered electricity for freezers and refrigeration units. The solar system is on track to meet or exceed the annual electrical production projected.

"We've been working on different projects to improve energy efficiency and the solar project is one of the largest and most impactful." Pat Burns, Operations Manager



*Rooftop Solar Electric at City Market
Photo by City Market*

Project Funding

ARRA	\$53,900
City Markets	\$135,897

New Renewable Generation

Solar Array	
Electrical Capacity	31 kW
Electrical Production	32,748 kWh

Commercial Ski Resort Renewable Energy – Wind

The fifty year old **Burke Mountain Ski Resort** received an ARRA-funded loan to purchase and install a Vermont-manufactured 100kW Northwind Turbine. An anemometer and wind maps both showed the average wind speed at the site to be over 17 miles per hour. This wind turbine is the centerpiece of Burke's sustainability goals, as well as an investment that will lower Burke's operating costs.

"We are grateful because without the [ARRA] funds, we couldn't have completed this good project. It's been good for the business, good for the environment and good for the local community as it caused significant job stimulation."

Tim McGuire, Vice President and General Manager of Burke Mountain Operating Company



*100 kW turbine atop Burke Mountain.
Photo by Burke Mountain Operating Group*

Project Funding

ARRA	\$500,000
Burke Mountain	\$473,200

Annual Energy Savings

Dollars	\$34,200
Electricity	285,000 kWh

New Renewable Generation

1 Wind Turbine	
Electrical Capacity	100 kW
Electrical Production	285,000 kWh

Municipal Waste Water Treatment Facility Renewable Energy – Biogas Digester

The **City of South Burlington** received an ARRA grant to design and install an energy generation system called a Biogas Digester at the new Airport Parkway Wastewater Treatment Facility. The digester burns biogas (methane emitted from organic waste, in this case sludge) and produces both heat and electricity. The heat generated by the digester aides the treatment of wastewater and heats the building. The electricity generated from the digester runs pumps, blowers, lighting, and other electrical equipment. The system designers estimate that approximately \$103,000 will be saved annually.

"The facility upgrade included several energy saving systems including the ability to capture methane gas from our biosolids digesters. The captured methane gas is cleaned, compressed and used to fire a 65kW micro-turbine that is sustainably reducing the plant heat and power bill by approximately 20%."

Steven Crosby, Water Quality Division Superintendent, City of South Burlington



*The Microturbine and Sludge Digester
Photos by Photos by John D. Reilly,
Senior Environmental Engineer,
Hoyle, Tanner & Associates, Inc.*

Project Funding

ARRA	\$242,650
City	\$279,900

Annual Energy Savings

Dollars	\$172,000
Natural Gas	8 mil. cubic feet
Electricity	492,000 kWh

New Renewable Generation

1 Biogas Digester	
Thermal Capacity	383 kBTU/hr
Electric Capacity	65 kW
Electrical Production	492,000 kWh

Research Collaborative Renewable Energy – Community Guidance Document

With ARRA funds, the PSD contracted Powersmith Farm in Guilford to create a public report called [Vermont Group Net Metering Information & Guidelines](#). The PSD wanted a guide to help community groups learn how to set up Group Net Metering for co-owned renewable systems. Powersmith collaborated with Vermont Law School's Institute for Energy and The Environment and with Marlboro College's Managing for Sustainability MBA Program. The Guide describes the optimal legal and operational structures, and presents options as well. The authors also developed and documented a conceptual plan for two Community Owned Renewable Energy systems for solar electricity.

Vermont Group Net Metering Information & Guidelines

Authors:

Michael Dworkin
Vermont Law School, Institute for Energy and the Environment

Dan Inghild
Powersmith Farm Inc.

Ralph Meina
Marlboro College MBA Program for Sustainability

Corey Rosser
Vermont Law School, Institute for Energy and the Environment

Jonathan Voegtle
Vermont Law School, Institute for Energy and the Environment

Mary Westervelt
Marlboro College MBA Program for Sustainability

Project Funded by:

Vermont's Clean Energy Development Fund (ARRA) & Powersmith Farm
December 2010

Vermont is a national leader in the application of net metering and has approved over 1,300 small renewable power systems. The Guide provides legal and technical information and guidelines to those interested in starting or joining GNM projects.

Project Funding

ARRA	\$26,900
Powersmith	\$1,850

Vermont Group Net Metering Information & Guidelines Page 1

About Group Net Metering (GNM) When an electric utility customer installs a renewable electric system such as solar or wind on their property, and connects it to the electric grid, the customer receives credit for the electricity generated on their electricity bills. This is called Net Metering. GNM allows multiple customers, in the same electric utility, to jointly invest in a renewable electric installation. Each investor receives credit on their electricity bills, regardless of where the renewable electric system is sited.

GNM projects are relatively small community-scale systems. The group system costs less than multiple small systems with the same electrical output. With GNM, individuals who do not have optimum sites for renewables, (ex. lacking sun or wind) can invest in electric generation. GNM fosters the expansion of renewable electricity markets, because more people can take advantage of direct savings on their electric bills.

Business Development

Three ARRA awards supported business development by supplementing capital funding for established Vermont manufacturers and other commercial entities. The funded projects helped establish how particular technologies can be best adapted for use in Vermont.

Commercial Manufacturer Renewable Energy – Energy Storage, Business Development

Dynapower is a nationally recognized manufacturer of custom electric power conversion equipment, headquartered in South Burlington. Dynapower used ARRA funds to further develop an innovative technology that controls the storage and release of electric power held in huge batteries. This emerging technology is helping to integrate renewable electric generators into the electric grid.

Dynapower coupled their new PowerSkid energy storage device to a Northern Power 100kW wind turbine and a 100 kW solar electric system. They demonstrated how to improve energy efficiency and utilization from these wind and solar renewable energy sources. The project involved a number of other Vermont based experts in this new field- Draker Laboratories of Burlington, Conant Excavation, and Green Mountain Power.



*Wind turbine coupled to an energy storage device
Photo by Dynapower*

Project Funding

ARRA	\$250,000
Dynapower	\$1,948,604

"The [ARRA] funding allowed us to demonstrate, at our factory, our latest product to support renewable energy and energy efficiency. We plan to use this great development and marketing tool to support the growth of our business within Vermont."
Aaron Pollack, Development Director at Dynapower

Financing Programs for Energy Projects

Available financing is a key to developing markets in energy efficiency and renewable energy. To support project financing, the PSD provided grants to select towns and contracted with Vermont non-profits that already had established financing programs. The ARRA funds significantly increased cash rebates, loans, and small grants issued by these programs to homeowners and businesses.

Statewide Program for Homes and Businesses Renewable Energy – Cash Rebates

The **Vermont Small Scale Renewable Energy Incentive Program** (SSREI), created in 2003, spurs the development and production of clean energy by growing residential and commercial markets for small scale renewable energy technologies in the most widely distributed and accessible way possible. The program is market based, cost effective, highly leveraged, and simple. Access to SSREI funds is open and transparent. The program provides rebates to individuals, businesses, municipalities, non-profits, and multi-family low-income housing projects for the installation of small-scale solar electric, wind, and micro-scale hydropower, and solar hot water systems. The PSD has contracted the administration of SSREI with the Vermont Energy Investment Corporation (VEIC).

SSREI received a boost from ARRA funding. ARRA funds provided over \$6 million in rebates for 1,172 renewable energy installations. The ARRA funding coincided with increased demand for these systems, as well as an increase in the number of installers seeking certification. The table below summarizes the number of installations and system capacities.

Project Funding

ARRA* \$7,034,328

Customers \$31,813,482

*Includes VEIC administration of ~10%

ARRA Funded Vermont Small Scale Renewable Energy Incentive Projects

Description	Wind	Solar Electric	Solar Hot Water	Total
Number of Projects Installed	26	668	478	1,172
ARRA Funded Rebates Paid*	\$653,470	\$4,887,399	\$842,192	\$6,383,061
Total Cost of Installed Systems	\$2,188,194	\$29,981,052	\$6,027,296	\$38,196,543
Total Installed Capacity	300 kW	4,844 kW	43,481 kBTU/day	—
Estimated Annual (kWh/yr)	611,785	6,149,703	—	—

*Does not include VEIC administration which totaled \$651,267

Data supplied by VEIC

Examples of SSREI Projects



Photo by PSD

Cathedral Square is a non-profit organization that manages housing communities for seniors and people with disabilities. They operate centers in Burlington, Colchester, Essex, Essex Junction, Jericho, Richmond, St. Albans, South Burlington, and Williston. Cathedral Square received a cash rebate of \$75,922 for a 36.48 kW rooftop solar array installed at their Senior Living building which has 108 apartments. Annual savings from the solar electric system is augmenting strained budgets for resident nursing and wellness services.



Photo by PSD



*Photo by Jason Powers
U.S. Department of Energy*

Graniteville Fire District owns and operates a public water system serving 270 customers in Upper and Lower Graniteville. The Fire District received a rebate to install a 50 panel 11.75 kW solar array that is grid connected. The solar system produces about half of the district's electricity demand to pump water from granite quarries and to run other equipment. The system reduces their operating costs by approximately \$3,500 per year.

The **Vermont Youth Conservation Corps** (VYCC) installed 14 ground mounted solar trackers totaling 58.8kW next to their headquarters at the West Monitor Barn in Richmond. The system is saving an estimated \$11,000 in electric cost each year by supplying all of VYCCs electricity plus giving any excess power to Chittenden East schools. The trackers were manufactured by All Earth Renewables just 7 miles away. All Earth's solar trackers, one of Vermont's renewable industry successes, are sold nationally.

Statewide Program for Public Institutions Energy Efficiency – Loans and Grants

The PSD contracted the Vermont Economic Development Authority (VEDA) to co-develop and underwrite a 0% **Revolving Loan and Small Grant Program** funded by ARRA monies. The program finances weatherization projects carried out by public serving nonprofit institutions, such as colleges and hospitals. All loans issued have a 5-10 year term. VEDA selected recipients through a competitive process, looking for projects with the best return on investment, comparing energy cost savings to projects costs. For each eligible project, the PSD conducted an energy technology evaluation and VEDA conducted an underwriting analysis. This collaboration has served the State well, leveraging each entity's expertise.

The reason for offering revolving loans was to assure perpetual funding for clean energy projects. As loans are paid off, money flows back into the loan fund to help finance new projects.

<u>Project Funding</u>	
ARRA	\$265,655

Statewide Program for Homeowners Energy Efficiency – Lower Interest Rate Loans for Retrofits

The PSD contracted the Vermont Energy Investment Corporation (VEIC) to create an ARRA funded **Interest Rate Buy-Down Program** (IRB), to augment the Property Assessed Clean Energy (PACE) loan program which is already administered by VEIC for Vermont cities and towns. PACE loans help homeowners finance weatherization projects; some renewable energy installations are also allowed. PACE and IRB involve intricate collaboration between Vermont banks, municipalities, and energy partners such as VEIC. PACE loans are issued to homeowners by banks; the homeowners then pay off their loan along with monthly property taxes, through their town's PACE program. The IRB serves low and moderate income homeowners by lowering the interest rate on their PACE loans.

<u>Project Funding</u>	
ARRA	\$430,578

The Interest Rate Buy-Down Program allows banks to offer homeowners a lower interest rate on their PACE loan. This makes more people eligible to borrow money for retrofit projects, so more people can benefit from lower energy costs in their home.

Town-wide Program for Homeowners Energy Efficiency – Cash Rebates

The **Town of Putney** was one of four Vermont towns awarded ARRA funds to stimulate building efficiency by offering cash rebates for retrofit projects in homes. Putney reported that \$145,086 was invested in total to retrofit 30 homes. Putney gave out \$53,639 in rebates and Efficiency Vermont provided an equal match. Eligible homes received up to \$5,000 as a cash rebate for completing their project. Homeowners are saving every year on their electricity and heating costs.

The town learned a great deal about how to manage a successful program to - attract and assist homeowners, partner with Efficiency Vermont, and help finance home energy efficiency projects. Putney's new knowledge and experience is helping the town implement the nationally formulated Property Assessed Clean Energy loan program.

"The highlights are that people are delighted with the program, happy they did the work, and surprised with the results. Warmer quieter homes that hold heat better in the winter and hold coolness better in the summer. Many older homes had moisture issues to address as well."

Chris Ryan, Town Manager



Photo supplied by Town of Putney

Project Funding

ARRA	\$53,639
Town	\$5,572

Annual Energy Savings

Dollars	\$32,839
Electricity	Not available
Fuel Oil	Not available

The State of Vermont Leading By Example

Vermont law requires the state government to carry out projects that advance clean energy in Vermont. The PSD is required to engage stakeholders, make recommendations, and publish a statewide energy plan. The PSD also updates Vermont's standards for building energy codes, incorporating national and international code revisions. Additionally, state-owned facilities undergo energy retrofits and renewable energy systems are installed; these measures reduce electricity use, petroleum consumption, and operating costs.

State of Vermont Geothermal Heating & Cooling System

The Vermont Department of Buildings and General Services received an ARRA grant to install a geothermal heating and cooling system in the newly renovated "Leed Silver-Certified" **Bennington District Court and State Office Building**. The overall project included demolition of much of the original building. Now, the 66,000 square foot structure has state-of-the-art insulation and air sealing, a ground source heat pump for cooling and heating with sophisticated monitoring and controls, and solar hot water heating.



*Bennington District Court & State Office Building
Photo by PSD*

Project Funding

ARRA	\$2,000,000
State	\$15,000,000

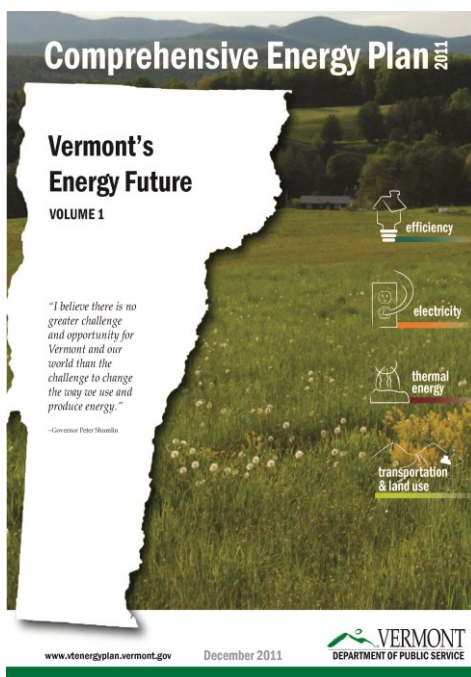
Annual Energy Savings

Dollars	\$16,378
Fuel Oil	1,377 gallons
Electricity	75,797 kWh

State of Vermont Statewide Energy Planning

ARRA supported the revision of [Vermont's Comprehensive Energy Plan](#) (CEP). With ARRA funds, the PSD covered staff time and contracted with technical advisors. The contractors developed and analyzed the results of sophisticated models that predict the future supply and demand for electricity, as well as related economic impacts. Reports completed under these ARRA funded contracts are contained as Appendixes to the final 2011 CEP.

The CEP describes the state's total energy consumption and recommends strategies to improve efficiency, expand renewable resources, and reduce costs. The plan looks 20 years forward and considers all aspects of energy use including electricity, building heating/cooling, industrial processing, and transportation. The PSD released a draft revision of the CEP for public review in the summer of 2011, and received over 9,000 comments. The final plan represents the combined efforts of many state agencies, private and public stakeholders, and Vermont citizens.



Project Funding

ARRA	\$228,750*
Other Sources	State staff ¹²

The [2011 Comprehensive Energy Plan](#) sets a visionary goal that Vermont achieve 90% of its total energy from renewable sources by 2050. Accomplishing the CEP's vision requires a paradigm shift to integrate energy efficiency and renewable technologies across all energy sectors- electricity, heating, and transportation.

¹²* Over 50 PSD and other state agency staff devoted tremendous effort to research, coordinate stakeholders, hold public meetings, write, and assemble the various sections of the CEP final document.

State of Vermont Statewide Building Energy Codes

Commercial and Residential **Building Energy Codes** are technical standards for building construction and renovation that serve to increase the structure's energy efficiency. The PSD contracted with experts and oversaw their work to revise Vermont's Building Energy Codes and to conduct subsequent professional trainings about the code revisions. Copies of the revised codes are available at [Residential Building Energy Standards](#) and [Commercial Building Energy Standards](#).

Navigant Consulting, Inc facilitated the code revision. A technical advisory panel formed with representatives from the PSD, electric and gas utilities, Efficiency Vermont, architects, engineers, and other professional groups. The panel reviewed national and international code standards and current research on building energy science, aiming to create a Vermont specific version of the 2009 International Energy Conservation Code. Vermont's revised codes underwent extensive public review and comment.



Project Funding

ARRA	275,710
Other Sources	\$40,000 ¹³

*Newly installed spray foam insulation in an attic
Photo by PSD*

¹³ Additional funding covered three PSD staff who oversaw and advised these projects on a part time basis. These costs are not counted in this figure,

The Vermont Energy Investment Corporation coordinated professional trainings to review Vermont's energy code changes. Over 1,000 professionals attended trainings. Participants were building contractors, engineers, bankers who finance construction, building owners, realtors, facilities managers, energy advocates, and others affected by the code revisions.

The Energy Futures Group developed a Vermont Energy Code Compliance Plan. The plan's goal is to achieve 90% compliance with building energy codes by 2017. PSD and stakeholders reviewed the mechanisms by which building energy codes are enforced in Vermont. Enforcement models from other states were studied. All new construction must follow Vermont's building energy codes; only homes that are constructed and occupied by the owner are exempt. Builders may self-certify that the building is compliant with the energy codes. Compliance certification may also be obtained through licensed engineers, architects, and energy rating organizations.

The revised building energy codes are 15% more stringent than the previous codes. More stringent code requirements result in reduced energy consumption by buildings. This has positive economic and environmental benefits for the building owners and for Vermont as a whole.

Conclusion

From 2009 through 2013, the State of Vermont's Public Service Department distributed \$31,592,500 million in ARRA awards to fund energy-related projects throughout the state. This report has provided an overview of the projects' impacts on the state and a glimpse into the impressive variety of projects implemented.

Now completed, ARRA projects continue to benefit Vermont's economy and move Vermont forward toward state goals. Weatherization projects in buildings, street light replacements, and revised state building codes are recycling energy savings back into the state economy. Renewable energy projects are keeping dollars in-state by generating energy from ARRA-funded wind, solar electric, solar thermal, biomass, and biogas installations sited around the state. ARRA supported the advancement of these technologies and markets through funding support for installations, as well as for finance programs, service programs, and business development. Additional planning projects outlined strategies and actions for energy infrastructure and policy work at the local, regional, and state levels. All of the projects leveraged Vermont's existing energy industry and further raised Vermont's expertise in the fields of energy efficiency and renewable energy. The ARRA projects supported jobs and job training to build Vermont's energy infrastructure. These ARRA projects are aligned with long term energy efficiency, renewable energy, and greenhouse gas emission goals set out in Vermont law and the Vermont Comprehensive Energy Plan.

The PSD wishes to acknowledge and commend the hard work of the people at businesses, municipalities, public institutions, and state agencies who carried out ARRA energy projects, as well as the state staff who administered the ARRA funds.