Appendix D: State Agency Energy Plan Leading By Example Case Studies

- Department of Fish & Wildlife: Fish Hatchery Energy savings
- BGS, Fleet Management Services: GoGreen State Fleets Initiative
- Department of Buildings & General Services: Waterbury State Office Complex
- Agency of Transportation: Solar Garages
- The Capital Commuters Program

LEADING BY EXAMPLE

How state government is saving energy, lowering costs, and reducing carbon pollution

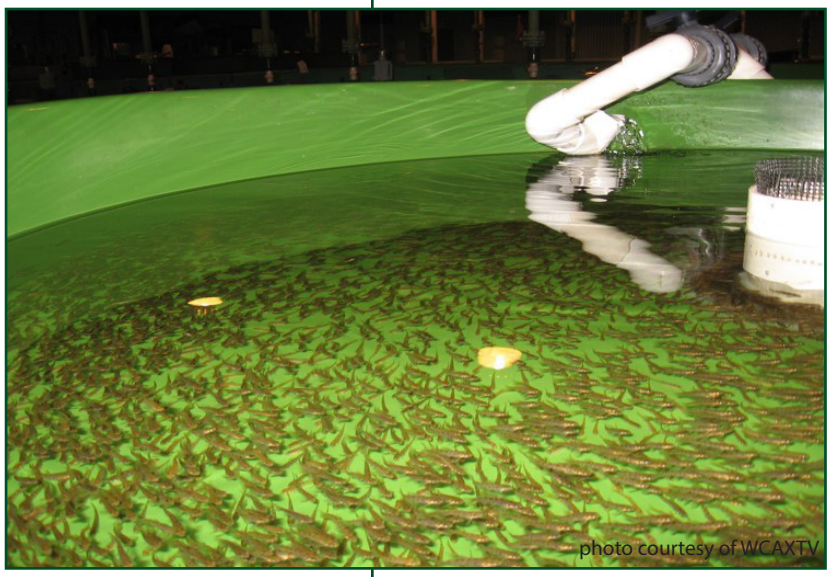
Vermont's five hatcheries produce more than 2 million healthy fish for release in state waters each year. Hatcheries require significant amounts of electricity, propane and other sources of energy to grow fish. These five facilities have become surprisingly energy efficient, just by replacing older lighting fixtures and heating systems, introducing new energy-smart equipment and adjusting production processes to reduce energy use.

This year alone, energy improvements at the hatcheries will save Vermont $75,000 on fuel bills and reduce emissions by 3,000 metric tons of carbon. Energy upgrades to date could power all of Grand Isle's homes for a year or allow passenger vehicles to circle the Earth 327 times.

Partnerships Make it Possible

Leveraging a variety of partnerships, the hatcheries have been able to make these changes without a large upfront budget. Funding was provided by the Department of Buildings and General Services (BGS) State Energy Management Program, utilizing one of the revolving loan funds that help agencies implement energy efficiency upgrades and use the energy dollar savings to pay back the loan. BGS reinvests the loan payments in other energy projects. The program is available to all agencies.

Additionally, strong relationships with the U.S. Fish and Wildlife Service yielded access to federal partners' experience and assistance. The Vermont Energy Investment Corporations, another key partner, provided expertize on upgrades to hatchery systems, from pumps to lighting.



Early rearing landlocked Atlantic salmon at Ed Weed are raised in a new tank system that recirculates water, saving water use and the propane needed to heat it.

Doing More Work with Less Energy

Ed Weed

- A variable frequency drive installed to reduce pump speed saves more than $2,900 per year.
- Recirculating heated water needed to grow fish during cold months has decreased propane and electricity costs by approximately $60,000 a year.

Bald Hill

- A high efficiency boiler replaced the less efficient oil fire burner, saving $79,000 over the expected life of the project.
- A solar photovoltaic system installed at the hatchery will produce approximately 34,000 kWh annually and generate $160,000 over the 25 year expected lifetime of the panels.

Bennington

- Installed netting over ponds will reduce predation, improve fish survival and increase production by nearly 30 percent with little additional energy use or cost.

Looking Ahead

Vermont's fish hatcheries have shown that even in tight budget times, and with very limited capital money, investments in energy efficiency and renewable power can be successful. Wide ranging energy improvements were made possible by using innovative financing mechanisms, while leveraging existing relationships between partners that understood that environmental and financial benefits can be achieved by working together. The fish culture program will continue to improve the efficiency of its operations and reduce the amount of non-renewable it uses to the greatest extent possible. Here is what we have in store:

Renewable Power - Growing Fish on Sunlight

To raise fish at a hatchery you need a lot of power. Despite their small size and efficiency, Vermont's hatcheries spend nearly $250,000 a year on electricity. Fortunately, by taking advantage of a state contract with the Vermont-based company All Earth Renewables, the Department of Fish and Wildlife will be able to build two new on-site solar projects that will offset all of its hatchery electricity usage and reduce its electricity bills by 10%, without upfront costs.

The partnership will enable the Department to access the company's expertise in permitting and design. The two projects, totaling 650 KW in capacity, will help support progress towards state government's ambitious 2025 and 2050 renewable energy goals.

Saving More Energy

The Fish & Wildlife Department is also planning the next round of efficiency investments.

Ed Weed

- New efficiency intake pumps will save $12,000 a year.
- Reducing the height of the water intake "headbox" will pay for itself in less than a year and save more than $2,000 a year.

Bald Hill

- A new solar thermal panel hot air heating system will circulate air warmed by the sun to supplement the hatchery building's conventional heating system.

Salisbury

- New variable frequency drives will reduce pumping costs by nearly $12,000 a year – and will pay for themselves in less than two years – with no loss of performance.
- New more efficient lighting will save money and electricity.

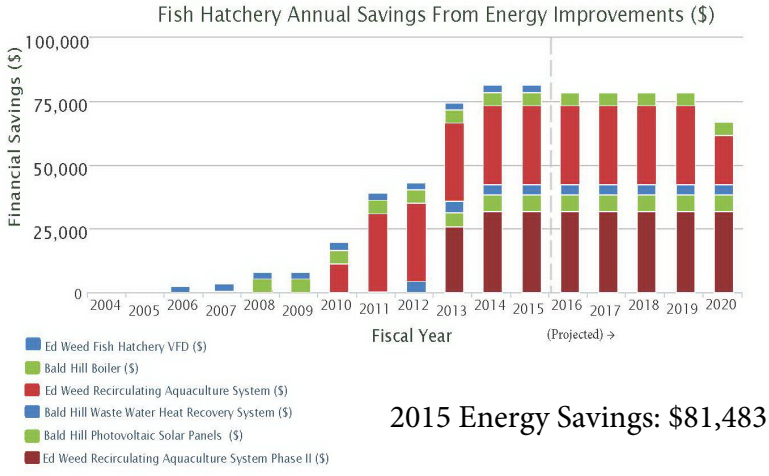
Bennington

- New efficient lighting fixtures will pay for themselves, saving electricity and money.

Roxbury

- Upgrading the current propane boiler to a wood pellet boiler will reduce fossil fuel use, save money, and support the timber industry.

Upgrades to date save enough energy annually to power all of Grand Isle's homes for one year, or to fuel a car traveling around the Earth 327 times.



2015 Energy Savings: $81,483

LEADING BY EXAMPLE

How state government is saving energy, lowering costs, and reducing carbon pollution

Transforming Transportation
The New GoGreen State Fleets Initiative

Almost half of Vermont's greenhouse gas emissions come from transportation –from moving people and goods around our rural state. State government is committed to reducing the fossil fuel use and emissions from its own transportation activities, by:

- Replacing conventional vehicles with cleaner plug-in hybrid and all electric models;
- Adopting new policies and practices to ensure that state employees travel from place to place as efficiently as possible; and
- Reducing our travel miles.

In the next five years, state agencies will work together on a new initiative to significantly reduce the fossil fuel used in state transportation.

Progress on Reducing Greenhouse Gas Emissions

Almost half of state energy use is from vehicle travel – from the use of passenger sedans that transport employees to meetings and site visits, and from the use of many trucks and plows that perform critical maintenance and construction work.

The new State Agency Energy Plan sets ambitious goals for greening state transportation, including displacing 10% of current gasoline use by 2020, 25% in 2025, and one-third by 2032.

Achieving them will be challenging. The path must include converting the state's fleet to electric vehicles – the cleanest cars on the road today. The Department of Buildings and General Services (BGS), the agency that manages approximately half of the State's vehicles, has made great progress in the last several years.

A More Efficient Fleet

- There are now 49 conventional hybrid vehicles and 13 plug-in electric vehicles in the state's BGS fleet, making it the largest electric fleet in Vermont.
- BGS is working with other agencies to ensure that when vehicle replacement occurs, the new vehicles are as fuel efficient as possible. Since electric models are not yet available for trucks, improving average fuel economy of the state's conventional vehicles is critical.
- In the future as more biofuels become available, the state may also be able to displace conventional diesel with these lower emitting alternatives.

There are now 13 plug-in electric vehicles in the state's BGS fleet, making it the largest electric fleet in Vermont.

BGS
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Charging Infrastructure

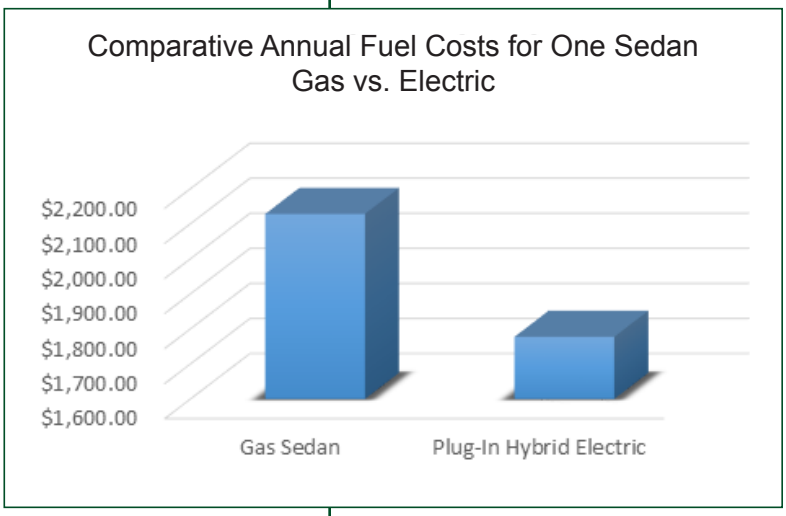
- During construction projects, BGS is pursuing installation of charging stations to power fleet vehicles and enable employees who commute in EVs to charge at their workplaces. Eight "Level 2" chargers with capacity to simultaneously charge 16 vehicles are now available at fleet headquarters. The new Waterbury Office complex includes two dual port Level 2s with electric infrastructure in place to increase the number of chargers when needed.

- BGS has awarded a contract to Green Mountain Power to provide electric vehicle charging infrastructure to all state agencies, local municipalities and public schools. BGS used its standard bid process to ensure new stations will meet high standards and be cost-effective.

Looking Ahead

Although state government has made good progress on electrifying the fleet, the total energy used in state transportation still increased almost 30% since 2012.

Starting in 2016, the state will launch a new **GoGreen State Fleets Initiative** to drive progress towards the transportation energy goals in the State Agency Energy Plan. Led by BGS with participation and support from many other agencies, the initiative will work on reducing fossil fuel use in state transportation to save taxpayer dollars, scale back energy use and reduce harmful greenhouse gas emissions.



By demonstrating the benefits of environmentally friendly, safe transportation for all Vermonters, the initiative will also help support progress on the state's plan to accelerate the adoption of electric vehicles by businesses, institutions and households all across Vermont.

What needs to be done?

- **Adding More EVS.** Converting a larger percentage of the fleet to electric vehicles is within reach: a wider selection of affordable cars with electric ranges up to 200 miles are soon coming to market. BGS will add at least five new EVs to the fleet each year. Employees whose trips can be made in EVs will be assigned those vehicles whenever possible.

- **Rightsizing the Fleet.** Maintaining a fleet with high average fuel efficiency – including efficient heavy-duty trucks for which there are no electric models yet– can dramatically reduce fossil fuel use.

- **Educating Employees.** BGS will offer Ride and Drive events and employee training to get the state's work force comfortable with new EV models, and to encourage their use. Education about eco-efficient driving practices that reduce fuel use and air emissions, such as avoiding single driver trips, reducing idling, and slowing average highway speeds, is also a top priority.

By using a Fleet Electric Vehicle, state employees save taxpayer dollars and reduce harmful greenhouse gas emissions.

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How state government is saving energy and money– while helping the climate – for all Vermonters

The Waterbury State Office Complex
A Model for Green, Climate Resilient Building

The State Office Complex in Waterbury, Vermont was hit hard by Tropical Storm Irene in 2011. Water levels rose above the first floor of many buildings, and agencies were forced to relocate their employees to temporary locations scattered across the state.

When Vermont's Governor Peter Shumlin decided to rebuild state offices at the site, the Vermont Department of Buildings and General Services (BGS) saw a rare opportunity to design and build a complex that would save state government tens of thousands of dollars annually and model green building for other organizations – with energy and climate smart features throughout.

Description and Financing

The property loss at the Waterbury State Office Complex was extensive. Complicating this challenge was the fact that many of the original buildings were located in floodplain areas at high risk for future flooding. New buildings would have to be highly cost effective to operate, and resilient to the more severe weather events and flooding that scientists are expecting in the northeast due to a changing climate.

The State funded the project with a combination of insurance, federal disaster recovery funds, and state bond revenues. BGS and the Agency of Natural Resources established close partnerships with the Federal Emergency Management Agency, the Town of Waterbury, and local community and business organizations to make the complete redevelopment of the historic complex possible.

The project includes the restoration of the site's "historic core," a collection of 13 historically significant buildings that face Main Street. It also includes a biomass heat plant, restored floodplain, a new energy efficient office building that can be heated and cooled at low cost to the state's budget, green stormwater infrastructure and enhanced pedestrian circulation.

Doing More Work with Less Energy

- **Energy efficient heating and cooling.** The new and retrofitted buildings include efficiency measures that will dramatically reduce the costs of operating office buildings. Integrated "building envelope systems" will protect historic exteriors while air sealing and insulating to reduce unwanted and costly heat transfer. New energy management systems will control HVAC and lighting to maximize occupant comfort and minimize building energy usage, for example by automatically shutting down heating and cooling systems when windows are open.

The Complex is on track to become the State's first LEED Gold Certified Campus, a renowned, internationally recognized green building accreditation.

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- **Heat from Vermont-grown wood chips.** The new central heating plant has a highly efficient woodchip-fired boiler with back-up propane. With this new heating system in place, the state will no longer burn the higher greenhouse gas emitting #6 fuel oil for heating state government owned buildings anywhere in Vermont

- **Conservation.** The complex will reduce water consumption with widespread use of low flow fixtures, which save energy too.

Preparing for Future Storms

The site plan integrates flood resilient site locations and designs to minimize the risk of future flood damage and restore a healthy floodplain that helps protect Waterbury's downtown. For example:

- **Moving Away from the River.** 22 buildings totaling 300,000 square feet located closest to the river were demolished, and fill was removed to lower the floodplain and reconnect it to the river. The removed fill was used to elevate the new office building and central heat plant above the 500 year flood elevation.

- **Flood-proofing.** All of the mechanical, electrical and plumbing in the historic building was removed from the basement areas, and the basement areas were filled and structurally reinforced, so that the lowest floor elevation of those historic buildings is also above the 500 year flood level.

- **Greening-up.** Almost 1000' of river frontage was replanted with vegetation to create healthy riparian buffers that can slow floodwaters. Green stormwater infrastructure, such as swales and plantings, were installed to help absorb and clean stormwater from rain events that can pollute the river.

Clean Energy On Site

- **A new solar roof.** The state has entered into a group net-metering agreement with a private solar developer to finance and install a 100 kW rooftop solar photovoltaic system on the new office building. The solar panels will save money and help Vermont achieve it's renewable energy goals with no upfront cost to taxpayers.

- **EV-ready parking.** The state's Fleet motorpool is going electric. The Waterbury State Office Complex will have two dual port charging stations to serve the all-electric and plug-in hybrid fleet vehicles, and capacity to host an additional five stations when demand increases.

Looking Ahead

The new Waterbury State Office Complex, due for full occupation in 2016, marks an exceptional achievement of state government and exemplifies construction practices for the future.

Energy smart investments will reduce the Complex's greenhouse gas emissions by 5,000 metric tons (CO2E) – the emissions from heating and powering over 450 homes.

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LEADING BY EXAMPLE

How state government is saving energy, lowering costs, and reducing carbon pollution

Powered by the Sun
VTrans Solar Garages

In 2013, the Vermont Agency of Transportation (VTrans) took the first significant steps towards reducing energy costs and greening operations at the agency's 60 garages, where hundreds of state trucks, plows and construction vehicles are housed and serviced.

VTrans has now installed on-site photovoltaic solar energy systems at six garages, and is planning to install solar net metering projects at a majority of its facilities as funding allows. The transition will help support progress towards Vermont's goal – included in the 2016 Comprehensive Energy Plan – of meeting 90% of the state's energy needs with renewable sources by 2050.

The solar panel array at the Orange garage is 100 feet long and consists of 72 panels ground-mounted on fixed racks.

Description and Financing

VTrans' decision to go solar was helped along by the state's "net metering" law. Net metering allows electric customers, including state agencies and other public and private institutions, to generate power from solar, wind and other renewable sources. In exchange, Vermont utilities credit the customers for the power that their systems produce.

The state garage in the town of Orange was the first to install its own photovoltaic system in 2013. Consisting of 72 panels each roughly 5 ½ by 3 feet in size, the solar array runs 100 feet along ground-mounted fixed racks positioned next to the parking lot at the garage. The annual projected power production of the array is 19,700 kWh – 21,000 kWh, or enough electricity to power three average households in Vermont for one year.

Although the photovoltaic system is relatively small, its installation required careful planning to stay within the agency's budget. The final price tag in Orange came to $52,777, a cost that included all equipment (solar panels, rack systems, inverters, foundation materials and miscellaneous hardware) and the labor of an electrical contractor to connect the photovoltaic system to the grid.

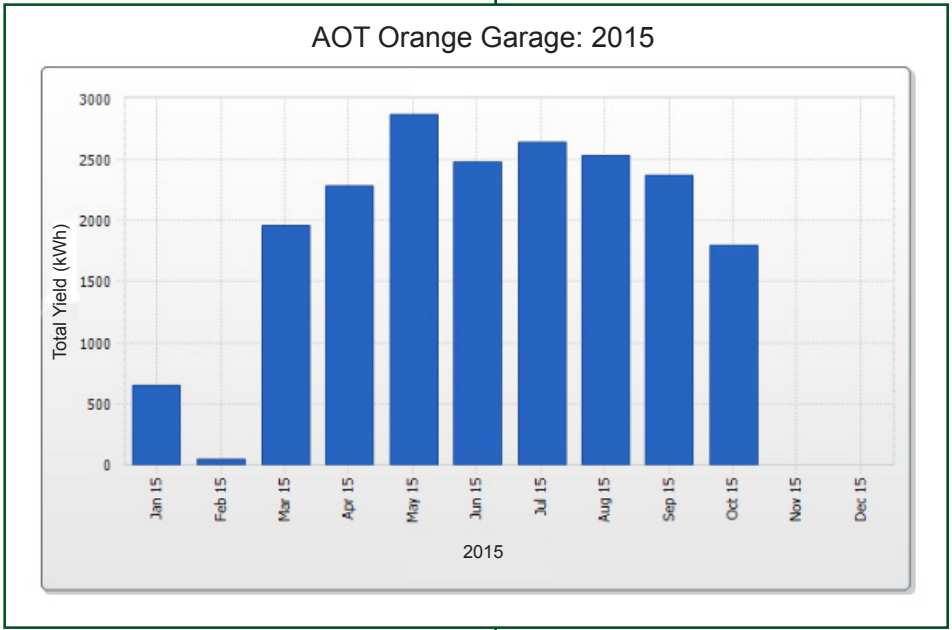
VTrans realized significant savings when the agency trained its own district employees to construct the system on-site. Done when the employees had down time from their regular highway maintenance duties, the in-kind labor resulted in an estimated savings of between $25,000 and $30,000. The installation work prepared staff to manage future maintenance and repairs on the array.

Solar net metering projects such as this one are on the rise in VTrans. To date, the Agency has installed six photovoltaic systems at the Orange, North Montpelier, Bennington, Readsboro, Wilmington, and Dummerston state garages. At an average cost of $61,500, the installations were paid for through the Agency's Transportation Buildings appropriation, which is approved by the legislature each year.

Saving Money Builds Support

These on-site energy initiatives can increase employee morale among staff who take pride in the fact that their efforts are reducing their workplace's reliance on fossil fuels, and the associated greenhouse gas emissions.

They also build staff support as they save VTrans money. At current rates, the power generated by the new solar systems is worth roughly $0.20/ kWh. As an example, over 12 months in 2015, the VTrans garage in Orange generated 19,601 kWh. The project will pay for itself in roughly 12 years and will generate energy valued at over $98,000 during the 25 year expected life of the panels.



Garage employees that helped build the six systems can now watch electric meters spin backward. VTrans has taken care to ensure that each garage gets credited with the cost savings from going solar, so they use the savings to meet other garage budget needs.

Looking Ahead

As budgetary constraints allow, VTrans plans to install three solar net-metering systems per year over the next 10 to 15 years. Each system will be similarly sized and dependent on an average annual budget of $200,000. Construction scheduling will be carefully planned to optimize staff availability during the spring and summer and minimize disruption to highway maintenance efforts.

For more information on the VTrans Maintenance & Operations Bureau's solar net-metering effort, contact Tim French, timothy.french@vermont.gov, 802-224-6593.

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The Orange garage project will pay for itself in roughly 12 years and will generate energy valued at over $98,000 during the 25 year expected life of the panels.

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How state government is saving energy, lowering costs, and reducing carbon pollution

Green Transportation Choices for State Employees
The Capital Commuter Program

The State of Vermont's Capital Commuter program, an innovative alternate transportation initiative, takes to heart the financial, logistical and environmental challenges of commuting in Vermont. Launched by the Agency of Transportation (VTrans) in July of 2013, Capital Commuters incentivizes state employees working in Montpelier to take the bus, carpool, bike, or walk to work, reducing the energy usage and greenhouse gas emissions from single-driver commute trips as well as the need for expansive parking lots at state offices.

Description

After the relocation of hundreds of state employees from the flood-damaged Waterbury State Office Complex to offices in Montpelier, competition for parking spaces was at an all-time high. The construction of hundreds of new spaces was not plausible, affordable or sustainable, so at the direction of the Agency of Administration (AOA), VTrans created a working group tasked with developing alternate transportation models for state employees.

The result was a three-year pilot project designed to benefit enrolled participants and provide a template for green commuting programs for state agencies and private businesses that want to reduce environmental impacts from employee travel and solve parking problems in downtown areas. Over 550 state workers (about 10% of the eligible workforce) have registered so far. Key features of a Capital Commuters membership include:

- **Discounted bus passes**
- **Preferential carpool and vanpool parking**
- **Discount card for use at local businesses**
- **Qualification for Go Vermont's "Guaranteed Ride Home" benefit that reimburses costs (up to $70) for an alternative way home (taxi, bus, rental car) in the event of an emergency**

The Many Benefits of Green Commuting

The Capital Commuter program was developed by VTrans along with representatives from the Agency of Administration, the Department of Buildings and General Services, the Human Resource Department, the Vermont State Employees Association, the Montpelier Energy Committee, and the Green Mountain Transit Agency. Local businesses supporting the program sponsored discounts at their stores. The program has:

Capital Commuters incentivizes state employees working in Montpelier to take the bus, carpool, bike, or walk to work, reducing the energy usage and greenhouse gas emissions.

- **Reduced Parking Needs.** Results from an annual survey of Capital Commuter participants indicated that the program is reducing parking needs between 100-200 spaces per day. The average cost to build a parking space in the U.S. is $15,500[1]. As such, the estimated cost savings of avoided construction of these 100-200 parking spaces is between $1,550,000 and $3,100,000.

- **Reduced Fossil Fuel Use.** By reducing the number of single-driver commutes, the program has saved participants money, lessened our environmental impact and supported progress towards the goals set forth in the Comprehensive Energy Plan. Those benefits have been quantified using participant responses to survey questions about their commuting activities before and during the program, and using the average distance Vermonters commute (23 miles). Because of the program:

    - More than 1 million passenger vehicle miles have not been driven.
    - More than 40,000 gallons of gasoline have not been consumed.
    - More than 780,000 pounds of climate polluting carbon dioxide emissions have been abated.
    - Program participants have saved over $100,000 by buying less gas.

The Capital Commuters working group and the forum it provides paved the way for other great solutions for reducing single occupancy vehicle travel, such as an expansion of CarShare VT to Montpelier and support for bike friendly infrastructure projects.

Looking Ahead

VTrans supported start-up work to launch the pilot as part of the state's Go Vermont program, including development of the brand and website, coordination of registration, and distribution of promotional material. State and federal funds covered the roughly $12,000 in start-up costs.

VTrans also covered the $244,900 cost of subsidizing employee bus passes between July 2013 and June 2015. As of July, 2015, state agencies cover the costs of subsidizing discounted bus passes for their own employees, estimated to be between $130,000 and $150,000 in SFY 2017.

The successful three-year pilot ends in June, 2016. The Steering Committee is meeting in March, 2016 to determine if this should be made into a permanent program and/or extended to all State employees. In addition, the state hopes the pilot will provide a model for private businesses, non-profits and other employers wishing to reduce the impact of their employees commutes by providing efficient commuting incentives.

For more information about Capital Commuters, visit: www.connectingcommuters.org/capital-commuters/ or contact Ross MacDonald, ross.macdonald@vermont.gov, 802-828-5577.

[1] *Transportation Cost and Benefit Analysis II – Parking Costs* Victoria Transport Policy Institute (www.vtpi.org)

By reducing the number of single-driver commutes, the program has saved participants money, lessened our environmental impact and supported progress towards the goals of the Comprehensive Energy Plan.