

Affordable Heat:
A Whole-Buildings Efficiency Service
for
Vermont Families and Businesses

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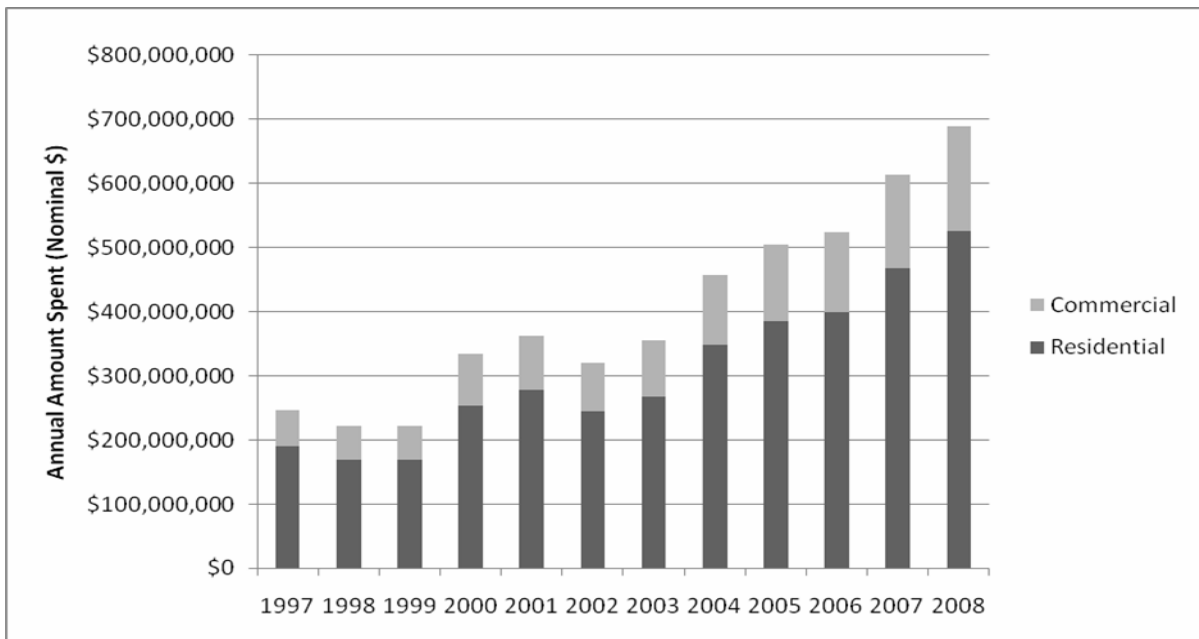
Executive Summary

A. Heating Affordability: The Present Challenge

The average Vermonter and the Vermont economy are facing a fuel affordability challenge of historic proportions. In 2008, Vermonters will pay close to \$800 million to import fossil fuels for use in our homes, businesses, and other buildings. That's at least \$300 million more than we were paying in 2004; the increase alone is about \$500 per person per year. The dollars Vermont families export for fossil fuels could otherwise stay in the Vermont economy, supporting our neighbors and our quality of life while buoying savings and local investment. By any standard, importing fossil fuels imposes a large tax on the Vermont economy. Even excluding the cost of transportation fuels, the statewide bill for fossil fuels in 2008 will be about \$300 million larger than the dollars brought into the state by the entire agricultural sector, including dairy, in recent years.

This problem will persist. Prices over the coming decades will be much higher than they have been in the recent past. World demand for energy continues to rise powerfully, driven in part by the rising economies of countries like China and India, and new sources of supply are not keeping up. Meanwhile in Vermont, this state has a higher than average dependence on unregulated fuels for heat, and low income fuel assistance per household is down while fuel bills are up. The chart below shows how Vermont's fuel costs for residential and commercial buildings have risen in recent years:

Figure 1-1: Vermont Fuel Bill for Residential and Commercial Buildings: Rising Costs, 1997 to 2007¹



¹ The chart breaks out residential and commercial building use. Industrial use makes up the remainder of the total statewide bill.

In addition to their direct economic costs, fossil fuels used in buildings also represent the second largest source of greenhouse gas emissions in Vermont (after transportation). The buildings sector represents a much larger fraction of statewide GHG emissions (27% in Vermont) than for the US as a whole (9%).

Potential good news. If these costs were unavoidable we would just have to accept them. But they are not. Analysis of Vermont’s building stock and years of experience with the low-income Weatherization Assistance Program and Efficiency Vermont’s new construction and retrofit programs all demonstrate that we could reduce fuel consumption in many thousands of individual buildings by 25% or more. While in some respects this is bad news – it’s not pleasant to learn that we are paying an energy penalty imposed by inadequate building shells, heating systems, and equipment that now exceeds \$100 million per year. But it also represents an opportunity to lower the cost of heat by deciding to invest in Vermont’s buildings infrastructure. This report recommends a set of policies and services that would over the next ten years:

- Lower Vermont’s overall fuel bill by about \$1.5 billion over the lives of the steps taken and measures installed;
- Substantially improve the energy fitness of over 60,000 buildings; and
- Lower the fuel bills of up to 56,000 participating families in existing housing by an average of \$600 to \$1,000 per year, and up to 3,000 participating businesses by an average of \$7,500 to \$10,000 per year.

B. Design Principles and Statewide Goals

The report sets out a broad-based strategy to improve the energy fitness of Vermont buildings and to lower fuel bills for Vermont families and businesses. That strategy is built on a set of design principles based on the experience gained by Vermont efficiency providers over the past twenty years. The most important guiding principles are:

- **Focus on the needs of customers – that is, Vermont families, homeowners and business building owners.** Programs must be customer-focused, maximizing easy-to-use services, “one stop shopping,” and minimizing transaction costs.
- **Address the persistent market barriers to efficiency.** This requires a combination of information/audit services, technical assistance, and financial assistance to owners.
- **Build on existing institutions.** Vermont has long and successful experience with efficiency delivery, including the state’s efficiency contractor, Efficiency Vermont, the Weatherization Assistance Program, fuel dealers, and utilities.
- **Maximize savings and minimize transaction costs with a “whole buildings” approach that considers all energy fuels and uses.** The best way to serve customers and reduce energy use is to treat buildings as a whole. Electricity and fossil fuel efficiency services should be delivered in a coordinated program.

- **Use public funds to leverage private investment capital.** Improving a large fraction of the building stock will take a great deal of investment capital. Most of this can come from private sources, but public support in the form of marketing, technical assistance and financial incentives will be required to leverage those private funds.
- **Begin capturing savings as soon as possible, but ramp up programs predictably over time.** Building retrofits are not mass produced, and the means to deliver them (e.g., energy auditors, outreach programs, trained installers) must be developed over time.
- **Set long-term goals and measure performance against them.** The Legislature should establish deliberate statewide goals for buildings efficiency, and a process to measure success over time.

RECOMMENDED GOALS FOR LEGISLATIVE ADOPTION

Based on the successes of Efficiency Vermont, the weatherization agencies, VGS, and others, and on the efficiency potential study commissioned last year by the Department of Public Service, the Legislature should adopt a set of challenging but realistic goals for the buildings efficiency initiative. Those goals are:

- To substantially improve the energy fitness of at least **20% of the state's housing stock by 2017** (over 60,000 housing units), **and 25% of the State's housing stock by 2020** (about 80,000 units);
- To reduce annual fuel needs and fuel bills **by an average of 25%** in the housing units served;
- To reduce total fossil fuel consumption across all buildings by an additional ½% each year, leading to a **total reduction of 6% annually by 2017 and 10% annually by 2025**; and
- To save Vermont families and businesses a total of **\$1.5 billion** on their fuel bills over the lifetimes of the improvements and measures installed between 2008 and 2017.

C. What is Needed: a Comprehensive Approach to Buildings Efficiency

Vermont has more than 250,000 occupied housing units, including about 49,000 units occupied by low-income families eligible for assistance through the Weatherization Assistance Program. Vermont has one of the nation's oldest housing stocks, with at least half of the existing housing stock built before Vermont's earliest energy-related building codes were adopted in 1973. There are also 21,000 businesses in commercial spaces of widely varying types, and about 3,000 new homes are built every year.

Achieving significant reductions in energy use across this widely-dispersed fleet of buildings will require more than a single approach. This report recommends a set of services containing four major elements:

1. Sustained improvements in **building codes, equipment standards and Act 250 reviews** for new construction, coupled with ongoing training for designers, engineers, and contractors. In addition to treating new construction, Vermont should initiate a **time-of-sale efficiency review** for rental housing, coupled with technical and financial assistance for efficiency upgrades for those building owners. (See Section 4);
2. Doubling the number of units served by the low-income **Weatherization Assistance Program** to improve efficiency and life safety in existing low-income housing. (See Section 5);
3. A **market-based service** of outreach, financial and technical assistance for other existing housing and commercial buildings on a **“whole-buildings”** basis, through the State’s efficiency contractor, Efficiency Vermont, supervised by the Public Service Department and Board. A principal component, and the source of most of its funding, will be an easy-to-access loan program for high-quality upgrades by home and building owners, with capital provided by a consortium of banks and private lenders, possibly supported by the state agencies with lending expertise in the buildings sector. (See Section 6); and
4. Expansion to all eligible natural gas customers of the building shell and heating system efficiency programs offered by **Vermont Gas Systems**. (See Section 6).

Overview of units and public costs. The table below provides a quick overview of the major elements of the recommended affordable heat service. For each major element of the service, it shows:

- The **number of units** of housing (or business installations) that would be improved through that service. Because most of the services ramp up in scale over time, the total number of units served rises from about 4,800 in 2009 to about 9,600 in 2017.
- The **publicly-supported cost per unit**, on average, for participating units. Importantly, this figure does not include the funds invested by building owners and/or covered by loans to those owners. It is also important to note that the public cost per unit is much higher for the low-income weatherization program (\$5,200 per unit) than it is in the Market Housing service, where owners are expected to contribute a large fraction of the total costs of upgrades. In the Market Housing retrofit service, incentive payments and costs vary across housing and income types.
- **New funds needed per year** provides a snapshot of the total new revenues that will be needed from public sources to support this level of activity. That amount rises over time as more units are served (from just \$1.7 million in 2009 to \$24 million in 2017). (New public funds needed are much less than total program budgets because some public funds come from existing sources, and the public funds are leveraging private investment capital as well.)
- Finally the table shows the **total number of units** upgraded due to the statewide energy efficiency service over the ten years from 2008 to 2017. At the levels shown

here, approximately 60,000 residential units and over 3000 businesses would be served. Even with these fairly extensive services, it will take at least 10 years to improve the energy fitness of about 21% of the state’s residential housing stock and 14% of its commercial buildings.

Figure 7-3: Statewide Energy Efficiency Services - Building Units Served

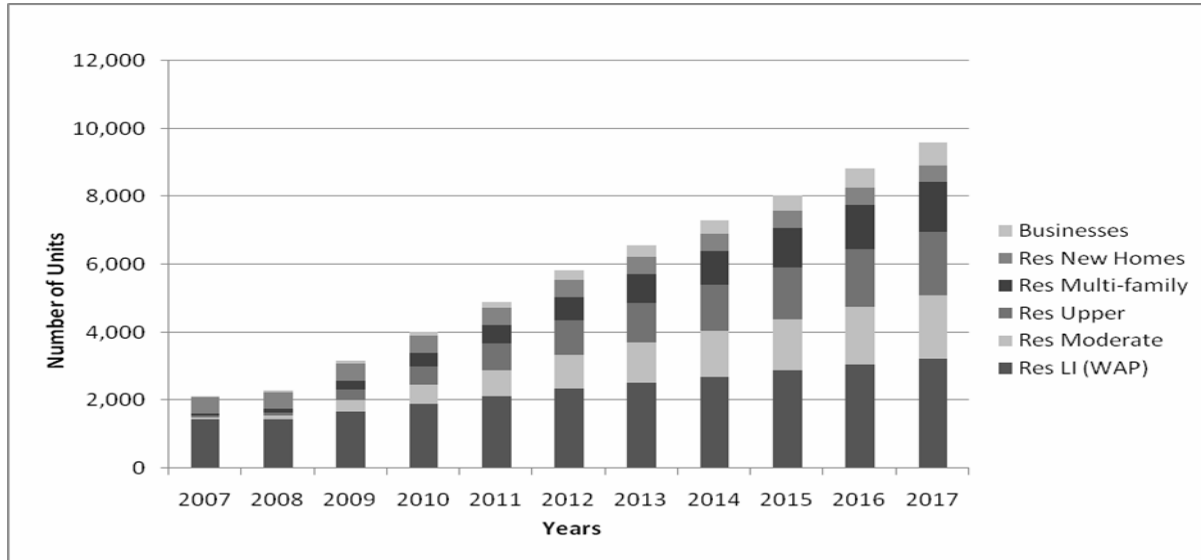


Figure 3-1: Affordable Heat -- Overview and Key Datapoints

Affordable Heat Service Summary and Funding Requirements				
Initiative/ Service	Units/ year	Public cost/unit	New funds needed/year	Total units over 10 years
Building codes and Act 250	2,500	\$200	Code assistance included in General Fund & EVT current budgets	25,000
New homes service	500 to 1,000 until 2012	\$1,000	\$0.5 million	4,000
Weatherization Assistance Program	1,500 rising to 3,000	\$5,200	\$1.3 million rising to \$13 million	24,000
Market housing retrofits & time-of-sale upgrades	200 rising to 3,000	\$400 to \$2,100	\$1.2 rising to \$8 million	25,000 to 28,000
Commercial building retrofits	315	\$2,100	Rising to \$1.7 million	3,150
Vermont Gas program	500	\$1,850	Included in rates	4,000
TOTAL	4,800 rising to 9,600 units per year	\$2,100/unit counting all weatherization	\$1.7 million/year (2009) rising to \$24 million (2017)	60,000 = ~21% of residential building stock by 2017**

**Note: Columns do not add, especially since new construction will be covered by new codes and may also participate in new construction efficiency service for additional improvements.

D. Institutional Roles

Among the design elements identified by policy-makers and experts for this effort is the important goal of building on Vermont's strengths, including:

- The expertise and program experience of Vermont's existing efficiency institutions, especially Efficiency Vermont and the community-level agencies administering the WAP program.
- The capacity of Vermont's fuel dealers and other private sector actors who can deliver funding, expertise, and on-the-ground installations of insulation, HVAC systems, and other building shell improvements.

The services and initiatives we recommend in this report are intended to build on those existing strengths. All of Vermont's existing efficiency service providers have important roles to play – and for many of them, significant new business opportunities -- in the expanded buildings service. The institutional arrangements summarized in the report build consistently on the arrangements and market roles that already characterize work in this domain. For example, in the low-income weatherization program, projects are managed by the five regional WAP agencies, with assistance from Efficiency Vermont and others. In the Market Housing service, the state's efficiency contractor, Efficiency Vermont (EVT), plays a larger role, including marketing, intake, providing financial incentives to building owners, and coordinating services provided by others.

There are two important lessons built into the review of institutional roles. First, any serious effort to upgrade the energy fitness of Vermont's building stock will need to employ the services of many existing or new private-sector professionals: auditors, building contractors, HVAC technicians, and banks and other lenders. The second lesson is that coordination among these actors will be essential for success. A customer-focused service must minimize confusion and the "hassle factor" for homeowners, and provide a seamless or invisible transition from one step to the next for their benefit. For this reason, it is crucial to provide a single point of contact and a trusted source of information and coordination for homeowners.

The state's efficiency contractor, Efficiency Vermont, is well-suited to play this role. It is already playing this role with respect to electricity efficiency in these same buildings, and with many of the same auditors and contractors. In addition, the broad market penetration of the "Efficiency Vermont" brand across the state provides an invaluable asset to the statewide energy efficiency service, giving customers easy access to a trusted source of information and a "one phone call" option to initiate service. Since the State of Vermont owns the "Efficiency Vermont" brand, it makes sense to capitalize on its broad appeal and acceptance as a means of marketing the statewide energy efficiency service.

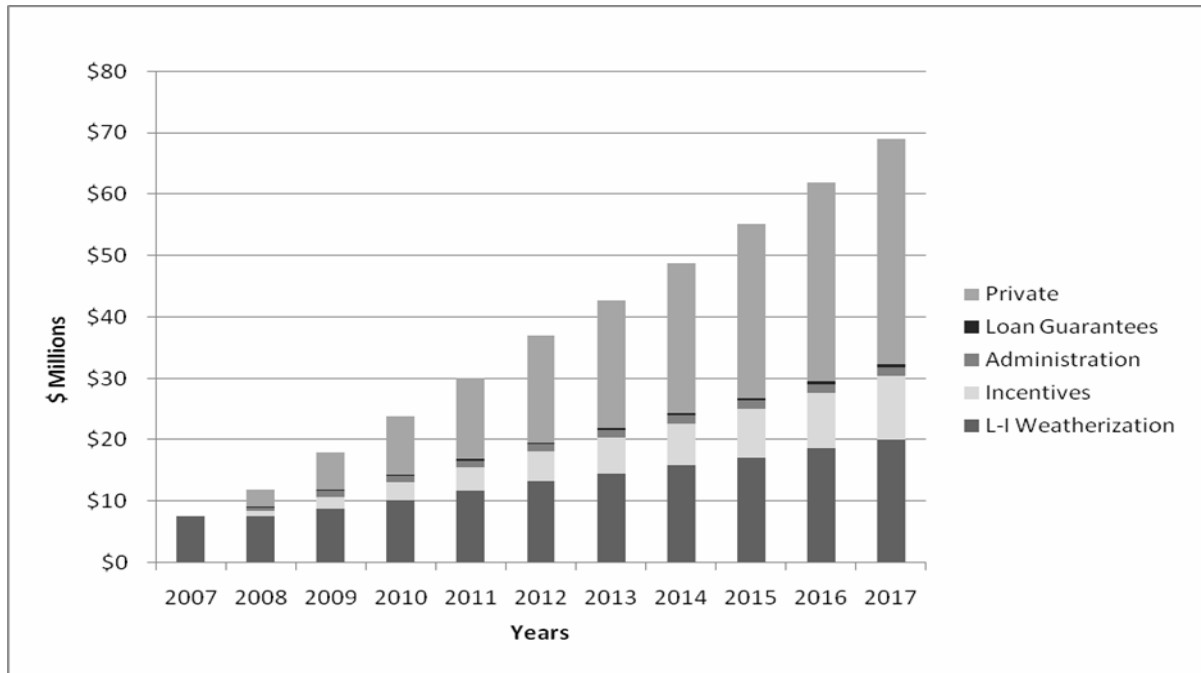
E. Costs and Benefits of Efficiency Services

Making substantial energy upgrades in more than 60,000 housing units across Vermont will require significant investment capital and a highly-professional, customer-focused team of program administrators, and energy experts. The report (see Section 7) examines the costs and benefits of the overall program. Overall, the services will deliver total investments over 10 years of about \$398 million, of which about half is private capital, and half will come

from a variety of public and utility sources. Outside of the low-income weatherization program, public investments to secure these savings amount to about 26% of the total cost.

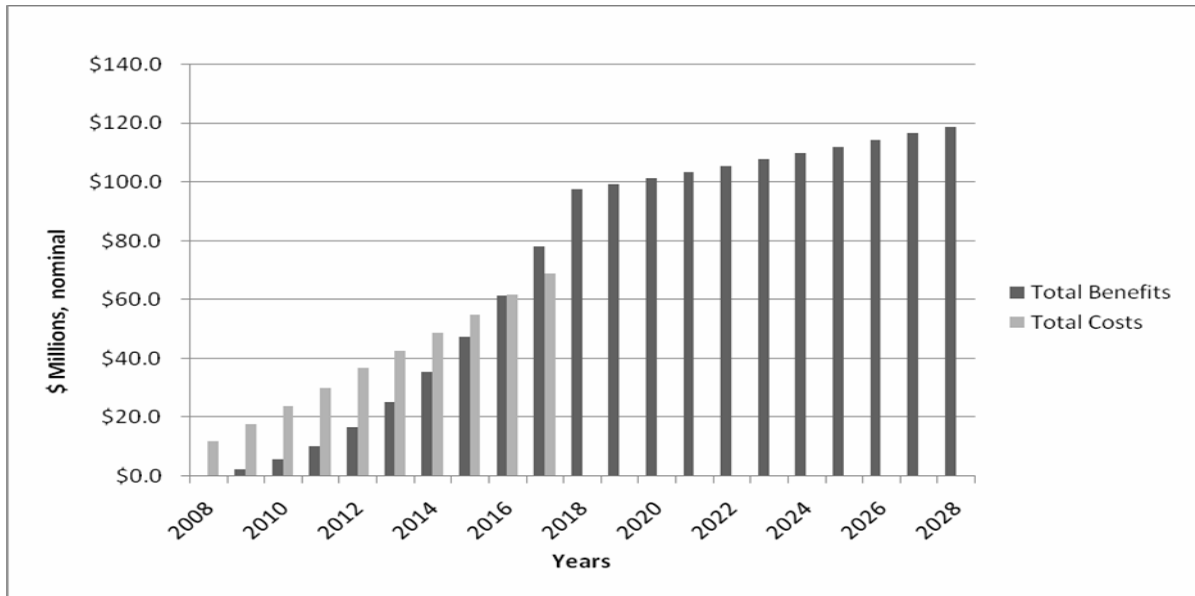
The large majority of public expenditures on buildings efficiency services are in the form of direct assistance to property owners, with small fractions for administration and possible loan guarantees. For low-income weatherization services, the program will continue to pay the full costs of the measures. The chart below shows how the efforts increase over time. Most of the funding is either in the form of private capital or public support for the low-income weatherization program.

Figure 7-5: Statewide Energy Efficiency Services Shares of Total Cost



Over their lifetimes, the efficiency services recommended for the first decade will return, for every public and private dollar invested, \$2.64 in overall savings. Thus, even after paying back the full cost of building upgrades, for every dollar invested, net savings of \$1.64 will remain in the pockets of Vermont’s home and business owners, instead of being shipped out of state to pay for heating fuels. This positive benefit-cost ratio is reflected in the chart below.

Figure 7-1: State Energy Efficiency Services: Total Benefits and Total Costs, 2008-2028

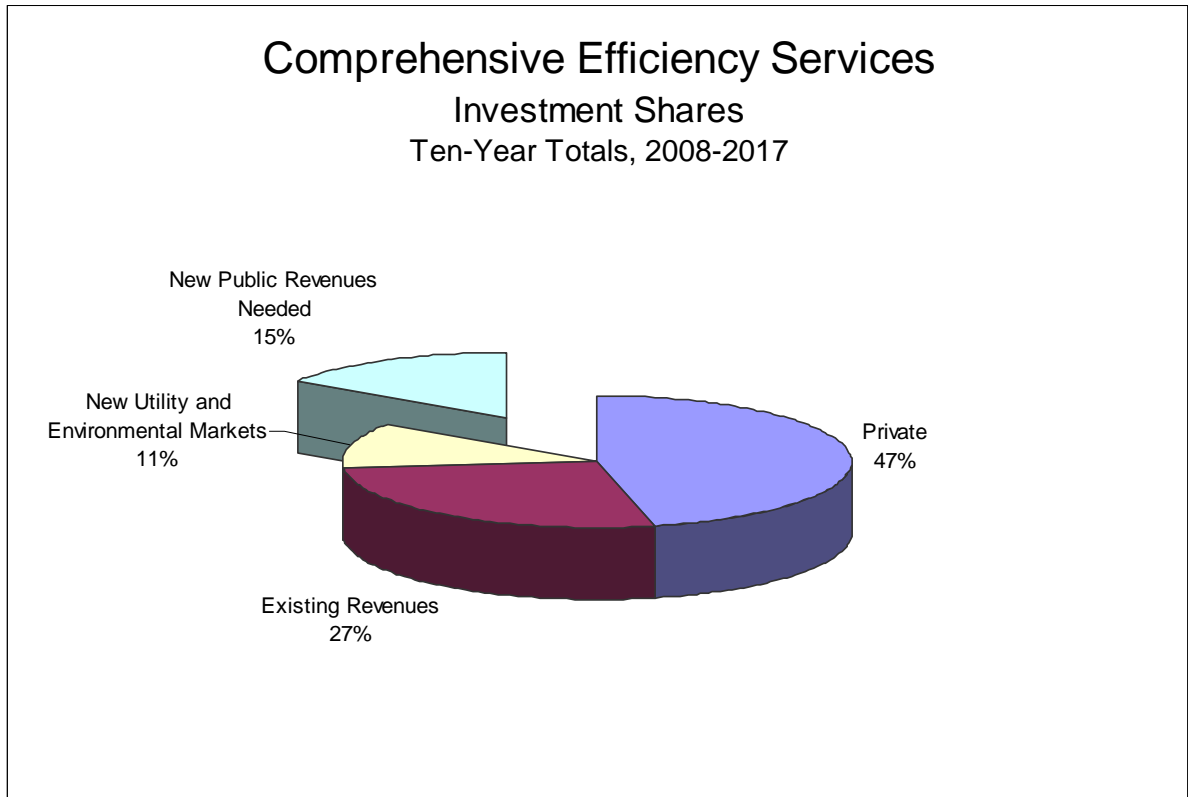


F. Funding Sources

This report (Section 8) examines a wide range of funding options for the broad-based efficiency services recommended, and concludes that a package of existing and new funding sources is needed to create the savings potential. It is also important to provide stable and predictable sources so that enterprises can hire and train the staff they will need, and customers can count on services they will need to make major renovations and investments. It evaluates the pros and cons of the most likely sources, and recommends that the Legislature evaluate several of them.

The most important observation is that, by relying on private investment capital, and by making use of multiple funding streams, the percentage of new public revenues needed for the entire program is only 15% of the total investments needed for the entire program. (See Figure 8-1 below)

Figure 8-1: Whole Buildings Efficiency Services: Investment shares: Ten-Year Totals, 2008-2017



- Private capital.** The most important financial component of the buildings efficiency program is private capital. Approximately three-quarters of the investment capital outside of the low-income weatherization program, and half of the total spending on efficiency in the first ten years of the programs comes from private capital—loans and out-of-pocket expenditures by customers. However, substantial programmatic assistance – including marketing, audits, technical assistance, and direct financial assistance to borrowers – will be needed to make these private investments a reality.
- An increase the gross receipts tax for the Weatherization Trust Fund.** The report concludes that the Fuel Gross Receipts Tax (GRT) is the most logical source of revenue for an enhanced weatherization program serving low-income households. It looks at three options for expanding the Trust Fund, and recommends that any expansion be done so as to reflect the higher investments in energy efficiency now being made by the electricity and natural gas sectors, compared with the liquid fuels sector.

Since the creation of the GRT in 1990, expenditures by the regulated utilities for electricity and gas energy efficiency programs have expanded greatly, while contributions from unregulated sectors to the Weatherization Trust Fund have remained at the historic rate. As a result, an increase of 1% in the GRT phased in from 2008 through 2014 would still leave the unregulated fuels paying much less to help Vermont become more efficient than the state is now collecting from natural gas and electric utility sales. (See composite of Tables 8-1 and 8-2 below.) This Table also shows an alternate

way to raise roughly the same total revenue, by raising the GRT across the board, including an increase in the rates charged on electricity and natural gas sales. (See the final column, “Alternate Efficiency Charge.”)

Current charges for energy efficiency services, including weatherization and the charges recommended in this report in 2008

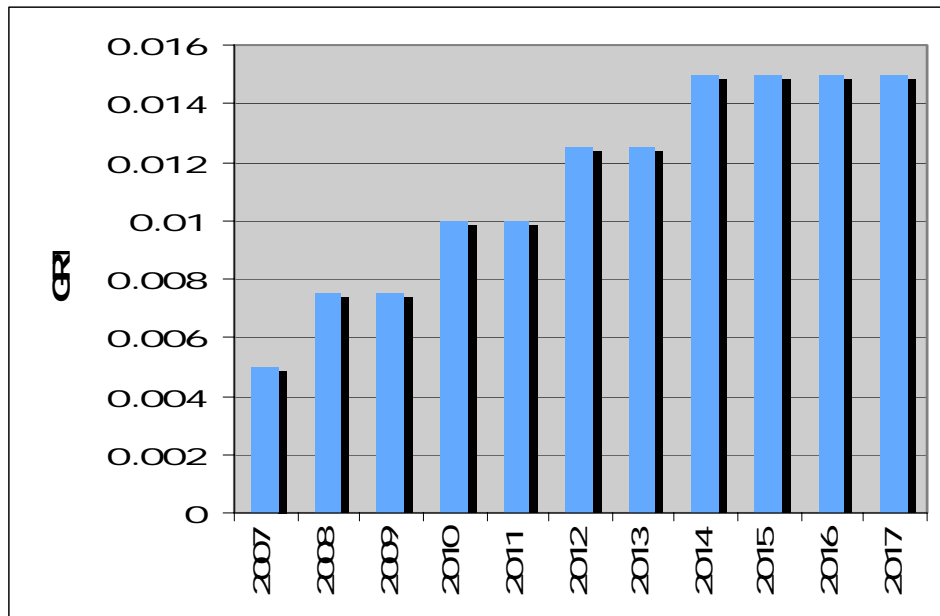
Current efficiency charges	Efficiency in Rates	Gross Receipts Tax	Total Current Efficiency Charge	Recommended Efficiency Charge 2008	With Alternative Efficiency Charge 2008 (estimated)
Electricity	4.0%	.5%	4.5%	4.5%	4.625%
Natural Gas*	1.5%-2.5%	.5%	2.0% to 3.0%	2.0% to 3.0%	2.125% to 3.125%
Unregulated fuels		.5%	.5%	.75%	0.625%

Composite of Tables 8-1 and 8-2

*Recent additions to VGS efficiency programs could raise the VGS rate to as much as 2.5% in rates, and thus the totals for natural gas, increasing the rate difference between gas and the unregulated fuels by an additional 1%.

The report recommends increasing the GRT in stages over the next few years, in small increments of ¼%, and only on those fuels not now contributing to significant energy efficiency programs supervised by the Public Service Board. This would raise an average of \$5.8 million in additional revenue per year for investments in low-income weatherization over the course of the coming decade, and much less in the early years. (See Figure below)

Figure 8-2: Recommended Gross Receipts Tax For Unregulated Fuels, 2007-2017



- **Support from the General Fund – direct appropriations and/or tax credits**
The report also discusses the reasons for seeking direct support from the General Fund for certain portions of the overall buildings efficiency service, observing that some of the

governmental functions required could, and perhaps should, be provided through General Fund revenues. It also observes that direct assistance for efficiency upgrades, either through budgetary support (perhaps for low-income weatherization) or through tax credits (for the Market Residential and Commercial programs) would also be appropriate.

In addition to these large potential sources of revenue, the report discusses potential contributions from a set of specialized revenue sources with ties to energy sectors and efficiency programs and concludes that several of these options are logical contributors to an overall funding stream to support improved efficiency in Vermont’s building stock. Those funding sources, which do not require raising taxes, include the following:

- *Additional utility-based system benefits charges (SBC) for Efficiency Vermont and in the rates of Vermont Gas Systems.*
- *Revenues from the sale of carbon dioxide allowances under the Regional Greenhouse Gas Initiative (RGGI).*
- *Revenues generated by Efficiency Vermont’s participation in the New England Forward Capacity Market (FCM).*
- *The Clean Energy Fund (CEF).*

Table 8-3: Summary of funding options -- Potential dollars for investments (millions), New money for energy efficiency is in italics

Source	Amount in 2010		Amount in 2015	
	Existing money	<i>New Money</i>	Existing Money	<i>New Money</i>
<i>Private capital & loans new</i>		9.5		28.2
Federal weatherization	1.0		1.0	
Weatherization Trust Fund	8.1		9.4	
<i>Weatherization Trust Fund new</i>		3.8		8.7
EEC -- Efficiency Vermont	1.0		1.0	
Vermont Gas EE program	0.5		0.5	
<i>Vermont Gas EE Program new</i>				1.0
<i>RGGI carbon credit sales</i>		2.5		4.8
<i>Forward capacity market</i>		1.9		1.4
<i>General Fund</i>		1.5+		1.6+
<i>Clean Energy Fund</i>		(study)		(study)
TOTAL		\$29.8 million		\$57.6 million

Taken together, these funding options provide a range of options for legislators to consider, and are adequate and appropriate sources of support for an all-fuels buildings efficiency program of the scale outlined in this study.

Section 1: Challenges and Opportunities for Whole-Buildings Efficiency

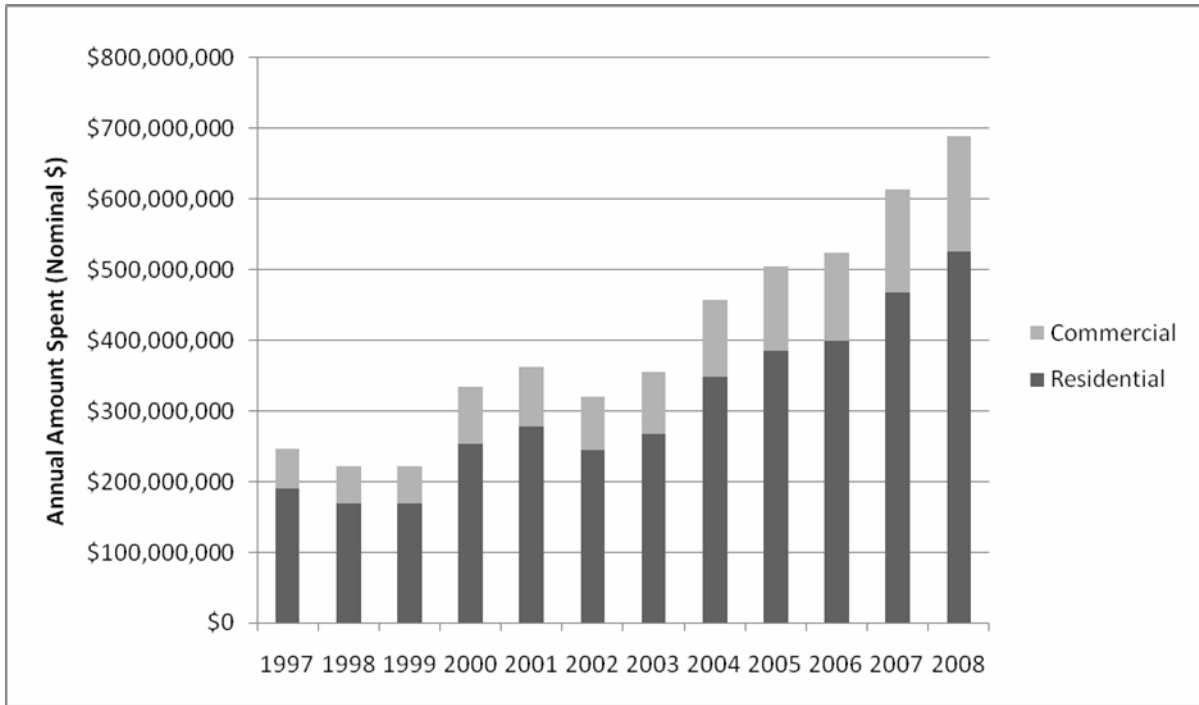
The average Vermonter and the Vermont economy are facing a fuel affordability challenge of historic proportions. In 2008, Vermonters will pay close to \$800 million to import fossil fuels for use in our homes, businesses, and industries. That's at least \$300 million more than we were paying in 2004; the increase alone is about \$500 per person per year.² As a result, Vermont is exporting more and more dollars out of state for fossil fuels. These dollars could otherwise stay in the Vermont economy, supporting our neighbors and our quality of life while buoying savings and local investment. Even excluding the cost of transportation fuels, the statewide bill for fossil fuels in 2008 will be about \$300 million larger than the dollars brought into the state by the *entire* agricultural sector, including dairy, in recent years.³

The problem does not appear to be abating anytime soon. While it is possible that the cost of oil and gas in world markets will moderate somewhat in the near term, prices over the coming decades will be much higher than they have been in the recent past. World demand for energy continues to rise powerfully, driven in part by the rising economies of countries like China and India, and new sources of supply are not keeping up. The figure below shows how Vermont's fuel costs for residential and commercial buildings have risen in recent years:

² The economic challenge of high fossil fuel prices is compounded when transportation fuels are also considered. Vermont's annual bill for diesel and gasoline fuels is even larger than the fuel costs of supporting buildings, at well over \$1.2 billion annually. Unfortunately, Vermont's attempt to reduce greenhouse gas emissions from new automobiles was blocked by the federal government, and policies that would directly regulate fuel efficiency in vehicles are preempted by federal law. The fuel efficiency of buildings, however, is squarely within state authority and does represent an area in which state initiative can deliver significant savings to Vermonters. For this reason it is appropriate for this report to focus on fuels consumed in buildings.

³ The cash receipts from all Vermont crops and livestock agriculture was \$503 million in 2006. U.S. Dept. of Agriculture, New England Agricultural Statistics, *New England Cash Receipts 2006*, September 2007.

Figure 1-1: Vermont Fuel Bill for Residential and Commercial Buildings: Rising Costs, 1997 to 2007⁴



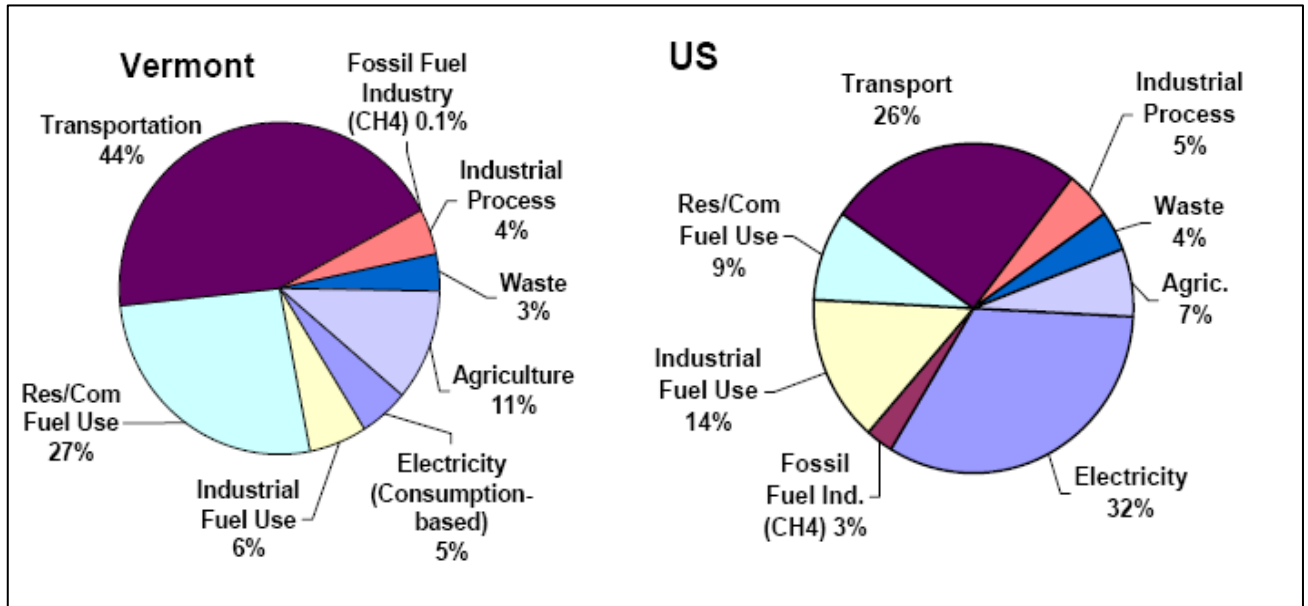
In addition to the direct out-of-pocket costs of fuel imports, the use of fossil fuels in buildings is also one of the largest sources of greenhouse gases in Vermont. Fossil fuels used in buildings represent about 26% of Vermont’s total energy use,⁵ and 27% of our greenhouse gas emissions (GHGs). Because the emissions profile of our electric power sector is relatively low in GHG emissions, compared with other US states, and because Vermont’s reliance on liquid heating fuels is relatively high,⁶ the buildings sector represents a much larger fraction of statewide GHG emissions (27% in Vermont) than for the US as a whole (9%). (See Figure 1-2 below).

⁴ Expenditures through 2004: Energy Information Administration, *State Energy Price and Expenditure Estimates: 1970 Through 2004*, June 2007; Expenditures in 2005 and 2006: Vermont gross receipts revenues for heating oil, kerosene, LPG, natural gas, coal, from the Vermont Tax Department; these numbers were deflated in order to subtract industrial uses by applying the average percent difference between the revenues and EIA expenditures in previous years; the money was allocated among residential and commercial using historical percent of total that was residential; Expenditures in 2007: for the first two quarters of calendar year 2007, the source is the same as 2005 and 2006; estimates were made for the second two quarters of 2007, based on inflating the gross receipts revenues from the 2006 second two quarters, using price increases documented or predicted by Energy Information Administration, *Short Term Energy Outlook*, Jan. 2007, for the Northeast region; Expenditures in 2008: Average 2008 prices were calculated for heating oil, propane, and natural gas using the Energy Information Administration, *Short Term Energy Outlook*, Jan. 2008, residential Northeast prices; the percent change between these prices and 2007 prices was calculated, and that percent change was applied to 2007 estimated expenditures to arrive at estimated 2008 expenditures.

⁵ Vermont Department of Public Service, *Utility Facts*, updated August 2007.

⁶ Fuel oil, propane and kerosene heat 70% of Vermont homes, but only 12% of homes nationally.

Figure 1-2: Principal Sources of Greenhouse Gas Emissions, Vermont and U.S.



Any serious attempt to curb greenhouse pollution in Vermont must include efficiency improvements in the building stock. This was one of the principal conclusions of the Governor’s Commission on Climate Change, which recognized that making progress on the Governor’s goal to reduce GHG emissions by 25% from 1990 levels by 2012 and 50% by 2028 logically requires that significant reductions be made in fuel use in residential and commercial buildings. The first recommendation of the Commission’s final report includes the following:

*In particular, we urge the Governor to... Cost-effectively enhance energy efficiency by developing mechanisms to extend Vermont’s existing and highly effective DSM efforts to include additional fuels beyond electricity and natural gas, especially heating oil used in residential, commercial, and industrial establishments.*⁷

Over the long term, lowering Vermont’s fuel bill requires making substantial investments in the energy efficiency of buildings and their heating systems. This represents a great opportunity and a great challenge. The opportunity for savings is quite large because Vermont’s building stock is, on average, fairly old, and many improvements can be made at relatively low cost. But these improvements are not easy to come by, for three reasons:

- The existing building stock is large, physically dispersed, and distributed among many, many owners. There are at least 250,000 occupied housing units in Vermont, and about 21,000 non-farm businesses.
- As numerous studies have documented, there exist a number of substantial market barriers to meaningful investments in energy efficiency in buildings, as outlined in the next chapter. In Vermont, as elsewhere in America, we have learned that

⁷ Vermont Governor’s Commission on Climate Change, *Report and Recommendations of the Governor’s Commission on Climate Change*, October 2007.

market forces alone will not deliver the investments in efficiency that Vermont needs.

- In contrast to the electric power sector, we do not yet have in Vermont a statewide, comprehensive delivery system for fossil fuel efficiency treating all buildings. Vermont's regulated utilities and Efficiency Vermont have demonstrated that significant improvements in electric and gas efficiency can be attained at low cost through well-managed programs to help customers save energy. Creating a comprehensive delivery system for fossil fuel efficiency in all buildings is an important and strategic response to global energy picture facing this state.

Opportunities for Efficiency Gains are Large and Well-Documented

While there are many challenges, Vermont is well-positioned to be a leader in efficiency initiatives for fossil fuels. Vermont has an unparalleled history of caring about and investing in energy efficiency through the electric and natural gas sectors and through a strong Weatherization Assistance Program. As a result, Vermont today has some of the most successful programs in those areas in the nation. These efforts have saved energy, reduced greenhouse gases, and saved Vermont businesses and residents money. And Vermont already has a diverse set of efforts underway to address fossil fuel efficiencies in buildings that can be built on for a comprehensive set of services, as outlined in the next chapter.

For example, Vermont's Weatherization Assistance Program (WAP) is highly cost-effective, and has demonstrated that large and valuable savings are possible across a wide variety of physical housing units. The program now weatherizes about 1,450 low-income households per year. According to recent reviews of the WAP program, each program dollar spent on energy efficiency measures in 2005 returns \$1.98 to the participant in the form of reduced energy costs. When the value of non-energy benefits⁸ is included with the above measures, each program dollar returns \$5.03 of benefits.⁹ With about 49,000 households eligible for the Weatherization Assistance Program in 2008, there are clearly many years worth of weatherization activity ahead to achieve potential savings.

There is also a large, documented, cost-effective potential for energy savings in the buildings sector generally. In 2006, the Department of Public Service commissioned a detailed study of the potential for greater fuel efficiency in buildings. The *Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels*¹⁰ found that after ten years of achievable, cost-effective program activity on energy efficiency measures for oil, propane, kerosene, and wood, the program would yield an estimated 12% reduction per year in total fuel consumption across those fuel sectors. The savings to Vermonters during ten years of such program activity was estimated to be \$486 million (in net present savings of 2007

⁸ Non-energy benefits include increased property values, community economic benefits, fewer illnesses, fewer fire deaths, injuries and property losses, environmental benefits, improvements in utility arrearages, and others.

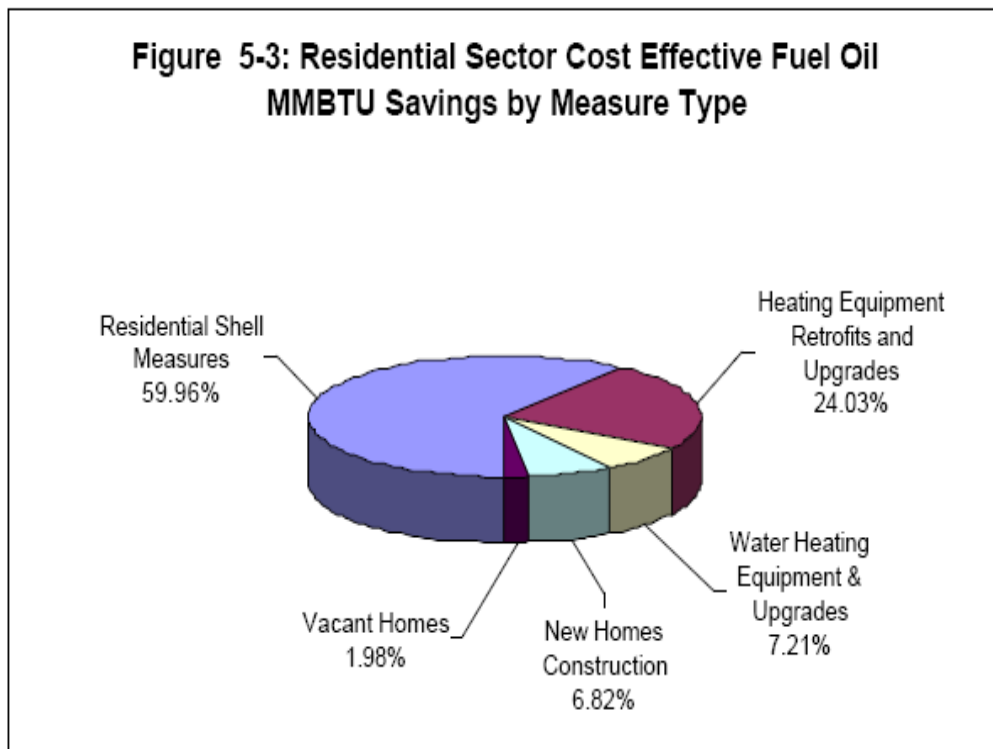
⁹ Dalhoff Associates, *An Update of the Impacts of Vermont's Weatherization Assistance Program*, February 2007. Total returns are higher, but they are spread out over time, since weatherization returns benefits for many years. In this report dollar benefits are expressed in net present value (2005) dollars.

¹⁰ GDS Associates, *Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels*, prepared for the Vt. Dept. of Public Service, January 16, 2007 (referred to in this report as "the GDS study.")

dollars). The actual savings likely would be even higher due to fuel prices increasing at a faster rate than expected.¹¹

The study examined potential savings in the residential, commercial, and industrial sectors for each of the four fuels. Efficiency measures addressing fuel oil use provide the largest portion of cost savings, providing about 2/3 of total cost savings after ten years. Fuel oil and wood see the largest percent reductions of their total use in the study. The program budget to achieve the savings ranges from \$13 million to \$16 million per year over ten years. In addition, participants must pay for 50% of the program measures, valued at \$8 - \$9 million per year. The total cost is the sum of program and participant costs. The following chart from the study characterizes the sources of energy efficiency savings for fuel oil-driven end uses.

Figure 1-3: Residential Sector Cost Effective Fuel Oil Savings Potential by Measure Type¹²



For the residential sector, the study included 24 efficiency measures¹³ for existing single-family and multi-family homes, new construction, and vacant homes. For fuel oil in the residential sector, the study found that usage could cost-effectively be reduced by more than

¹¹To calculate savings, the GDS study used 2005 fuel prices of \$1.74 per gallon for fuel oil and \$1.32 per gallon for propane. November 2007 prices are \$2.97 per gallon for fuel oil and \$2.59 for propane (Vt. Dept. of Public Service, *Vermont Fuel Price Report*, November 2007). The GDS study also forecast that fuel prices would increase at the rate of inflation (about 2.25%), but recent fossil fuel price increases have exceeded the inflation rate by a wide margin.

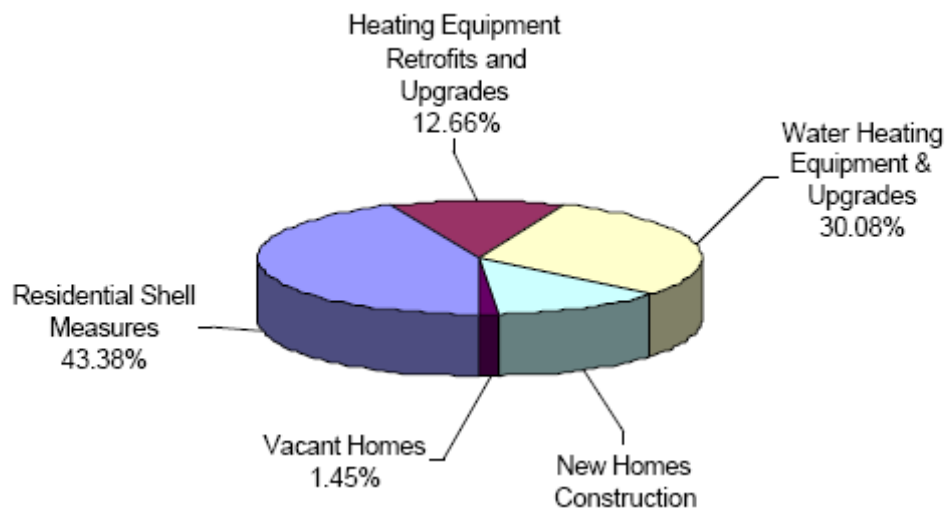
¹² See note 10.

¹³ Efficiency measures included insulation and weatherization, efficient windows, programmable thermostats, sealing ducts, new efficient heating systems, improved vents, and many others.

10%. (This is a statewide total; savings rates in treated homes would obviously be greater.) About 60% of those energy savings could be gained through shell measures that include insulation and weatherization, programmable thermostats, and Energy Star windows. Heating equipment retrofits and upgrades provide another 24% of the savings, with the remaining 16% divided between water heating retrofits and upgrades, measures installed in new homes, and measures installed in vacant homes.

For each remaining fuel and sector, the study supplies similar information. For example, the second largest building fuel opportunity is propane. Here the total cost-effective reduction potential is smaller (about 8% across all sectors). As compared to fuel oil, with propane a larger fraction of savings comes in the water heat area, and somewhat less in residential building shells. The opportunities for saving propane in buildings are shown in Figure 1-4 below.

Figure 1-4: Residential Sector Cost-Effective Propane Savings by Measure Type¹⁴



Conclusion

Vermont can and should start realizing and benefiting from these energy savings soon. This report indicates that there is no “silver bullet.” Savings are achieved in several ways, targeted in distinct ways to be successful in new buildings and renovating buildings, residential and commercial buildings, and a range of different residential building types. There is also no “free lunch.” New money for incentives and to support some infrastructure will be needed to support marketing and technical assistance, to organize loans for upgrades, and to motivate customers to make these valuable investments. Fortunately, Vermont can build on excellent institutions and experience to produce reliable returns, positioning the state as well as possible to face an uncertain energy future.

¹⁴ See note 10.

Section 2: Existing Fuel Efficiency Programs and Persistent Market Barriers

A. Current Fuel Efficiency Efforts in Vermont

As we seek to build an energy efficiency service to lower fuel bills in Vermont, it is important to understand that there is a strong foundation to build upon. Vermont has a variety of programs and initiatives underway related to improving the energy efficiency of heating fuels and other energy sources in buildings. Following is a summary of the major efforts:

NEW CONSTRUCTION EFFORTS

Building Codes and Standards

The state of Vermont requires new residential and commercial buildings to meet energy codes, which have been in effect since 1997 and 2007 respectively.¹⁵ The Residential Building Energy Standards and Commercial Building Energy Standards are based on the International Energy Conservation Code (IECC) produced by the International Code Council, a code widely used in many states. The IECC is updated every three years; Vermont's current residential code is based on the 2000 IECC code and the commercial code is based on the 2004 IECC code. Vermont statute calls for the state's energy codes to begin an update process every three years; during the update process, a working group of stakeholders makes recommendations for new codes, which are then adopted through the state's rule-making process. In lieu of an enforcement mechanism, legislation established a process in which builders, architects, and engineers can self-certify that they have built buildings to meet the codes, and property owners have the right to take legal action if this does not occur. There is no statewide inspection program for enforcing codes.

Burlington, however, is an exception. Burlington Electric Department (BED) enforces building codes by inspecting newly constructed buildings and signing off on the city's building inspections for new buildings. In addition, there is a "Minimum Rental Housing Energy Efficiency Standards Ordinance" that applies to rental housing in Burlington at the time-of-sale. Passed in 1997, the ordinance establishes the Burlington Electric Department as the program administrator. BED coordinates efficiency programs and financing from all sources to assist with each project. Sellers and buyers negotiate who is responsible for compliance. There are requirements for which efficiency measures must be installed, and there are cost caps. The cost of efficiency improvements must not be more than 3% of the sale price or \$1,300 per unit, whichever is less. Also, only measures that have a payback of 7 years or less are required.¹⁶

While the IECC code establishes a baseline for efficient buildings, there also are other voluntary building rating systems that bring buildings to a higher level of efficiency. For

¹⁵Residential Building Energy Standards: 21 VSA §266-267; Commercial Building Energy Standards: 21 VSA §268.

¹⁶City of Burlington, *Minimum Energy Efficiency Standards Ordinance*, Article VII, Sections 18-500 – 18-511.

example, the United States Green Building Council developed the LEED (Leadership in Energy and Environmental Design) Green Building Rating System in 2000, a point-based system for high performance green buildings. The Vermont Builds Greener (VBG) Program, an initiative of Building for Social Responsibility (BSR), is the local USGBC Chapter (the parent organization for LEED). As such, the organization certifies residential buildings constructed to LEED criteria and offers training for contractors. The ECHO Lake Aquarium and Science Center in Burlington was the first building awarded LEED status in 2003. In 2006, the University of Vermont adopted a policy that all new buildings and extensive renovation projects will be LEED-certified.

The U.S. Environmental Protection Agency and the U.S. Department of Energy offer the Energy Star program to certify efficient new buildings. To earn the Energy Star label, new homes must include additional energy-saving features that typically make them 20–30% more efficient than standard homes. Efficiency Vermont and Vermont Gas Systems offer the Vermont Energy Star Homes program for new homes as they are being constructed. Together, they provide design assistance, give financial incentives, and test and rate homes after they're built. Contractors have completed more than 2,540 Energy Star homes in Vermont.¹⁷ As of the end of 2007, 246 contractors had completed projects through the Energy Star Homes program.¹⁸

In addition, Vermont Gas Systems offers a WorkPlace New Construction Program for efficiency measures, and completed 23 such projects in 2006.¹⁹ Efficiency Vermont also assists businesses and multi-family buildings with new construction efficiency measures, including fossil fuel efficiency measures. Efficiency Vermont's program assists a significant share of the new commercial and multi-family buildings in Vermont.

Appliance Standards

The U.S. government has established efficiency standards for many appliances. The U.S. Department of Energy has the authority to update the standards, and for appliances covered under the federal standards, states are pre-empted from enacting their own standards if the standards are more stringent than the federal ones. States may apply to the Department of Energy for a waiver in order to enact stricter standards, but to date no state has received a waiver.

Some states have become concerned that the Department of Energy has not been updating some appliance efficiency standards in a timely manner, and have proposed and adopted new standards that conflict with the federal standards. In 2005 and 2006, Vermont, Massachusetts, and Rhode Island enacted standards for certain appliances; those standards included new efficiency requirements for residential boilers and furnaces. The three states now are working together to prepare a waiver request with the Department of Energy for residential boilers and furnaces so that the standards for those appliances may be implemented.

¹⁷Efficiency Vermont, "Builders who have constructed Energy Star Qualified Homes."

¹⁸KEMA, Inc., *Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs*, Dec. 2005.

¹⁹Vermont Gas Systems, *2006 Annual Report: Demand Side Management Programs*, 2007.

While state-specific appliance standards risk confusion in the marketplace, states are addressing that by enacting consistent standards, and are also accelerating the development of national standards for many products.

Energy Efficiency in Act 250

Vermont's Land Use and Development statute (Act 250) provides a quasi-judicial process for reviewing the environmental, social, and fiscal impacts of major subdivisions and developments in Vermont. Developments subject to Act 250 must meet an energy efficiency criterion, which states: "A permit will be granted when it has been demonstrated by the applicant that ... the planning and design of the subdivision or development reflect the principles of energy conservation and incorporate the best available technology for efficient use or recovery of energy."²⁰ "Best available technology" has been interpreted to mean the best of proven design techniques of normally accessible equipment and materials; those using the least amount of energy or having the lowest life-cycle costs. For residential buildings, compliance with Vermont's Residential Building Energy Standards has been treated as complying with the Act 250 criterion. For commercial buildings, compliance with the Commercial Building Energy Standards has been treated as providing strong evidence that the Act 250 criterion is met. The Department of Public Service evaluates projects and may recommend that applicants consider specific energy efficiency measures based on a life-cycle cost approach; the Department can recommend above-code designs for commercial developments. For both commercial and residential projects, electric heat is generally avoided and alternatives to electric water heating are given strong consideration.²¹ Because of Act 250, more than a generation of buildings has been built without electric heat and with significant building insulation. Modern building science presents additional savings opportunities that are not yet incorporated into standard practice.

The Act 250 process tends to address developments of significant new buildings and building complexes and it has a high standard for energy efficiency, so it presents an excellent opportunity to assure quality construction and energy systems. The complexity of energy systems in buildings can lead to a lack of understanding by participants and decision-makers on how to interpret the Act 250 energy efficiency standard. Although this is a challenge, Act 250 can be a process that assures continuous improvement in building practices for energy efficiency.

RETROFIT PROGRAM FOR LOW-INCOME VERMONTERS: VERMONT WEATHERIZATION ASSISTANCE PROGRAM

Vermont's Weatherization Assistance Program was started in the 1970s to provide free weatherization services to low-income Vermonters who qualify for the program. In 1990, the program was expanded by establishing a permanent funding source: the Weatherization Trust Fund, financed by a gross receipts tax of 0.5% on the sale of electricity, natural gas, oil, propane, kerosene, and coal. The program in 2007 received \$6.8 million from the Weatherization Trust Fund, and \$1.2 million from the U.S. Department of Energy.

²⁰ 10 VSA §6086.

²¹ Natural Resources Board Land Use Panel, *Act 250 District Commission Training Manual, Criterion 9F*, revised 2006.

The weatherization program is administered by the State Office of Economic Opportunity, and delivered to low-income households through four of Vermont's regional Community Action Program agencies and the Northeast Employment and Training Organization. These agencies have their own weatherization crews, and rely on private contractors for work requiring licensed tradespeople and for some other work. The weatherization program performs its services in partnership with Vermont Gas Systems, Efficiency Vermont, Burlington Electric Department, fuel dealers, and private contractors. The first three entities provide incentives that allow the weatherization program to install cost-effective electrical and natural gas efficiency measures.

To be eligible for the weatherization program, Vermonters must earn 60% of state median income or less – about \$42,800 for a family of four. This income level was raised in 2005; previously, it had been set 150% of poverty level income, or about \$31,000 for a family of four. There will be about 49,000 households eligible for weatherization as of March 2008.

The program has weatherized about 18,300 low-income units since 1993, and currently weatherizes about 1,450-1,460 units per year. The average cost per unit when all costs are included is estimated to be \$5,300-\$5,400 per unit, or \$4,400 in average direct costs of weatherization (including health and safety measures, but not including heating system work). For the 2005 program year, each dollar spent on energy efficiency measures in the program returned \$1.98 to customers.²²

The Weatherization Assistance Program in Vermont is successful in service quality and scope. Yet the number of qualifying residences that remain unaddressed is large, indicating that a great many low-income families are paying more for energy than they should have to.

OTHER RETROFIT PROGRAMS FOR VERMONTERS

Home Performance with Energy Star / Efficiency Vermont

Home Performance with Energy Star (HPwES) is a service for testing energy efficiency and retrofitting homes on a whole-house basis, and is sponsored nationally by the U.S. EPA and U.S. DOE. Vermont's HPwES program is a project of Efficiency Vermont, which offers financial incentives for the electrical efficiency improvements and reduced interest financing for non-electrical efficiency improvements.

Vermont's HPwES program started in 2005, and about 124 homes have completed improvements under the program through October 2007.

The HPwES program relies on trained contractors to perform the work. To participate in the program, contractors must be certified by BPI (Building Performance Institute) to perform whole-house efficiency work, and sign a participation agreement with HPwES which requires them to complete and report a certain number of jobs per year that meet BPI standards, among other things. The HPwES program maintains quality assurance with its contractors, and contractors receive incentives for BPI training and HPwES work. About 20 contractors currently are participating in the HPwES program.

²²In 2005 net present value dollars. From Dalhoff Associates, *An Update of Vermont's Weatherization Assistance Program*, February 2007.

Customers who wish to participate in the program select from the list of contractors participating in HPwES. The customers pay for the whole-house energy audit, which recommends measures to improve the non-electrical efficiency of the house. On the electrical side, HPwES contractors install compact fluorescent light bulbs and receive reimbursement for the bulbs from Efficiency Vermont. In the future, contractors may be able to offer full electrical audits as part of HPwES.

Customers who choose to make the improvements recommended in their energy audit can qualify for reduced interest rate financing. The HPwES program pays down the interest rates for the improvements by 3.5%, when customers use one of three currently participating lenders.²³ This buy-down often places the interest rate between 2.49% - 5.25% (or even lower), depending on the type of loan and the credit record of the customer. The HPwES program screens the proposed efficiency measures and generally will finance any measures recommended by the contractors: usually insulation, air sealing, and health and safety measures. The lenders work to find the most advantageous loan type for customers and communicate with the HPwES program that the loan is going forward. After receiving approval of the efficiency measures from HPwES, the lenders notify the contractor that the customer has been approved for the loan, and the money is released when the project is completed. The HPwES program then sends the entire sum of the interest rate buy-down for the loan to the lender. Twenty-six of the 73 HPwES homes completed in 2007 (through October) were financed with low-interest loans.²⁴

HPwES represents continuous improvement in energy efficiency, improving the quantity and quality of investments with every customer contact, driving down costs in the process. While all Vermonters are eligible for HPwES, those who participate are mostly in the upper-middle and upper income categories. Customers must be able to afford an audit, qualify for the loan, and afford the loan payments.

Vermont Gas Systems

Vermont Gas Systems (VGS), providing natural gas to more than 40,000 customers in Chittenden and Franklin counties, has an award-winning, proactive energy efficiency program. In 2006, VGS installed efficiency measures for 1,774 residential customers and 70 commercial and industrial customers. The efficiency programs cover new construction (described above), equipment replacement, and retrofit projects on both the residential and commercial/industrial sides, and VGS works closely with Efficiency Vermont, the Champlain Valley Office of Economic Opportunity Weatherization, and Burlington Electric Department on these programs. VGS offers cash rebates, incentives, free technical assistance, free audits, reduced interest rate financing, and other measures.

For example, under VGS's Homebase Retrofit Program, free energy audits are performed on qualifying homes, and potential improvements are modeled. Homeowners receive a report detailing recommended efficiency measures and a list of contractors, and are provided with financial incentives, technical assistance, and project management services from VGS.

²³Banks currently participating in HPwES are Opportunities Credit Union, Vt. State Employees Credit Union, and Brattleboro Savings and Loan.

²⁴Interviews with Emily Levin, Homes Market Manager, Efficiency Vermont, 12/14/07 and 12/18/07.

Customers may obtain bids from contractors, or have VGS assign a pre-screened contractor through their “FastTrack” option (the option most choose). VGS gives cash incentives equal to 33⅓% of the installed measure cost if the owner pays the heating bill for the property, or 50% if tenants pay the bill in rental properties. And, VGS offers reduced interest rate financing for the balance of the installed measures’ cost through Opportunities Credit Union: a 0% loan for three years, 2% for five years, or 4% for seven years. The reduced rate loans also can cover the cost of replacing qualified heating equipment if the customer also commits to installing the recommended retrofit shell work. For low-income customers, VGS works collaboratively with the partners mentioned above.

VGS energy efficiency programs are successfully addressing some energy efficiency needs of its customers, and could do more with more resources. The Public Service Board can add energy efficiency costs to regulated rates, but they may consider the issue of competitiveness of VGS compared with liquid fuel dealers, who presently have fewer expenses for comprehensive energy efficiency service built into their costs.²⁵

Private Contractors and Fuel Dealers

In addition to retrofit projects undertaken through the Weatherization Assistance Program, Home Performance with Energy Star, or Vermont Gas Systems, there are many other private contractors performing energy efficient retrofits that are not reported or verified under any program. While some fuel dealers only sell fuel, others are full-service companies that deliver fuel and provide many services. And, there are many companies that perform heating services only, including installations, maintenance, and energy efficiency work.

Some private contractors market energy efficiency aggressively, while many don’t market it at all. Some companies partner with lending institutions to offer financing for efficiency improvements. Many private contractors work cooperatively as sub-contractors with the other retrofit programs mentioned above. For example, the Central Vermont Community Action Council (CVCAC) uses private contractors for all of the installation and maintenance work on heating equipment.

In addition, CVCAC and the Northeast Employment and Training Organization have a “for-profit” side, as well as providing services for low-income Vermonters through the Weatherization Assistance Program. CVCAC’s for-profit side participates in Home Performance with Energy Star, and also does a few other projects per year that fall outside that program.

The *Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs* (KEMA, Dec. 2005) has information from interviews with private contractors on their level of use of energy efficient measures.

Vermont has many businesses knowledgeable in energy efficiency that today are working without the benefit of coordination.

²⁵Both VGS and fuel dealers include the gross receipts tax to fund the Weatherization Assistance Program, while only VGS has the added cost of comprehensive energy efficiency programs.

INSTITUTIONS SUPPORTING ENERGY EFFICIENCY

Energy Service Companies

Energy Service Companies (ESCOs) are businesses that develop designs, install equipment, and arrange financing for comprehensive efficiency projects for buildings. In addition, ESCOs verify the project's energy savings and assume the financial risk that the project will save money through lower energy use. The ESCO concept, called performance-based contracting, guarantees energy savings and allows customers to make debt payments for the efficiency improvements with the money saved from using less energy.

ESCOs are used widely in other states, but there has been limited experience with them in Vermont, possibly because of our smaller scale and smaller projects. The University of Vermont has done a few projects with ESCOs. Fletcher-Allen Health Care is engaged in an ESCO project with Carrier Corporation.

In what may be the first smaller ESCO project in Vermont, the Montpelier school district contracted with Honeywell to install about \$2 million worth of efficiency improvements in the elementary, middle, and high schools. The school system now is in the first full year of operation after the measures were installed, so it remains to be seen if the energy savings promised by Honeywell will be achieved. The school district has a 10-year guarantee of energy savings from Honeywell, and they receive money from Honeywell yearly if the savings are not achieved. Honeywell is committed for ten years to ensure that the project works correctly. In addition, the school maintenance crews have become better educated and undertake practices to ensure the systems work efficiently as a result of the project.

Lending Institutions

Some lending institutions participate with efficiency programs or offer on their own reduced rate financing for energy efficiency home improvements. For example, the Vermont State Employees Credit Union participates in the Home Performance with Energy Star program, but also offers their own energy improvement loan program, in which they buy down a customer's starting interest rate by 1%. A bank in Brattleboro partners with an oil company to offer financing for efficiency improvements.

The Opportunities Credit Union (OCU) in Burlington, operating statewide, has a unique model which serves lower-income Vermonters. OCU has a credit counseling component, and seeks to assist motivated applicants who do not immediately qualify for a loan to remove the barriers to eligibility. OCU offers loans for energy efficiency, works with Vermont Gas Systems to provide financing for their efficiency programs, and is one of the lenders offering financing through the Home Performance with Energy Star program.

School Energy Management Program

Vermont's School Energy Management Program, working in partnership with the Vermont Superintendents' Association and the Vermont Dept. of Public Service, helps local school officials save energy through efficiency projects. The program can provide a range of services to lower energy costs and improve efficiency, and for many years has helped site wood-chip energy systems at schools.

B. Persistent Market Barriers Continue to Block Fuel Efficiency Investments

Even though Vermont has taken meaningful steps to improve fuel efficiency in buildings, and there are some programs in place to assist building owners, many studies have reported that the potential for cost-effective savings far exceeds the rate of investment that is occurring in the market today. For example, in a major study prepared for the Vermont Department of Public Service last year found that Vermont's fuel bills could be lowered further by more than 12% per year after ten years (which would be around \$100 million per year at recent fuel prices).²⁶

Years of experience and numerous studies have demonstrated that there are a host of reasons for consumer under-investment in energy efficiency, and that public initiatives are needed to surmount these barriers and make real progress. Those barriers persist in Vermont today. Understanding them is crucial to developing effective efficiency services and marketing those services successfully to households and businesses. Major barriers include:

CUSTOMER BARRIERS

- Split incentives: One of the biggest problems in delivering the full value of efficiency investments in buildings is the distinction between *who can make the investment now?* and *who will benefit from the investment over the long term?* Builders build buildings that they will never live in. Almost all commercial office space is built by developers who will never pay for power or heat in the building. Many homeowners do not expect to stay in their present home long enough to fully benefit from insulation or other upgrades. Tenants have little opportunity to upgrade their rental units and have little reason to invest in the owner's property. All of these actors may take a short-term view, yet the building stock overall is very long-lived, and will be adding to the state's overall power and fuel demands for decades to come, through changes in owners and tenants.
- Upfront costs and high discount rates: Another substantial barrier to consumer investment in energy efficiency lies in the relationship between today's costs and tomorrow's benefits. It is difficult for many families to pay the up-front costs of efficiency improvements that will lower bills over several years. Most consumers discount those future benefits greatly, resulting in under-investment in efficiency over the long term. The cost of efficiency audits and upgrades significantly limits the demand for many efficiency retrofits. Even when a relatively short payback period can be demonstrated, the up-front costs often remain a barrier to consumer investment. The majority of Vermonters do not qualify for services under the Weatherization Assistance Program, and cannot afford to invest in their homes at a level that would provide meaningful energy savings (even with the reduced interest rate financing available through Home Performance with Energy Star). Some cannot qualify for reduced rate financing.

²⁶GDS Associates, *Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels*, for the Vt. Dept. of Public Service, 2007. Other recent reports have reached similar conclusions. See e.g., Vermont Council on Rural Development, *Strengthening Vermont's Energy Economy*. (August 2007).

- Poor understanding of benefits: Homeowners have a limited understanding of the benefits that can result from efficiency retrofit projects, including better comfort, increased safety, increased property value, and lower energy bills. Many people are resigned to being cold and uncomfortable during Vermont winters. In addition, many efficiency improvements such as insulation and air sealing are largely invisible after installation.
- Lack of information about efficiency and quality contractors: There is limited information from trusted sources about the most cost-effective efficiency measures, what retrofit work needs to be done in homes, and which contractors to hire to perform these services. There is not a statewide referral service for reputable auditors or contractors who have experience in whole-buildings retrofits. Most customers have a limited understanding of the connections between various problems in a home, such as discomfort, high maintenance costs, air quality, ice dams on roofs, and energy use. Homeowners also attempt to make efficiency improvements themselves, often to reduce the costs, but limited information exists to help do-it-yourselfers accomplish a high-quality retrofit.
- Piecemeal approach: As a result of the previous three barriers, many homeowners make only partial efficiency improvements instead of more comprehensive ones. For example, a homeowner of an un-insulated house may insulate just the attic instead of both the attic and sidewalls, using a contractor who gave the lowest bid. Such a contractor may not understand that significant air leakage from the home into the attic should be sealed first, before attic insulation is added (once attic insulation is installed, it is much more difficult to fix the air leakage). The greatest energy savings are achieved when homes are treated comprehensively.
- Timing of home improvements: Home improvements and equipment upgrades often take place when a home reaches a certain age, in the first few years after a home has been purchased by a new owner, or when existing equipment fails. Most homes do not fall into the first two categories, and homeowners replacing failed equipment may not be interested in undertaking a more extensive efficiency project at that time.
- Commercial / industrial issues: Commercial, institutional, and industrial buildings often do not have an employee with the authority, knowledge, or time to make good efficiency decisions. There is high turnover at some workplaces, and a lack of institutional knowledge of building operations. As a result, such buildings often are not retrofitted comprehensively or at all. Efficient products for some commercial and industrial customers are not quickly available in Vermont, and often require transactions involving new suppliers. Such customers are sometimes unwilling to take risks on unfamiliar equipment or designs, and there is no quality assurance for efficient HVAC equipment and building shell upgrades. Some customers do not have the capital to invest in efficiency upgrades or have other priorities.

CONTRACTOR BARRIERS

- Perceived lack of customer demand: Many contractors do not believe there is enough customer demand for whole-buildings efficiency projects.
- Contractor shortage: There is a shortage of contractors trained to do high-quality, whole-buildings efficiency work. There are geographic areas of the state where there are not many contractors providing efficiency services, especially the Northwest and Northeast. Home Performance with Energy Star currently has about 20 contractors statewide who are participating in the program, but this is not enough to meet the demand even of the population of people who can afford the Home Performance with Energy Star services.
- Contractor education: Contractors who have worked for the Weatherization Assistance Program, who are certified by the Building Performance Institute, and who are participating in the Home Performance with Energy Star have the training to retrofit buildings to provide a high level of energy savings and ensure that health and safety issues are minimized. However, many other contractors do not have the expertise to accomplish this.
- Contractor unwillingness: Contractors who want to become certified by the Building Performance Institute or receive other efficiency training must invest time and resources into learning new skills and purchasing new equipment. Many contractors are not willing to undertake this, especially if the demand for efficiency services is not clear. In addition, weatherization work can be physically taxing.

Taken together, the customer and contractor barriers to building fuel efficiency raise substantial bars against the long-term improvement of Vermont's building stock. The fuel efficiency services proposed in this report are designed, as they must be, to overcome these barriers so that long-term improvements in the state's building infrastructure can be achieved, providing very large long-term economic gains to the families and businesses that will be occupying those buildings in the decades ahead.

Section 3: Affordable Heat: A Whole-Buildings Efficiency Service for Vermont Families and Businesses

A. Design Principles

The need is great, and growing. As previous sections demonstrate, the cost of importing fossil fuels is placing a growing burden on families, businesses, and the state's economy as a whole. The cost of fuels for buildings in Vermont has risen by at least \$300 million in the past four years. Meanwhile, the energy demands of Vermont's building stock are significantly larger than they need to be -- the energy penalty imposed by inadequate building shells, heating systems, and equipment now exceeds \$100 million per year.²⁷

The building stock is very large, includes many older units, and is widely dispersed among many owners. One of the greatest challenges to improving efficiency is the broad-based ownership pattern of the Vermont building stock. The need for efficiency improvements and services is very broadly spread, both in physical terms, and among many, many different owners (and thus decision-makers):

- There are more than 250,000 occupied housing units in Vermont, and at least 40,000 unoccupied or seasonal units;
- At least 50,000 units are occupied by low-income families;
- About half of this housing stock, over 125,000 units, was built before Vermont's earliest energy-related building codes were adopted in 1973;²⁸
- New construction adds approximately 3,000 residential units in an average year;
- There are more than 21,000 businesses occupying commercial space throughout the state.

This means that efficiency services for buildings must be designed with low barriers to entry and low transaction costs. Broad-based marketing and outreach efforts to many owners will be needed, rather than high-impact deals with just a few large market players.

Reducing the energy penalty will require effort, but it is well within our grasp to accomplish. To design an effective set of services, we have called on the experience of Vermont's existing energy and efficiency providers, the judgments of experts in state government, and a wealth of national experience on "what works" when seeking to enlist and assist building owners, contractors, and efficiency providers. We have found a surprisingly high degree of consensus on the basic principles to guide program design, summarized below. We recommend that the Vermont Legislature direct delivery of statewide comprehensive energy efficiency services based upon the following design principles:

²⁷The GDS study found that achievable, cost-effective reductions could equal about 12% per year of total consumption statewide after ten years, which is about \$100 million per year at current fuel costs. This is not an estimate of future savings foregone – it is a conservative view of the size of the energy penalty that Vermont families and businesses *are paying in 2008* by failing to upgrade inefficient buildings and heating systems.

²⁸Vermont Public Interest Research Group, *Building Solutions: Energy Efficient Homes Save Money and Reduce Global Warming*, 2006, p. 12.

- **Focus on the needs of customers – that is, Vermont families, homeowners and business building owners. Services must be “customer-focused,” not agency-focused.**

Efficiency services for buildings must be designed to attract enrollment, overcome the market barriers to efficiency, and actually deliver building upgrades – if they do not actually attract and help customers to deliver upgrades, they will not work.

- **Address the persistent market barriers to efficiency.**

When it comes to energy efficiency, homeowners and businesses face a variety of barriers to action. Customers need high-quality, trusted, impartial audits and recommendations; up-front financial assistance; easy access to “one-stop shopping;” and longer-term financing options.

- **Design services to address major market segments differently.**

Experience and common sense both dictate that “one size fits all” will absolutely not work to deliver energy efficiency savings across Vermont’s building stock. A customer-focused service will need to separately address the market barriers, financial capabilities, and needs of at least four separate market segments:

- Low-income residential
- Market residential
- Multi-family residential, and
- Commercial buildings.

- **Deliver a broad-based set of services – one with opportunities for Vermonters in all housing and income categories.**

To make a meaningful difference in total fuel consumption in Vermont, the efficiency service must seek to upgrade at least 20% to 25% of the building stock over the course of a decade or more. To meet that goal – a total of 75,000 or more residential units and commercial buildings -- a range of opportunity areas must be tapped. In addition, it is important to provide savings opportunities for customers in all types of housing, in all customer classes, and all across the State. Services should cover all major opportunity areas:

- Building design and new construction;
- Building shell retrofit opportunities in commercial buildings and all types of housing; and
- Building systems -- HVAC systems, services and operations.

- **Build on existing institutions.**

Vermont has the advantage of several effective, existing institutions that can be tapped to provide greater building efficiency: the Weatherization Assistance Program (WAP), its regional agencies and fuel dealer partners; the State’s electrical efficiency contractor, Efficiency Vermont, including the partners involved in the Home Performance with

Energy Star program; the institutions that support Act 250; Vermont Gas Systems; and the government agencies that oversee efficiency entities and building codes (including the Department of Public Service, Public Service Board, and Office of Economic Opportunity). Building on these effective delivery mechanisms is the best way to expand performance.

- **Maximize savings and minimize transaction costs with a “whole-buildings” approach that considers all energy fuels and uses.**

A “whole-buildings” approach is important for a variety of reasons. Customers want one-stop shopping for energy efficiency, and should not have to knock on different doors for service on regulated vs. unregulated fuels. Building shells and HVAC systems cut across fuel types (e.g., insulation affects both oil heat consumption and air conditioning electricity demand). Customer contacts and high-quality audits are relatively expensive, so it is important to reduce costs by including both regulated and unregulated fuels in the analysis, recommendations, and funding package. This will help to maximize savings for individual participants and for the effort as a whole, help to minimize “lost opportunities,” and will lower administrative costs as a percentage of total costs and savings.

- **Use public funds to leverage private investment capital.**

Upgrading a meaningful fraction of the state’s building stock will provide very large benefits, but it will also require a large pool of investment capital. Most of that capital should be privately provided by building owners or lenders. Public funds are needed to provide assistance to low-income families, but beyond that should be used strategically to provide audits and technical assistance, and to leverage private investments to upgrade the building stock.

- **Ensure public oversight for the use of public funds.**

Mechanisms are already in place within State government to supervise program designs and oversee the use of public, utility, and other funds for energy efficiency. The statewide energy efficiency service should build on those mechanisms, including the State OEO’s oversight of the weatherization program, and the DPS and PSB supervision of utility efficiency programs and the state’s efficiency contractor, EVT.

- **Invest cost-effectively, and for the long term.**

A principal objective of Vermont’s efficiency programs has been to save energy cost-effectively. In the context of the building stock, it is especially important to recognize the power of long-term investment strategies. Vermont has an especially long-lived building stock, and while the ownership of individual buildings will change over time, the building stock persists. Efficient buildings will benefit future owners and the Vermont economy for many years into the future. This means that the investment vehicles, loan arrangements, and cost-benefit analyses for these services should all take a long-term view.

- **Begin capturing savings as soon as possible, but ramp up services predictably over time.**

Vermont’s fuel bill is now at record levels, and the prospects are for high costs to continue over the long-term. The earlier services can begin, the larger the savings will be, so services should be designed to help Vermonters save on fuel costs as soon as possible. At the same time, smart services will need trained workers, marketing and financial support, and other elements that will take time to add carefully. Program designs and financial supports will need to grow over time and should ramp up to capture as much of the achievable saving potential as funding will support.

- **Set long-term goals and measure performance against them.**

One important lesson from past efficiency programs is the importance of setting long-term goals at the highest levels of public decision-making. The Legislature should set minimum goals for attainment of buildings efficiency in Vermont, and should create stable administrative mechanisms and funding sources to achieve them. Stability promotes a clear public understanding of energy efficiency, and also promotes the business relationships that support energy efficiency. Goals without funding are not helpful, and “on-again/off-again” programs will not be successful. The statewide energy efficiency service should contain provisions for continuous assessment and regular reporting by administrators, coupled with oversight by the Public Service Department and Board, so that improvements can be made when needed, and legislative oversight can be assured.

Design Principles for a Statewide Comprehensive Energy Efficiency Service

- **Focus on the needs of customers – that is, Vermont families, homeowners and business building owners. Programs must be “customer-focused,” not agency-focused.**
- **Address the persistent market barriers to efficiency.**
- **Design services to address major market segments differently.**
- **Deliver a broad-based set of services – one with opportunities for Vermonters in all housing and income categories.**
- **Build on existing institutions.**
- **Maximize savings and minimize transaction costs with a “whole-buildings” approach that considers all energy fuels and uses.**
- **Use public funds to leverage private investment capital.**
- **Ensure public oversight for the use of public funds.**
- **Invest cost-effectively, and for the long term.**
- **Begin capturing savings as soon as possible, but ramp up programs predictably over time.**
- **Set long-term goals and measure performance against them.**

B. What is Needed: A Comprehensive Approach to Buildings Efficiency

Overview: Based on the design principles set out above and the factual setting described in previous sections, we have considered a range of ideas to improve efficiency in buildings in Vermont. In the summary below, and in the sections that follow, we set out a comprehensive, decade-long plan to improve buildings on a “whole-buildings” basis.

We conclude that the Vermont Legislature should enact legislation launching a high-level commitment to buildings energy efficiency, with a **legislative goal to reduce direct fossil fuel consumption by at least 6% by the end of the coming decade**, through cost-effective energy efficiency investments and operational improvements. That goal can be met by adopting and implementing best practices and codes for new construction, expanding the low-income weatherization program, and investing in cost-effective building shell and furnace upgrades that together will improve about 25% of the state’s existing building stock by 2020.

This report recommends an Affordable Heat program containing four major elements:

1. Sustained improvements in **building codes, equipment standards and Act 250 reviews** for new construction, coupled with ongoing training for designers, engineers, and contractors. The code for new construction should be coupled with a **time-of-sale efficiency standard** for rental housing, coupled with technical and financial assistance for efficiency upgrades for building owners; (See Section 4.)
2. Expansion to all eligible natural gas customers of the building shell and heating system efficiency programs offered by **Vermont Gas Systems**; (See Section 6.)
3. Doubling the units served by the low-income **Weatherization Assistance Program** to improve efficiency and life safety in existing low-income housing; (See Section 5.)
4. A **market-based service** of outreach, financial and technical assistance for other existing housing and commercial buildings on a “**whole-buildings**” basis, through the State’s efficiency contractor, Efficiency Vermont, supervised by the Public Service Department and Board. A principal component, and the source of most of its funding, will be an easy-to-access loan program for high-quality upgrades by home and building owners, with capital provided by a consortium of banks and private lenders, possibly supported by the state agencies with lending expertise in the buildings sector. (See Section 6.)

C. Statewide Energy Efficiency Service Goals

Through these four services, Vermont could reach or exceed the following goals:

- Substantially improving the energy fitness of at least **20% of the state’s housing stock by 2017** (over 60,000 housing units), **and 25% of the State’s housing stock by 2020** (about 80,000 units);

- For the housing units served, reducing annual fuel needs and fuel bills **by an average of 25%**;
- Reducing total fossil fuel consumption across all buildings by an additional ½% each year, leading to a **total reduction of 6% annually by 2017 and 10% annually by 2025**; and
- Saving Vermont families and businesses a total of **at least \$1.5 billion** dollars on their fuel bills due to the improvements and measures installed in the first 10 years (through 2017).

This report outlines a set of services and associated funding requirements and options to attain these goals. Some may find an efficiency plan of this scale too large, and others may find it not ambitious enough. Certainly the potential for cost-effective fuel savings is larger than this limited effort would attain. Over the first ten years, for example, it would weatherize less than half of the currently eligible stock of low-income housing units across the state, and provide concentrated services to only about 10% of the market-rate residential units. The GDS Report commissioned by the Department of Public Service indicates a potential to save 12% of annual direct fossil fuel consumption per year after ten years, double the 6% supported by this report. Yet new funds are needed to attain these goals, and this report and most observers agree that customer funds alone, even in the form of low interest loans, will not produce the necessary investments.

If decision-makers want to accelerate these services, a more rapid expansion is possible, particularly after the first two or three years. In addition, **we recommend that the Legislature create an ongoing review of energy use in buildings, and ask the Public Service Department and Board to report at periodic intervals on how greater savings could be secured.**

D. Summary and Funding Requirements

Overview:

The table below provides a quick overview of the major elements of the Affordable Heat program. For each major element of the service, it shows:

- The **number of units** of housing (or business installations) that would be improved through that service. Because most of the services ramp up in scale over time, the total number of units served rises from about 4,800 in 2009 to about 9,600 in 2017.
- The **publicly-supported cost per unit**, on average, for participating units. Importantly, this figure does not include the funds invested by building owners and/or covered by loans to those owners. It is also important to note that the public cost per unit is much higher for the low-income weatherization program (\$5,200 per unit) than it is in the Market Housing service, where owners are expected to contribute a large fraction of the total costs of upgrades. In the

Market Housing retrofit service, incentive payments and costs vary across housing and income types.

- **New funds needed per year** provides a snapshot of the total new revenues that will be needed from public sources to support this level of activity. That amount rises over time as more units are served (from just \$1.7 million in 2009 to \$24 million in 2017). **Details on the potential sources of these new revenues are set out in Section 7, below.**
- Finally, the table shows the **total number of units** upgraded due to the statewide energy efficiency service over the ten years from 2008 to 2017. At the levels shown here, approximately 60,000 residential units and over 3,000 businesses would be served. Even with these fairly extensive services, it will take at least 10 years to improve the energy fitness of about 21% of the state’s residential housing stock and 14% of its commercial buildings.

Figure 3-1: Affordable Heat -- Overview and Key Datapoints

Affordable Heat Service Summary and Funding Requirements				
Initiative/ Service	Units/ year	Public cost/unit	New funds needed/year	Total units over 10 years
Building codes and Act 250	2,500	\$200	Code assistance included in General Fund & EVT current budgets	25,000
New homes service	500 to 1,000 until 2012	\$1,000	\$0.5 million	4,000
Weatherization Assistance Program	1,500 rising to 3,000	\$5,200	\$1.3 million rising to \$13 million	24,000
Market housing retrofits & time-of-sale upgrades	200 rising to 3,000	\$400 to \$2,100	\$1.2 rising to \$8 million	25,000 to 28,000
Commercial building retrofits	315	\$2,100	Rising to \$1.7 million	3,150
Vermont Gas program	500	\$1,850	Included in rates	4,000
TOTAL	4,800 rising to 9,600 units per year	\$2,100/unit counting all weatherization	\$1.7 million/year (2009) rising to \$24 million (2017)	60,000 = ~21% of residential building stock by 2017**

**Note: Columns do not add, especially since new construction will be covered by new codes and may also participate in new construction efficiency service for additional improvements.

E. Institutional Roles

Among the design elements identified by policy-makers and experts for this effort is the important goal of building on Vermont’s strengths:

- The expertise and program experience of Vermont’s existing efficiency institutions; and
- The capacity of the private sector actors who can deliver funding, expertise, and on-the-ground installations of insulation, HVAC systems, and other building shell improvements.

The services and initiatives we recommend in this report are intended to build on those existing strengths. The chart below displays in a general sense the principal roles that could be played by the main institutions and private-sector service providers who will be needed to deliver building upgrades throughout Vermont.

As this chart shows, all of Vermont’s existing efficiency service providers have important roles to play – and for many of them, significant new business opportunities – in the Affordable Heat service. The institutional arrangements summarized here build consistently on the arrangements and market roles that already characterize work in this domain. To take two examples from the chart (acronyms in parentheses correspond to those in the chart):

- In the low-income Weatherization Assistance Program, energy audits are performed by WAP-trained auditors (often WAP staff members). Air sealing and other building shell improvements are performed by WAP weatherization crews, while furnace repairs and upgrades are contracted out to trained technicians working for fuel dealers or other HVAC contractors. The cost of these improvements is paid for out of WAP program revenues. This section also notes that Vermont Gas Systems (VGS) sometimes provides services to low income units.²⁹
- In the Market Housing service, the state’s efficiency contractor, Efficiency Vermont (EVT), plays a somewhat larger role, mostly coordinating services provided by others. Energy audits will be provided by independent auditors certified to work with the Home Performance with Energy Star program (HP). Air sealing and insulation services can also be provided by those Home Performance contractors, while more significant building shell construction work may require other building trades professionals and contractors (PC). Here too, furnace and HVAC system upgrades will be provided by certified technicians working for fuel dealers and other private HVAC contractors (VFD/HVAC). Financial support to the building owner can be provided by Efficiency Vermont (EVT) under the program. Those incentive payments will be but a fraction of the total upgrade cost, and will need to be combined with a significant investment by the building owner, who could, if desired, use loan funds made available (NF or B).

The Commercial Buildings service is not envisioned to focus on government and institutional buildings because of the attractiveness of this subset to Energy Service Companies. As discussed elsewhere, ESCOs are successful in improving the energy efficiency performance

²⁹Under Vermont law, when VGS provides weatherization services to qualified low-income households, it is entitled to a credit against the Fuels Gross Receipts Tax otherwise payable to the Weatherization Trust Fund.

of these buildings while profiting from receiving a share of the savings over a period of time. Government and institutional building owners tend to have a tolerance for longer term paybacks that match the ESCO business model.

Figure 3-2: Overview of Affordable Heat Program – Who performs which functions?

	Energy Audits	Air Sealing & Insulation	Fuel Switching, HW & HVAC Upgrades	Process equipment upgrade	Other Shell Improvements (windows & doors)	Incentives	Financing
Single-Family Residential							
Low-income Weatherization Assistance Program	WAP	WAP	WAP hires VFD/HVAC members	NA	WAP	WAP VGS	NA
Market housing	HP	HP	VFD/HVAC	NA	PC	EVT	NF or B
Vermont Gas customer units	VGS or HP	Varies	VFD/HVAC	NA	PC	VGS	NF or B
Multi-Family Residential							
Low-income	WAP	PC	VFD/HVAC	NA	PC	WAP	NF or B
Other	EVT VGS	PC	VFD/HVAC	NA	PC	EVT VGS	NF or B
Other Buildings							
Commercial	EVT VGS	PC	PC	PC	PC	EVT VGS	NF or B
Municipal or state building	EVT ESCO	PC	PC	PC	PC	NA	B, Bonds ESCO
Institution (e.g. college, hospital)	EVT ESCO	PC	PC	PC	PC	NA	B, Bonds, ESCO

- B – Commercial Banks
- ESCO – Energy Service Companies
- EVT – Efficiency Vermont
- HP – Home Performance with Energy Star Contractors
- NA – Not Applicable
- NF – (New Fund) The pool of private capital made available through a coalition of banks, VEDA and/or VHFA
- PC – Private Contractors
- VFD/HVAC – Vermont Liquid Fuel Dealers and other HVAC Contractors
- VGS – Vermont Gas Systems
- WAP – Weatherization Program

There are two important lessons built into this chart of institutional roles. First, it should be apparent that any serious effort to upgrade the energy fitness of Vermont’s building stock will need to employ the services of many existing or new private-sector professionals:

auditors, building contractors, HVAC technicians, and banks and other lenders. This is true to some degree in the Weatherization Program, but to a much larger degree in the Market Housing and Commercial program. In the latter two programs, the state's efficiency contractor plays a coordinating role, but most of the work is done by others, chosen from among qualified contractor lists at the discretion of building owners.

The second lesson is that coordination among these actors will be essential for success. A customer-focused service must minimize confusion and the "hassle factor" for homeowners, and provide a seamless or invisible transition from one step to the next for their benefit. For this reason, it is crucial to provide a single point of contact and a trusted source of information and coordination for homeowners. The state's efficiency contractor, Efficiency Vermont, is well-suited to play this role. It is already playing this role with respect to electricity efficiency in these same buildings, and with many of the same auditors and contractors. In addition, the broad market penetration of the "Efficiency Vermont" brand across the state provides an invaluable asset to the statewide energy efficiency service, giving customers easy access to a trusted source of information and a "one phone call" option to initiate service. Since the State of Vermont owns the "Efficiency Vermont" brand, it makes sense to capitalize on its broad appeal and acceptance as a means of marketing the statewide energy efficiency service.

Section 4: Improving the Energy Fitness of New Construction in Vermont

Section 2 of this report recounts the status of new construction and retrofit efficiency efforts in Vermont, while this section covers possible enhancements.

Policies to Support Energy Efficient Buildings

- Building Energy Codes
 - Enforce
 - Update
 - A Base for Energy Efficiency Services to Build on
- Land Use Permitting – Act 250
 - Review effectiveness of Act 250
 - Training on “Best Available Technology”
- Time-of-sale Code Compliance or Disclosure
- Leadership in Public Buildings

A. Building Energy Codes

According to a recent study by Northeast Energy Efficiency Partnerships, a significant amount of energy efficiency is available from adoption and enforcement of building energy codes at low cost.³⁰

As in most states, there is some question whether builders pay attention to the energy code. The complexity of the codes and the fact that they address parts of buildings hidden from occupants makes it challenging for most owners to tell whether their building meets the codes. For this reason, enforcement of building energy codes by a trusted third party or government is an issue. Yet enforcement is expensive, and some consider enforcement to be intrusive to the building process, so adherence to building energy codes in most places is unreliable, demonstrated mostly by anecdotal evidence. An exception is in Burlington, where building energy code inspection is an integral part of the multi-family building inspection process, and the city actively enforces the code.

Vermont law provides for the customer and the building team (builder, contractors, architect, etc.) a “private right of action,” or the right to sue, in the event an otherwise acceptable building is later found to have been built to a standard below the code. This can be a deterrent to sub-code practices, but its real influence is unproven.

As standard building practices improve, state building codes should be updated. Model codes are updated regularly for this purpose. States can adopt rules or other practices to automatically reflect these changes, but Vermont codifies a code of a particular year and does not now have a functional way to automatically update to the most recent code. In these latter cases, the code comes to represent a standard of building practice that is inferior. This

³⁰Northeast Energy Efficiency Partnerships, *Economically Achievable Energy Efficiency Potential in New England*, May 2005, http://www.neep.org/files/Updated_Achievable_Potential_2005.pdf. Codes also promote health and safety of building occupants, notably with respect to indoor air quality and comfort.

report recommends that *Vermont adopt a process to automatically update building codes to current editions.*

Building energy codes reflect standard practice, not all cost-effective energy efficiency. From a long-run perspective, spending more on higher quality materials, equipment and practices can save a lot of energy in a cost-effective manner. A standard for energy efficiency programs like Energy Star Homes would provide incentives that produce buildings that exceed energy code in energy efficiency performance by 20%-30%. An additional service that can work with codes can call for a certified inspector to deliver a code compliance assessment, which provides confidence to the current owner and assurance to future owners.

B. Act 250

For buildings subject to the Act 250 land use permitting process, there is an opportunity to secure a more energy efficient result than pure reliance on the building energy code. Criterion 9f calls for the use of “best available technology for energy efficiency.”³¹ While this standard is sometimes consistent with building energy codes, in other instances, best available technology for energy efficiency exceeds the code. As applied in Vermont, these measures would be cost-effective from a long run, societal perspective, and represent building practices already in general use so there is a reasonable limit to the term “best available.” This high standard is an effective way to improve the quality of the state’s buildings.

Still, these incremental investments add to the first cost of a building, and so despite the benefit to the long run economics of the building, and the fact that retrofitting similar measures later will tend to cost more than to build them into the building at the beginning, these investments are sometimes resisted by Act 250 applicants.

An important way Criterion 9f is applied today is to rule out electric heat and to specify significant building insulation. Owing to Act 250, more than a generation of buildings has been built without electric heat and with significant building insulation.³² Act 250 proceedings address specific projects, and these decisions present opportunities to determine the meaning of “best available technology” in each case.

As with building energy codes, the meaning of the best available technology for energy efficiency changes over time, and the Act 250 process should reflect these improvements. Compared with building energy codes, best available technology exceeds this standard in many cases, and a customized analysis of a project is often the only way to apply a system perspective to a project.

Applying the Act 250 criterion for best available energy efficiency technology has the added benefit of reducing the burden on energy efficiency programs. As technology and practices

³¹ 10 VSA Section 6086.

³²This is a good example of addressing the “split incentive barrier,” in which the parties responsible for the initial construction of the building may not have a stake in its long term operating cost and may lack a market-based incentive to make the cost-effective investment, illustrating the value of regulation to step in and force that investment to occur.

improve after a building is finished, however, programs are still valuable to assist building decision-makers to make new cost-effective investments.³³ It would be unfortunate, however, to expend program resources on measures that should already be required by the Act 250 permitting process.

Is Act 250 delivering best available technology for energy efficiency? It is hard to answer this question because there is no systematic evaluation of results (as there is with energy efficiency programs). There is also no systematic effort for district commissions and the Vermont Natural Resources Board to maintain a current standard to interpret criterion 9f. This report recommends *a thorough review of the effectiveness of Act 250 to deliver best available energy efficiency technology*. This review should include an assessment of instances where best available technology exceeds the applicable building energy code, and should consider the extent to which this guidance can be published in a manual for use by Act 250 participants. Nor is there a training program for Act 250 applicants on expectations for interpreting criterion 9f. Such assistance could be cost-effective in improving the quality and consistency of applications, evidentiary records, and decisions. This report recommends that *such a training effort for Act 250 participants be implemented*. Recent developments in the use of Energy Star Homes program will clarify superior building practices and tend to improve the cost-effectiveness of any training programs.

C. Time-of-Sale Opportunity

Building energy codes can apply retroactively to pre-existing buildings. At the time of sale of a building, new financing is generally put in place and work is often done on the property, so there is an opportunity to bring an existing building up to the current energy code. Government can accelerate energy efficiency gains by placing a requirement that buildings be brought up to code at the time of sale, or within a modest period (one year is typical) thereafter. A time-of-sale requirement is most often applied to multi-family residential buildings, but could be applied eventually to all residential buildings or to all buildings. A multi-family time-of-sale code requirement has been adopted by Burlington.

A less burdensome alternative to requiring time-of-sale code compliance for some or all buildings that this report recommends is *for the seller to disclose to the buyer and the DPS the condition of the building as compared with the energy code*. Audits would be provided by the statewide energy efficiency service. This information could lead to energy efficiency investments and would generate information on the condition of buildings that would allow for a study of making time-of-sale code compliance required, and whether the right-of-action is a sufficient motivator for new construction compliance with codes.

D. Government Buildings and Leadership

Publicly funded buildings can demonstrate leadership by government in energy efficiency. These buildings include state and municipal buildings, including offices, schools, public housing, water, sewer and maintenance facilities. These buildings are often centerpieces in their communities. This report recommends that *Vermont set high energy standards for these*

³³To illustrate technology progress, the headquarters of the Federal Energy Regulatory Commission in Washington were built in 1994 to state-of-the-art energy specifications. Yet a 2007 retrofit of the lighting in the suite of one commissioner will provide the same or better light for less than half the energy.

public buildings, requiring energy efficiency performances exceeding the applicable code by 20% or more.

E. Summary of Recommendations

With a solid foundation for energy efficient buildings from building energy codes, Act 250 permitting, time-of-sale requirements, and higher standards for publicly funded buildings, energy efficiency programs can make a meaningful difference at a minimum cost to society by enabling further cost-effective investments. For example, an energy efficiency program that addresses a whole building might provide incentives for measures if the total effect in the building is 20%, 25%, or 30% more efficient than what the code would accomplish. Pressure on programs diminishes if Act 250 and government leadership produce buildings that exceed code.

This section recommends that Vermont should:

- Adopt a process to automatically update building codes to current editions.
- Conduct a thorough review of the effectiveness of Act 250 to deliver best available energy efficiency technology.
- Undertake a training effort for Act 250 participants on expectations for interpreting the energy efficiency criterion of Act 250.
- Require that sellers disclose to buyers and the DPS the condition of buildings as compared with the energy code.
- Set high energy standards for public buildings, requiring energy efficiency performances exceeding the applicable code by 20% or more.

Section 5: Expanding the Weatherization Assistance Program

A. Introduction

There has long been a serious problem of energy affordability among Vermont's low-income households, and the impact of rising fuel prices is now most acute in this housing category. This is true for three reasons:

- Energy costs comprise a higher percentage of household budgets for low-income families;
- The low-income housing stock tends to be older and less efficient than housing available to higher-income households; and
- Energy costs have been rising much faster than the average wages or retirement payments for lower-income workers and fixed-income seniors.

For these reasons, even if Vermont does not adopt a comprehensive approach to improve energy efficiency in buildings, the Legislature should consider significant expansion of the state's Weatherization Assistance Program and other efficiency programs for low-income households.

Vermont has for many years implemented a very successful program to weatherize homes occupied by low-income families at no cost to them. The Weatherization Assistance Program (WAP) provides several important benefits:

- Lowering household energy use and fuel bills by approximately 20% per treated unit;³⁴
- Improving comfort and living conditions for low-income families;
- Improving life safety and healthful living conditions both through better insulation and by resolving dangerous heating system risks;
- Reducing the need for fuel assistance and other forms of public assistance; and
- Reducing bill arrearages and bad debt problems for fuel dealers and utility companies.
- Providing highly cost-effective investments. Several in-depth studies of the weatherization program have been conducted. In general, these studies reveal that weatherization is highly cost-effective, returning 1.5 to 2 dollars in direct energy

³⁴ Dalhoff Associates LLC, *An Update of the Impacts of Vermont's Weatherization Assistance Program*, prepared for the Vermont State Office of Economic Opportunity, February 2007. Measured savings range from 13% to over 50% depending on building characteristics and heating fuel type.

cost benefits for every dollar spent on the program. For example, the Vermont Weatherization Assistance Program returned \$1.98 for each program dollar spent for energy efficiency measures in 2005.³⁵ When non-energy benefits, including health and life safety benefits are also considered, the total benefit-to-cost ratio is better than 5 to 1.³⁶ With today’s higher fossil fuel costs, the benefit-cost ratio will be even higher.

- An important advantage of the weatherization program is that the stream of benefits from an upgraded housing unit is long-lived, lowering heating bills and improving comfort and safety to one family or a succession of tenants over the period of a decade or more.

Since its inception, the WAP has been operated by community-based low-income weatherization agencies, initially supported by grants from the federal government. In 1990, following recommendations growing out of an investigation into low-income energy issues by the Public Service Board,³⁷ the Legislature expanded the program with the creation of the Weatherization Trust Fund. The Trust Fund is financed by a small Gross Receipts Tax (½%) on the sale of most non-transportation energy sources in Vermont: electricity, natural gas, oil, propane, kerosene, and coal. The Gross Receipts Tax is imposed on the sellers of these energy sources at the wholesale level, rather than as a sales tax on buyers at the retail level; for this reason the forces of market competition may reduce the amount of the tax that is actually passed through to end-use customers.

Table 5-1: Recent Annual Sources of Weatherization Assistance Program Funds

Federal Weatherization Program	\$1.3 million
Vermont Gross Receipts Tax	\$6.7 million
Efficiency Vermont: Low-income single-family	\$1.1 million
Efficiency Vermont: Low-income multi-family	\$0.2 million
Total	\$9.3 million

³⁵ See note 34.

³⁶ See note 34.

³⁷ Docket 5308, *Board investigation into the adoption and implementation of energy programs for low-income households* (opened July, 1989). –The Board’s final Order in that docket contains this summary: “Low-income weatherization program. Evidence introduced in this docket demonstrated that the Weatherization Assistance Program administered by the Vermont State Office of Economic Opportunity was a cost-effective means of reducing energy bills for low-income households, while increasing household comfort and safety. In response to dramatic cuts in program funding by the federal government, the Board worked with legislative leaders, program administrators, low-income advocates and utilities to create a stable, Vermont-based funding source for this program.

We recommended a small gross receipts tax on both regulated and non-regulated fuels, coupled with a tax credit option for utility efficiency programs that met the same program goals. The General Assembly adopted those recommendations in Act No. 272, *An Act Relating to a Home Weatherization Assistance Program* (1990), and extended the program in Act No. 262, *An Act Relating to the Fuel Gross Receipts Tax and the Home Weatherization Trust Fund* (1992).”

In recent years, the existence of the Weatherization Trust Fund has enabled the WAP program to serve many more households than it would have served if it depended on federal weatherization assistance alone. Since 2005, the program has received between \$6.0 to \$6.8 million per year from the state Trust Fund (83% to 85% of the program budget), and only about \$1.2 - \$1.3 million per year from the federal WAP program (15% - 17% of the budget).³⁸

The program now weatherizes about 1,450 low-income units per year, at an average direct cost of about \$4,400 in air sealing and insulation per unit served; other program costs, including heating system improvements and general administration, bring the total average cost up to roughly \$5,350 per unit.³⁹

B. Weatherization Program Administration

The WAP program is delivered to Vermont households through installation crews working for four regional Community Action Program (CAP) agencies and the Northeast Employment and Training Organization (NETO), as part of a coordinated program under grant agreements supervised by the Vermont State Office of Economic Opportunity (SOEO). The state allocates funds among these organizations based on a formula that includes heating degree days, population, and other factors. The WAP program employs approximately 80-85 people statewide distributed among several community and state agencies.

Administration through the CAP agencies and NETO provides some advantages. Those agencies are involved in the low-income community through a variety of other service and anti-poverty programs, so they are often in direct contact with the families and/or the housing stock most in need of weatherization service. This enables them to identify, reach out to, and enroll those most in need, and to take advantage of other assistance programs that complement the weatherization efforts.⁴⁰ They are also able to train and employ members of the community as members of the weatherization assistance teams. Because they are regional agencies, the program has some of the advantages of local presence and distributed administration.

There are some disadvantages to this arrangement, though. CAP agency salary levels are among the lowest in the industry, and trained weatherization installers are often able to make higher salaries in other building trades jobs, despite a strong loyalty to the mission. This leads to rapid turnover on the program staffs. Weatherization installers typically receive very high-quality on-the-job training in the WAP, and the program loses the benefit of this training when workers leave for higher salaries elsewhere. In addition, as part of the national weatherization program, the CAP agencies and NETO are subject to a variety of nationwide federal spending restrictions and program rules, many of which are inappropriate in Vermont's climate, and which have to be "worked around" through separate accounting rules for Vermont-based funding.

³⁸ Support for electric efficiency measures through Efficiency Vermont now provides almost as much funding for the program as the federal WAP grant. EVT's participation adds significant power bill savings to the fuel bill savings that have been the main focus of the WAP program.

³⁹ Personal communications with Jules Junker, State Office of Economic Opportunity, Nov. 2007 – Jan. 2008.

⁴⁰ For example, they can find housing assistance to fix a roof before WAP installs insulation in an attic, or to fix a chimney before installing a new furnace.

In recent years, an important aspect of the program is that it operates on a “whole-house” basis, combining building shell and weatherization services with furnace/heating system improvements, and with electricity efficiency programs funded through Efficiency Vermont. EVT’s financial assistance and program offerings are delivered to weatherization customers through the trained WAP program contractors. This has allowed the WAP program to leverage funds available through the utility efficiency programs and thus deliver greater savings to low-income households. This is also important from the point of view of the program’s clients, who receive a full package of energy savings through a single point of contact and with a minimum of red tape and administrative complexity. A related important lesson is that by lowering the barriers to customer participation, the two programs – weatherization and electric efficiency – improve the cost-effectiveness of both programs by making the most of each substantive customer contact.

The WAP program also works cooperatively with Vermont’s fuel dealers. Local fuel dealers know the consumption characteristics of many housing units, and over time are able to identify units that are likely to be in need of weatherization assistance. Local fuel dealers are often the “first call” when a furnace is in bad condition or has failed, and they are aware of the households that are unable to pay their fuel bills as the heating season progresses. Fuel dealers also work closely with the WAP program, providing emergency furnace repairs and replacements under contracts with the WAP program providers, financed by about \$650,000 in the WAP program budget.⁴¹

C. Need for an Expanded Weatherization Assistance Program

Since 1993, approximately 18,300 homes have been weatherized through the program, which has lowered the heat bills and improved the lives of thousands of Vermont families. Since federal assistance for weatherization is extremely inadequate, it is obvious that state action is necessary if we are to improve the energy fitness of Vermont’s low-income housing stock.

Unfortunately, the number of untreated low-income units greatly exceeds the number of units that the existing weatherization program could ever address. To give an idea of the magnitude of the problem:

- Vermont has, on average, some of the oldest housing stock in the nation; a large fraction of housing units in the state were built before modern insulation materials and techniques were available. Many of those older units have depreciated or deteriorated over time.
- Due to severe historic funding constraints, the WAP program has traditionally been limited to serving units occupied by very low-income families. Before 2005 the cut-off level for weatherization assistance was 150% of the poverty level, well below the levels set for access to many other social service programs. To address this problem, and make the program available to more of the working poor, in April 2005 the income level for qualifying for the weatherization program changed from 150% of poverty level to 60% of state median income. This raised the cut-off level for a

⁴¹ Fuel dealers are certified to install and service boilers and furnaces, and do so under contract with the WAP agencies.

family of four from about \$31,000 to \$42,829, which significantly increased the number of families and housing units that would qualify for participation in the WAP program.⁴²

- According to the most recent American Community Survey data from the U.S. Census, there are approximately 254,000 occupied housing units in Vermont. Of these households, there are 62,000 households with incomes below \$25,000, and more than 67,000 households with incomes at or below 60% of state medium income. Excluding units that have already been weatherized, weatherization program managers estimate that there will be about 49,000 housing units in Vermont that are still eligible for weatherization assistance in 2008.⁴³ At current program activity rates, the program is treating less than 3% of the eligible units each year, and it would take 35 years to provide even minimal assistance to all of those units.
- However, even if the current program were continued for 35 years, it would not meet the weatherization need since new low-income households would be added to the state, some already-treated homes will merit further investment, and because the entire stock of housing, especially low-income housing, will continue to depreciate over time.

D. Recommendations for an Expanded Weatherization Assistance Program

From the data above, and based on the success of Vermont's weatherization program to date, we conclude that the WAP program could be greatly expanded, and that it would be both cost-effective and equitable to do so. Fortunately, Vermont has good programs to build on, including the Vermont Weatherization Trust Fund, the CAPS and NETO that deliver weatherization services, and the utility-sector efficiency programs, now administered by Efficiency Vermont, Vermont Gas Systems and Burlington Electric Department.

Principal recommendation: *The Legislature should establish a goal and stable funding mechanisms to comprehensively improve the energy efficiency of the largest possible fraction of the low-income housing stock over the next decade. Those goals should be specific, and at a minimum should be to reduce total energy use in at least 2,500 qualified low-income housing units per year by an average of at least 20% per unit.*

Improving electric and fuel efficiency in at least 2,500 low-income housing units per year will capture savings from about 1% of Vermont's existing housing stock, or about 5% of the eligible low-income housing stock per year over the course of the next decade. However, treating a large number of units should not be accomplished by "cream-skimming" on efficiency measures or avoiding hard problems in those units that are weatherized.

How can this be accomplished? In general terms,⁴⁴ the essential elements are as follows:

⁴² For comparison, this is roughly 200% of the poverty level income for a family of four.

⁴³ Communication from Jules Junker, Vermont SOEO, January 7, 2008.

⁴⁴ This report is not intended to address the many detailed issues inherent in expanding the weatherization program, which would need to be dealt with by SOEO, the regional agencies, Efficiency Vermont, and other

- **Administration:** The low-income program should build on existing implementing agencies and arrangements.
 - Efficiency Vermont, Vermont Gas, Burlington Electric Department, fuel dealers, the four CAPs and NETO should continue to work in a coordinated way to provide a single point-of-contact for each owner or family receiving assistance.
 - The CAPs and NETO should expand their delivery of weatherization services, with implementation success subject to monitoring and verification by independent evaluations under direction of the Public Service Department.
 - The State Office of Economic Opportunity should continue its historic role as the coordinating and supervising authority for the four CAPs and NETO and supervision of the Weatherization Trust Fund to deliver weatherization services.
 - Under supervision of the Public Service Board, Vermont Gas Systems should accelerate its deployment of efficiency services to low-income households.
 - The system of contracts between Efficiency Vermont and the weatherization agencies should be continued as a formal means of coordinating customer contacts and service delivery, and ensuring accountability for program funding.

- **Funding** for the expanded Weatherization Assistance Program should be provided from three sources:
 - The Public Service Board should ensure that VGS is able to support all cost-effective *natural gas efficiency* measures in the weatherization-eligible units served by natural gas;
 - Costs of all low-income *electricity-related efficiency* measures, as well as contractor training, inter-agency coordination, and marketing, can be assigned to Efficiency Vermont and supported through receipts from the Energy Efficiency Charge (EEC), under supervision of the Public Service Department and Board.
 - The principal financial costs of the weatherization program are the major costs of air sealing, insulation, furnace repairs and upgrades. The increase in these costs due to the larger number of units served should be paid for through increased receipts to the Weatherization Trust Fund. These increases should come from broad-based funding sources, including the General Fund, or through an expansion of the Fuel Gross Receipts Tax.

In addition to the absolute availability of funds, weatherization faces one other persistent funding challenge. Since its inception, the WAP program has had to deal with the inherent tension between the long-term bill reductions made possible by investments in weatherization, and the short-term fuel assistance needs of low-income households. The Weatherization Trust Fund was established, as a parallel to LIHEAP and other *fuel assistance* efforts, to promote the fiscal discipline needed to invest in long-term savings rather than short-term bill support, even though there are always pressing short-term needs among low-income households. In recent years, some of the funds available for weatherization have been diverted from the Weatherization Trust Fund to support short-

partners. Indeed, we are aware that the Governor has asked Vermont's OEO to prepare a strategic plan for an enhanced Weatherization Assistance Program. Legislative adoption of the overall recommendations of this report would provide explicit support for such a concerted effort.

term needs for fuel assistance through the LIHEAP program. Approximately \$5 million has been taken from the Trust Fund – roughly \$1 million in FY05, \$3.5 million in FY06, and \$400,000 in FY07⁴⁵ It is crucial for the Legislature to recognize, on an ongoing basis, that diversions of funds from the Weatherization Trust Fund will undermine the state’s ability to permanently reduce fuel bills for low-income families. If the goals of the weatherization program, and the state’s overall fuel use reduction goals are to be met, a secure funding base for weatherization must be maintained.

*Table 5-2: Possible Funding for Expanded Low-Income Efficiency Programs (2012 snapshot)**

Expenditure category	Units per year	Annual cost	Sources of funds
Natural gas- low income	Up to 200	~ \$1 million	VGS rates
EVT – Electric EE, training, marketing & coordination	All	\$2.5 million	EEC
Weatherization agencies	2,300	\$12.5. million	Weatherization Trust Fund
Totals	2,500+	\$15 to \$16 million	VGS rates, EEC, Weatherization Trust Fund

*Note – As shown here, direct provision of weatherization services by VGS services meets a meaningful fraction of program goals, and would reduce VGS’s payments into the Weatherization Trust Fund.

Summary of recommendations

1. The Legislature should establish a statewide goal to gradually increase the number of housing units served by the low-income weatherization program to a total of 2500 units per year by 2012 and 3000 units per year by 2016, with an overall goal of serving at least 23,000 eligible low-income units between 2008 and 2017.
2. The Public Service Board should ensure that Vermont Gas Systems has adequate revenue in rates to serve the cost-effective efficiency needs of its customers, with particular attention to accelerated service in low-income households, including weatherization services.
3. Legislation should provide stable funding sources for the Weatherization Trust Fund adequate to meet these goals, and should ensure that those funds are not diverted for other purposes.
4. The State OEO, weatherization agencies, VGS and EVT should examine current state rules on expenditures from the Weatherization Trust Fund to ensure that maximum cost-effective use is made of weatherization opportunities, and that attainment is not unnecessarily constrained by federal weatherization rules.

⁴⁵ Interview, Elizabeth Chant, Champlain Valley OEO (January 8, 2008).

Section 6: Creating a Statewide Service to Deliver Fuel Efficiency to Building Owners on a Whole-buildings Basis

Vermont's experience with energy efficiency is valuable and provides significant guidance when designing delivery of comprehensive energy efficiency services for Vermont buildings. While there are different approaches that are workable, some ideas may be superior when applied to Vermont. An over-arching objective is a system that is customer-focused, recognizing that it is customers who make the decisions to improve the energy efficiency of their buildings. Experience indicates that a structure that is designed primarily for the convenience of program administrators will be inferior.

A. Design Criteria

Evidence is clear on a number of points important for the design of energy efficiency programs, and these represent important touchstones for making choices about programs and program administration:

- Existing buildings of all sorts in Vermont have a large and cost-effective potential to save energy and lower bills while maintaining or improving the comfort and usefulness of the space, as described in the GDS potential study;
- These potential savings are in regulated energy forms (electricity and natural gas) and unregulated energy forms (fuel oil, propane, wood, etc.);
- Current regulated efficiency programs for electricity are able to address some end uses served by unregulated energy forms, but only when these savings are incidental to acquiring electric energy efficiency. Conversely, in situations where Efficiency Vermont is in a building addressing electric efficiency and there are comparatively large fuel oil or propane savings elsewhere in the building, Efficiency Vermont often points out these savings to customers, but does not offer incentives or financial analysis to help them get implemented. Thus, many efficiency opportunities are lost under present circumstances;⁴⁶
- Vermont has a well-developed capacity for energy efficiency administration and service delivery notably associated with the low-income Weatherization Assistance Program, Efficiency Vermont, Vermont Gas Systems, and other utility programs and infrastructure that can be applied to an expanded mission, though a dramatic increase in services could be limited by the rate at which the trained workforce can grow;
- Consistent with placing the customer first, programs should target the **barriers** to energy efficiency that block routine action by specific segments of customers – in other words, programs should be targeted to specific segments of buildings

⁴⁶This is due to a concern for nexus between the source of funds (electricity customers) and the electric system benefits that derive electric energy efficiency. Policymakers could decide, as is the case in other states (e.g. Rhode Island) explicitly to allow electric utilities to acquire non-electric energy efficiency savings.

- (residential, stratified by income and location, and commercial of distinct types) and building decision-makers (builders, owners, renters, permitting authorities);
- Customers should have many familiar ways to access standard energy efficiency programs and services (through retail outlets, energy providers, contractors and architects, the Internet, easy responses to marketing and advertising, etc.), but there should be a coherent organization of these services to assure that customers are getting consistent messages and consistent quality and a “one-stop shop” design should be in place wherever possible;
 - Liquid fuel dealers are experts in “basement equipment” – furnaces, boilers and water heaters – while others are experts in building envelope design and installation. The statewide service should bring these experts together to increase the rate of installation of more efficient heating and building systems;
 - Liquid fuel dealers are also aware of customers more likely to benefit from energy efficiency investments based on their knowledge of customer usage history;
 - The ways to “sell” customers on energy efficiency and the ways to raise funds for energy efficiency are distinct – the combination of information assistance and incentives should be driven primarily by getting the best savings results from customer actions;
 - There is some critical mass for any energy efficiency program – financial and administrative support should be at least enough to support such a critical mass, or else the program will be wasteful of public funds;
 - Services should be designed to be continuously available – implicit in this design is a set of incentives that will create a steady flow of clients throughout a budget year, while avoiding a situation where all incentives available in a year are expended months before year end, and also avoiding a situation where incentives are inadequate to produce a significant reaction by customers;
 - Oversight of energy efficiency programs is critical to their long-run success. These programs spend significant monies in a variety of ways in the interest of producing measurable and sustained reductions in energy consumption, and also produce private benefits for participants. Therefore, it is important for society and for public confidence that a system of accountability is in place, as it is for regulated electric and gas energy efficiency programs, to assure that funds are well-spent for real gains;
 - Vermont Gas Systems successfully delivers energy efficiency services today, with routine coordination among the Weatherization Assistance Program and Efficiency Vermont. These relationships work well and suggest ways to develop participation by liquid fuel dealers;⁴⁷

⁴⁷This report recommends an increase in Vermont Gas Systems’ energy efficiency programs, but no change to the administration associated with those programs.

- Energy efficiency programs will have a beneficial effect on the state’s carbon goals – and it is important to set realistic goals for carbon savings that are connected to the financial and program resources available;
- A key element of Vermont’s successful experience with energy efficiency is placing the customer first and building a program around maximizing value while minimizing barriers to participation, remembering that **the decision to make energy efficiency investments** (whether as part of a program or not) **rests with the customer** – issues associated with administration, coordination of administrators and contractors, fundraising, oversight, etc. are irrelevant to the consumer;
- Finally, energy efficiency is about getting the same or better service while using less energy, and in the long run paying less money – an efficiency assessment of a building can lead to greater comfort, productivity and satisfaction while also saving cash.

Lessons learned about financial incentives: cash and loans

During the past two decades, efficiency programs have used loans and rebates to market to and assist customers to make energy efficient investments. This experience is useful in considering how these tools will be used here.

Cash incentives have many advantages. They soften the financial hit at the moment the customer is feeling it. Cash has a track record of grabbing the attention of customers. Customers are left with the freedom to decide how to manage their funds, and there are no relationships to manage, as there is with a loan.

A loan also has advantages, especially if the interest rate can be reduced to zero. Zero-percent financing can particularly grab the attention of customers, keeping in mind that many customers have home equity loans or other market rate alternatives that they are not using for energy efficiency now. Program experience will lead to more sophisticated ways to set interest rates for routine and promotional purposes. Customers pay for the loan out of the savings, and accrue the benefits of below-market interest rates, if available, over the life of the loan. Loans to residential customers tend to be small, \$10,000 or less with an average of \$6,000 -- \$8,000, so it is critical that they have standard terms to reduce servicing costs.

A loan should not be offered as an alternative to a cash incentive, but they can work together. A program can offer a cash incentive, say, \$500 toward a new furnace, that represents a percentage of the incremental cost. A loan with an attractive interest rate over, say, a four- or five-year period can make the remaining cost of this large purchase more manageable.

Those with direct contact with customers (liquid fuel dealers, Efficiency Vermont, weatherization contractors, for example) can be trained to be a gateway for the loan process. Loans can be serviced by a state entity, like VHFA, or by a bank or other financial services contractor that could be competitively selected. Alternatively, lenders could be screened by the program administrator for their acceptance of standard loan terms and conditions and their willingness to work with borrowers of lower credit quality and other vital terms.

Experience indicates that loans are useful in specific contexts, while cash is appealing nearly all the time.

B. Market Segments

To retain simplicity, services should be targeted to serve a few distinct populations or market segments. Homes qualifying for the Weatherization Assistance Program are one obvious segment. Efficiency services must be designed and delivered specifically for households in this category. (See Section 5.) For other **residential single family homes**, program administrators can choose to make a distinct offering to these families, or segment middle and upper-income families. **Multi-family rental housing** has distinct needs and is such an important population that it will require a distinct set of services. **Commercial property** would be the focus of a distinct service.⁴⁸ It is outside the scope of this report to present detailed program designs, which should in any event be left to the implementing entities (and adjusted over time as they gain market experience), but to set out basic policy choices and structural elements central to potential enabling legislation.

C. Administration

Government must pay attention to the administration of an energy efficiency program to assure the right balance of the many social issues involved. In addition, markets and independent customer action are incompatible with energy efficient investment in many cases.⁴⁹ Policymakers are naturally concerned that a system uses public and private funds in an honest way, and in an intelligent and competent way that produces significant energy savings. There may also be concerns about assuring that benefits flow in acceptable proportions to key customer groups, such as low-income customers, or small commercial customers. Investment in administration at the front end pays dividends with smooth operation later. Who should administer the delivery of statewide comprehensive efficiency services? This reports concludes that *service coordination should be performed by the Weatherization Assistance Program for low-income households, and by Efficiency Vermont and Vermont Gas Systems for Market Residential and Commercial buildings*. The major options, including a state-agency option are discussed below.

EFFICIENCY VERMONT

In 2000, Vermont utility regulators supervised the creation of Efficiency Vermont. This entity was created to deliver energy efficiency service throughout Vermont.⁵⁰

⁴⁸Public buildings, as a subset of commercial buildings, may increasingly have the opportunity to work with energy service companies (ESCOs), which profit from performance contracts that split savings produced by their energy efficiency expertise between the ESCO and the customer. Honeywell recently provided ESCO services to the City of Montpelier (see Section 2).

⁴⁹This is not a criticism of markets, but simply a reality borne out by decades of experience that gave rise to the energy efficiency programs already in place.

⁵⁰Municipal utilities and cooperatives were given the opportunity to opt out of the statewide effort and deliver comparable services – Burlington Electric Department is the only electric utility that takes advantage of this opportunity.

Electric customers pay the cost for Efficiency Vermont's energy efficiency services, which all pass a cost-benefit test. The services are designed chiefly to produce electric savings, which reduce the long run need to acquire new power supplies, transmission lines and other growth-driven investments in the power sector.

But in many instances, an assessment of a customer's premise also reveals significant cost-effective non-electric energy savings potential. This means energy savings for an end use, like space heating or water heating, currently using fuel oil or propane.⁵¹

What is Efficiency Vermont?

Efficiency Vermont is a brand created and owned by the state of Vermont. Its purpose is to deliver quality energy efficiency services to the entire state in a coordinated way. An entity of this nature is explicitly authorized in statute. A contractor selected in a competitive process supervised by the Public Service Board delivers the service. Presently, the contractor is Vermont Energy Investment Corporation (VEIC), a Vermont-based expert in energy efficiency. VEIC won the first six-year Efficiency Vermont contract, and then won the second Efficiency Vermont contract, which is currently in place.

VEIC and the PSB negotiated contracts to include significant performance goals and incentives. The goals represent public policy objectives consistent with the statute and sound management incentives. If a goal is not met, funds reserved for incentive payments become available for energy efficiency.

Funds for Efficiency Vermont activities are collected by the utilities through a charge on all electric bills. A fiscal agent under a contract with the Public Service Board collects these funds from the utilities, accounts for them, and disburses them to Efficiency Vermont for appropriate costs.

Regardless of the identity of the contractor, Efficiency Vermont retains all information about customers and its services, so a change in contractor would lead to little or no disruption in service.

Burlington Electric Department retained the opportunity to deliver comparable programs and continues to do that while cooperating with Efficiency Vermont. Other electric utilities rely on Efficiency Vermont to deliver energy efficiency services to their customers.

Efficiency Vermont has had to develop a policy, in consultation with its regulators, on what to do in this situation. One variation of this situation works well – this is where the building qualifies for the low-income Weatherization Assistance Program, referred to in the previous chapter. In this instance, Efficiency Vermont and the local Weatherization delivery services work together for the benefit of customers. In many cases, the local Weatherization team delivers the efficiency services for the whole house, and Efficiency Vermont pays the cost of delivery of qualifying electric efficiency measures as part of a whole-house service. This approach has allowed the Weatherization Assistance Program to provide better and consistent services to more homes than would be the case without this cooperation.⁵²

⁵¹Vermont Gas Systems programs cooperate with Efficiency Vermont to procure comprehensive energy efficiency results.

⁵²This cooperation started when electric energy efficiency programs were delivered by utilities, and regulators wanted this to be continued with Efficiency Vermont.

What about other buildings? Based on our observation, Efficiency Vermont will attempt to capture these savings in unregulated end uses if there are also significant electric savings in the building, and the overall investment still meets the cost-benefit test threshold. In many other cases, however, where Efficiency Vermont sees that there are few added electric savings available but significant savings to unregulated fuels, they can offer some parting advice on what the owner can do, but then they exit.⁵³ Figure 6-1 is a rough conceptual representation of Efficiency Vermont’s interaction with building owners in capturing non-electric energy efficiency.

Figure 6-1: Conceptual Representation of Efficiency Vermont’s Capture of Non-Electric Efficiency (except for weatherization-qualified residences)

	Homes with Big Electric Efficiency Savings	Homes with Small Electric Efficiency Savings
Homes with Big Liquid Fuel Efficiency Savings	<u>Some</u> Acquisition of All Energy Efficiency	<u>Little or No</u> Acquisition of Liquid Fuel Energy Efficiency
Homes with Small Liquid Fuel Efficiency Savings	<u>Good</u> Acquisition of All Energy Efficiency	<u>Little or No</u> Acquisition of Liquid Fuel Energy Efficiency

A customer-oriented perspective drives consideration to expanding the mission of Efficiency Vermont (EVT) to deliver comprehensive energy efficiency services. Here are some attributes of EVT developed since its inception in 2000.

- One of the most important advantages of Efficiency Vermont is its statewide coverage, statewide brand identification, and single point-of-contact for Vermonters needing information or services. Customers know the brand “Efficiency Vermont” and this single brand is helpful in selling efficiency to consumers;
- EVT is experienced in delivering programs using Home Performance with Energy Star, a national standard in a whole building approach to procuring energy efficiency across the full spectrum of residential buildings;
- The State of Vermont already has in place a thorough system of oversight and accountability for EVT’s services through the Public Service Board, the Department of Public Service (for savings verification and program evaluation), and an advisory board. Public officials, stakeholders, and EVT have developed a performance-based regulatory system for EVT that has been quite successful in focusing the program on ever-higher efficiency and effectiveness targets.⁵⁴

⁵³EVT could be administered with more flexibility to allow Efficiency Vermont to acquire comprehensive energy efficiency savings.

⁵⁴Like any large and fast-growing operation, Efficiency Vermont undoubtedly has room for some improvement, but its overall performance has been rated excellent in repeated reviews, and by outside experts. EVT has received numerous awards from the US EPA, US DOE, ACEEE and other expert groups for nationally-

- EVT already packages together comprehensive (whole-buildings) and customized offers to business customers or multi-family housing owners, combining the financial and technical tools in their toolbox;
- EVT manages a statewide database of customers and tracks the efficiency improvements to buildings over time, which is useful in managing customer relationships;
- EVT has built an established organization for essential program design, customer contact, and evaluation services, and assures that expertise stays in Vermont in the form of its employees, who are paid competitive salaries;
- EVT has built relationships with the community of interests associated with delivering energy efficiency, including trade allies, utilities, builders, architects, engineers, weatherization providers, equipment suppliers and retailers;
- EVT can maintain consistent standards for audits, employee certification, customer advice and, importantly, incentive packages that implement public policy preferences and treat all customers fairly;
- EVT ensures quality control for the benefit of customers, overseeing a significant amount of implementation work, most of which is done by independent contractors. Throughout the state, the roster of independent contractors implementing efficiency upgrades includes independent fuel dealers and HVAC contractors upgrading furnaces and heating systems; and independent builders and contractors, including affiliates of local weatherization providers installing building shell improvements and insulation services;
- EVT and other utilities have the backing of pre-certified loan administrators (this is discussed later);
- As a privatized service with goals defined by public policy, EVT is not controlled by government hiring and budgeting rules, enabling it to be more nimble than a government administrator.⁵⁵

Efficiency Vermont has the elements of a successful comprehensive energy efficiency delivery system. A different administrator would have to recreate these elements.

superior performance in delivering energy efficiency, and is widely recognized as one of the most successful efficiency delivery models in the world. Equally important, the regulatory oversight structure in Vermont produces results in excess of goals and promotes improvement as lessons are learned.

⁵⁵By way of contrast, Efficiency Maine (which is run directly by the state utilities commission) took a significant amount of time owing to state rules just to hire a second staff person. The strategy in Maine is to administer contractors to manage and deliver services, as compared with Efficiency Vermont, which internalizes significant management and delivery service, while contracting for specialized services. The new state energy utility being developed in Delaware is expected to be a private organization directed by a board with public and private members.

COORDINATION BETWEEN EVT AND VERMONT GAS SYSTEMS

Vermont Gas Systems administers its own energy efficiency programs for its customers in Chittenden and Franklin Counties, providing a range of prescriptive (the same basic deal for all) and custom services.

Vermont Gas Systems program administration should not have to change, and the nature of coordination that exists today with Efficiency Vermont would continue to evolve with lessons learned. In addition, customer relationships with the liquid fuel dealers would serve as a gateway to energy efficiency services. Programs may provide prescriptive incentives for furnace/boiler replacement (as is the case with Vermont Gas) that could be sold and serviced by the liquid fuel dealers, as well services for the balance of the building.

Vermont Gas Systems Retrofit Program Details

- Increase annual number of residences receiving retrofit energy efficiency services from VGS and its HomeBase program from roughly 150 to 500 over the course of ten years.
- Retrofit 4,000 residences from 2008 – 2017.
- This report estimates the average cost to VGS customers per residence is \$1,850 – this cost would be included in VGS rates.

This report recommends that the scale of the VGS energy efficiency program to retrofit existing homes be more than tripled, from 150 residences each year at present to 500 each year by 2017.

Vermont Gas Systems Prescriptive Incentives

Vermont Gas Systems offers its Equipment Replacement Program. Equipment with high efficiency ratings, higher than business-as-usual, qualifies for rebates of varying amounts. For example, a VGS customer installing a hot air furnace with a rated efficiency of 90% to 92% will get \$150. Furnaces with higher ratings yield a \$300 rebate. Hot water boilers, steam boilers, water heaters and other equipment also qualify if they exceed threshold efficiency ratings.

Over time, VGS seeks to lower rebates, or raise efficiency ratings as business-as-usual changes.

Regarding oversight, the Department of Public Service remains in a good position to oversee monitoring and verification of results of an expanded whole-buildings efficiency service. The Department's historic expertise and responsibility extends to all fuels. To provide regulatory oversight, the Public Service Board authority would need modification, as the revised scope of Efficiency Vermont services would go beyond regulated utility service. It is not apparent that there are any aspects to this oversight task that would be beyond the capability of the PSB, however, were they given the task. The beneficial "arms-length" relationship between the administrator and the state would remain generally as it is.

STATE AGENCY ADMINISTRATION OPTION

There is an alternative to an expansion of Efficiency Vermont's energy efficiency administration duties to cover all end uses. State government could directly administer the

program as part of a state agency's line obligations. One way this could work is to expand the scope of the Weatherization Assistance Program, which is housed in the Agency of Human Services State Office of Economic Opportunity and which was discussed in some detail in Section 5. Some aspects of this option include:

- The AHS Weatherization staff is expert in most residential end uses, but experience with commercial customers beyond multi-family housing is less clear. Efficiency Vermont would still need to be involved as a service provider and customer gateway. Liquid fuel dealers would also be an important customer gateway, regardless of the administrator;
- It is unclear how statewide customer awareness would be accomplished in a way that would not cause overlap and potential confusion with Efficiency Vermont. If the brand and entry point for the public is the local weatherization agency (for heating and building shell issues) and Efficiency Vermont (for electricity issues), marketing would have to raise awareness of at least two entry points in each part of the state. Alternatively, all of the agencies could cooperate on creation of a single brand and entry point (perhaps the "Efficiency Vermont" brand) but in that case it is unclear why this should be housed in AHS. There is potential for confusion that would have to be addressed between the organization that operates Efficiency Vermont now, VEIC,⁵⁶ and the AHS administered work.
- If the Market Residential and Commercial buildings efficiency service were developed as extensions of the WAP, community weatherization service providers would need to expand their capabilities well beyond low-income housing. In some cases, this is already occurring, as some of these local experts are leveraging their expertise and delivering some efficiency services for full fees to middle and upper-income homes. If the weatherization providers were to provide full services to these homes, this trend would have to accelerate. In addition, the current weatherization providers are skilled in residential efficiency work, but do not have experience with commercial properties, or with contractors and auditors who work on commercial buildings.
- Creating a statewide market-oriented efficiency service in the weatherization agencies would raise some administrative challenges. It is unclear if inconsistencies among the varied local weatherization program delivery systems in Vermont would need to diminish to support a broader statewide mission. In addition, these providers would have to address the relatively lower pay-scale in place for weatherization installers, and to hire more highly-trained analysts for multi-family and commercial services. Other administrative challenges could exist too, such as managing customer data from many more customers, developing a marketing capacity and web presence, etc.
- Oversight of an AHS-administered program would look different, as the state would be overseeing itself, and it is unlikely that the DPS and PSB would play a regulatory role in oversight of another State government department. It appears likely that there

⁵⁶Vermont Energy Investment Corporation has operated Efficiency Vermont under a contract with the Public Service Board following competitive solicitation consistent with Vermont law.

would be more pressure on the Legislature to monitor program administration, and pressure in the appropriations process to use efficiency funds for other purposes. State rules for budget and hiring have affected the performance of state energy efficiency programs in other states.

D. Loan Administration

However service delivery is administered, a key objective of the comprehensive statewide efficiency effort is to maximize the use of customer funds to secure cost-effective efficiency investments. With cost-effective energy efficiency installations costing \$5,000 to \$10,000 or more, a lack of cash on hand can lead to a lost opportunity. Loans are an important way to draw customer funds to energy efficiency investments by reducing the amount of public funds needed to stimulate long-term savings, and by not requiring customers to pay for upgrades all at once. To achieve the savings and financial objectives in this report, consumers will need to pay roughly two-thirds of the cost of energy efficiency services, and a significant share of this can come from loans.

Our interviews indicate that the needed *capital* to support loans is available, provided that lender risks are moderated or shared through a risk pool. The challenge is to create a loan application and servicing system that is simple for customers, originators, and service organizations. This suggests a process that can be explained by the person dealing with the customer – that is, the liquid fuel dealer, the weatherization or heating system retailer, the builder, or Efficiency Vermont -- and that can be initiated through a standardized, common application.

Including attractive financing in the package helps to assure that customers act on the audit information (of course, customers can always obtain their own financing). Credit quality for the population that may be seeking loans will range from excellent to poor, so credit counseling will need to be available to minimize defaults and the size of a default reserve. An entity that can stand behind these consumer gateways to administer a loan program would be a good way to support the work of the program administrator and service providers.

Keys to Effective Loan Administration

- Capital Available
- Lender Risk Minimization through Risk Pooling or Other Means
- Consistent Application and Terms to Lower Transaction Costs
- Several Possible Loan Servicers
- Interest Rate Management

Vermont has two entities associated with state government that are well-situated to service loans, the Vermont Housing Finance Authority (VHFA) and the Vermont Economic Development Authority (VEDA). VHFA already manages loans associated with residential property, and has experience with loans associated with energy efficiency. VEDA already manages a range of financing types for Vermont businesses of all types. Naturally, these entities will incur costs to service energy efficiency loan portfolios and will require fees to

address these costs. VEDA and VHFA could also provide a secondary market (using state-issued bond proceeds) for the loans originated by banks or credit unions.

Nevertheless, the state may wish to consider a competitive approach to assigning this task. Credit unions, commercial banks and other financial institutions may have attractive attributes, including attributes particularly suited for servicing energy efficiency loans.

There are multiple possible sources of capital for loans. Commercial banks or credit unions may choose to make capital available, either for commercial opportunity, or to address their public service obligation that is part of their charter. Alternatively, or in addition, the state could issue a bond that could be used for energy efficiency loans.

Key Assumptions about Energy Efficiency Loans

- Consumers provide roughly two-thirds the cost of energy efficiency
- Capital is available for loans if conditions for lenders are favorable
- A significant interest rate reduction may be needed, sometimes all the way to zero percent
- Loans cannot compete with grants or rebates – these must complement each other for loans to be useful

Energy service companies could be drawn to Vermont if bad debt risk could be offloaded (most likely to the state), and aggregation of loans could bring the dollar level into million dollar increments pooling risk while minimizing transaction costs. This last option would be a new model for generally available energy efficiency services.

Energy efficiency loans may need to be below market interest rates to be successful. In this event, funds will be necessary to offset or buy down the market level starting rates that capital sources will expect. The amount of these outside funds will depend on the size of the interest rate buydown, and popularity of the loan program. The next section, Section 7, considers a financial plan to accomplish the savings goals recommended in this report. Administrators can choose to balance the allocation of public monies toward grants and rebates on the one hand, or loan interest rate reductions on the other hand, in such a manner as to optimize the results.

E. Upgrading Buildings: Steps In The Process

Users of this report may appreciate a tangible idea of what energy efficiency programs focusing on unregulated fuel end uses are likely to do. Each element below addresses and solves barriers that prevent customers from making cost-effective energy efficient investment on their own. Most people can find at least one hindrance that they can identify with. These barriers are the targets of existing energy efficiency programs, so this is really a refresher on what energy efficiency programs already do as well as an explanation of what the statewide comprehensive efficiency service would do. Here is a summary of the steps and other components of the process:

- a) **Marketing, outreach, customer acquisition** – Without a sufficient body of customers interested in the value of services, these services are doomed. Marketing, outreach and customer acquisition addresses an important, initial barrier: **awareness**. The program administrator will want to create a statewide buzz about energy efficiency that will promote specific offerings. For specific services, specific populations will be targeted, like builders and architects, or customers actively considering remodeling their building. Staff with skill at “closing the deal” are useful to assure that development work leads to energy savings.⁵⁷

Key Barriers to Energy Efficiency

- Insufficient customer motivation and awareness
- Lack of knowledge of what to do, how to get it done, and who can do a quality job
- Insufficient cash on hand
- Perception of expensive price tag
- Long payback period and customers’ high discount rates
- Split decision-making among builders, owners and occupants

- b) **Building energy audits and analysis** – Because many people do not see their building as a system, or know how that system really works, an energy audit by a professional can be an eye-opening experience.⁵⁸ A well-run program will screen audit requests to give highest priority to building owners more likely to take action, but will provide audits for a fee to any eligible owner on request. A “whole-buildings” audit will evaluate the use of all energy sources and recommend a suite of improvements with priorities for the owner to consider. The report would have information about the cost-effective improvements that can be done to the building and is an important start to the customer’s thinking about making a personal investment in energy efficiency. Audits also generally provide ideas about the most effective investments or changes in the way the customer uses the building, and cost.

Audits cost several hundred dollars, so it is desirable to maximize the number of audits that turn into energy efficient investments. One way to do that is to offer audits to customers who are likely on the verge of investing; “trade allies,” such as building contractors or home stores, can refer such customers. Audits are sometimes provided at the customer’s cost, which can be rebated if the customer chooses to implement a significant portion of the recommended efficiency upgrades.

Experience indicates that treating the typical house will produce 20-30% in energy savings, and that many older houses can see 40%-50% reductions in consumption and

⁵⁷Market transformation refers to bringing consumers to the point where they are self-motivated to do the rest of the steps themselves and make the investment without the need for incentives. To the extent energy efficiency programs cause this transformation, the resulting savings are known as “Free Driver” savings. Conversely, to the extent that some consumers were already motivated to choose the efficient option, but are also happy to take advantage of information and incentives offered, these savings are known as “Free Rider” savings. Benefit-cost analyses factor in these opposite effects.

⁵⁸With the use of thermal imaging and blower door tests to show the exact locations of heat losses, it can be almost literally eye-opening.

bills. The amount of gain depends a great deal on the condition of insulation and sealing, as well as the efficiency of equipment that might be replaced. Many Vermont buildings are poorly insulated, according to many we spoke with, and as documented in the GDS report. Additional savings are available from easier-to-use control systems that reduce the amount of time that heating and cooling operations are occurring even when no one is occupying the space.⁵⁹

In Vermont and elsewhere in the U.S., **Home Performance with Energy Star** is increasingly used as a structure to guide procurement of comprehensive energy efficiency savings. This structure, supported by federal agencies and users nationwide, provides a continuously improving program template that supports the whole-building / whole-system approach that is most cost-effective and that produces the most savings.

Key Services to Overcome Barriers

- Marketing, Outreach and Customer Acquisition
 - Market Segmented Pitches and Offers of Assistance
 - Low-income residential
 - Market residential
 - Multi-family
 - Commercial
 - Mass Market Buzz and Success Stories
- Trade Ally Development (stores, equipment suppliers, contractors, etc.)
- Technical Assistance
 - Audits
 - Contractor Referrals
- Financial Assistance
 - Loans
 - Cash Rebates

- c) **Owner decisions, with technical assistance from the efficiency service and/or fuel dealer** – Even with information from a thorough energy audit in hand, the building decision-maker may not know how to prioritize their actions, find a skilled contractor and get the needed services, or how to know if the job was done right. Practical knowledge about how the building envelope and the heating system interact can, for example, give insight to the customer that can help lead to a more comprehensive building investment and larger savings. Technical assistance is a helping hand to maintain progress toward the actual investment. The Internet, through the program administrator's website, can provide easy access to successful stories that customers can identify with and seek to replicate.

A key factor of success is making it easy for the building owner to make a decision to do energy efficiency for the whole building, and a key way to do this is to enable a

⁵⁹The GDS study found that efficiency savings in unoccupied buildings were higher, on average, than in occupied buildings.

“one-stop” way to delivering a comprehensive menu of efficiency services to the customer following the audit.⁶⁰

- d) **Installation by fuel dealer or private contractor** – An important part of any energy efficiency service portfolio is to provide information and referral services to enable the wide array of contractors and service providers to deliver their products to customers. The addition of liquid fuel dealers, who are expert in furnace and boiler replacement and maintenance, and building envelope and HVAC contractors, who are expert in insulation and sealing services and equipment installation, is consistent with the ways contractors are used in existing programs. Many of these contractors are already engaged with Efficiency Vermont and the Weatherization Assistance Program and this role would be expanded.

With the emphasis on whole building approaches, building commissioning, the process of verifying that the building energy system is working as it should, may be an important service, and there are contractors expert in this field also.

- e) **Financial incentives** – The most obvious barrier to energy efficiency investments is often financial, and direct financial incentives may be provided depending on circumstances and co-benefits with electricity and natural gas.⁶¹ Perhaps there is a misperception by the customer that a cheaper device is not significantly different in performance than a more expensive, more efficient one; or the customer does not have the money for the cost difference; or the customer has many uses for a limited budget and chooses investments that are more central to the business or family. In situations like these, absent a program of some kind that offers financial incentives, cost-effective energy efficient investments do not happen.

⁶⁰It will also be important to develop a large and varied base of well-trained energy technicians, builders and installers throughout the State, which will require continuous training but offers an important way to build Vermont’s building trades infrastructure. Customers ready to contract for services should have a choice of capable builders, insulation contractors, and HVAC professionals to call on, and will be helped by being able to get a list of certified professionals through the auditor or an easily-accessed database.

⁶¹It is often though not always true that the sticker price of a more energy efficiency system is higher. In cases where equipment can be down-sized or eliminated due to efficiencies elsewhere, total initial cost can be less!

Prescriptive and Custom Incentives Address Distinct and Important Purposes

Incentives go along with two main types of programs: prescriptive and custom. A **prescriptive** incentive is one where the level of financial incentive is the same for everyone and is applied to mass market items, like a new efficient water heater or furnace. For prescriptive programs, it is wise to monitor the market and the incentive for evidence that the product is being increasingly accepted, signaling that the incentive can be reduced and perhaps ultimately eliminated.

A **custom** incentive addresses the needs and opportunities of specific customers, and the incentive might be based on a negotiation based on a comprehensive package of investments and savings. Some program administrators create a competitive process where customers, usually commercial and industrial customers, will bid to see which ones require the least cash incentive in order to implement a given amount of energy efficiency. In any event, the administrator will not pay more than savings are worth, based on rules established in advance in the oversight process.

Financial incentives can be in the form of **cash**, or can take the form of **reduced rate loans**. Choosing between them should always be driven first by addressing the barrier preventing the investment in the least cost way.

While experience shows that financial incentives are often critical to success, it is just as important to design incentives to be no more than they have to be to get the customer to say “yes.” One measure of the level of incentives needed to accelerate efficiency investments in Vermont is the level of customer assistance provided to natural gas fuel uses through the programs of Vermont Gas Systems.

- f) **Loan origination** – With information from an energy audit, and with the technical adviser acting as a gateway, the building owner can be declared eligible for low-cost loan and/or customer financial assistance. If a loan makes the difference in an investment, making it easy for the customer to secure and manage the loan is another important function for the energy efficiency program. Customers could be given the option to choose a lender from a pre-certified loan origination list, as Efficiency Vermont does with Home Performance with Energy Star, or they could choose to have the program administrator place the loan for them with a lender providing the most favorable overall terms, as is the case with existing Vermont Gas energy efficiency services.

In many cases loan duration will be 4-5 years, even if payback periods are ten years or more. Experience will guide loan lengths, which will aim to meet a balance of objectives. Lender risk is moderated by shorter loan lengths, and consumers may resist taking on obligations that last too long. On the other hand, many building shell and heating system investments have very long lives, and it makes sense to spread out their costs over time. A balance point can be found in a loan length that keeps payments manageable, preferably no more than the annual energy savings from the investment, so the customer effectively is saving money from the start, even during the loan payback period.

- g) **Loan servicing and payback** – A system to service loans should be consistent for all customers within a customer class. Credit counseling should be available to avoid unnecessary defaults and a system that promotes deteriorating credit. The interest rate needs to impress customers. Use of zero-percent financing does that, but good management would have program administrators set interest rates at levels that are as high as possible to get desired participation rates at the lowest cost.

In some instances loans and cash incentives will work together. Loans and cash can work either in the context of prescriptive or custom incentives, or in situations where the whole building cost of energy efficiency investments exceeds the limits of loan qualification, and cash “financial aid” fills the gap between the price tag and the loan.

Rental Housing Is A Particular Program Area

Rental housing presents distinct challenges for energy efficiency program administrators. Occupants in many instances pay their heating bill, but have little or no ability to influence the quality of the building shell or heating system. Rental housing owners in a competitive market often do not welcome costs for efficiency investments that they may not be able to extract in a reasonable time from rent, yet they retain control of the decision to make these investments. This condition is often referred to as a split incentive, and requires distinct program features.

Rental housing serves thousands of Vermont families, including many for whom home heating is a high percentage of household expenses, so it is important that a whole-buildings efficiency initiative include a program design that is specific to rental housing

Steps in Acquiring Energy Efficiency – The Customer Perspective

The text of this section discusses the process of delivering energy efficiency from the administrator's perspective. Here in this box, a generalized customer perspective is the focus.

Customers are very busy. Even if they are motivated to invest in energy efficiency, in most cases, action is postponed. In many cases, the customer does not know the questions to ask or to whom to ask them. So the first step from the customer perspective is **awareness**, followed by **knowledge**. The energy efficiency service must find ways to get into the consciousness of customers so that when the opportunity to make an energy decision comes along, customers have the wherewithal to respond. Venues such as the print and electronic media, and home and hardware stores are good places to plant opportunities for customers to run into the efficiency message. Many customers are now accustomed to doing their research on the Internet, so information about services and contractors should be available that way. In the long run, a general "buzz" through the population associated with energy efficiency will indicate success.

When customers are motivated to consider energy efficiency investments, reinforcement in various ways is crucial. If the efficient action appears too complicated, business-as-usual will usually suffice. Making the initial call for help should be easy, and **technical assistance** in the form of audit arrangements and other advice should be the norm. Calling should be just one way to access energy efficiency services. Contractors, stores and Efficiency Vermont work on electric efficiency and represent opportunities to funnel customers interested in more comprehensive services. Competent contractors find ways to minimize the personal inconvenience inevitably associated with building shell and heating equipment work.

Once a customer is on the way to a clear idea of what to do, the financial reality sets in. Comprehensive energy efficiency services in a home can cost \$10,000 or more in excess of conventional construction practices and equipment. While savings will be twice that or more (see Section 7), **financial assistance** at the point of decision may be critical. Customers have many uses for cash on hand that can seem more compelling than energy efficiency. Matching the right combination of assistance and incentives with the right customers produces the most cost-effective savings strategy.

A statewide system can hope to develop a customer database that will assure that customer contacts (matching addresses or names) are recorded to inform future customer needs.

- h) **Industrial customers** – At least at outset, industrial customers would not participate in the comprehensive statewide energy efficiency service. They will likely fund some cost-effective energy efficiency that meets their payback criteria. If industrial customers wish to participate in the statewide service, this class of customers can be brought in later as experience dictates.

F. Readiness and Growth

The statewide comprehensive efficiency service can start right away with existing capacity at a modest level. To grow to the potential outlined in this report will take time. Ramping up scope and funding allows for a fast-paced but reasonable expansion of the workforce of building shell experts, furnace installers, energy auditors, efficiency measure installers, and administrators as well the building of new business and customer relationships. An important supporting policy is to support workforce training in secondary schools and colleges for key energy efficiency skill sets.

G. Summary of Recommendations – Market Residential and Commercial Building Services

This report envisions a set of services for market-based outreach and assistance to building owners that is aimed at the entire range of homeowners and commercial building owners who do not qualify for the low-income Weatherization Assistance Program. It would offer Market Residential, Multi-Family, and Commercial Buildings assistance services. The essential outlines of this initiative are:

- A statewide marketing brand and single point of entry for non-weatherization customers, based on the state’s “Efficiency Vermont” brand;
- An approach to audits, assistance, loans, and construction that focuses on whole buildings, and links the assistance available through regulated utility services with financial assistance made available through new legislation for the non-regulated liquid fuels;
- Supervision of the plans and work of the statewide efficiency entity by the Public Service Department and Public Service Board;
- Opportunity for both technical assistance and direct financial assistance for 20% to 30% of the total cost of efficiency measures associated with building upgrades, as a means of accelerating customer uptake and delivered efficiency savings;
- A loan fund or set of lending institutions that will make financing available to building owners on a standardized, simplified basis at the lowest possible interest rates (either a consortium of lending institutions, or using VHFA and VEDA or both);
- Installation of efficiency measures and building upgrades by private building contractors, fuel dealers, HVAC technicians, and the market-based services of the WAP agencies, together with training and certification programs to ensure high-quality service delivery for customers statewide;
- Savings verification and program evaluation should continue to be done by the Department of Public Service.

- Regular reports to the Legislature from the Department of Public Service on the progress of the effort, whether it is meeting the state's overall goals for building efficiency, and what improvements ought to be made.

This report recommends that the Legislature set as the basic goals for this program accomplishing substantial upgrades of the following numbers of building units:

- **Market Residential** : beginning with 200 units in 2008, growing to 3,750 units per year by 2017, for a ten-year total of about 20,750 units;
- **Market Multi-family**: beginning with 100 units per year in 2008, growing to 1,450 units/year in 2017, for a ten-year total of 7,750 units;
- **Commercial buildings**: beginning with 54 businesses served in 2008, growing to 680 businesses served in 2017, for a ten-year total of over 3,100 businesses; and
- **Vermont Gas Systems**: beginning with 150 units annually, growing to 500 units each year for a total of 4,000 over ten years.

The services the report envisions should address building shells and HVAC systems comprehensively, and should aim to reduce fuel consumption per treated building by at least 20% for residential retrofits and between 7%-15% for new homes and commercial buildings.

This report recommends a workforce development initiative in Vermont secondary schools and colleges to supply workers with key skills to support delivery of energy efficiency services.

Section 7: Costs and Benefits of the Affordable Heat Efficiency Service

The preceding chapters describe a comprehensive approach to delivering building-envelope and related efficiency services to Vermont's homes and businesses. In this chapter we set out the costs of the services and relate them to their benefits. Detailed financial analyses can be found in the spreadsheet at the end of this section.⁶²

The bottom line is very clear.

- Over their lifetimes, the efficiency services recommended in this report would yield **fuel cost savings to Vermonters of more than \$1.47 billion** on private and public investments totaling roughly \$398 million.⁶³ That is a net savings in present and future fuel costs of over \$100 million for each year of this projected program.
- Savings to individual families and businesses will also be substantial. **More than 56,000 residential retrofit customers will save on average between \$600 and \$1,000 per year** (at 2008 prices), depending on fuel type and housing conditions. The annual bills of participating **new home owners will be some \$210 to \$400 less** than they would have otherwise been, and **the average upgraded business will see savings on the order of \$10,000 to \$13,300 every year.**
- Over their lifetimes, the efficiency services recommended in this report will return, **for every dollar invested, \$2.64 in overall savings.** Put another way, this means that even after paying back the full cost of efficiency upgrades, for every dollar invested, net savings of \$1.64 will remain in the pockets of Vermont's home and business owners, instead of being shipped out of state to pay for heating fuels.
- Not included in these numbers is an estimate of the value of the improved health, comfort, life safety, avoided fires, etc. that the building improvements will deliver to Vermont families. Studies done for the Weatherization Assistance Program over the years have found that these benefits are also very high, roughly equal in magnitude to the direct fuel cost savings from weatherization.

⁶²The financial analyses are based on information derived from a variety of sources, among them the Department of Public Service, Department of Taxes, the Legislative Joint Fiscal Office, Efficiency Vermont and its contract administrator, and the Office of Economic Opportunity (OEO). The projections of costs and revenues are based on estimates of escalation factors, fuel costs, average investment costs and savings per unit served, and so on, and the effects of changes in those assumptions can be tested. Fuel cost projections are inherently uncertain, and the numbers here are surely not "correct" – but they are conservative and well within the range of reasonable expectations.

⁶³In net present value terms (2008 \$), gross savings will total \$687.6 million and total costs \$260.6 million, yielding a benefit-cost ratio of \$2.64. For clarity and ease of analysis we project program costs for 10 years, and show the benefits from those investments over only 20 years in total. Since we count fuel savings out only to 2028, this is a conservative figure. Insulation and other upgrades installed in, say 2016 and 2017, will deliver savings far longer than that.

Figure 7-1 represents these costs and savings graphically; Figure 7-2 compares the total benefits to only the public share of the investment costs.

Figure 7-1: State Energy Efficiency Services: Total Benefits and Total Costs, 2008-2028

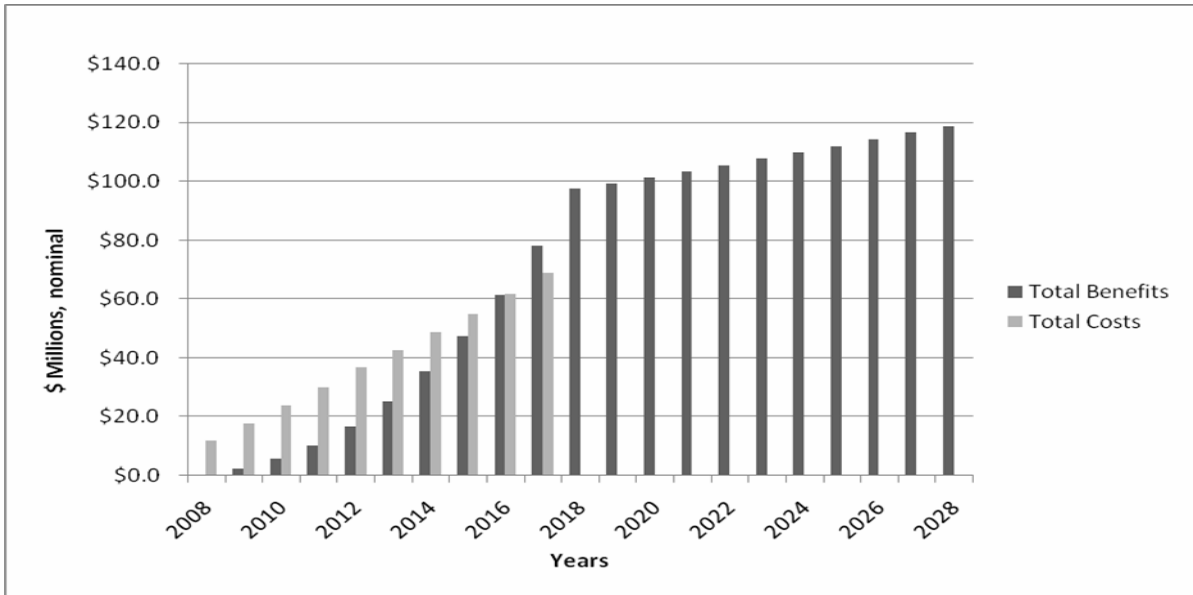


Figure 7-2: State Energy Efficiency Services: Total Benefits and Public Costs, 2008-2028

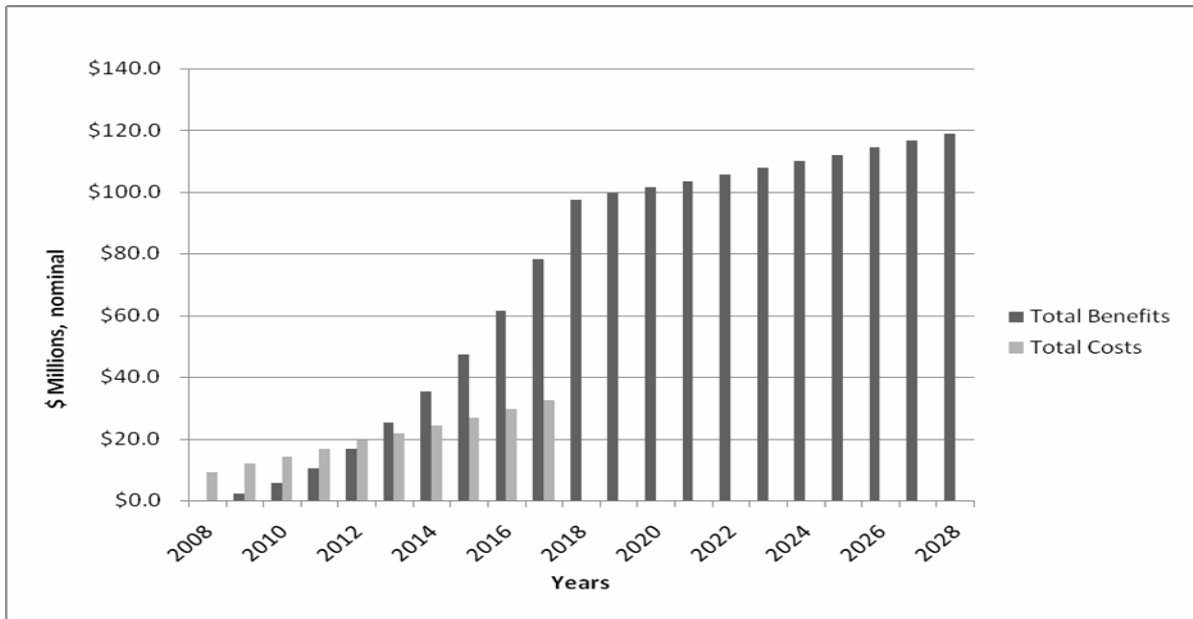


Figure 7-2 shows total fuel cost savings in relation to the public dollars that are needed to provide weatherization assistance to low-income families, and to assist other families and businesses to upgrade their buildings. This chart reminds us that the services outlined in this report are, outside of the low-income program, focused on using limited public services to leverage substantial private capital investments in Vermont’s buildings infrastructure. From

a public point of view, the benefit-to-cost ratio is extremely favorable – yielding \$4.80 in direct benefits for each \$1.00 of public funds invested.

A. Costs of Services

The analysis of costs is broken out by major service categories: residential low-income weatherization, residential retrofit services (which consist of three parts: residential moderate income, residential upper income, and multi-family), new homes, and businesses.⁶⁴ The principal reason that these market segments are treated separately is that builders and owners in these different categories have different needs and interests, and a consumer-oriented, market-based efficiency service must use somewhat different strategies to succeed with each of them. What differentiates these program elements *financially* is the amount of the assistance needed to be paid to the property owner in order to leverage private capital for substantial investments in the energy saving measures. The table below summarizes these design features.

Table 7-1: Program Design Assumptions

Program Design	Average Incentive	Average Incremental Cost/Unit for EE Measures	Average Incentive per Unit⁶⁵
Residential Low-Income (WAP)	100%	\$ 5,200	\$ 5,200
Residential Moderate	35%	\$ 6,000	\$ 2,100
Residential Upper	5%	\$ 8,000	\$ 400
Residential Multi-family	35%	\$ 4,000	\$ 1,400
Residential New Homes	33%	\$ 3,000	\$ 1,000
Businesses	350 MMBtu at \$6/MMBtu	\$ 8,500	\$ 2,100
Annual Cost Escalation Factor	2%		

The programs analyzed here call for a doubling, over ten years, of the number of low-income units currently being served (from 1,450/year to approximately 3,225/year), the development of a market residential program that will serve some 5,700 units/year by 2017, and the creation of a commercial program that will grow to serve over 600 businesses each year. Figure 7-3 describes the numbers of units to be treated.

⁶⁴We have analyzed the non-regulated fuels components of the statewide efficiency services described in this report. Investments (with the exception of low-income weatherization) made by Vermont Gas Systems on the premises of its residential and commercial customers are not included in the analysis here, as they are currently included in the company’s regulated cost of service, and we recommend that VGS’s expanded efficiency programs continue to be treated as part of its regulated services. VGS does deliver some low-income weatherization services, and is credited for some of its costs through a reduction in its Gross Receipts Tax obligations.

⁶⁵The costs of audits are included in the incentives.

Figure 7-3: Statewide Energy Efficiency Services: Building Units Served

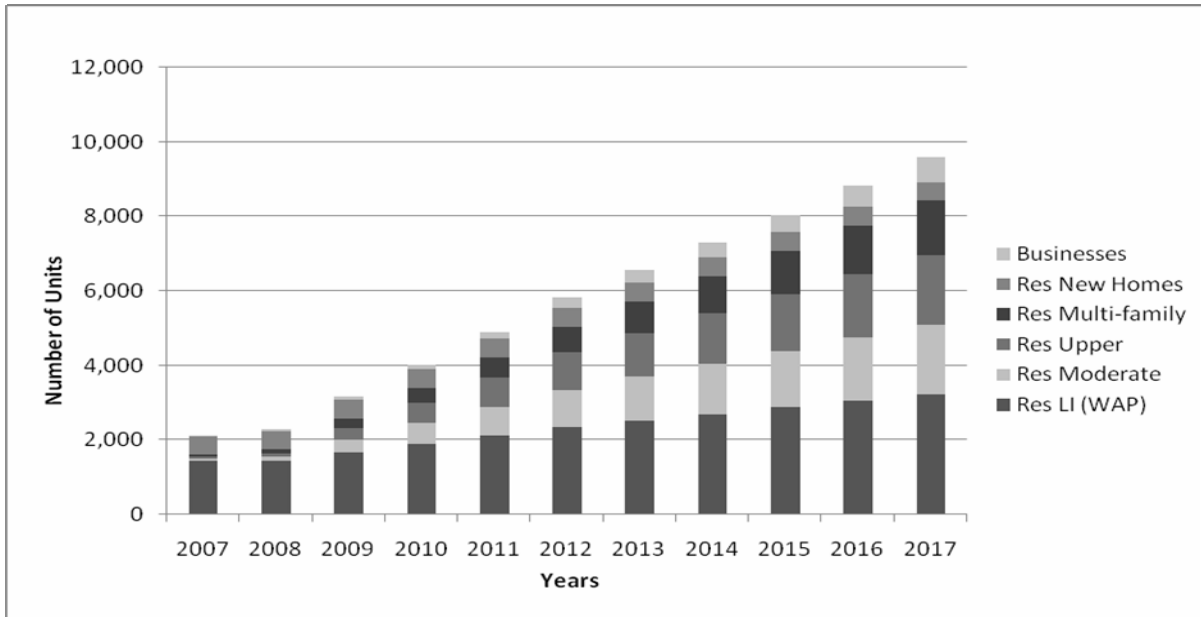
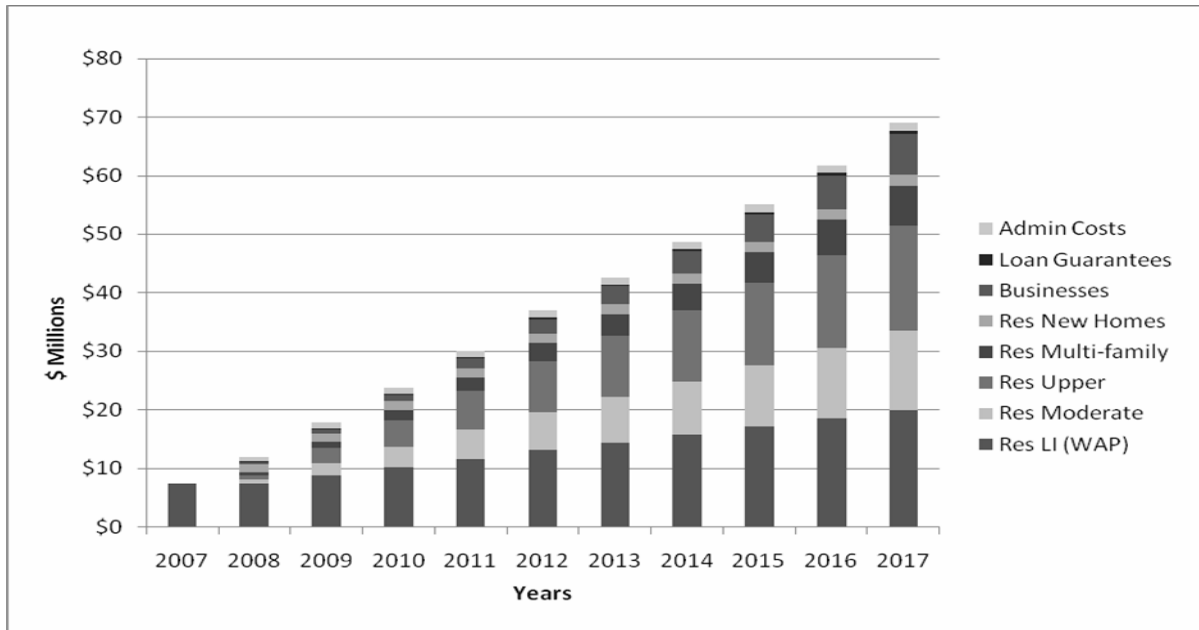


Figure 7-4 below illustrates the total expected expenditures, public and private, under the programs. The lion’s share of the costs of the programs is driven by the investment-per-unit and the numbers of units served. A small portion of the costs consists of incremental administration and, for the loan programs, the costs of loan guarantees (to the extent required). In 2007, spending on the Weatherization Assistance Program amounted to approximately \$7.4 million dollars, all of which came from public sources (the Weatherization Trust Fund and the federal government).

The programs detailed in this report call for a steady ramping up of investment, not only in low-income weatherization, but in all market segments, through a combination of public expenditures and private investment. By 2017, some \$69 million of annual investments will serve 8,900 homes and about 680 businesses each year. Over the ten-year period, more than 60,000 units will have received efficiency measures, which will return savings of approximately \$2.64 for every one dollar invested (described in the following subsection).

And the investments will put dollars back into the Vermont economy: all told, more than 95% of the total spending (i.e., the financial assistance provided by the public sector and the loans provided by the private) will go to local private enterprises to pay for the measures and their installation. Less than 5% will be used to cover administration, marketing, and, as needed, loan guarantees.

Figure 7-4: Statewide Energy Efficiency Services: Total Service Cost



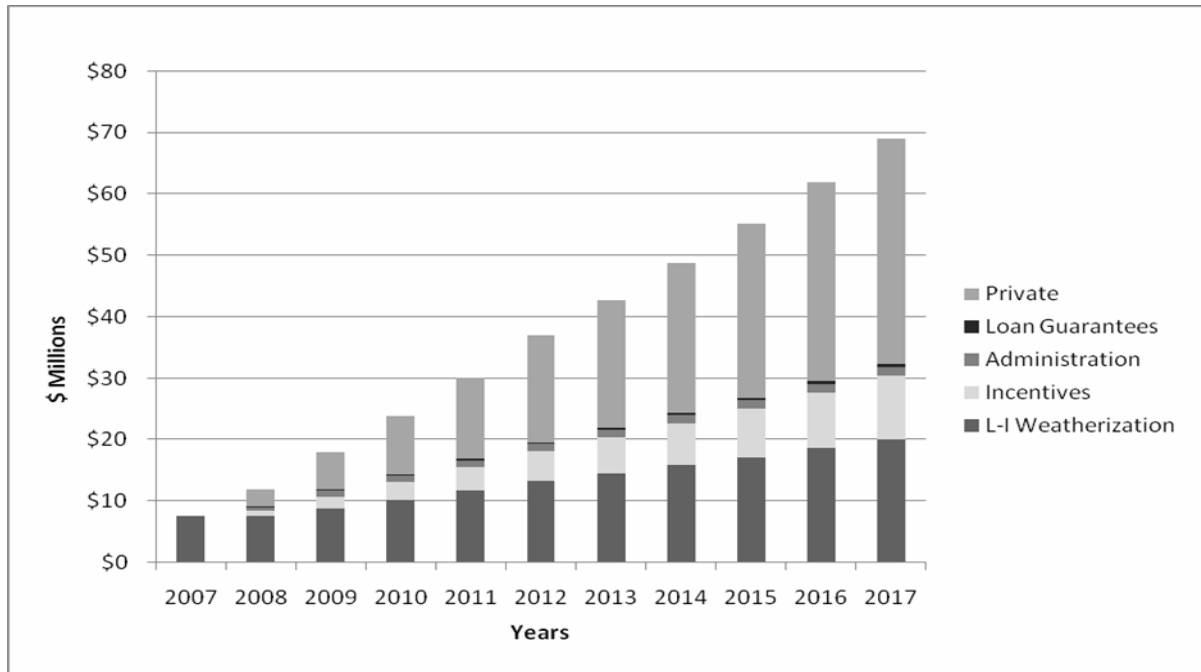
Outside of the low-income weatherization program, public investments to secure these savings amount to about 26% of the total cost. The large majority of public expenditures on buildings efficiency services are in the form of direct assistance to property owners, with small fractions for administration and possible loan guarantees. For low-income weatherization services, the program will continue to pay the full costs of the measures. For customers with higher incomes, the amount of the incentive available will fall, and the remainder of the cost will be made up by the customer, either through loans or out-of-pocket. Our analysis is based on average incentive levels for property owners in the various market segments. Actual incentives may vary along a sliding scale, designed to limit the incentive to the minimum amount necessary to induce the customer to make the investment. Figure 7-5 illustrates the shares of public and private spending on these programs. Note the growing proportion of private (customer) spending over time.

A Note on Vermont Gas Systems

This report recommends a meaningful increase in the number of buildings to be upgraded through the efficiency programs of Vermont Gas Systems. The VGS programs have been cost-effective and successful, and could be expanded to benefit additional customers, particularly as the VGS service territory expands over time. However, the financial analysis in this section focuses on unregulated fuels, so we have not included expected investments by Vermont Gas Systems in this financial analysis. Still, it is important to note here their importance and magnitude. Currently, the VGS buildings retrofit program serves approximately 150 units per year, at an average cost of roughly \$2,700 per unit. Under the proposed program, the number of units served would increase in stages to 500/year, and will yield annual savings per unit at least equal to the savings that the other efficiency services will generate.*

*A conservative estimate. VGS's most recent DSM filing with the Public Service Board shows that the energy savings per unit served are higher than the average assumed for all units in this report.

Figure 7-5: Statewide Energy Efficiency Services: Shares of Total Cost



B. Benefits

The benefits of the efficiency services are substantial. As shown in Table 7-2, retrofit investments in residential efficiency are expected to reduce fuel usage, on average by 20%-30% every year after installation. In new homes, the savings will be smaller—on the order of 10%-15%—because current designs, materials, and equipment already capture much of the benefit: but even so, there remain cost-effective savings opportunities beyond code requirements. For businesses, the average savings will be on the order of 7%-9%, but total savings per business receiving assistance will be much greater than the average residential unit.

Table 7-2: Statewide Efficiency Services - Energy Benefits per Building Unit

Program Sector	Weighted Avg. Annual Usage/Unit, MMBtu	Savings Ratio	Average Annual MMBtu Savings/Unit
Residential Low Income (WAP)	110 ⁶⁶	25%	28
Residential Moderate	110	25%	28
Residential Upper	110	25%	28
Residential Multi-family	110	25%	28
Residential New Homes	na	10% to 15%	10
Businesses	na	7% to 9%	350

Usage decreases of these magnitudes will result in immediate and substantial savings on customers' annual heating bills. As Table 7-3 shows, residential retrofit customers will save on average between \$600 and \$1000 per year (at 2008 prices), depending on fuel type or energy source. The annual bills of participating new home owners will be some \$210 to \$400 less than they would have otherwise been, and the average business will see savings on the order of \$10,000 to \$13,300 every year.

Table 7-3: Statewide Efficiency Services - Financial Savings per Building Unit

VALUE OF AVERAGE ANNUAL SAVINGS PER UNIT (at 2008 prices, adjusting for end-use efficiency)							
Unit Type	Average Annual MMBtu Savings/Unit		Value of Average Annual Savings, Fuel Oil	Value of Average Annual Savings, Kerosene	Value of Average Annual Savings, Propane	Value of Average Annual Savings, Natural Gas	Value of Average Annual Savings, Electricity
All Residential Retrofit	28		\$ 794.61	\$ 888.31	\$ 1,080.79	\$ 587.81	\$ 1,047.77
New Homes	10		\$ 288.95	\$ 323.02	\$ 393.01	\$ 213.75	\$ 381.01
Businesses	350		\$ 10,113.22	\$ 11,305.82	\$ 13,755.46	\$ 7,481.25	\$ 13,335.29
Fuel Statistics	Btus/gal, kWh, or therm	Efficiency	Dec 2007 Price/gal, kWh, or therm				
Fuel Oil	138,000	80%	\$ 3.19				
Kerosene	136,000	80%	\$ 3.53				
Propane	91,600	80%	\$ 2.88				
Natural Gas	100,000	80%	\$ 1.71				
Electricity	3,412	100%	\$ 0.13				

The aggregate savings for the state and its citizens are likely to be huge. Table 7-4 summarizes the total benefits and costs (public and private) of the programs. The benefits are conservatively estimated, accounting for only twenty years of savings (through 2028), but even so the direct benefits amount to 2.6 times the investments: which means that the net benefits—the fuel dollars that remain in the hands of Vermont's home and business owners—are more than one-and-one-half the outlay.⁶⁷ Over the two decades, Vermonters

⁶⁶At \$3.19 per gallon of fuel oil, usage of 110 MMBtus per year will cost a homeowner \$3,178.44 annually. For propane at \$2.88/gallon, the annual cost to a homeowner will be \$4,323.13. See Table 7-3 for conversion factors.

⁶⁷Because most of the efficiency measures that these programs will deliver are related to weatherization, insulation, heating, and cooling, they will continue to provide savings for as long as the buildings exist. Our

will save approximately \$1.1 billion (net) or more than \$100 million in present and future savings for each year of this projected program.⁶⁸

An additional benefit, also very large in practical effect, is that the investments made in building better buildings, retrofitting existing buildings, and changing out heating systems involve payments made to builders, carpenters, HVAC technicians, and other Vermonters in the local economy—that is, not exported almost immediately from Vermont to import fossil fuels. The benefits to the State of Vermont and the Vermont economy from this local economic activity, and the re-spending effects resulting from lower fuel bills, will be very large. They will be the subject of a separate macro-economic analysis.⁶⁹

Table 7-4: Statewide Efficiency Services - Aggregate Benefits and Costs

Annual Cumulative Savings		Nominal Savings, \$ (20-Yr Horizon)	Net Present Value, 2008 \$ (20-Yr Horizon)
2008 Weighted Fuel Price/MMBtu	\$ 30.86		
Fuel Price Escalation Factor	2%		
Discount Factor	6%		
Res. Low-Income (WAP)		\$ 388,850,966	\$186,410,041
Residential Moderate		\$ 160,405,850	\$74,554,765
Residential Upper		\$ 160,405,850	\$74,554,765
Residential Multi-family		\$ 119,538,397	\$55,517,870
Residential New Homes		\$ 30,767,019	\$15,064,684
Businesses		\$ 610,383,470	\$281,528,382
Total Cumulative Savings		\$ 1,470,351,552	\$687,630,506
Total Costs		\$ 383,561,100	\$260,631,185
Net Savings		\$ 1,086,790,452	\$426,999,321
Ratio, Total Benefits/Total Costs			2.64
Total Cost, Public Funds		\$ 206,807,444	\$143,283,131
Ratio, Total Benefits/Public Costs			4.80

Lastly, residential participants in the programs will reduce their emissions of carbon dioxide, on average, by two tons per year and business participants by 26 tons. Overall, the programs will decrease the state's output of CO₂ by roughly 3.1 million tons over the twenty-year horizon.

analysis ignores most of these “end effects:” our figures reflect twenty years of benefits for units treated in the first year, but only ten years’ for those treated in 2018.

⁶⁸Even discounting future benefits, we calculate a net savings (net present value) for the programs presented in this report of \$426 million. This is a very conservative calculation: it is based on fuel price increases averaging 2% per year, but it discounts those savings back to the present at the rate of 6% per year. If the price of oil and related fuels continues to rise more rapidly than the 2% predicted by US DOE, the net present value of these savings will be higher.

⁶⁹To be conducted by the Legislative Joint Fiscal Office in early 2008.

Following is a spreadsheet showing the data and calculations on programs, units receiving energy efficiency services and public and private costs over a ten-year period that led to many of the figures used in this section and elsewhere in this report.

Table 7-5: Whole Buildings Efficiency, Non-Regulated Fuels Portion

WHOLE BUILDINGS EFFICIENCY, NON-REGULATED FUELS PORTION																																																																																																																																																																																																																																																																																																																																			
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Revenues, All Sources	8,267,732	10,529,441	15,843,872	18,774,008	18,665,390	22,280,082	22,721,845	25,294,196	26,917,327	27,354,761	27,808,673																																																																																																																																																																																																																																																																																																																								
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Res Upper	225	175	50	100	325	550	775	1,000	1,175	1,350	1,525	1,700	10,375																																																																																																																																																																																																																																																																																																																						
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Public Investment	1,294,707	3,980,060	4,471,745	1,805,084	2,692,498	827,155	980,430	62,914	(2,173,233)	(4,539,218)		Total Public Investment (adjusted for previous year carryover)	9,234,734	13,178,519	18,262,323	21,332,051	21,392,668	24,587,188	25,140,911	27,834,844	29,580,907	30,174,658		Share of Program Costs Served by Loans	2,755,600	6,024,018	9,511,961	13,274,545	17,394,252	20,781,031	24,375,137	28,201,162	32,288,555	36,672,688	191,278,948	% of total - public \$	77%	66%	60%	56%	53%	51%	50%	49%	48%	47%		% of total - loan/private \$	23%	34%	40%	44%	47%	49%	50%	51%	52%	53%	
TOTAL PROJECTED INVESTMENT (Public & Private)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	10-Year (08-17) TOTAL																																																																																																																																																																																																																																																																																																																								
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Total Costs for EE measures	7,540,000	11,299,000	16,777,470	22,589,945	28,810,869	35,551,064	41,147,353	47,057,947	53,316,627	59,963,651	383,561,100																																																																																																																																																																																																																																																																																																																								
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Admin Costs	0	650,000	1,040,000	1,081,600	1,124,864	1,169,859	1,216,653	1,265,319	1,315,932	1,368,569	11,656,107																																																																																																																																																																																																																																																																																																																								
Total spent for all-fuels EE measures	7,540,000	11,990,334	17,907,830	23,814,225	30,134,851	36,987,836	42,675,721	48,688,893	55,055,576	61,816,548	398,096,392																																																																																																																																																																																																																																																																																																																								
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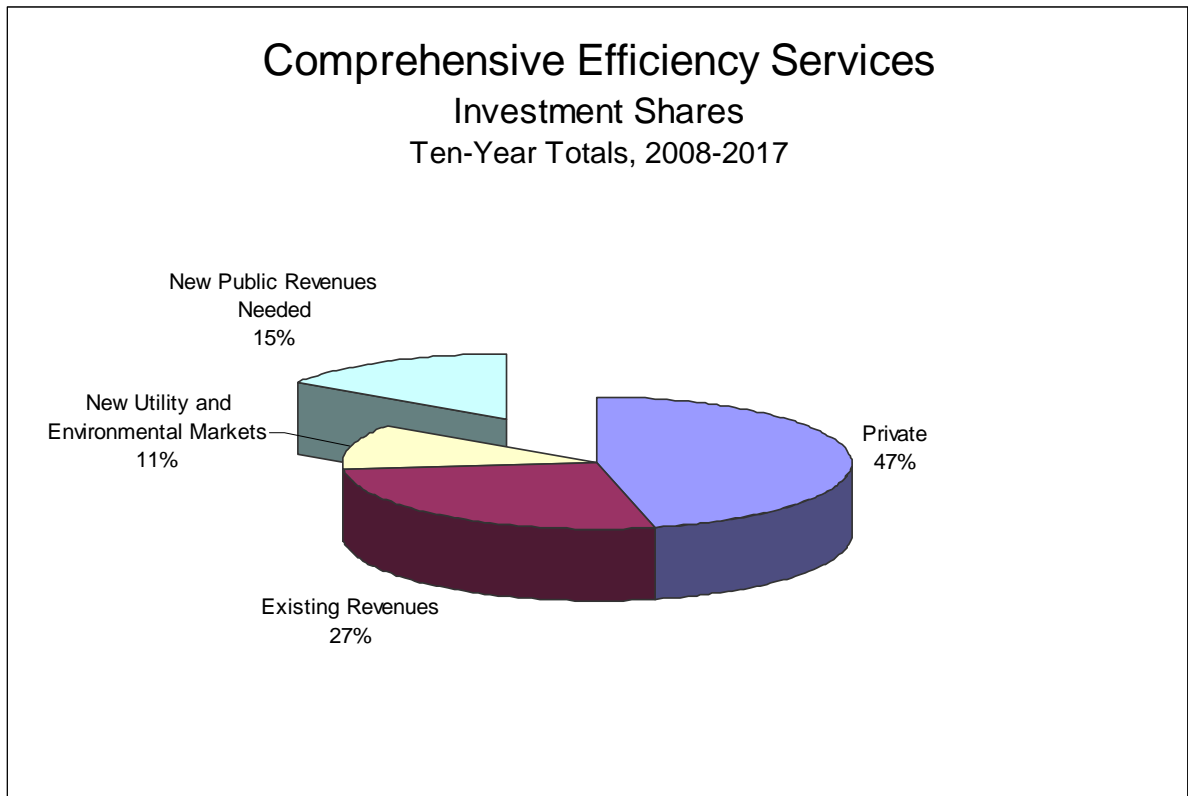
Section 8: Funding: How Should Building Efficiency Initiatives Be Supported?

A. Principal Funding Options

This section examines a wide range of funding options for the broad-based efficiency services recommended, and concludes that a package of existing and new funding sources is needed to create the savings potential. It evaluates the pros and cons of the most likely sources, and recommends that the Legislature evaluate several of them. To support a long-term program that grows over time, it will be important to provide stable and predictable revenue sources so that enterprises can hire and train the staff they will need, and customers can count on services they will need to make major renovations and investments.

The most important observation about the recommended funding mix is that, by relying on private investment capital, and by making use of multiple funding streams, the percentage of new public revenues needed for the entire program is only 15% of the total investments needed for the entire program. (See Figure 8-1 below)

Figure 8-1: Whole Buildings Efficiency Services: Investment shares: Ten-Year Totals, 2008-2017



A variety of revenue sources have been proposed for funding an expanded set of building efficiency programs. Of course, whether any of these sources should be chosen is a matter for legislative determination, but we are able to comment on their likely magnitude and on some of the pros and cons of using different approaches. Among the funding options considered are the following:

BUILDING ON THE EXISTING WEATHERIZATION TRUST FUND

Vermont's Weatherization Trust Fund receives revenues from two sources, the federal government and a 0.5% gross receipts tax (GRT) on the sale of all non-transportation fuels (except wood). The GRT generates more than four-fifths of the monies in the fund, which means that the total amount available each year is a function of energy prices and total consumption of energy in Vermont.⁷⁰ Since weatherization is aimed at Vermont's neediest households, there is a strong logic in this linkage between fuel prices and the size of the fund; and it follows as well that an expansion of the program should be funded largely by a secure revenue stream associated with the fuels in question. The GRT has served Vermont, and particularly the low-income community, very well. If we are to successfully double the weatherization program in an era of declining federal spending for weatherization generally, it is appropriate to examine this revenue source to fund it.

An increase in the GRT could be structured in any of several ways. Leading options are:

- All existing sources: An increase applicable to all fuels (heating oil, propane, kerosene, electricity, natural gas, and coal) presently covered by the GRT;
- Unregulated fuels only: An increase targeted to those fuels (heating oil, propane, and kerosene) whose sales are not already funding other efficiency programs;⁷¹ or,
- Tiers within the unregulated fuels: A variation on the second option, in which the gross receipts tax on non-regulated fuels would be applied in tiers. The first tier, on sales up to, say, \$10 million in annual sales by a single fuel seller, would stay at the existing rate or set at a new first tier rate, while incremental sales over that level would be charged at a higher rate.

The main purposes of the tiered rate would be to mitigate the effects of a GRT increase on retail prices and to place the tax burden on those portions of the oil industry best able to bear it in an era of very high oil company profits. The intent would be to place more of the GRT burden on very large companies that have greater

⁷⁰Vt. Office of Economic Opportunity estimates that the GRT will generate about \$7,189,416 for the Trust Fund in 2008. Given higher-than-expected increases in the costs of fuels, we estimate that the GRT will contribute slightly more than OEO's forecast, about \$7,643,472. We use this figure as the starting point for our revenue projections. For the sake of conservatism, we use a lower escalation rate (3.0%) than OEO expects for the Fund (5.1%).

⁷¹In addition to the 0.5% gross receipts tax for the Weatherization Trust Fund, electricity ratepayers pay a system benefits charge that funds Efficiency Vermont, while Vermont Gas Systems' customers already cover the costs of the company's efficiency efforts (which, as noted earlier, could be increased). An argument can be made that expanded weatherization services, which complement existing programs and which primarily target heating oil, propane, and kerosene end-users, should be funded by an increase in the GRT for those fuels only.

economies of scale, and often have corporate links to upstream assets and profit centers in the fossil fuel business (e.g., distribution networks, wholesale tank farms, wholesale hedging, and commodity investment programs) and therefore have greater means of absorbing the GRT's small impacts through increased operational and managerial efficiencies.

Potential revenues: Each one-half of 1% increment in the GRT would raise about \$8.5 million in 2008, with about half (\$4.1 million) of that coming from the regulated companies that also support electric and gas efficiency efforts. Increasing the GRT by 1% in stages, on unregulated fuels only, would raise adequate funds to double the weatherization program by 2014.

ADDITIONAL UTILITY-BASED SYSTEM BENEFITS CHARGES (SBC) FOR EFFICIENCY VERMONT AND IN THE RATES OF VERMONT GAS SYSTEMS

Since the state's efficiency contractor will perform "clearinghouse" functions for the statewide comprehensive energy efficiency service, it might be argued that a slight increase in the SBC to cover Efficiency Vermont's administration of the buildings/unregulated fuels portion of the work is appropriate. While mildly inconsistent with the general principle that revenue sources should be closely linked to the services to which those revenues will be put, since there is significant overlap between electric customers and the customers of non-regulated fuels and as there are synergies to be captured through the "whole buildings" approach, this may not be a significant concern. On the other hand, a major expansion of the electric sector Energy Efficiency Charge (EEC) to support the direct costs of building shell and furnace upgrades to reduce liquid fuel use would be a departure from the idea that different sectors should bear their own program costs.

Potential revenues: The work of Vermont Gas Systems to expand buildings efficiency services to more customers can be supported in utility rates by order of the Public Service Board. VGS currently spends about 1.5% of revenues on DSM, for a variety of programs. Raising the number of households served comprehensively could require an increase to about 3% of total sales in rates. For buildings not served by VGS, additional revenues for all-fuels work would be limited to supporting audits, coordination, training, etc. – perhaps to \$1 million per year. As authorized and historically managed – with a direct nexus between the EEC and efficiency measures for the regulated energy sources – the PSB is unable to charge electricity customers for fossil fuel building shell improvements. However, with legislative direction mandating electric and utility support for unregulated fuels savings, full program funding would be possible from this source.

REVENUES FROM THE SALE OF CARBON DIOXIDE ALLOWANCES UNDER THE REGIONAL GREENHOUSE GAS INITIATIVE (RGGI)

RGGI is a multi-state program aimed at reducing the greenhouse gas emissions from the power sector in the northeast United States. Its central mechanism is a cap on carbon dioxide emissions, the allocation of permits to produce CO₂ under the cap, and the trading of those permits (allowances) among those obligated to meet the cap and others who wish to participate in the market. Vermont law provides for the sale at auction of the state's RGGI-based carbon allowances, with auction revenues to be put to energy cost- and carbon-reducing efforts on behalf of customers. Existing legislation emphasizes that these benefits

should be focused on electric power customers, but since whole building efficiency investments will lower energy costs and deliver reductions among one of the largest sources of carbon emissions, RGGI revenues could appropriately be dedicated to the buildings efficiency initiatives.⁷²

Potential revenues: Vermont is allocated about 1,225,000 carbon credits under the RGGI agreement each year between 2009 and 2014, and somewhat lesser amounts thereafter. The market sales price of RGGI credits is unknown, but many observers believe they may be worth about \$2 per ton in the early years, and \$4 per ton later. If most RGGI revenues were dedicated to buildings efficiency programs, \$2.4 million to \$4.5 million per year could be raised through this means.

REVENUES GENERATED BY EFFICIENCY VERMONT'S PARTICIPATION IN THE NEW ENGLAND FORWARD CAPACITY MARKET (FCM)

In an effort to assure the availability of sufficient capacity to meet the region's electric demand, the Independent System Operator of New England (which is regulated by the Federal Energy Regulatory Commission) has created the Forward Capacity Market. It is a resource-neutral market: suppliers of both generation and demand reductions can participate, so long as they can demonstrate that their resources will provide capacity benefits to the power grid when required. To the extent that Efficiency Vermont's investments in electric end-use efficiency qualify on reliability terms and clear in the three-year forward market, the FCM program will pay Efficiency Vermont, and those funds could be made available for investment in additional efficiency measures.⁷³

Potential revenues: FCM revenues earned by Efficiency Vermont's programs are estimated to rise from only \$100,000 in 2008 to about \$1.4 million/year for the rest of the decade.

SUPPORT FROM THE GENERAL FUND – DIRECT APPROPRIATIONS AN/OR TAX CREDITS

The expanded programs recommended in this report will create some additional costs associated with administration of the Weatherization Program, the administration and

⁷²We have also considered whether Vermont's enhanced buildings efficiency program would be entitled to earn "offset" credits under the RGGI program. Under RGGI's Model Rule and the individual state rules built on it, offsets can be granted to greenhouse-reducing projects that meet certain strict standards. Even though enhanced buildings efficiency investments in Vermont would reduce additional GHG emissions, it is not at all clear that the programs described in this report would qualify for offset credits under RGGI's rules. The value of future offsets, if any, is also highly uncertain. For these reasons we have not quantified or counted on any additional value from this source.

⁷³Whether FCM income earned by electricity-based efficiency should be spent on efficiency for unregulated fuels is listed here as a matter for discussion. However, the capacity payments that Vermont's *electric utilities* receive from the FCM would *not* be available for all fuels efficiency. Vermont's utilities remain the only vertically integrated companies in the region and, as such, the costs of their generating entitlements are included in regulated rates. Utilities have always sold rights to electric capacity, and this is a revised way to receive compensation for electric capacity. Any revenues they receive from wholesale transactions are applied as credits to their costs of service. Being vertically integrated, they are both buyers and sellers of capacity in the wholesale market; the diversion of their FCM revenues to other uses would result in a direct increase in their costs and, therefore, in their retail rates.

enforcement of building codes and Act 250, facilitating the participation of financial institutions in the programs, and perhaps the origination of VHFA and VEDA loans and their servicing. General Fund monies could certainly be used to support these activities. In addition, it is consistent with general taxation principles to support energy efficiency, particularly efficiency in low-income housing, through broad-based taxes.

There is no strong policy reason why General Fund revenues could not be used to provide significant support to an expanded weatherization program, but there may be practical reasons not to do so. Expanding the WAP program requires expanding its human resource base -- training auditors and installers, deploying crews, enlisting the help of trained furnace technicians who will work for fuel dealers and other HVAC contractors, and the like. It also requires an outreach program to building owners and tenants, and a waiting list that gives them a reasonable estimate of when the work will be accomplished. A predictable and stable funding platform is essential to such an effort -- "on-again/off-again" programs will be inefficient, will result in long waiting lists among low-income households, and will be unable to keep the best trained technicians. If General Fund revenues were to be used for a buildings efficiency program in Vermont, the Legislature and Administration should make a serious commitment to providing such funds on a predictable basis that matches the rate of expansion that is needed.

For the Market Residential and Commercial programs, tax credits might be a different way of using General Fund revenues. Recent federal legislation created a limited tax credit for part of the costs incurred by building owners to invest in energy-saving technologies, including insulation, windows, and high-efficiency furnaces.⁷⁴ If usefully connected to other program elements, some portion of the financial assistance needed to promote the Market Residential and Commercial services outlined in this report could be provided through enhanced tax credits by the State of Vermont.⁷⁵

Potential revenues: General Fund revenues, either directly or through tax credits, or both, could fully cover all of the expenses of the buildings efficiency services described in this report. However, there are many other pressing public programs and needs, so realistic funding availability is subject to many competing factors. At a minimum, \$1.5 million per year could be appropriated or absorbed in agency budgets to implement the public agency aspects of the building efficiency services.

THE CLEAN ENERGY FUND (CEF)

As part of the terms of the sale of the Vermont Yankee (VY) nuclear facility to Entergy, a fund was established to support investment in clean energy resources in the state. The CEF

⁷⁴These tax credits were very small, providing only about 10% of the cost of high-efficiency measures, and only up to a total of \$500 per household, and they applied only to measures placed in service through the end of 2007. Experience with this federal program suggests that tax credits are not likely to stimulate much new investment unless they are large enough to inspire action and stable enough to give owners time to take action and install the measures being supported. Other program elements (audits, technical advice, help with trained contractors, etc.) would also go a long way towards making tax credits a useful tool in a buildings retrofit program.

⁷⁵Since tax credits provide the same value to the taxpayer regardless of income (unlike tax deductions) they can play much the same role in promoting efficiency investments as direct assistance can, providing that the program administrator can address the timing/lag problem on payments.

has been funded until 2012, when VY's operating license is set to expire. If its license is extended, the CEF will continue to be funded to the extent that market prices for its output exceed a trigger price. In general terms, investments in efficiency in buildings are appropriate investments under the Clean Energy Fund; however, most stakeholders who have been involved in developing the Fund and its spending plans have assumed that these funds would be spent on distributed energy projects and renewable energy—also needed initiatives in meeting Vermont's long-term energy needs.

Potential revenues: The Clean Energy Fund will receive about \$2.5 million per year until 2012. There is an existing investment plan to manage the fund expenditures, with a mixture of grants and loans, mostly for renewable and distributed energy projects. Funds for 2008 and later years are not yet committed, however, so they are potentially available for buildings efficiency services.

B. Discussion and Recommendations

We have considered these several revenues sources, their pros and cons, and their potential to provide sustained support for whole-buildings efficiency services. We have tried to balance program design against potential revenues—with the object of delivering the greatest amount of service for the least cost. Recommendations about funding are influenced by four important practicalities:

- First, a long-term, stable funding stream is needed to deliver investments that will grow predictably and steadily. “On-again/off-again” programs will bedevil implementation, and undermine training, development and marketing efforts.
- Second, it is likely that a combination of resources will be needed to support a program that has many elements and serves a variety of market segments, as well as a range of public policy objectives.
- Third, total funding requirements are extremely modest when compared to Vermont's total energy bills. Total energy bills in Vermont are measured in the billions of dollars. Energy efficiency efforts are funded at very small percentages of the total resources spent on energy supply.
- Finally, programs and funding can be phased in over time. It is important to begin implementation of efficiency initiatives as soon as possible, so that marketing, training, and fuel savings can begin now, even if decision-makers decide to phase in additional funding over time.⁷⁶

The cost of delay. As can be seen on the financial spreadsheet in Section 7, the efficiency efforts recommended in this report are projected to be fairly modest in the first two or three years, but are aimed to expand quickly after that. This may lead some to conclude that a one-

⁷⁶It's worth noting that the current slow-down in new housing starts may make 2008 a good time to launch a program that would employ Vermont contractors and building tradesmen in enhanced housing retrofits. Professionals will be more available for training in efficiency techniques, building owners will benefit from lower prices for services, and the state's economy will benefit from a significant stream of business activity—all supported by net savings in dollars otherwise sent out of state to buy fuel.

year or two-year delay in implementation will only lose the savings that would have come in those early years. But this is not so—moving the start date to the future moves the entire ramped program to the future, with the result that total program savings will be reduced in every subsequent year. Unless compensated for by rapid escalation rates (which would raise some real implementation challenges) total lost savings from a one-year delay now are likely to be on the order of \$100 million dollars in extra fuel costs paid by Vermonters over the period of our forecasts.⁷⁷

Whether any of the funding options described below should be tapped is, of course, a matter for the Legislature to decide. Additional ideas may well emerge, and as a general matter policymakers will want to take a practical and creative approach to funding choices. It is important to emphasize, however, that “savings” that come from a failure to invest in low-cost efficiency are illusory – they will be paid for two or three times over by the additional fuel and human costs of higher fuel bills and affordability challenges built into an inefficient buildings infrastructure.

ONE POTENTIAL FUNDING COMBINATION

Although a variety of funding combinations are surely possible, in order to advance discussion of the options and to demonstrate how efficiency goals could be met we set forth here and in the accompanying spreadsheet a funding package that would support the initiatives set out in this report and lower Vermont’s fuel bills by more than one billion dollars due to measures installed between 2008 and 2017 (see the spreadsheet at the end of this section for funding details. Program needs and funding amounts change over the course of a decade-long program, but for discussion purposes the text below calls out 2015 as an example.) That funding package includes the following elements:

1. ***Private capital.*** The most important financial component of the buildings efficiency program is private capital. Approximately three-quarters of the investment capital provided outside of the low-income weatherization program, and half of the total spending on efficiency in the first ten years of the programs comes from private capital—loans and out-of-pocket expenditures by customers. Private capital’s share of the investments increases over time. The aim of this proposal is to take advantage of markets to the greatest extent possible, and to direct public dollars to those segments that have the most difficulty accessing private funds. In 2015, private capital will underwrite \$28.2 million of these services; over the ten-year period, it will fund \$191.3 million.
2. ***An increase the gross receipts tax for the Weatherization Trust Fund.*** As discussed above, the Fuel Gross Receipts Tax is the most logical source of revenue for an enhanced weatherization program serving low-income households.

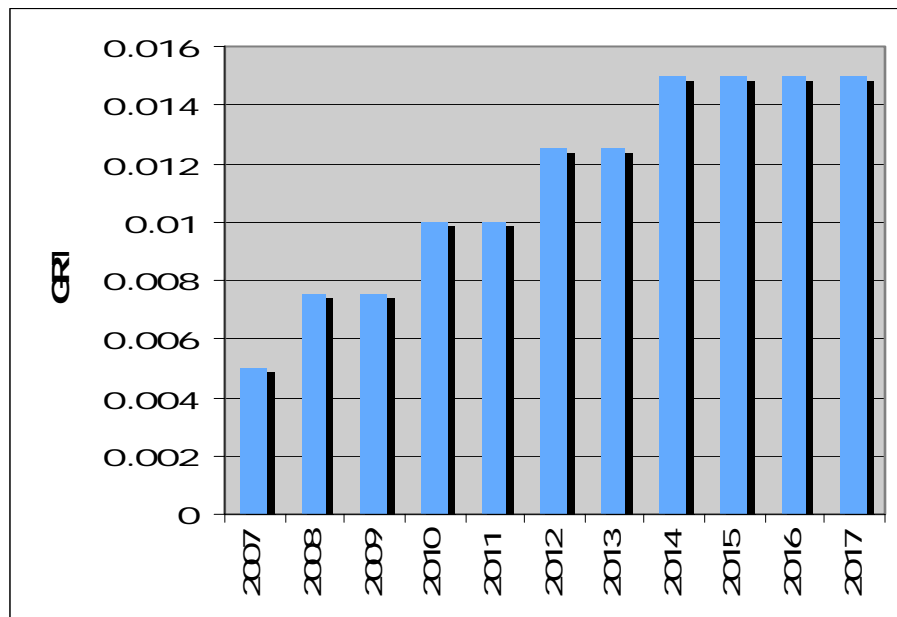
There are several ways in which an appropriate increase can be designed. Because the investments here are aimed at whole-building efficiency, this report recommends ramping-up the GRT on non-utility fuels not now contributing to significant energy efficiency programs supervised by the Public Service Board (heating oil, propane, kerosene, and coal), from 0.5% to 1.5% in four ¼% steps over the coming decade. This

⁷⁷The cost of a one-year delay in net present value terms is less, about \$39 million, since future fuel savings are worth less in today’s dollars.

would raise an average of \$5.8 million in additional revenue per year for investments in low-income weatherization over the course of the coming decade, and much less in the early years. See Figure 8-1.

Assuming also a modest increase in the price of all fuels, this will increase revenues from roughly \$7.0 million in 2007 to \$18.6 million in 2018. As an alternative, the Legislature could decide to collect the increased revenues through a tiered gross receipts tax, with a higher rate of contribution only for those sales by a single non-utility entity after the first \$10 million per year. In that case, rates for the first tier could stay the same as they are now, or increase slightly, while the rate for the higher tier would have to be somewhat higher. Research by the Tax Department is needed jto determine the combination of first tier and second-tier rates that would collect the revenue needed to expand the weatherization program.⁷⁸

Figure 8-2: Recommended Gross Receipts Tax For Unregulated Fuels, 2007-2017



We assume also that federal support for weatherization will continue, but at a declining rate. The state Office of Economic Opportunity estimates that federal dollars will decrease annually by 4.4% through 2012; we assume level funding of the DOE grant for the following five years. Under our proposal, the Weatherization Trust Fund will underwrite critically important investments of \$18.1 million in 2015; over the ten-year period, its contributions will total \$145.6 million. (US DOE grants may provide an additional \$10.0 million over the decade.)

When thinking about the GRT, it may be useful for policymakers to understand the relationship between this revenue source and other similar sources. Considering the pervasive impacts of high fuel bills on Vermont, it is ironic, for example, that the sales

⁷⁸Individual taxpayer data are confidential, but estimates from a quick review by the Vermont Tax Department suggest that approximately 20% of all unregulated fuels sales are made by 6 to 8 sellers whose annual sales exceed \$10 million. There appear to be about 65 fuel dealers with sales of between \$1 million and \$6 million per year, and 50 smaller operators with sales under \$1 million annually.

tax does not apply to residential consumption of heating fuel, but it does apply to the purchase of insulation, efficient windows, air sealing materials, and high-efficiency HVAC systems. In this area, tax policy is not sending efficient price signals to consumers.

More significantly, through the example of the regulated energy industries (electricity and natural gas), we have learned that it is cost-effective to affirmatively invest in energy efficiency and that it is worth adding a small charge to utility rates in order to save even more on utility bills. Vermont is now cost-effectively spending about 4.5% of power system revenues on energy efficiency, and about 2% of natural gas revenues on efficiency, but only 0.5% of unregulated fuels' total sales on efficiency.⁷⁹ In addition, since natural gas and the unregulated fuels compete directly in certain markets, the difference between VGS's contributions to efficiency and the current level of the GRT is a matter of discussion. An increase of 1% in the GRT would still leave the unregulated fuels paying less to help Vermont become more efficient than the state is now collecting from natural gas and electric utility sales. (See Table 8.2).

Table 8-1: Current charges for energy efficiency services, including weatherization

Current efficiency charges	Efficiency in rates	Gross Receipts Tax	Total current
Electricity	4.0%	0.5%	4.5%
Natural Gas	1.5%*	0.5%	2.0%*
Unregulated fuels		0.5%	0.5%

**Recent additions to VGS efficiency programs could raise the VGS rate to as much as 2.5% in rates, and thus the totals for natural gas, increasing the rate difference between gas and the unregulated fuels by an additional 1%.*

Table 8-2: Potential changes in the GRT to support buildings efficiency

Support for affordable heat program	Efficiency in rates	Gross Receipts Tax	Total program
Electricity	4.0%	0.5%	4.5%
Natural Gas	3.0%	0.5%	3.5%
Unregulated fuels Single rate		1.5%	1.5%

- EVT's FCM revenues.*** Projections of net revenues from FCM capacity payments to Efficiency Vermont are relatively modest, ranging from \$114,000 in 2008 to \$1.6 million in 2018. The market, however, is new, and these projections reflect the significant uncertainty surrounding it.⁸⁰ We have reduced the forecasts by 10% more, for an added measure of safety. In 2015, under this proposal FCM revenues will contribute \$1.4 million of these services; over the ten-year period, FCM receipts could provide \$13.2 million.

⁷⁹This is the combined effect of the regulated utilities' efficiency programs and the 0.5% GRT that electric and gas utilities also pay into the Weatherization Trust Fund.

⁸⁰The first FCM auction is scheduled to take place in February 2008.

Recommendation: The Legislature should authorize the state's efficiency utility and the Public Service Board's Fiscal Agent to assign FCM revenues earned by the state's efficiency utility to accounts that will support the development and implementation of market-based efficiency programs for residential and commercial buildings on an whole buildings basis.

4. ***Vermont's RGGI Revenues.*** As with the FCM revenues, the RGGI revenues are likewise uncertain. The regional auction mechanism is currently under development, and there is speculation about the level of demand for allowances in the early years (before the cap is ratcheted down, beginning in 2015). This report does not rely on a forecast of RGGI revenues. Consequently, we include low prices for allowances, slowly increasing, over the next ten years. It may also make sense not to allocate all RGGI revenues to these programs; collections in excess of those generated by specified price levels could be put to other uses as directed by the legislation. Under our assumptions, RGGI revenues will yield approximately \$2.4 million in 2009 (at \$2.00/ton), rising to a high (at \$4.00/ton) of \$4.7 million in 2015, and falling slightly thereafter as price remains constant and the cap declines. By our reckoning, RGGI revenues will contribute \$4.7 million to these services in 2015; over the ten-year period, it will provide \$32.4 million.

Recommendation: The Legislature should authorize the Public Service Board to deposit revenues received from the sale of RGGI allowances with the Board's Fiscal Agent, for distribution to the state's efficiency utility for the purpose of supporting a market-based efficiency program for residential and commercial buildings on an whole buildings basis. To provide flexibility in credit markets, where prices may fluctuate, up to \$3 million per year (until 2012) and up to \$5 million per year (thereafter) could be dedicated to this purpose. Any receipts above this amount could be spent for the other general purposes set out in the RGGI enabling legislation.

5. ***The General Fund.*** For the reasons given above, it is reasonable to conclude that the General Fund and General Fund-supported state agencies could support the buildings efficiency program by the amount of at least \$1.5 million per year. The spreadsheet shows this amount growing at a modest escalation rate; in 2015, this will have increased to \$1.61 million; over ten years it will total \$ 14.94.

Recommendation: The Legislature should consider appropriating approximately \$1.5 million per year to support implementation of building codes and Act 250, time-of-sale disclosure, loan origination, and other techniques to promote energy efficiency in buildings. It is also appropriate for decision-makers to consider whether more substantial General Fund revenues or tax credits should be offered beyond this minimum level of support.

6. ***The Clean Energy Fund.*** The Clean Energy Fund has an enabling charter, an investment plan, and an investments advisory committee in place. Although it is possible to capture some of these funds for buildings efficiency services, trade-offs with renewable and distributed energy should be considered carefully, together with the other funding options suggested in this report.

Recommendation: The Legislature should consult with the Department of Public Service and the members of the CEF investment committee to discuss whether any of the funds now committed to the CEF could appropriately be devoted to the buildings efficiency services outlined in this report.

Table 8-3: Summary of funding options --Potential dollars for investments (millions)

Source	Amount in 2010	Amount in 2015
Private capital & loans	9.5 million	28.2 million
Federal weatherization	1.0	1.0
Weatherization Trust Fund	11.9	18.1
EEC -- Efficiency Vermont	1.0	1.0
Vermont Gas EE program	0.5	1.5
RGGI carbon credit sales	2.5	4.8
Forward capacity market	1.9	1.4
General Fund	1.5 or more	1.6 or more
Clean Energy Fund	(study)	(study)
TOTAL	29.8 million	57.6 million

For additional detail on a year-by-year basis, see the attached spreadsheet.

Potential Sources Funds and Estimates of Fund Levels for Whole Buildings Efficiency

11-Jan-08

Cells in grey highlights are variables.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Gross Receipts											
Escalation Factor		3.00%									
GRT Rates for HO, K & P											
Heating Oil & Kerosene		3,026,370	3,740,593	5,137,081	5,291,194	6,812,412	7,016,785	8,672,746	8,932,928	9,200,916	9,476,943
Propane		1,407,740	1,739,967	2,389,554	2,461,241	3,168,848	3,263,913	4,034,196	4,155,222	4,279,879	4,408,275
Coal		2,644	3,268	4,488	4,622	5,951	6,130	7,576	7,804	8,038	8,279
GRT Rates for NG & E		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Natural Gas		500,744	515,766	531,239	547,176	563,592	580,500	597,915	615,852	634,328	653,357
Electricity		3,593,325	3,701,125	3,812,158	3,926,523	4,044,319	4,165,649	4,290,618	4,419,337	4,551,917	4,688,474
Subtotals, GRT	6,992,953	8,530,823	9,700,719	11,874,521	12,230,757	14,595,122	15,032,975	17,603,051	18,131,142	18,675,077	19,235,329
Federal Weatherization Assistance											
Escalation Factor		-4.40%									
Subtotal	1,231,576	1,146,018	1,095,593	1,047,387	1,001,302	957,245	957,245	957,245	957,245	957,245	957,245
FCM Auction Revenues											
Allocation Factor		90%									
EVT Capacity Revenues	43,203	102,600	1,080,900	1,870,290	1,436,220	1,489,320	1,477,620	1,464,120	1,440,000	1,440,000	1,440,000
RGGI Auction Revenues											
Tons	0	0	1,225,830	1,225,830	1,225,830	1,225,830	1,225,830	1,225,830	1,195,184	1,164,539	1,133,893
Price/Ton	-	-	2.00	2.00	2.00	3.00	3.00	3.00	4.00	4.00	4.00
RGGI Revenues			2,451,660	2,451,660	2,451,660	3,677,490	3,677,490	3,677,490	4,780,737	4,658,154	4,535,571
General Fund											
Escalation Factor		1.00%									
GF Contribution	750,000	1,515,000	1,530,150	1,530,150	1,545,452	1,560,906	1,576,515	1,592,280	1,608,203	1,624,285	1,640,528
Other Potential Funding Sources											
TOTALS	8,267,732	10,529,441	15,843,872	18,774,008	18,665,390	22,280,082	22,721,845	25,294,186	26,917,327	27,354,761	27,808,673

Notes: The FCM figures do not include BED's FCM revenues.
 On the assumption that the all-fuels programs will begin in July, the total revenue figure for 2008 reflects only a six-month contribution from the general fund contribution and, likewise, only a half-year for the increase in the GRT on non-regulated fuels.

Appendix A: Home Performance Partners Job Workshop

A. 1800's Farmhouse, Montpelier, Vermont

Project Overview:

The home was audited on 12-5-05 by Geoff Wilcox. The original structure was constructed in the early 1800s. With additions it now totals 3,700 ft². A blower door test was conducted and the home was found to be drafty at **5,000 CFM50**.

The home uses approximately 1,000 gallons of fuel oil and electric space heaters (roughly 1,000 KW) per season to heat the core of the building. Based on these estimates, the following energy savings can be realized by carrying out the recommendations—totaling \$5,231—generated by Home Performance Partners:⁸¹

- \$ 1,324. First Year Annual Fuel Savings
- 25.3 % Return on Investment
- 3.9 Year Linear Payback Period
- 71 Million Btu's Annual Fuel Savings

Recommendations:

1. The crawl space floor has little to no insulation. The fiberglass that was installed has fallen out of the floor cavities. We should apply Tytar and strapping, and then dense pack the floor with cellulose insulation; 252 sf. 8" cavity.
2. The dryer vent that sticks through this floor should be continued out through the skirting with rigid, insulated vent pipe, and attached to a vent hood; 9 linear feet.
3. The ceiling over the kitchen and washer and dryer room has a lot of air leakage in it. There is a 6" change in ceiling height between the kitchen and utility room. We should dense pack this floor with cellulose insulation; 8" floor cavity approximately - will have to drill and plug. This floor will have to be conscientiously dense packed to insure all cavities are filled, and air leakage stopped; 450 sf.
4. The walls of this utility room can be dense packed from this attic floor space; 375 sf. 4" cavity.
5. The box-sills in the basement should be air sealed and insulated with 2 part foam. Applied from the underside of the sub-floor continuously over the mudsill and touching the foundation wall; 178 linear feet perimeter of basement.
6. The door at the bottom of the bulkhead opening is very leaky and should be rebuilt with a sandwich door, using plywood on both sides sandwiching 2" high-R rigid insulation; opening is 4' x 5'... needs pressure treated jambs, new hinges and latches.
7. Weather-strip the door from the upstairs bathroom to the cold attic, as well as the door at the bottom of these stairs, and the door in closet in this attic. These may need door sweeps also.

⁸¹ Prices of \$2.50 per gallon of oil, \$160 per cord of wood, and an estimated 45% reduction in air infiltration after our work is completed were used to determine project economics.

8. The attic hatch should have weather-strip and 4” rigid high-R applied to the back.
9. The opening to the plumbing pipes behind the bathtub needs to be air sealed; plug it with 1’ x 3’ high-R behind the access door, caulk in place.
10. Note: There is wet cellulose in the wall below this bath tub. I believe it is from water splashing out of the tub and leaking through the crack between the linoleum and the bathtub. This should be caulked to keep water out of the floor system.

Other Recommendations:

- Repair the air filter assembly and replace the air filters.
- Have the barometric damper adjusted/ replaced so that it isn’t stuck wide open.
- The furnace stack temperature is real high, 800 degrees. This lowers efficiency (a lot of heat lost up chimney). Ask oil technician for solutions, fixing barometric damper will help.

B. Contemporary Home, Middlesex, Vermont

Project Overview:

An energy audit was conducted by Geoff Wilcox on 2-26-07. The 2,000 ft² home was found to be fairly drafty for the age of the home (**3,450 CFM50**) and the insulation in the sloped ceilings and attics was not very effective. See IR pics. A list of cost effective energy improvements have been determined and are proposed to be done by our Home Performance Partners Crew.

Based on an estimated fuel consumption of 475 gallons fuel oil and 3.25 cords of wood per year, the following energy savings can be realized by carrying out the recommendations—totaling \$6,100—generated by Home Performance Partners:⁸²

- 11 % Return on Investment
- 9.1 Year Linear Payback Period
- 44 Million Btu’s Annual Fuel Savings
- \$ 672. First Year Annual Fuel Savings

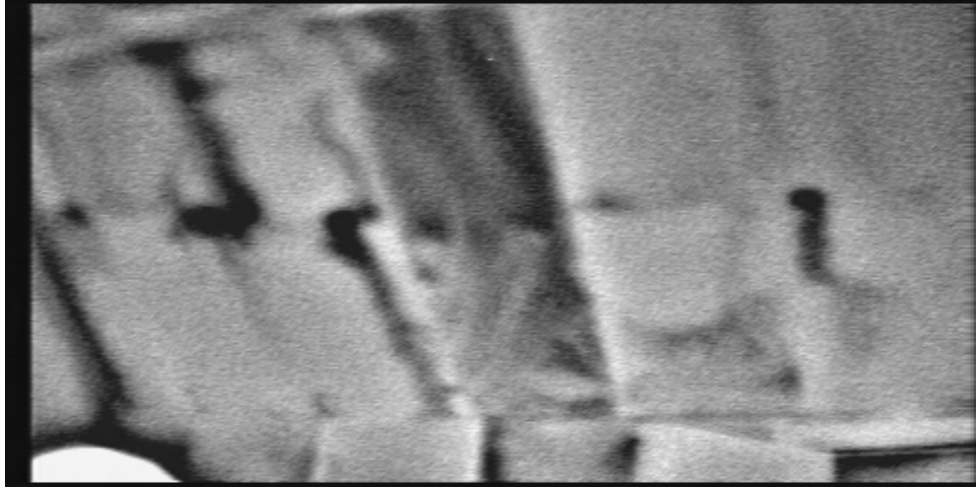
Project Workscope:

Attic:

- Will air seal the chimney air bypass with flashing and hi temp caulk. Will also dam around it to keep cellulose 3” from chimney.
- Will build a dam around the attic access hatch.
- Will apply 4” of rigid insulation to the back of the attic hatch. Will also weather-strip this leaky hatch. Will need to bring some 1” x 4” pine to trim around the opening to install Q-lon weather-strip to.
- There is a change in ceiling heights from both end bedrooms to the middle ceiling over the stairway. This 2’ change in ceiling height leaves a big interior wall bypass.

⁸² Prices of \$2.50 per gallon of oil, \$160 per cord of wood, and an estimated 45% reduction in air infiltration after our work is completed were used to determine project economics.

- Will remove the fiberglass from this wall and then apply 5 inches of Closed Cell Foam. 200 board feet of foam. 40 sf. of R-19 fiberglass to remove and dispose of.
- Will foam the tops of the gable end walls in the attic with Closed Cell Foam (CCF). 75 board feet of foam.
 - The sloped ceiling insulation is performing poorly, see IR pic. Below. This is due to the proper vent and strapping in the ceiling. Will dense pack the slopes with cellulose insulation to improve this. Will pull the bat of fiberglass from the top of each bay and remove. They are unfaced and will come out. Will then dense pack 462 sf. of 8" cellulose.



IR pic. Of slope ceiling performance. Black is cold. Air is moving between the fiberglass insulation and sheetrock ceiling lowering its effectiveness. The real black bay has a plumbing vent pipe in it and fiberglass above it, virtually doing nothing.

- Will air seal all pipe and wire penetrations through this attic floor with foam.
- Will remove the fiberglass from the gable end bays of this attic. Will then open blow 12" here, and 4" over the rest of the attic to encapsulate the existing fiberglass (improve performance by stopping convective currents). 274 sf.

Kneewalls: There are several kneewalls that are accessed from the closets on the second floor. There is fiberglass insulation in the slopes with poly over it. There is no true air barrier here, thus a lot of air leakage and ineffective insulation.

- Will remove the fiberglass insulation and poly from all kneewalls. A few hatches will need to be made through the back of the shelves in these 2 bedrooms. Will replace the sheetrock in these access's and tape with one coat of mud once foam is applied.

NOTE: There is a kneewall over the kitchen table that will need to be accessed through the bookshelf upstairs. Also there are 2 kneewalls that are visible from the closet in this room. Will have to make a larger access from each bedroom.

- Will apply Closed Cell Foam to all kneewall slopes. Will apply 5" thick (R33). There is approx. 150 sf. of slope, 750 board feet.
- The kitchen ceiling is connected to outside. It gets very cold with blower door on. Will cut a hole in the sheetrock on the sloped ceiling of the closet upstairs above the kitchen. Will make this down low by the floor to see if blowing the slopes will stop this air leakage into the ceiling. If not a bag and blow through this plywood floor will have to be made. Approx. 20 linear feet of kitchen ceiling. **NOTE: This would be an addition price, and is not included in the estimate.**

- Will apply one coat of tape and joint compound to the sheetrock on the slope of the closet.
- Will also air seal the sloped ceiling to kneewall junction with foam.

Cantilevered Floors: These are very cold and a source of air leakage into the building.

- Will remove the finished 3/8" plywood from the bottom of cantilever floors. Will need staging, there is a 2.5' x 7.5' cantilever on the first floor and a 4' x 7.5' cantilever on the second floor.
- Will apply Closed Cell Foam to the exterior shell of the building to air seal and insulate. 250 board feet of foam.
- Will replace the plywood if possible, if not will replace with new 3/8" plywood soffit material. NOTE: This won't be painted.

Other Measures:

- Will remove any fiberglass from the basement sills and apply a nominal 3" of Closed Cell Foam. 200 board feet.
- Will apply mastic to all return ducts in the basement.
- Will apply a butterfly damper in the down flow kitchen vent duct. Will attempt to repair the existing vent hood also.
- Will replace the existing bathroom exhaust fans in both bathrooms. Will use Panasonic 90 cfm fan lite combination unit. Will connect to the existing vent pipe.
- Will vent the clothes dryer to the outside with rigid aluminum. Need 8' of vent pipe, elbows, vent hood.
- Once all measures are done, will set up blower door and perform blower door assisted air sealing using foam, caulk, etc. Pre was 3,450 CFM50. (*Post construction was 1,250 CFM50, a 36% tested reduction in leakage*)

Other Recommendations:

- Your fridge was rated to use 1,140 kwh/yr. when it was brand new. (It is probably using at least 25% more now due to leaky seals, wear and tear, etc.) An energy star rated fridge of the same size uses approximately 425 kwh/ yr. At .13 cents a kilowatt hour, you would probably save \$8-\$10 a month if replaced with an Energy star fridge.
- I would highly recommend getting a digital humidity gauge and monitoring the relative humidity in your home. It appears the humidifier on the furnace is putting too much moisture in the air, that is why you have condensation on your windows (as well as the unvented dryer and non-functional bathroom fans). 30-50% relative humidity is recommended, the lower the better on a cold day or night.

Audit and Estimate by Geoff Wilcox

Home Performance Partners

476-2093

C. Classic Rambling Farmhouse, Brookfield, Vermont

Project Overview:

An energy audit was done at this home on 2-12-07. The approximately 3,000 ft² home includes a 17th century core structure with multiple generations of additions extending in different directions. A blower door test was done and the home was found to be a very drafty 10,358 CFM50. The Infra red camera showed the home to have a lot of inadequately insulated attics, sloped ceilings, and exterior walls as well. A list of cost effective energy improvements have been determined to improve these issues and are proposed to be done by Home Performance Partners.

Based on historical fuel consumption of 2,300 gallons fuel oil per year, the following energy savings can be realized by carrying out the recommendations—totaling \$14,290—generated by Home Performance Partners:⁸³

- 14.1 % Return on Investment
- 7.1 Year Linear Payback Period
- 112 Million Btu's Annual Fuel Savings
- \$ 2,012. First Year Annual Fuel Savings

Recommendations/Proposal:

Attic (Main House) Access is through the ceiling in the small guest bedroom.

- There is some chopped fiberglass in the sloped ceilings, but it has settled and there is a lot of voids. Will dense pack these slopes with cellulose. 192 sf. of 6" dense pack.
- Will air seal all pipe and wire penetrations through the ceiling, including pipes, wires, etc.
- Will air seal all interior partition top plates with 2 part foam. Approx. 50 linear feet.
- Will air seal where the chimney penetrates the attic floor. Use flashing and hi temp. caulk. Will also dam around this chimney with flashing.
- Will apply 4" of rigid insulation to the back of the attic access hatch. Will also weather-strip the hatch.
- The ceiling in the small guest bedroom where the access hatch is located is very drafty. This needs to be sheetrocked to air seal. Will apply ½" sheetrock to the ceiling and one coat of joint compound. 90 sf.
- There is only about 4-5" of loose fiberglass in the attic. Will open blow 8" of cellulose after all air sealing is done. 592 sf. of 8" open blow.

Floored attic (access through door in daughters room)

- Will air seal all penetrations through this attic floor. Including flashing/ sealing and damming the chimney penetration.

⁸³ Prices of \$2.50 per gallon of oil, \$160 per cord of wood, and an estimated 45% reduction in air infiltration after our work is completed were used to determine project economics.

- There is only 4” of fiberglass in this walk in attic floor. Will dense pack the plywood floor with cellulose. 336 sf. of 7” floor cavity.
- There is 168 sf. of attic floor on the sides of this floor section that will be open blown with 8” of cellulose.
- Will weather-strip the access door to this attic and apply 2” of rigid insulation to the back of it. Install a door sweep if necessary.

Small 5’ x 12’ kneewall area accessed from this attic

- Will air seal all penetrations through the floor, pipe, wires, etc.
- Will remove all of the fiberglass from the back of the wall, and the floor and dispose of this. Floor is 5’ x 12’, wall is 4.5’ x 12’.
- Will open blow 12” of cellulose on this floor after wall is foamed and floor is air sealed. 60 sf. of 12” open blow.
- Will apply a nominal 3” of Closed Cell spray applied urethane foam to the back of the kneewall from the floor to the bottom of roof (6’ tall x 12’ long). 216 Board Feet.

Attic over rental apartment

- Will air seal all interior partition wall top plates with 2 part foam from the attic.
- Will air seal the chimney penetration with flashing and hi temp caulk. Will dam around it also.
- Will weather-strip this access hatch, and apply 4” of rigid insulation to the back of the access hatch.
- Will air seal all penetrations through this attic floor (pipes, wires, etc.) with foam or caulk.
- Will remove the fiberglass batts from the 2 bays adjacent to the gable end walls. Will open blow 12” here and 6” over the existing 6” of fiberglass on the attic floor. 480 sf. of 6” open blow.
- Will access the kneewall behind the kitchen sink. Will remove the loose poly and fiberglass in the slope and then apply a nominal 5” of Closed Cell spray applied urethane foam to this slope. Approx. 6’ x 8’. 240 Board Feet.

Exterior Walls

- The gable end wall in the sons bedroom is very poorly insulated. Will dense pack these walls with cellulose as well as the other poorly insulated sections. Will need the Infra red camera to identify these areas. Approx. 300 sf. of 4” cavity to dense pack.

Garage / Basement

- Will pull down the ceiling of the garage and any fiberglass insulation that is in place.
- Will apply Closed Cell spray applied urethane foam to this garage ceiling. 3”. 1,404 board feet.
- This garage needs to be separated from the rest of the basement to keep carbon monoxide and other harmful chemicals out of the house. Will make the existing wall air tight and insulated. Will also build or install an air tight entry door from the garage to the basement. This wall is approx. 13’ long.
- The alcove needs to be air sealed so the garage is separated from the basement. Will use foam.
- Will use Closed Cell spray applied urethane foam to insulate and air seal this above mentioned wall. 373 board feet.

- Will apply a nominal 3” of Closed Cell spray applied urethane foam on the sills and top of foundation walls. Will apply from 3” thick on top 3’ of foundation (including sill) throughout this rambling basement. 1530 board feet.
- Will apply Closed Cell spray applied urethane foam to the sills (nominal 3 inches) in the garage/ workshop under the apartment. 234 Board feet.
- The fiberglass insulation that is in the garage walls is very ineffective and drafty. This should be removed and 3” of Closed Cell spray applied urethane foam applied to the exterior walls. 1,248 Board Feet.

Misc. Air Sealing

- Will apply weather-strips and door-sweeps to the 4 different entrance doors. One of the doors will need some padding down at the top, as the frame has settled and there is a large gap at the top corner.
- This is a big drafty house. 10,358 CFM50 whole house air leakage. After all above measures are done, will set up the blower door and identify additional air sealing opportunities. Will use caulk, foam, etc. to air seal.

Audit and Estimate by Geoff Wilcox and Paul Zabriskie
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