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Thermal Efficiency for Low-Income Households in Vermont

Economic Performance, Energy Justice, and the Public Interest

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Acronyms

ARRA	American Recovery and Reinvestment Act
BED	Burlington Electric Department
CO_2	Carbon dioxide
CVOEO	Champlain Valley Office of Economic Opportunity
EEO	Energy efficiency obligation
EERS	Energy efficiency resource standard
ESCO	Energy service company
GHG	Greenhouse gas
GWh	Gigawatt hour
IECC	International Energy Conservation Code
IRP	Integrated resource planning
LEED	Leadership in Energy and Environmental Design
LIHEAP	Low Income Home Energy Assistance Program
NEEP	Northeast Energy Efficiency Partnership
NO_X	Nitrous oxide
NWWVT	NeighborWorks® of Western Vermont
PM	Particulate matter
PPESCO	Public purpose energy services company
SO_2	Sulfur dioxide
T&D	Transmission and Distribution
TETF	Thermal Energy Task Force
VEIC	Vermont Energy Investment Corporation
VFEP	Vermont Fuel Efficiency Partnership
VGS	Vermont Gas Systems
WAP	Weatherization Assistance Program

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Thermal Efficiency for Low-Income Households in Vermont

Economic Performance, Energy Justice[1], and the Public Interest

Executive Summary

This paper seeks to characterize and quantify the multitude of benefits that are associated with investments in thermal energy efficiency initiatives, especially as they relate to reducing the burden on low-income households. This paper also offers promising pathways and a platform for capturing and delivering these benefits.

Vermont, one of the most beautiful states in the nation, is well known for winter activities as a result of its mountains and snowfall. However, this also means that Vermont is consistently among the top ten coldest US states on an annual basis. For low-income residents, such cold temperatures invariably mean a struggle to heat their homes. Inadequate fuel for heating in the winter is a problem that multiplies. High fuel costs take a disproportionate chunk out of families' tight budgets and make it more difficult to meet other basic needs, contributing to inadequate nutrition, missed school and work days, and discomfort at home. The result is increased winter illness, diminished job performance and reduced job opportunities; and an ongoing struggle to pay for food and medicine after energy costs are accounted for.

Thermal energy efficiency refers to improvements to the usable heating and cooling performance of buildings and equipment associated with the heating fuel or energy provided. Thermal energy efficiency creates direct benefits from lower energy costs — but the indirect benefits experienced largely by these households, but also by the broader public community, may provide the most compelling case for public policy intervention, especially for lower income households. A summary of these benefits follows:

Lower Fuel Bills: Perhaps the most apparent and well understood benefit of energy efficiency is the benefit of fuel savings that extends broadly to the public welfare or well-being. The economic case for investing in energy efficiency, rather than continuing to pay unnecessarily high fuel bills, is strong, yielding energy savings alone equivalent to 465,000 gallons of fuel oil from weatherization services in the first year.[2] Efficiency Vermont reports that in 2012 alone, their work resulted in lifetime customer savings of $206 million.[3] The benefit-cost ratios have are typically more than 2 to 1 (benefit versus costs), and often greater.

Energy Affordability: Inability to afford high-cost energy is recognized as fuel poverty. People who are fuel-poor are compromised in their ability to meet other basic household needs such as food, medical expenses, and education, as well as their ability to stay comfortable in their own homes. By one measure, the number of fuel-poor in the state increased from 71,000 in 2000 to 125,000 in 2012, largely due to the fairly significant rise in the price of fossil fuel, particularly fuel oil, over that period. But it is also due to the fact that most Vermonters, including the lowest-income segments of the population, have seen little income growth.

Health and Safety: An average of 172 deaths a year in Vermont are directly attributable to winter weather, and most of those are likely due to inadequate home heating. Fuel expenses compete with other utility bills, food, and medications for limited household funds, especially for low-

1 The topic of ethical issues around energy, referred to as "energy justice," was the subject of *Global Energy Justice,* a 2014 book by Benjamin K. Sovacool and Michael H. Dworkin.

2 Vermont Office of Economic Opportunity, 2012.

3 Efficiency Vermont, 2013.

income Vermonters. Hard choices here ultimately present challenges to personal health, with repercussions in the form of absence from school and work and loss of productivity.

Extending the Reach of Public Services: As noted above, inadequate heat places pressure on other basic services, and the increased demand on government to help meet the heightened need. Nationally, 32 percent of low-income households are unable to meet essential needs broadly defined, including food, medical needs, utilities, and rent. Low Income Home Energy Assistance Program (LIHEAP) services only reach a fraction of the eligible need (1 in 5). If the homes of low-income Vermonters were insulated and airtight, they could spend 30 to 40 percent less to keep their homes warm, and use the savings to meet other basic needs.

Regional and Global Environment: The GHG reduction potential from thermal efficiency improvements is also material. In Vermont heating oil is relied on most heavily for heat. Each gallon of heating oil saved from energy efficiency reduces carbon emissions by 22.6 pounds, and homes receiving thermal retrofits through the Weatherization Assistance Program (WAP) save an average of 200 gallons each. Program installs since 2008 have resulted in over 28,000 tons of CO_2 reduced annually.

Improving the Local Economy: Lower fuel costs and efficiency improvements stimulate economic development and job creation. Approximately 66 job-years typically result from each million dollars of investment in energy efficiency.[4] About 75 to 85 percent of the job creation is associated with increased real disposable income that results from these investments and reduced energy bills. Programs targeting low-income households will predictably lead to higher job and output multipliers because of higher spending rates (and lower savings rates), which result in money spent by low-income households being recirculated in the economy. Direct employment also results in thousands of Vermont jobs.

Recommendations: A number of policy recommendations logically flow from these insights. At the highest level, the recommendation is to strengthen the state's commitment to thermal energy efficiency. Categories of benefits that are typically omitted from formal reviews can provide justification for more efforts and deeper savings across all income groups. There is an especially strong case for programs that particularly target low-income households.

There are a variety of standard approaches to advancing thermal energy efficiency for low-income households. The approach recommended here builds from a strong foundation of effective codes, standards, and time-of-sale requirements related to labeling and disclosure.

- Strengthening building codes, appliance standards, and disclosure;
- Continuing to work with builders and manufacturers specializing in low-income housing and modular homes to build more efficient homes through incentive programs and education;
- Fostering strategies beyond codes to spur introduction of high efficient and net zero modular homes;
- Capturing benefits for screening and targeting in integrating resource planning and weatherization assistance;
- Establishing enforceable thermal energy savings targets;
- Enabling of new markets for energy efficiency services;
- Expanding existing programs with track records of success; and
- Combining social welfare assistance efforts and health-care-related funding to provide help in paying for energy efficiency.

Binding targets, new markets, and growth of existing programs can all be applied to more intensively target low-income households. Integrated resource planning can also be employed in ways that recognize the multiple categories of benefits that apply in some unique respects to low-income households.

4 Howland and Murrow, 2009.

I. Introduction

Since the turn of the century, investments in energy efficiency have significantly reduced the economic burden on Vermonters. The total annual demand for electricity, expressed in kWh, has been reduced by 13.1 percent since the inception of a centralized delivery structure for energy efficiency programs through Efficiency Vermont in 2000.[5] Retrofit investments in thermal energy efficiency by Efficiency Vermont and Vermont Gas have reduced energy demand in about 6,700 homes, and investments in thermal efficiency for low-income households eligible for weatherization assistance have reached more than 10,700 homes since 2008, equivalent to roughly $10 million in savings annually.[6,7]

Yet despite this progress, the state is still underperforming on its own legislative goals for thermal energy efficiency and weatherization of lower-income households. An estimated 125,000 Vermonters (about 53,000 households) remain in fuel poverty — a situation that could be relieved through thermal energy efficiency initiatives. Illness and even dozens of deaths in the state each year are attributed to inadequate heat in the winter. There is a two-year waiting list for weatherization services, and low-income fuel assistance benefits declined in recent years amid an environment (until recent months) of high oil and gas prices.

Approximately 10 percent of households (or 27,000 households) in Vermont rely on low-income heating assistance through LIHEAP, for an average benefit in 2013 of $853 per home.[8] Approximately 20 percent of Vermont households are considered low-income and therefore qualify for weatherization assistance. Local utilities and Efficiency Vermont also provide overlapping assistance.[9] Inadequate heat has repercussions in the areas of health and well-being (and health care costs), student and worker productivity, housing assistance, and even food assistance. In recent years, Vermont supplemented the federal budget allocation for fuel assistance to help meet gaps from federal reductions.[10] The initial 2015 federal grant allocation for Vermont low-income consumers is $18.9 million, marginally down from prior years.[11] Most of the LIHEAP funds are from federal government block grants.[12] Vermont typically matches the LIHEAP funds with supplemental assistance of approximately $6 million annually.

Reducing the costs of this assistance, and the risks involved when it falls short of Vermonters' needs, is one of many compelling policy reasons for investments in low-income thermal energy efficiency. Some of these apply broadly to all income groups. Vermont has already established formal goals for thermal efficiency retrofits and energy codes for new construction. However, the state has already fallen off a trajectory that would meet those goals (due to inadequate funding), despite a period of heavy

5 Efficiency Vermont, 2014.

6 Thermal Energy Task Force, 2014. Figures reflect values equal to figures reported through 2013, plus estimates for 2014.

7 Assumes roughly 270 gallons of heating oil saved at approximately $3.50 per gallon. This figure contrasts sharply with the target of $1.5 billion in lifetime savings pursuant to Vermont Statute Title 10 V.S.A. § 581.

8 Eligible households include those up to 185 percent of the poverty line. See Spotlight on Poverty, 2015. Approximately 68,000 of the 257,000 households in Vermont qualify for LIHEAP assistance. Census data shows 160,000 individuals that are at 185 percent of poverty level in Vermont, out of the approximately of 601,000 for which poverty status was determined. Based on these figures, only about 40 percent of households that are eligible for LIHEAP participate.

9 US Health and Human Services, 2015.

10 Vermont Speaker of the House, 2011.

11 In FY 2014, LIHEAP spending was over $19 million and over $27 million in FY 2013. LIHEAP Action Center, 2014.

12 US Health and Human Services, 2014.

federal budget support from the American Recovery and Reinvestment Act of 2009 (ARRA).[13] Vermont's goals were established in March of 2008,[14] just prior to the ARRA supplemental funding of these programs.

Low-income households present challenges for participation in thermal efficiency initiatives that are distinct from other segments of the population. First, low-income families who own their homes have greater difficulty raising the necessary capital to invest in sealing up or otherwise improving the homes' energy performance. (Low-income households that qualify for LIHEAP heating assistance is 185 percent of the federal poverty level.[15] Households that are in crisis, or otherwise unable to pay for fuel, qualify at 200 percent of the federal poverty level. Households eligible for weatherization include those that receive fuel assistance or are below 80 percent of Vermont median household income.)[16] These households typically cannot meet traditional underwriting criteria.

Second, almost half of Vermont's low-income families rent rather than own their homes.[17] In private rentals, they typically pay the home heating bill, either as a portion of the monthly rental or separately, but they do not control home-improvement investments. Nor, for that matter, do those with control over investment decisions typically see a benefit from these thermal efficiency improvements. Despite a strong incentive to control costs, tenants' ability to do so is limited by their control over investments in the building structure and heating system, which are the responsibility of the property owner or landlord. Even if the issues associated with these so-called "split incentives" were not present, renters tend to have a shorter tenure in a given home, which also presents challenges for recovering the value of the investment from the energy savings or returns to the renter or building owner making the investments.

Vermont needs to address these challenges head on, strengthening its commitment to both thermal energy efficiency and to low-income households. Reviews show that while programs such as weatherization are cost-effective based on energy benefits alone, the non-energy benefits of such programs are typically even larger.[18]

Low-income families experience greater hardship from rising costs of fuel, primarily because fuel competes with other basic needs for household dollars, which can in turn compromise health and safety and lead to further absenteeism and lower productivity. It follows that the lower the income of the affected population, the higher the magnitude of these secondary non-energy benefits. This conclusion logically extends further to economic development benefits due to the higher spending rates of lower income households. For the reasons explained in this paper, the policy foundation for investments in energy efficiency extend well beyond the economic benefits of energy savings to include issues of efficient use of public funds, issues of social and energy justice, and public health and well-being.

The graphic below shows the thermal energy efficiency measures that are applied to households engaged in energy retrofits by Efficiency Vermont. While the graphic applies broadly to single-family thermal energy retrofits, the measures are also specifically appropriate for thermal efficiency in low-income households.[19]

In Vermont, 2,593 homes have participated in whole-house retrofits administered by Efficiency Vermont. The cost of the weatherization projects, including the Home Performance with Energy Star initiatives, is $11,430,637 (about $4,408 per household). The estimated benefit of the program in Vermont is $13,665,498 ($5,270 per household), yielding a net benefit of $2,234,862 ($862

13 ARRA was the economic stimulus package passed by the 111th Congress that was signed into law in February of 2009. Among the provisions of the Act was $5 billion set aside for weatherization of lower income households. ARRA funding of thermal energy efficiency initiatives were due to be completed by the end of 2012. The ARRA contributions served as a significant boost toward helping Vermont make substantial progress toward meetings its objectives for thermal efficiency. As ARRA funds, however, subsided, so too has the promise of achieving the legislative targets.

14 Building Efficiency Goals, 10 V.S.A. § 581 (2007 and 2013).

15 LIHEAP Action Center, 2014.

16 Vermont Department of Children and Families, 2015.

17 Approximately 47 percent of the lowest earning 20 percent of the population are renters. VLS, 2015.

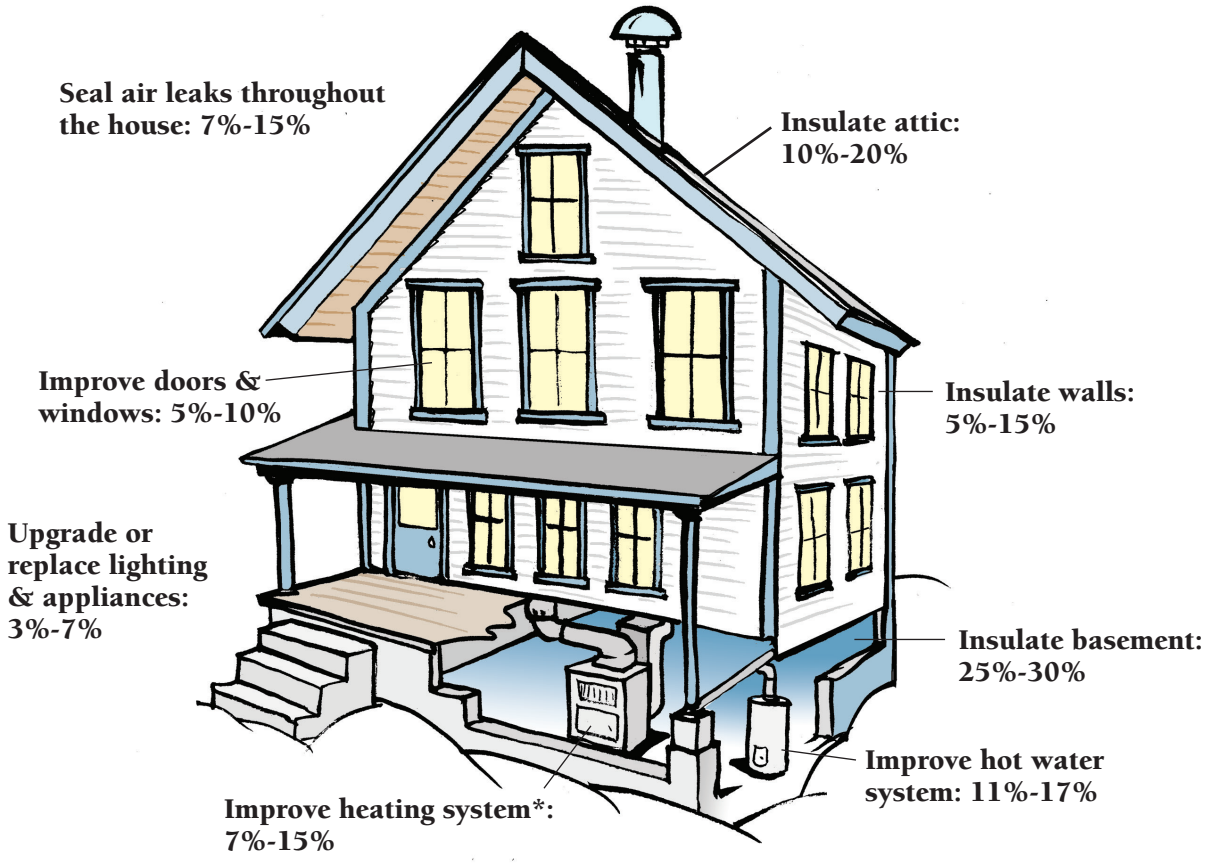
18 As an example, a survey of the literature by Oak Ridge National lab in 2002 showed that on an investment of $1,779 (in 2001 dollars) for weatherization services, resulted in energy benefit of $3,174 and non-energy benefits of $3,347, that included safety, health, comfort, and environmental benefits. Schweitzer and Tonn, 2002.

19 VEIC, 2015. Graphic from Tim Newcomb and percentage savings estimates from VEIC provided January 2015.

Figure 1

How Do Retrofits Save Households Money?

Percentage of Annual Retrofit Savings Due to Different Efficiency Measures.



**Can go much higher with a complete change of system, e.g., from oil to heat pump.*

Source: Efficiency Vermont, Graphic by Tim Newcomb

per household).[20] The program is administered under the auspices of Efficiency Vermont, which provides incentives as part of the services delivered through the statewide efficiency utility funded by the Vermont Energy Efficiency Charge.[21]

The low-income WAP is distinct from the Home Performance with Energy Star initiative. The fully loaded costs of installations with the WAP per installation is $8,965 (including roughly 15 percent devoted to measures designed specifically to address home improvements for health- and safety-related concerns). With each installation, the corresponding fuel benefit alone is required to be greater than costs by a factor of at least 1.2 (roughly $10,760) per household. Even while health and safety improvements are an integral component of project costs, they are unrecognized in the benefit calculations, which also leave out the other categories of policy benefits and imperatives that are associated with these investments enumerated below.

Energy efficiency is the invisible fuel. It is easy to measure and monitor the fuel that is consumed, but it is harder conceptually to measure and monitor fuel that we avoid using as the result of energy efficiency improvements to the building shell or performance equipment and lighting. There is often a device or end use associated with energy consumption, but there is typically little outward difference between standard devices and efficient ones. Building shell improvements are not apparent except during installation. Because it is invisible, it typically goes unrecognized or ignored. The performance of energy efficiency is, in the end, a matter that requires effort to

20 Efficiency Vermont, 2015. Calculated based on 2593 participants per Table 4.28, Efficiency Vermont, 2014.

21 Ibid.

verify. Recognizing the challenges and opportunities, Vermont utilities and the state have made energy efficiency a priority, at least for regulated fuels. Vermont utility ratepayers now fund electric programs at a level of $52 million (relative to retail sales revenue of just over $800 million). Vermont Gas Systems invests roughly $2.2 million a year in energy efficiency (relative to retail sales revenue in 2013 of $91 million).[22]

Some of this investment goes toward thermal efficiency improvements, but the bulk of it does not. However, buildings in the state, including residential, commercial and government, are the most significant users of fossil-fuel use other beyond transportation. Thermal use of energy to heat buildings and hot water accounts for roughly 28 percent of energy use.[23] The majority of energy used for home heating in Vermont is from oil and propane. Vermonters rely on regulated fuel as the primary source of heat for only about 21 percent of households (see Appendix I).

22 Gilleo et al, 2014.

23 Thermal Efficiency Task Force, 2013.

II. Thermal Energy Efficiency: Imperatives for Investments in Low-Income Households

The efficient use of fuels, or energy intensity of fuels, to meet household needs is an imperative for many reasons that are increasingly well understood and accepted in Vermont. Vermont's commitments are increasingly evidenced by the programs and funding of activities of Efficiency Vermont and the state's utilities. Perhaps less well understood are the imperatives related to thermal efficiency, which typically depend on fuels that are not price regulated; they also lack dedicated funding or a framework for aggressive deployment of all cost-effective initiatives. Commitment to low-income households' thermal energy efficiency is especially important and deserves focused explanation and understanding. There is a long list of compelling reasons for policymakers to create programs and mechanisms to address the need. The cornerstone of the policy case for investments in energy efficiency targeting low-income households is the sound economics, as these investments pay for themselves over time.

The justification for public sector policies that require or fund programs to support energy efficiency are fundamentally tied to the many categories of benefits that are either unrecognized or systematically undervalued by consumers. But even policymakers may fail to appreciate the inherent value of investment in energy efficiency, especially investments that target heating fuels and low-income households.

Among the public policy imperatives supporting public and utility investments in energy efficiency include the following: economic efficiency from fuel savings, local environmental performance of energy services, global environment, public health and safety, and economic development.

Among the public policy imperatives that support public and utility investments in thermal energy efficiency for low-income households are basic notions of fairness or social equity that in turn tie to issues of concerns for affordable energy, public health, student performance, as well as productivity of the workforce. Adding to the list of benefits include the relief that efficiency investments can provide to low-income households that in turn can rely less heavily on overstressed network of related public safety nets, including LIHEAP, food banks, and health care.

Challenges for Renters

Low-income renters who pay their fuel bills separate from the monthly rent face a special challenge. About 29 percent of Vermont households (approximately 74,000 households) are renters, and low-income families are disproportionately renters.[24,25] The challenge for renters is that investment decisions in major appliances, furnaces, and building shell improvements are made by property owners, while fuel bills are often paid for by tenants. The challenge is long-recognized challenge of "split incentives" where there is little alignment between the incentives of landlords and tenants. Rental housing is a particular concern for the city of Burlington. That city's approach to these challenges is instructive.

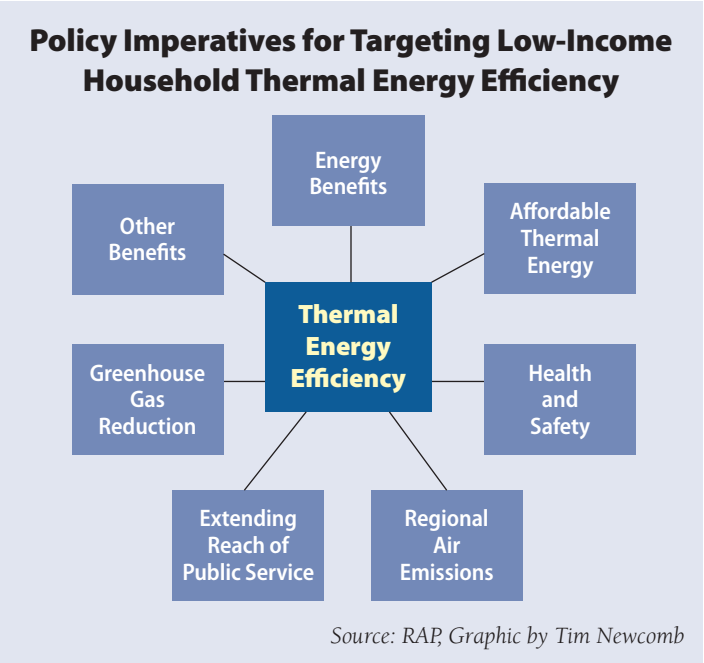
Burlington offers rebates for new, energy-efficient refrigeration and ventilation equipment, as well as free lighting and water conservation equipment for existing rental properties. Additional weatherization services are available through Vermont Gas Systems or the Champlain Valley Office of Economic Opportunity (CVOEO). The city also has a long-standing time-of-sale ordinance that sets a minimal standard for energy efficiency in rental properties. The ordinance is implemented in partnership with its electric company, the Burlington Electric Department. The requirements of the ordinance are modest, and effectively ensure code compliance for certain levels of weatherization.[26]

24 As noted earlier, approximately 47 percent of households in the lowest earning 20 percent of the population are renters. Only about 4 percent of the population in the top 10 percent bracket are renters.

25 Thermal Energy Task Force, 2013.

26 Thermal Energy Task Force, 2013.

Figure 2



Source: RAP, Graphic by Tim Newcomb

A. Energy Benefits

The energy benefit of thermal efficiency investments captures the fuel savings that are most directly associated with these investments. The fuels savings or benefits of energy efficiency are those that consumers recognize and respond to. Energy benefits also capture the avoided capacity and system benefits including the bricks and mortar that are associated with installed generation, transmission lines, pipeline capacity, and the rail and distribution network that is associated with liquid fuels and biomass.

Closely associated with energy efficiency is a cost reduction or net economic benefit. More often than not, the concept of net economic benefit applies to a narrow set of benefits experienced by the utility, or the customer. In Vermont, the concept has been extended for our regulated utilities to include system benefits and societal benefits generally under the "societal economic test." But for 79 percent of the homes in Vermont that rely primarily on non-regulated fuels and on customer economics and energy benefits in the calculation of economic benefits, an even broader application of a societal test would be more inclusive and is accepted in state policy.[27]

The policy case for investments in thermal energy efficiency is compelling and has many elements. However, the economic case, or ***net economic benefits,*** of thermal efficiency represents a policy foundation upon which many other benefits naturally follow. The economic savings that result from these investments reduce both the immediate needs for fuel services and the longer-term cycle of dependence on future supplier capacity and annual fuel requirements. The real savings or net economic benefit of thermal energy efficiency is also the key driver for jobs and development benefits.

Energy efficiency investment by providers in Vermont has a long history that rests on planning efforts designed to capture investments based on objectives of lowest cost and comprehensive treatment of end uses. In the US, electric utilities invested approximately $6.3 billion in 2013 in energy efficiency programs that are tied to formal program activities.[28] Combined with gas utility investments, electric and gas utilities have invested $7.2 billion in energy efficiency in 2012, approaching twice the investment of just four years prior in 2008 ($4 billion). Vermont has been a leader and currently ranks among the top three for the savings levels (as a percent of sales) achieved by state-funded, electricity-utility-delivered energy efficiency programs. Vermont Gas ranked first among gas utilities for the level of savings achieved (1.5 percent of sales).[29] In Vermont, $52 million in has been budgeted for investments in energy efficiency in 2015.[30]

Recent analysis of thermal energy efficiency investments show that the investments' benefit/cost ratios is over 2.6, and returns on public funds committed to be as high as a 5.6 ratio and to yield a targeted benefit of roughly $927 million.[31]

Societal Benefits of Thermal Energy Efficiency

The concept of energy efficiency and economic efficiency in energy use is not limited to any specific fuel. While in regulated fuels, the connection may be clearer in that ratepayers are investing in a less expensive supply resource through efficiency efforts to serve their needs, it is equally applicable to non-regulated fuels. Policymakers have a variety of tools discussed below to help encourage both regulated and non-regulated providers of services to encourage or incorporate thermal energy efficiency

27 See State Energy Policy. 30 V.S.A. 202a (1981) and Least cost integrated planning. 30 V.S.A. 218c (1991 and 2011).

28 Gilleo et al., 2014.

29 Gilleo et al., 2014.

30 Vermont Public Service Board, 2015.

31 Thermal Energy Task Force, 2013.

Table 1

Economic Benefits of Thermal Efficiency Task Force (TETF) Recommendations

Programming Combination	Net Present Value of Benefits	Benefit-to-Cost Value of all Investments	Benefit-to-Cost Value of Public Investments
Total renewable and efficiency initiatives (via current and recommended incremental funding)	$2 billion	$2.23 to $1.00	$6.40 to $1.00
Incremental renewable and efficiency initiatives, per TETF recommendations	$1.4 billion	$2.05 to $1.00	$6.18 to $1.00
Incremental efficiency initiatives alone, per TETF recommendations	$927million	$2.59 to $1.00	$5.57 to $1.00

Source: TETF

initiatives in the business model. (See recommendations at the end that include energy efficiency obligations and market transformation as potential pathways.)

For regulated utilities, Vermont regulators have adopted a variety of credits for benefits in the process of screening energy efficiency measures and programs in the development of investment plans for energy efficiency.[32] These screening tools can be further modified to recognize the full complement of benefits to low-income households. Screening tools used by state agencies can be further modified for deeper savings associated with WAP initiatives.

Lowering the demand for a specific fuel can affect its price and society as a whole is not investing in goods and services that are not needed. The ability to redirect monies that would have been spent on inefficient energy use into other goods and services is one of the largest economic benefits of energy efficiency.[33]

In the electric sector, inefficient and insufficient investments in energy efficiency consign utilities to a cycle of unnecessary investments in central station generation capacity that present financial exposure and risks to both utility shareholders and ratepayers. Energy efficiency can be implemented with very little risk to either party. Since programs are, by design, cost-effective, the financial outlays are less as well.

For regulated utilities, the opportunities for avoiding expensive new capital commitments extends to the transmission and distribution system. Inefficient and insufficient investments in energy efficiency also lead to a cycle of overinvestment in other long-lived capital assets such as improvements to transmission and distribution plant that could be avoided. In addition to the capital outlays, these projects can be impactful from an environmental point of view. Further, as Vermont has seen in several recent projects, cost estimating for these types of projects can be problematic and initial estimates can rise dramatically as the projects proceed.

B. Affordable Thermal Energy[34]

Approximately 11.8 percent (70,000) of the population people in the state live below the poverty line, but the number of Vermonters exposed to fuel poverty is significantly higher (see below). Public safety nets like LIHEAP serve less than half of the approximately 53,000 households in fuel poverty.

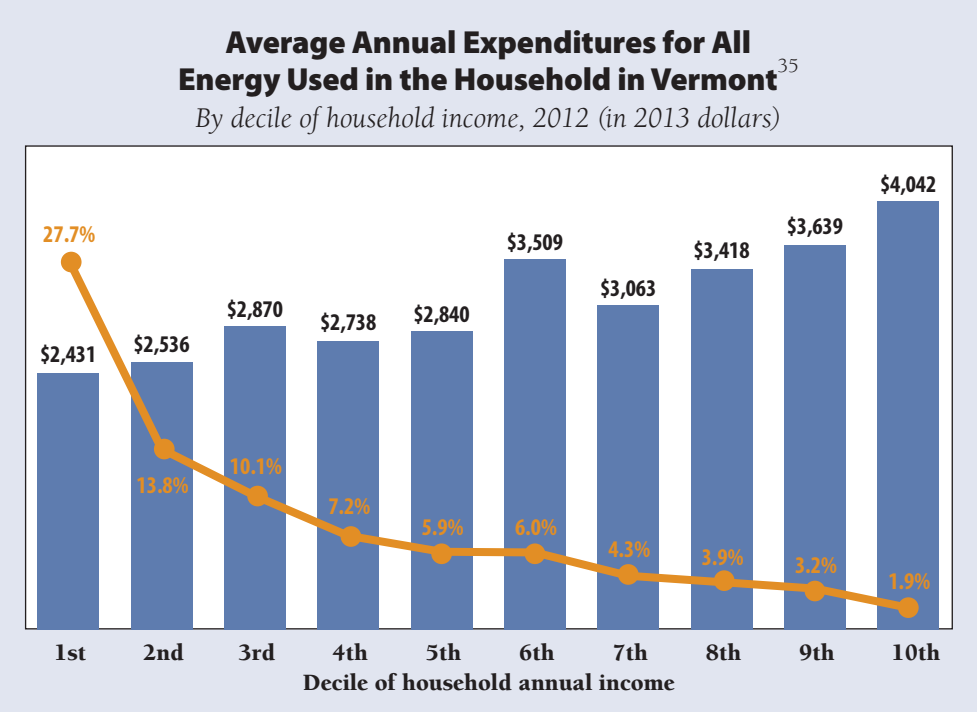
Energy services fulfill a basic need in the home for warmth, cooling, and comfort. As mentioned, for lower-income households, especially those that are fuel-poor, payments for energy can mean hard choices with negative effects on household nutrition, comfort and health. Figure 3

32 For example, Vermont recognizes a 10 percent reduction in cost for reduced risk of efficiency over generation, a 15 percent adder for non-energy benefits, and a 15 percent adder for low-income benefits. Vermont Public Service Board, 2012.

33 Of course, lost revenues can be viewed by some utilities as a potential concern. Potential responses to the concern can be addressed my adjusting the business model to divorce the financial performance of the utility from sales volumes that give rise to concerns with lost revenues. Appropriate forms of regulation and business models create an effective alignment of interest between the utility and its customers. Interested readers can revue numerous reports on revenue and revenue cap regulation available at www.raponline.org.

34 The bulk of this section is based on the research and findings reported in the recently published report on energy burden of fuels on Vermont's lower-income population segments. VLS, 2013.

Figure 3

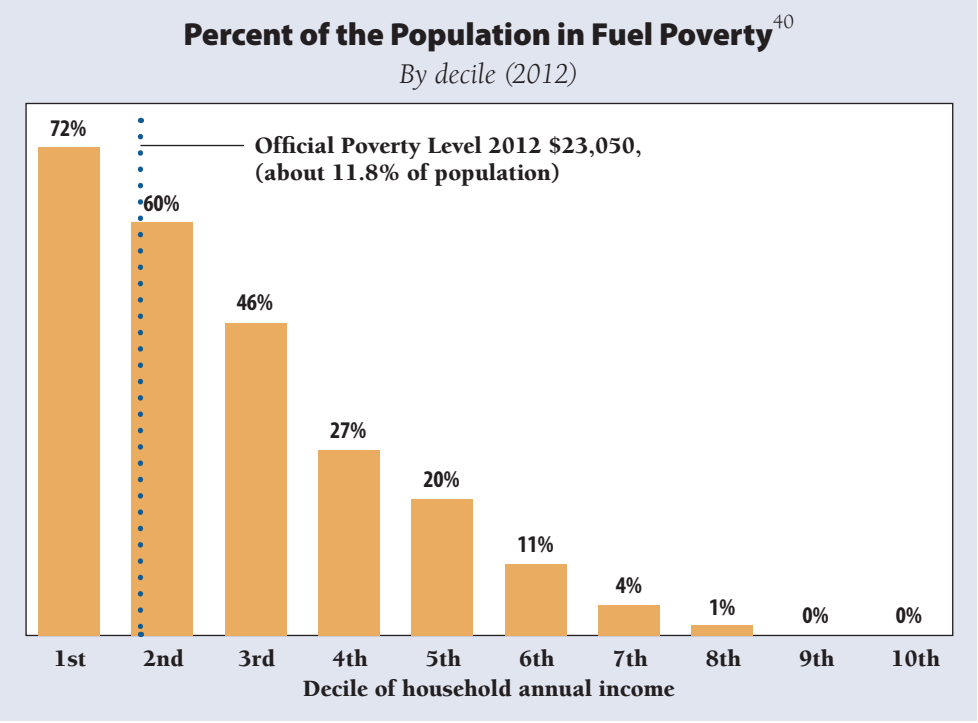


shows the average expenditures and burdens of energy by income segments of Vermonters.

By at least one definition, fuel-poor refers to households in which 10 percent or more of the monthly household income is used for energy services.[36] By this definition, roughly 125,000 individuals in Vermont's population of 627,000 are fuel-poor. People that fall into this category and fail to stay warm face a long list of related health risks.[37] Excess mortality during the winter as a result of fuel poverty accounts for 3.3 percent of all deaths in Vermont. This is roughly double the rate of deaths in automobile accidents in the state.[38] As noted above, the elderly (36 percent of fuel-poor households), disabled (49 percent), and households with young children (25 percent) are most vulnerable.[39]

The concept of fuel poverty is distinct from the definition of poverty generally. The official poverty level in the US corresponds to $23,050 for members of a family of four in 2012, or just above the bottom decile of the Vermont population. Figure 4 shows the share of each decile of the Vermont population that meets our definition of fuel-poor. Of course, the lower-income deciles experience it disproportionately, but what this figure shows is that fuel costs can extend the reach of energy poverty even to the upper income deciles.

Figure 4



35 VLS, 2015.

36 There are a variety of definitions of fuel poverty VLS, 2015.

37 The list includes a higher risk of stroke, heart attack, pulmonary embolism, influenza, pneumonia, asthma, arthritis, depression, anxiety, and accidents within the home (Liddell and Morris, 2010).

38 VLS, 2015.

39 LIHEAP, 2015.

40 Official poverty level for a family of four with two children. US Census, 2014 and US HHS, 2012. US Census 2015. VLS, 2015.

A review of census data from Vermont Law School shows that the proportion of the Vermont population that can be considered fuel poor is growing. By their definitions, the number of fuel poor in the state increased from 71,000 in 2000 to the 125,000 in 2012.[41] This is largely due to the fairly significant growth in the price of fossil fuels, particularly fuel oil, over that period (prior to the more recent declines seen in late 2014 and early 2015). Between 2000 and 2012 real income levels have remained flat or even declined among the lower income segments of the population.[42]

Minimum adequate warmth in homes, as determined by the World Health Organization, is 21°C (69.8°F) in the main living space and 18°C (64.4°F) in other rooms.[43] Children and the elderly are especially vulnerable to low room temperatures. When homes are kept too cold and damp, children suffer respiratory problems and miss more days of school. In families that live in colder climates, children require more calories to stay healthy. Yet evidence suggests that fuel-poor households may instead be forced to reduce calorie intake during the colder months as they confront the high costs of fuel. Studies show that fuel assistance can have a material positive impact on the health and well-being of infants in low-income homes.[44]

Over the last 12 years, the rate and level of fuel poverty has increased. As noted above, the number of affected people in Vermont increased from 71,000 to 125,000. With increasing budget pressures at the federal government, the state's allocation of LIHEAP funding has been in decline and is only projected to provide a $14 million share in 2015 (see Table 2 below). Yet over 27,000 households have been served annually by LIHEAP in the three of the last four years of available information. In 2013, the average benefit was $858 in assistance.[45] For participating households, available funds and the price of fuel limit the available benefit and the percent of energy costs that can be met through LIHEAP. Since 2010 the benefit has ranged from 31 percent per participating household up to 52 percent.

Table 2

Federal LIHEAP Appropriations and Vermont's Allocation of LIHEAP Funding and Households Served[46]

Fiscal Year	Base	Contingency	Total	Allocation	Served
2015	$3.05B	$300M	$3.35B	$18.9M	TBD
2014	$3.4B	$0M	$3.4B	$19.2M	TBD
2013	$3.3B	$0M	$3.3B	$18.2M	27,457
2012	$3.47B	$0M	$3.47B	$19.5M	27,363
2011	$4.51B	$200M	$4.71B	$25.7M	26,546
2010	$4.5B	$590M	$5.1B	$25.6M	27,850

For the most part, the declines in LIHEAP have occurred during a period of rising fossil fuels prices. The recent precipitous declines in global petroleum prices will help improve the ability of households to meet their real heating needs. January 12, 2015 prices for heating oil were down to $2.76 per gallon, almost $1 below the prevailing prices during last winter's harsh heating season.[47] The fossil fuel prices are difficult to predict and are, in any event, volatile. And the demand for fuel is a function of difficult to predic winter weather patterns. LIHEAP is not an entitlement, but is subject to an annual appropriation. The policy framework supporting low-income households to meet their energy needs should, ideally, withstand the variability of market performance.

Fuel poverty, energy affordability, energy burden, and energy justice[48] are all concepts that focus on the sometimes overwhelming burden that high energy costs can place on people in homes in Vermont, especially during harsh winter conditions. Vermont has no practical control

41 VLS, 2015.

42 This is true for at least the lowest four segments of society as organized around income deciles. An income decile refers to 10 percent of the population ranked by household income. Most income deciles of the household population saw increases in income of between 0.3 and 0.5 percent increases annually over the 12 years from 2000 to 2012. The second decile, however, experienced a decline in real income levels. See, VLS, 2015, p. 10.

43 WHO, 2007.

44 VLS, 2015

45 LIHEAP, 2015a.

46 LIHEAP, 2015a; LIHEAP, 2015b

47 US EIA, 2015b.

48 The concept of "energy justice" was recently featured in another publications with Vermont authors called Global Energy Justice. Sovacool, 2014.

over the market price of fossil fuels, which is the least predictable element of the pressure that energy costs place on most households, and especially those that face lower monthly incomes. Vermont does, however, have a say in controlling the demand for energy services. The state scores well in delivering energy efficiency services to customers of regulated utilities. Progress to date with thermal energy efficiency, however, has seriously lagged, despite its central importance to the health and well-being of the Vermont population.

Fuel assistance is a critical but unreliable and inadequate backstop to the need among the fuel-poor. Progress with building codes has been notable, but Vermont's existing housing stock is an aged one that requires improvements. Achieving the state's broader legislative goals for improvements to the housing stock is now in jeopardy. But efforts around low-income segments of the population, and especially the fuel-poor, represent an appropriate point of emphasis as a matter of sound economics and social justice.

Approximately 27,000 low-income households have been weatherized over the past two decades. Even if all of the households that qualified were to participate, the standard for success is a moving target so that more can be achieved in the future. The state of knowledge about what can be cost-effectively achieved through weatherization is an evolving target that includes both consideration of avoided costs (i.e., generally the costs of heating oil or propane avoided by measures and program), the state of technology changes (e.g., heat pump water heaters) and the state of our understanding about what can be achieved change.

C. Health and Safety

As indicated in the prior discussion, the issues around fuel poverty do not stand in isolation of other public policy concerns. Fuel is just one of a broader set of basic needs that compete for scarce funds. Most segments of the population can balance these choices without compromising them. But for the energy-poor, basic services can be compromised. Even beyond the issue of illness and death caused by inadequate heat, a shortage contributes to household discomfort and associated illness and well-being in the household that can translate into measurable impacts on worker and student productivity and illness. In Vermont, basic health and safety improvements that are related but separable from energy efficiency improvements are also part of the WAP. CVOEO reports that the work performed includes the installation of carbon monoxide detectors, moisture management, limited roof repairs, ensuring that there is adequate draft, and where necessary, the replacement of old knob and tube electrical wiring.[49]

Fuel poverty and poor use of energy threatens public health and safety in many ways. Cold winters in Vermont challenge our ability to stay comfortable and warm. This is sometimes just an issue of comfort, but for vulnerable segments of the population this can be a more fundamental matter of health and even survival.

Of particular concern with poor-quality housing is condensation and mold. Mold results from condensation on cold surfaces. Not only is it unpleasant and smelly, but it is also destructive and difficult to remove. Of particular concern is the impact on children, in whom mold can cause incurable asthma. Weatherization measures have been shown to be an effective way to prevent mold, suggesting that prevention of asthma through low-income weatherization may result in health cost savings.[50]

National statistics show that cold-related deaths increase precipitously among Americans over 75. While approximately four cold-related deaths per million deaths overall are reported nationally by the National Center for Health Statistics, the figure increases by a factor of almost 4 (15.4 per million) for the 75-to-85 age group, and by almost a factor of 10 for those 85 and older (39.4 per million).[51] The health consequences extend to infants as well; investigators report negative impact on healthy weight and susceptibility to illness among infants in fuel-poor households.[52]

Families use healthcare services, including pediatric emergency services to respond to inadequate control and conditions in the home. Nationally, the annual costs of asthma approximates $50 billion annually.[53] The health

49 Vermont Office of Economic Opportunity, 2015.

50 Heffner, 2011.

51 NCHS, 2010, Deaths from acute exposure to the cold, hypothermia, are a small in relation to overall winter season-related deaths.

52 Liddell and Morris, 2010.

53 Norton, 2014

benefits of thermal efficiency initiatives can and do sometimes outsize the energy-related benefits of these core efforts. Survey findings from the Green and Healthy Home Initiative showed that a combination of education and environmental controls with weatherization and energy efficiency services lead to significant reductions in reported asthma symptoms, use of hospital and emergency room visits, and productivity losses at school and work.[54] The results of this and other studies suggest that programs directed at reducing overreliance on emergency care could be coupled with energy efficiency programs targeting low-income households.

A recent case study for the Government of New Zealand analyzed the benefits and costs of a home retrofit program that centered on the delivery of building shell improvements and "clean heat" from efficient heat-pump technologies. The study demonstrated that participation in the program led to a statistically significant 27 percent reduction in mortality for participants aged 65 and over who had recently undergone a cardiovascular hospitalization. There are some notable differences. New Zealand heating needs are more moderate than those of Vermont,[55] and wood, electricity, and natural gas provide the majority of heating needs as opposed to fuel oil. The authors estimated that this ongoing benefit could be valued at $439.95 per year per treated household. When all health benefits were included the health benefits were estimates to range from $608 to $1,926 relative to program costs that ranged between $205 and $460. The health benefits of the program dominated and represented approximately 99 percent of the program benefits.[56]

Building shell improvements related to investments in the thermal efficiency of homes is also a matter of public safety. When the power fails, even homes that are fired with oil and propane are without heat, unless there is a backup source such as a wood stove.[57] When there is not such a backup source, building shell improvements help to prolong healthy home temperatures for longer periods.

Health and safety improvements also tie directly into the weatherization programs. When building shell improvements are planned, typically other issues related to the health and safety of households are revealed and require remediation. These expenses add to the project costs but provide basic improvements to household health and safety that would otherwise not be addressed. Health and safety benefits typically include reduction in carbon monoxide levels, reductions in emergency calls, fewer illnesses, a reduction in fire hazards, and increased comfort. A review of the Vermont Weatherization program in 2007 revealed health and safety improvements added an additional $1044 in project cost and returned benefits that equaled $2,372 per unit in then-current 2005 dollars.[58]

Table 3

Health and Safety Benefits Associated with Vermont's Weatherization Program[59]

Average Impacts per Project Housing Unit (2005 dollars)

Health and Safety	
Fewer fire deaths, injuries, and property loss	$523
Fewer emergency calls	$428
Fewer illnesses/nursing home avoidance	$1,421
Health and Safety Sub-total	**$2,372**

Perhaps less an issue in Vermont than in most regions of the US that fail to meet basic standards for air quality, exposure to criterion pollution is a public health concern even in Vermont.[60] Exposure to airborne pollution, whether in the home or as a byproduct of thermal fuels in a community or region is addressed further below.

D. Extending the Reach of Public Services

Weatherization of housing in Vermont — both by improving the comfort of residents and freeing up income for other household needs — can help to reduce the financial and operational pressure on a variety of other public-service programs, from fuel assistance to health care.

54 Norton, 2014.

55 For example, the heating degree days in Christchurch, New Zealand, are only about 67 percent of those in Burlington, Vermont, and Auckland's are about 32 percent.

56 Grimes, 2009.

57 Even most backup fuels require electricity to fire the combustion process.

58 Dalhoff, 2007.

59 Dalhoff, 2007.

60 Of the six pollutants, particle pollution and ground-level ozone are the most widespread health threats. Among the legal standards applied to criteria pollutants are that they "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare". Clean Air Act of 2009, Section 108(a).

Federal funding of fuel assistance through LIHEAP is on a slow but steady decline. That decline increases the vulnerability of the fuel-poor. As noted above, Federal funding of LIHEAP has declined from $5.1 billion in 2010 to a new recent low of $2.8 billion. Vermont's allocation of the available funds has declined with the decline in federal appropriations, from just under $26 million in 2011 to $19 million estimated for 2015.

There is, however, some positive news in this otherwise sobering narrative for the fuel-poor. Since 2007, the combined effect of expanding initiatives outlined above, and especially the funding of weatherization has helped to reduce the total burden of heating costs. Weatherization assistance alone has reduced energy demand in approximately 10,700 Vermont households since 2007 with a typical reduction of over 200 gallons per household.[61] Since 1993, the low-income weatherization alone accounts for reducing the burden of fuel poverty by approximately $10 million annually. Funds that would otherwise largely be needed, yet are unavailable in the form of backup assistance through LIHEAP, are available to help stretch the fuel assistance.

The sudden (and uncertain in duration) decline in oil prices means that more funds are available to extend the reach of the fuel assistance. While it is uncertain how long this decline in oil prices, and thus boon to fuel assistance funds, will last, the reach of each dollar of fuel assistance goes 36 percent further than it did just a year ago. The fuel assistance funds are available to the roughly 27,000 households that receive benefits each year.

The benefits here extend well beyond the available fuel assistance. As noted above, the down stream effects of fuel poverty extents to demands on the education system, food assistance, and health care services. The relief that the weatherization brings allows other programs and service to focus and extend their reach, hopefully in areas reflecting their primary focus.

E. Economic Development

Job creation and economic development reflect real improvements to the economic wellness and well-being of society. Energy efficiency is often associated with improvements in economic development due to direct local job creation (e.g., construction trades) and the increase in disposable income that may be associated with the savings that materialize.

Local job creation results from either the employment of underutilized or underemployed individuals within the community, or the attraction of new jobs and individuals from outside the community or state. Energy efficiency scores well in job creation because energy efficiency jobs involves skilled work at the local level that may involve building shell improvements, equipment installation, or increased retail activities. The alternative often involves payments for fuel from upstream service providers that either extract or transport the fuels.

Low-income households can benefit disproportionately if they help to fill these direct jobs, or enjoy the pressure placed on labor rates among lower wage jobs. Also the employment and output multipliers that are associated with segments of the population that spend more as a share of disposable income, as lower income households do.

Local jobs in turn are associated with their own economic job multipliers. As new jobs create additional income that typically is re-spent, in large measure in the local economy of additional goods and services.

Another reason that energy efficiency is a source of job creation is that energy efficiency saves money and generates increased spending from additional disposable income. The cost advantage translates into additional disposable income that in turn creates new jobs. A study by the Northeast Energy Efficiency Partnership (NEEP) showed that the majority of jobs created by energy efficiency are associated with increased disposable income. Every dollar spent on energy efficiency in New England produces $2.6 in savings that is available to be re-spent in the local economy.[62]

According to one study, 66 job-years[63] typically result from each million dollars of investment in energy efficiency.[64] 75 to 85 percent of the job creation is associated with increased real disposable income that results from these investments.[65] The Public Service Department modeled the job impacts from the TETF report recommendations for expanded (incremental) investments in thermal efficiency.

61 The level of savings achieved has been fairly consistent over time. A 2007 report for 2005 revealed energy savings levels per household of approximately 200 gallons. The most recent report reveals a level of 205 gallons per year.

62 Northeast Energy Efficiency Partnership, 2010.

63 A "job-year" is a year of employment. Howland and Morris, 2009.

64 Howland and Morris, 2009.

65 Howland and Morris, 2009; Northeast Energy Efficiency Partnership, 2010.

The report found that nearly 800 job-years can be created over the life of the measures. The value of incremental efficiency programs described in the report reflected benefits to costs of well over 2 to 1. So for every dollar spent on thermal efficiency programs, Vermonters have more than two dollars to spend on something other than heating their homes and businesses."[66] The results for Vermont and the northeast are consistent with the findings of other states and regions that have analyzed these impacts.[67]

Of particular concern is the loss of technical persons that have been trained to provide audits and technical services necessary to meet state targets for home efficiency improvements. Vermont is now at risk of losing the well-developed pool of trained, experienced service providers. Within the weatherization program alone, there are five service providers operating a total of nine field offices statewide. At present, a total of 21 energy auditors and coordinators supervise the work performed on clients' homes. Approximately 45 in-house crewmembers and a variety of skilled subcontractors deliver the services.[68] In 2013, weatherization program activities accounted for less than half of the whole house retrofit projects completed.[69] For 2012, Efficiency Vermont reported 2,630 contractors, retailers, and supplier partnerships that contributed to the Vermont economy. Fluctuating funding of the WAP makes it difficult for agencies to plan for and sustain a reliable and capable work form. Fluctuating funding may result in the loss of trained and experienced workers, and the subsequent training of new staff with the associated loss the capacity from field experience.

The following economic development benefits have been associated with the recommended investments in thermal energy efficiency.

Table 4

Job Creation and Increase to State Product from Recommended Investments in Energy Efficiency

Indicator	Benefit
Gross state product – all incremental programs	$1.47 for every $1.00 invested
Gross state product – incremental efficiency programs only	$1.80 for every $1.00 invested
Net job-years – all incremental programs	793

Source: TETF, 2013

F. Regional Environmental Benefits

Air emissions from energy use cause serious health effects. Reducing emissions through energy efficiency therefore has a lot of beneficial air quality benefits. A recent EPA report calculated that each ton of reduced emissions from power plants has the following public health benefits: $130,000 to $290,000 for PM2.5, $35,000 to $78,000 for sulfur dioxide (SO_2), and $5,200 to $12,000 for NO_X. Furthermore, the EPA's regulatory impact analysis for the Mercury and Air Toxics Standards estimates that for each dollar spent to remove these pollutants, $3 to $9 in health-related benefits will be realized, with a value of $37 billion to $90 billion per year.[70]

These numbers illustrate that energy efficiency is an effective air quality compliance measure. The accumulated benefits of programs such as appliance standards, updated building codes, and more efficient manufacturing have been responsible for significant air quality improvements achieved by the United States since the 1970s.[71] In addition to the health benefits listed above, energy efficiency as an air quality measure is the most cost-effective means to meet EPA and state air quality regulations. Efficiency jointly reduces all pollutants: criteria pollutants, toxic pollutants, and greenhouse gases.[72] Experience around the world has borne this out. For example, in California energy efficiency programs in 2010-11 saved 5,900 gigawatt hours (GWh) of energy and avoided the construction of two power plants, saving an estimated $590 million in capital costs. The state has avoided the construction of about 40 power plants and their associated emissions since the late 1970s. In the European Union, energy efficiency is responsible for one-third of SO_2 reductions achieved since the mid-1970s.[73] In Vermont, energy efficiency measures avoided adding 15MW of load to the system in the Mad River Valley.[74]

66 Thermal Energy Task Force, 2013

67 For example, Alaska. See, Institute for Social and Economic Research, 2012.

68 Vermont Department of Children and Families, 2015.

69 Thermal Energy Task Force, 2014.

70 Lazar and Colburn, 2013. p. 51 and 52.

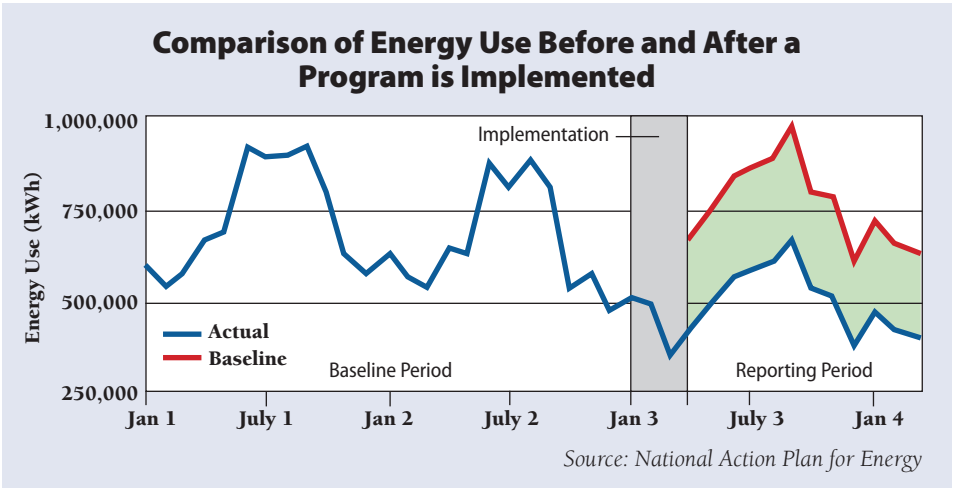
71 James, et al., 2014.

72 Ibid.

73 Ibid.

74 Neme and Sedano, 2012.

Figure 5



The graph above shows energy demand before and after the implementation of a program. The red line reflects the baseline or what evaluators believe energy demand would have occurred in the absence of the measures, and the blue line following the shaded implementation reflects the actual measured demands.

G. Global Environmental Benefits (GHG Reduction)

Heating oil is the most popular fuel for heat in Vermont. However, it is also the most carbon intensive fuel after coal. Consequently, the carbon emissions profile of our homes is high. Heating oil used in homes throughout the state is estimated to produce 670,000 tons of CO_2 emissions annually. A recent report produced by the TETF estimates that a comprehensive strategy for improving the efficiency of home heating in Vermont could reduce the profile by 6.8 gigatons. The federal government estimates that energy efficiency retrofits to existing pre-2000 homes to post 2000 levels could reduce annual greenhouse gas initiative by 24 percent of greenhouse gas emission.[75]

Vermont's contribution to global carbon emissions is small relative to other states and the scale of the global challenge. Vermont ranks low relative to other states in emissions due, in large part, to the small population, which is the second smallest population among states in the US, but also to the modest contribution from the power sector which continues to rely predominantly on Canadian hydro generation, in-state hydro and biomass, and other small-scale renewables. As a result, Vermont came in last among all states for carbon emissions based on 2010 data.[76] Vermont was the only state exempted from having to submit a State Implementation Plan pursuant to the EPA requirements under Section 111(d) of the Clean Air Act.

Nevertheless, Vermont relies heavily on fossil fuels for meeting its heating needs, and produces emissions at high levels for the level of energy services required. The state has committed to reducing its greenhouse gas emissions. Its statute enshrines these goals as percentages below the 1990 baseline as follows: (1) 25 percent by January 1, 2012; (2) 50 percent by January 1, 2028; (3) if practicable using reasonable efforts, 75 percent by January 1, 2050.[77] Vermont missed the 2012 goal, as according to the Agency of Natural Resources, emissions were approximately 8 million metric tons of carbon dioxide (CO_2) – almost exactly the same as the state's emissions in 1990.[78] In 2011, which had a similar emissions level, the breakdown of emissions from all sectors was as follows:

- 46 percent from transportation;
- 32 percent from residential / commercial / industrial fuel use;
- 10 percent from agriculture;
- 5 percent from electricity consumption;
- 4 percent from various industrial processes; and
- 3 percent from waste in landfills.[79]

As the above numbers indicate, a large portion of emissions come from residential fuel use. The contribution from home heating is high (at about 1.1 Mt CO_2 emissions), almost 20 percent of the 5.7 MT CO_2 emissions credited to the state from energy use. About 44 percent of the energy used for home heating in Vermont is from distillate fuel. Natural gas and propane follow at about 17 and 15 percent respectively.[80] Each gallon of distillate is

75 Joint Center for Housing Studies, 2012.

76 Clark, 2013.

77 Greenhouse Gas Reduction Goals. 10 V.S.A. 23. (2005 and 2007). Retrieved from: http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=10&Chapter=023&Section=00578

78 Dobbs, 2013.

79 Vermont ANR, 2012.

80 EIA, 2015a.

Table 5

Carbon Dioxide Emissions Coefficients by Fuel[81]

Carbon Dioxide (CO_2) Factors: For homes and businesses	Pounds CO_2 Per Unit of Volume or Mass lbs.	Kilograms CO_2 Per Unit of Volume or Mass kg	Pounds CO_2 Per Million Btu lbs.	Kilograms CO_2 Per Million Btu kg
Propane	12.7 gallon	5.8 gallon	139.0	63.1
Butane	14.8 gallon	6.7 gallon	143.2	65.0
Butane/Propane Mix	13.7 gallon	6.2 gallon	141.1	64.0
Home Heating and Diesel Fuel	22.4 gallon	10.2 gallon	161.3	73.2
Kerosene	21.5 gallon	9.8 gallon	159.4	72.3
Coal (All types)	4,631.5 short ton	2,100.8 short ton	210.2	95.3
Natural Gas	119.9 thousand cubic feet	54.4 thousand cubic feet	117.0	53.1
Gasoline	19.6 gallon	8.9 gallon	157.2	71.3

responsible for about 22.4 lbs of CO_2 (see Table 5). The total CO_2 contribution from heating oil alone is about 670,000 tons.[82]

The carbon emissions associated with various fossil heating fuels used in Vermont are listed below, along with the percent of households that rely on the fuel. After coal, fuel oil for home heating has the highest level of CO_2 emissions of any fuel on an equivalent energy basis.

The Thermal Efficiency Task Force estimates that the lifetime CO_2 reductions associated with the recommended thermal efficiency programs would create a lifetime carbon reduction of 6.8 Mt.[83]

Vermont has a comparatively small footprint for GHGs next to other states. But the heavy reliance on fossil fuels for heat means that the rate of emissions is high. The above statistics indicate that Vermont can do a lot to decrease that global contribution by focusing on thermal energy efficiency.[84]

H. Other Benefits

There are many other benefits of energy efficiency that are worth noting, although most apply more to the regulated forms of energy, including natural gas and electricity. Some of these represent benefits to categories of utility stakeholders (especially customers and owners).[85]

Utility-related benefits are relevant because natural gas is the primary fuel for 16 percent of households and electricity for about 5 percent. Electricity is also a secondary or supplemental fuel source for many households vacation homes and homes that are occupied during the summer season. Utility-related benefits include the following:

1. avoided rate subsidies;
2. lower bad debt write-off;
3. reduced carrying cost on arrearages;
4. fewer notices and customer calls;
5. fewer shut-offs and reconnections for delinquency;
6. reduced collection costs;
7. fewer emergency gas service calls;
8. transmission and distribution (T&D) loss reduction;
9. insurance savings;
10. reduced need for fuel oil or other sources of heat; and
11. improved quality of life.

81 EIA, 2015b.

82 About 8.3 Tbtus of heating oil are consumed by residential households (EIA, 2015b). At a rate of 161.3 lbs of CO_2 per million BTUs of consumption, roughly 670,000 tons of CO_2 are emitted.

83 Thermal Energy Task Force, 2013.

84 Vermont and the District of Columbia are exempted from EPA obligations under the Clean Power Plan, as laid out in Section 111(d) of the Clean Air Act, because they do not have qualifying fossil fuel plants that meet threshold requirements.

85 Dalhoff, 2007.

Most of these savings may flow to consumers only indirectly, but because the costs of utility services are rate regulated, these cost reductions will be passed through to consumers in the form of lower bills.[86] When oil is part of any energy policy discussion, issues of national security can, and often does, also enter the benefit calculus.

Other values that are sometimes credited to energy efficiency initiatives, whether focused on weatherization or energy efficiency programs generally, include the following:

- Increased property values
- Federal taxes
- Unemployment insurance[87]
- Lower mortgage default

Even while these benefits are very real to segments of the population, some caution may be warranted. For some categories of benefits, including the at least three above, broader societal value may already captured in earlier items, and are not likely additive to benefits such as health, safety, comfort, and energy that are the result of building permanent fixtures and weatherization, and which a portion of those benefits may show in the resale value of the home.

86 For a detailed estimate of the value of these factors, see Schweitzer and Tonn, 2002.

87 Lower unemployment insurance and increased federal tax revenues flow logically from the increased jobs, output, and income levels that generation taxes and reduce need for unemployment insurance.

III. Policy Options and Recommendations

The focus so far has been on highlighting the many imperatives for strengthening commitments to thermal efficiency. A number of policy recommendations logically flow from these insights. At the highest level, the recommendation is to strengthen the state's commitment to thermal energy efficiency. Categories of benefits that are typically omitted from formal reviews can provide justification for more efforts and deeper savings across all income groups. But there is an especially strong case for programs that particularly target low-income households. More emphasis should be placed on recognizing and quantifying these benefits to strengthen the case for expanding and improving low-income energy efficiency programs. The value of these initiatives is compelling not only in terms of traditional criteria of economic efficiency commonly used by utilities for screening programs and measures, but also on the basis of community health, environment, job growth, and social justice concerns.

There are a variety of standard approaches to advancing thermal energy efficiency for low-income households, even apart from existing programs described in the Appendix. Many of these efforts focus on thermal energy efficiency more broadly, but could be further structured to set aside and capture benefits for low-income households. These approaches can typically be grouped into the following categories.

- Strengthening Codes and Standards;
- Integrated Resource Planning;
- Binding Energy Savings Targets;
- Enabling of New Markets for Energy Efficiency Services; and[88]
- Expansion of Existing Programs with Track Records of Success.

Though not well suited to differentiating on the basis of income, the strengthening of building codes and standards is nevertheless a cost-effective approach to improving the heating performance of homes. Binding targets, new markets, and growth of existing programs can all be applied in ways that can more intensively target low-income households. Integrated resource planning[89] can also be employed in ways that recognize the multiple categories of benefits that apply in some unique respects to low-income households.

A. Codes, Standards, and Disclosure

Strong and effective codes and standards provide the most cost-effective avenue for achieving energy efficiency in buildings. Since 1980, building codes have offset 70 percent of the increase in energy consumption from growth in the number of units and the larger size of new homes in the United States.[90] It is always cheaper to incorporate energy efficiency as a design consideration in the original design or when substantial building additions or retrofits occur. As one expert group notes,

> *Setting minimum efficiency performance standards for the production, importation, and sale of energy-consuming products, as well as codes for the efficiency of construction of new buildings and major renovations, is a policy that virtually any jurisdiction can and should adopt.*[91]

Vermont now scores well in terms of standards for new buildings. A new residential construction standard that took effect in the state in March 2015 is based on the International Energy Conservation Code (IECC) standard established in November 2014. Vermont was the first state to adopt the new standard; the state guidelines for commercial construction are also based on the IECC.

88 Wasserman and Neme, 2012.

89 Integrated resource planning is the broad planning framework that is relied on by utilities to enable consideration of a broad array of supply and demand-side solutions that result in a portfolio that is considered the least-cost path to meeting the needs of their retail customers and loads.

90 From 1980 to 2009 the number of households increased by 33 percent and total floor space by 52 percent, yet energy demand from the residential sector only increased by 8.9 percent. US DOE, 2015.

91 Wasserman and Neme, 2012.

Vermont also adopted a residential stretch code to be used in Act 250 projects that goes into effect December 1, 2015, along with commercial stretch code guidelines.

Additionally, the city of Burlington has required that all existing residential rental properties meet minimum energy efficiency standards at time of sale. Such an approach may be of particular importance to Vermont because it helps to address the challenge of split incentives with rental units; among the households in the lowest income decile, almost half of the population is in rental housing. Better codes and standards provide a foundation for all housing but help to ensure that both homeowners and renters have comparable access to energy-efficient buildings.

Codes and standards can be further strengthened and combined with aspirational objectives that may enhance the value of properties at time-of-sale through stretch goals and certification (e.g., Leadership in Energy and Environmental Design, or LEED).

Time-of-sale audit and disclosure requirements can further enhance programs that can establish or strengthen the ability of buyers and sellers of home to capture the value of energy improvements to the home in the price of the home that is sold. Time-of-sale audit and disclosure, potentially coupled with future seller performance requirements, could also be employed as a promising avenue for overcoming the challenges of owner-renter situations involving the split incentives that persist.

B. Beyond Codes: Developing Strategies for Moving to High-Efficiency Net-Zero-Capable Homes and Buildings

In coordination with other recommendations in this report, state policymakers, regulators, energy efficiency providers and affordable housing developers should work to foster net zero capable rehabilitation and new construction. A focus on net zero rental housing will help with progress toward permanently affordable rental housing in Vermont.

Accessing additional energy efficiency resources, potentially by broadening the scope of benefits recognized, will be a critical component of this effort. Recent advances in technologies such as cold-climate heat pumps, renewable generation technologies and cost-effective thermal envelope design options have made this goal more within reach. Although some efforts have been undertaken in recent years to achieve deeper savings above code in affordable rental housing developments, energy efficiency targeted financial resource tools which pair well with affordable housing resources to achieve net-zero-capable, *permanently* affordable buildings have yet to be developed.

Recent program development efforts in Vermont to create net-zero-capable replacement units for Vermont's stock of manufactured housing both in mobile home parks and on private lots have proven this concept to be viable and affordable over the long term for low- and moderate-income buyers. Approximately 20 of these units have been sold under a pilot project launched in 2013 and the development of secondary financing options which utilize the substantial energy savings of these units as a financing tool will be critical to long-term market penetration of these units.

C. Integrated Resource Planning (IRP)

Integrated resource planning applies to regulated utilities and requires them to take a long-term view of cost minimization while ensuring adequate resources to meet energy demand. As mentioned earlier, 21 percent of homes in Vermont rely on regulated fuels (electricity and natural gas) as their primary heating source. For reasons discussed above, regulated utilities may realize categories of benefits that apply to the entire utility system that are not experienced by other energy providers. Targeting low-income households to improve their thermal energy efficiency is likely cost-effective under traditional measures. However, given the many additional system benefits that apply to low-income households, there is a strong case for creating deeper program opportunities and savings.

Regulated utilities have lower costs of capital, a longer investment horizon, enjoy standards of cost-recovery that are relatively secure, and also bear the burden on non-compliance that can harnessed to encourage investors. Regulated utilities can be readily encouraged — by regulators — to capture levels of savings that would be overlooked by investors in competitive markets for energy efficiency such as energy service companies (ESCOs).

When such improvements are not cost-effective for utility ratepayers, other support frameworks through the weatherization program can be used to close the gap.

D. Binding Energy Efficiency Targets

Binding targets are recognized as one of the most effective approaches to moving the market toward energy efficiency service delivery. Twenty-one states, including Vermont, already have energy efficiency targets — also referred to as energy efficiency resource standards (EERS)

or energy efficiency obligations (EEOs). A recent analysis from ACEEE suggested that binding targets may be a more effective tool for advancing energy efficiency, even more than IRP.[92] US states employ these energy efficiency targets exclusively toward traditionally regulated fuels (electricity and natural gas),[93] but experience from Europe (Denmark and France) suggests that they can work well for non-regulated fuels, including heating oil and propane, as well.[94] Because certain categories of benefits that are closely tied to low income consumers will add to the list of benefits otherwise associated with broadly-framed thermal efficiency initiatives, low-income household set-asides can be targeted for deeper saving through additional programs and measures. These programs benefits can be secured through the performance requirements locked in through regulatory oversight. Performance criteria are already part of the criteria and objectives that Efficiency Vermont meets annually and on a three-year cycle.[95]

E. Enabling New Markets and Delivery Approaches for Energy Efficiency Services

Vermont participates in new markets for energy efficiency by regulated utilities offered through the regional wholesale market. Vermont bids in the capacity value of energy efficiency services to ISO-NE.

Markets for energy efficiency have also emerged over the decades through the establishment of ESCOs that generally target government, schools, and institutional customers. But ESCOs typically go after customers with very large energy bills, and even then they typically do not implement a deep and comprehensive set of measures. Vermont has introduced the concept of a public purpose ESCO, or PPESCO, to help extend the reach of ESCOs to smaller enterprises and for deeper savings.[96] Larger rental structures could be served by such entities. Low-income households could be targeted through effective use of ESCO initiatives (whether PPESCO or traditional ESCO) by leveraging of public money through weatherization funds, utility sources, or dedicated funds.

F. Integrating Energy Conservation with Programs in Social Welfare and Innovative Health Care

There is a close tie between the nation's health care costs as they relate to childhood illnesses and the deteriorating condition of homes in low-income communities. Healthy housing combined with energy conservation is an important issue for the health of children in low-income families. Low-income energy efficiency programs could potentially leverage health care funds to extend the reach of energy efficiency, to drive deeper program efforts, and to improve the health and well-being of families afflicted by deteriorating housing.

G. Expanding Existing Programs and Delivery

Vermont relies on a group of nonprofit entities for the delivery of thermal energy efficiency services. Community action program (CAP) agencies deliver thermal efficiency services to low-income households through the WAP, which is described in further detail in the Appendix. The weatherization program performs its services in partnership with Vermont Gas Systems, Efficiency Vermont, the Burlington Electric Department, fuel dealers, and private contractors. Green Mountain Power committed $10 million to weatherization assistance over a 2.5-year period that ended in 2014.[97]

Weatherization services in the state work in collaboration with the Vermont Fuel Efficiency Partnership described in the Appendix below to realize deeper savings. Also discussed in the Appendix is the role that Vermont utilities and the NeighborWorks® of Western Vermont program plays in providing weatherization-related services to income-eligible households. Also, Efficiency Vermont has certain performance targets established for thermal program activities that link to low-income households.

Vermont Weatherization has the human resource capacity to weatherize approximately 1,700 households and multi-family dwellings per year. The TETF

92 Kushler, 2014.

93 DSIREUSA, 2015.

94 Crossley et. al., 2012.

95 Efficiency Vermont, 2014.

96 VEIC, 2013. After developing and vetting the business model for the PPESCO, VEIC established a wholly owned L3C subsidiary, Commons Energy, that implements the PPESCO. In the low-income sphere, multifamily properties are the focus, and now working on project development both in Vermont and in the DC metro area.

97 GMP's commitment was tied to an regulatory decision and GMP commitment related to the sale of the Company.

recommendations included a focus on low-income households and recommended an expansion of the program to weatherize 700 more homes each year (for a total of 2,400).[98] These programs have a long history of success in Vermont, and any targeted expansion of thermal energy efficiency programs that focus on low-income households should begin with them. Probably the most straightforward approach to improve Vermont's commitments to low-income households and thermal efficiency is to sustain and build from the strong base of existing programs.

Effective support for existing programs will require an appropriate source of funding. The best funding sources are those that rely on dedicated sources necessary to support stable program delivery.

Certain features of the calculated costs and benefits, when combined with the recent declines in oil prices, may impact the strength of current commitments. Those factors should be carefully reviewed to ensure that all benefits valued by policymakers are recognized in program efforts going forward.

An issue that ties closely with this is efforts related to building codes and stretch codes, including those that specifically target low-income households.

98 Thermal Energy Task Force, 2013.

IV. Conclusion

The case for investment in thermal energy efficiency is robust based on multiple categories of benefits or policy objectives that extend well beyond the value of the calculated energy savings from programs. The public policy case for investment in low-income households through weatherization and other targeted initiatives is also compelling, largely due to the second order non-energy benefits and impacts that often grow inversely with income levels or satisfy basic needs that are otherwise provided by other categories of services less efficiently.

The public policy case presented above covers a broad range of overlapping benefits that do not lend themselves to simple summation and presentation as an aggregate total. This is because the public policy objectives are often appropriately focused on a mix of economic, as well as social justice and development objectives that capture not only a benefit or cost, but also unique issues that are most relevant to lower income households. Also, development objectives for jobs and growth in state output (as measured by GDP), simply do not translate easily into measures of costs and benefits. Nevertheless, they do represent appropriate objectives for public policy.

Emerging technologies such as heat pumps, electric vehicles, and distributed generation are causing traditional utilities to pause and rethink traditional models of energy service delivery. New business models are emerging that promise to alter the traditional approaches for utility and new businesses to engage consumers and recover costs. Emerging communications and control technologies are also extending the potential reach of third-parties and aggregators to provide services to and from households. These changes offer opportunities for better capturing value and efficiency for low-income households in ways that remain unexplored.

While there is a long list of benefits to low-income consumers from energy efficiency, we have featured some of the most significant for Vermonters. Among the benefits and impacts covered include the following:

Energy benefits: Typically, the economic case for generating fuel savings is straight forward and compelling with benefit-cost ratios in isolation of other benefits that exceed a 2.0 ratio of benefits-to-costs. For every dollar of investment in thermal energy efficiency, $2 of present value savings are generated.

Fuel poverty: Fuel affordability and poverty is an issue of fuel cost (price x quantity) in relation to household incomes and competing demands for other basic services. An estimated 125,000 Vermonters are considered to be fuel-poor, forcing them to make hard choices between the household health and comfort, and other basic services. Weatherization is the most efficient way to meet the need.

Health and safety: The health and safety of the public are directly implicated through the fuels used in the home, and the thermal efficiency of homes. Roughly 172 deaths annually in Vermont are directly attributable to winter weather, and of those most are due to inadequate home heat.

Economic development: Weatherizing homes, especially homes that are in the worst condition, keeps more money circulating in the local economy by generating net savings among segments of the population that require available funds to serve other basic needs. Weatherization also reduces dependent on expensed for fossil fuels that are effectively exported from the local economy; each million dollars of spending on energy efficiency creates 66 job-years and increased output in the economy by $1.8 million.

Extending the reach of public services: Weatherizing homes reduces pressure on fuel assistance while providing a more sustainable solution to meeting energy needs for lower income Vermonters in greatest need. It is simply the most cost-effective way to deliver and sustain the delivery on the multitude of cascading hardships that befall low-income households and are ultimately shared between those that are impacts and the public and taxpayer burden to remedy. Weatherization services delivered over recent years are saving the state $10 million annually, much of which would come from LIHEAP.

Environmental benefits: Energy efficiency as an air quality measure is the most cost-effective means to meet EPA and state air quality regulations. EE jointly reduces all pollutants: criteria pollutants, toxic pollutants, and greenhouse gases. Heating oil is most frequently used fuel, but is also one of the most harmful from an environmental perspective contributing approximately 670,000 tons annually.

Recommendations that flow from this report are twofold. First, low-income programs are a subset of thermal efficiency initiatives generally with a long list of public policy benefits. Thermal energy efficiency programs should ideally be pursued through a broad-based framework of policies that represent sound strategies for improving the health and well-being of Vermont households, regardless of income level. For new housing, whether designed for high- or low-income families, building codes and standards have always represented the best efficiency strategy, when combined with effective means of enforcement. For existing households and retrofits, some form of energy efficiency resource obligation is effective and is being used by the state in the delivery of both electricity and non-regulated fuels. These programs can be crafted to target lower-income households through deep retrofits as well. (For a discussion of strategies to achieve deep-energy savings, see the Thermal Energy Efficiency Task Force Report.)[99]

But for low-income beneficiaries, Vermont has, over time demonstrated the value of existing programs delivered through the Office of Economic Opportunity that relies on a variety of non-profit and community action programs that should represent a solid point of departure for growing and strengthening. Over time, the implementation framework that applies has helped to ensure that deep savings are realized through implementation. At a minimum, Vermont needs to maintain and strengthen the capable workforce that has emerged and is delivering deep retrofit services to more than 1,400 households a year. With recent declines in oil prices, the deep investments in energy measures may be compromised. A set of factors may conspire to unnecessarily reduce the required "savings-to-investment" levels that are required to proceed with current levels and depth of activity. These factors may need to be recognized and included in benefit calculations to maintain the current level of activity.

Vermont can also explore new avenues for growing markets for energy efficiency through public purpose ESCOs, increasing the visibility of energy efficiency improvements at time of sale (e.g., enhance ratings and disclosure opportunities or requirements), establishing community programs and objectives, and setting stretch goals or targets (with some form of certification) that can form the basis for effective marketing and sale of more efficient housing over time.

In summary, investments in ***thermal efficiency*** are sound investments from both a participating household and a public policy perspective. Investments in the thermal efficiency of ***low-income*** household are even more compelling from a public policy perspective because of the additional economic benefits and energy justice concerns that are advanced.

99 Thermal Energy Task Force, 2013.

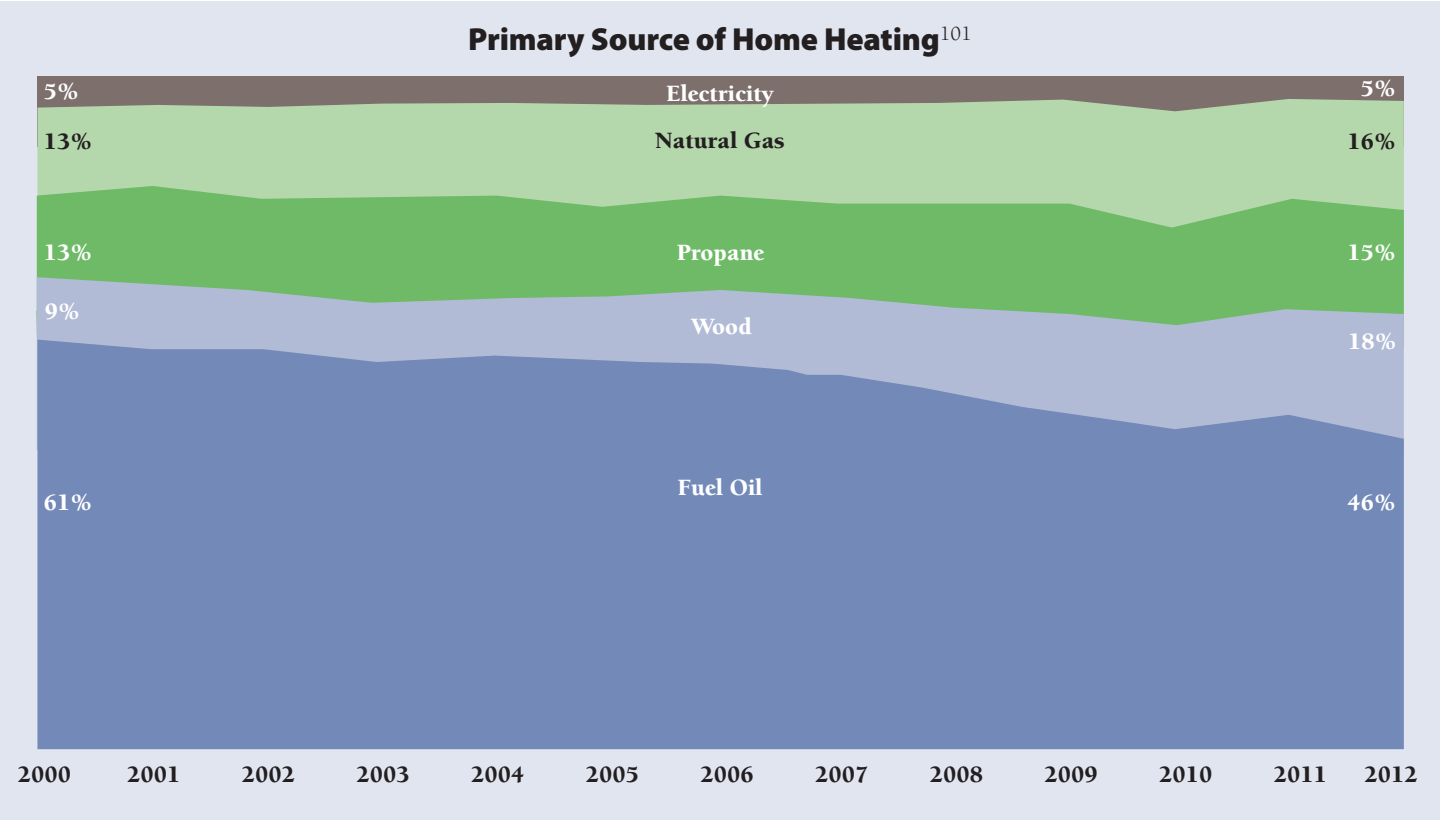
Appendix

Progress on Thermal Efficiency in Vermont[100]

According to the Vermont Department of Public Service, 28 percent of energy demand in Vermont is associated with heating fuels, including fuel oil, natural gas, propane and biomass. However, even electricity contributes to heating, and its share is likely to grow with technology improvements in air source space and water heating that is increasingly recognized as a cost-effective alternative to heating oil, propane, and electric resistance heat. Figure 6, below, shows the shares of fuels used in Vermont as the primary source of heat.

Vermont's commitments to energy efficiency are now decades old. Vermont's utility energy efficiency programs began in the late 1970s and 1980s. They were formalized and integrated into the utility planning framework in the early 1980s and further refined in the 1990s. Important changes to energy efficiency programs occurred in 2000 with the establishment of the efficiency utility. And in 2005 through 2007, they were integrated into the utility transmission planning process pursuant to legislation[102] and later a Vermont Public Service Board Order.[103] Energy efficiency has also taken hold at the regional level and

Figure 6



100 A comprehensive summary on Vermont's commitment to energy efficiency in residencies is beyond the scope of this report. Interested readers are referred to RAP's Affordable Heat (see Allen et al., 2011) summary of the many initiatives.

101 See VLS, 2015. Original data from US Census, 2013.

102 The Vermont Legislature passed 30 V.S.A. § 218c(d) as part of Act 61; it requires VELCO to prepare a long-range transmission plan that integrates consideration of alternatives, or non-transmission solutions.

103 Vermont PSB, 2007.

has contributed to $400 million in deferred transmission projects across the New England region.[104] Vermont scores well in its commitments to regulated fuels, but as the figure reveals, regulated fuels are only a small share of the challenge related to home heating requirements.

Vermont commitments to thermal efficiency focused on low-income concerns around the WAP, described below. More recent efforts to strengthen thermal efficiency included adoption of residential building codes and commercial building standards, most recently in 2011 and 2012,[105] and use of funds from regional power sector markets and RGGI funds[106] for thermal efficiency, the ARRA funding, and the establishment of formal legislative targets in 2008.

In early 2008, Vermont was in the midst of a fuel crisis, and heating fuel prices were spiking to unprecedented levels. In response, the Vermont General Assembly in 2008 adopted a set of challenging but achievable goals for building efficiency with Act 92, the Vermont Energy Efficiency and Affordability Act.[107] Those goals aimed, among other things, to substantially improve the energy fitness of 25 percent of the state's housing stock by 2020 (about 80,000 units)[108] and reduce annual fuel needs and fuel bills by an average of 25 percent in the housing units served. To achieve, or even substantially advance this goal, further progress would be needed with the roughly 20 percent of households that are considered energy poor.[109]

Vermont's commitment to thermal efficiency for energy poor households is now a long-standing one. Support for low-income households energy use began at least as early as the 1970s and has seen gradual expansion and the addition of new ones that extends to Vermont's regulated utilities. Summarized below are some of the earlier efforts and their evolution to present day, beginning with the WAP.

Weatherization Assistance Program

Vermont's Weatherization Assistance Program began 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 percent on the sale of electricity, natural gas, oil, propane, kerosene, and coal. The program received about $66.8 or $88.2 million per year from the Weatherization Trust Fund prior to 2008. In addition, the program receives between $1 and $2 million from the U.S. Department of Energy per year, and in 2009 received $16.8 million from the American Recovery and Reinvestment Act, until sunset in 2012. Supplemental funding of $10 million was received from GMP in 2012 through 2014.

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 a small portion of the 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 are regulated utilities in Vermont that provide additional funding toward the WAP costs related to electrical and natural gas efficiency measures.

To be eligible for the WAP, Vermonters must earn 80 percent or less of the state median income.[110] For a family

104 EEU, 2014.

105 DSIREUSA, 2015.

106 RGGI or Regional Greenhouse Gas Initiative pertains to the nine state cooperative that is the first market-based regulatory program in the United States to reduce greenhouse gas emissions. The RGGI cooperative is an effort of the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont to cap and reduce CO2 emissions from the power sector. A share of the revenue that flows to the state from the sale of available allowances can be used to fund energy efficiency and other public benefit uses. See the Regional Greenhouse Gas Initiative home page: http://www.rggi.org/

107 Vermont General Assembly. (2008, March 19). The Vermont Energy Efficiency and Affordability Act (Act 92). Retrieved from: http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2008/acts/ACT092.HTM.

108 Building Efficiency Goals, 10 V.S.A. § 581 (2007 and 2013).

109 The concept of "energy-poor" was recently adopted in a report from the Vermont Law School to mean the share of the population that spends more than 10 percent of their income on energy services. For purposes of this discussion, we adopt this definition.

110 Home Weatherization Assistance Program. 33 VSA 2502(b)(3)(C)(1989 and 2013).

of four, the threshold varies by county and ranges from $55,050 to $63,900.[111] If a household includes a member who receives Supplemental Security Income (SSI) or Fuel Assistance, the household is automatically eligible for weatherization services.[112]

The program has weatherized over 28,000 low-income units since 1993, and currently weatherizes between 1,200 and 1,800 units per year. The total average cost per unit was about $5,943 in 2012, but rose to $8,965 in 2014 after changes in law requiring focus on high energy intensity homes.[113] For the 2005 program year, each dollar spent on energy efficiency measures in the program returned $1.98 to customers;[114] more recent estimates of savings potential are even higher given price levels for heating oil that remained above $3 a gallon for the four years ending in December of 2014.[115] The TETF report estimated net savings and a benefit cost ratio from thermal efficiency recommendations contained in the report at 2.59 from data that was largely organized during 2012.[116]

The Weatherization Assistance Program in Vermont is successful in service quality and scope. Yet the number of qualifying residences that remain unaddressed is large. Only about 10,700 of the roughly 125,000 households in the state that are considered to be fuel-poor have undergone retrofits in recent years, when fuel prices have been high.

Vermont Fuel Efficiency Partnership (VFEP)

The Vermont Fuel Efficiency Partnership[117] is a joint venture of the five regional organizations that weatherize homes under the state, including the WAP, Efficiency Vermont, Home Ownership Centers, Vermont Housing Conservation Board and the local Community Land Trust network, private housing providers, lenders and state agencies. VFEP was formed in 2009, and provides incentives for "deep energy retrofits," primarily in multi-family buildings whose tenants are income-eligible for the Weatherization Assistance Program or are slightly above that income level (up to 80 percent of the area median income). The energy retrofits are intended to go beyond what the Weatherization Assistance Program and other efficiency programs have incentivized, to achieve savings of 25 percent or more. Multi-family housing has been identified as a priority because of the investment of both public and private resources in developing critical housing capacity to serve the needs of the state's most vulnerable populations. VFEP is funded by the Regional Greenhouse Gas Initiative, and, until recently, grants from the American Recovery and Reinvestment Act and federal Energy Efficiency and Conservation Block Grants. The initiative is on track to serve over 2,000 units in 200 buildings for an average improvement of 24 percent.[118]

NeighborWorks® of Western Vermont (NWWVT)

NeighborWorks® of Western Vermont is a not-for-profit housing organization. Among other services, NWWVT conducts energy audits to determine the most effective improvements for homes, helps find reliable contractors to do energy work, and helps customers to manage the project. NWWVT offers incentives and financing for credit-qualified individuals to help bridge out-of-pocket expenses.

In June 2010, NWWVT won a $4.5 million grant for its proposal to save energy and create jobs retrofitting homes and municipal buildings.[119] The funding was awarded by the U.S. Department of Energy under an energy efficiency block grant program. Over the three-year grant period, NWWVT planned to serve up to 40 percent of eligible households in Rutland County (an estimated 7,300 customers) with home visits addressing ways to lower energy costs.

Key partners in this project include Efficiency Vermont, Green Mountain Power (formerly the CVPS service

111 Vermont Department of Children and Families, 2015b.

112 DCS, 2015.

113 Vermont Office of Economic Opportunity, 2014.

114 In 2005 dollars. Dalhoff, 2007.

115 See, Vermont Department of Public Service, 2015. Price levels in January 2015 dropped below $3 with the recent precipitous declines in crude oil prices at the end of 2014 and into 2015.

116 Thermal Energy Task Force, 2015.

117 For multi-unit residential, the Vermont Fuel Efficiency Partnership reports that while the efficiency improvements in recent years are paid by the Weatherization Assistance Program and other agencies providing assistance, over 80 percent of the costs borne by the customer are for health and safety-related aspects of efficiency improvements. Communications with Scott Campbell, VFEP, February 12, 2011.

118 Vermont Fuel Efficiency Partnership, 2015.

119 NeighborWorks of Western Vermont. Webpage. Retrieved from: http://www.nwwvt.org/news.htm

territory), Green Mountain College, the Rutland Regional Planning Commission, local banks, local retailers, local governments, and community volunteers. The NWWVT efforts represent a laboratory for Vermont in general, to demonstrate how energy efficiency retrofit efforts can be ramped up significantly over time and hopefully sustained through many years into the future.

Vermont Utility Programs

Vermont Gas Systems (VGS)

Vermont Gas Systems serves approximately 45,000 customers in the communities in and near Burlington and north to the Canadian border. Low-income customers in VGS territory are referred to the CVOEO for assistance under the state WAP. CVOEO determines the customer's income status and eligibility, performs the energy audit, submits the recommended measures to VGS for screening, and coordinates the installation of the cost-effective energy saving measures. VGS shares the costs of these jobs with CVOEO.[120] Regulated thermal efficiency programs offered by VGS are available only in its service territory.

Burlington Electric Department (BED)

BED collaborates with the Weatherization Assistance Program on offering electric efficiency measures to low-income consumers, and with Vermont Gas Systems on its whole-building retrofits.[121] The Burlington Electric Department is also the one remaining electric utility in the state with a designation as an efficiency utility by the Vermont Public Service Board. Further discussion of BED's role in addressing rentals and issues related to split incentives is features in the discussion in the body of the report.

The table below summarizes the progress to date in advancing the goals established for progress on home thermal efficiency improvement. WAP and the Vermont Fuel Energy Partnership services overlap. For purposes of this table, the overlap is counted only once under the WAP program.

It is worth noting, however, that efforts to improve housing stock and energy performance need not focus solely on targeted measures and programs designed specifically for low-income households. Other broad-based measures identified by the TETF include areas such as improvements to building codes, improvements in code compliance, workforce training for technical professionals, building labeling, and improving the role and intersection of historic preservation. These can provide some further support and help reduce the need for more ambitious targeted initiatives.[122]

Table 6

Vermont Total Units Retrofitted through 2013

	2008	2009	2010	2011	2012	2013	2014	Totals
EVT	298	480	644	952	1,132	1,162		4,668
BED		3	2	8	7	2		22
VGS	164	239	176	171	214	207		1,171
WAP	1,427	1,570	1,832	1,722	1,773	1,100	1281	10,705
VFEP			16	319	87	42		464
Statewide	1,889	2,292	2,670	3,172	3,213	2,513		
Cumulative	1,889	4,181	6,851	10,023	13,236	15,749		

Source: RAP

120 Allen and Rao, 2011.

121 Allen and Rao, 2011.

122 For a more complete description, see the Thermal Energy Task Force, 2013 report.

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Related RAP Publications

Affordable Heat: Whole Building Efficiency Services for Homes and Businesses

http://www.raponline.org/document/download/id/4439

This 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. It is an update of "Affordable Heat: A Whole-Buildings Efficiency Service for Vermont Families and Businesses," which was first published by RAP in 2008.

Policies to Achieve Greater Energy Efficiency

http://www.raponline.org/document/download/id/6161

This best practices guide provides a "cookbook" summary of the most effective policies to promote energy efficiency. Governments ranging from local to national can adopt these policies to foster the use of products and services which require less energy input to deliver the same or greater output. The policies are organized around foundational mechanisms, implementation mechanisms, and supporting mechanisms. The foundational mechanisms include Integrated Resource Planning, standards, and market design, while the supporting and pricing mechanisms feature structures for programs, funding, information and labeling, tax policy, R&D and training. The paper describes how each policy mechanism operates, assesses its likely effectiveness, and identifies best practices. The paper also identifies jurisdictions that have successfully applied the policies described.

Residential Energy Retrofits: A Roadmap for the Future

http://www.raponline.org/document/download/id/918

Roughly half of all efficiency and/or carbon emission reduction in North American and European buildings can be achieved through retrofit improvements to existing homes. In this publication, RAP offers a roadmap to help policymakers and practitioners design and implement a comprehensive residential retrofit strategy. We present eight principles for success based on two decades of international experience, designed to achieve the level of energy savings that will be needed to address the challenge of climate change.

US Experience with Energy Efficiency as a Transmission and Distribution System Resource

http://www.raponline.org/document/download/id/4765

Transmission and distribution (T&D) investments by investor-owned utilities, which collectively account for approximately two thirds of the electricity sales in the United States, have averaged about $26 billion annually over the past decade. This paper summarizes US experience to date of efforts to use geographically targeted efficiency programs to defer T&D system investments. It presents several case studies and summarizes lessons learned from those initiatives. Most importantly, it concludes that targeted efficiency programs – either alone or in combination with other demand resources – clearly can be a cost-effective alternative to T&D investments. However, their cost-effective potential as a T&D resource has been grossly under-utilized for a variety of policy and institutional reasons. The paper offers several policy recommendations to address those barriers.

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