Vermont Climate Action Commission
Building Energy Workgroup
DRAFT – June 14, 2018

Background:

Thermal energy use, or heat, in buildings accounts for approximately 30% of Vermont's total site energy consumption. This energy is largely provided by burning fossil fuels: fuel oil, kerosene, natural gas, and propane. The residential sector accounts for 60% of Vermont's thermal fuel consumption, commercial 29% and industrial 11%.

Approximately 68 million gallons of heating oil are sold annually in Vermont for residential consumption. Approximately 67 million gallons of propane are sold annually for residential consumption. Wood is widely used for residential heating; an estimated 21% of Vermont homes and businesses rely on wood and wood pellets as the heat source.[1]

Commercial enterprises primarily use heating oil and propane for space heating, but also for air conditioning, refrigeration, cooking, and a wide variety of other purposes. These uses consume 24 million gallons of heating oil and 43 million gallons of propane each year.

Industrial enterprises typically use heating oil and propane for manufacturing, with few instances of its use for space heating. These industrial uses in Vermont annually use 21 million gallons of heating oil and 4 million gallons of propane.

In 2013, Vermonters paid over $500 million to import and use fossil-based heating fuels. Most of this money left the Vermont economy.

Investing in thermal efficiency improvements, primarily air sealing, insulation and heating system replacements, can dramatically reduce a building's thermal fuel requirements while increasing its affordability.

Thermal energy use is the second largest contributor to Vermont's GHG emissions (the Agency of Natural Recourses "ANR") attributes about 24% of GHG emissions from residential and commercial building energy requirements); therefore, curbing emissions will require significantly reducing fuel use in existing buildings.

Overall Goal:

The Comprehensive Energy Plan calls for reduction in total energy consumption by one third from our current level by 2050 (through increased efficiency in energy production and use), and by 2025 obtaining 30% of the heat used in buildings and 25% in industry from renewable sources.

[1] BERC, Wood Heating in Vermont, 2016 available at http://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/AWH%20Baseline%20Report%20FINAL.pdf

1. Low Income Weatherization

Goal: Double the amount of low-income homes weatherized through the state Weatherization Assistance Program

Recommendation	Impact	Feasibility	Cost
Accelerate the weatherization of low-income households	High	High	$$$
Action Step(s)		Who's Responsible	
1.) Identify and advance viable funding solutions to doubling the Weatherization Assistance Program		Legislature, Treasury	
2.) Double the rate of Weatherization Assistance Program activities consistent with funding		Agency of Human Services, Community Action Agency Partners	

Background:

Current resources to meet Vermont's low-income weatherization goals are inadequate. For many low-income residents, this means colder homes, burdensome heating costs, discomfort, and adverse health impacts. In 2007, Vermont set a goal of weatherizing 20,000 low income homes by 2020. As of March 2016, there was still a gap of 9,200 homes. Currently, Vermont spends about $9.5 million annually to weatherize about 900 homes through the Weatherization Assistance Program; that is $11,000 per home, producing approximately 25% in home energy savings and lowering GHG emissions by 1.8 tons per home annually.

The Vermont Low Income Weatherization Program has the experience and capacity to work with Community Action Agencies and weatherization partners to implement grants to dramatically expand low income weatherization today. The challenge has been and continues to be funding. Low-income weatherization inevitably requires 100% funding. The benefits should more than match the investment by reducing the burdens on fuel assistance and other safety nets. Evidence from other jurisdictions, suggest that the health-related benefits alone are several times that of the investments. The benefits to the health and well-being of the affective populations are a central concern. Various funding approaches seem viable but the upfront investment substantial, adding roughly $10 million annually to the cost of the existing programs.

2. Advanced Wood Heating

GOAL: Accelerate the adoption of Advanced Wood Heat ("AWH") to replace high-GHG emitting systems to reach 30% of VT thermal needs by 2025 (triple installations).

Recommendation	**Impact**	**Feasibility**	**Cost**
Accelerate the adoption of advanced wood heat (AWH) to replace fossil fuel heating systems	High	High	$$$
Action Step(s)		Who's Responsible	
1.) Expand incentives through Clean Energy Development Fund		Clean Energy Development Fund/Public Service Department	
2.) Provide low-income rebates on efficient renewable heating systems through Heating Assistance Fee on new high greenhouse gas heating systems		???	
4.) Reopen school construction aid for biomass projects (remove moratorium)		???	
5.) Fund State Wood Energy Program (see below) to provide greater outreach and TA to target sectors		???	
Recommendation	**Impact**	**Feasibility**	**Cost**
Accelerate the adoption of advanced wood heat (AWH) to replace fossil fuel heating systems	Low-Med	High	$
Action Step(s)		Who's Responsible	
1.) Streamline Act 250 requirements for wood fuel producers		Legislature/Act 250 Commission	
2.) Ensure that the State Energy Management Program (SEMP) performance contracting model developed for state buildings (and MUSH sector) incorporates wood heat in feasibility		Building and General Services	
3.) Provide TA to schools, municipalities, commercial customers to encourage AWH systems (by BERC or SWEP)		Building and General Services or State Wood Energy Program	

IMPACT: reduce GHG emissions, reduce heating bills, improve air quality, develop local economy, and create new jobs through the forest products value chain, thereby helping sustain and manage the state's extensive forest resources.

METRICS[2]: Triple AWH installations = GHG reduction of 0.257 (million tons of CO2 equivalent) MMTCO2e

- 18,000 more residential pellet stoves (from the current 31,000)
- 5,100 more automated pellet boilers (from the current 377)
- 1,260 more commercial/institutional bulk pellet systems (from the current 162)
- 108 more commercial woodchip systems (from the current 61)
- At least 4 new small pellet mills to ensure the increased demand is met from locally produced pellets

3. Building Electrification

Goals:

Encourage cost-effective investment and customer use of building electrification for heating and cooling and ensure that building electrification is done in a way that best serves customers and the electricity system.

Recommendation	Impact	Feasibility	Cost
Accelerate the adoption of building electric technologies that displace fossil fuels used for space and water heating.	High	High	$
Action Step(s)		Who's Responsible	
1.) Customer Education		Vermont electric distribution utilities/PSD	
2.) Rate Design/and or incentives for load control		Vermont electric distribution utilities/PSD	
3.) Aggregation		Vermont electric distribution utilities/PSD	
4.) Electric Distribution Utility Incentives		Vermont electric distribution utilities/PSD	

Background:

Building Electrification refers to the pathways to help shift largely fossil fuel consumption toward increasingly clean, and ideally less expensive forms of heating enabled through electricity. Promising technologies here include cold climate heat pumps and heat pump water heaters. Heat pump technology transfers heat from a cold space toward a warmer space. Heat pumps are three to four times more effective at heating a space than traditional electric resistance heat. The same technology that is used to heat a space can also be used to cool a space. Because the categories of end-uses for which the technology is employed represent flexible loads, these loads can be managed or controlled for additional grid value or benefit.

Recommendations to encouraging the technology include customer education, ratepayer incentives, rate design, and aggregation of shared access. Most of these recommendations are within the ability of the distribution utility to implement. The obligations and the form of regulation should be aligned with

[2] BERC and State Wood Energy Team estimates

customer interests. The costs of these measures should not drive up costs for customers, should be low, even for the electric system, as these could constitute new loads, adding new margin, and offer the potential to add new services that can help integrate growth in distributed generation.

4. Roadmap to Net Zero Design by 2030

Goal: Adopt and implement a roadmap for all new buildings to meet net zero design by 2030

Recommendation	Impact	Feasibility	Cost
Adopt and implement a roadmap to net zero design by 2030	Medium	Medium	$
Action Step(s)		Who's Responsible	
1 3-year updates toward goal of net zero design by 2030		PSD and stakeholders	

Background:

A typical Vermont residence heating with No. 2 heating oil has a heating load requirement of 80 to 100 MMBtu. The average commercial structure ranges from 120 to 150 MMBtu. New household construction is roughly 1000 new homes that only grow the challenge. Typical new homes add about XX MMBtus per household. Net-zero buildings have zero net energy consumption. Energy requirements are met through more efficient systems or integrated renewable energy systems. The most cost-effective way to implement energy efficiency is by ensuring that the technologies are embedded in its construction or manufacturing. Net-zero design ensures that buildings are both energy efficient, and that the enabling technologies for building management and renewable integration exist on commissioning of the building or premise. The code requirements would apply to new building by 2030. Part of the path to affordable housing is to ensure that all cost-effective technologies are integrated into the new building and housing stock to help ensure that the challenges do not continue to grow.

The State is far along already as they have standards to meet high energy efficiency performance in new buildings and are moving away from fossil fuel heating. Several states have developed or are developing goals for net-zero designed homes. California has established a target for 2020 for all new residential homes. A Massachusetts task force has set a target for 2030 for all residential and commercial buildings.

5. Building Energy Labeling

Goal: Increase building energy labeling in Vermont to make building energy use more visible

Recommendation	Impact	Feasibility	Cost
Label new and existing buildings participating in state energy programs and require benchmarking for the largest buildings.	Low-Med	High	$
Action Step(s)		Who's Responsible	
1.) For existing homes, require state funded programs (Energy Efficiency Utility programs and the Home Weatherization Assistance program) to generate a label when residential buildings are receiving energy assessments and/or being weatherized		PSD, OEO, EEUs	
2.) For new homes, require the generation of a building energy label when buildings are first being constructed. This could also be done through the EEU new construction programs.		PSD, EEUs	
3.) For commercial buildings require benchmarking and a rating utilizing Energy Star Portfolio Manager for at least the largest buildings (50K+ square feet).		Legislature for commercial buildings, EEUs	

Background:

Energy ratings and labeling can be used to provide information on a building's energy use. A building rating takes the building energy usage information and provides a comparison with similar buildings. The energy data and rating can be used to develop a building energy label, which can present a simple visual of the information, much like a fuel economy sticker on a new car. This information can be useful to potential buyers as a means of comparing energy efficiency levels of various buildings and to assess what their future energy costs might be for those buildings. This information may also encourage investment in efficiency on the part of either a prospective buyer or a property seller. For home buyers, this also presents a potential opportunity to include any needed efficiency improvements in an energy-efficient mortgage.

6. **<u>Increase low-to-moderate income homes weatherized through the Energy Efficiency Utility programs</u>**

Recommendation	Impact	Feasibility	Cost
Accelerate the weatherization of households for low-to-moderate income households	Low	High	$
Action Step(s)		Who's Responsible	
1.) Increase low-to-moderate income homes through the state's energy efficiency homes by 25%.		PSD, OEO, EEUs	
2.) Expand the Heat Saver Loan and Neighborworks of Western VT loan program by $5 million		Efficiency Vermont, State Treasurer	

Background:

Current resources to meet Vermont's low-income weatherization goals are inadequate. For many low-income residents, this means colder homes, burdensome heating costs, discomfort, and adverse health impacts. Since 2008 the Energy Efficiency Utilities (Efficiency Vermont, Burlington Electric Department, and Vermont Gas Systems) have weatherized over 10,000 homes through their efficiency programs, however there is only a modest emphasis on serving low-income households.

An increase in low-income weatherization investments made today will reduce fuel needs for the most vulnerable Vermonters, lower their energy costs, make their homes healthier, reduce carbon emissions, thereby providing significant economic returns on up front investments.

Although the state Weatherization Assistance Program can serve low-income households up to 80% of median income, households up to 60% of median income are prioritized leaving most households between 60-80% of median income unserved. Additionally, there are not services or incentives targeted to the 80-120% low/moderate income households. This gap of vulnerable Vermonters who need significant assistance to complete weatherization projects need to be served. Tiered incentives can be used to buy down the cost of loans. This recommendation would target increased resources to this population to help fill the gap of service to this population by reallocation of existing energy efficiency program resources and direct recently approved State Treasurer funds for low-interest loans to serve this population.

7. Create a State Institutions Energy Management Program (SIMP)

Goal: Build on the success of Vermont's SEMP to create a state institutions energy management program by 2020.

Recommendation	Impact	Feasibility	Cost
Create a State Institutions Management Program	Medium	Medium	$$
Action Step(s)		Who's Responsible	
1.) Expand on existing State Energy Management Program design to complete comprehensive program design		State Buildings and General Services, PSD	
2.) Establish pilots with universities and schools		Financial Institutions, BGS, Universities, Schools	

Background:

Create a State Institutions Energy Management Program to provide energy management services to Vermont's institutional market. The program will build off the success of the Department of Buildings and General Services' ("BGS") State Energy Management Program ("SEMP") model. In its current form, the SEMP is augmented, in accordance with ACT 58 of 2016 Sec. E.112, through a partnership between Efficiency Vermont and BGS to achieve a specific amount of annual savings. The innovative model employed to achieve these savings can be adapted to obtain new energy savings and greenhouse gas reductions in other parts of the broader institutional market in the state.
The institutional market includes Municipalities, Universities, Schools and Hospitals (i.e., the MUSH sector). Many organizations within this sector struggle with high energy costs which in turn are passed down to tax payers, students and patients. While there have been previous achievements of energy savings in this sector, barriers still exist that often hinder success in many regions.

Institutions lend themselves to investment by Energy Service Companies ("ESCOs") through energy performance contracting ("EPC"). The characteristics of MUSH institutions include relative stability of their services and energy requirements, long investment horizons, and low cost of capital. The ESCO industry is an estimated $7 billion market in the US that has reliably partnered to provide $55 billion of guaranteed and verified savings since 1990. About 80-85% of the industry is focused on MUSH and federal customers.

A key concern in Vermont associated with Energy Performance Contracting through ESCOs is their requirement for relatively higher cost projects with higher rates of return. To achieve Vermont's significant energy conservation and greenhouse gas emissions reduction goals within the MUSH sector, deeper energy retrofits that encompass as many energy saving opportunities within a building as possible are necessary.

Many states have created government bodies to facilitate the implementation of performance contracting and Vermont can learn from their successes while adapting the innovations to the performance contracting model employed within the SEMP leading to lower project costs and deeper energy savings.