

Vermont Climate Action Commission
Building Energy Workgroup
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Contributors:

Commission Members – Riley Allen, Kristen Carlson, Paul Costello, Matt Cota, Tom Donahue, Linda McGinnis, Bob Stevens, Jennifer Wallace-Brodeur

State Agency Staff – Daniel Edson, Josh Kelly, Kelly Launder, Jared Ulmer

Technical Assistance – Emma Hanson, Paul Frederick, Andy Perchlik, Adam Sherman, Dave Westman

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 50% of Vermont homes use it as a primary or secondary heat source.

Commercial enterprises primarily use heating oil and propane for space heating, as well as 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 (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:

Reduce 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.

Recommendations:

I. Recommendation: Dramatically expand low income home efficiencies through a Weatherization Surge

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.

A Surge 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.

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. Vermont should use this existing accountable and efficient structure. Funds are available today through multiple sources to support loans to middle and upper income Vermonters. This project would meet the long waiting lists for low-income home weatherization that exist today even without outreach by the agencies, and dramatically advance affordability and protect the most vulnerable Vermonters, including children in poverty and seniors living in inadequately weatherized homes.

Funding pathways and options

The State of Vermont should boost investment in low income weatherization over the next four years to boost program capacity with the goal of doubling the current rate of home weatherization. This could be done by:

- Increasing the appropriation of Vermont General Fund dollars appropriated to AHS Low Income Weatherization.

- Leveraging resources from Vermont participation in the Western Climate Initiative cap and trade structure or an expansion of REGI to include heating and transportation sectors.
- Leveraging funds from a potential future transmission deal (like TDI).
- Bonding from the Weatherization Program Fund.

Actions/Recommendations

Dramatically increasing low-income weatherization efforts will move Vermont towards statewide efficiency goals, create jobs and workforce development and training opportunities, reduce carbon emissions, and dramatically lower heating costs for low income Vermonters for years to come.

II. Recommendation: Increase Building Electrification

Discussion

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 control of the distribution utility to implement or forestall. The obligations and the form of regulation should be aligned with customer interests.

Actions/Recommendations

Customer Education – To date, the cold climate heat pump technology has been reasonably well accepted. Roughly 20,000 have been installed by consumers in recent years. Education can be increased on best usage. Set and forget it operation is the typically the most efficient operation, yet consumers attempt to manage its operation during the winter months, resulting in uneconomic operation.

Ratepayer incentives, rate design, and aggregation/controlled loads listed below represent a suite of options for helping to move that market that can be enjoyed by utilities in isolation or combined.

Incentives – Even while the economics of the technology appear to be strong, ratepayer economics can fluctuate with fuel oil prices. The addition of cold climate heat pumps to the electric system is estimated to provide system and ratepayer benefits through additional margins and the potential for managed loads. The system benefit is approximately \$2000 per device. Ratepayer incentives can improve the economics.

Rate Design – Rate design can be used to improve the comparative economics of electric consumption versus use of fossil fuels for participating customers. Rate design and controlled charging can provide incentives for increasing the adoption of flexible loads, and for improving prospects for management of customer loads and for the harvesting of grid value streams by grid operators or third-party aggregators.

Aggregation – Flexible loads like CCHP and heat pump water heaters can function like storage devices. Third parties can function as either agents of customers or the utility to aggregate customer heat pump or other flexible loads to provide grid management services, or otherwise provide utility or customer loads by arbitraging peak and off-peak price signals. In addition, Utilities can employ direct control programs as well and in some cases they are already to benefit customers. In some instances, this can provide more benefit due to reduced overall costs to manage these resources.

Utilities - Tier III obligations are already in place to help encourage utilities to adopt mechanisms that help to transform the Vermont energy profile from fossil fuel technologies toward electrification. Regulation can be structured to provide incentives or the flexibility to encourage more innovations by utilities that include those listed above.

III. Recommendation: Adopt a roadmap for all new buildings being designed to be net zero by 2030. State lead by example by following net-zero design when constructing new buildings

Discussion:

- Will ensure steady progress in Vermont’s energy codes.
- 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.
- CA has done this – could be a good model and could help with defining what is meant by net zero.

Actions/Potential Steps:

- The Public Service Department, in consultation with stakeholders, should develop a road map for the required improvements in the buildings energy codes needed for every three year update to reach the goal of all buildings being designed to be net-zero by 2030.

IV. Recommendation: Increase building energy labeling in Vermont to make building energy use more visible to prospective buyers and renters; to establish baselines in buildings and identify where building energy improvements are most needed; and to acknowledge the value of these improvements.

Discussion:

- The General Assembly would have to pass legislation to make labeling or benchmarking mandatory. Multiple bills have been introduced, including this year, but they haven't been successful.
- Realtors aren't supportive of a mandatory label, but have distributing information about the VT Energy Profile and how to get one.
- There's currently work being done to translate Home Energy Ratings (for new construction) into Home Energy Scores.
- DOE Home Energy Score requires training to get DOE certification to use tool to provide score; there are some issues with this and may not be good communication tool; report is good though to provide transparency about building; someone could invest a lot in EE and not get a big bump in score
- Commercial: New York passing legislation to do a grading score – based on an energy star rating.

Actions/Potential Steps:

- Mandatory labeling or possibly other means such as requiring/encouraging when buildings are being weatherized and/or first constructed.
 - For commercial buildings possibly require benchmarking for at least the largest buildings (50K+ square feet).
- Utilize the already developed *Vermont Energy Profile* for residential building energy labeling (this is asset-based and provides an MMBtu number that can be compared to other homes).
- Utilize Energy Star Portfolio Manager to benchmark commercial buildings and provide rating.

V. Recommendation: Create a State Institutions Energy Management Program

A State Institutions Energy Management Program can be created 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.

Opportunities

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.

The key distinction of the SEMP model from the standard EPC model is the internalization of key elements that lead to deeper savings, and the potential to access low-cost capital. This requires having the technical expertise necessary to organize and manage an energy performance contract **within** the organization (i.e., evaluating buildings, structuring contracts, managing delivery of services, maintaining data, assessing outcomes and measuring the performance of each project).

The Program would also provide consulting and liaison services to institutions when hiring an ESCO to implement a traditional ESP. This versatile approach could increase the programs capacity and expedite performance goals.

Action Steps:

- A detailed proposal is under development.

- The Clean Energy Finance Collaborative is developing funding and financing proposals to meet the needs of the program
- The State is compiling MUSH sector energy data to characterize the scope and opportunities
- Engaging key stakeholders to spur sector pilots

VI. Recommendations – Promote Biomass Heating

Goal: To reduce GHG emissions and meet CEP goals in the heating sector by accelerating Advanced Wood Heat (AWH) adoption (Commercial, Institutional and Residential) to replace high GHG emitting systems. By doing so, Vermont will also develop our local economy and create new jobs through the forest products value chain, thereby helping sustain and manage the state’s extensive forest resources.

Metrics¹: to meet Vermont’s CEP and GHG reduction goals (Paris Accord) by 2025, we need to install all of the following:

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

Actions/Recommendations

Recommendations requiring little or no revenue (Low-medium GHG reduction impact)

1. Executive Order to codify the State Wood Energy **Program** (see attached draft) and provide official endorsement of 2025 goal of meeting 30% of VT thermal needs through AWH
2. Enact sales tax exemption for AWH systems
3. Streamline Act 250 requirements for wood fuel producers
4. Increase public awareness for efficient wood heat as a local renewable energy product that can save money and reduce GHGs if replacing fossil fuel or inefficient wood stoves
5. Ensure that the internalized Energy Performance Contracting (EPC) model developed for state buildings (and MUSH sector) incorporates wood heat in feasibility studies using life-cycle benefits/costs analysis, incl. benefits to local forest economy.
6. Provide TA to schools, municipalities, commercial customers to encourage AWH systems (by BERC or SWEP)
7. Eliminate EVT rebates for any fossil fuel equipment (e.g. fossil fuel boilers)

¹ BERC and State Wood Energy Team estimates

High impact recommendations_ (high GHG reduction impact, requires revenue with options outlined in detailed discussion below)

1. **Expand AWH incentives/rebates to accelerate AWH installs** and for support of the pellet and dry/green chip supply/infrastructure through increased funding for the CEDF (*metric: #s of installs*)
2. **Initiate Heating Assistance Fee on new high GHG heating systems** (e.g. fuel oil, propane, inefficient wood systems)
 - Revenue raised should be used to fund low-income rebates on efficient renewable heating systems.
 - Combine this with a sales tax exemption for AWH systems (above) to further accelerate adoption for all Vermonters
3. **Offer rural economic development incentives/support** for developing pellet mills
4. **Reopen school construction aid for biomass projects (remove moratorium)**
5. **Fund SWEP to provide continued outreach and technical support to target sectors**
 - Budget for statewide marketing campaign building off of the Feel Good Heat campaign.

DRAFT

**Climate Action Commission
Building Energy Subgroup
Recommendations Summary**

Goal/ Recommendation	Potential Action Steps	Metrics/ Measurements	GHG Reduction Impact			Fiscal Impact/ Cost to Implement			Governor Priority Area			Discussion
			Low	Medium	High	Low	Medium	High	Economic Growth	Affordability	Protecting the most vulnerable	
Building Energy Improvements – Net - zero roadmap	<ul style="list-style-type: none"> - PSD develop a road map for building energy code improvements needed for all buildings to be designed to be net- zero by 2030 - State lead by example by following net-zero design when constructing new buildings 	<ul style="list-style-type: none"> - Road map completed and implemented 		X			X		X	X	X	<p>This will ensure steady progress in VT's energy codes.</p> <p>Will result in lower building operating costs and neutralize volatile fuel prices.</p>
Building Energy Improvements – Labeling	<ul style="list-style-type: none"> - Adopt mandatory labeling or encourage by other means such as requiring when buildings are being weatherized and/or first constructed. - Utilize the <i>VT Energy Profile</i> for residential building energy labeling (asset-based and provides an MMBtu number that can be compared to other homes). 	<ul style="list-style-type: none"> - Labeling requirements adopted 		X		X			X		X	<p>Will make building energy use more visible to prospective buyers and renters and value energy improvements.</p> <p>Will establish baselines in buildings and identify where energy improvements are most needed.</p> <p>The General Assembly would have to pass legislation to make labeling or benchmarking mandatory.</p>

	<ul style="list-style-type: none"> - Utilize Energy Star Portfolio Manager to benchmark commercial buildings and provide rating. - For commercial buildings require benchmarking for at least the largest buildings (50K+ square feet). 											Work currently being done to translate Home Energy Ratings (for new construction) into Home Energy Scores.
Building Energy Improvements – State Institutions Energy Mgt. Program Expansion	<ul style="list-style-type: none"> - Expand existing SEMP to provide energy management services to the institutional building sector - Engage key stakeholders to spur sector pilots 	<ul style="list-style-type: none"> - SEMP is successfully expanded and a pilot program is developed and instituted. 			X		X		X	X		<p>The institutional market includes Municipalities, Universities, Schools and Hospitals. High energy costs for this sector are passed down to tax payers, students and patients.</p> <p>The key distinction of this model is the internalization of key elements that lead to deeper savings, and the potential to access low-cost capital.</p>
Building Energy Improvements – Low income weatherization (Wx) surge through bonding	<ul style="list-style-type: none"> - Bond from the Wx program to add \$32 M over the next four years 	<ul style="list-style-type: none"> - Weatherize an additional 2,900 homes. 			X	X				X	X	<p>A surge in investments will reduce fuel needs for the most vulnerable, lower their energy costs, and make their homes healthier.</p> <p>Bill pending that would allow the State Treasurer to assign \$5M/year to support weatherization in households with income under 120% of the statewide median family income.</p>
Building Energy Improvements – Low income weatherization surge through additional funding	<ul style="list-style-type: none"> - Boost Wx program funding by \$36M over the next four years by one of the following options: increase the appropriation of General Fund dollars; leverage resources from participation in Western Climate Initiative; leverage funds from potential future transmission deal (like TDI) 	<ul style="list-style-type: none"> - Weatherize an additional 3,600 homes. 			X			X		X	X	

Building Electrification – Customer Education	<ul style="list-style-type: none"> - Customer education by utilities - Customer access to state agency information 	<ul style="list-style-type: none"> - Utility customer education pilot initiated (10,000 customers over 3 years) - State sponsored information available online 	X			X			X	X		<p>Impacts of customer-focused education is still under investigation by utilities.</p> <p>Impacts on customer adoption apart from efforts to improve the economic case are still largely unknown.</p>
Building Electrification – Incentives	<ul style="list-style-type: none"> - Utilities pilots and ratepayer incentives - Tariff riders 	?		X		X			X	X		<p>Electricity ratepayer (non-participant) economics are favorable.</p> <p>Some incentive, rate redesign or controlled loads are likely needed to improve participating ratepayers economics necessary to bring demand to scale.</p> <p>As a flexibly and potentially controlled new load, ratepayer economics are expected to be favorable.</p>
Building Electrification – Rate Design	<ul style="list-style-type: none"> - PSD/PUC Investigation of alternative pricing pathways 	?		X			X		X	X		<p>Electricity ratepayer (non-participant) economics are favorable.</p> <p>Some incentive, rate redesign or controlled loads are likely needed to improve participating ratepayers economics necessary to bring demand to scale.</p> <p>As a flexibly and potentially controlled new load, ratepayer economics are expected to be favorable.</p>
Building Electrification – Aggregation	<ul style="list-style-type: none"> - Controlled loads by utilities and 3rd party aggregators 	?		X			X		X	X		<p>Electricity ratepayer (non-participant) economics are favorable.</p> <p>Some incentive, rate redesign or controlled loads are likely needed to improve participating ratepayers economics necessary to bring demand to scale.</p>

												As a flexibly and potentially controlled new load, ratepayer economics are expected to be favorable.
Building Electrification – Utilities	<ul style="list-style-type: none"> - Tier III implementations - Rate regulation and multi-year rate plans 	<ul style="list-style-type: none"> - Consider incentives for electrification as component of regulation plans 		X			X		X	X		
Biomass Heat – SWOP Exec Order	<ul style="list-style-type: none"> - Formalize SWOP (State Wood Energy Program) with 2025 goal of meeting 30% of VT thermal needs through AWH by 2030 	<ul style="list-style-type: none"> - Executive order - Legislated Goal 				X			X	X	X	Relatively easy to implement
Biomass Heat – Sales Tax Exemption	<ul style="list-style-type: none"> - Draft language (ACCD/ANR) - Pass legislation 	<ul style="list-style-type: none"> - #s AWH systems installed 		X		X				X		Combine with incentive (see below) for highest impact
Biomass Heat - Act 250	<ul style="list-style-type: none"> - Streamline Act 250 requirements for wood fuel producers 	<ul style="list-style-type: none"> - #s of new VT pellet mills - #s of new jobs created 	X			X			X			
Biomass Heat – Public Awareness	<ul style="list-style-type: none"> - Increase public awareness for efficient wood heat as local renewable energy product that can save money and reduce GHG if replacing Fossil fuel or inefficient wood stoves 	<ul style="list-style-type: none"> - # AWH systems installed 				X				X	X	
Biomass Heat – Energy Performance Contracts	<ul style="list-style-type: none"> - Ensure that the internalized Energy Performance Contracting model developed for state buildings (and MUSH sector) incorporates AWH 	<ul style="list-style-type: none"> - #s AWH systems installed in state and MUSH sectors - GHG reduction/system 				X				X		Use life-cycle benefit/cost analysis, including benefits to local forest economy.
Biomass Heat – Technical Assistance	<ul style="list-style-type: none"> - Ensure that sufficient TA is provided to MUSH sector and commercial sector to encourage AWH systems 	<ul style="list-style-type: none"> - #s clients assisted - #s AWH systems installed from 		X		X				X		

	- BERC or SWEP to implement	assisted customers										
Biomass Heat – Eliminate EVT rebates for fossil fuel equipment	- Already underway?	- Reduction in # FF systems sold - GHG reduction/system		X		X						This will incentivize customers at time of purchase to select lower GHG emitting systems
Biomass Heat – Expand AWH Incentives	- Expand incentives/rebates to accelerate AWH installs and to support pellet and dry/green chip supply/infrastructure through increased funding for CEDF	- #s AWH systems installed - GHG reduction/type of system			X			X	X	X		This is the highest GHG impact recommendation overall for Biomass Heat, and has a proven record through existing CEDF programs. It will both accelerate AWH adoption by making it more affordable and help generate demand for local pellet production. A range of funding options are discussed below.
Biomass Heat – AWH Heating Assistance for Low Income	- Initiate heating assistance fee on new high GHG heating systems. - Apply Revenue raised to fund low-income rebates on efficient renewable heat systems	- #s AWH systems installed - GHG reduction/system			X		X				X	This is the highest impact recommendation for low income. Combine with sales tax exemption for AWH systems (above) to further accelerate adoption
Biomass Heat – Rural Economic Development Incentives	- Offer rural economic development incentives/support for developing pellet mills (ACCD)	- #s of new VT pellet mills - #s jobs created		X			X		X			This is the highest impact recommendation for economic development.
Biomass Heat - Reopen school biomass construction	- Reopen school construction aid for biomass projects under CEDF	- #s VT schools with AWH heating systems - GHG reduction/system		X			X			X		Not only will this accelerate large system adoption (bigger GHG reduction) but it will also save taxpayer dollars over the long term.
Biomass Heat – Fund SWEP for TA and outreach	- Budget for statewide marketing campaign building off of the Feel Good Heat campaign.	- #s AWH installs statewide - Statewide GHG reduction related to AWH				X			X	X	X	This will allow for greater understanding of this local renewable resource, and provide economies of scale in TA for rapid acceleration of AWH adoption

Biomass Heat – Options to Fund Highest Impact Recommendations

Energy Performance Contracts	Utilize Energy Performance Contracts already proven in state buildings to incorporate AWH	- \$ generated		X								Applies primarily to (state and MUSH sectors)
Tier III Funds	Utilize Tier III Funds to fund AWH projects (e.g. as backup systems to heat pumps), or use penalties to fund AWH through CEDF	- \$ generated			X							Note rapid ramp up of Tier III requirements, allowing for potentially greater penalties to be generated
Heating Assistance Fee	Implement Heating Assistance Fee on new fossil fuel fired heating systems.	- \$ generated		X								Revenue generated should be targeted to low-income households switching out high GHG systems for efficient renewable systems
Western Climate Initiative	Join the WCI cap and invest program to generate revenue for both the thermal and transportation sectors	- \$ generated			X							Note that Quebec has already generated over \$2billion in 4 years to be utilized for GHG reduction
Expand RGGI to heating fuels		- \$ generated										Funds generated would be utilized to accelerate a rapid transition to renewable heating systems, and could be targeted to low-income customers