

Residential Weatherization in Vermont:

Where are we and where are we going?

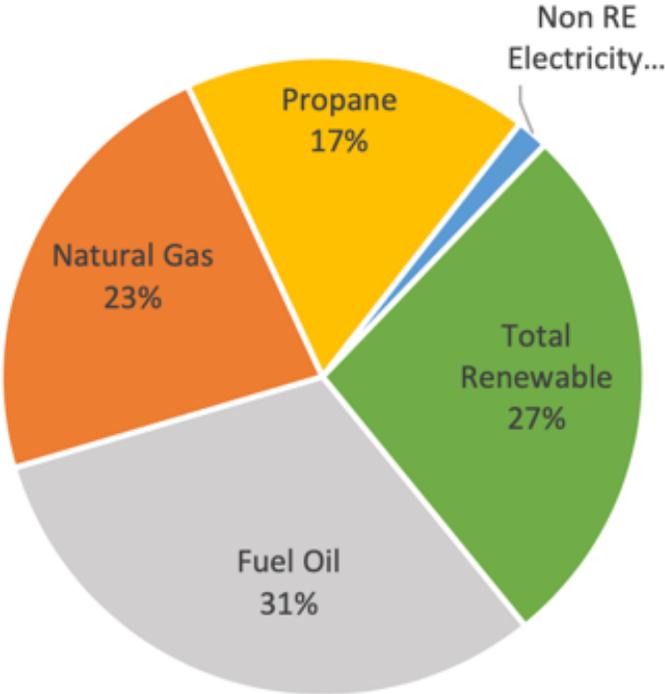
Phil March
Essex Energy Committee
March 10, 2021

Overview

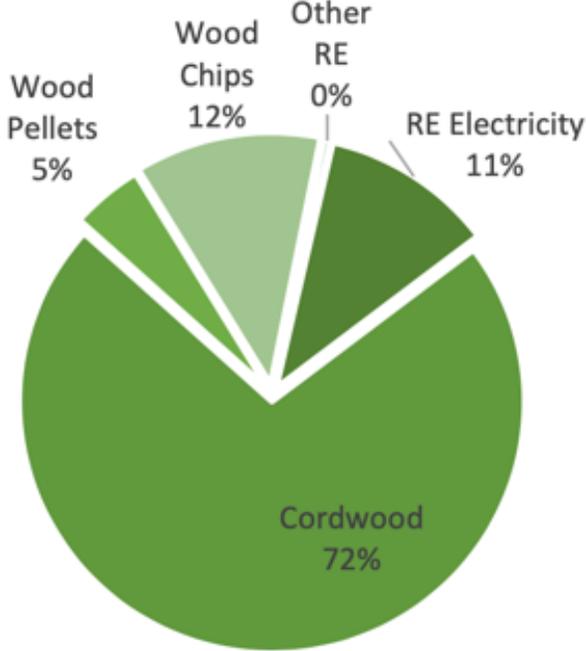
- Thermal sector issues unique to Vermont
- Weatherization goals
- Current status of weatherization
- The Energy Efficiency Utilities (EEUs)
- The evolving picture of eligibility criteria and weatherization incentives in VT
 - What is an appropriate level of “comprehensive” weatherization?
 - How have the weatherization programs changed for 2021?
- The Essex track record and EVT’s 2019 results
- Future directions
 - Are we significantly reducing GHG emissions and heating costs using the current “standards”?

Our dependence on fossil fuel for heat in 2020

Thermal Site-Energy Fuel Use Percentages

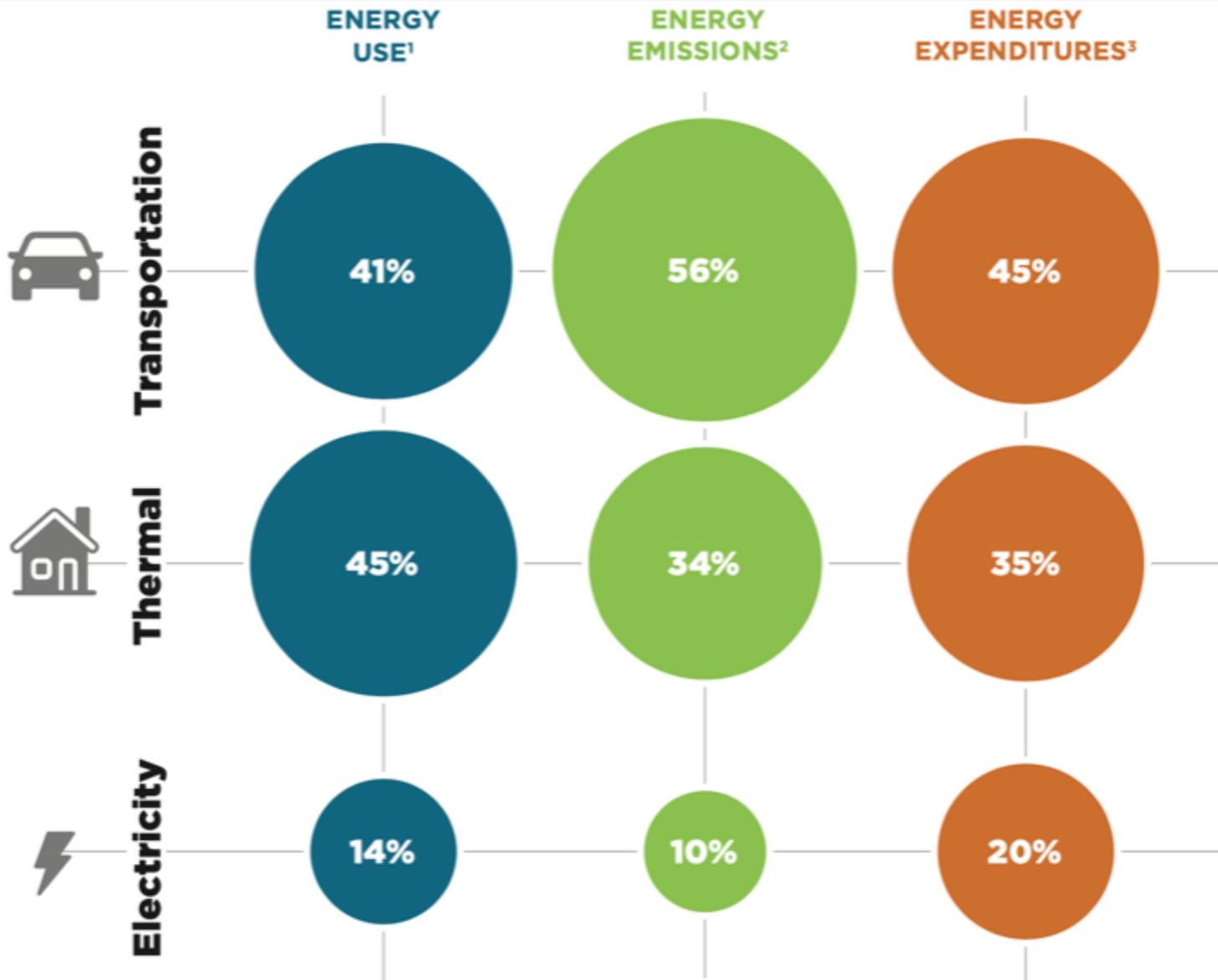


Renewable Energy Portion Percentages



From: DPS 2020 Annual Energy Report

³¹ Based on 2017 EIA fuel (site energy) data (as of Nov. 2019) updated with data compiled by the VT Energy Action Network from EVT for electric vehicles, heat pumps & electric resistance heating, PSD for electrical system mix in 2017, and ANR 2018 data for wood use.



The Thermal Sector produces the second highest GHG emissions and is the highest energy user in Vermont

From: DPS 2019 Annual Energy Report

1. Thermal and transportation based on EIA 2017 site energy; electricity based on Department of Public Service 2018 site energy after accounting for RECs. 2. Vermont Agency of Natural Resources. January 2020. 3. Efficiency Vermont. October 2019. Vermont Energy Burden Report.

Where emissions increases and decreases have come from across the region, 1990 vs. 2016¹



Vermont's GHG emissions from the thermal sector (orange) and the transportation sector (green);

WHY are we going in the wrong direction??

From: DPS 2019 Annual Energy Report

Weatherization Goals in VT

- 2008: VSA Title 10, Section 581 (1), Act 92
 - Improve "substantially" the energy fitness of at least 60,000 housing units by 2017 and 80,000 housing units by 2020
 - Annual goal of about 6700 homes per year
 - Section 581 (2): Reduce annual fuel needs (and heating bills) by an average of 25% in the housing sector

Weatherization Goals in VT

- 2013: PUC delegated DPS to monitor progress toward meeting these goals
 - 2014: PUC ordered a working group to do this and established “interim goals” to try to ‘catch up’
- 2018 update from DPS and working group
 - Falling far behind in reaching goals
 - Revised calculations of fuel usage reductions due to inconsistent reporting of weatherization outcome data from the EEU's

Current status of weatherization in Vermont

Figure 20: Progress toward Section 581(1) goals

	Number of Comprehensive Retrofits Qualified Under 10 V.S.A. § 581(1)											Program Total (as of 2018)
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
EVT	298	480	644	952	1,132	1,162	1,081	821	834	653	581	8,638
BED	0	3	2	8	7	2	13	5	19	4	17	80
VGS	178	393	465	235	332	360	388	356	331	344	204	3,586
OEO/WAP	1,427	1,570	1,785	1,162	1,479	927	1,102	802	646	674	806	12,380
3E Thermal	0	0	63	813	381	215	190	129	205	337	169	2,502
Statewide Total (annual)	1,903	2,446	2,959	3,170	3,331	2,666	2,774	2,113	2,035	2,012	1,777	
Statewide Total (cumulative)	1,903	4,349	7,308	10,478	13,809	16,475	19,249	21,362	23,397	25,409	27,186	

From: PUC and DPS 2018 Annual Report on Vermont's progress toward meeting energy fitness goals

The Fuel Usage Reduction Requirement of 25%: A Moving Target

- 2015-2018: EEU's not consistently reporting pre- and post-installation assessments at the individual project level
- Began submitting assessments at the program level even if some individual projects or individual programs did not achieve the 25% reduction in fuel usage
- 2018 DPS report only reported a “weighted average” of the fuel usage reductions across all 5 EEU's
 - Was 26% in 2018
 - Fuel usage reductions were estimated in most cases using various models or sampling techniques
 - I asked DPS to provide me with the reported program fuel usage reductions for each of the EEU's in 2018

Fuel usage reductions due to weatherization projects in 2018

Project Energy Savings	2018 Average savings
Vermont Gas	18%
Efficiency Vermont	17%
BED	32%
OEO	29%
3E Thermal	52%
Overall	26%

Keith Levenson, Energy
Program Director, DPS,
3-8-21

The Energy Efficiency Utilities (EEUs) serving Northwest Vermont

- Efficiency Vermont (EVT)
 - Statewide
 - Weatherization initiatives primarily funded by the Thermal Energy and Process Fuels (TEPF) Fund (2010 to present)
 - Actual dollars are from the FCM of ISO-NE and RGGI
 - Supports reduction in use of fuel oil, propane, kerosene, and woody biomass
 - Some additional funding by the Energy Efficiency Charge (EEC) on electric bills (varies year to year)
 - Approximately \$4M of total EVT annual budget goes to “comprehensive” weatherization (total budget currently is approximately \$55M)

The Energy Efficiency Utilities (EEUs) serving Northwest Vermont

- Vermont Gas Systems (VGS)
 - North and Northwest VT only
 - Weatherization initiatives primarily funded by the Energy Efficiency Charge on gas bills
 - Restricted to VGS customers only
- Champlain Valley Office of Economic Opportunity (CVOEO)
 - Northwest VT only (4 counties)
 - Manages the weatherization assistance fund (WAP) for low income VTers
 - 1976: DOE funded initially (\$1M annual budget)
 - 1990: VT Weatherization Trust Fund established
 - Funds from fuel taxes or % of gross receipts (all fossil fuels and electricity)
 - Current budget of >\$10M

The Energy Efficiency Utilities (EEUs) serving Northwest Vermont

- Burlington Electric Department (BED)
 - Burlington only
 - Funds from the TEPF, the EEC on electricity, and other sources
- 3E Thermal
 - Statewide (affiliated with Capstone)
 - Offers free audits, weatherization plans/budgets, and project monitoring for landlords owning affordable apartment units with leaky buildings
 - TEPF subsidizes
 - Cash incentives for the weatherization work done
- All EEUs under the supervision of the PUC

Major Weatherization Programs in Northwest Vermont

- EVT: Home Performance with Energy Star Program (HPwES)
 - Geared to all Vermonters, regardless of income
 - Qualify if use any fossil fuel except natural gas to heat home
 - If a VGS customer, EVT will supervise the project but VGS pays the incentive
 - This can get complicated!!
 - Weatherization incentives have evolved over time
 - Emphasis on moderate-income VTers over last couple of years
- VGS: Home weatherization programs
 - Originally started as the “Comprehensive Retrofit” program
 - Now programs are most closely aligned with EVT’s HPwES programs
 - Only VGS customers
 - Incentives tend to be better than those of EVT

Major Weatherization Programs in Northwest Vermont

- CVOEO
 - Strictly geared to low income VTers (see table in guide)
 - If qualify, the audit and weatherization work are free as long as all recommended work is completed
 - Screening process is rigorous
 - Long wait times for work to proceed
 - Eligibility guidelines and program details have not changed significantly over the past 2-3 years
 - Excellent opportunity for low income VTers but not widely publicized
 - Both EVT and VGS are now referring interested homeowners to the CVOEO on their respective websites

What is a “Comprehensive” Weatherization Project?

- The DOE/EPA definition
 - Complete audit followed by recommended work on all areas of heat loss
 - The thermal shell (insulation, air sealing of attic/ceiling, exterior walls, floors, basement walls (above and below grade and rim joists))
 - Doors/windows/attic hatch/outlets
 - Heating ducts/pipes
 - Other non-weatherization areas examined on a complete audit
 - Heating/cooling/hot water system efficiency
 - Energy efficiency of other appliances, lighting
 - Ventilation
 - Thermostats, health and safety equipment

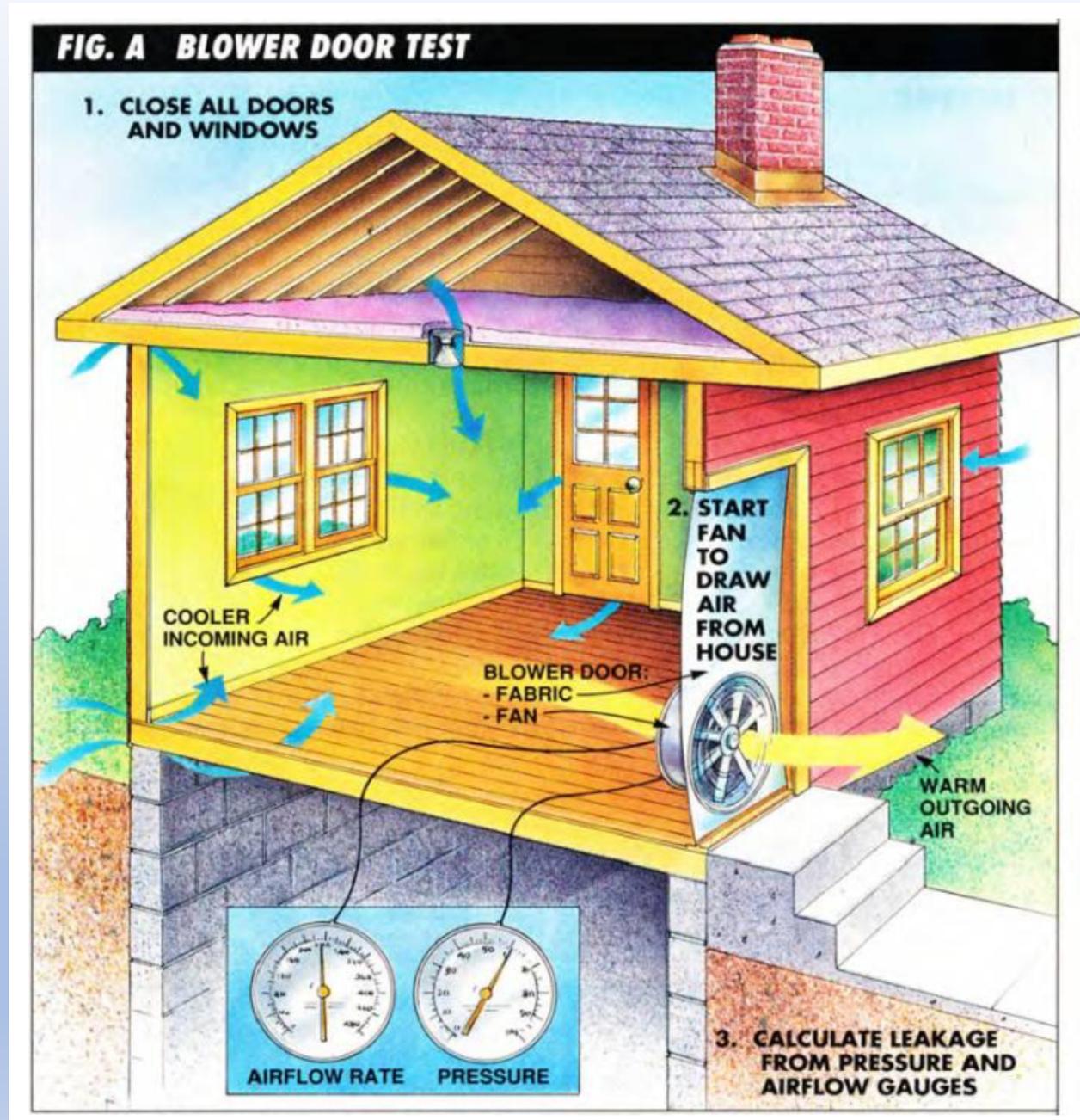
What is a “Comprehensive” Weatherization Project in Vermont?

- The CVOEO program follows the federal DOE/EPA guidelines
- The original VGS comprehensive retrofit program generally followed these guidelines
- However, VGS and EVT have now redefined the attributes of a comprehensive weatherization project (as reported to the state)
 - A comprehensive audit can be done but is not necessary
 - A more focused audit based on the homeowner’s needs and desires is allowed
 - If a comprehensive audit is done, the owner can pick and choose the measures they want to have performed
 - Some thermal shell work is required
 - Door, window, duct/pipe insulation not required (and no incentives for any window/door work done)
 - A minimum of a 10% reduction in home air leakage based on the blower door test is required to qualify for rebates



The Blower Door Test as a measure of potential heat loss

- The mechanics of the test
 - The greater the leakiness of the home's thermal shell, the greater the air volume needed to maintain an internal home pressure of 50 Pascals
 - The most common unit of measure is the cfm50 measure
- Performed before and after weatherization work is done



From: 2020
BestLife52.com,
"Lower Fuel Bills
with a Blower
Door Test", Aug. 8,
2020

The Blower Door Test as a measure of potential heat loss

- What do the values mean?
 - <1250 = a 'tight' home
 - 1250-2000 = slightly leaky home
 - 2000-3000 = moderately leaky home
 - >3000 = very leaky home
- There is no direct correlation between these values and degree of heat loss/fuel usage but it is generally used as an indicator of heat loss
- The percent reduction in heating fuel usage is usually 10-30% LESS than the percent reduction in home air leakage

Does a 10% reduction in air leakage equate to a significant reduction in heat loss?

- Sources consulted (including other state guidelines) indicate that a 10% reduction is a very low bar and likely not to result in significant heat energy/fuel bill savings
- A 20-30% reduction in air leakage is considered a minimum goal by most states
- The Energy Conservatory states that, after a comprehensive retrofit for a very leaky home, a 40-50% decrease in the cfm50 can be expected

Changes in EVT's Weatherization Programs in 2021

- Eligibility criteria to qualify for incentives have not changed
 - Minimum of 10% reduction in air leakage on blower door test is major requirement
 - A BPI contractor (same as an Efficiency Excellence Network contractor) performs the audit and work
- A free preliminary, virtual Home Energy Visit is still offered through Button Up
- Moderate-income VTers are still eligible for a greater rebate
 - Same income limits
 - Receive 50% of project costs up to \$3,000 (was \$4000 in the fall of 2020)

Changes in EVT's Weatherization Programs in 2021

- Higher income VTers still qualify for 50% of project costs up to \$1000
- The above rebates also available for multifamily dwellings with 4 or fewer units
 - Good opportunity for landlords
 - Tenants also benefit indirectly
- Owners of multifamily dwellings with 5 or more units are eligible to receive a 50% rebate on project costs up to \$3,000 as part of EVT's Building Performance Program
 - The cap is down from the \$5,000 cap in 2020
- \$100 rebates for DIY projects still available

Changes in VGS's Weatherization Programs in 2021

- Eligibility criteria of a 10% reduction in air leakage appeared in the late fall of 2020 and has continued
 - Now matches the EVT criteria
- A BPI-certified contractor, *including any of those listed by EVT*, performs the audit and the work
- Comprehensive audits by VGS personnel are still offered at no charge only to owners of homes with high energy use (contact VGS to see if you qualify)
- For all projects, all weatherization measures recommended after an audit do not need to be performed to qualify for the rebate
 - This differs from the previous requirement for the VGS comprehensive retrofit program in 2020

Changes in VGS's Weatherization Programs in 2021

- An Income-Eligible Adder program still exists for moderate income VTers
 - VGS will discuss this option with those who qualify after submitting a request for a home energy consultation
 - In this program, the rebate is 50% of costs; An additional incentive of \$500 is available if all weatherization measures are performed after a comprehensive audit
- Incentives for owners of single family dwellings have changed significantly!
 - Single family homes occupied by the homeowner: 50% of costs, up to \$3,500
 - There was no cap on the rebate in 2020
 - Single family homes occupied by tenants who pay the VGS bill: 75% of costs, up to \$5,000, payable to the property owner (landlord)
 - This is NEW!!

Changes in VGS's Weatherization Programs in 2021

- Incentives for owners of multi-family dwellings with 4 or fewer units have changed significantly!
 - If property owner pays the VGS bill, rebate is 50% of costs, up to \$7,000
 - If tenant pays the VGS bill, rebate is 75% of costs up to \$10,000
- Townhouse/Condo incentives
- Modular or Manufactured home incentives

Results of EVT's weatherization projects in Essex in 2019

- Requested weatherization measures done and blower door test results from all homes that were “comprehensively” weatherized in 2019
- 15 homes (5 Button up and 10 non-Button up) were weatherized according to EVT's HPwES criteria
 - Audits with very weak requirements (blower door test was enough)
 - Work done satisfied requirements as long as 10% reduction in air leakage
 - Some homes had minimal shell work done
- Baseline (pre-work) blower door tests showed that 6 out of 15 homes were ‘tight’ or only slightly leaky before any work was done
 - 6 were moderately leaky
 - 3 were very leaky

Results of EVT's weatherization projects in Essex in 2019

- The mean % reduction in air leakage post-work was 34%
- However, the % reductions ranged from 11% to 83% (median was 25%)
 - 7 out of 15 homes achieved a % reduction of less than 25% (mean of 18.6%)
 - 3 out of 15 homes achieved a % reduction of 25% to 35% (mean of 28%)
 - 5 out of 15 homes achieved a % reduction of over 35% (mean of 59%)
- The mean estimated heat energy saved was 18.3% (compare to 2018)
 - Only 3 of 15 homes with $\geq 25\%$ estimated heat energy savings
 - The formula used to calculate this estimate was not provided by EVT
- Homes that were in the moderately to very leaky category at baseline tended to have greater % reductions in air leakage post-project, but this was not consistent

Take home messages from the Essex data

- Large variability in leakiness at baseline
 - Some homes already well-insulated/sealed
 - Some homes excessively leaky
- The comprehensiveness of the measures done varied considerably
- The tighter homes generally had the lowest reductions in air leakage post-project
- The leakiest homes generally had the greatest reductions in air leakage post-project, but even some of these homes had less than 20% reductions
- The vast majority of homes (80%) did not achieve the estimated heat energy savings that the original state statute required (25%)
 - Overall mean of 18.3%

Conclusions, Questions, and Future Directions

- The weatherization standards for EVT and VGS have become very loose
 - Almost any house and any homeowner can qualify for a substantial rebate
 - The comprehensive audit is not required and, even when performed, all recommended measures are optional while still allowing homeowners to remain eligible for a rebate
 - The blower door test requirements are well below standards
 - If the Essex data are representative.....
 - Many homes that “qualify” using the 10% rule do not need additional weatherization
 - Many homes that need extensive weatherization are not receiving it from EVT

Conclusions, Questions, and Future Directions

- Re-visiting state goals:
 - Quantity of homes weatherized falling way short
 - Quality of the work done is not fulfilling the goal of “substantially improving” the energy fitness of Vermont homes
 - Many homes that are listed as being comprehensively weatherized on the state list have not been comprehensively weatherized by EVT, and this will worsen as VGS requirements become more closely aligned with those of EVT
 - Will need to question the accuracy of current and future annual reports by the state regarding weatherization progress
 - GHG emissions will not be as curtailed as much as expected

Conclusions, Questions, and Future Directions

- Recommendations:
 - More thorough and rigorous definition of “comprehensive weatherization” across all EEUs
 - In parallel, more rigorous air leakage reduction requirements, especially by EVT and VGS
 - More emphasis on comprehensive audits by contractors
 - Consider graduated incentives based on income and/or the percent reduction in air leakiness
 - Survey homeowners regarding why they are not weatherizing
 - Increase publicity of EEU programs (esp. CVOEO, 3E Thermal)
 - Improve website information for each program

Conclusions, Questions, and Future Directions

- Recommendations:
 - Compare Vermont's weatherization budget to those in other northeast states
 - Other states appear to be doing a much better job at weatherization
 - Re-examine fund allocations in EVT's budget
 - Consider new ways/sources to enhance funding of EVT's weatherization programs
 - Promote transparency of all details of programs, including:
 - Work measures performed and blower door test results
 - Budgetary allotments and specific costs
 - Follow up data on customer satisfaction
 - More thorough fuel savings data assessment and follow up

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- Google

