2024 Annual Energy Report

Vermont's Energy Supply and Demand

Summary of Progress Toward Comprehensive Energy Plan Goals

January 18, 2024

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Table of Contents

VERMONT
DEPARTMENT OF PUBLIC SERVICE

1. Introduction & Overview

Vermont's **energy policy**, as articulated in 30 V.S.A. 202a, is:

> To assure, to the greatest extent practicable, that Vermont can meet its energy service needs in a manner that is adequate, reliable, secure, and sustainable; that assures affordability and encourages the State's economic vitality, the efficient use of energy resources, and cost-effective demand-side management; and that is environmentally sound.

Vermont's Comprehensive Energy Plan, released in January 2022, recognizes that these goals are sometimes in competition. The plan balances the principles of Vermont energy policy which are all essential for a vibrant, resilient, and robust economy and for the health and well-being of all Vermonters. In doing so, the Comprehensive Energy Plan (CEP) builds upon and re-established long-standing high-level goals: To meet 25% of Vermont's energy needs from renewable sources by 2025, 45% by 2035, and 90% by 2050. In addition, the CEP sets sector specific targets.

This **Annual Energy Report** is designed to provide objective data as well as transparency regarding the policies pursued by the Department of Public Service (PSD). This Annual Energy Report is organized differently than in years past with a slide format intended to increase accessibility. Importantly, the report continues to describe major trends or initiatives for the energy sector as a whole, then specifically within each sector while providing objective data in simple exhibits throughout. Appendix A distills every recommendation in the Comprehensive Energy Plan and assesses progress on those recommendations.

2022 Comprehensive Energy Plan Theme: Equity

The CEP recognizes that the current energy system is marked by systemic inequities that have a disproportionate impact on many of Vermont's communities, and that the transition required to meet our targets presents us with opportunities to root out and redress those existing inequalities.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

2022 CEP Theme: Equity

In **2023**, the Department worked to advance diversity, equity, inclusion, and justice within it's work through several avenues, including:

Participating in 7 meetings of the **Interagency Environmental Justice Committee**, alongside with Environmental Justice Advisory Council, to advance implementation of Vermont's Environmental Justice Law. Through this work, Department staff contributed to efforts to draft Core Principles of Community Engagement. More information available here.

Complying with federal requirements related to the Justice40 initiative in all federal funding applications, which included the development of community benefits plans and additional proposals for future engagement to support development of programs. Justice40 seeks to ensure 40 percent of the overall benefits of certain federal investments (including those related to clean energy, energy efficiency, and workforce development) will be directed toward disadvantaged communities.

Working to advance more equitable engagement on renewable electricity policies and programs under the Renewable and Clean Electricity Policies and Programs review effort. See https://publicservice.vermont.gov/renewables for more information.

Adopting an Initial Language Access Plan (available here) and ensuring all Department accessibility policies were posted online.

Participating in regional and national discussions of advancing equity in energy planning, such as the Northeast Equity Roundtable organized by the National Association of State Energy Officials, National Governors Association, and National Association of Regulatory Utility Commissioners.

The 2022 CEP outlines seven recommended actions for the Department and other agencies to take to advance equity and justice while striving to meet state energy goals. These recommendations and the progress towards meeting them made over the last year are outlined in Appendix A.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

2022 Comprehensive Energy Plan Theme: Grid Evolution

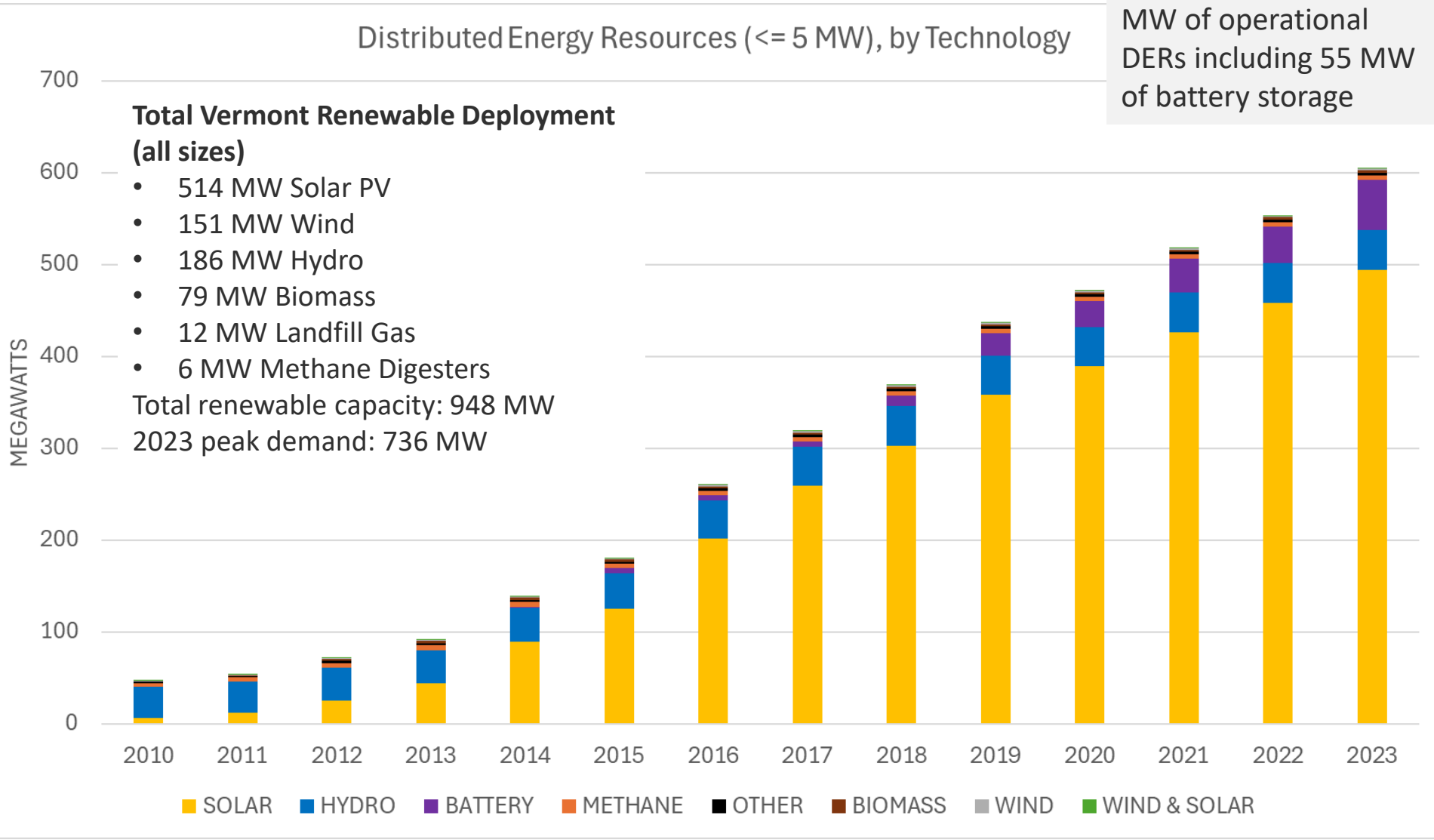
The CEP calls for a secure and affordable grid that can efficiently integrate, use, and optimize high penetrations of distributed energy resources to enhance resilience and reduce greenhouse gas emissions

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont currently has significant penetration of renewables, especially Distributed Energy Resources.

See Section 2.d for Storage Deployment and Drivers

VT now has over 604 MW of operational DERs including 55 MW of battery storage



VERMONT
DEPARTMENT OF PUBLIC SERVICE

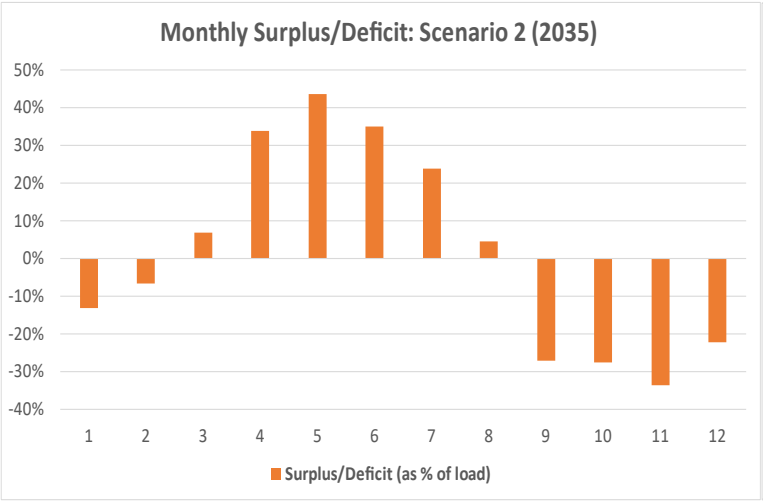
Variability of Load and Generation Creates New Challenges that underscore need for flexibility mechanisms

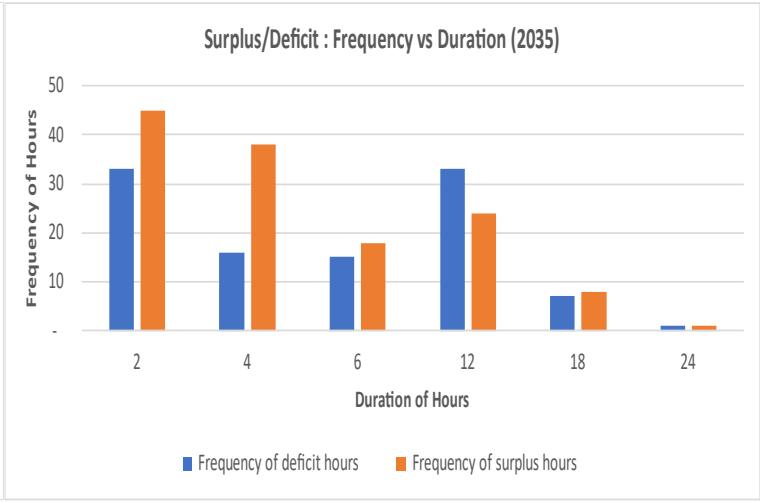
Vermont's Renewable Energy Standard (and all regional RPS) compliance is currently demonstrated on an annual basis.

As policymakers consider quarterly, monthly, or hourly compliance, storage and load management options will be required to align generation and load

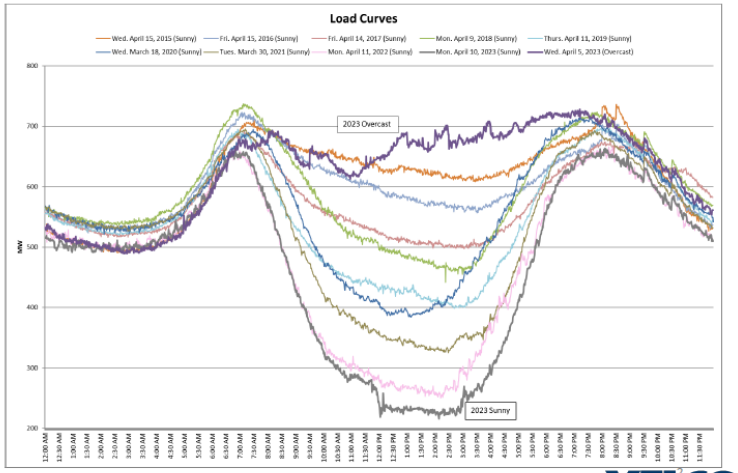
The bar charts on the left show an example from the Public Service Department's technical analysis, showing significant monthly energy surplus/deficit in the year 2035, assuming a 30% Tier II plus a 30% Regional Tier. The second bar chart shows the frequency of different surplus/duration deficits.

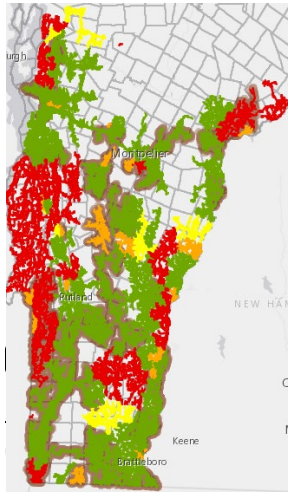
The line chart shows data from VELCO highlighting the impact of solar on load during the day, comparing a 2023 overcast spring day to sunny spring days from the last several years. The map shows Green Mountain Power's distribution circuits that have headroom to support additional solar (green) and those that don't (red).





Solar PV Offset





Federal Funding

Vermont, like other states, has received, will receive, and has the potential to access unprecedented amounts of federal funding for energy-related initiatives and projects through the American Rescue Plan Act (ARPA), the Infrastructure Investment and Jobs Act (IIJA, also called Bipartisan Infrastructure Law or BIL), and the Inflation Reduction Act (IRA).

Applying for and receiving federal funding takes time. There are often significant restrictions on use of funds, and matching funds must be obligated to access many of the available dollars. Enormous amounts of resources are being dedicated to securing, distributing, and reporting on federal funds. Formula distributions from the federal government combined with responses to competitive solicitations provide opportunity to further Comprehensive Energy Plan goals. Funds allocated for energy projects in 2021 are being deployed now. The following few slides provide an overview – select program specifics can be found in appropriate sector sections of this document.

American Rescue Plan Act (ARPA)

Covid Relief Funding that was originally allocated to States in March 2021.

- $74 Million ARPA Funds allocated to Public Service Department via FY 2022 and 2023 Budgets
- $5 M to EVT for moderate income weatherization (being deployed)
- $2 M to EVT and NeighborWorks for workforce development (being deployed)
- $35 M to EVT for moderate income weatherization
- $10 M redeployed in 2023 to support flood impacted LMI HH with equipment replacement

Must be made available to those who received Weatherization

- $20 M to support home electric upgrades for low and moderate income (LMI) households (~5,000)
- $5 M to install heat pump hot water heaters for LMI (~2,000)
- $7 M for Energy Storage Access Program for storage systems in VT homes, municipal buildings, support muni/coop software solutions
- $10 M to Affordable Community Renewable Energy
- $5M (+ $2M 2023 General Fund + 1M Congressionally Directed Spending) to School Heating Assistance for Renewable Energy (SHARE) Program

Building Infrastructure Law (BIL)/Infrastructure Investment and Jobs Act (IIJA) *November 2021 – Formula Funding*

$3M IIJA funds through State Energy Program (over 5 years) to be used for:

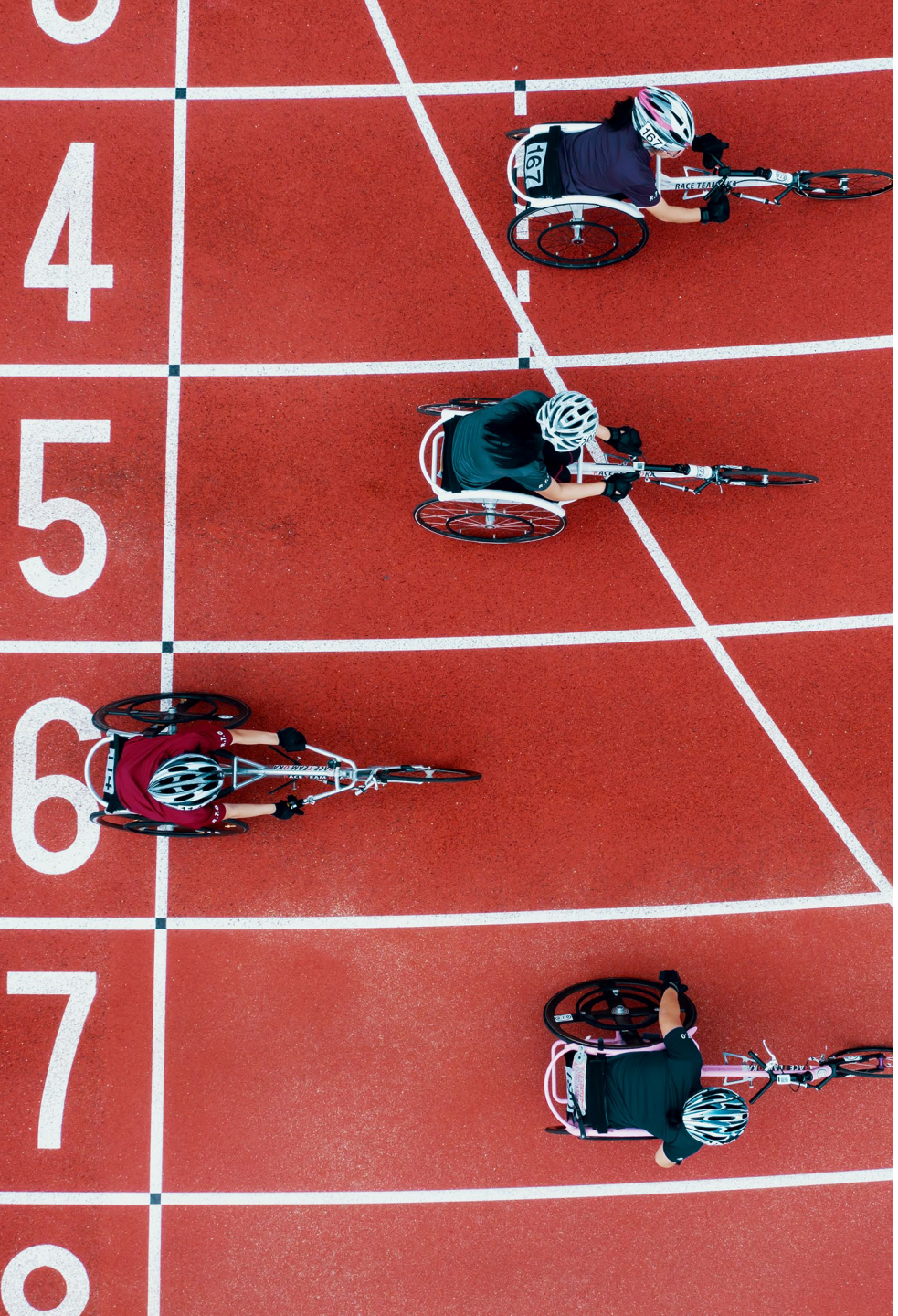
- workforce training
- innovation grants to RPCs, municipalities, energy committees, and small utilities
- Equity and engagement work

$1.6M IIJA Funds directed by Legislature to BGS State Energy Management Program for Municipal Energy projects

$900K Energy Efficiency and Conservation Block Grant funds to be sub-granted to eligible municipalities.

$16Mi (over 5 years) for utility grid investments that reduce the frequency & duration of outages

VERMONT
DEPARTMENT OF PUBLIC SERVICE



Building Infrastructure Law (BIL)/Infrastructure Investment and Jobs Act (IIJA)

Competitive Funding Applications – Grid Resilience & Innovation Partnerships

Coordination with NE states to consider application for projects to facilitate the future connection of offshore wind, including:

- Shoreline transmission reinforcement
- Energy storage
- Onshore transmission upgrades

Vermont submittals for potential funding of:

- Over $100M to support New England Clean Power Link
- Approx $60M to support installation of battery storage in disadvantaged communities

Potential further opportunities for grant applications by electric utilities

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Inflation Reduction Act (IRA)

Passed August 2022, funds expected to flow late 2024/2025

$59 Million Formula funds via Department of Energy

- $29 M for weatherization and comprehensive energy efficiency projects (HOMES)
- $29 M for point-of-sale rebates for appliances (High Efficiency Electric Home Rebates)
- $1 M for contractor training

Competitive Solicitations via EPA:

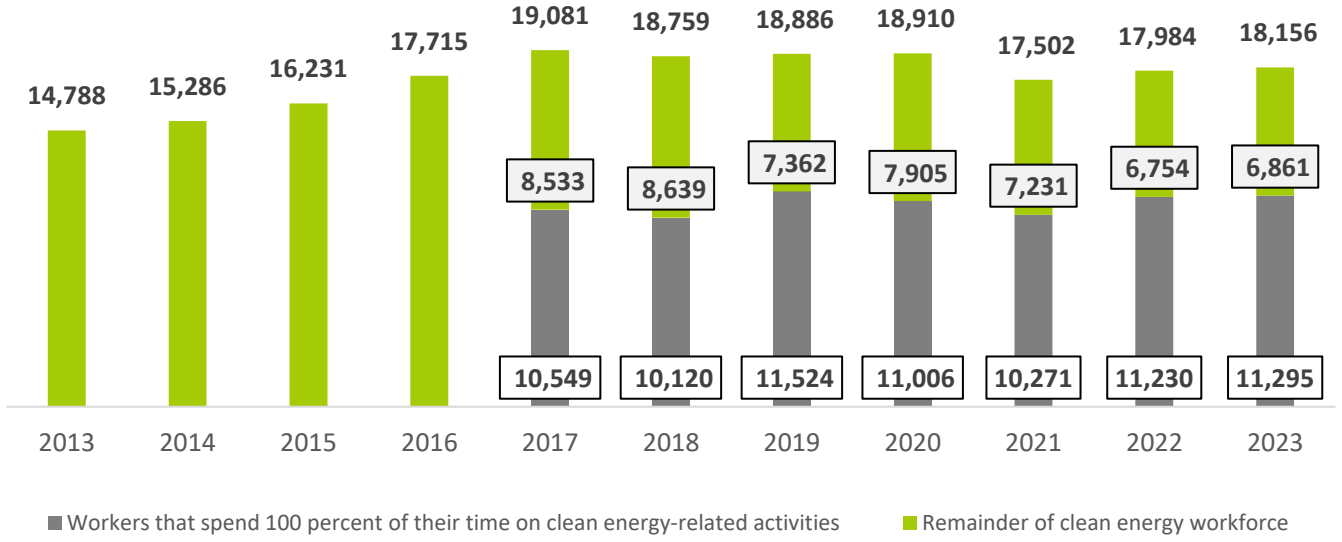
- Greenhouse Gas Reduction Fund – Solar for All -- **$100 Million**

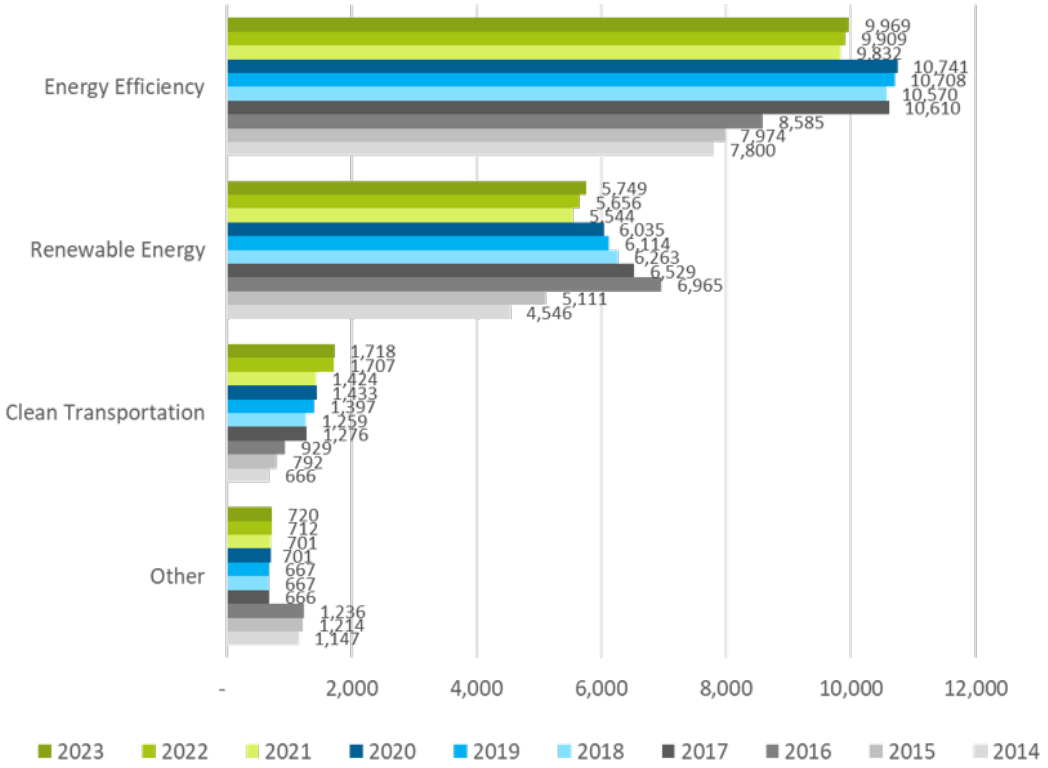
Tax Credits Available Now

- Efficient Appliances
- Renewable Energy Development

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont's Clean Energy Economy





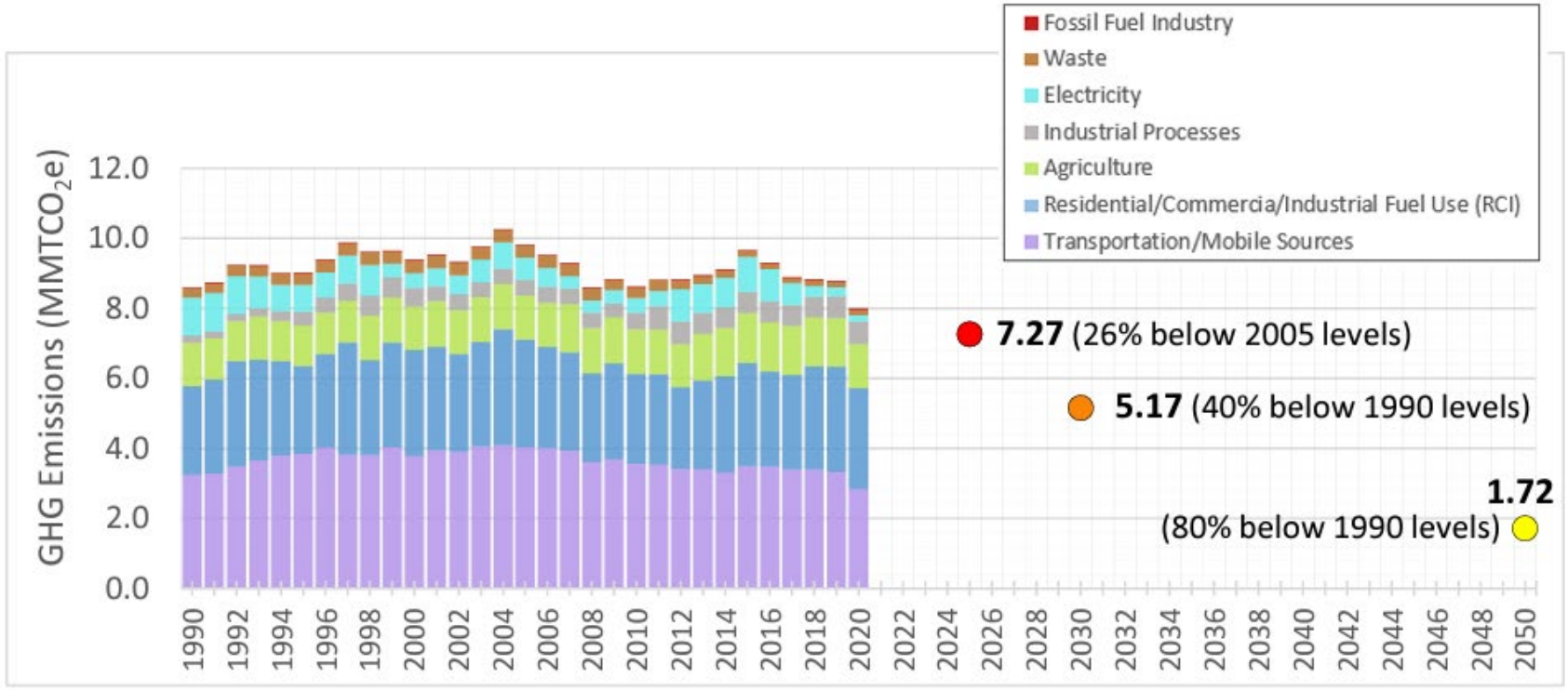
Vermont continues to lead the nation in the number of clean energy jobs per capita. Each year, the Department's Clean Energy Development Fund issues the Vermont Clean Energy Industry Report, drawing on data collected by the U.S. Department of Energy and its well-established methodology to characterize employment trends. The 2023 report shows that Vermont's clean energy economy gained 172 jobs in between the fourth quarters of 2021 and 2022 to a total of 18,156 workers.

Notably, **more workers than ever reported spending 100% of their time on clean energy-related activities**. The renewable energy sector had the largest gain in employees, while the energy efficiency sector remained the largest sector of the clean energy economy

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Past GHG Emissions and Future Targets

Vermont's Agency of Natural Resources, provides annual estimates on the amount of greenhouse gas emissions (GHG) by sector. The Vermont Greenhouse Gas Emissions Inventory and Forecast (GHG Inventory), completed pursuant to 10 V.S.A. § 582, establishes historic baseline greenhouse gas levels and tracks changes in emissions through time to determine progress toward Vermont's GHG requirements. As in prior years, the largest emitting sectors of GHG emissions in 2020 were transportation, building energy use, and agriculture. Vermont's GHG emissions declined 10% percent from 2017 to 2020.The decrease in transportation emissions was responsible for most of this decline and was largely due to the global pandemic and Vermonters staying home. It remains to be seen how much of those emission reductions will remain long-term.



VERMONT
DEPARTMENT OF PUBLIC SERVICE

2. Electricity

a. Renewable & Clean Electricity Policy Review

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Renewable & Clean Electricity Policy Review

The Department of Public Service in 2022-2023 has undertaken a significant review of Vermont's renewable and clean electricity policies and programs. This effort responded to recommendations from the 2022 Comprehensive Energy Plan and 2021 Climate Action Plan to review those policies in a transparent and open manner.

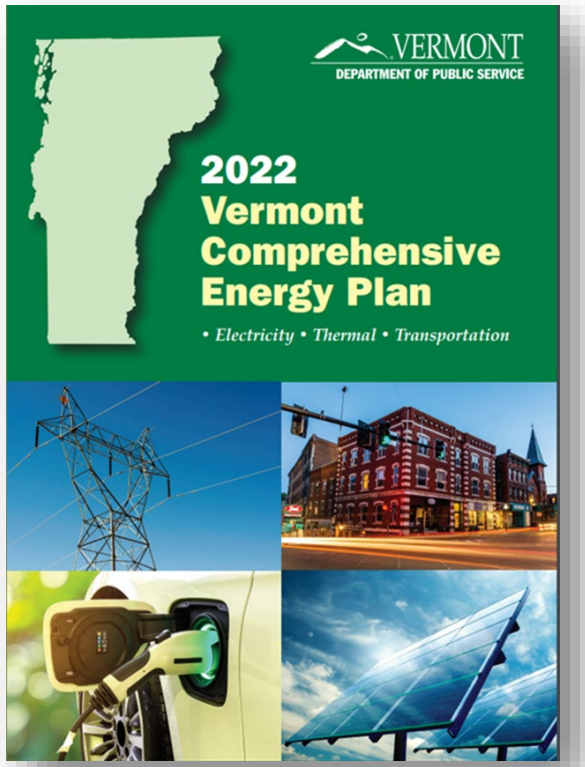
The resulting draft report begins to synthesize learnings from across the public engagement efforts and supporting technical analyses conducted between January and November 2023. It distills five initial takeaways related to the future of electricity in Vermont and offers several reflections on the process taken to engage Vermonters in this effort.

The following slides describe the context for the report, the Department's process, and the Key Learnings. The full report, as well as information about the process and all interim documents and presentations, can be found at https://publicservice.vermont.gov/renewables

VERMONT
DEPARTMENT OF PUBLIC SERVICE

What motivated this review of programs & policies?

To meet state renewable energy goals and greenhouse gas requirements, the 2022 Comprehensive Energy Plan and 2021 Climate Action Plan both made recommendations about reviewing and revising Vermont's Renewable Energy Standard.



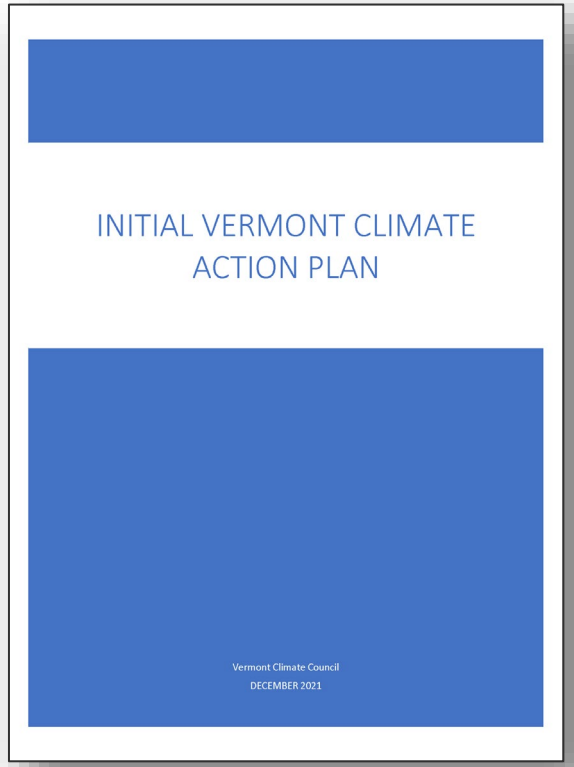
2022 Comprehensive Energy Plan:

"Consider adjustments to the Renewable Energy Standard and complementary renewable energy programs comprehensively, **through a transparent and open process**. . . The Considerations should include:

- Consideration of a low-carbon or carbon-free standard, in addition to a 100% renewable energy standard
- Consideration of a cohesive set of programs to support the standard" (p.270)

2021 Climate Action Plan:

Electric Sector Strategy 1 Pathway 1: "Vermont should develop 100% carbon free or renewable electric portfolio standard to ensure progress continues into the 2030s and beyond while being mindful of the economic impact on cost-burdened Vermonters and maintaining the cost-effectiveness of fuel-switching to electric measures." (p.111)



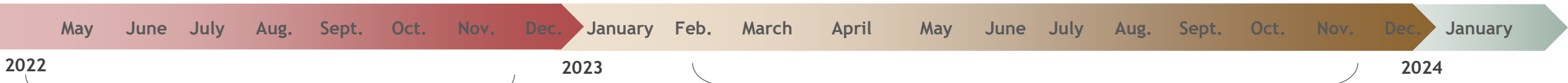
VERMONT
DEPARTMENT OF PUBLIC SERVICE

Policy Review Process

Between December 2022 and December 2023, the Department, in collaboration with many partners, executed its three-phased process through educational webinars, polling, focus groups, regional events, and technical analyses. These efforts occurred through a mix of in-person and virtual opportunities. The following slides summarize each of the activities, the outreach undertaken, and who participated in each process.

Phase 1: Awareness & Capacity Building
Three-part webinar series

Phase 3: Recommendations & Reporting
Public comment period & workshops



0

Pre-Planning Input

July 2022: Request for Input on Stakeholder Engagement, Decision Criteria, Key Issues

December 2022: Release of Public Engagement Plan based on RFI Input

2

Phase 2: Policy & Program Review

1. Statewide polling & focus groups (June – July)
2. Regional engagement event series (September – October)
3. Technical analyses with Stakeholder Advisory Group (July – November)

From June onward, the Department issued a monthly newsletter to its stakeholder list to provide an update on the process and highlight opportunities for engagement.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Policy Review Key Learnings

In reviewing the public engagement efforts and technical analyses, the following initial takeaways have emerged about electricity in Vermont:

1. Affordability and reliability were consistently highlighted as the most important issues to prioritize by Vermonters. Reducing carbon emissions was also important, but slightly less so

2. A move toward a 100% Renewable or Clean Energy Standard, including increases in new renewable energy requirements, calls for tradeoffs between costs to ratepayers and societal benefits from emissions reduction

3. There is general support for solar, wind, and hydropower as sources of electricity. Support for nuclear and biomass is more mixed; a majority of Vermonters at least somewhat support every resource

4. Many Vermonters are at least somewhat supportive of policy and program changes that increase requirements for low carbon and renewable electricity in a way that supports the most vulnerable Vermonters

5. As Vermont considers achieving 100% renewable or low carbon electricity, it will need to do so in combination with a more granular understanding of the alignment of renewable generation and demand for electricity

VERMONT
DEPARTMENT OF PUBLIC SERVICE

2. Electricity

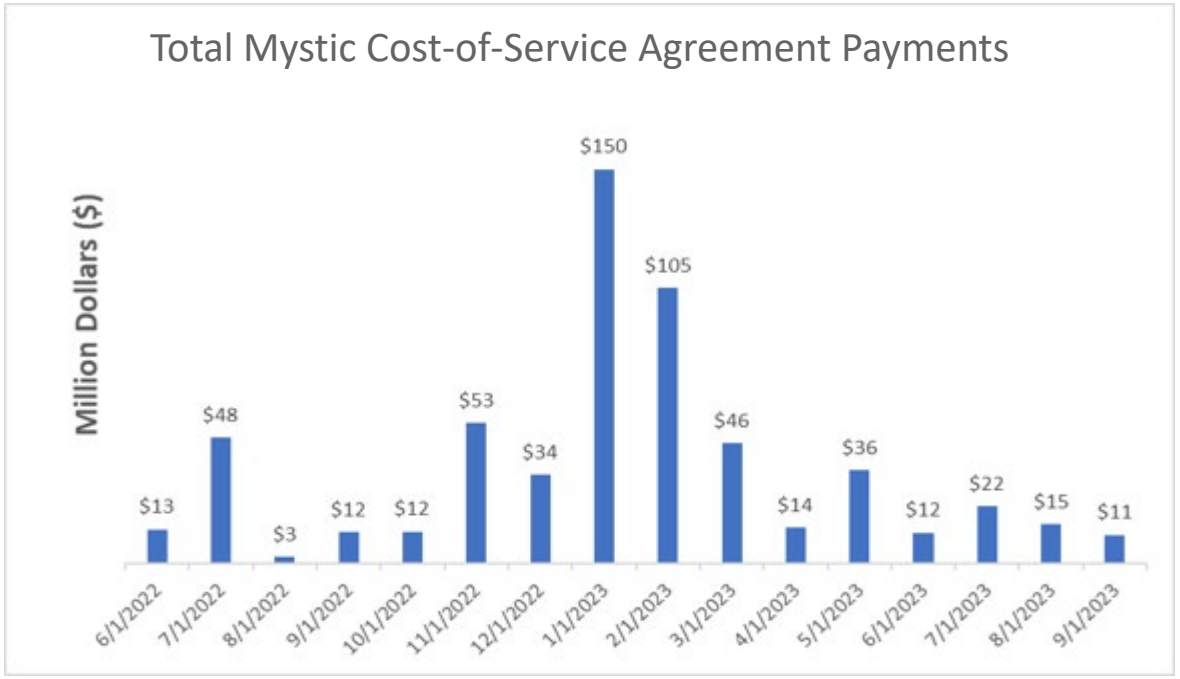
b. Major Trends and Initiatives

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Winter Energy Security

Over the past decade, many fossil and nuclear generating units have been retired from ISO New England's system, increasing the reliance on natural gas as a generating resource. Natural gas pipeline import capability in New England can become constrained in the winter as gas for electricity generation competes with demand for heating purposes in other New England states. (Vermont Gas is supplied by a Canadian pipeline and its load does not impact the New England electricity prices.) As a result, when there is a prolonged cold snap and home heating requires more natural gas, New England risks electric supply shortages.

To reduce risk, ISO New England entered into a Cost-of-Service Agreement with the owners of the Mystic generating units 8 and 9 in Everett, MA for two years ending May 31, 2024. Charges to all New England utilities have fluctuated dramatically due to the relationship between liquified natural gas fuel costs and wholesale energy market revenues. Vermont utilities have been charged ~$21 million for their share of regional load (~4%) in just the first year of the contract. ISO-NE also implemented the Inventoried Energy Program to provide financial incentives for resources that are able to store more fuel, to do so. The impact of the program on fuel security remains to be seen. Locally, the Public Service Department encouraged utilities to convene a winter preparedness task force which has developed policies to mitigate impacts from fuel shortages or other winter related events in Vermont.

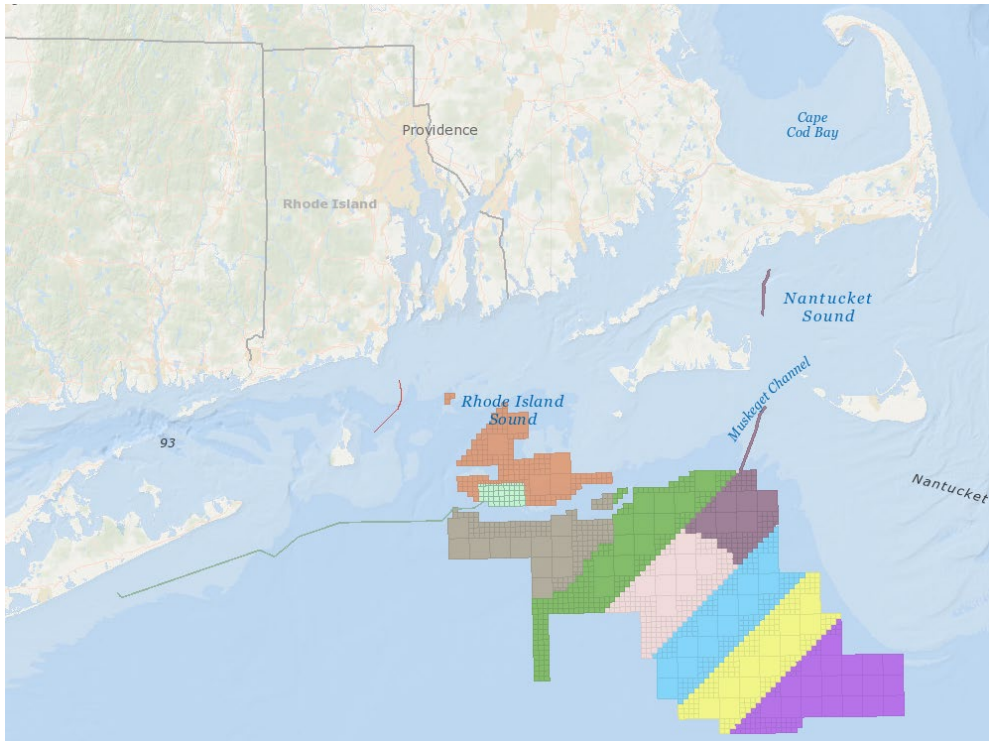


Mystic Generating Station in Everett, MA

Offshore Wind

The development of wind resources off the shores of New England has the potential to help New England states meet their renewable and clean electricity targets, while mitigating energy security issues. With significant new generating capacity being considered, states have been discussing the onshore transmission infrastructure that may be necessary to deliver supply from these resources. The six New England states are presently reviewing onshore transmission proposals to submit to the Department of Energy for potential funding under the Grid Resilience Innovation Partnerships program that would serve to facilitate the connection of offshore wind.

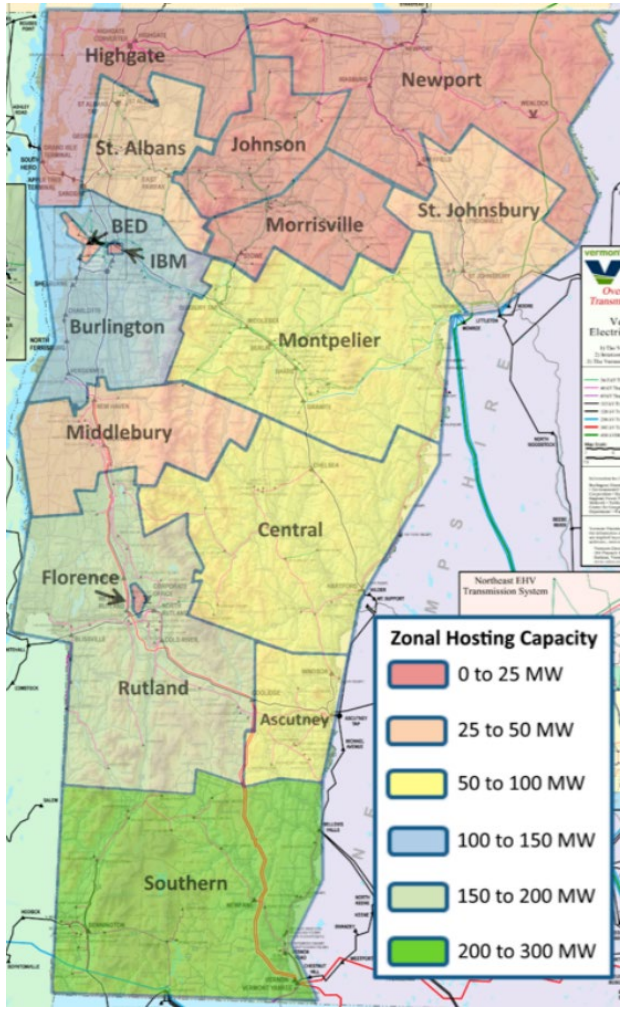
https://newenglandenergyvision.com/new-england-states-transmission-initiative/



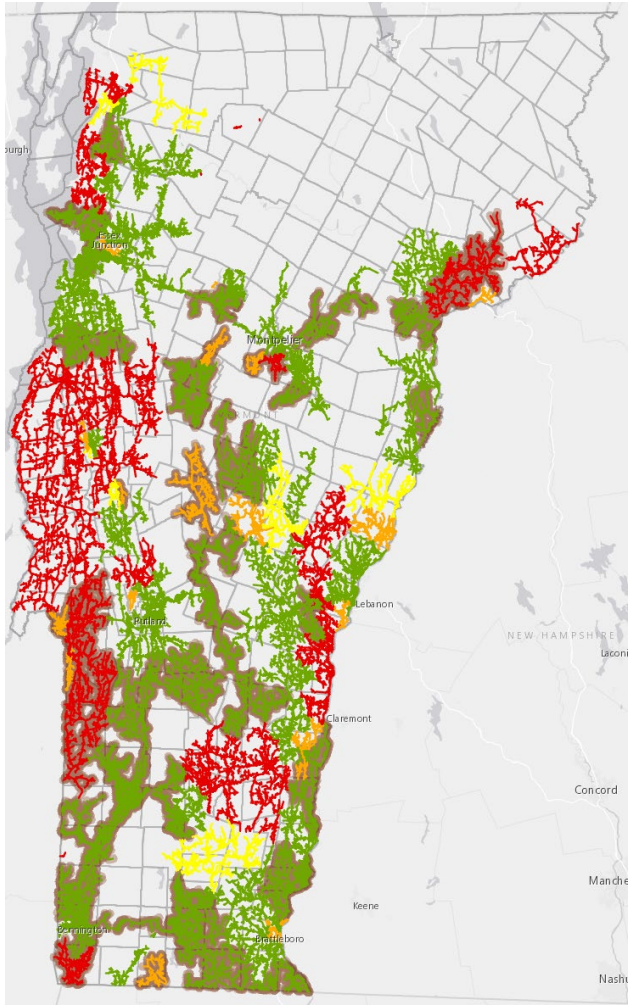
Northeast offshore wind Bureau of Ocean Energy Management lease areas from northeastoceandata.org

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Generation Constraints



Transmission hosting capacity by region from 2021 VELCO Long-Range Transmission Plan



GMP distribution system hosting capacity from Green Mountain Power Solar Map

Despite its small size, Vermont has experienced a high rate of growth in distributed energy resources, specifically in the deployment of solar installations. Having seen almost 50 megawatts (MW) of small-scale solar installations each year for the better part of the past decade, and with total Distributed Energy Resource (DER) capacity now at about 575 MW, there are certain parts of the Vermont grid that are saturated with generation resources. Particularly in western Vermont, several distribution substations are no longer able to accommodate the connection of additional distributed generation resources above a certain size. Reverse power flow from these resources would exceed utility system equipment ratings. Additionally, a transmission constraint in the northern part of Vermont, in an area referred to as the Sheffield-Highgate Export Interface, means that utility-scale generation within this area is subject to limits and curtailment by the ISO-NE system operator to maintain system reliability. Vermont utilities are coordinating to increase grid capacity through a small portfolio of cost-effective projects to mitigate curtailments.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Winter Storm and Flooding Response

- Distribution utilities continue to reinforce distribution infrastructure by:
  - Feeder undergrounding
  - Relocation to roadside
  - Line hardening (i.e. tree wire)
  - Vegetation management
- Utilities continuing short/mid-term winter weather forecasting efforts and long-term climate projections
- Continued meetings of emergency load shedding working group as requested by Department
- Establishment of “Vermont Energy Recovery Teams” to help connect survivors with contractors to efficiently rebuild and replace heating systems
- Conformance with State Energy to Security Plan and State Hazard Mitigation Plan

Montpelier during the 2023 flood, from VTDigger

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Grid Resilience and Reducing Outages Program

- PSD is the recipient of ~$15 million over four years via the US Department of Energy's (DOE) Grid Resilience State Formula Grant Program
- Received allocations for year 1 & 2 (combined) > $6 million with an additional $2million allocated to PSD by end of FY '24
- Additional expected allocations: $2-4million in '25, '26*
- Eligible measures reduce duration and frequency of electric outages, with focus on disadvantaged communities
- Ineligible measures: new electric generation, storage not supplying electricity during disruption, cybersecurity
- PSD expects DUs will be the likely subrecipients of this funding

*Pending allocation of funding in future federal budgets

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Affordable Community Renewable Energy (ACRE) Program

$10 million for “the Affordable Community-Scale Renewable Energy (ACRE) Program…to support the creation of renewable energy projects for Vermonters with low-income”

- Distribution Utilities (DU) developed four subprograms: GMP, VPPSA, VEC/WEC and Stowe Electric Department
- Benefits delivered as monthly on-bill credit to eligible customers – 185% Federal Poverty Guideline
- Credits range $12-45 monthly savings each of the 8,000 participants for 5-10 years - $240-500 annual savings
- Each DU subprogram serves as a pilot, ideally leading to a future statewide low-income energy assistance program
- Provides a model for alternative to net-metering

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Solar For All

- PSD submitted competitive application for $100million to EPA's Greenhouse Gas Reduction Fund (GGRF) Solar For All (SFA) Competition - $7billion available for PV for low-income solar programs
  - $25million - Residential Assistance In Solar Energy (RAISE) Program – for single-family homes
  - $40million – Multifamily Affordable Solar Housing (MASH) Program - for MFAH developments
  - $35million – Affordable Community Renewable Energy (ACRE) Program – expansion of ACRE
- Each subprogram designed to:
  - Offer substantial long-term savings ---> 20% electrical bill reduction up to 20 years
  - Be sustainable offering a revolving funding mechanism

VERMONT
DEPARTMENT OF PUBLIC SERVICE

2. Electricity

c. Electricity Demand and Load Management

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Historical ISO-NE and Vermont System Peak Demand

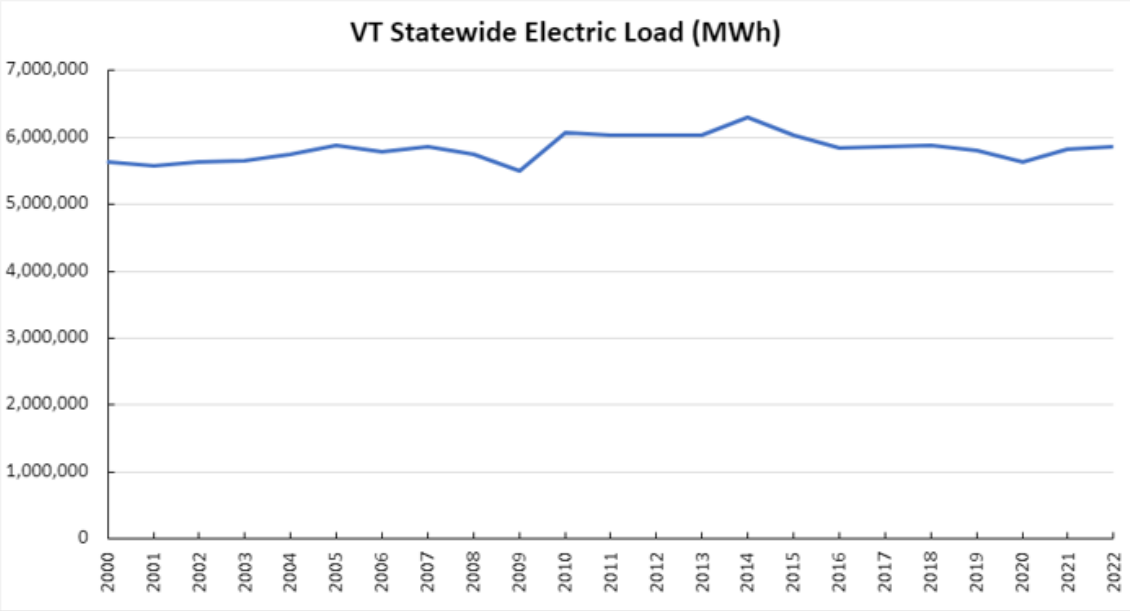
The regional grid continues to reach system-wide peaks during hotter summer weather. In the past decade, peaks have shifted later into the evening over time due to the penetration of behind-the-meter solar production which reduces metered demand the most during peak daylight hours (noon and the few hours around noon). Vermont, on the other hand, has reached its peak demand during colder winter months in 5 of the last 8 years. Most monthly peaks (not shown), which form the basis of regional transmission cost allocation, occur late in the evening near or after dark.

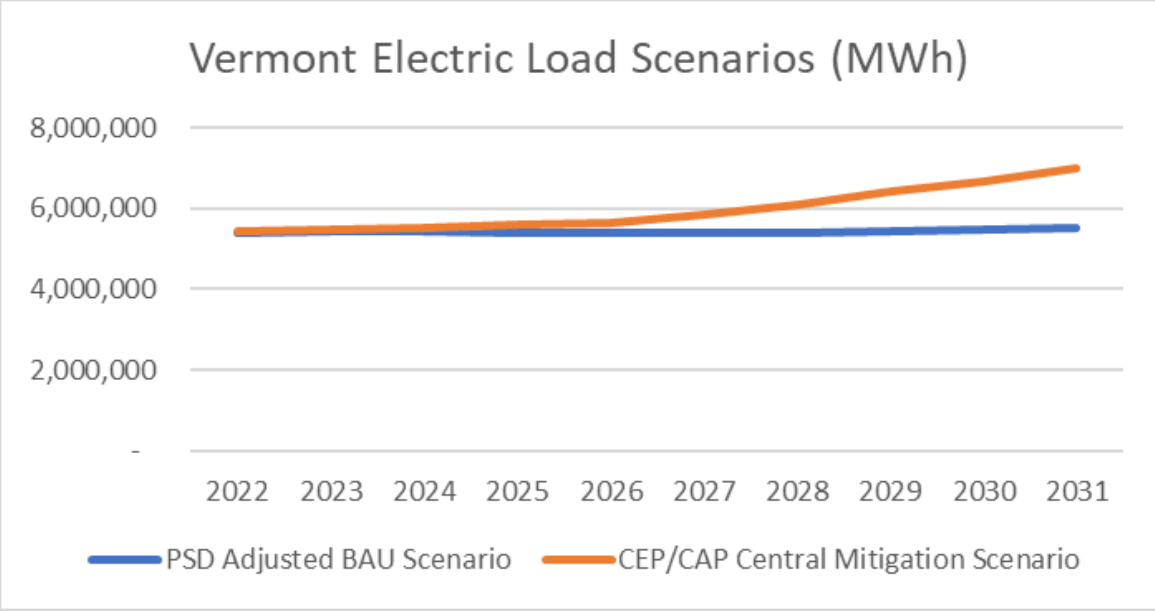
ISO New England System					Vermont		
Year	Peak Date	Hour Ending	System Peak Load (MW)	Vermont Coincident Peak (MW)	Peak Date	Hour Ending	System Peak Load (MW)
2016	8/12/2016	15:00	25,111	868	1/4/2016	18:00	931
2017	6/13/2017	17:00	23,508	849	12/29/2017	18:00	942
2018	8/29/2018	17:00	25,559	726	7/2/2018	20:00	935
2019	7/30/2019	18:00	23,929	837	1/21/2019	18:00	892
2020	7/27/2020	18:00	24,727	792	7/27/2020	20:00	890
2021	6/29/2021	16:00	25,280	825	8/26/2021	20:00	962
2022	8/4/2022	18:00	24,445	765	1/29/2022	19:00	904
*2023**	*9/7/23*	*18:00*	*23,614*	*735*	*2/3/2023*	*18:00*	*874*

**2023 data is preliminary*

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Historic and Projected Annual Demand



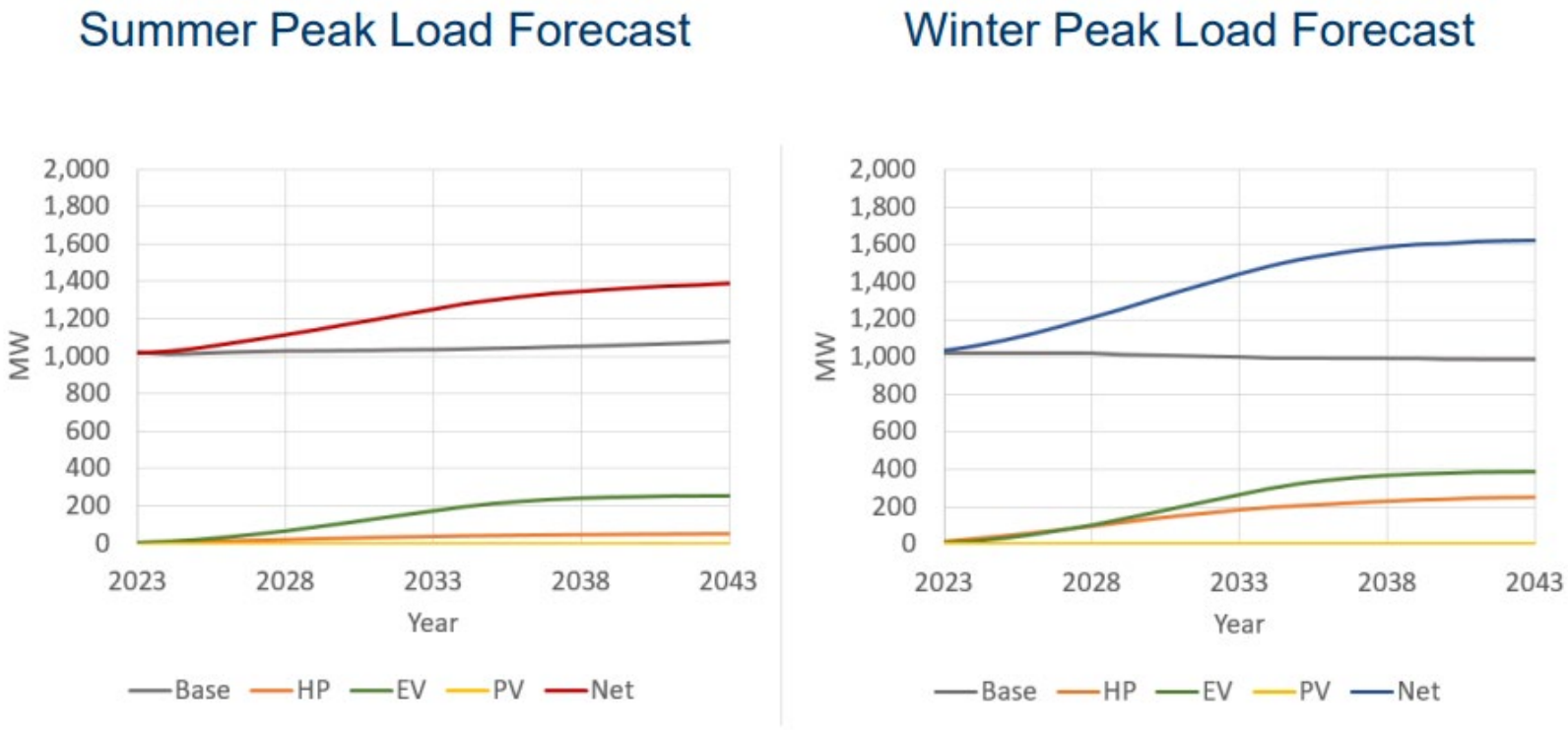


As shown in the first chart, Vermont Statewide electric load has rebounded since reductions seen from the pandemic. Overall demand has remained lower than that seen in the early 2010s, despite increases in the use of electricity for thermal and transportation uses (via heat pumps and electric vehicles, respectively). The chart on the right shows forecast annual demand scenarios developed for purposes of the Comprehensive Energy Plan and Climate Action Plan modeling, detailing a possible "Business-As-Usual" scenario and a "Mitigation" scenario assuming greenhouse gas reduction requirements are achieved.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont Peak Demand Forecast

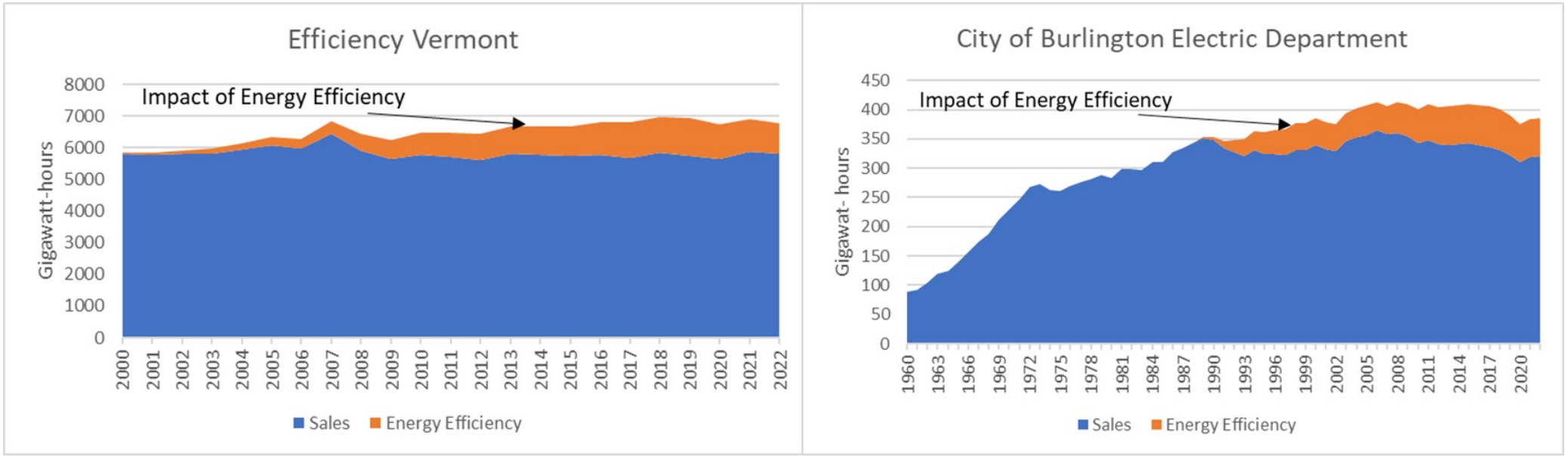
Though the annual peak in Vermont peaks has remained flat or even declined over the past years, that trend is expected to change with upcoming growth in electrification of the heating and transportation sectors. **These charts do not include any effects of load flexibility**, which will be a critical tool in managing the impacts of peak load on the transmission and distribution systems.



Vermont seasonal peak forecasts, from the [VELCO 2024 Long-Range Transmission Plan Scope]

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Energy Efficiency Impacts

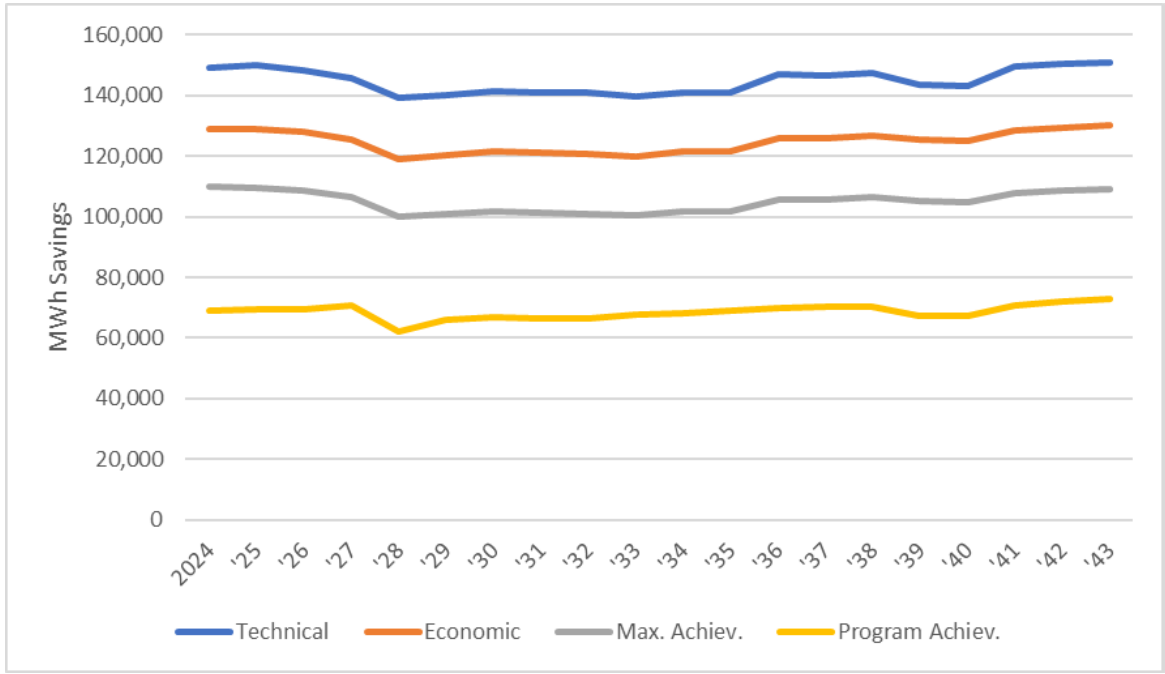


The Public Utility Commission sets EEU budgets to acquire “all reasonably available cost effective” electric efficiency, pursuant to 30 V.S.A. § 209(d) and least-cost planning principles of 30 V.S.A. § 218c. Since 2000, Vermont’s energy efficiency utilities (EEUs) have acquired electric efficiency resources that have met a significant portion of Vermont’s electric needs, at a lower cost than supply resources. The chart on the left shows Efficiency Vermont (EVT) cumulative savings over time, while the chart on the right illustrates the results of Burlington Electric Department (BED) efforts. EVT serves all of Vermont except Burlington.

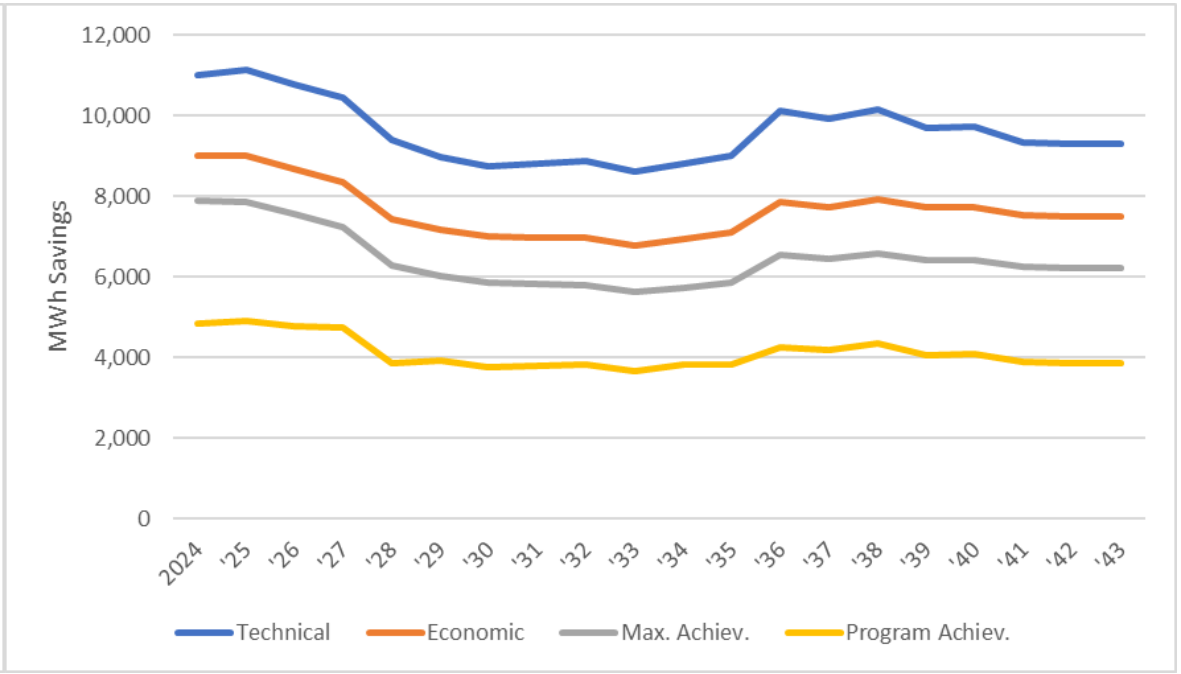
VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electric Efficiency Potential

The efficiency potentials for both Efficiency Vermont and Burlington Electric Department decrease during the first decade of the forecast, largely reflecting the impact of legislation (Act 120 of 2022) addressing commercial lighting and the increased pace of retrofitting four-foot lamps containing mercury, which will be replaced with LED bulbs. The rise in savings potential later in the forecast reflects renewed savings opportunities from measures adopted early in the forecast after they need replacement.



EVT Potential Incremental Annual MWh Savings



BED Potential Incremental Annual MWh Savings

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electric Energy Efficiency Budgets

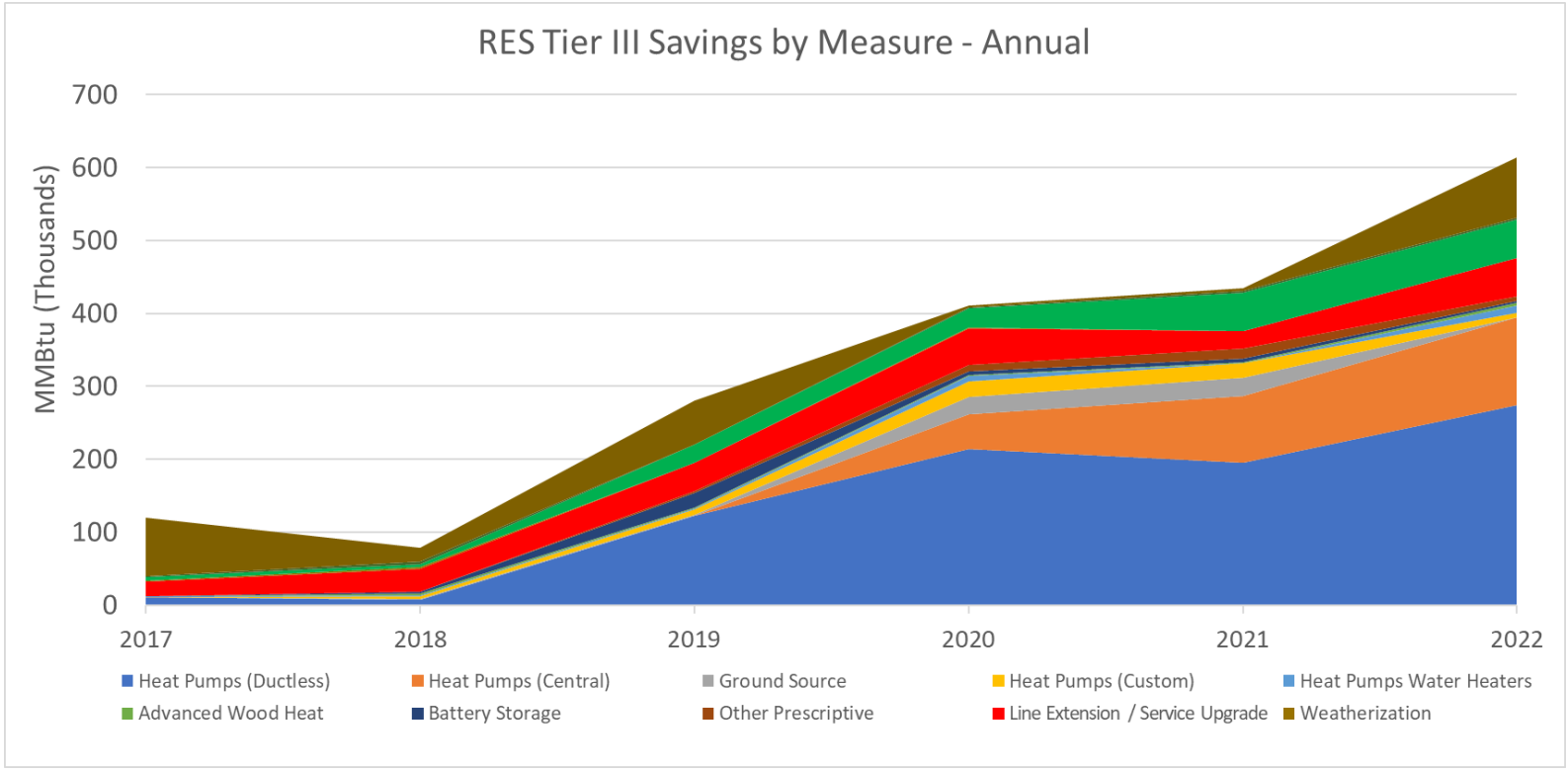
The Public Utility Commission sets EEU budgets to acquire “all reasonably available cost effective” electric efficiency, pursuant to 30 V.S.A. § 209(d) and least-cost planning principles of 30 V.S.A. § 218c. In the Commission's recent Demand Resource Plan proceeding, Case No 22-2954-INV, the following electric energy efficiency budgets were approved for Efficiency Vermont and the City of Burlington Electric Department.

	2024	2025	2026	Total
EVT Electric Efficiency	$46,462,409	$47,655,281	$48,411,102	$142,528,792
BED Electric Efficiency	$2,669,000	$2,712,700	$2,776,120	$8,157,820
Total	**$49,131,409**	**$50,367,981**	**$51,187,222**	**$150,686,612**

VERMONT
DEPARTMENT OF PUBLIC SERVICE

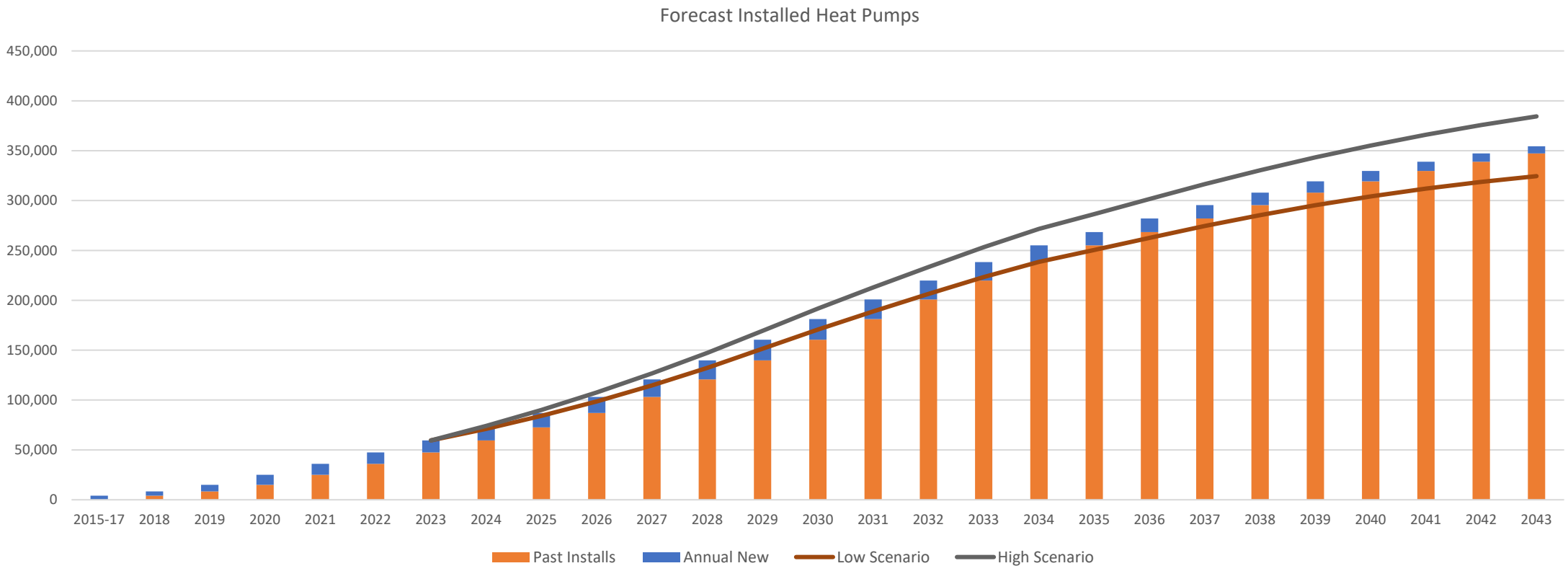
Renewable Energy Standard Tier III

Tier III of the Renewable Energy Standard requires utilities to cause fossil fuel reductions for their customers. Many of the measures taken by utilities electrify fossil fuel end uses, such as thermal demand, water heat demand, or maple sugaring operations. Measures implemented have changed over time, with the more recent mix dominated by cold climate heat pumps.



VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electrification – Heat Pump Forecast



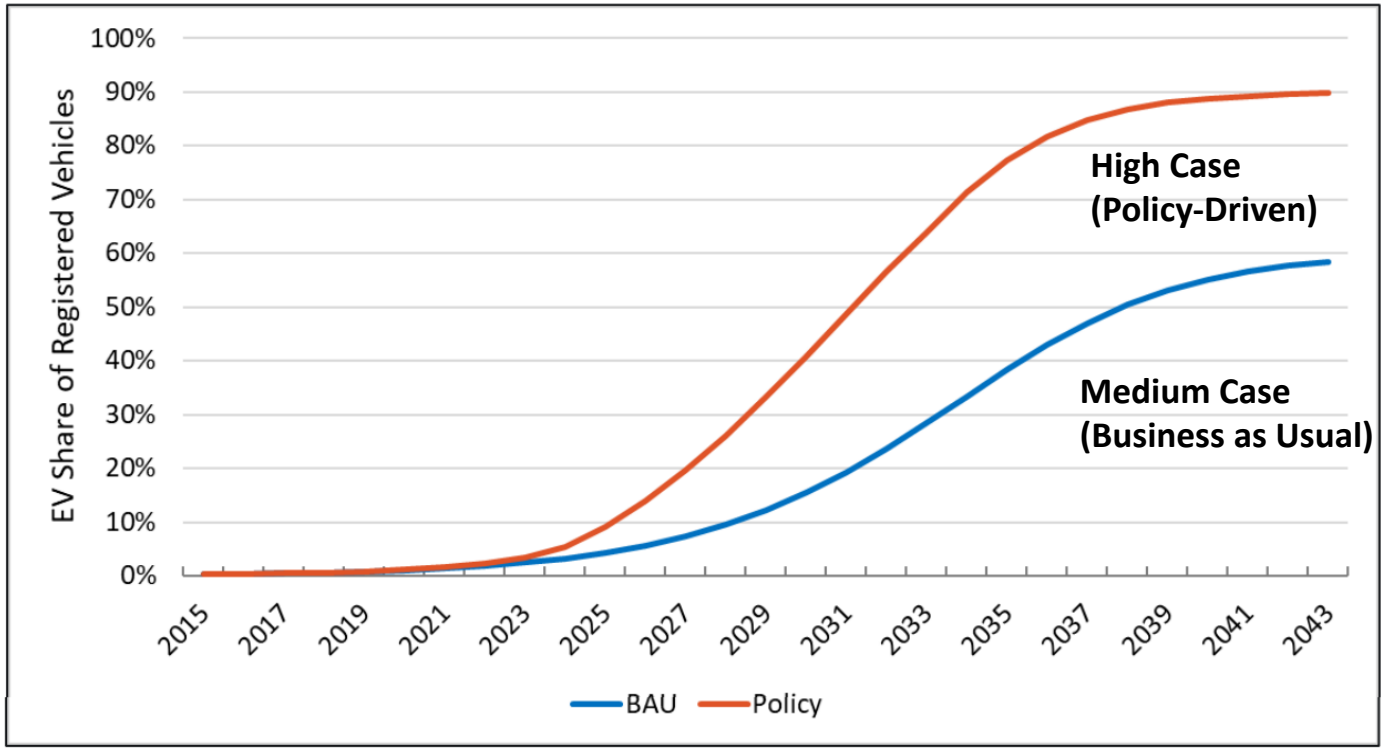
The above chart shows historical and forecasted cumulative and annual cold climate heat pump (CCHP) installations for the state. The forecast represents high efficiency CCHP units supported by EVT and BED efficiency programs (including units supported by DUs through Tier III programs). Starting in 2024, on an annual basis, the number of new CCHP installations reaches approximately 13,000, then gradually increases to peak at 20,700 in 2030, then tapers gradually to 7,200 in 2043. Even in the low scenario, Efficiency Vermont expects over 170,000 CCHP to be installed by 2030.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Light-Duty EV Adoption Forecast

Although electric vehicle adoption continues to grow, the exact pace of adoption is unpredictable. Itron, a consultant assisting VELCO update Vermont's Long-Range Transmission Plan, prepared two scenarios to estimate impacts on the electric grid. The Transmission Plan will be finalized in June 2024.

Each distribution utility conducts a similar analysis as part of the Integrated Resource Plan required every three years.



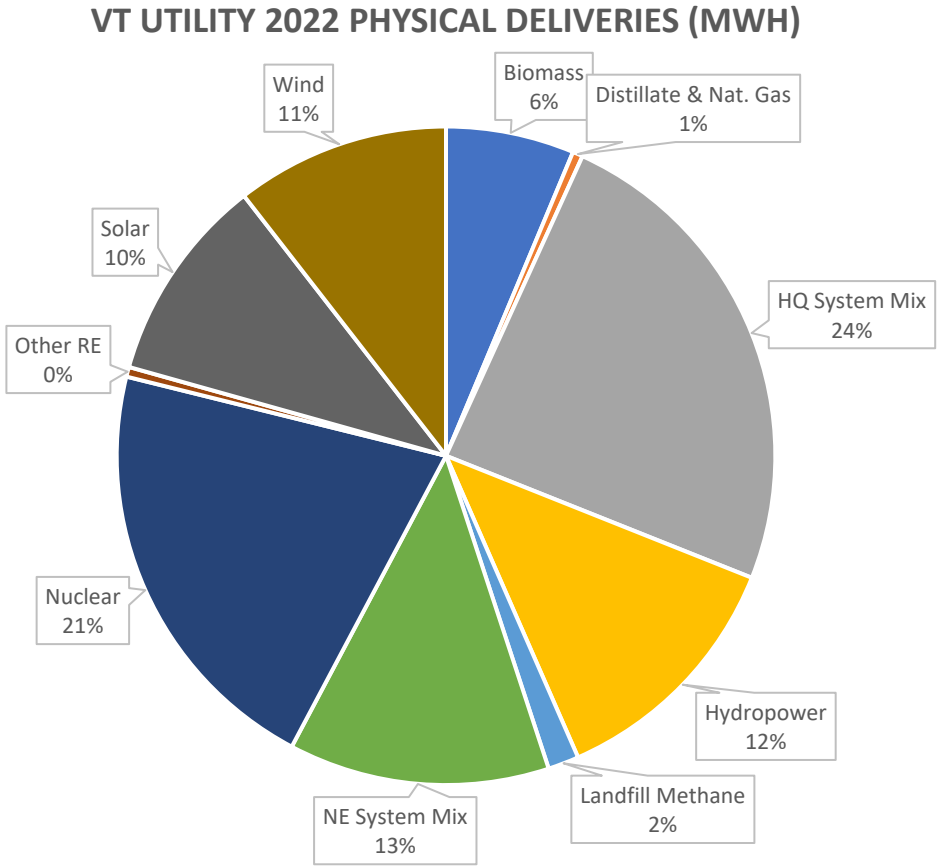
Data Source: Itron / Drive Electric Vermont for VELCO, 2023

2. Electricity

d. Electricity Supply

VERMONT
DEPARTMENT OF PUBLIC SERVICE

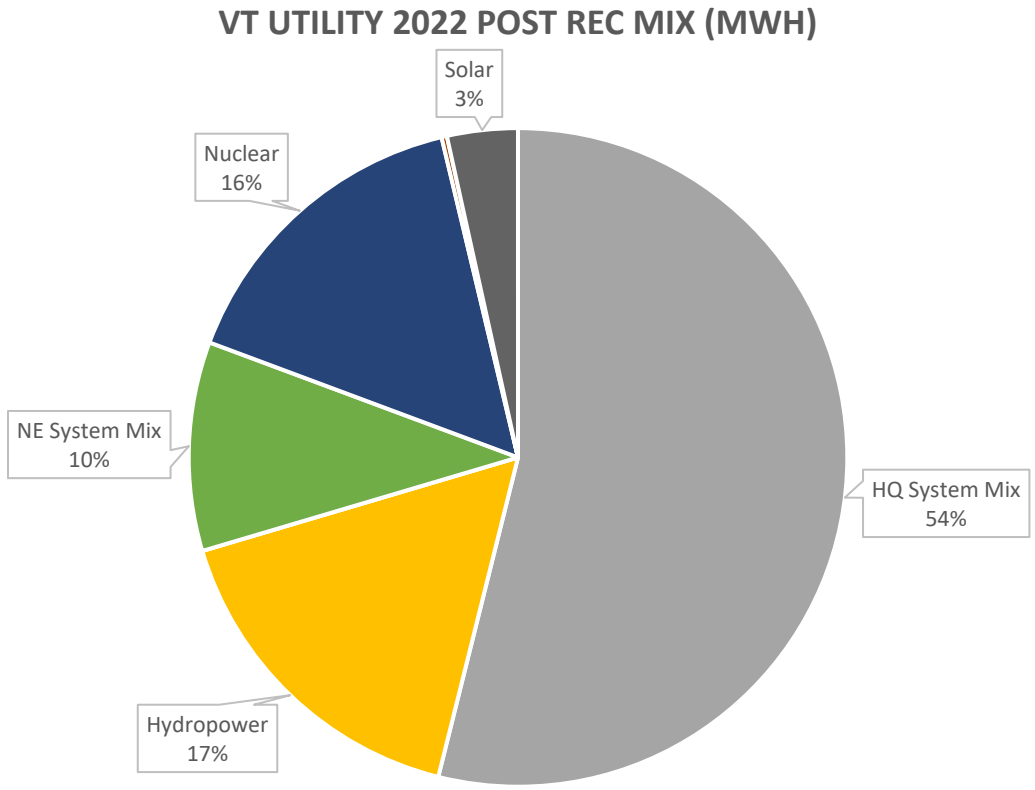
Vermont's 2022 Electric Power Mix Based on Physical Deliveries



In 2022, Vermont distribution utilities purchased 5.8 Million megawatt-hours of electricity to meet the demand of their customers. Of this: 65% came from renewable resources and an additional 21% came from carbon-free resources (nuclear)

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont's 2022 Electric Power Mix After Renewable Energy Credit Retirements

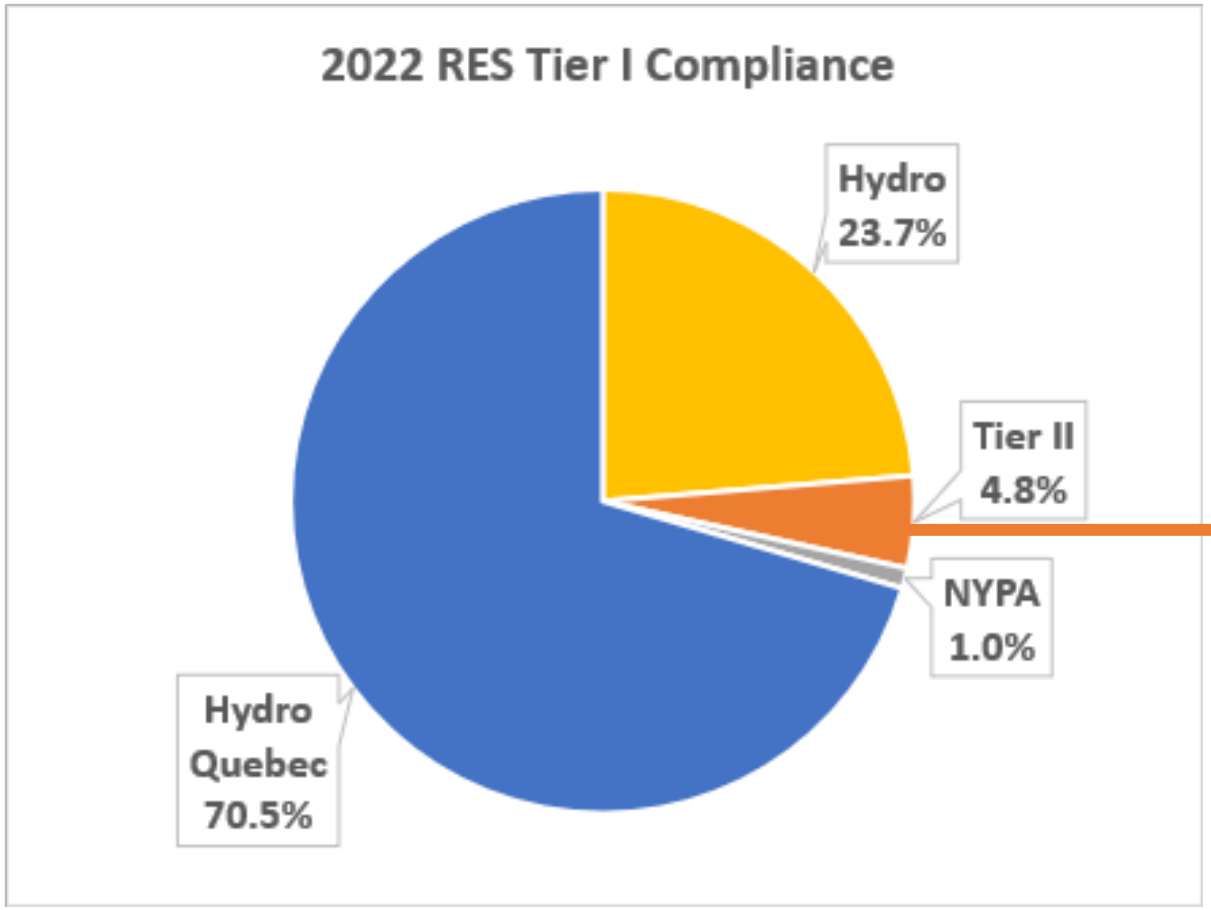


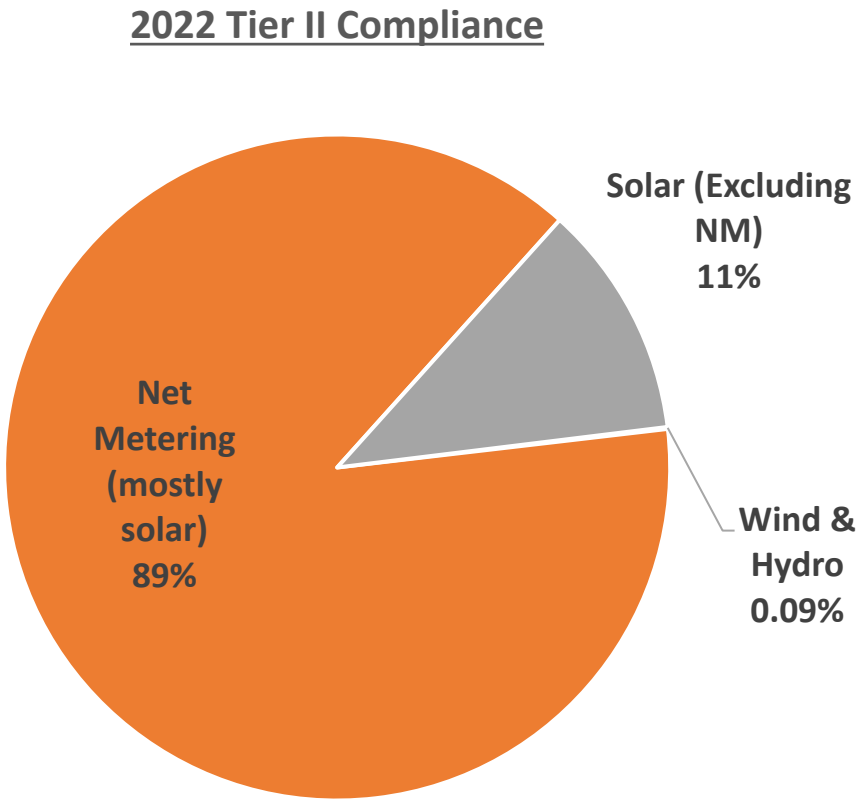
In 2022, Vermont distribution utilities retired 4.3 million renewable energy certificates (i.e. equivalent to 4.3 million megawatt-hours of electricity) to meet their obligations under Vermont's Renewable Energy Standard. These RECs accounted for 74% of Vermont's electricity in 2022.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

2022 Renewable Energy Standard (RES) Compliance

In 2022 the RES required that Tier I renewable energy sources be at least 59% of the total for all electric distribution utilities' sales. For 2022, Tier I renewable energy credits totaled 78% of the State-wide power mix. The types of renewable energy that make up that 78% are in the chart below on the left. The chart on the right shows the types of Tier II in-state credits, which were almost all solar.





Source: 2022 Utility RES Compliance fillings with the PUC

VERMONT
DEPARTMENT OF PUBLIC SERVICE

2022 Renewable Energy Standard Compliance (continued)

Each distribution utility has complied with requirements under the RES.

In addition to Tier II, Washington Electric Cooperative and Hyde Park used Tier II Renewable Energy Credits (RECs) for part or all of their Tier III compliance. These RECs are counted towards their Tier III obligation and not their overall renewability as measured in Tier I/II.

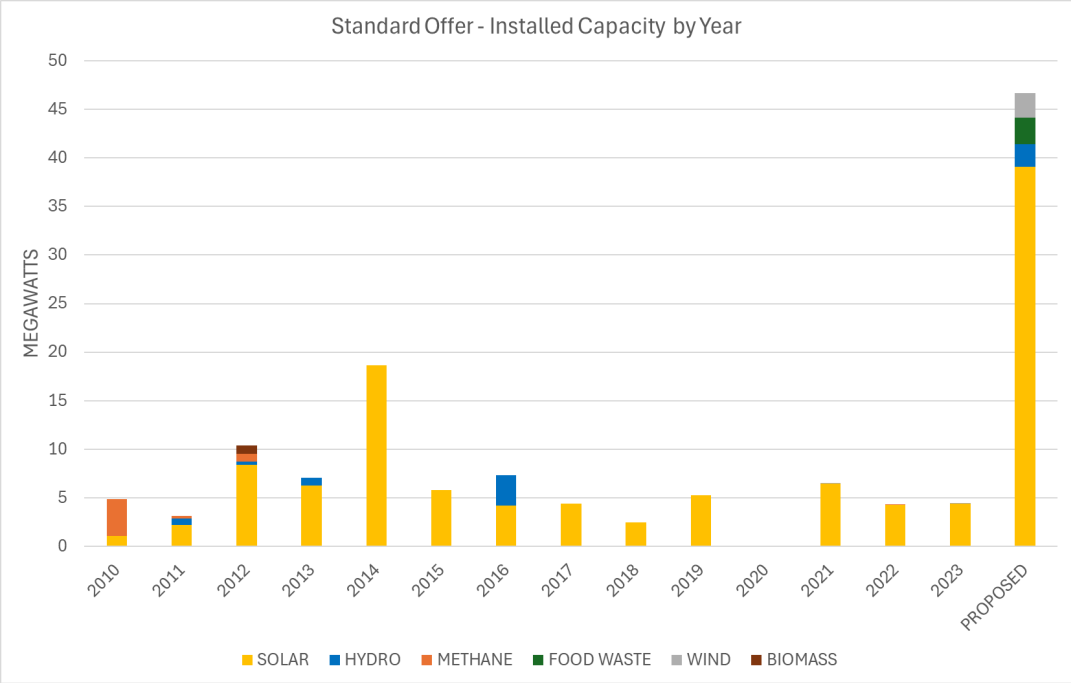
Utility	2022 REC Retirements and Tier III Savings as Percent of Sales		
	Tier I	Tier II	Tier III
Barton	59.9%	4.0%	4.0%
Burlington	102.7%	0.0%	5.3%
Enosburg Falls	59.9%	4.0%	4.0%
Green Mountain Power	80.0%	4.0%	5.3%
Hardwick	59.9%	4.0%	4.0%
Hyde Park	59.0%	4.0%	4.0%
Jacksonville	59.9%	4.0%	4.0%
Johnson	59.9%	4.0%	4.0%
Ludlow	59.9%	4.0%	4.0%
Lyndonville	59.9%	4.0%	4.0%
Morrisville	59.9%	4.0%	4.0%
Northfield	59.9%	4.0%	4.0%
Orleans	59.9%	4.0%	4.0%
Stowe	59.0%	4.0%	4.0%
Swanton	100.0%	0.0%	4.0%
Vermont Electric Cooperative	59.0%	4.0%	5.3%
Washington Electric Coop	101.0%	4.0%	5.3%
Vermont Total	**78.2%**	**3.7%**	**5.2%**

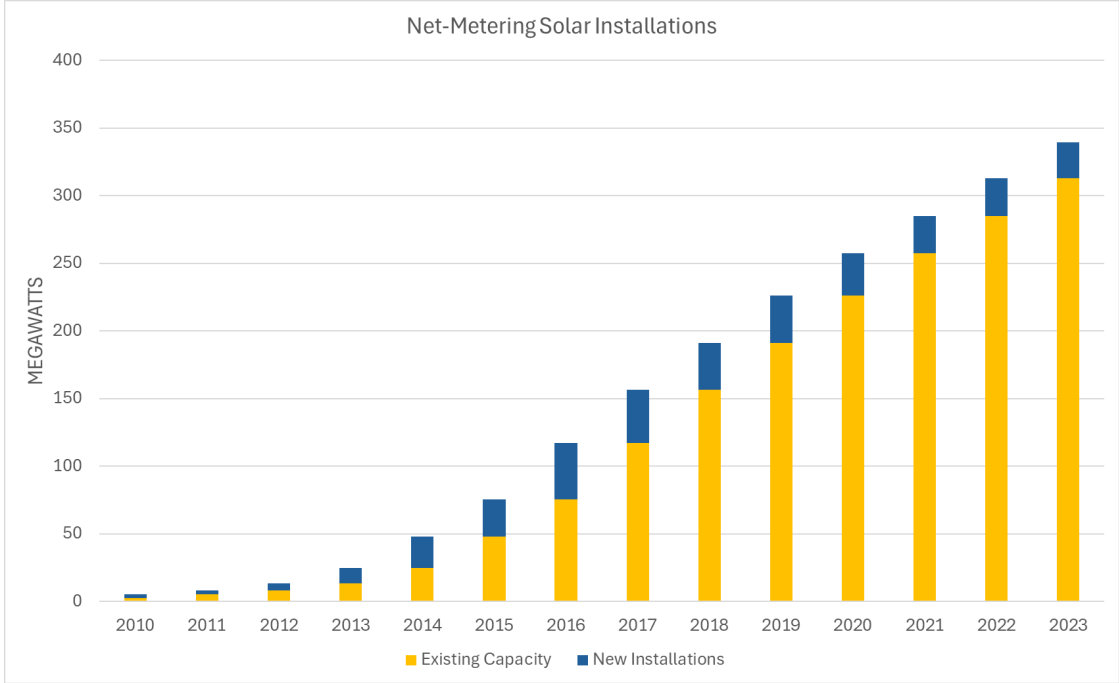
Source: 2022 Utility RES Compliance fillings with the PUC

Standard Offer and Net Metering Installations

A total of 87.6 MW of Standard Offer renewable projects have been commissioned as of January 1, 2024. An additional 46.68 MW of projects have been awarded contracts through prior solicitations but have not yet been commissioned.

Over 339 MW of solar has been installed by the Net Metering program.





VERMONT
DEPARTMENT OF PUBLIC SERVICE

Storage Deployment & Dockets:

54 MW of storage is operational, with another 20 under development in specific dockets (with additional residential storage added every month).

	MW	MWh*	Proceeding	Type
GMP Powerwall & BYOD pilots/tariffs	27	73	19-3167-TF, 19-3537-TF, 21-5254-TF, 22-0955-TF, 23-1355-TF	GMP tariffs approved June 2020; 3030 installations thru 12/31/23; various pilots ongoing
VEC BYOD pilot	0.45	1.201	VEC Tier III program offering	Installations in BYOD program thru 9/28
GMP Stafford Hill Solar + Storage, Rutland	2	3.4	Docket 8098	First utility storage project in VT (GMP, permitted 2014). Actually 4 MW but inverter-limited to 2 MW.
Panton Storage	1	4	Case No. 17-2813-PET	GMP battery co-located with solar; amended to enable islanding
Essex Solar + Storage	2.1	8	Case No. 18-2902-PET	GMP JV Solar + Storage
Milton Solar + Storage	2	8	Case No. 17-5003-PET	GMP JV Solar + Storage
Ferrisburgh Solar + Storage	2.1	8	Case No. 17-5236-PET	GMP JV Solar + Storage
Dynapower	1.5	6	N/A	Backup power only
E. Barre Co Barre	4.999	20	Case No. 18-1658-PET	ESA with GMP
Viridity Hinesburg	1.9	5.3	18-3088-PET	ESA with VEC
Georgia Storage	4.99	10	21-1042-PET	ESA with GMP
Springfield Storage	4.99	10	21-1254-PET	ESA with GMP
Operational	**55**	**157***		
Bristol Solar & Storage	*2.958*	*11.832*	21-0974/5-PET	Co-located (but not integrated) with 2.2 MW Standard Offer solar project
Pittsford Solar & Storage	*0.498*	*2*	21-0100-NMP	Net metered project with integrated storage behind the inverter
Royalton Storage	*4.9*	*19.6*	21-2114-PET	ESA with GMP
S. Hero Storage	*4.99*	*14.94*	21-5049-PET	ESA with VEC. On hold as of 9/28 due to increases in battery prices
E.R. South St. Storage	*2*	*8*	21-3022-PET	ESA with GMP
N. Troy Storage	*3*	*12*	22-4009-PET	GMP & VEC Joint owners. Under construction as of 9/28
Rochester Brandon Mountain Solar	*2*	*8*	23-1639-PET	3rd party project selected by GMP for "Rochester Resiliency Zone," paired with 1 MW solar; CPG issued 12/5/23
Operational + under development	***75***	***233***		*Assumes all systems are 4 hours

Vermont Storage Deployment in New England Context

State	Goal*	Milestone	2023 summer peak (MW)**	Goal as % of 2023 summer peak	2023 deployed storage (MW)	Current % of peak
CT	1000 MW x 2030	300 MW x 2024	5950	17	12	0.2
ME	400 MW x 2030	300 MW x 2025	1817	22	49	2.7
MA	1000 MW**h** x 2025	N/A	11178	2***	307	2.7
NH	N/A	N/A	2251			
RI	N/A	N/A	1688			
VT	N/A	N/A	736		55	7.5 (10.2 including under construction/in permitting; note these does not include proposals for transmission-level storage)

The above table shows New England State's storage deployment targets. While three states have targets, those same states are currently at far lower levels of storage deployment relative to Vermont, as measured by percent of peak load. Vermont is already on pace to exceed the targets set in other states.

*MA and CT storage goals apply just to Investor-Owned Utilities ("IOUs"). ME's is unclear.

** Preliminary 2023 summer peak contribution values

***Assumes all batteries are 4 hours in duration

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Federal Funds & Other Drivers of Storage

Federal Funding:

- ARPA $7M for Energy Storage Access Program to improve low-income household access to energy storage and increase flexible load management by Vermont's distribution utilities (in progress – est. ~130 homes, 10 municipal buildings)
- Grid Resilience & Innovation Partnerships (GRIP) Program (Dept of Energy):
  - State application for $100M to support residential, distribution, and transmission scale storage (est. 35 MW distributed and 40 MW commercial/utility-scale storage)
  - Utility applications for > $100M to support distributed and commercial/utility-scale storage (est. > 50 MW)
  - Potential further opportunities for Resilience & Innovation Grants

Other:

- BGS Municipal Energy Resilience Program
- EVT FLM initiatives
- RES Tier III
- Regional initiatives e.g., FERC Order 2222, SATOA
- Federal ITC
- Other utility initiatives (e.g., LDES demonstration award, VEC/VELCO radio backup sites, VPPSA & GMP RFPs)
- Dockets (e.g., GMP "Zero Outages Initiative" Case No. 23-3501-PET)

Ryegate Power Plant Contract Extension Update

The 20 MW Ryegate woodchip fueled electricity plant (Plant) is located in Ryegate, Vermont and qualifies for Vermont's Baseload Renewable Energy Standard. Under 30 V.S.A. § 8009, Vermont electric utilities must purchase their pro rata share of the output from the Plant for a price set by the Vermont Public Utility Commission (PUC). The current contract was set to expire November 1, 2022; however, Act 155 of 2022 temporarily extended this obligation for two years and creates an opportunity for a further extension out to 2032 provided that the Plant's owners increase the efficiency of the Plant by at least 50%.

On July 19, 2023 the PUC issued an order requesting comment on Ryegate Associates' filings pursuant to the Act 155 efficiency requirements. The Vermont Department of Public Service ("Department") reviewed the filings made by Ryegate Associates, owner of the Plant, consisting of:

(1) a signed contract providing for waste heat recovery modules;
(2) the construction of a facility to use the recovered waste heat from the modules to dry green wood chips and mill the chips into pellets;
(3) a certification by a qualified professional engineer as to the Plant's overall efficiency gain provided by the wood chip dryer and
(4) a cover letter.

Based on the fillings, the PUC determined that the owner of the Plant had met the requirements of 30 V.S.A. § 8009(k)(2)(A) & (B) by:

- submitting two contracts for the construction of a facility that would recover waste heat from the Plant to dry green wood chips and mill those chips into pellets, and that the use of waste heat in the milling of wood pellets would be a beneficial purpose and;
- providing a certification by a Vermont licensed professional mechanical engineer that if the contacted facility was built to his prescribed design the facility would meet the requirement of increasing the Plant's efficiency by at least 50%.

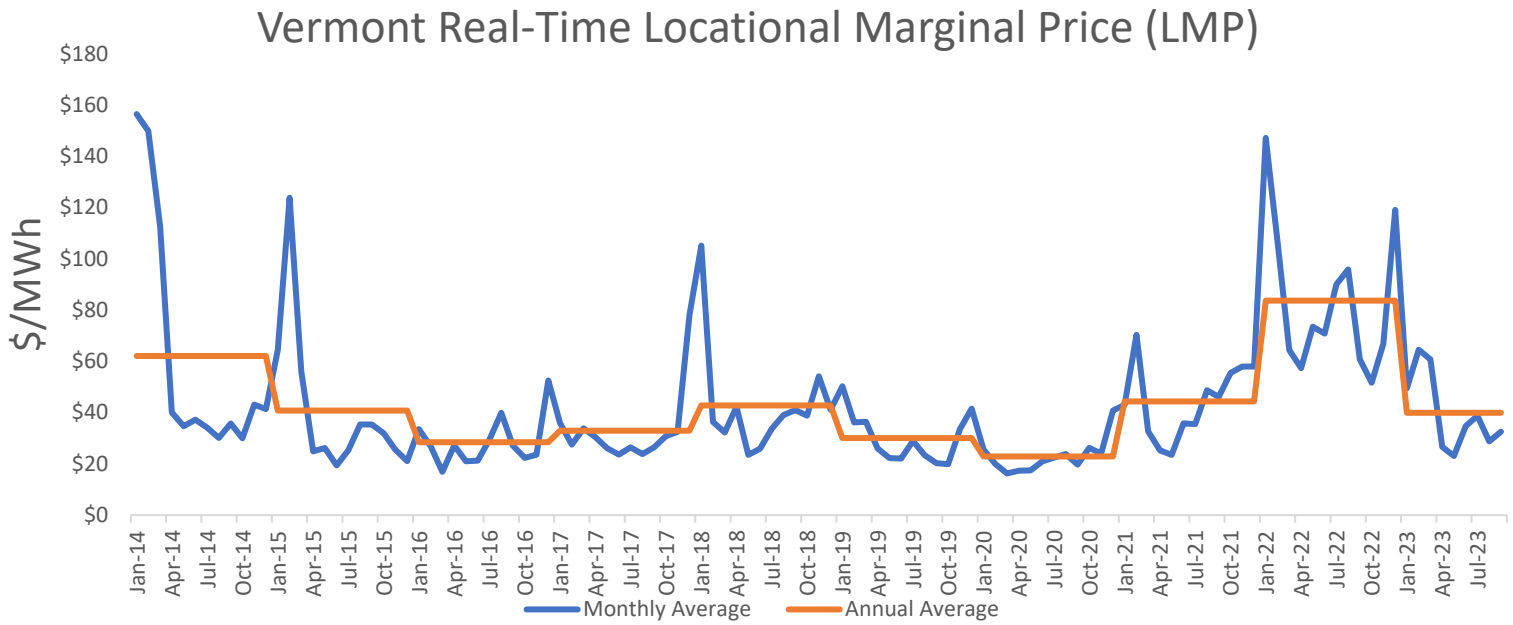
The next step for the Ryegate Plant is, per Act 155, to submit on or before October 1, 2024 to the PUC and the Department a certification that the main components of the facility improvements needed to increase efficiency of the Plant by at least 50% have been installed/completed. If such a certification is not submitted then the obligation for each Vermont electric utility to purchase a pro rata share of the Plant's power output would cease on November 1, 2024.

2. Electricity

e. Electricity and Renewable Energy Credit Prices

VERMONT
DEPARTMENT OF PUBLIC SERVICE

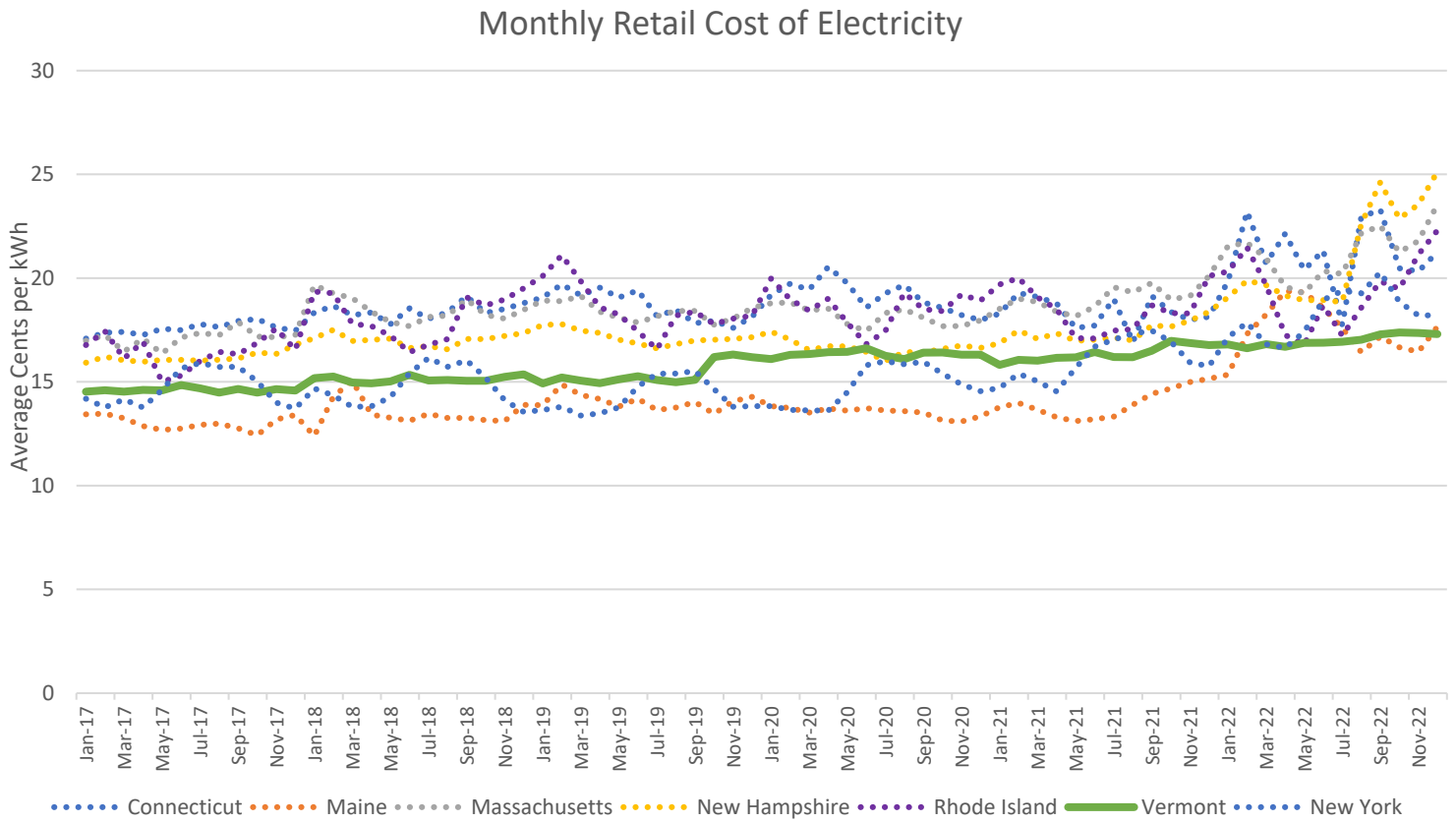
Electricity Prices



World events have caused significant spikes in the price of many fuels, including natural gas. Natural gas generating facilities generally set the wholesale price of electricity in the ISO New England (ISO-NE) marketplace which serves Vermont utilities. The figure on this slide shows the wholesale price of electricity for the Vermont zone, declining from 2022 highs but still higher than pre-pandemic prices.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

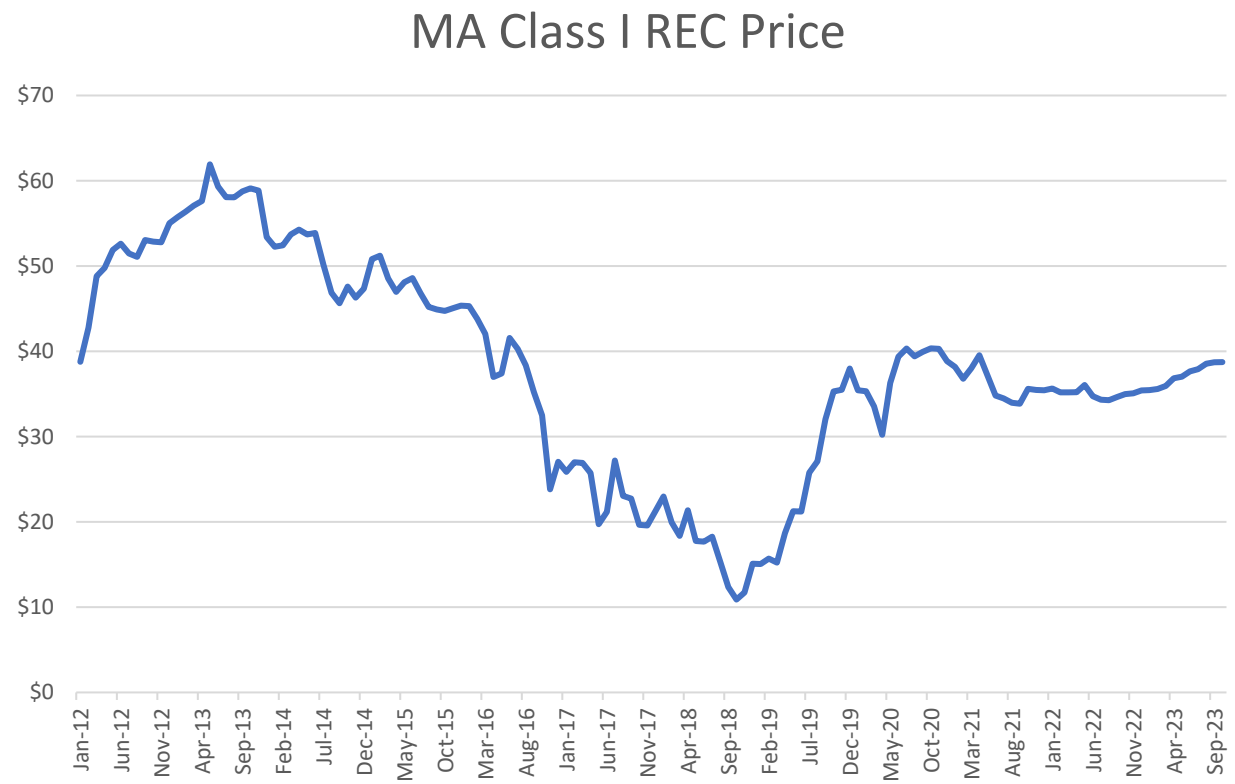
Electricity Prices



Generally, Vermont operates within a regulated electric utility structure, whereby utilities remain “vertically integrated” and are responsible for supply, transmission, and retail services to end-use customers. Unlike some other states, where power generation and supply roles are managed separately from distribution services, Vermont utilities are allowed to meet their supply needs through long-term contracts. As a result, contracts secured before the price spike insulate Vermont customers from some of the short-term market impacts. As shown by, Vermont’s prices have risen over the last two years, albeit much more slowly and steadily than other Northeastern states.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

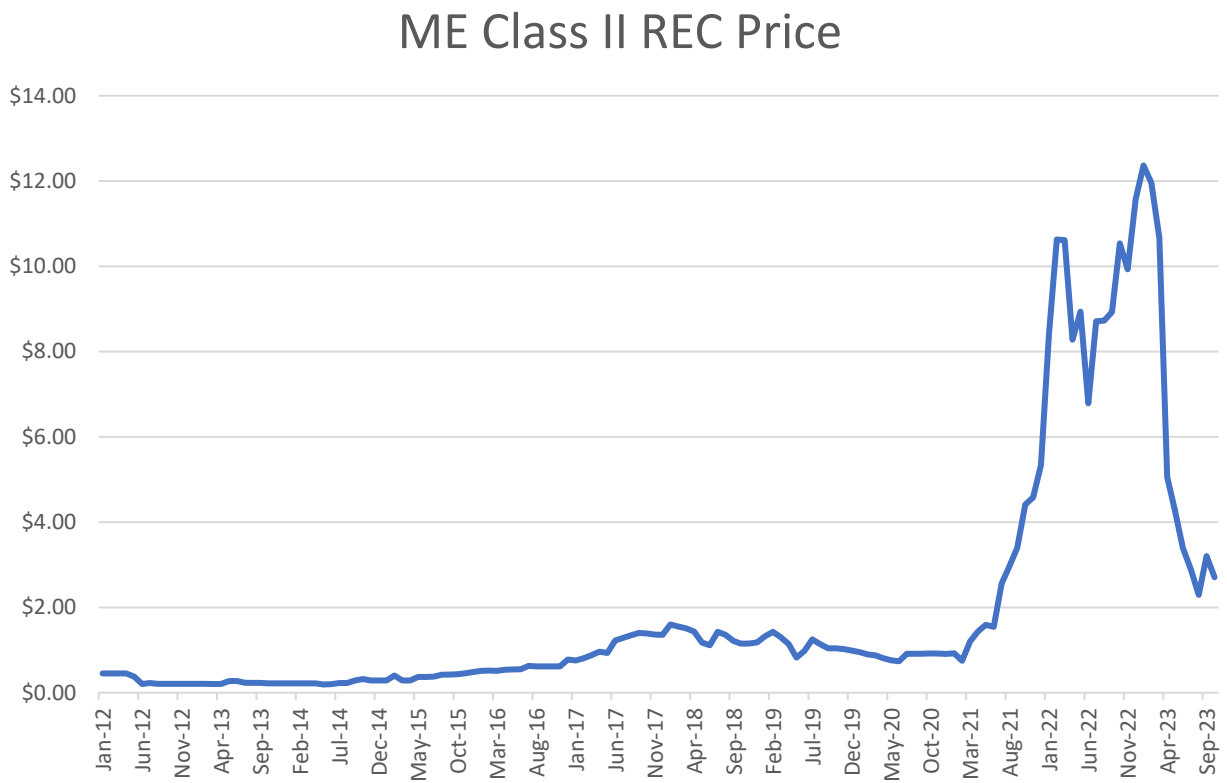
Average Massachusetts Class I REC Prices



Massachusetts Class I renewable energy credit (REC) prices are a useful measure of the cost of Tier II RECs from new renewable generation in Vermont. Most utilities have excess Tier II RECs that can be sold into other states' regional compliance markets.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Maine Class II REC Prices



Maine Class II REC prices are a useful measure of the value of Tier I RECs from existing renewable generation. Prices have recently been extremely volatile due to changes in regional demand from existing resources used for compliance with other state renewable and clean energy standards.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

3. Transportation

a. Major Trends & Initiatives

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Clean Cars & Trucks Rules Set to Advance Low- and Zero-Emissions Vehicle Adoption

Vermont's Advanced Clean Cars II and Advanced Clean Trucks regulations, adopted in December 2022, require vehicle manufacturers to deliver an increasing percentage of zero-emission vehicles from model years (MY) 2026 to 2035.

After 2035, sales of all new light-duty vehicles delivered will be zero-emissions, while 40-75% of medium- and heavy-duty vehicles (depending on class) will be zero-emissions.

Vehicle Class	MY 2026 **Requirement** for New Vehicle Sales or Deliveries	MY 2035 **Requirement** for New Vehicle Sales or Deliveries
Cars & Light Duty Trucks 	**35%**	**100%**
Class 2b-3 Large Pickups & Vans 	**10%**	**55%**
Class 4-6 Straight Trucks & Buses 	**13%**	**75%**
Class 7-8 Tractors 	**10%**	**40%**

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Transportation Carbon Reduction Strategy

Completed in November 2023 for the Agency of Transportation, the Carbon Reduction Strategy provides direction for spending certain federal funds to reduce transportation sector emissions.

While federal funding is insufficient to implement all elements, the Strategy will be used to shape the Capital Program for Vermont's transportation infrastructure and inform other policies.

Carbon Reduction Program Funding Priorities for State-Directed Funds

Project Type		Examples	Allocation Target %	Approx. Total Funds FY22-26	GHG Reduced (2030)
	Bicycle & Pedestrian Projects	Shared-use paths, bike lanes, and sidewalks	33%	$9-10 million	130 MT
	Transit & Micromobility Services & Incentives	Microtransit, shuttles, e-bike incentives	33%	$9-10 million	1,200 MT
	Fleet Conversion	Converting transit buses and heavy equipment to electric technology	33%	$9-10 million	530 MT

VERMONT
DEPARTMENT OF PUBLIC SERVICE

3. Transportation

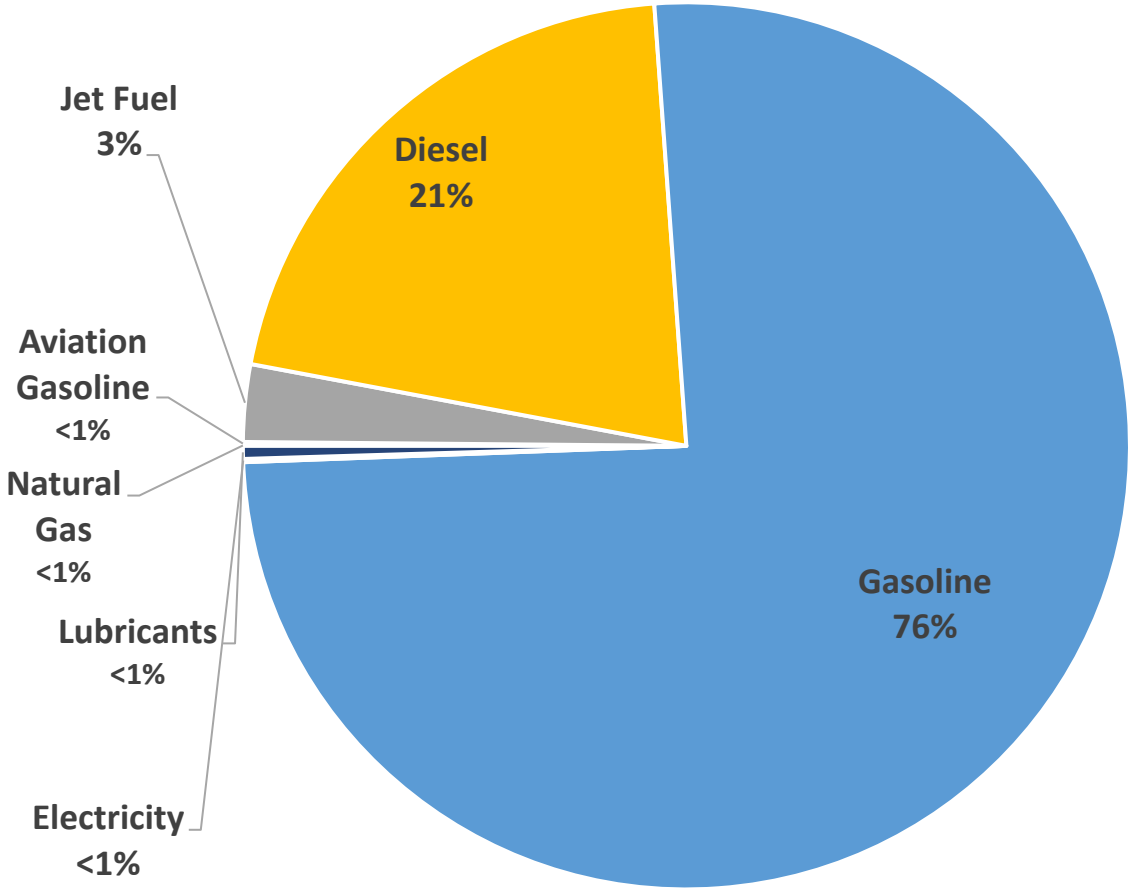
b. Transportation Fuel Demand

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Transportation Energy Consumption by Fuel Type

Gasoline and diesel account for the vast majority of transportation energy fuel. Gas consumption peaked in 2005 and has declined since, largely as a result of more efficient vehicles. Diesel consumption has remained level.

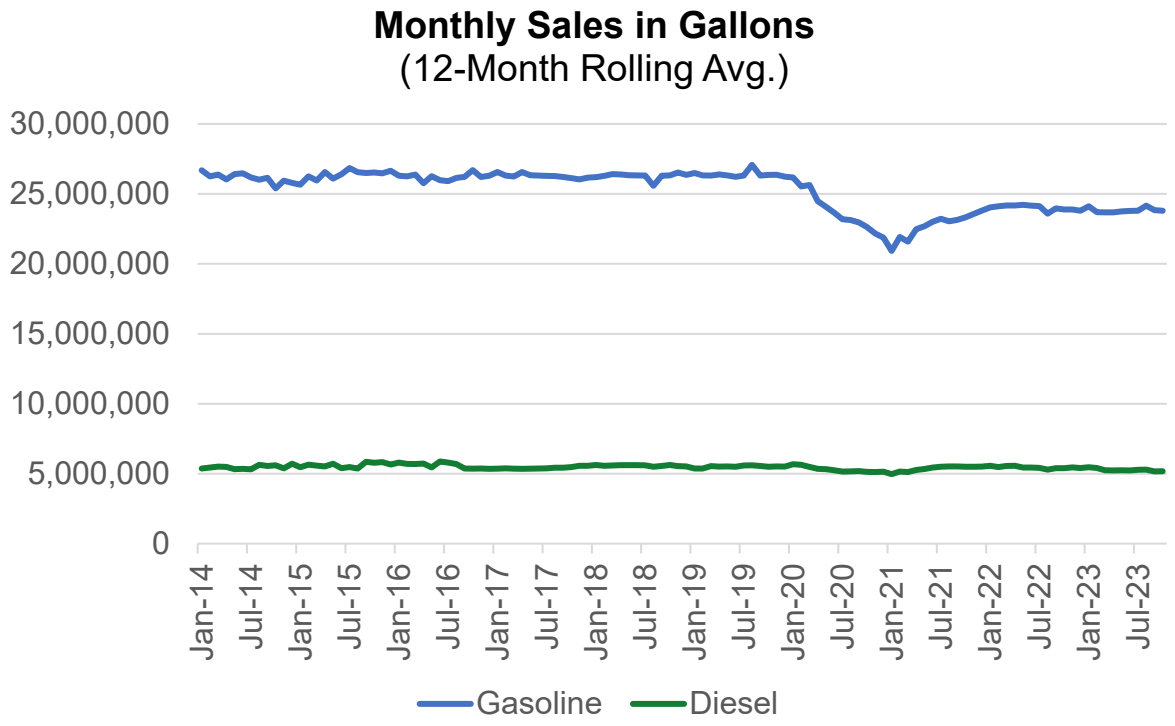
While electric vehicle adoption is growing, their relatively small number and overall efficiency mean that EVs consume less than 1% of transportation energy.



Source: US Energy Information Administration, SEDS Table C8 and Table CT7 for 2021. Residual fuel oil and hydrocarbon gas liquids are not shown.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Gasoline and Diesel Sales, 2014-2023



Gasoline and diesel taxes and assessments account for 31% of Transportation Fund revenues.

While diesel consumption, and tax revenue by extension, remain stable, Vermont gasoline consumption has not returned to pre-pandemic levels.

Source: Joint Fiscal Office, February (FY23 revenue forecast) and December 2023 (sales data).

VERMONT
DEPARTMENT OF PUBLIC SERVICE

3. Transportation

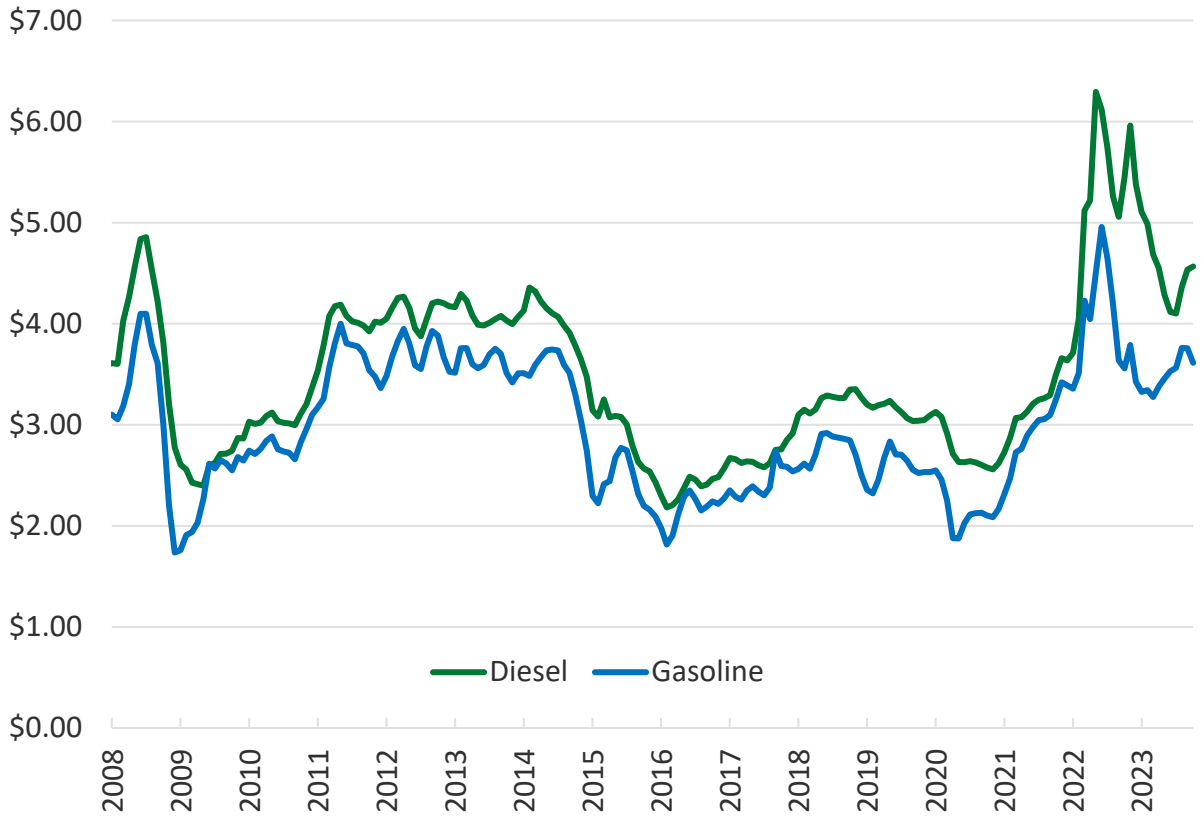
c. Transportation Fuel Prices

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Gasoline and Diesel Retail Prices, 2008-2023

Although gasoline and diesel prices are both based on the global market for crude oil, other factors influence the price that consumers pay at the pump. These include refining capacity, inventories at regional ports, and local retail competition.

By the end of 2023, gasoline and diesel prices had fallen from the high prices of 2022, but remain higher than the ten-year average.



Source: US Energy Information Administration for PADD 1A (New England). Monthly regular gasoline (all formulations) and ultra-low sulfur diesel prices are shown.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

3. Transportation

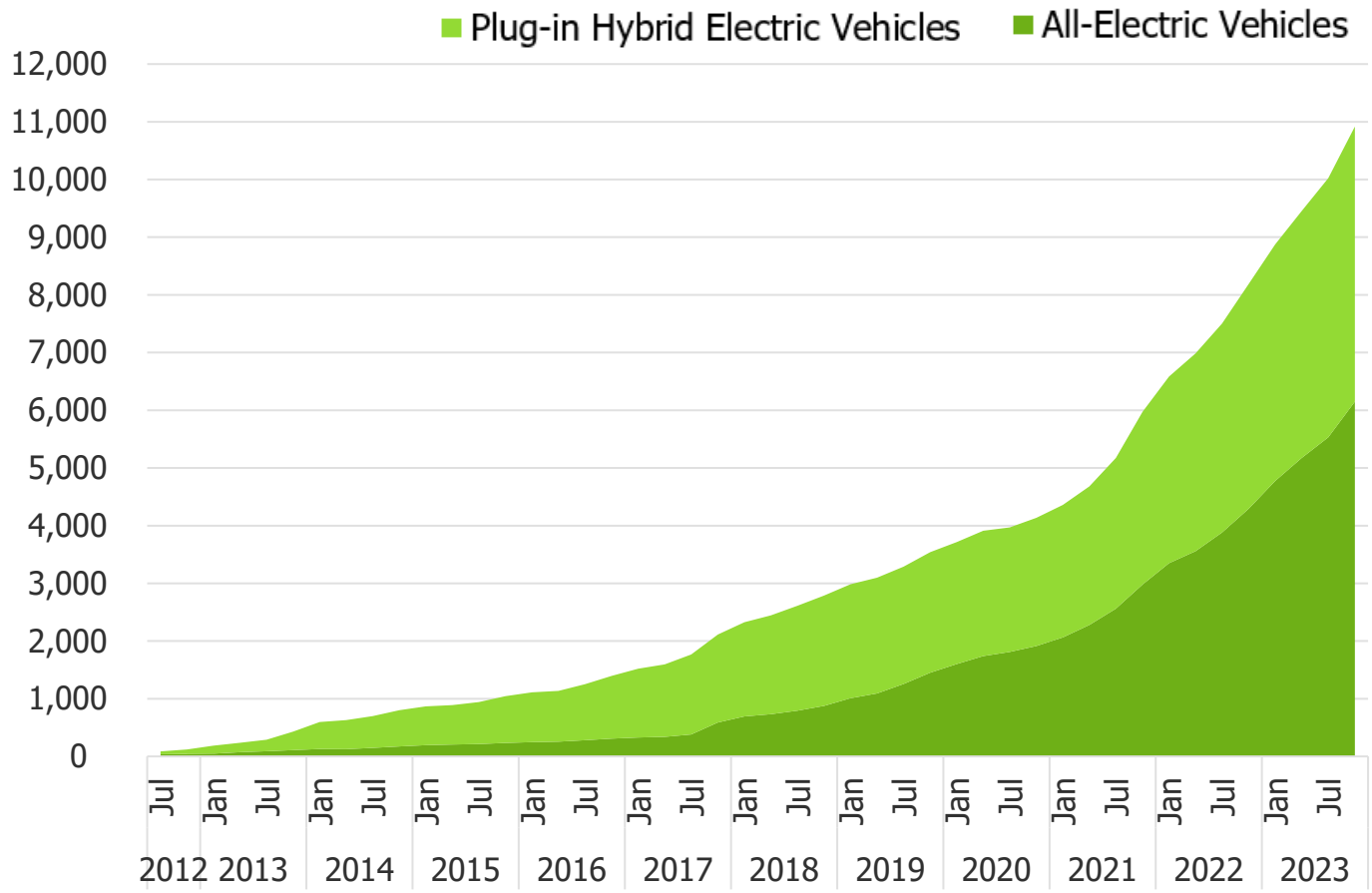
d. Electric Vehicle Adoption & Charging Infrastructure

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electric Vehicle Adoption and Availability

There were 10,916 registered electric vehicles in October 2023, an increase of 33% over the prior year (equal to 2,726 net added EVs).

56% of registered EVs were all-electric models and 44% were plug-in hybrids. Drive Electric Vermont reported 35 all-electric and 25 plug-in hybrid models available for sale, with 14 models priced at under $40,000 for a base trim level.



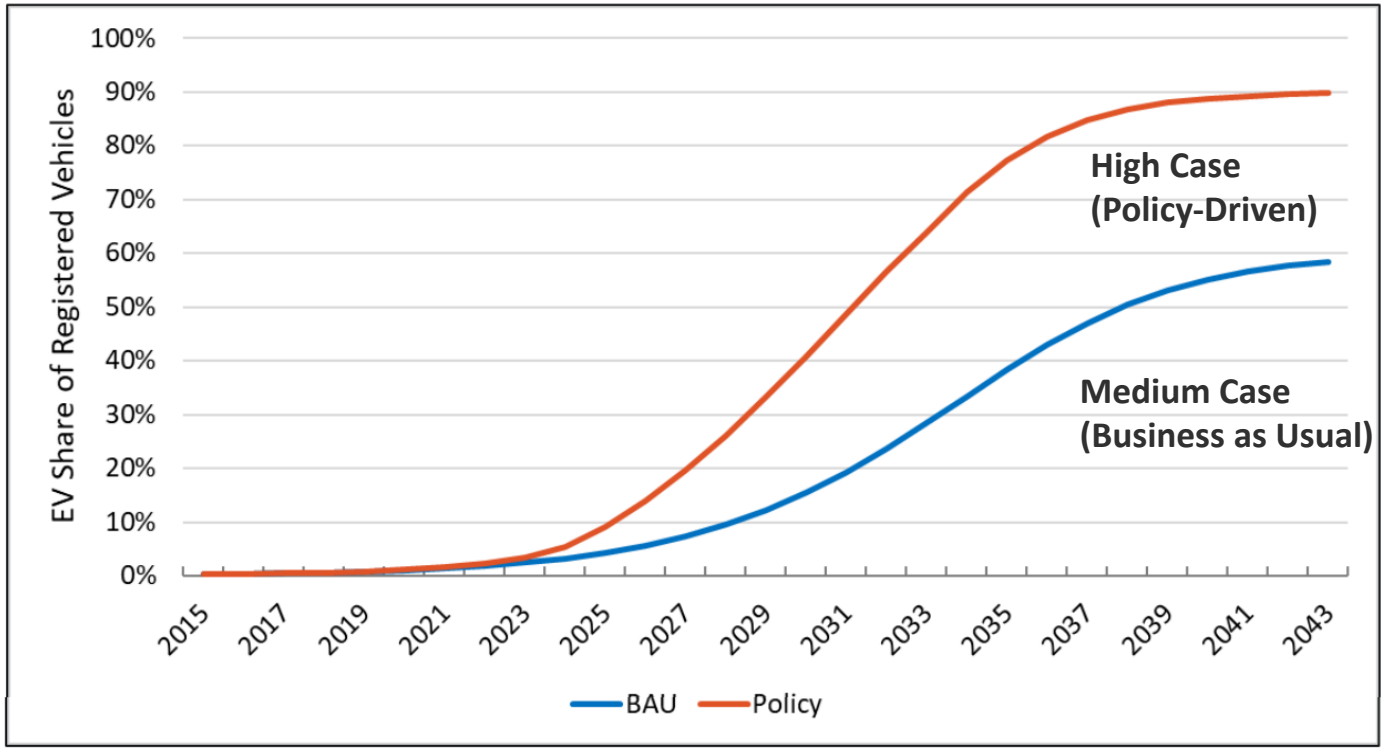
Source: October 2023 DMV data. Analysis by ANR. Chart prepared by Drive Electric Vermont.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Light-Duty EV Adoption Forecast

Although electric vehicle adoption continues to grow, the exact pace of adoption is unpredictable. Itron, a consultant assisting VELCO update Vermont's Long-Range Transmission Plan, prepared two scenarios to estimate impacts on the electric grid. The Transmission Plan will be finalized in June 2024.

Each distribution utility conducts a similar analysis as part of the Integrated Resource Plan required every three years.



Data Source: Itron / Drive Electric Vermont for VELCO, 2023

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electric Vehicle Incentives

Vermonters interested in the purchase or lease of an electric vehicle typically qualify for incentives. Recent federal legislation and state programs have added incentives for use vehicle purchasers as well as corporate, non-profit, and municipal fleets. See program rules for details and eligibility.

Distribution Utility Incentives	Federal Tax Incentives	State of Vermont Incentives			
$750 - $3,200 for qualifying purchases (varies by vehicle and utility)	Up to $7,500 depending on manufacturing location, material sourcing, battery size, income, purchase price, and tax liability	New Vehicles: $2,500 - $5,000	Used Vehicles: Up to $5,000	Replace Your Ride: Up to $5,000	Electrify Your Fleet: $500,000 available in total for commercial, municipal, and nonprofit fleet owners
Select utilities offer additional free charging equipment	Additional 30% tax credit for charger installations				

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electric Vehicle Rates

Act 55 of 2021, the Transportation Bill, required each distribution utility to offer electric vehicle rates for all customer classes by June 30, 2024. The rates must encourage EV adoption without adversely impacting other ratepayers.

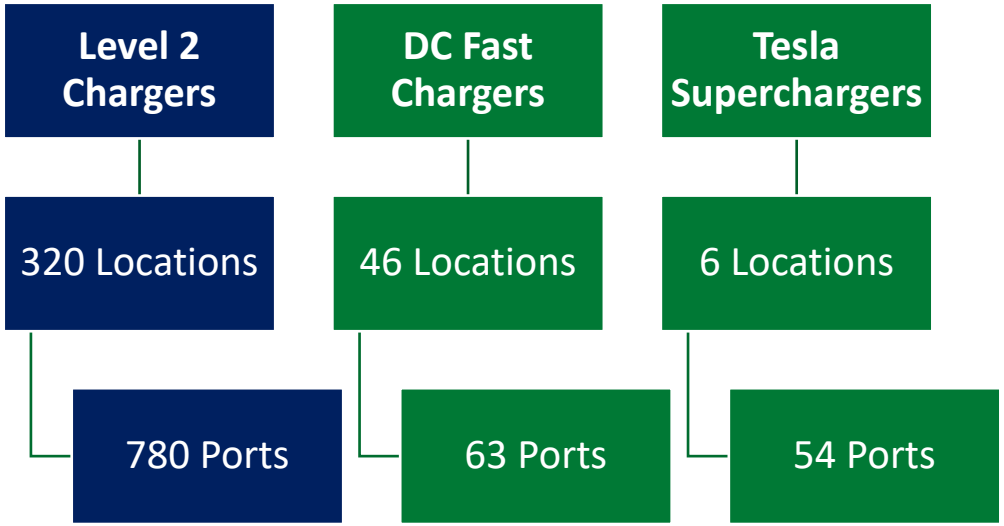
The Public Utility Commission is authorized to review EV rates and—if warranted—approve time extensions.

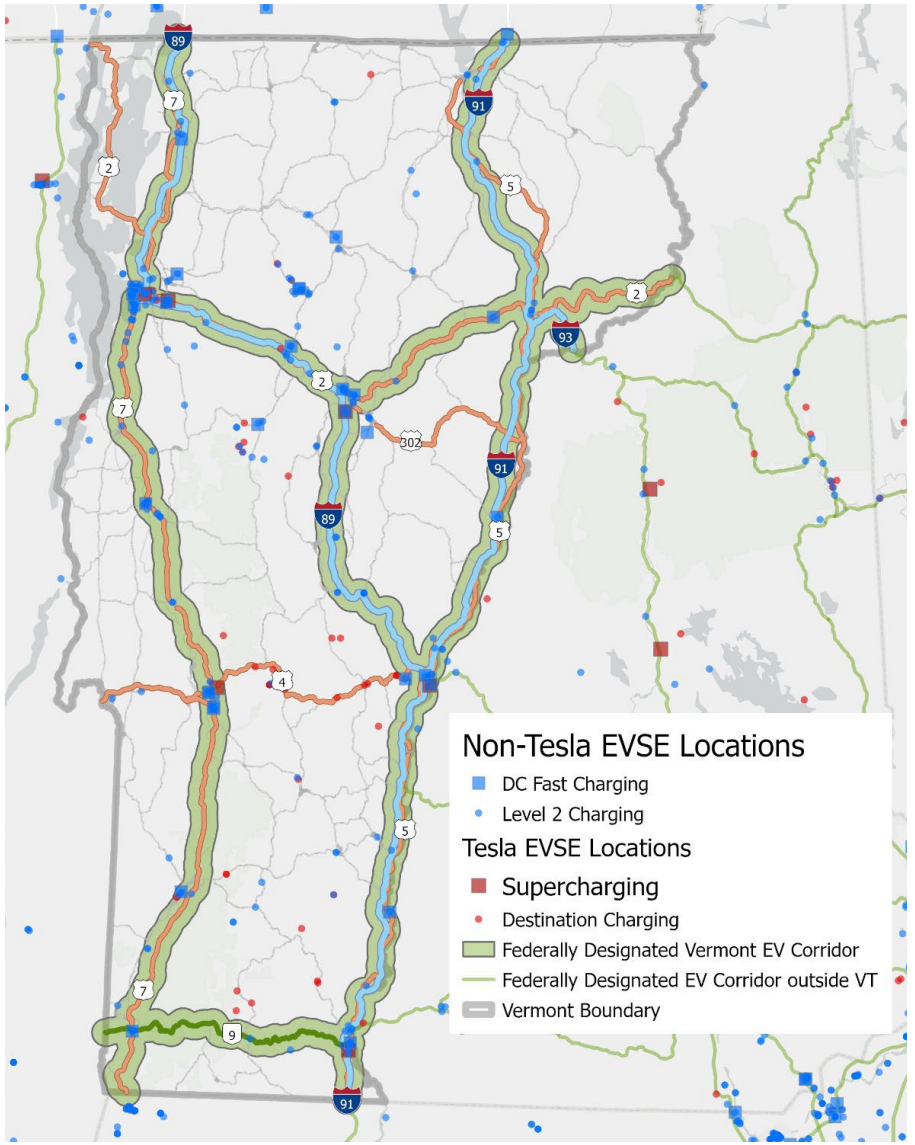
Utility	Currently Offers EV Rate	Request to PUC in Autumn 2023
Green Mountain Power	Yes	Exemption based on existing rates
Burlington Elec. Dept.	Yes	Exemption based on existing rates
VPPSA (11 Municipal Utilities)	Pilot Program	Approval of new rate
Vermont Elec. Coop.	Pilot Program	Approval of new rate (residential) and exemption for existing rate (commercial)
Stowe Elec. Dept.	No	Time extension to 2025
Village of Hyde Park	No	Time extension to 2026
Washington Elec. Coop.	No	Time extension to 2027
GF Power	No	Exemption (no retail customers)

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Electric Vehicle Public Charging

Vermont leads all other states in the count of public charging ports per capita. However, the need for additional chargers is growing as both residents and visitors make more journeys with electric vehicles. Fast chargers are operated by both private and utility actors. Publicly-funded fast chargers are being installed to improve access in vital travel corridors, including in the Northeast Kingdom.





Count: US Department of Energy Alternative Fuels Data Center, December 2023.
Map: Existing chargers, Agency of Transportation 2023 NEVI Plan.

Electric Vehicle Charging Incentives

Nearly 80% of EV charging occurs at home. However, a number of state, federal, and utility incentives support the installation of electric vehicle supply equipment (EVSE) along travel corridors, at workplaces and attractions, and to serve residents of multiunit dwellings.

Distribution Utility Incentives	Federal Tax Incentives	National Vehicle Infrastructure Program (NEVI)	Vermont Community Electric Vehicle Chargers Incentive		
$250-900 for residential and workplace chargers (varies by utility)	30% tax credit for cost of equipment and installation, for up to $1,000 for residents and $30,000 for businesses	$21.2 million for FY22-26, mainly for highway corridor fast charging	Workplaces: $500 - $56,000 per applicant	Public Attractions & Fast Chargers: $3,000 – $160,000 per applicant	Multiunit Dwellings: $500 - $56,000 per applicant

VERMONT
DEPARTMENT OF PUBLIC SERVICE

4. Thermal

a. Major Trends and Initiatives

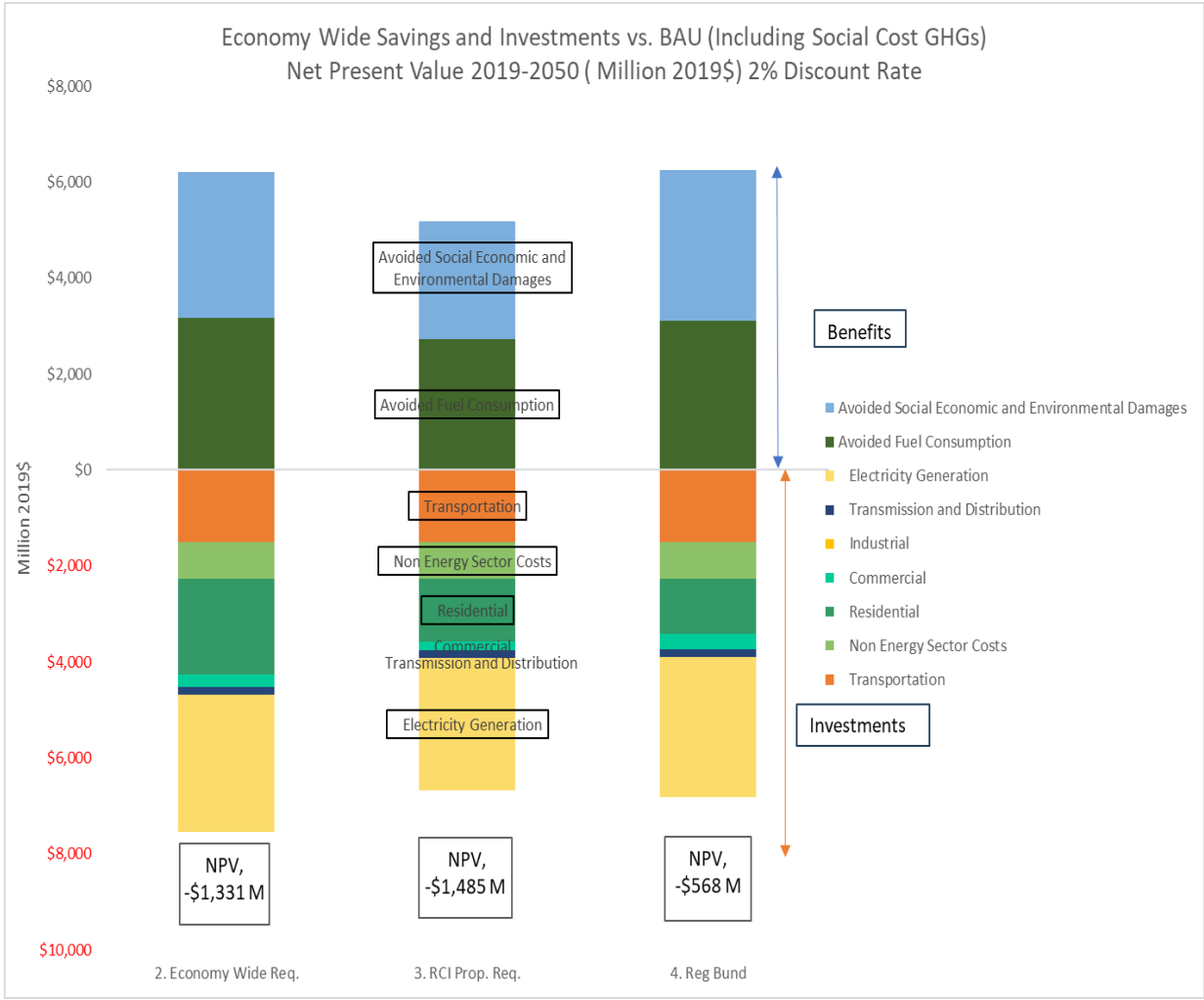
VERMONT
DEPARTMENT OF PUBLIC SERVICE

Clean Heat Standard

The General Assembly passed the "Affordable Heat Act" in 2023, which directs the Public Utility Commission (PUC) to design a potential "Clean Heat Standard" (CHS) for authorization by the Legislature in 2025. A CHS would create an obligation on fuel providers that import heating fuels into Vermont to reduce carbon equivalent emissions over time. Obligated entities would comply with the CHS by purchasing credits from a "Default Delivery Agent", or by actively investing in either supply- or demand-side activities (e.g. increasing the supply of renewable fuels, or causing the installation of weatherization, cold climate heat pumps).

The PUC has opened multiple proceedings to fulfill its requirements, including developing the rules and procedures that would govern the CHS (PUC Case No. 23-2220-RULE), and the details and parameters of the potential "Default Delivery Agent" (PUC Case No. 23-2221-INV).

The Agency of Natural Resources, in collaboration with the Public Service Department, in 2023 commissioned a study to estimate the costs to both society and Vermonters of the CHS, relative to other policy options. The study estimated that the Clean Heat Standard would have net societal costs of approximately $1.5 billion through 2050. The presentation and full study can be found on the Climate Council's website.



VERMONT
DEPARTMENT OF PUBLIC SERVICE

School Heating Assistance with Renewables and Efficiency (SHARE)

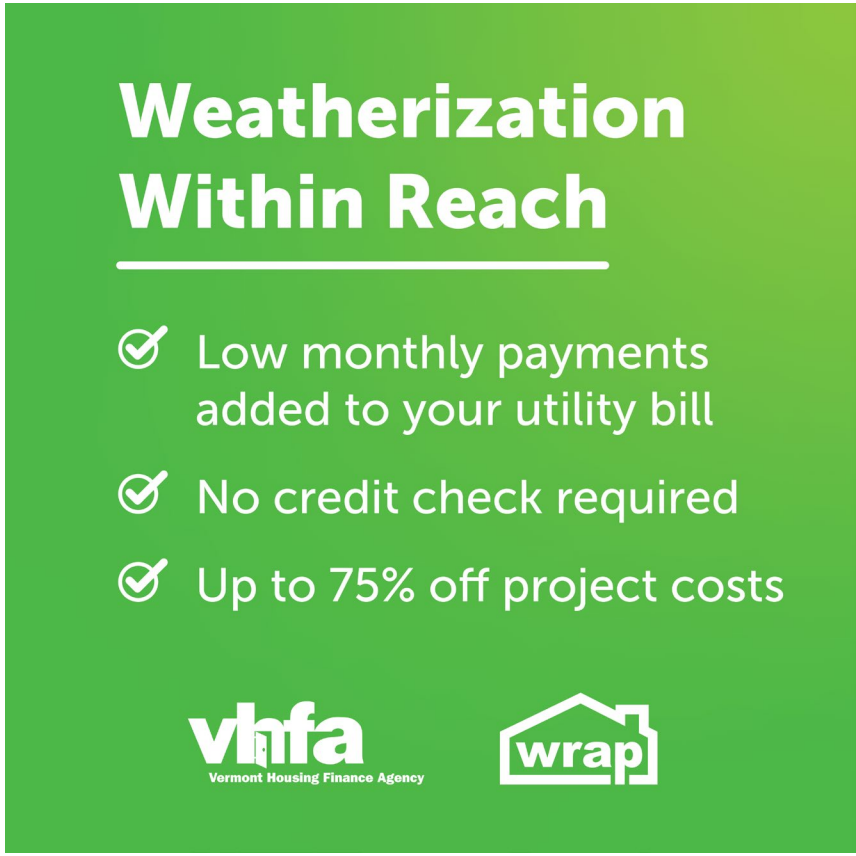
- Clean Energy Development Fund (CEDF) Board allocated ARPA Funding - $3.75 Million – Rounds 1&2
- Eligible Measures: Advanced Wood Heat (AWH), Heat Pumps (HPs), Controls and Efficiency Projects
- Round 3 - $2 Million funding for FY24 of General Fund $$ - **AWH associated projects only**
- Title I Schools Eligible for grants $25K-250K
- 95 initial applications seeking $15.25 million in funding requests for projects totaling $52 million
- 20 ARPA-funded projects - ~15 expected projects expected in round 3
- Annual expected savings per school - ~$23K; 8,600 gallons of oil
- Warmer, more comfortable learning and working environments

VERMONT
DEPARTMENT OF PUBLIC SERVICE

The Weatherization Repayment Assistance Program (WRAP)

The *Weatherization Repayment Assistance Program* is an innovative new program run by Vermont Housing Finance Agency to help Vermonters participate in comprehensive home efficiency projects. WRAP allows Vermont households to pay for qualifying weatherization projects as well as heat pumps, advanced wood heating systems, and health and safety measures through a monthly charge on their electric or gas bill. The charge is tied to the *meter* rather than to the individual customer – overcoming the barriers of access to credit, high upfront costs, and long payback periods. Both homeowners and renters (with landlord permission) can participate in the program. Although the program is open to Vermonters of all incomes, the majority of program funding is targeted to households earning 80% to 120% of the area median income.

The WRAP pilot was initially proposed by Governor Scott in 2021 and funded with $9 million in State appropriations in that year. Green Mountain Power, Ludlow Electric, Vermont Electric Cooperative, Vermont Gas Systems, and Burlington Electric Department have put tariffs in place to offer the program to their customers starting in late 2023. VHFA is in discussions with additional utilities to encourage them to participate.



VERMONT
DEPARTMENT OF PUBLIC SERVICE

Building Energy Codes Study Committee - Charge

The Building Energy Codes Study Committee (BECSC) was established in Act 47 of 2023 to address issues related to compliance rates with Vermont's mandatory energy codes, known as Residential Building Energy Standards (RBES) and Commercial Building Energy Standards (CBES).

The Committee developed a list of recommended strategies to increase awareness and compliance with the energy codes, which include the following:

- Structural, statutory, policy, and programmatic changes to Vermont's energy code environment.
- Improve the process for filing and tracking energy code certificates.
- Improve workforce training and support.
- Increase awareness of building energy codes and requirements.
- Establish a plan for funding base-code and above-base code compliance.
- Coordinate code compliance grant efforts in Vermont.

The final report to the General Assembly is available on the PSD website at:
https://publicservice.vermont.gov/efficiency/building-energy-standards/building-energy-code-study-committee

VT Energy Workforce Development Funding and Initiatives

Office of Economic Opportunity's (OEO) Weatherization Program – Weatherization Training Center (WxTC)
Funding: $1.7M from U.S. Department of Energy (DOE)
Purpose: To support weatherization and other construction trades in recruiting, training, and placing workers in careers. The WxTC will serve as a hub to coordinate existing training programs and develop new training programs for Vermont. A specific goal of the WxTC is to diversify the workforce and bring underrepresented individuals into the weatherization field.

State Energy Program (SEP) Bipartisan Infrastructure Law (BIL) - Workforce Development Training
Funding: $875,000 from U.S. DOE, BIL
Purpose: The PSD has budgeted a portion of the SEP BIL award to provide weatherization workforce development.

Vermont Energy Code Administration Project
Funding: $693,000 from U.S. DOE, BIL to Energy Futures Group
Purpose: A portion of the $1,000,000 grant from DOE has been budgeted for "Energy Professionals (HERS Raters) Workforce Development and Support" and "Education, Training and Support". Most of this activity will be carried out by a full-time energy code circuit rider who will provide outreach, field support and training on energy codes to design, build, supply, finance and affordable housing communities.

Efficiency Vermont ARPA Workforce Development Training Grant
Funding: $1M from American Rescue Plan Act (ARPA)
Purpose: To provide funding for entities and programs that increase the number of people working in or supporting the weatherization field in Vermont. Programs must directly serve an eligible population, which includes low and moderate income (up to 120% AMI) or individuals who, as a result of the COVID-19 pandemic, are unemployed or are employed part time but want and are available for full-time work. Selected entities to provide programs include Vermont Adult Learning (VAL), ReSource, and the VT Fuel Dealers Association.

VT Energy Workforce Development Funding and Initiatives

Efficiency Vermont ongoing Building Energy Code Support
Funding: $105,500 for 2024-2026 DRP – DSS budget
Purpose: This funding is to provide technical support and training regarding the development and implementation of state energy codes and standards. The anticipated support includes, but is not limited to:

- Direct technical assistance, including a telephone assistance hotline;
- Development, production, and delivery of educational materials;
- Development and delivery of workshops and professional training; and
- Technical support for the development or amendments of energy codes and standards.

Efficiency Vermont – Weatherization Training & Building Science Certifications
Funding: ~$70,000 from TEPF funds
Purpose: This funding is allocated to subsidize coursework, field training, and exam fees for Building Performance Institute certifications. Some or all of it could be redirected to the VT Weatherization Training Center once it is up and running.

Efficiency Vermont - Workforce Development FTE position
Funding: TBD
Purpose: A full time position will be hired in 2024 to assist with Talent Pipeline Management in the energy efficiency trade workforce. This position will work collaboratively with Vermont partner organizations on helping to build and implement long term strategies to recruit and retain more skilled workers in the weatherization and heating electrification fields. The specific funding to support this position is currently being determined, in parallel with the scope and job description.

EAN Climate Workforce Network Action Team
Purpose: Create and implement a plan to reduce the gaps in the climate workforce to support implementation of the Climate Action Plan.

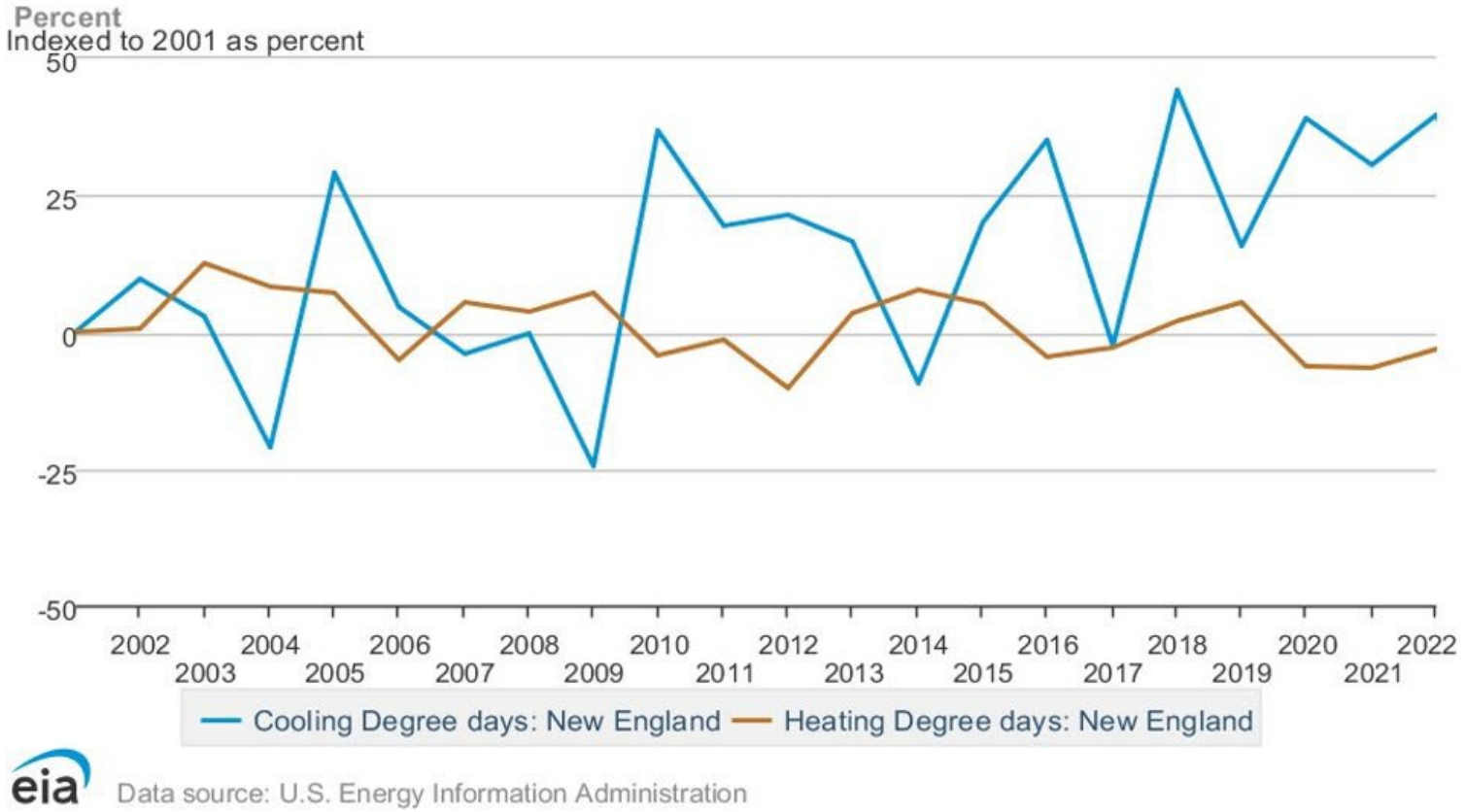
State-Based Home Energy Efficiency Contractor Training Grant Program
Funding: $1,048,680 from U.S. DOE, Inflation Reduction Act (IRA)
Purpose: Formula grants to states to develop and implement a state workforce energy program that prepares workers to deliver energy efficiency, electrification, and clean energy improvements. Applications are due January 31, 2024.

4. Thermal

b. Thermal Fuels Demand

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Thermal Demand Impacted by Weather



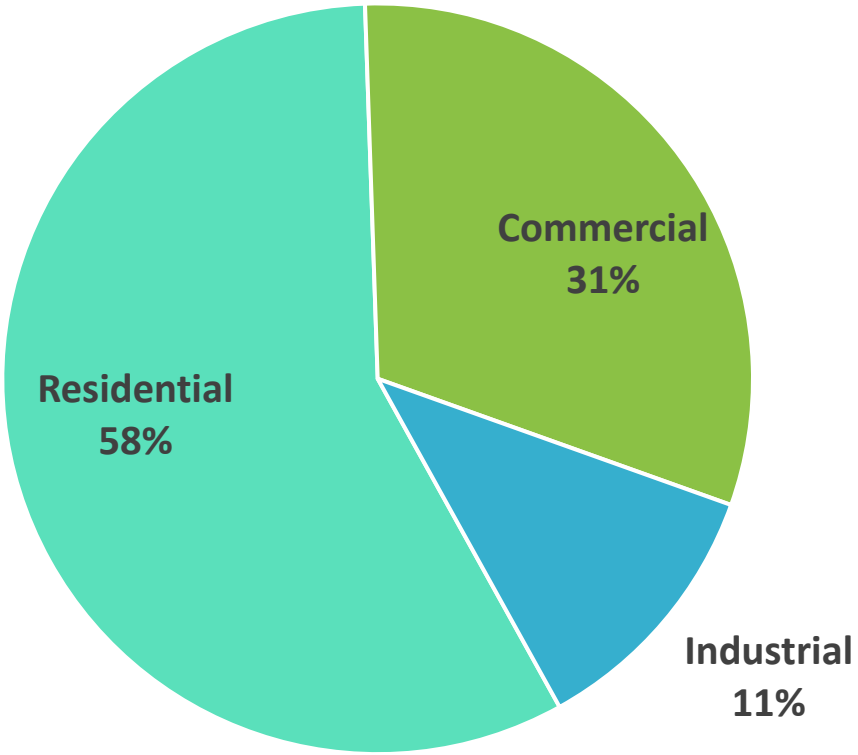
Vermont's thermal energy needs depend on the weather. Over the last twenty-one years, the amount of Cooling Degree Days in New England has increased by 39.7% while the amount of Heating Degree Days has decreased by only 3%. The changing climate is decreasing slightly the demand for heating fuels in the winter.

Source: 2021 EIA State Energy Data System (SEDS).

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont 2021 Thermal Energy Demand by Sector

Thermal uses of energy by sector/building type has remained steady in Vermont, The residential sector uses the most thermal energy to keep our homes warm. Businesses use about 30% to heat their buildings and the industrial sector uses about 10% for space heating and for manufacturing/material processing.



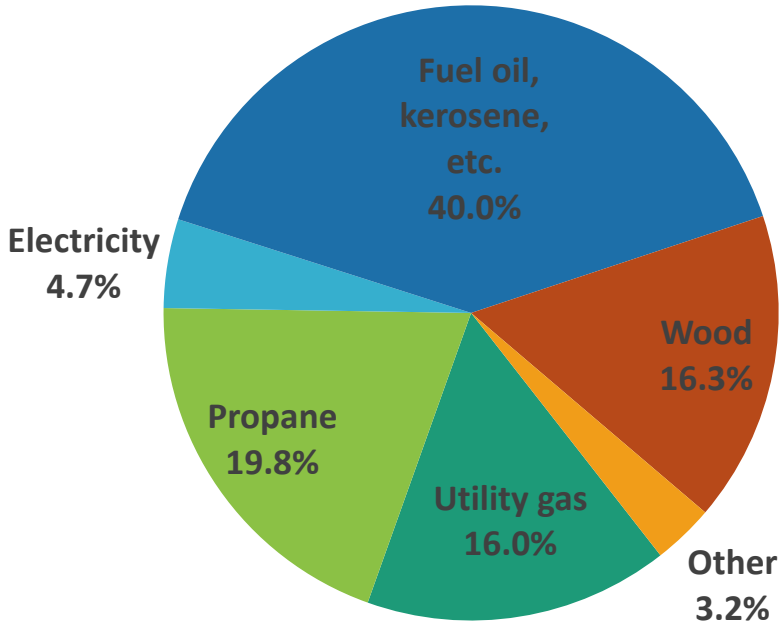
Source: 2021 EIA State Energy Data System (SEDS).

VERMONT
DEPARTMENT OF PUBLIC SERVICE

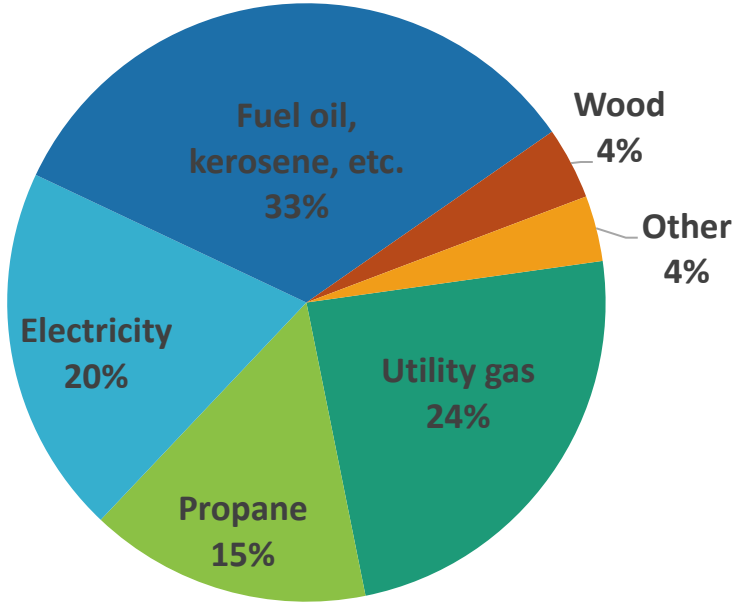
Heating Fuel Source by Housing Type

Vermont is seeing an increase in the use of electricity in heating, especially in renter occupied households. For renter occupied homes the estimated number of households where electricity was the primary fuel increased 5% in 2022 over the 5-year average from 2017 to 2021. Fuel oil decreased 3% and propane showed a 2% decline as a primary fuel. Despite 20% of the renter occupied homes and almost 5% of the owner-occupied homes using electricity as their primary fuel the percentage of electricity that is meeting the total heating load is just over 3%, as shown in Section 4c. This could be because of the increase in the use of heat pumps, which are about twice as efficient as electric resistant heat and thus use less energy to heat the same space.

Owner Occupied Type of Heating Fuels Used
2022 Estimate



Renter Occupied Type of Heating Fuel Used
2022 Estimate

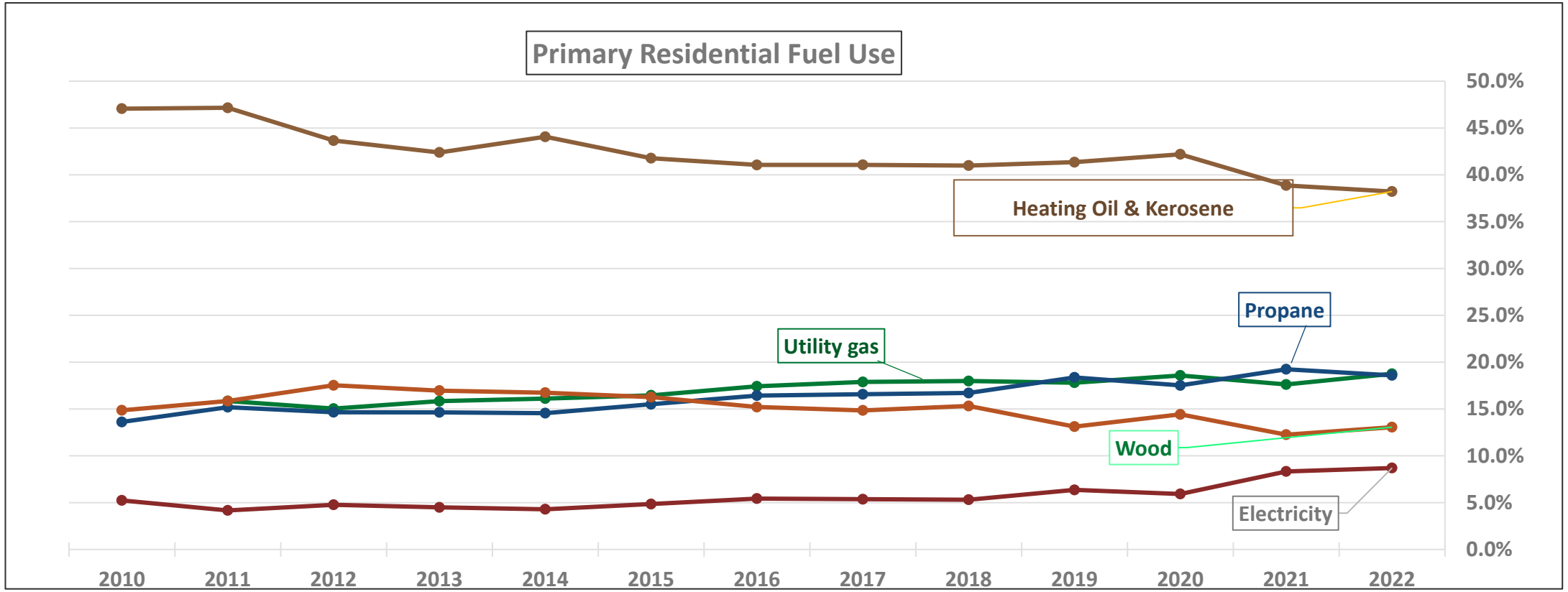


Source: US Census – American Community Survey Data, 2022.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Primary Residential Fuel Use 2010-2022

Residential use of heating oil and kerosene is dropping while electricity is on the rise due to the adoption of heat pumps as a primary heating source. The drop in heating oil as a primary source matches heating oil sales data, but the sales data shows an increase in propane which is not evident in the Census Bureau data.



Source: US Census Bureau's American Community Survey. Totals don't equal 100% as there are small amounts of other fuels respondents reported as their primary heating fuel (e.g., Coal, Solar, and "other").

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Weatherization

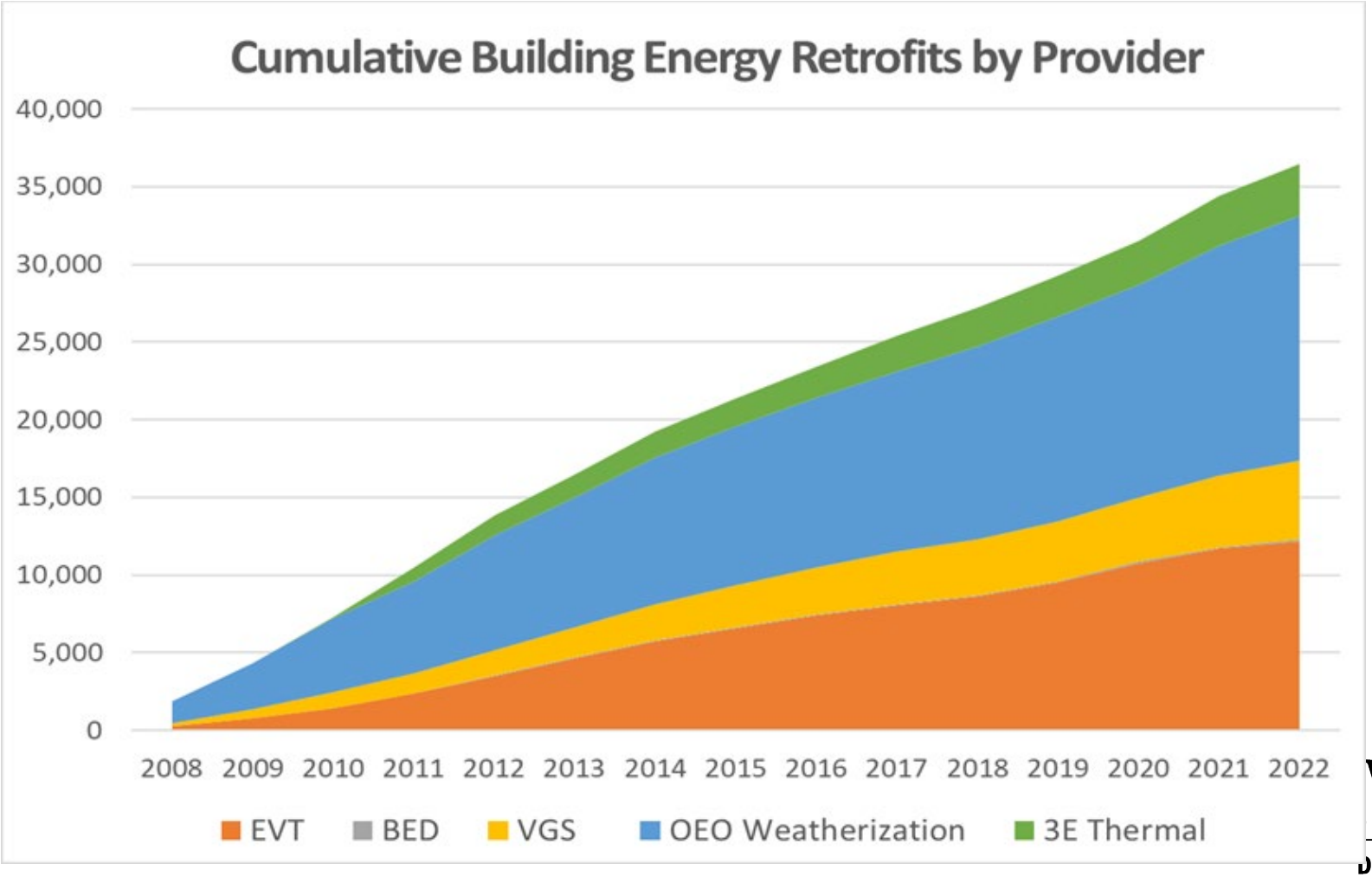
Weatherization programs focus on improvements to building insulation and air sealing to reduce the energy required to heat and cool indoor spaces, homeowner costs, and the carbon emissions from the burning of fossil fuels for space heat.

The 2022 Comprehensive Energy Plan set a target of comprehensively weatherizing a total of 120,000 homes by 2030. While significant federal funding has been dedicated to support Weatherization (as described elsewhere in this report), available workforce and organizational capacity remain insufficient to meet that aspirational target. This is largely due to available workforce and resources to do the work. There are five major weatherization programs in Vermont that are contributing to meeting the building energy goals of the state: Efficiency Vermont's Home Performance with ENERGY STAR program, Vermont Gas Systems' Home Retrofit program, the Burlington Electric Department, the Weatherization Assistance Program agencies coordinated by the Office of Economic Opportunity (OEO), and 3E Thermal. As shown below, 2,082 comprehensive retrofit projects were completed in 2022, with an average fuel usage reduction of 25%.

Metric	Amount	Description
Total projects (# of units served)	**2,082**	Total number of housing units weatherized, including all comprehensive projects completed through the five participating organizations (EVT, VGS, BED, OEO, and 3E Thermal).
Average % fuel usage reduction	**25%**	Average fuel usage reduction for projects completed. Fuel use reductions measured using fuel usage data when available and modeled estimates when fuel usage data is unavailable.
Carbon emissions reductions (pounds)	**5,071,180**	Carbon reductions use a uniform calculation method based on Federal standards published on the EIA website for fossil fuels, and Department of Public Service values for electricity savings.
Carbon emissions reductions (tons)	**2,536**	
Incentive costs	**$17,772,340**	Direct financial incentives to the homeowner or building owner
Participant costs	**$5,334,931**	Participant contributions to the cost of building improvements
Total project costs	**$23,107,270**	Total costs

Weatherization

Vermont has supported the weatherization of over 36,000 units between 2008 and 2022.



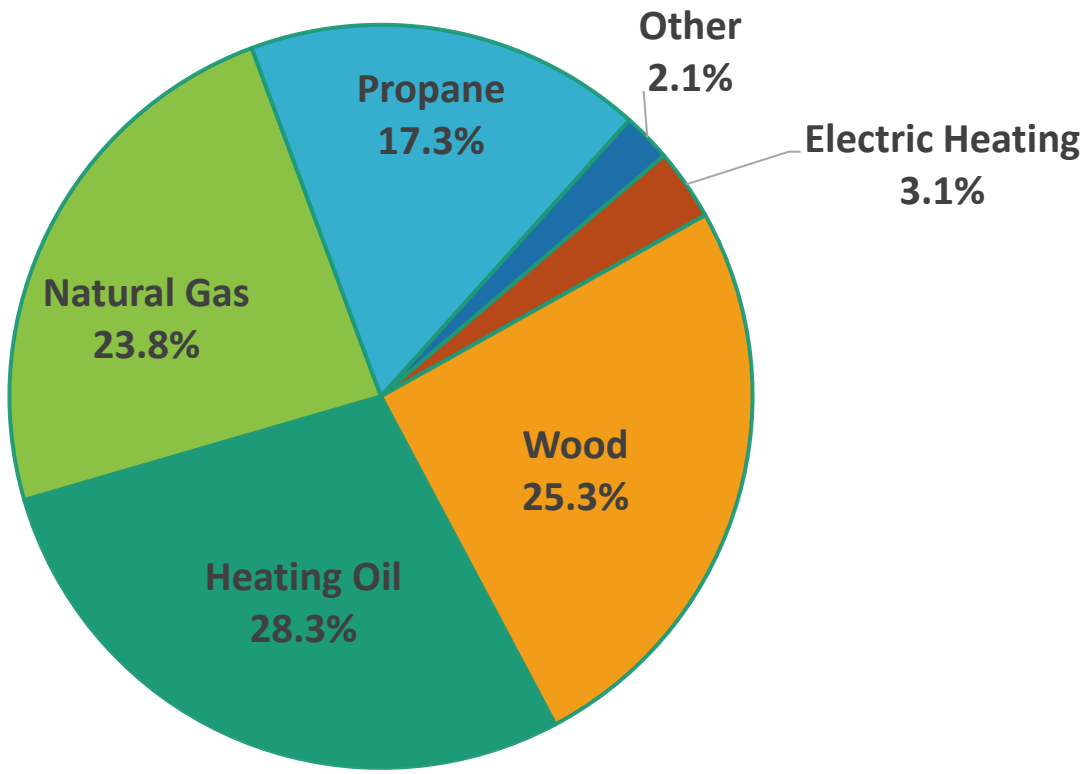
VERMONT
DEPARTMENT OF PUBLIC SERVICE

4. Thermal

c. Thermal Fuel Supply

Vermont 2021 Thermal Energy Supply

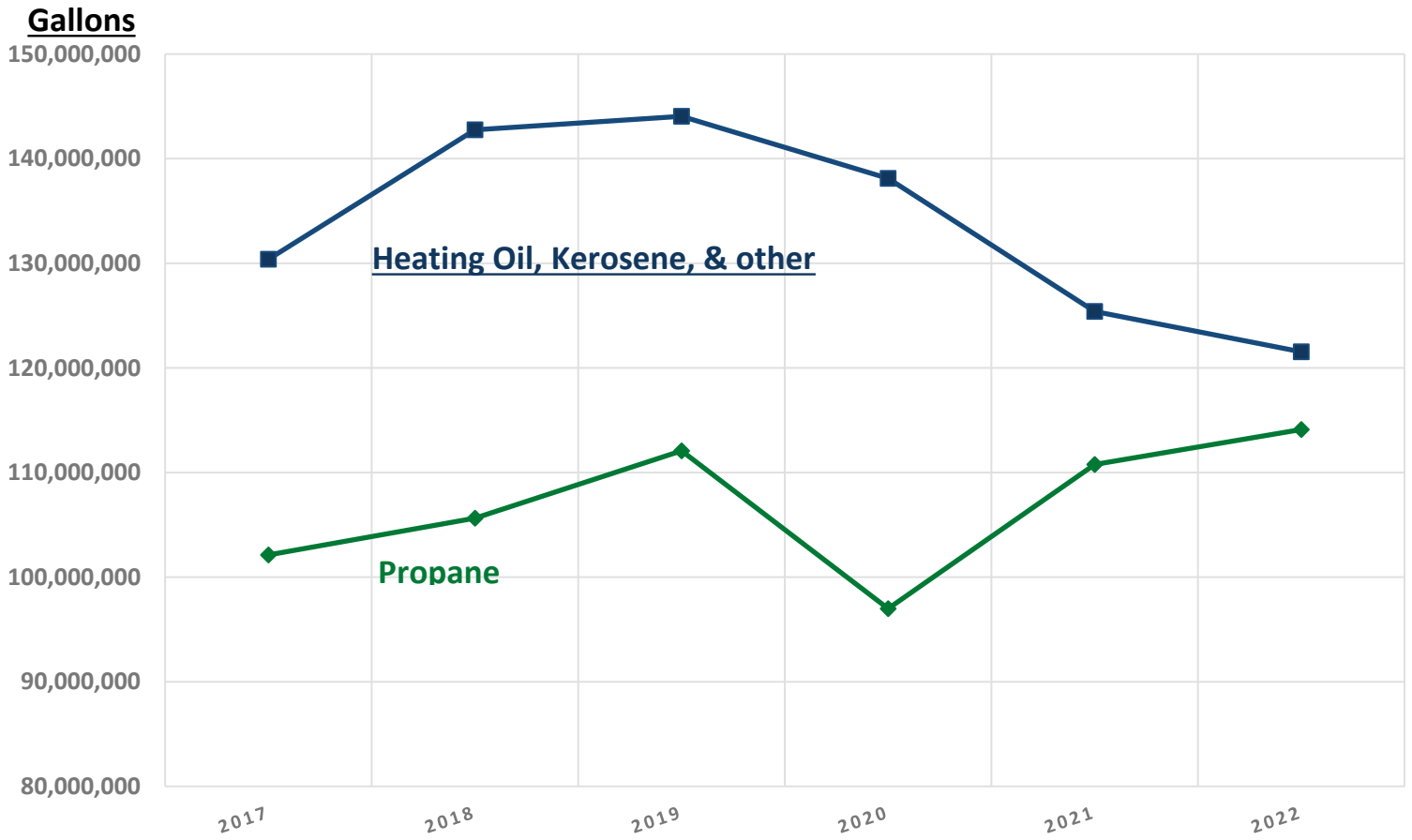
In 2021 Vermont continued to use a variety of fuels to meet heating needs. No one heating fuel dominates supply in Vermont; fossil fuels together continue to provide over 70% of heating needs. Renewable Fuels make up over 28% of Vermont's thermal energy needs. Thermal energy data shown here is primarily from the U.S. Energy Information Agency (EIA). EIA data was not available for 2022 and thus 2021 data is used.



Source: 2021 EIA State Energy Data System (SEDS). The methodology for calculating the use of electricity in heating changed this year and resulted in an estimate that was less than in 2021 compared to 2020, despite significant penetration of heat pumps beginning to impact the portfolio.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Total Delivered Fossil Heating Fuels Sold in Vermont



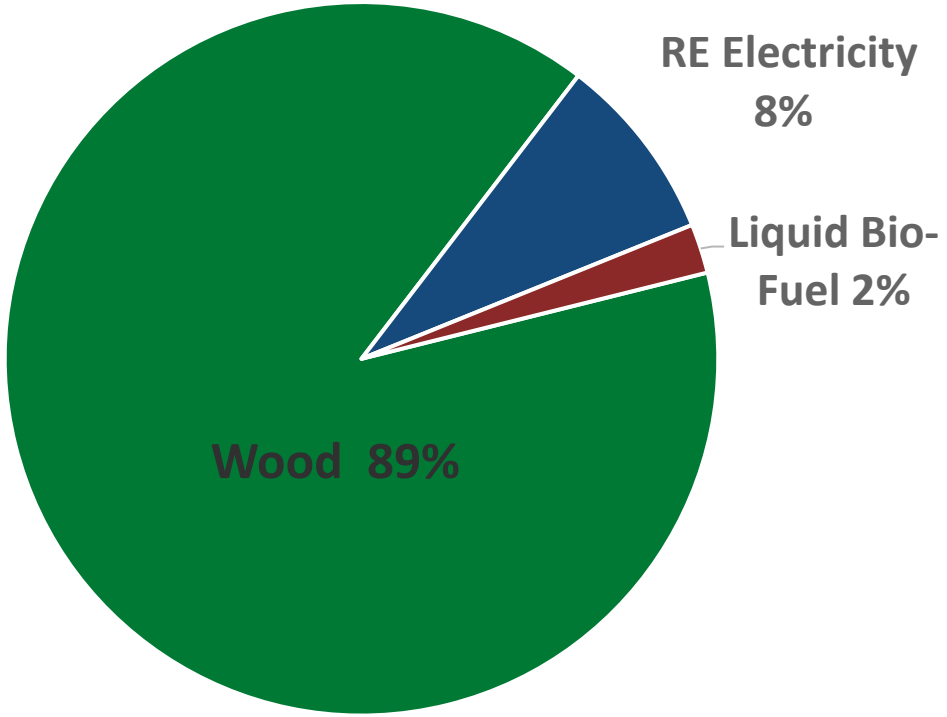
Sales of fossil heating fuels are down 8% from the 2019 high. This is largely a result of a decrease in heating degree days since 2019. The chart also shows that, independent of heating degree days, propane use is increasing, and the use of heating oil and kerosene are decreasing.

Source: Vermont State Tax Department

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont 2021 Thermal Energy Supply - Renewable

Of the twenty-eight percent of total heating fuel usage in Vermont that is renewable, the vast majority of that is wood fuel of various types (cord wood, wood chips, and wood pellets). As electricity use for heating increases with more efficient cold-climate heat pumps being installed and the amount of electricity generated from renewable sources grows the PSD expects the percentage from renewable electricity to increase.

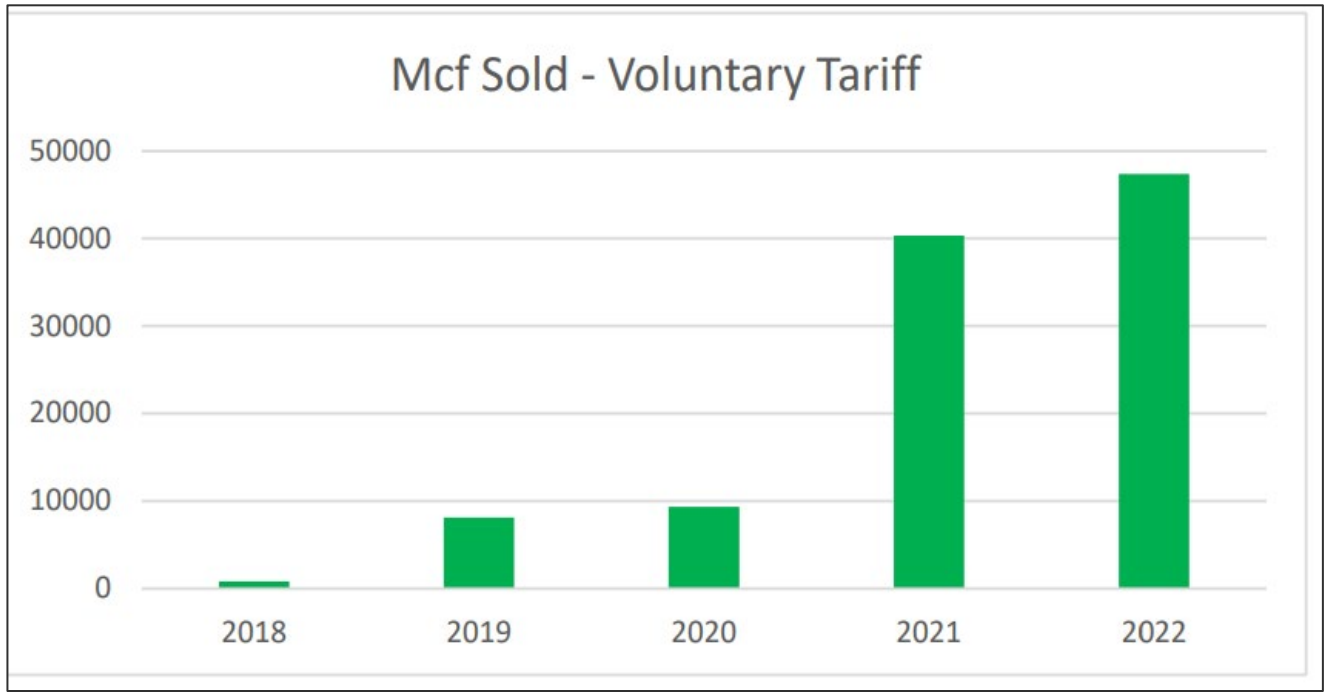


Source: 2021 EIA State Energy Data System (SEDS) and PSD data

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont Gas Alternative Supplies

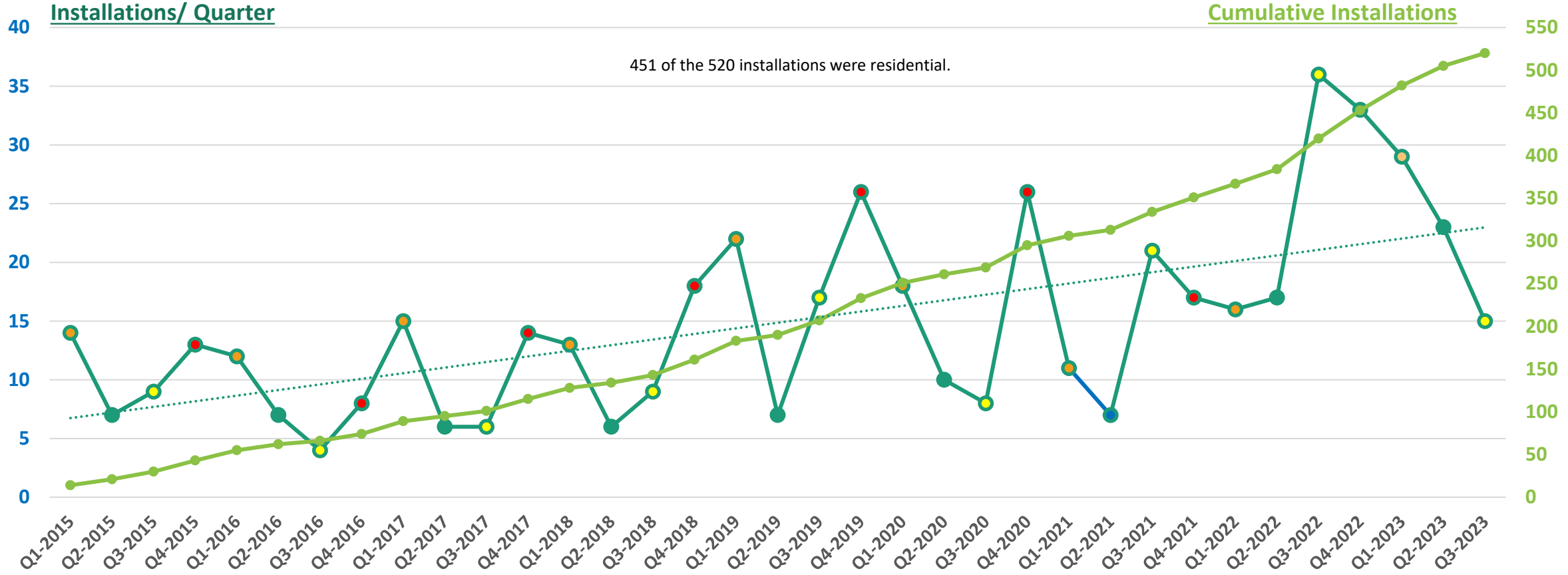
Vermont Gas Systems (VGS) continues to invest in alternative supplies such as renewable natural gas (RNG) and pilots for emerging technologies such as green hydrogen. These resources have varying emissions intensities based on the method of production and use-case. VGS has seen increasing sales under their voluntary RNG tariff since it's inception in 2018. Under their Alternative Regulation Plan - any investment in alternative supplies passed through VGS' supply portfolio to all customers is subject to cost-effectiveness screening against the societal cost of carbon established by the VT Climate Council.



See: Docket 22-5085-PET for VGS Alternative Regulation Plan

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Clean Energy Development Fund's Incentive Program
Number of Pellet Boiler Installations in Vermont



Pellet boiler/furnace installations hit a high in the summer of 2022 but since have declined over four consecutive quarters. The high number in the second half of '22 and first half of '23 was driven in by the COVID recovery funds that increased incentives for low-income residential installations. In addition, an incentive to change-out old coal systems helped boost projects in '22 and '23. The pace of installations reduced in 2023 when COVID funds were expended.

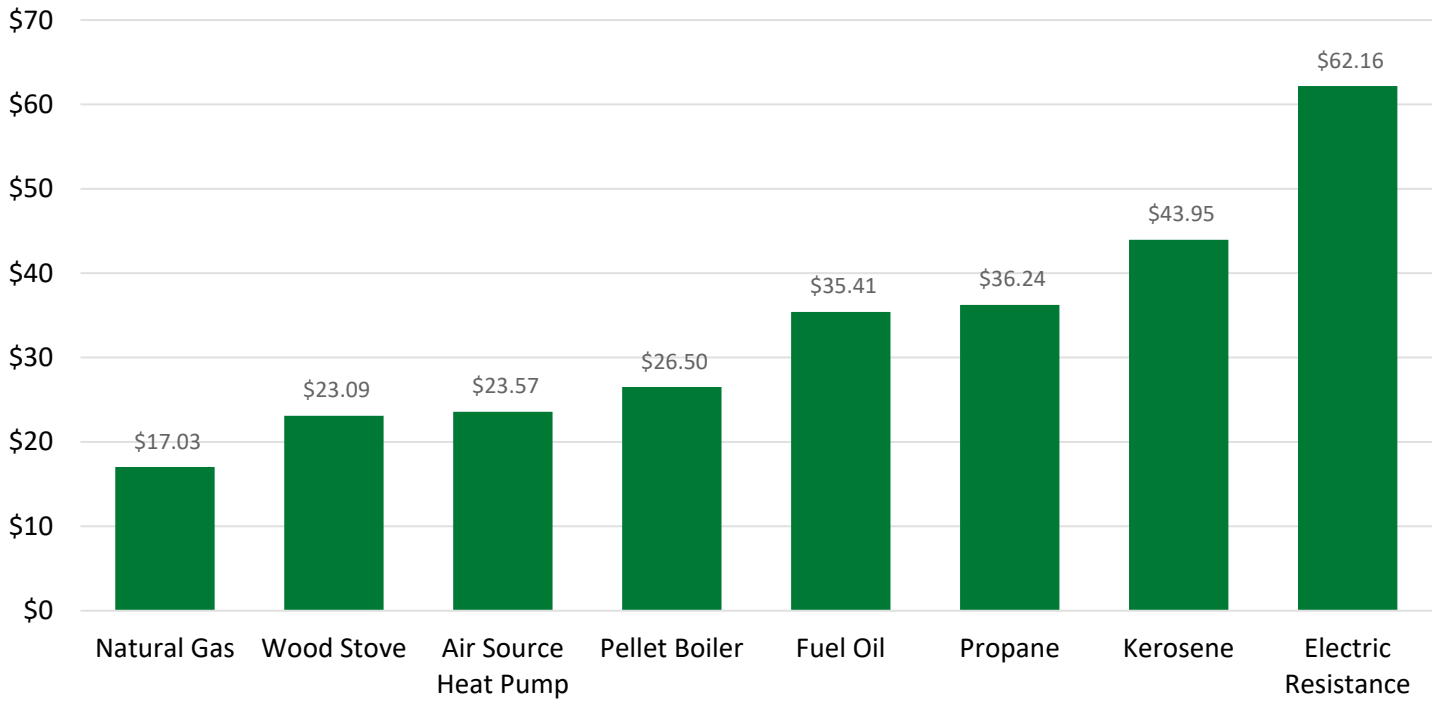
Source: Public Service Department, 2023

VERMONT
DEPARTMENT OF PUBLIC SERVICE

4. Thermal

d. Thermal Fuel Prices

Residential Effective Cost per MMBTU of Fuel in VT

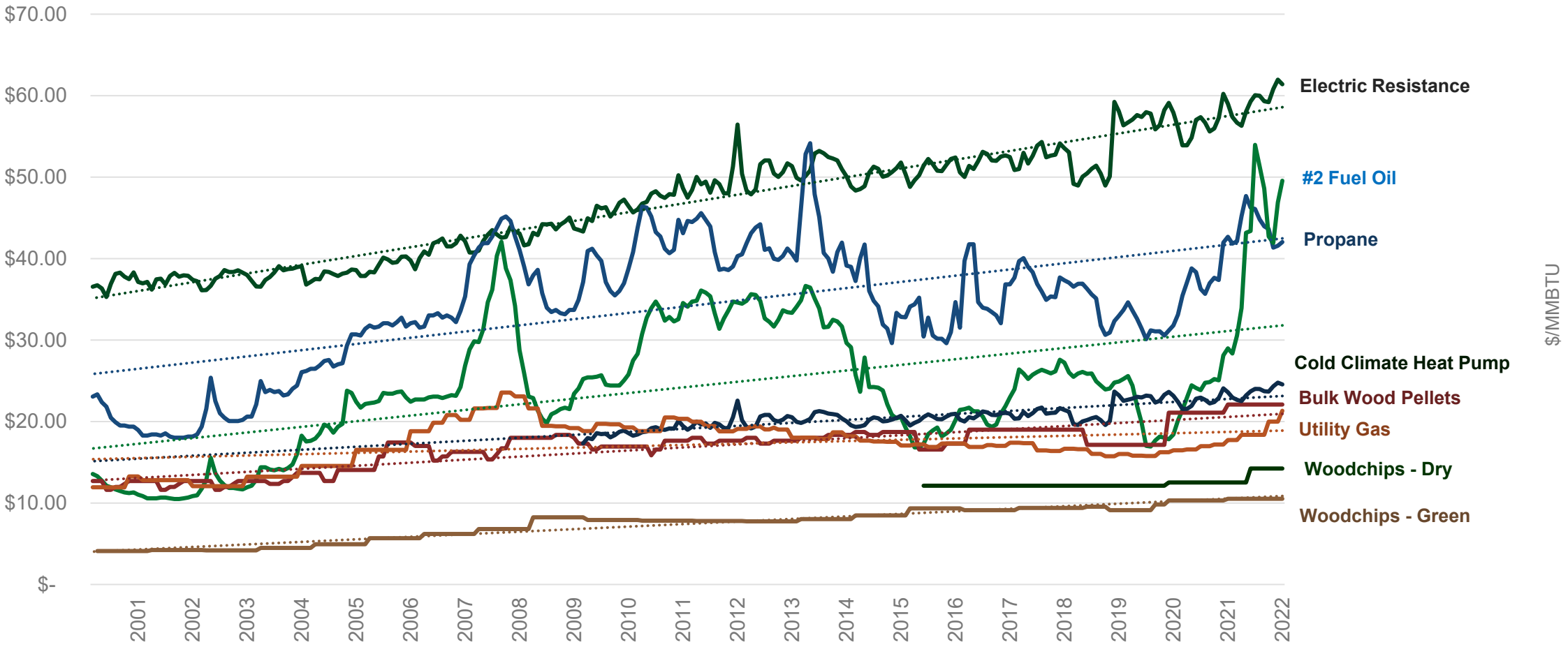


Delivered Fuel prices generally fell during 2023 relative to 2022 highs, as impacts from world events softened. Natural gas has recently remained the cheapest option to meet thermal operational needs on a $/MMBTu basis.

Prices collected in late November and early December 2023.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Vermont Heating Fuel Price Trends ($/MMBTU)

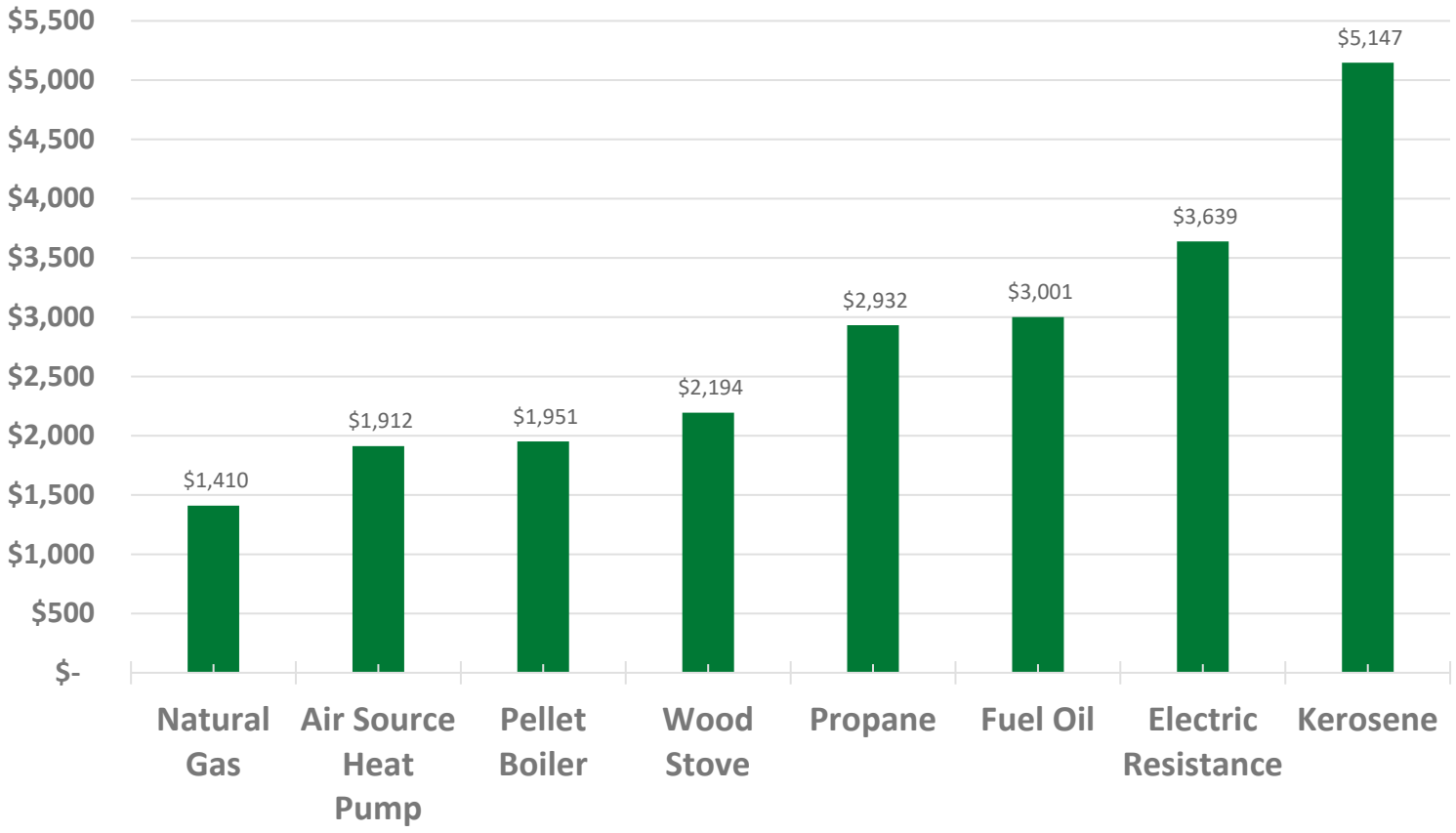


Fossil heating fuel prices are more volatile than electricity and wood fuels. Utility gas prices are regulated in VT helping to smooth out the gas commodity market price. The above graph shows prices from 2001 through 2022. Heating oil and propane have recently lessened to around $36/MMBTU in 2023.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Source: Public Service Department and the fuel price data came from the Energy Action Network, 2023.

Annual Average Household Heating Costs



There is a wide range of potential annual heating costs that an average Vermonter might pay if using a singular fuel to meet 100% of thermal demand (assumed to be 83 MMBTU/year).

Prices collected in late November and early December 2023.

VERMONT
DEPARTMENT OF PUBLIC SERVICE

Appendices

a. Progress Toward 2022 Comprehensive Energy Plan Recommendations
b. Report on Renewable Energy Programs
c. State Agency Energy Plan Update
d. Small Hydropower Assistance Program, Vermont Village Green Program, and Fuel Efficiency Fund Activity

VERMONT
DEPARTMENT OF PUBLIC SERVICE