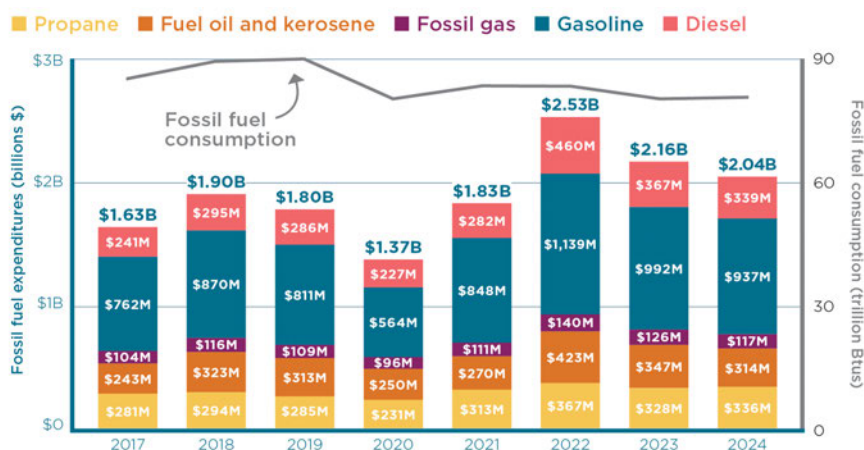




9. The Vermont Climate Economy: Energy, Resilience, and Opportunities Related to Climate Action

This chapter describes the economic impact of Vermonters' energy choices. These choices include the purchase of fuels, energy utilizing appliances and equipment, and other related investments. Beyond the direct impacts of the costs, the circulation of the money spent represents a significant portion of the Vermont economy.

FIGURE 9.1: Fossil fuel price volatility has led to large cost swings for Vermont, despite relatively flat consumption. ⁽⁶⁵⁾



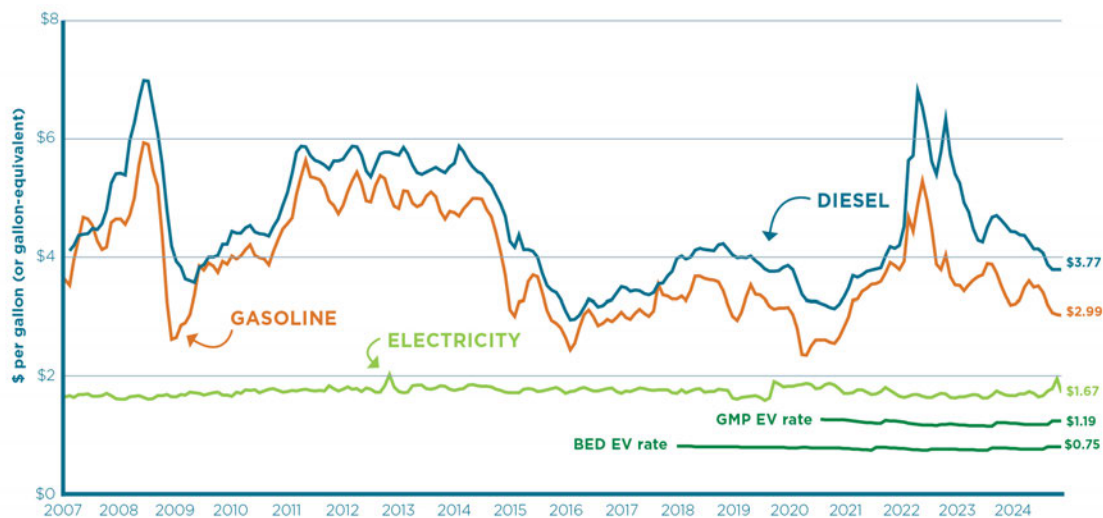
Sources: Gasoline and diesel sales volumes from Vermont Department of Taxes via the Joint Fiscal Office; fuel oil, kerosene, and propane sales volumes from Vermont Department of Taxes; fossil gas sales volumes and prices from VGS; other fuel prices from Vermont Department of Public Service and EIA. **Note:** This estimate only includes Vermont sales of gasoline, diesel, propane, fuel oil and kerosene, and fossil gas. It does not include sales of aviation gasoline or jet fuel from the transportation sector or of fossil fuel-based electricity generation (less than 10% of Vermont's electricity portfolio).

65 Energy Action Network, Annual Progress Report for Vermont 2025. (Energy Action Network, 2025), 3.

Figure 9.1 shows that Vermont continues to spend billions of dollars for the purchase of fossil fuels. Over \$2 billion per year was spent on fossil fuels for transportation and heating during each of the past three years. While there are some changes in overall fossil fuel volumes used, we are not yet seeing the scale of reductions necessary to meet the greenhouse gas emissions reduction requirements established in the Global Warming Solutions Act (GWSA).

As shown in Figure 9.2, fossil fuel prices since the Initial Plan was adopted in 2021 continue to show large fluctuations. Prices dropped during the Covid-19 pandemic but spiked in 2022 to the point where fuel oil and diesel prices reached more than \$5 per gallon.

FIGURE 9.2: Cost comparison of different transportation fuels over time in Vermont (adjusted for inflation, December 2024 dollars).⁽⁶⁶⁾



Sources: VT electricity, gasoline, and diesel prices: EIA, 2025; Off-peak EV rates: Green Mountain Power and Burlington Electric Department, 2025. Notes: Data through December 2024. Prices shown are in December 2024 dollars, using the U.S. Bureau of Labor Statistics Consumer Price Index. The electricity prices shown in light green are average statewide residential rates.

Additional Investment

Beyond the purchase of energy and fuels, each year Vermonters, businesses, and property owners also buy cars, appliances, and other equipment that uses energy. Many of the ways to reduce our use of fossil fuels involve the replacement of inefficient, polluting equipment with more efficient and less polluting electric or renewably fueled equipment. In some cases, the purchase of more efficient equipment and appliances leads to lower lifetime costs but also requires additional upfront cost, both of which are important in considering the overall economic impact of a cleaner energy future.

Table 9.1 provides a picture of estimated average annual spending in Vermont on the purchase and replacement of heating, cooling and cooking appliances, many of which have traditionally been powered by fossil fuel.

66 Energy Action Network.

TABLE 9.1: Estimated Average Annual Spending in Vermont on the Purchase and Replacement of Heating, Cooling and Cooking Appliances

Annual Energy Equipment Choices in Vermont	# of Units	Cost per Unit	Total Cost	Reference for Unit Numbers	Reference for Unit Costs
Heating system replacements	11,300	\$5,700	\$64.4 million	Zero Emission Heating Standard Study ⁽⁶⁷⁾ by Energy Action Network (EAN)	Blend for boiler and furnace ⁽⁶⁸⁾
Heating systems for new construction	1,680 residential	\$20,000	\$33.6 million	Zero Emission Heating Standard Study (EAN)	Above plus estimate for distribution system
Heat pumps to supplement existing systems	11,000	\$9,700	\$107 million	Zero Emission Heating Standard Study (EAN)	Blend of costs from NV5 Potential Study Appendices
Wood stoves to supplement existing systems	2,000	\$3,000	\$6 million	2020 Vermont Single Family Existing Homes Baseline Study ⁽⁶⁹⁾	Review of retail prices
Window unit air conditioners	15,000	\$400	\$6 million	2020 Vermont Single Family Existing Homes Baseline Study	Review of retail prices
Hot water heating replacements ⁽⁷⁰⁾	23,500	\$1,500	\$35.3 million	Zero Emission Heating Standard Study (EAN)	PSD Tech Ref Manual for HPWH; review for others
Hot water heating for new construction	1,680 residential	\$2,000	\$3.4 million	Zero Emission Heating Standard Study (EAN)	PSD Tech Ref Manual for HPWH; review for others
Cooking appliance replacement	15,000	\$1,000	\$15 million	Estimate based on average replacement time of 20 years	Review of retail prices
Cooking appliance for new construction	1,680 residential	\$1,500	\$2.5 million	Zero Emission Heating Standard Study (EAN)	Retail price plus installation

In total, these annual purchases amount to more than \$250 million. These numbers provide important context for the design of incentive programs meant to encourage the replacement of fossil-fueled appliances, both when such equipment reaches the end of its useful life as well as to promote replacement of a working appliance.

67 Energy Action Network. [Assessing zero-emission heating equipment standards for Vermont: Analysis of emissions, energy use, and energy costs](#). February 2025.

68 “How Much Does a New Furnace Cost?” Angi, last modified July 22, 2025.

69 This study reported an increase in room air conditioning penetration, which represents about 6,000 homes per year, and the replacement of existing air conditioners represents about 9,000 per year.

70 A mix of resistance, combustion, and heat pump (HPWH).

FIGURE 9.3: Vermont thermal measures: Historical uptake and Climate Action Plan pathways.⁽⁷¹⁾



There is appropriate interest in considering the investments necessary to transition to a lower greenhouse gas-emitting future. For thermal energy needs, the electrification of heating systems requires the purchase of heat pump systems that often cost more up front than the oil, propane, or natural gas combustion devices they are replacing; additionally, switching may necessitate changes to the existing ductwork and electrical system to accommodate the heat pump. However, these up-front costs can be balanced by multiple years of reduced expenditures on heating fuels, depending on the fuel being replaced and the utility territory they are located in. This hurdle of higher up-front costs to realize lower annual and lifetime costs points to the important role of grants and incentives (especially for Vermonters with lower- and middle-incomes) and financing programs (especially for middle- and upper-income Vermonters).

In addition to appliance purchase costs, Vermonters have been gradually carrying out weatherization actions to improve the quality and efficiency of existing homes and buildings. Historically, this has occurred at a level of about 2,000 homes per year, though that number has often increased when additional federal funding has been available, as in recent years.⁽⁷²⁾ Weatherization costs are a combination of materials purchased and the labor for installation.

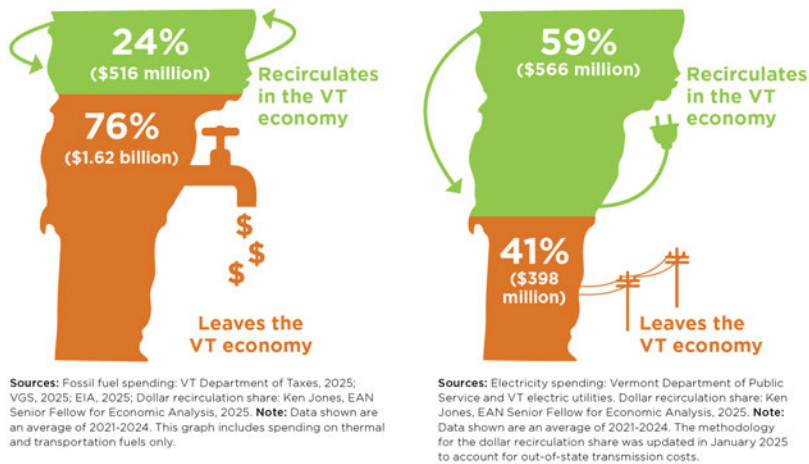
71 Energy Action Network, Annual Progress Report for Vermont 2024. (Energy Action Network, 2024), 27.

72 Based in part on [Annual Reports from the Office of Economic Opportunity](#) and supplemented by estimates on subsidized weatherization from Efficiency Vermont.

A different and more dramatic investment is represented in the purchase of vehicles in Vermont. In fiscal year 2024, Vermonters purchased new and used vehicles with an annual net cost of about \$2.4 billion.⁽⁷³⁾ In addition to the purchase price and fuel costs described earlier, Vermonters spend money for repairs, registration and insurance. To get an overall number, the total vehicle miles traveled in Vermont (7.15 billion miles in 2023)⁽⁷⁴⁾ can be applied to a fleet average of \$0.80 per mile,⁽⁷⁵⁾ meaning Vermonters spend more than \$5.7 billion on vehicle-based transportation needs.

In total, it is estimated that Vermonters annually spend more than \$1 billion on home heat and appliances, of which about 80% is represented by fuel costs, and more than \$5.7 billion on vehicle-based transportation needs, of which about 20% is represented by fuel costs. Fossil fuel purchases result in a large flow of dollars to out-of-state entities (on average, 75%)⁽⁷⁶⁾ because no fossil fuel production takes place in Vermont.

FIGURE 9.4: Vermont average annual fossil fuel spending versus Vermont average annual electricity spending.⁽⁷⁷⁾



To put these large numbers into context, Vermont's GDP totaled more than \$35 billion in 2023. There is no simple calculation of Vermont's energy GDP. The calculation would include the in-state portion of fuel (electricity, fossil and renewable) amounting to about \$1 billion and the in-state portion of capital expenditures for cars, trucks, HVAC equipment and building construction, which may add another \$1 billion. The remaining billions of out-of-state expenditures for fuel and capital purchases must be paid for by the export of Vermont goods and services.

73 This calculation is based on the collection of the vehicle Purchase and Use Tax. For both new and used car purchases, the tax is based on the difference between the purchase price and the trade-in value of the car being replaced (when appropriate). This means that the tax represents the increase in the vehicle stock value in the state.

74 Vermont Agency of Transportation. [Vermont Mileage and Vehicle Miles of Travel \(VMT\) Report: Calendar 2023](#).

75 "Average Cost of Owning and Operating an Automobile." Bureau of Transportation Statistics, last modified March 2025.

76 Energy Action Network. [Annual Progress Report on Emissions, Energy, Equity, and the Economy](#) (page 7). 2024.

77 Energy Action Network, Annual Progress Report for Vermont 2025. (Energy Action Network, 2025), 7.

In addition to the cost of the fuel itself, another portion of fuel purchase costs is in Vermont employment. Because fuel purchases have not changed significantly since the Initial Plan in 2021, the employment numbers for those involved in fossil fuel delivery have largely remain unchanged. There remain about 3,500 people employed at gas stations and convenience stores and 1,100 involved in fuel oil and propane deliveries. On top of these numbers, there are several hundred people employed in the wholesale movement of fossil fuels. Costs beyond employment include those related to transportation and business operations. Beyond fossil fuel delivery, there is also employment related to the installation and maintenance of fossil fuel-based equipment not reflected in the job numbers above.

The Clean Energy Economy

As with other sectors of the economy, the expenditures by Vermonters are reflected in economic activity that results in local employment and, for investors, a return on their capital. The “clean energy economy” includes the development of renewable energy supplies, design and installation of efficiency technologies, and the several support sectors that result in retail sales and service.

Each year, the Department of Public Service produces a report that focuses on the employment associated with the clean energy economy. The most recent report reflects conditions through the year 2024.⁽⁷⁸⁾ At that time, more than 18,000 people were employed in the clean energy sector, which represents about 6% of the Vermont workforce.

The largest subsectors include solar installations, weatherization, installation of heating systems, and production of woody biomass. It is also important to recognize that some of this employment includes workers carrying out functions in the non-clean energy economy; the full-time equivalent in the clean energy sector is closer to 13,500 people.

Beyond the thermal and transportation sectors, Vermont has focused on the efficient use of electricity for more than 25 years. These electric efficiency investments have helped avoid the need for new electricity supplies and distribution and transmission investments.

Efficiency Vermont, overseen by the Public Utility Commission, uses funds from ratepayers to support cost-effective investments in electric efficiency. In 2023, Efficiency Vermont invested more than \$40 million in “electric resource acquisition” spending. These are direct investments in businesses and residential properties to reduce electricity use. In 2023, the electricity reductions amounted to more than 72,000 Megawatt hours (MWh). These savings accumulate over time, and in their 2023 annual report, Efficiency Vermont reports that the lifetime savings from the past three years of investments is more than 3 million MWh.⁽⁷⁹⁾ At current rates, this amounts to more than \$480 million in customer savings.

78 Vermont Department of Public Service, Clean Energy Development Fund. [2024 Vermont Clean Energy Industry Report](#).

79 Efficiency Vermont. [Annual Report 2023](#), p. 34. December 23, 2024.

One set of strategies worthy of note is an increase in the use of liquid and gaseous biofuels. Liquid biofuel feedstocks include waste fats, oil and grease, which can be sourced locally, but larger volume liquid biofuels rely on seed oil crops that are largely grown in more intensively cropped parts of the U.S. and Canada.

Renewable natural gas can be derived from animal manure waste, which has multiple benefits when compared to management that allows for methane release to the air. Renewable natural gas is also created in the anaerobic treatment of wastewater and other food wastes. To the extent that these activities take place in Vermont, it displaces the purchase of natural gas from the Canadian pipeline.

Forest resources have also long been used to provide heat. Modern wood heating appliances are more efficient in their use of wood. Cord wood and wood chips primarily come from in-state sources. Wood pellets, while produced in Vermont, currently largely come from out-of-state suppliers.

Current Costs of Climate-Related Damages

Chapter 15, Scientific Underpinning of Emissions Reductions, includes information on the updated calculation for the social costs of greenhouse gases that assigns a dollar amount to each ton of greenhouse gas emitted. Those calculations are based on global impacts and report the incremental damage from each ton emitted. A different way to look at economic damages is to consider the actual costs in Vermont that have risen from climate-related impacts on economic activity. It is possible to look at trends in damages and, utilizing advances in attribution science, estimate how much greater damages have been due to climate destabilization.

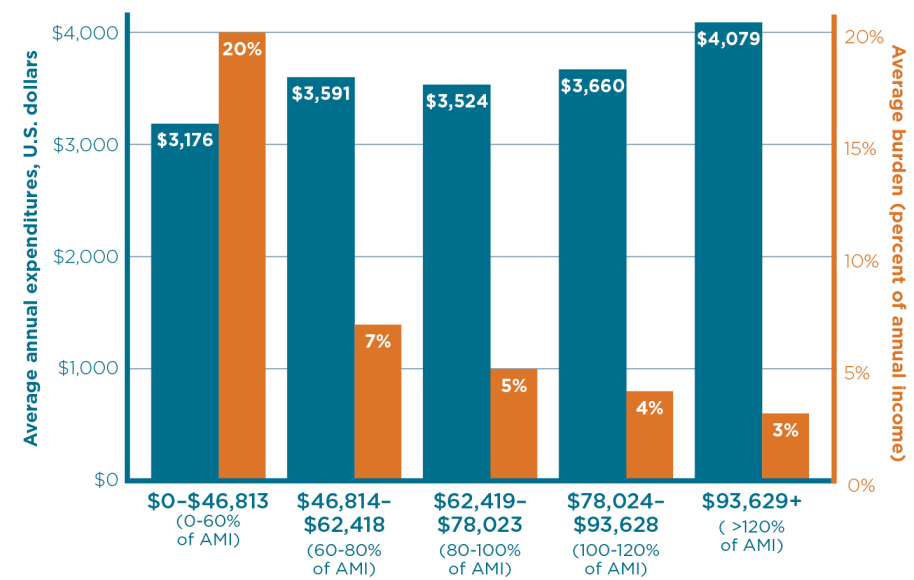
The most obvious examples of climate-related damages in Vermont are the increasing frequency and severity of flooding events. From 2011 to 2024, Vermont tied for the fifth highest number of climate-related disaster declarations of any state in the U.S., and had the fourth highest per capita climate disaster costs, as measured by FEMA and HUD assistance dollars.⁽⁸⁰⁾ Unfortunately, FEMA and other federal government payments represent only a fraction of the total costs that Vermonters face in repairing the damages from climate-related events. Insurance payments are in addition to FEMA payments and the continuing trend of increasing insurance premiums reflects the increasing payments that are necessary in addressing climate-related damages. Furthermore, insurance companies that work in multiple states must also address climate-related damages that are resulting from increases in hurricane and wildfire events taking place outside of Vermont. In this way, Vermont pays a portion of the costs of the climate-related damages resulting from out-of-state occurrences.

80 [“Atlas of Accountability: County-level Disaster Declarations and Congressional Districts \(2011-2024\).”](#) Rebuild by Design, last modified December 31, 2024.

Recognizing the Important Aspect of Equity in the Energy Economy

It is typical and yet somewhat misleading to talk about the Vermont economy as the dollar total of income and expenditures. Unfortunately, such a presentation, including in this section, misses the important fact of the distribution of costs and income to different portions of the Vermont population.

FIGURE 9.5: Vermont combined average household heating and electricity fuel costs and burden by income level, 2019–2023.⁽⁸¹⁾



Source: U.S. Census Bureau, 2019–2023 American Community Survey 5-year Public Use Microdata Samples.
Notes: Income categories are based on 2019–2023 median household income in Vermont of \$78,024. Energy burden refers to the share of annual household income spent on energy. Costs include fuel only and are not inclusive of equipment and maintenance costs.

Understanding that the over \$2 billion spent on fossil fuels means that some households are spending 20% or more of their overall income on those purchases is critical in the design of strategies to move us to a lower carbon future. Energy burdens above 6% are considered to be high and above 10% are considered severe.⁽⁸²⁾

A corollary to the direct expenditures for energy purchases is the very different cost of capital when households need to borrow to make purchases for their home or transportation. Any program that increases household debt has a much greater negative impact on a low-income household than on a middle- or upper-income household.

81 Energy Action Network, Annual Progress Report for Vermont 2025. (Energy Action Network, 2025), 6.

82 American Council for an Energy Efficient Economy. [National and Regional Energy Burdens](#). September 2020.

Resilience and Adaptation

This *Vermont Climate Action Plan 2025* includes the consideration of resilience and adaptation as a necessary direction for Vermont to pursue in the context of rapidly changing climate conditions.

Vermonters have made and will, to an increasing extent, need to make investments to reduce the economic danger from future climate-related events such as floods, drought, and high temperature events. As with mitigation, these activities will require investments, and such investments will yield local economic activity as well as a reduction in future costs. Concurrent with the development of the CAP, the Agency of Natural Resources led the development of the Resilience Implementation Strategy that sought to catalog existing programs and identify critical gaps within the resilience and adaptation work supported by state government. As a next step, the Vermont State Treasurer will be examining possible approaches to expand funding for this work.⁽⁸³⁾ In addition to state-led work, there are also considerable resilience and adaptation efforts underway at the regional and local levels. A visit to the [Flood Ready Vermont](#) website provides a snapshot of the planning activities underway in each of Vermont's municipalities. As resilience and adaptation efforts are growing rapidly at all levels, developing a more fulsome understanding of the economics of resilience and adaptation will require additional research and data collection.

83 [“Resilience Implementation Strategy,”](#) State of Vermont, last modified September 2025.