

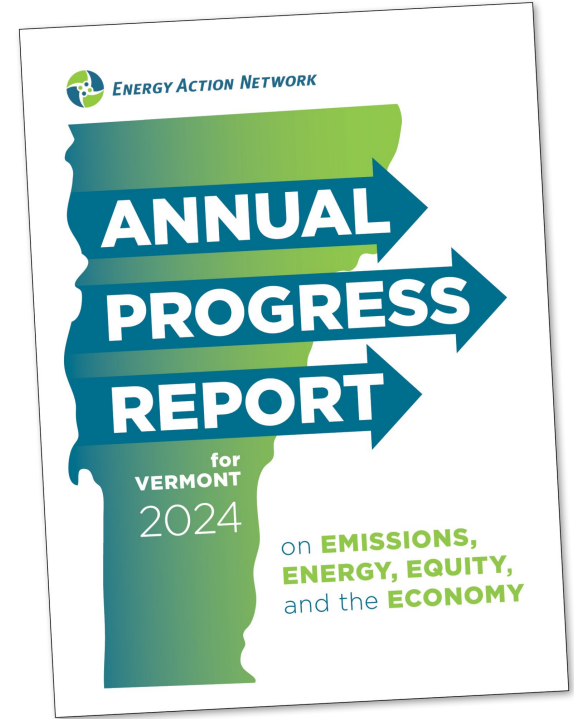
# 2024 Annual Progress Report for Vermont

on Emissions, Energy, Equity,  
and the Economy

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Lena Stier, Data Manager & Research Analyst

Jared Duval, Executive Director

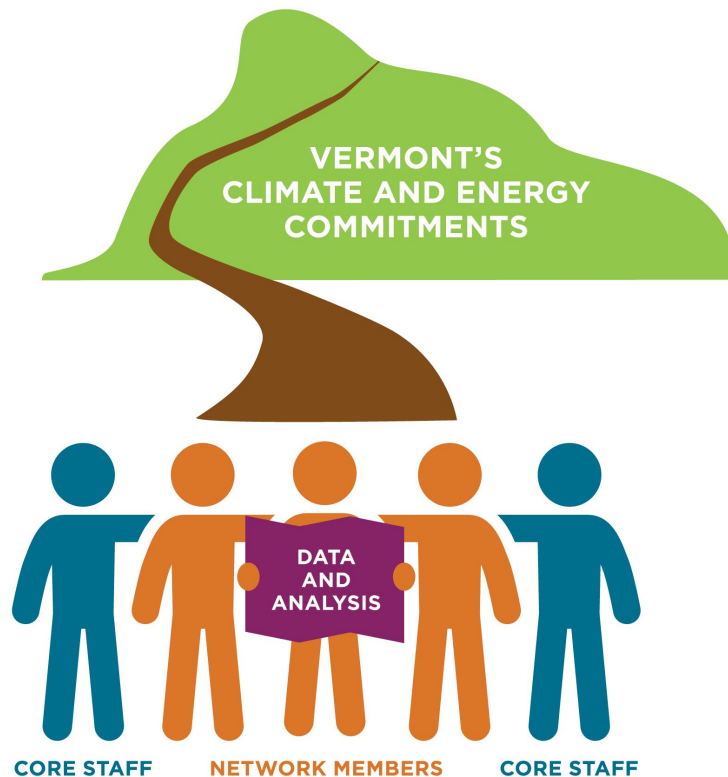
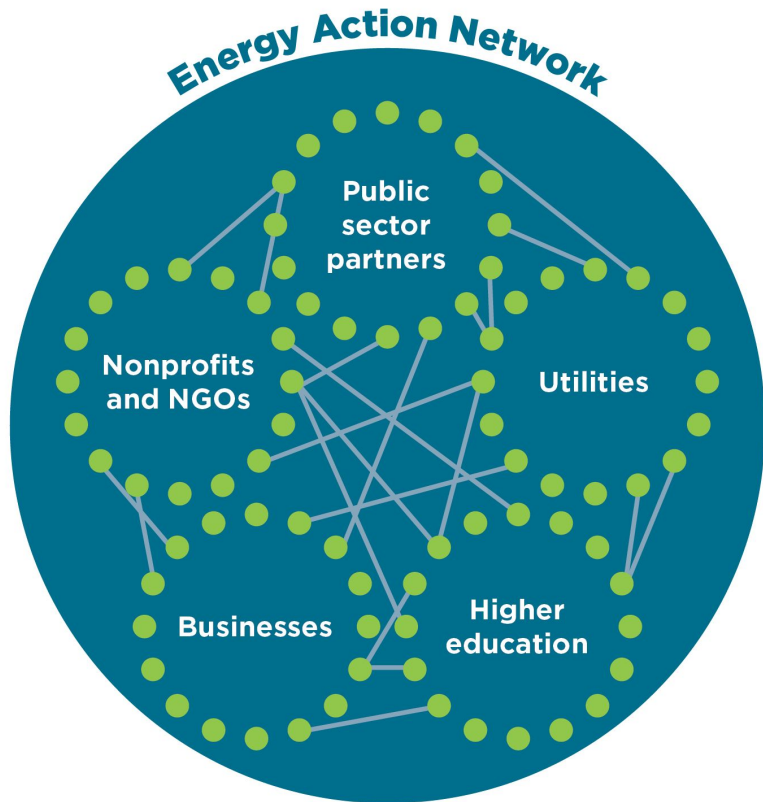


October 23, 2024





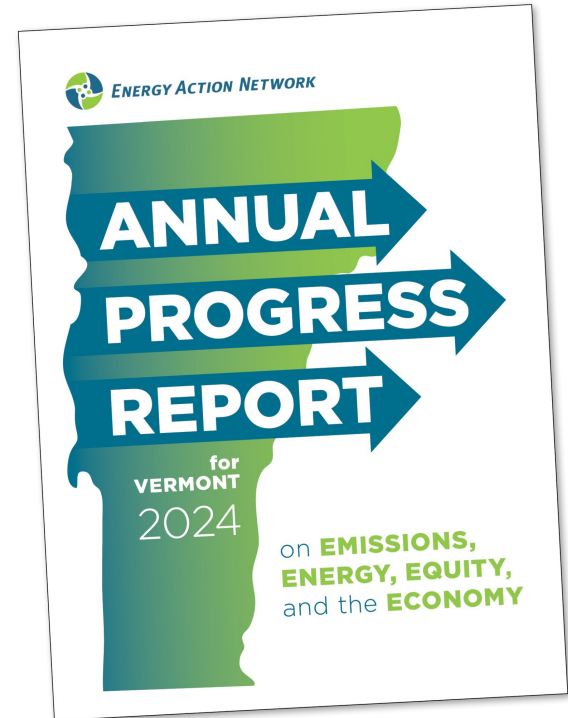
# About Energy Action Network





# Key Findings

1. Climate disruption is here
2. True resilience requires adaptation and mitigation
3. Delaying action is costly
4. Getting off fossil fuels benefits Vermont's economy, health, and more
5. Vermont is often a leader, but not always
6. Progress requires policy





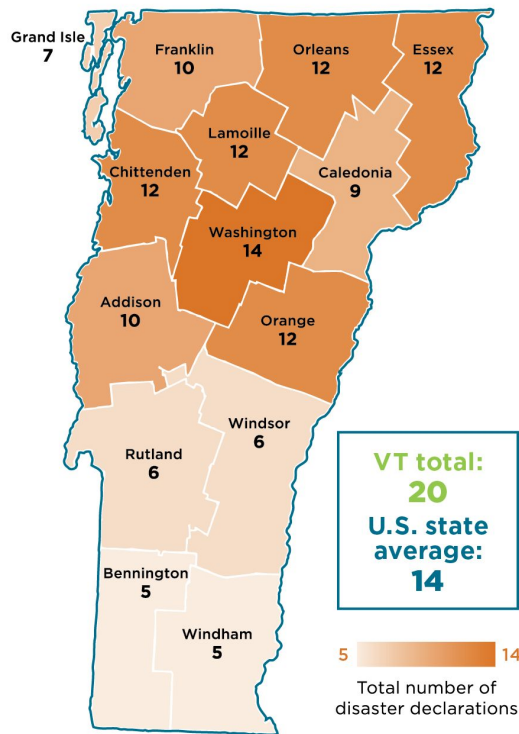
# Key Finding 1: Climate disruption is here



*Image source: VT  
National Guard*

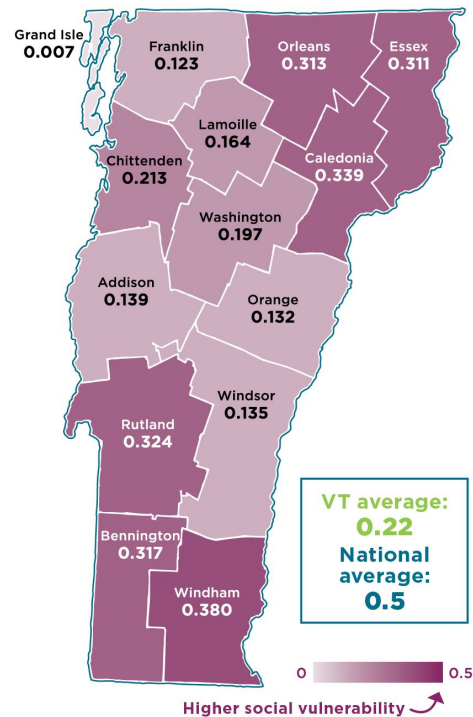
- 7th highest number of climate disasters in the U.S.
- 5th highest per capita disaster costs (\$684/person)

## Climate-related federally declared disasters in Vermont, 2011–2023



**Source:** Rebuild by Design, "Atlas of Accountability," 2024.  
**Note:** There were 20 total disaster events that impacted one or more counties in Vermont.

## Social vulnerability index by Vermont county



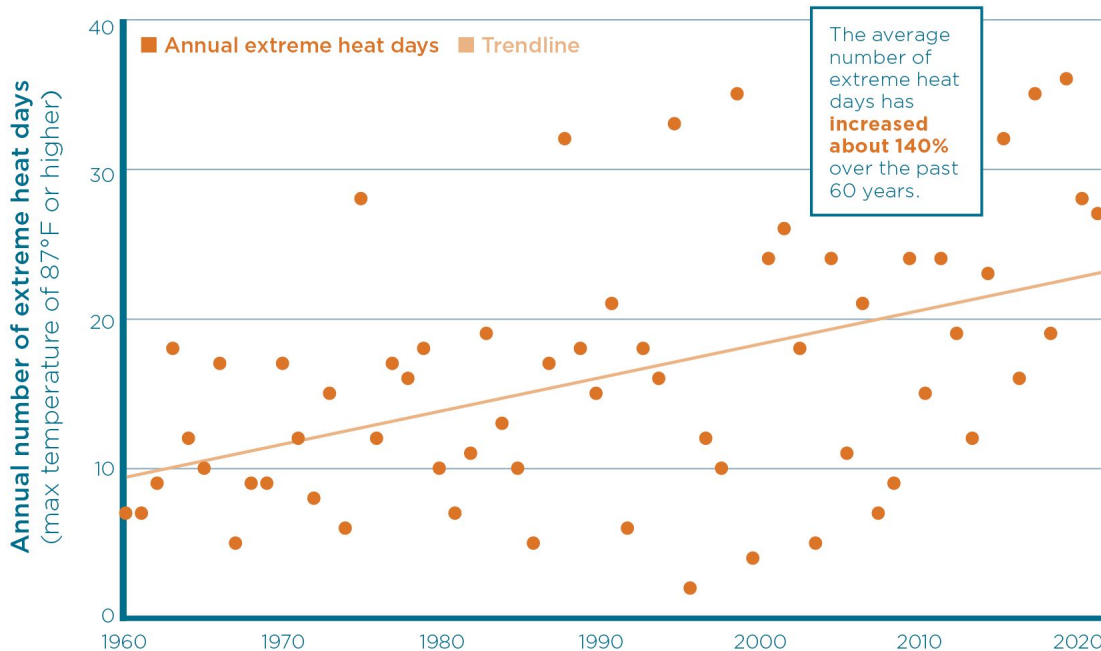
**Source:** Centers for Disease Control and Prevention, National Social Vulnerability Index 2020 Database. **Note:** Darker colors indicate higher relative social vulnerability. "Social vulnerability" includes factors such as poverty, lack of access to transportation, and crowded housing that may weaken a community's ability to prevent human suffering and financial loss in a disaster. Values range from 0 to 1, with higher values indicating greater vulnerability.





# Key Finding 2: True resilience requires mitigation and adaptation

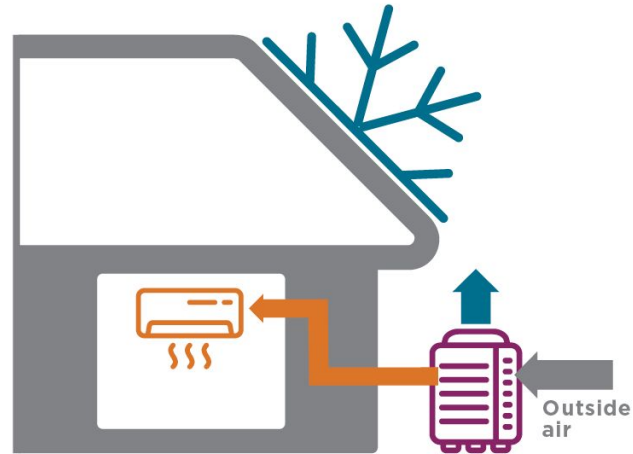
## Extreme heat days in Burlington, VT, 1960–2022



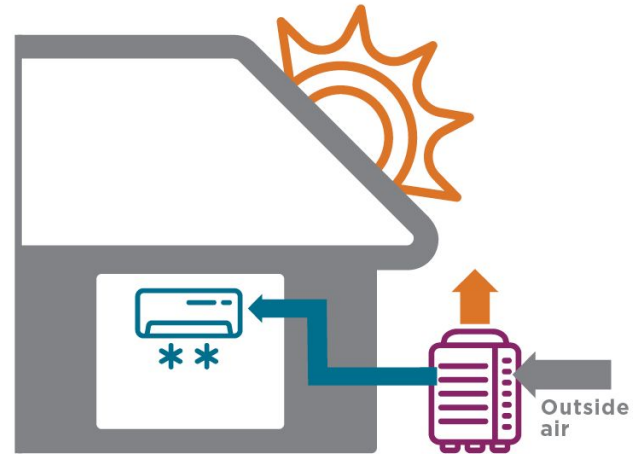
Source: Burlington Weather Station, 2024. Note: In Vermont extreme heat is considered 87°F (31°C) or higher.

As Vermont experiences more extreme heat, heat pumps are an important mitigation *and* adaptation strategy

## Heat pumps provide both heating and cooling



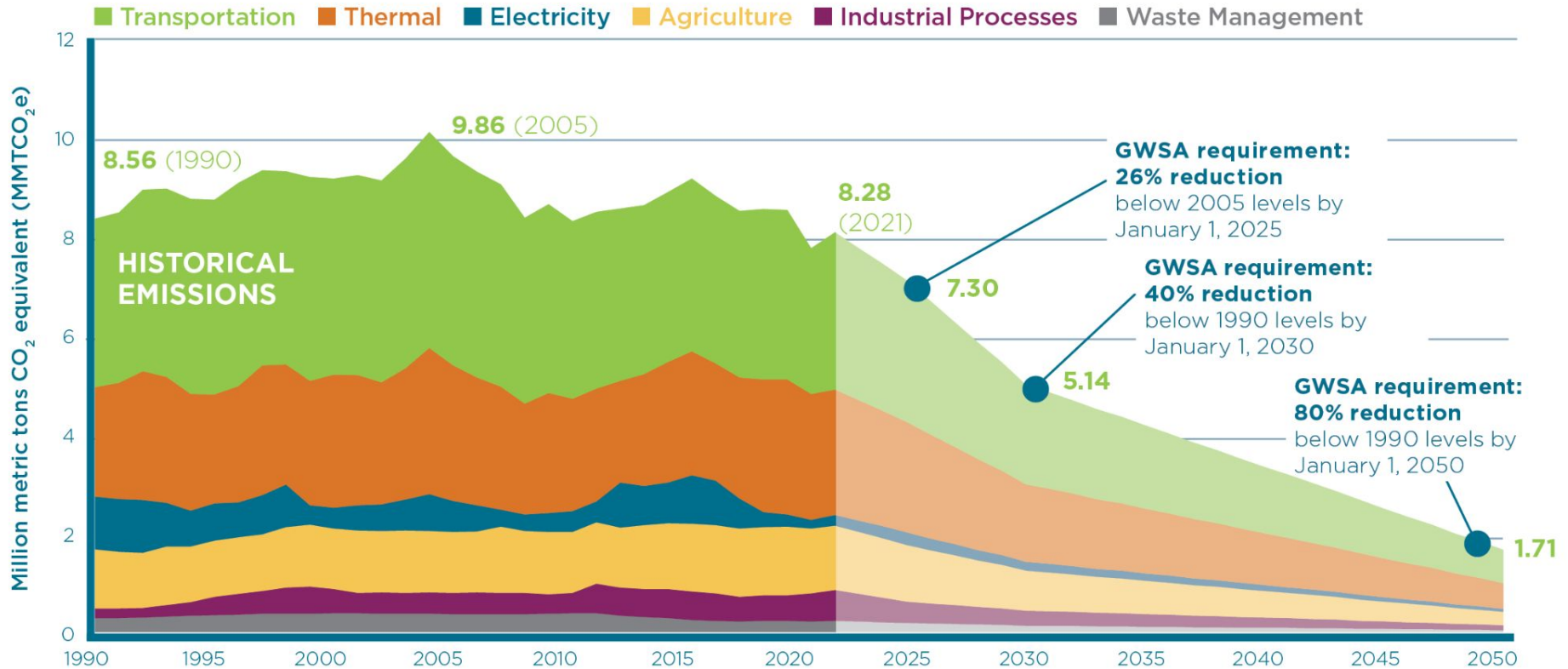
Heating mode



Cooling mode

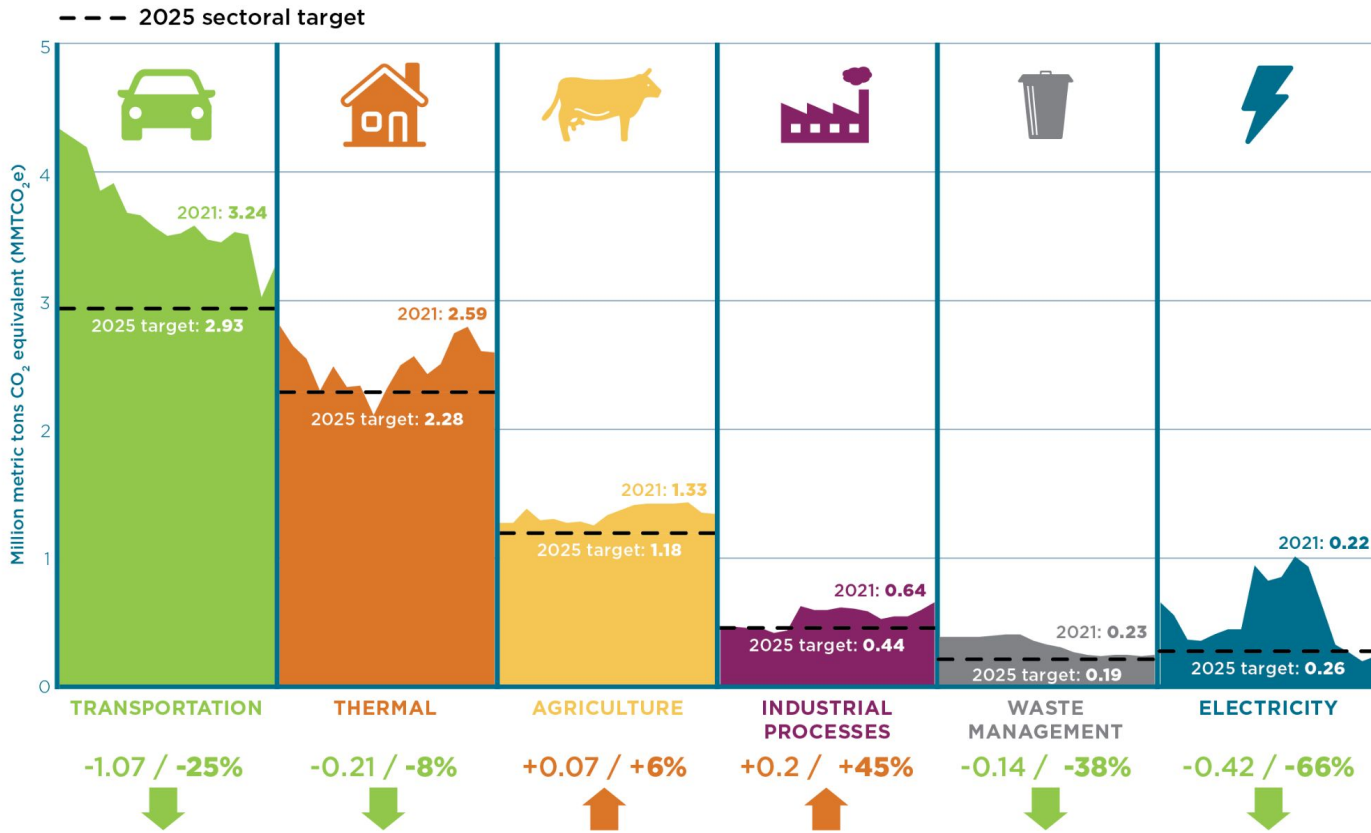


# Vermont's historical GHG emissions and future requirements

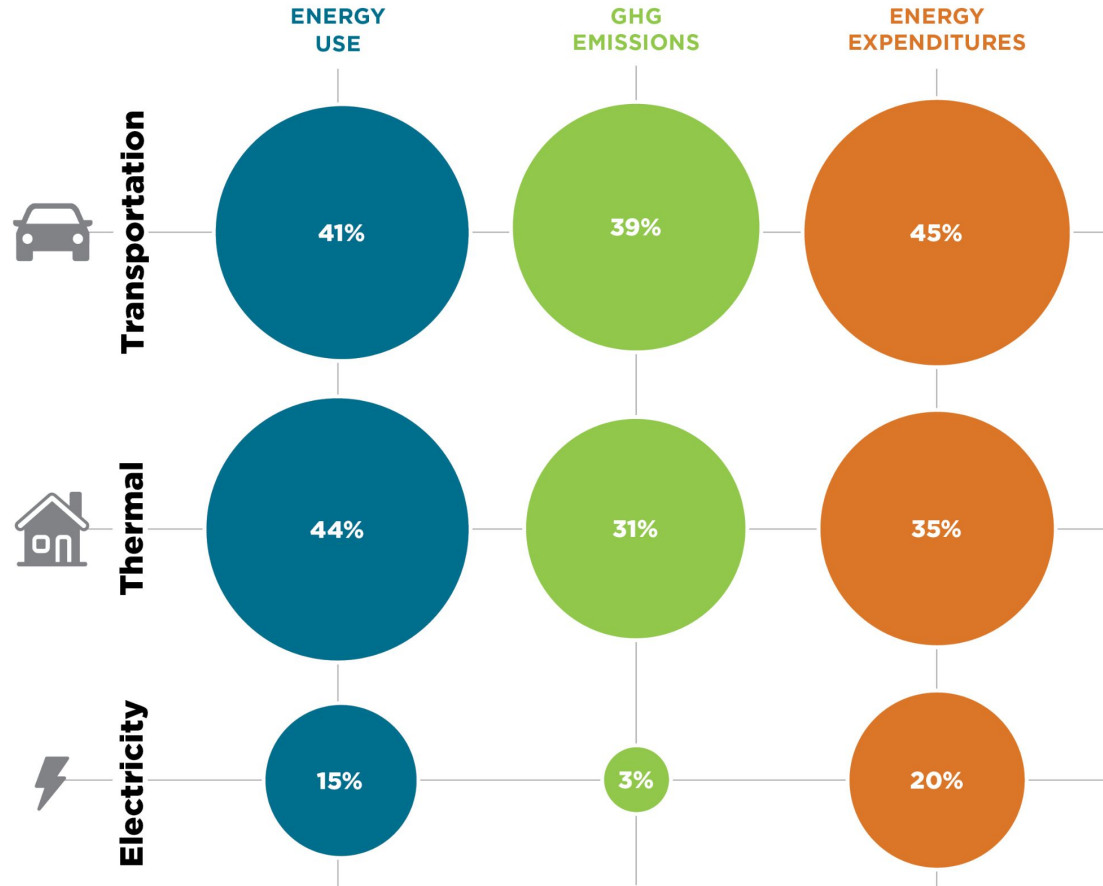


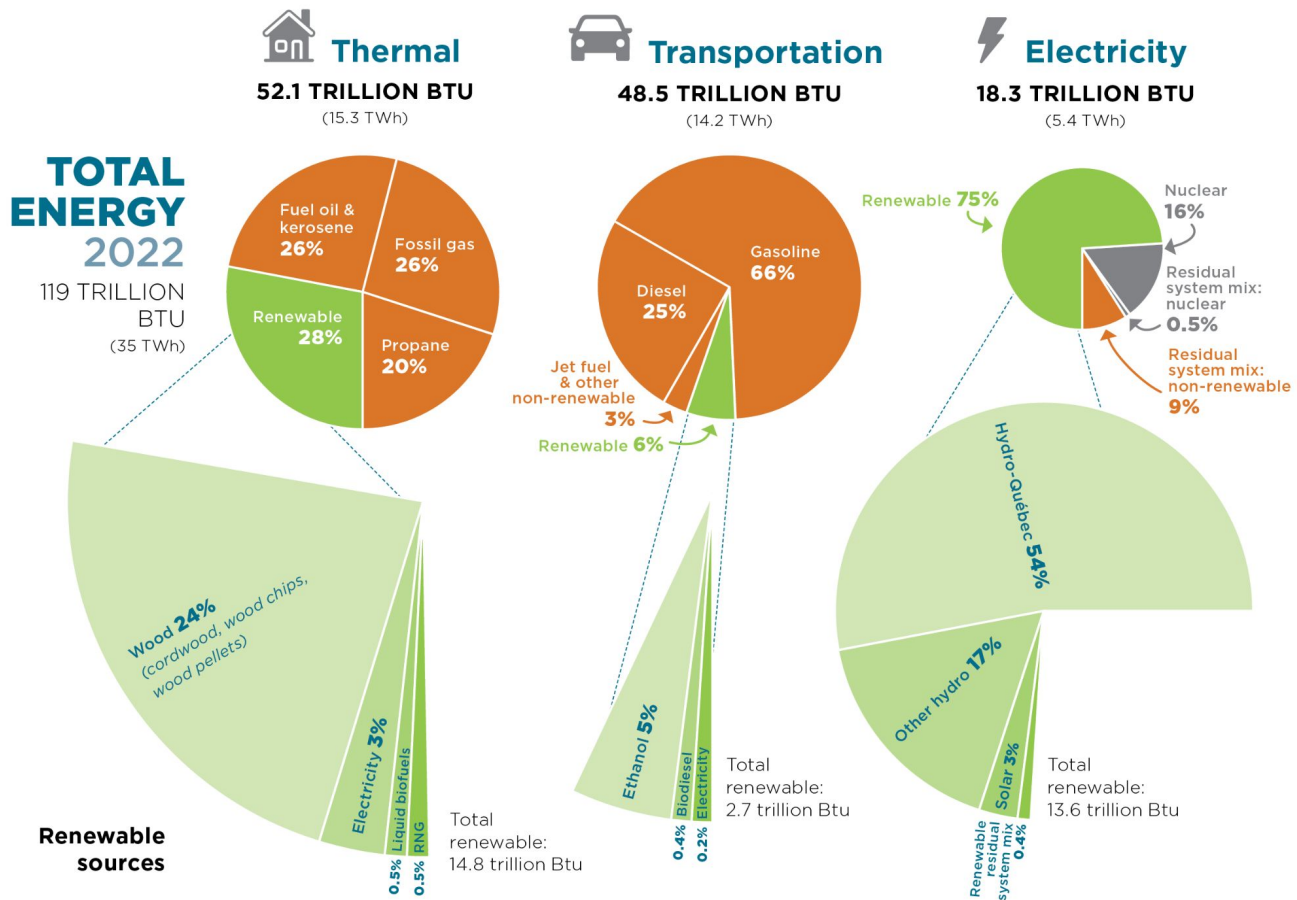


# Vermont GHG emissions by sector, 2005-2021



# Key sectors: Transportation and thermal/buildings





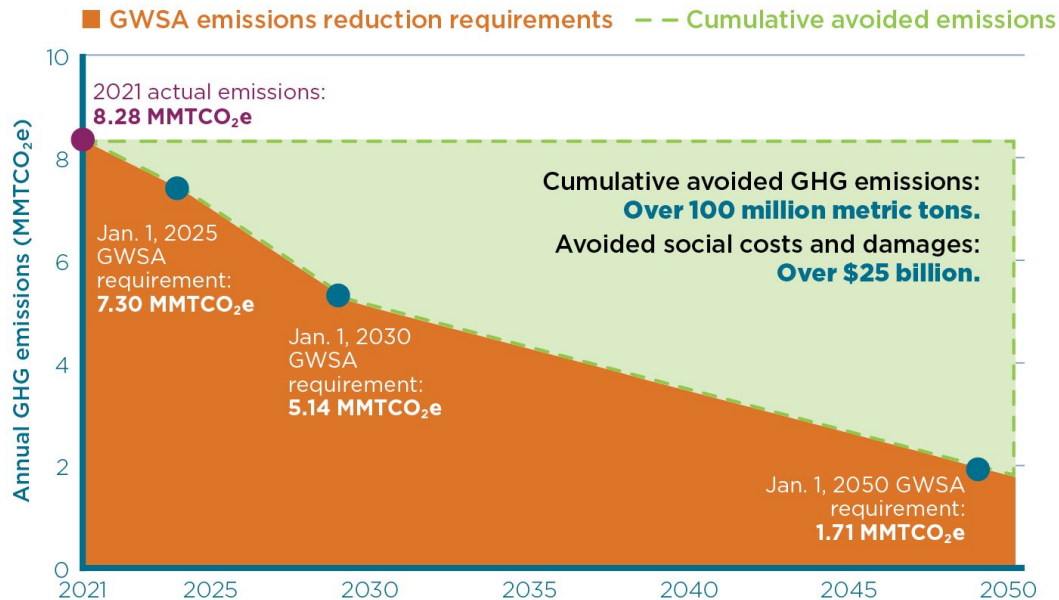
**Sources:** Energy Information Administration, 2024; Efficiency Vermont, 2024; Vermont Department of Public Service, 2024; Vermont Department of Taxes, 2024; EAN, 2024. **Notes:** The electricity pie chart does not include electricity used for thermal and transportation purposes, as that electricity usage is shown in the respective thermal and transportation pie charts. Percentages may not sum exactly to 100% due to independent rounding. The electricity pie chart shows Vermont's electricity portfolio after accounting for RECs. One result of this is that wind and biomass generation in Vermont do not show up as electricity resources, since RECs from those resources are primarily sold out of state. Fuel oil includes a small amount of kerosene, which accounts for 0.6% of total thermal energy use.



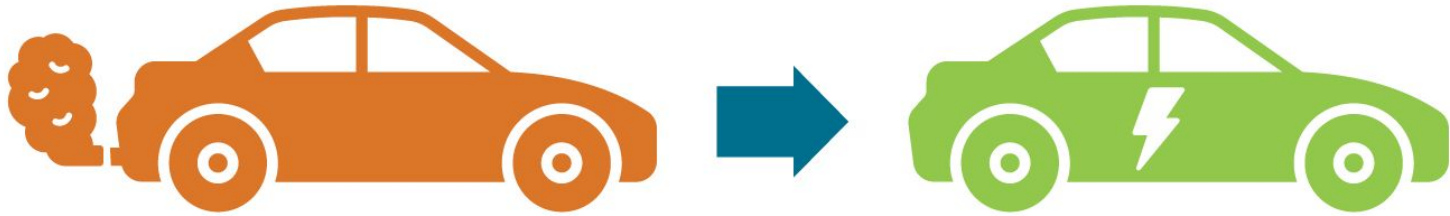
# Key Finding 3: Delaying action is costly

## Cumulative avoided GHG emissions by 2050 and avoided social costs

### VT Global Warming Solutions Act compliance scenario



## Lifetime cost savings of switching to an electric vehicle



**Estimated savings on fuel and maintenance: ~ \$9,500**

**+**

**Avoided social costs from reduced fuel-related GHG emissions over the life of the vehicle: ~ \$7,000**

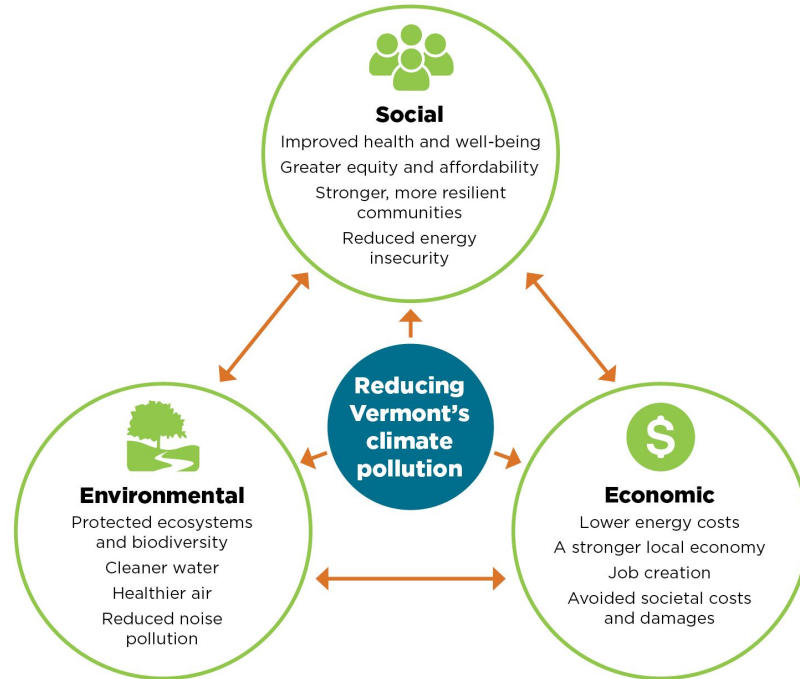




# Key Finding 4: Getting off fossil fuels benefits Vermont's economy, health, and more

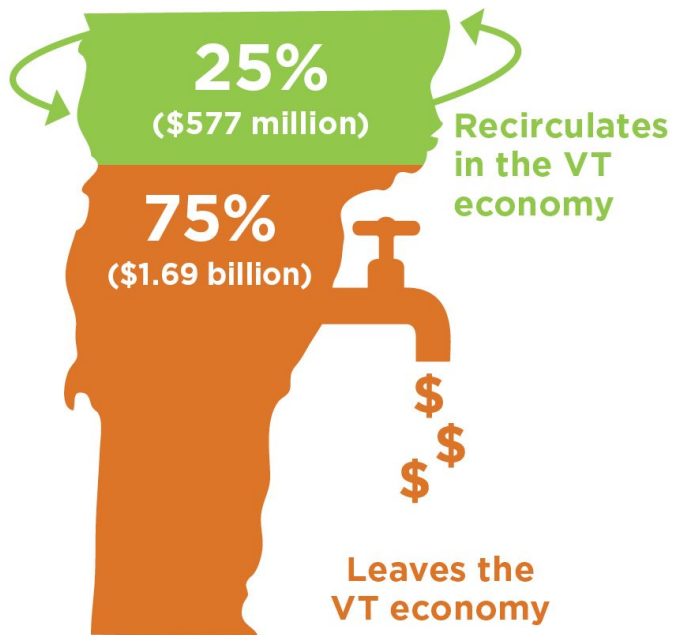
Reducing VT's climate pollution is a win-win-win.

## Co-benefit opportunities from reducing Vermont's climate pollution

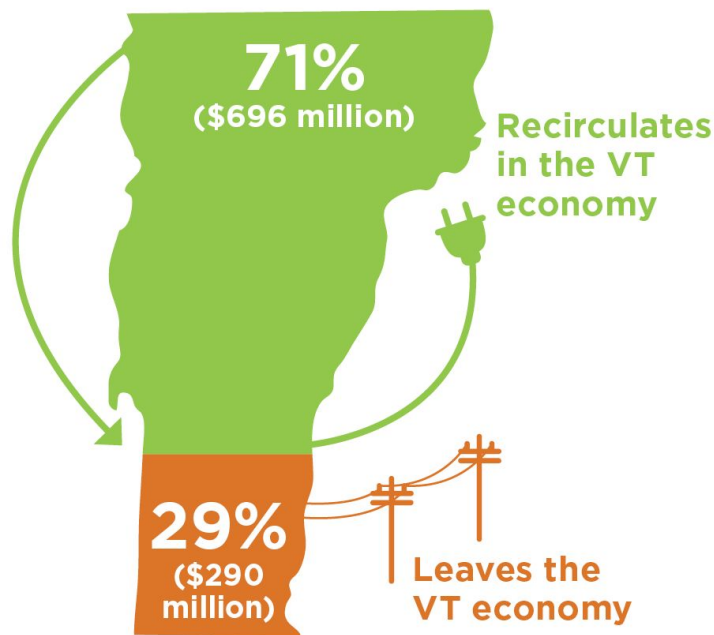


# Fossil fuels are a drain on Vermont's economy

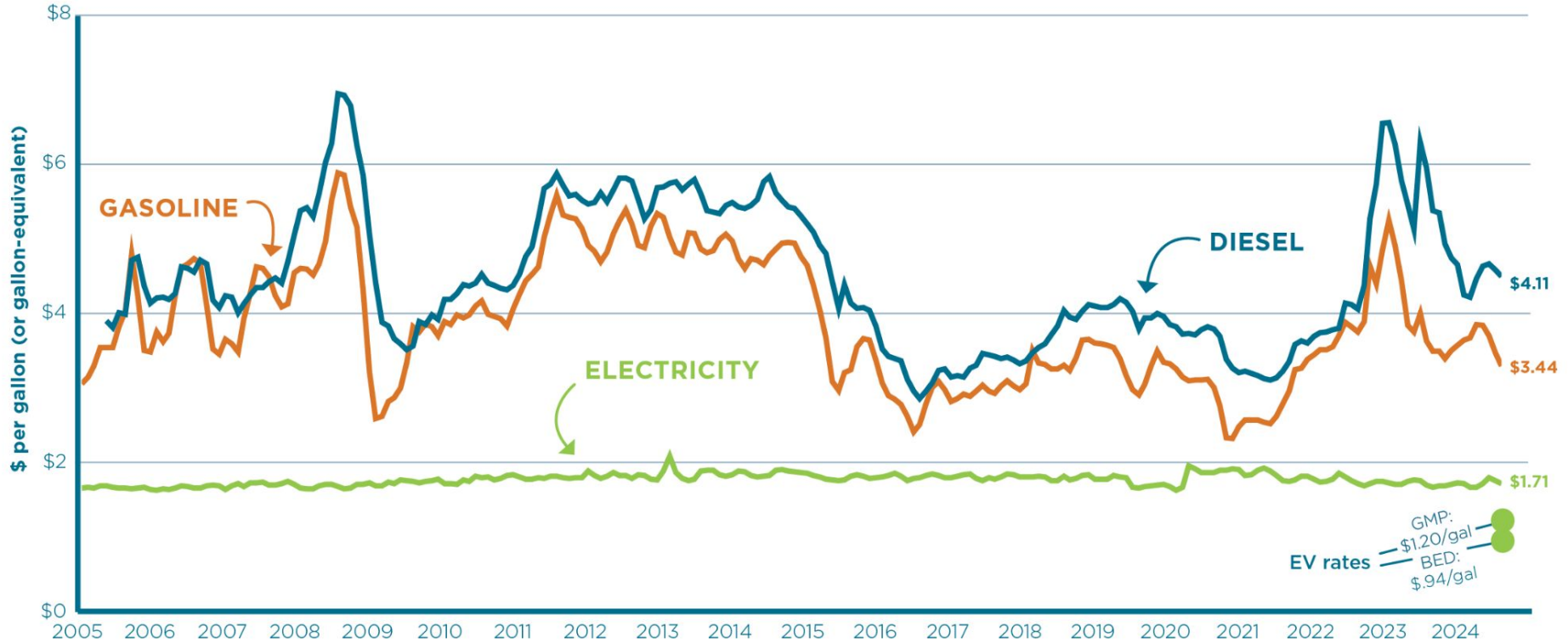
## Vermont fossil fuel spending, 2023



## Vermont electricity spending, 2023

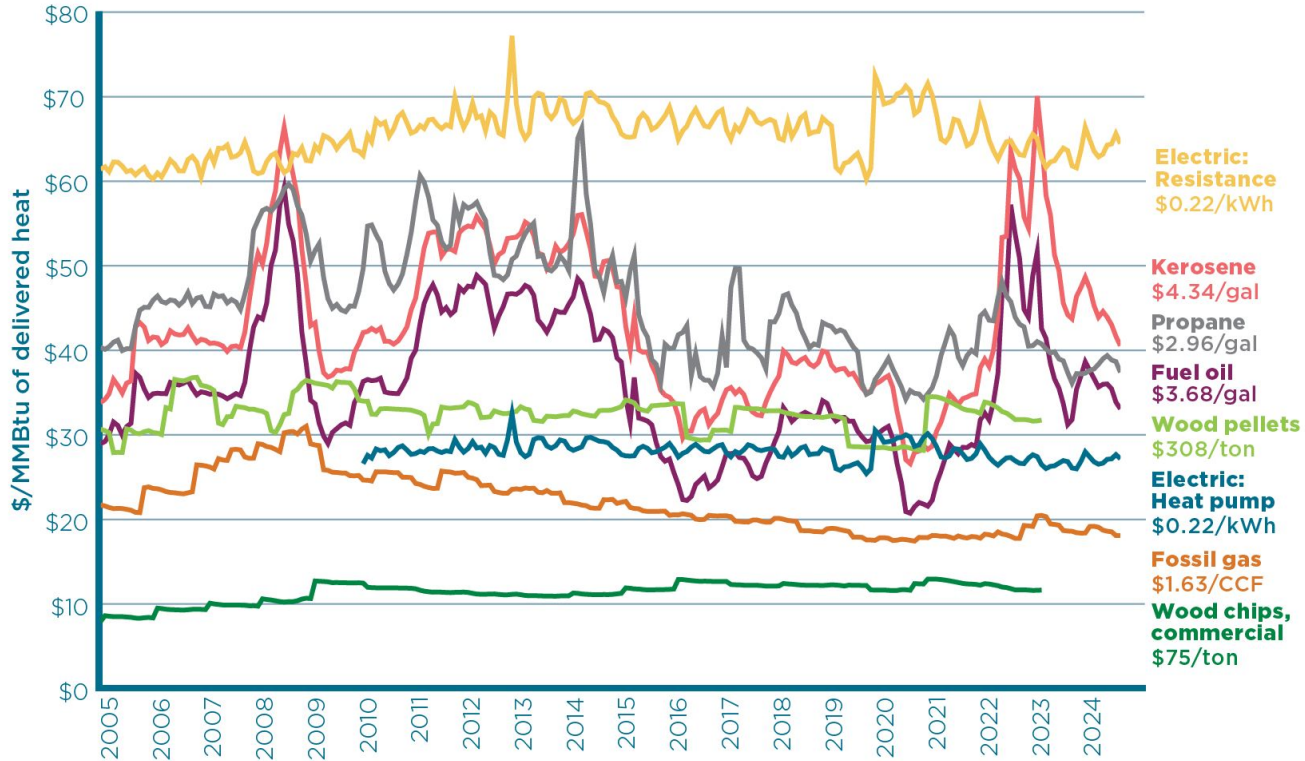


# Cost comparison of different transportation fuels over time in VT (adjusted for inflation, June 2024 dollars)

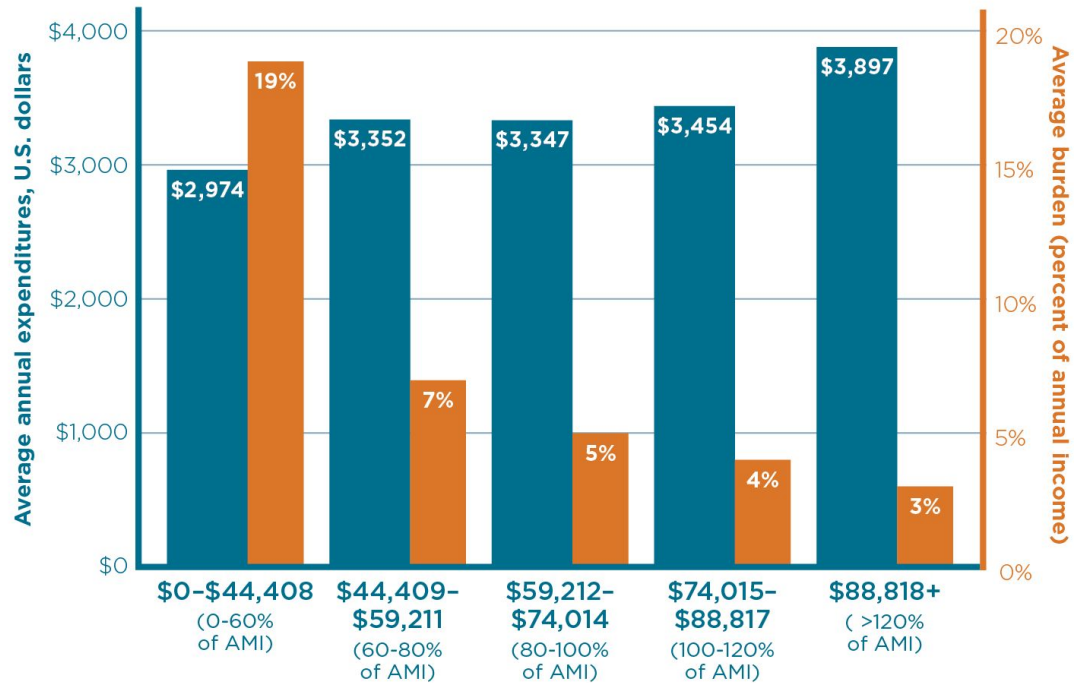




# Cost comparison of different heating fuel options over time (adjusted for inflation, June 2024 dollars)



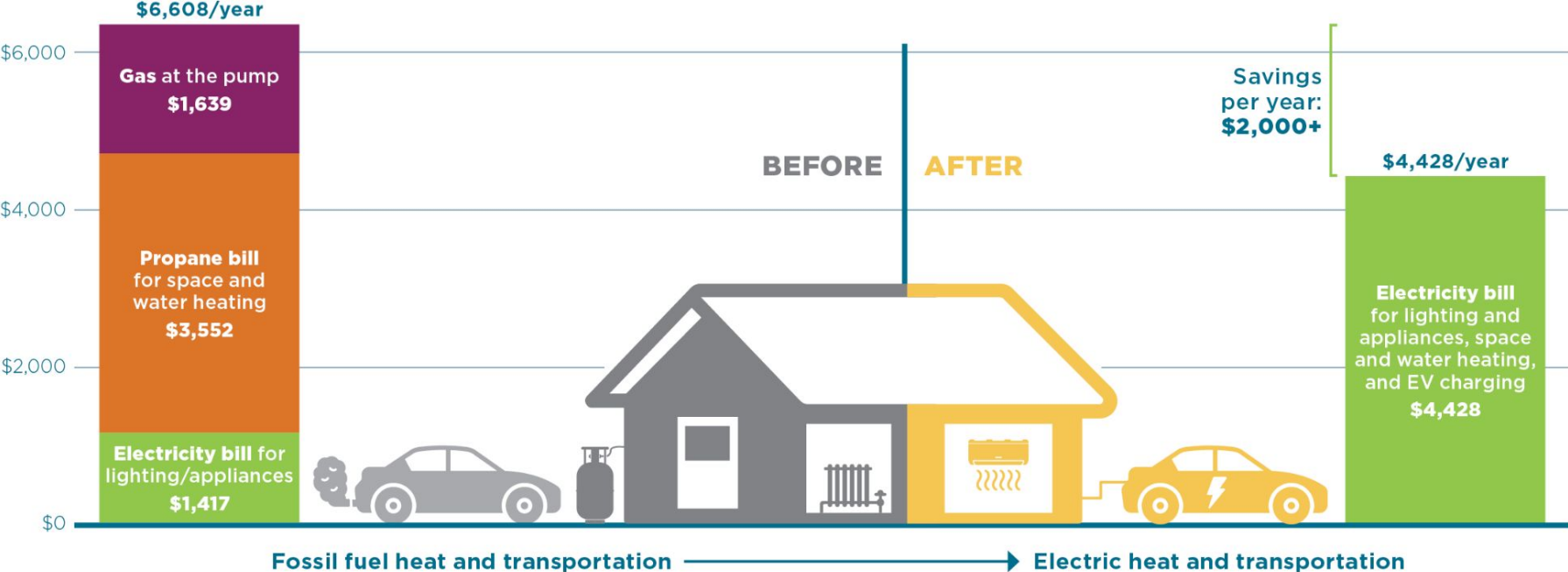
# Vermont combined average household heating and electricity fuel costs and burden by income level, 2018-2022



**Source:** U.S. Census Bureau, 2018-2022 American Community Survey 5-year Public Use Microdata Samples. **Notes:** Income categories are based on 2018-2022 median household income in Vermont of \$74,014. 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.

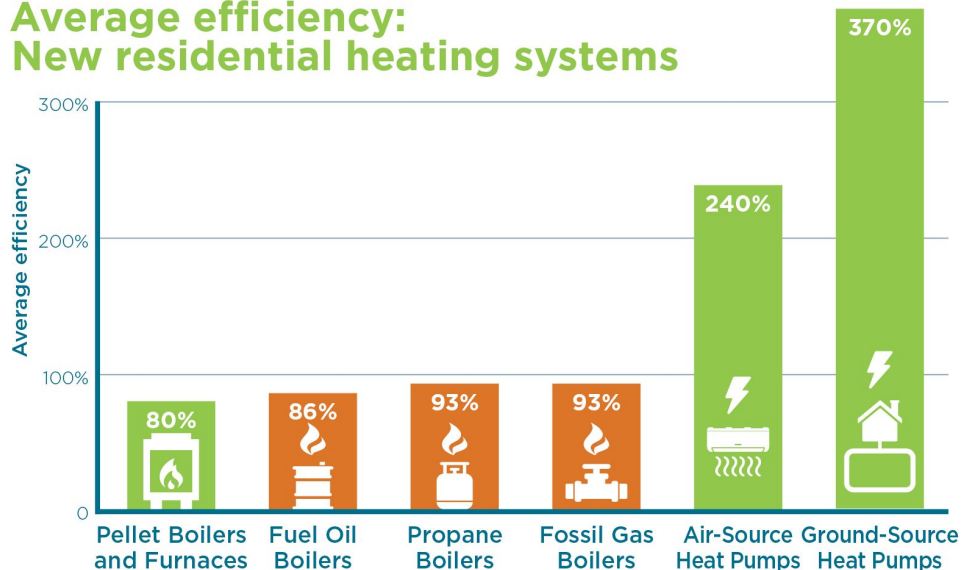


# Estimated annual energy bill costs for a sample Vermont single-family household, before and after electrification

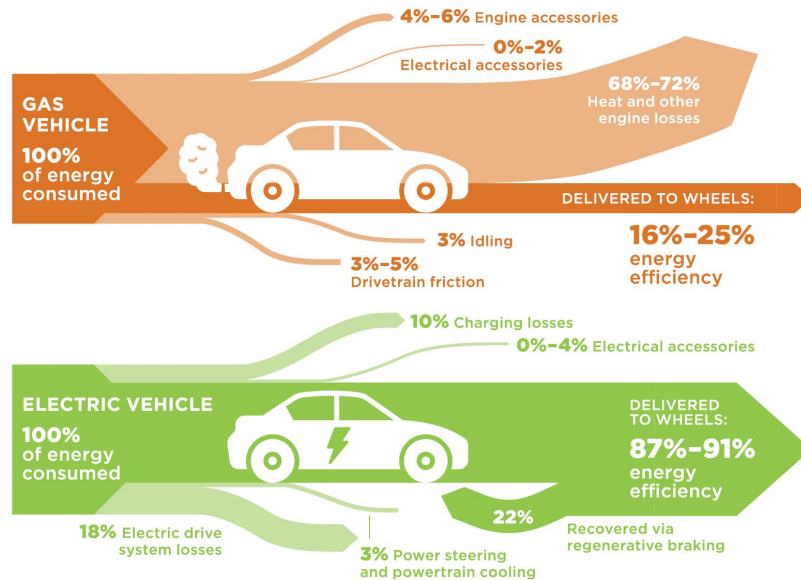


# Modern electric equipment is more energy efficient

## Average efficiency: New residential heating systems

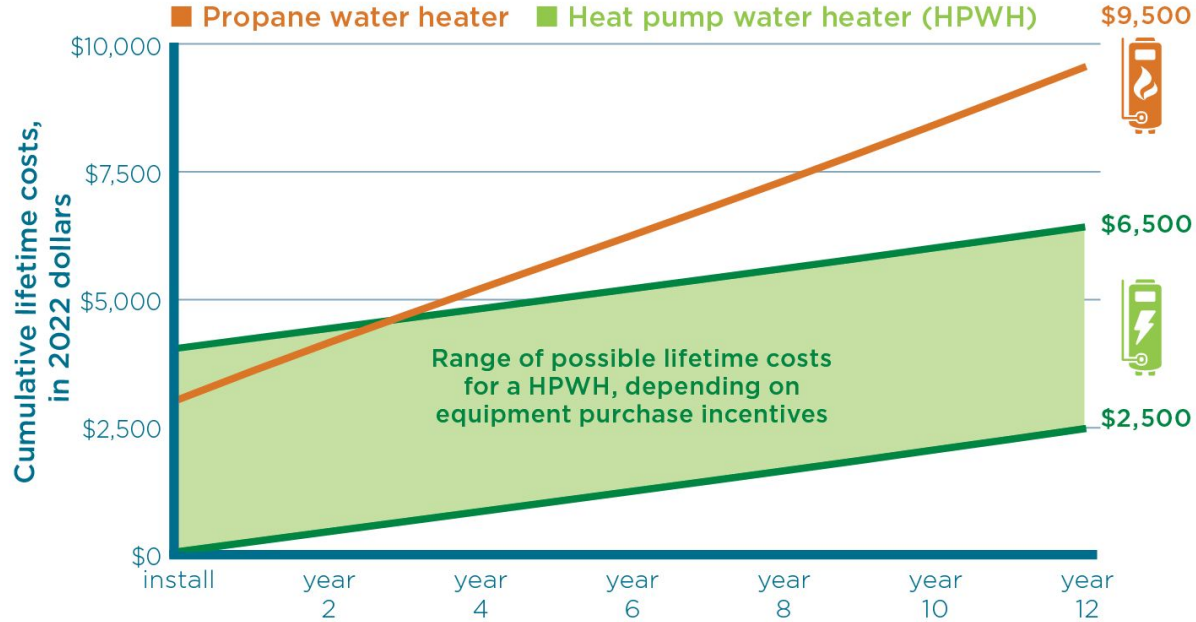


## Efficiency of energy use: Gas vehicles vs electric vehicles



Source: fueleconomy.gov. Note: Estimates shown are combined city and highway driving.

# Lifetime costs of propane water heater vs. heat pump water heater (installed cost + fuel)



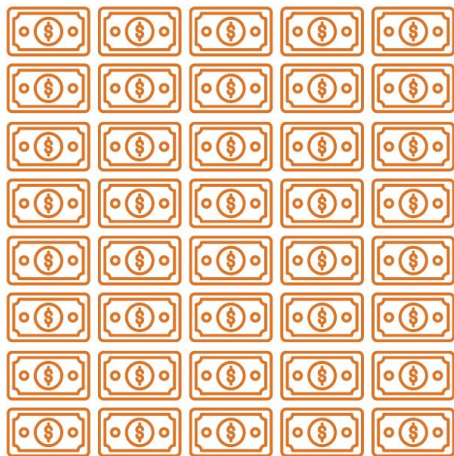
Propane water heater lifetime emissions: **12.2** metric tons of CO<sub>2</sub>e

Heat pump water heater lifetime emissions: **0.1** metric tons of CO<sub>2</sub>e



# Average annual fuel savings from switching to an EV: Vermont high gasoline users vs. typical gasoline users

**\$4,034/year in savings**



**High gasoline user:** fuel savings after switching to an EV



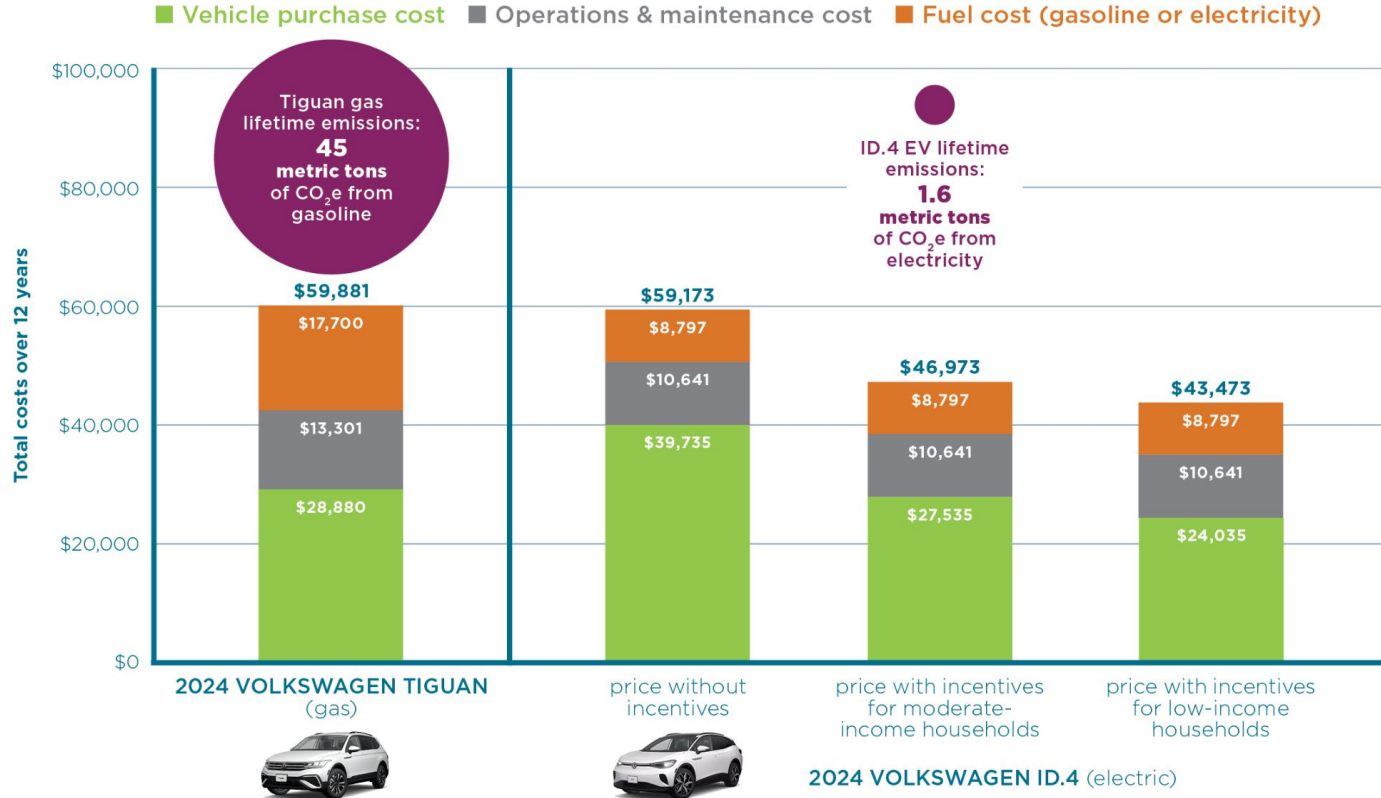
**\$943/year in savings**



**Typical gasoline user:** fuel savings after switching to an EV



# Lifetime costs and GHG emissions of comparable gas vs electric vehicles in Vermont



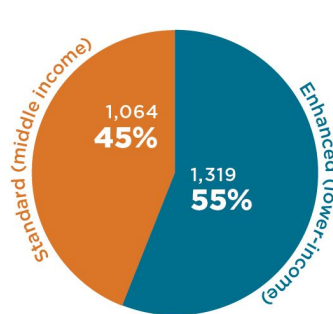
## Potential cost of a used EV after incentives



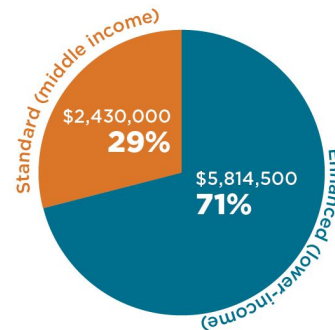
|   | Standard incentive          | < \$57,000 income incentive  |
|---|-----------------------------|------------------------------|
| Used 2022 Chevrolet Bolt EV 1LT Hatchback 4D: Typical listing price | \$20,043                    | \$20,043                     |
| Federal: Tax credit   | -\$4,000                    | -\$4,000                     |
| Electric utility: Rebate*   | -\$250 to -\$1,500          | -\$900 to -\$2,500           |
| State: MileageSmart**   | \$0                         | -\$2,500 to -\$5,000         |
| State: Replace Your Ride (if applicable*)                           | \$0 to -\$2,500             | \$0 to -\$5,000              |
| <b>Total incentives</b>   | <b>-\$4,250 to -\$8,000</b> | <b>-\$7,400 to -\$16,500</b> |
| <b>Cost after incentives</b>  | <b>\$12,043 to \$15,793</b> | <b>\$3,543 to \$12,643</b>   |

## Vermont state incentives for new EVs, by income level

Rebates issued

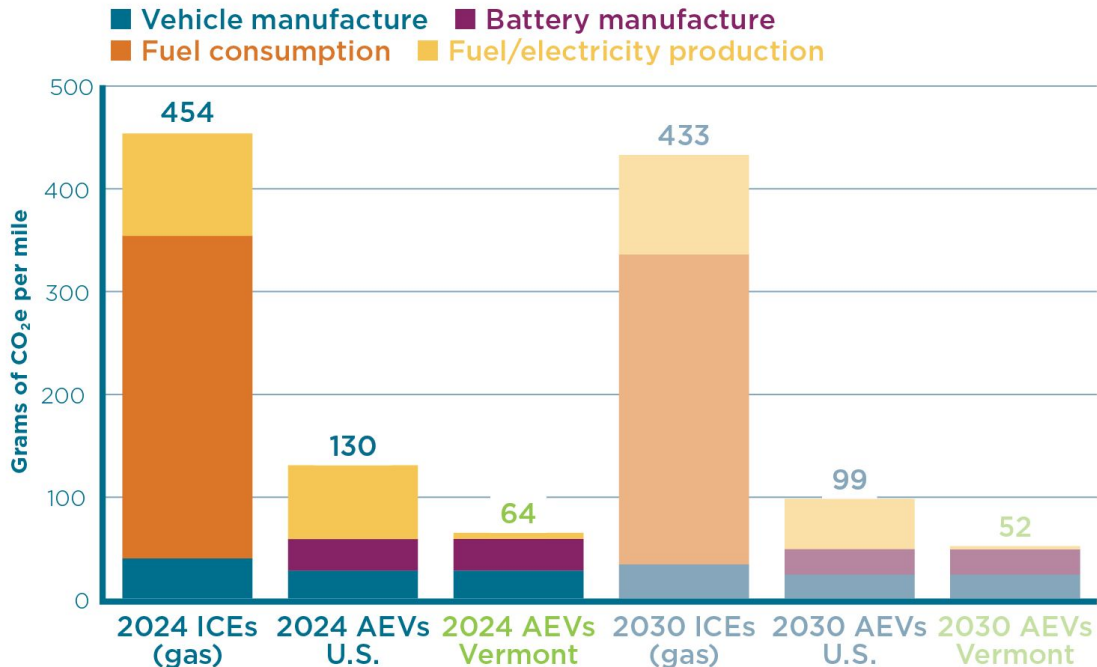


Funding issued





# Lifecycle GHG emissions of gas vs electric SUVs in the United States and Vermont



**Sources:** ICCT, "Life-cycle greenhouse gas emissions of U.S. sedans and SUVs with different powertrains and fuel sources," 2024. Vermont electricity emissions based on 2020 life cycle emissions from Vermont

Agency of Natural Resources/ERG, "Vermont Energy Sector Life Cycle Assessment," 2024. **Notes:** AEV = all-electric vehicle, ICE = internal combustion engine vehicle. Emissions from AEVs are presented separately for the US and Vermont because Vermont's electricity portfolio is much lower-emitting than the national average. Emissions from AEVs in 2030 are expected to be lower than in 2024 because of reduced production-related emissions and continued decarbonization of the electricity sector.





# Key Finding 5: Vermont is often a leader, but not always

CLIMATEWIRE

## Vermont enacts groundbreaking 'Climate Superfund' law

By Adam Aton | 05/31/2024 06:15 AM EDT

The state will seek money from fossil fuel companies to cover the costs of climate change.



## Where Vermont is LEADING

Among the first states to establish a legal requirement to reduce climate pollution with the 2020 **Global Warming Solutions Act**

First state to pass a **Climate Superfund Act**, requiring fossil fuel companies to pay for climate damages

First state to create an **energy efficiency utility** (Efficiency Vermont)

First state after California to adopt the **Advanced Clean Cars II program**, which requires that all new vehicle sales be zero-emission by 2035

**Highest number of EVs per capita** in New England and highest number of public EV chargers per capita of any state in the country

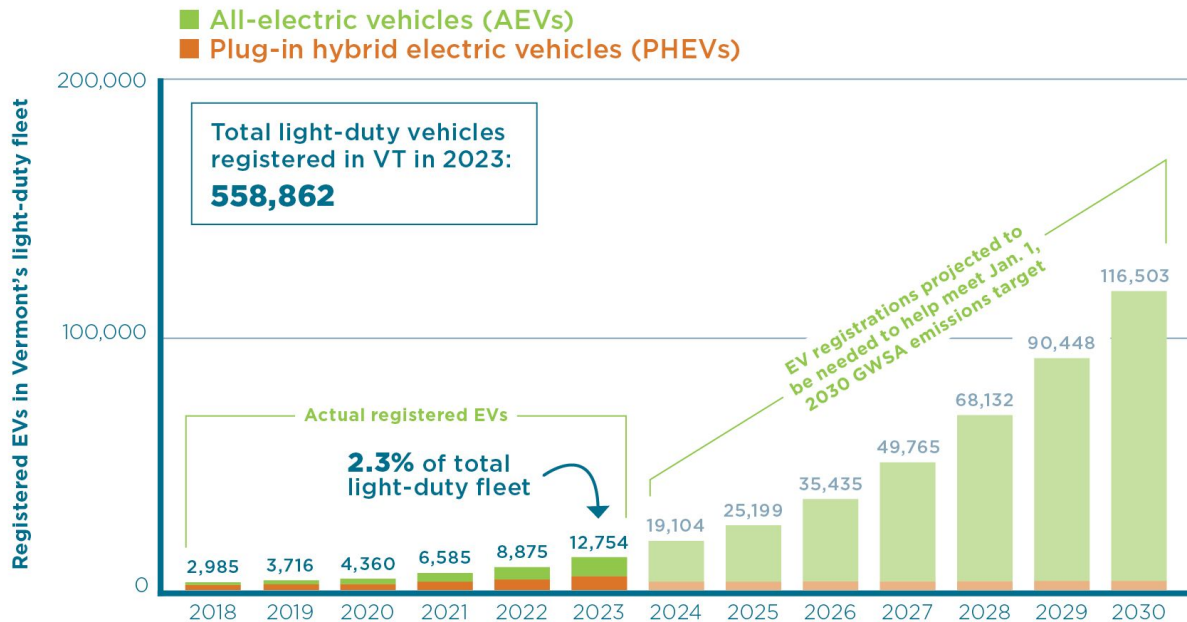
**Highest number of heat pumps** installed per capita in New England

2nd state in the country to pass a **100% by 2035 Renewable Electricity Standard**

**Least carbon-intensive electricity portfolio** in the U.S., making electrification especially beneficial

- VT has the highest number of EVs per capita in New England
- **15,144** plug-in EVs in VT as of July 2024
  - **58%** all-electric

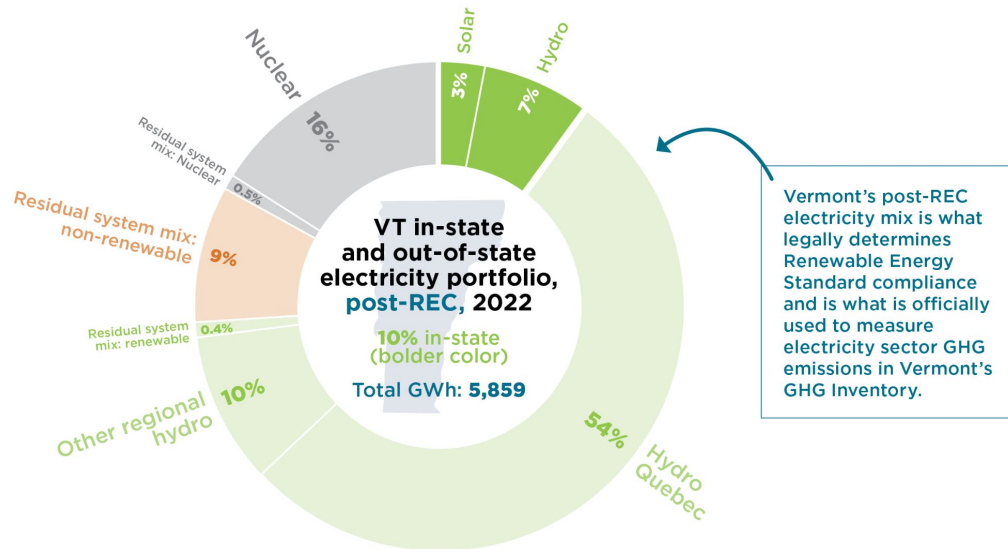
## Vermont EV registrations and future Pathways targets



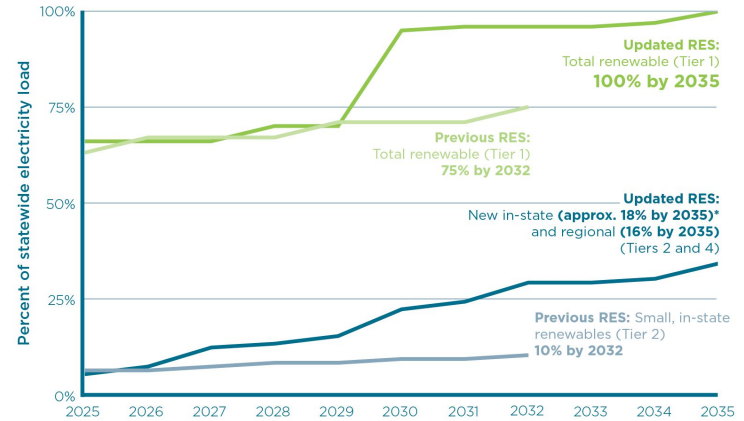
Source: Drive Electric Vermont, 2024; Vermont Pathways Report 2.0, 2022; VT Agency of Natural Resources, 2024.



- ➔ Least carbon-intensive electricity portfolio in the U.S.
- ➔ 2nd state to require 100% renewable electricity by 2035



### Vermont Renewable Energy Standard requirements: Previous RES (Act 56, 2015) vs. updated RES (Act 179, 2024)



Sources: Vermont Department of Public Service, 2022 Electric Utility Resource Survey; NEPOOL GIS Residual Mix, 2022.  
Notes: Non-renewable is primarily energy from fossil fuels. Totals do not add up to 100% due to independent rounding.



Source: Vermont General Assembly, Act 179, 2024. Notes: Actual requirements in the updated RES vary by utility. Percentages shown for each tier are estimates based on the current size of each utility relative to Vermont's total electricity load. Previous RES compliance was based on electricity sales, rather than total electricity load. Electricity load includes transmission and distribution losses that would not be counted in sales. \*There are provisions in the RES that reduce the Tier 2 requirement to slightly lower than 20%.





# Key Finding 5: Vermont is often a leader, but not always

## Where Vermont is LAGGING

**Least progress made toward 2025 GHG emissions reduction target** of the Paris Agreement of any state in New England

**2nd highest per capita GHG emissions** of any state in New England

**No cap on climate pollution** outside of the electric sector

**No central policy or regulation to reduce GHG emissions from transportation fuels** has been advanced legislatively or administratively

**Highest annual vehicle miles traveled (VMT)** per capita in the Northeast

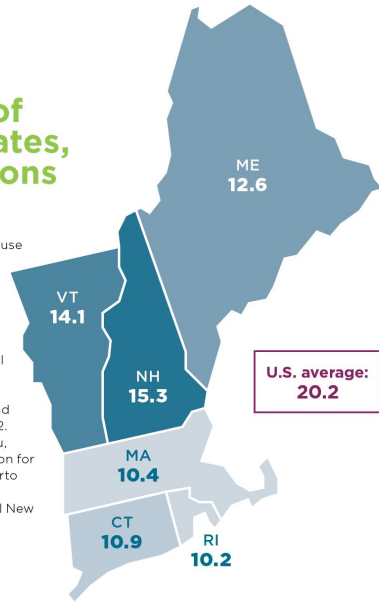
**No central policy or regulation yet implemented to address thermal sector GHGs** (A Clean Heat Standard is in development but not yet implemented)

Among the 4 states with the **highest reliance on fuel oil and propane** for home heating

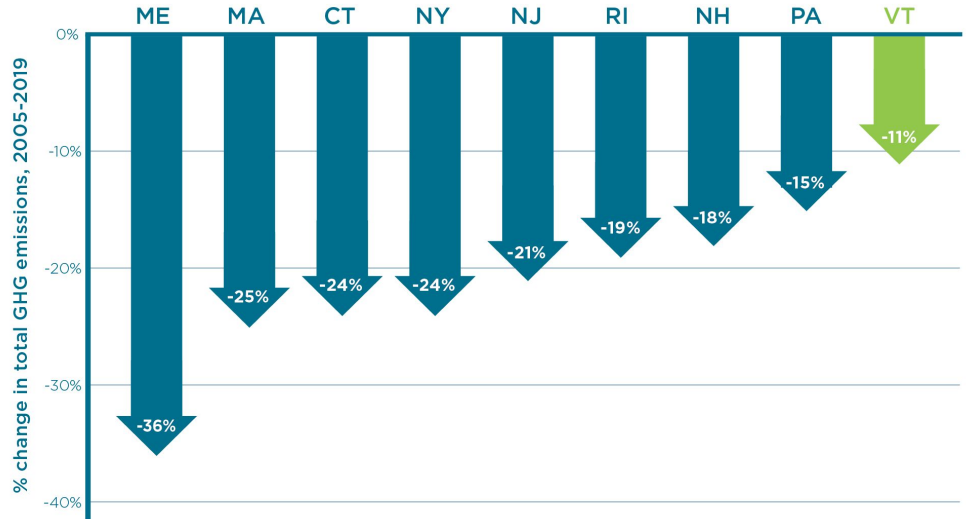
**3rd highest average energy burden** (share of household income spent on energy costs) in the U.S. (8.3%)

## GHG emissions of New England states, 2019, in metric tons per capita

**Sources:** Vermont ANR, "Vermont Greenhouse Gas Emissions Inventory and Forecast: 1990 - 2020," 2023; Connecticut DEEP, "Connecticut Greenhouse Gas Emissions Inventory: 1990-2021," 2023; Maine DEP, "Ninth Biennial Report on Progress Toward Greenhouse Gas Reduction Goals," 2022; Massachusetts DEP, "Massachusetts Annual Greenhouse Gas Emissions Inventory: 1990-2020, with Partial 2021 & 2022 Data," 2022; Rhode Island DEM, "2019 Rhode Island Greenhouse Gas Emissions Inventory," 2022; Clean Energy NH, 2023; U.S. Census Bureau, "Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico," 2019. **Note:** 2019 is the latest year for which comparative data is available from all New England states.



## Percent reduction in total GHG emissions, 2005-2019





# Key Finding 6: Progress requires policy

## Comparison of key climate policies among selected states

✓ Enacted ✓ In development

|  | VT           | MA | MD | NY           | CA            | OR           | WA           |
|--|--------------|----|----|--------------|---------------|--------------|--------------|
| Multi-sectoral <b>Cap-and-Trade</b> or <b>Cap-and-Invest</b> program |              |    |    | ✓            | ✓             | ✓            | ✓            |
| <b>Zero Emission Vehicle Standard</b> (ACCII/ACT)                    | ✓            | ✓  | ✓  | ✓            | ✓             | ✓            | ✓            |
| <b>Low-Carbon Fuel Standard</b> for transportation                   |              |    |    |              | ✓             | ✓            | ✓            |
| <b>Clean Heat Standard</b> for thermal sector                        | ✓            | ✓  | ✓  |              |               |              |              |
| <b>Zero-Emission Heating Equipment Standard</b>                      |              |    | ✓  |              | ✓             |              |              |
| <b>100% Renewable/Clean Electricity Standard</b>                     | ✓<br>by 2035 |    |    | ✓<br>by 2040 | ✓<br>by 2045* | ✓<br>by 2040 | ✓<br>by 2045 |

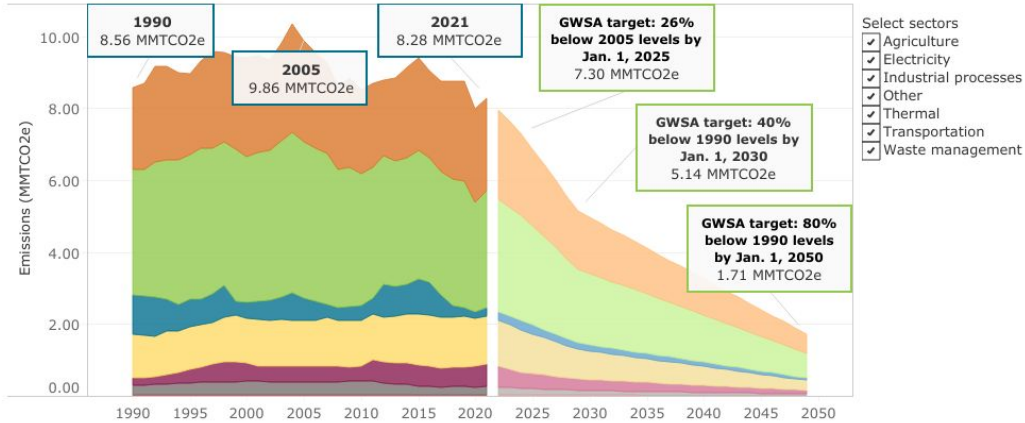
\*Note: Allows fossil fuel generation with carbon capture and storage (CCS) for a portion of the 100% requirement.



# Vermont GHG emissions dashboard

|         |         |                |             |                    |
|---------|---------|----------------|-------------|--------------------|
| Overall | Thermal | Transportation | Electricity | Progress by sector |
|---------|---------|----------------|-------------|--------------------|

## VT historical GHG emissions and future requirements



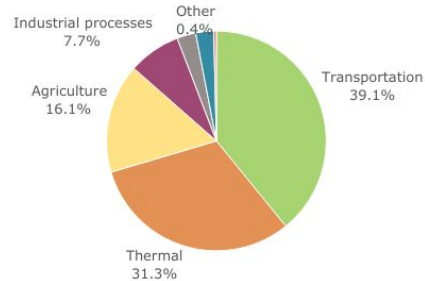
**What is the GWSA?** The GWSA (Global Warming Solutions Act) was passed by the Vermont Legislature in 2020 and established legally binding emissions reduction obligations for Vermont. The Act requires:

- 26% reduction below 2005 levels by Jan. 1, 2025
- 40% reduction below 1990 levels by Jan. 1, 2030
- 80% reduction below 1990 levels by Jan. 1, 2050

In 2021, Vermont's GHG emissions were 8.28 million metric tons of CO<sub>2</sub> equivalent, just **16%** below 2005 levels.

## VT GHG emissions by sector, 2021

Click on a sector to highlight in the graph above



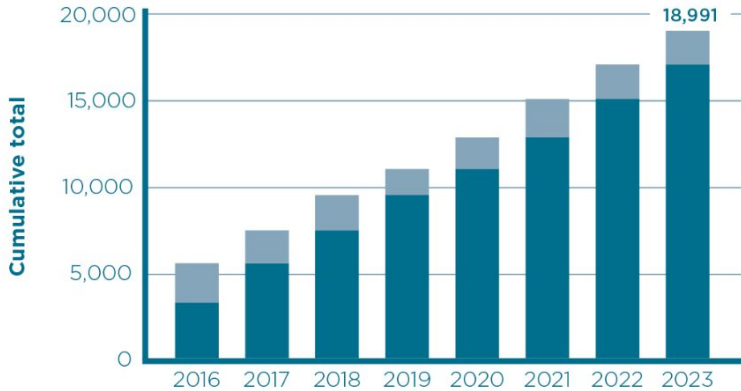
Source: Vermont Agency of Natural Resources, Vermont Greenhouse Gas Emissions Inventory and Forecast: 1990-2021, 2024 (<https://climatechange.vermont.gov/climateactionoffice/greenhouse-gas-inventory>).

<https://eanvt.org/emissions-dashboard/>



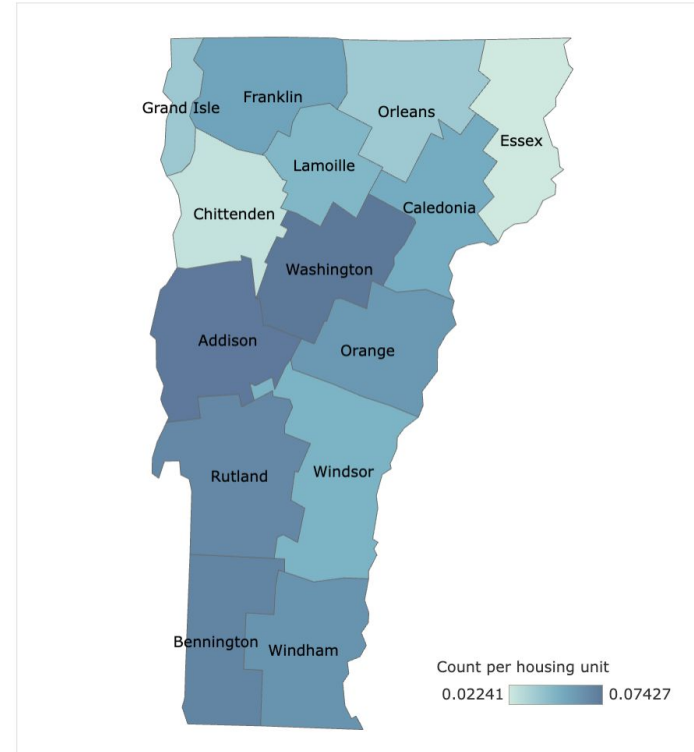
# Tracking adoption of key climate pollution reduction strategies

## Residential heat pump water heaters



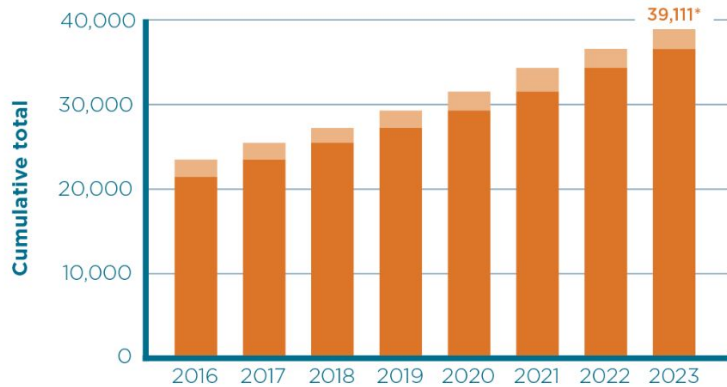
## Heat pump water heaters by county as of 2022

Click on a county to filter



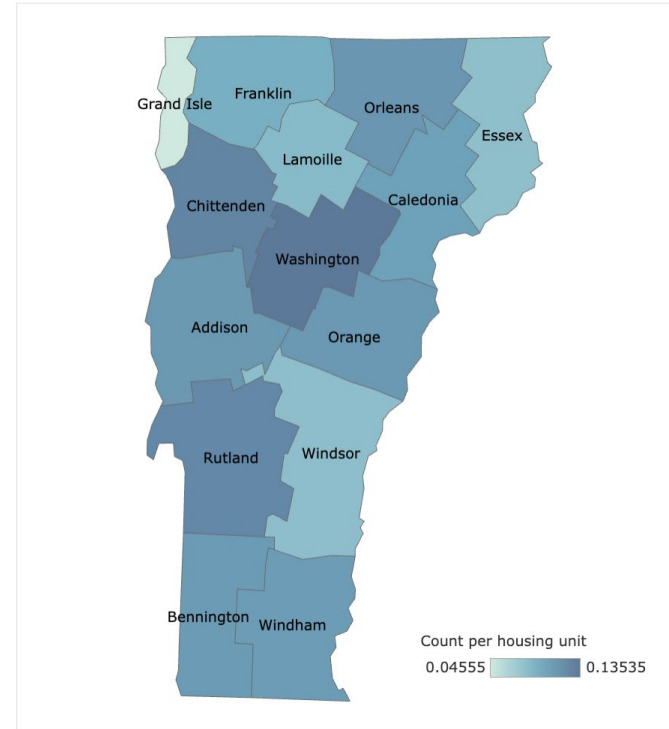
# Tracking adoption of key climate pollution reduction strategies

## Housing units comprehensively weatherized



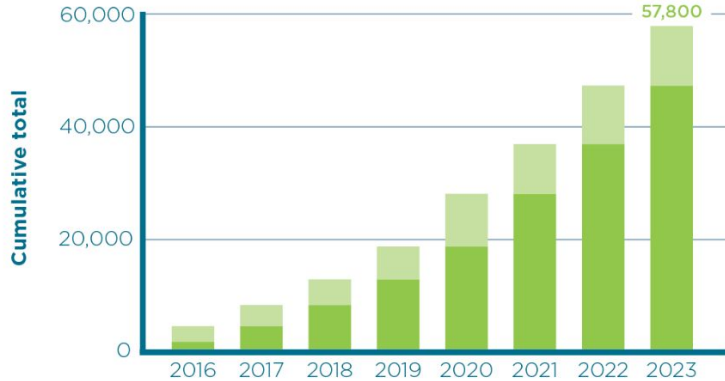
## Weatherization by county as of 2022

Click on a county to filter



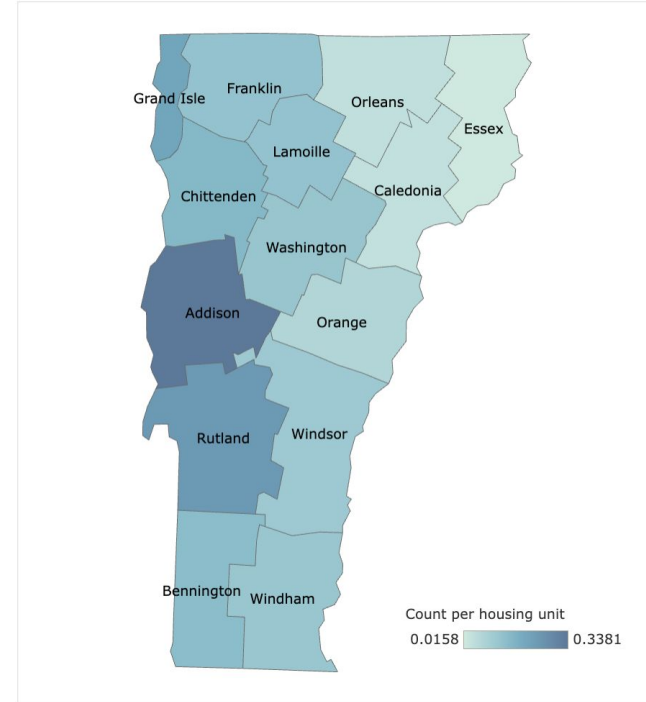
# Tracking adoption of key climate pollution reduction strategies

## Residential cold-climate heat pumps

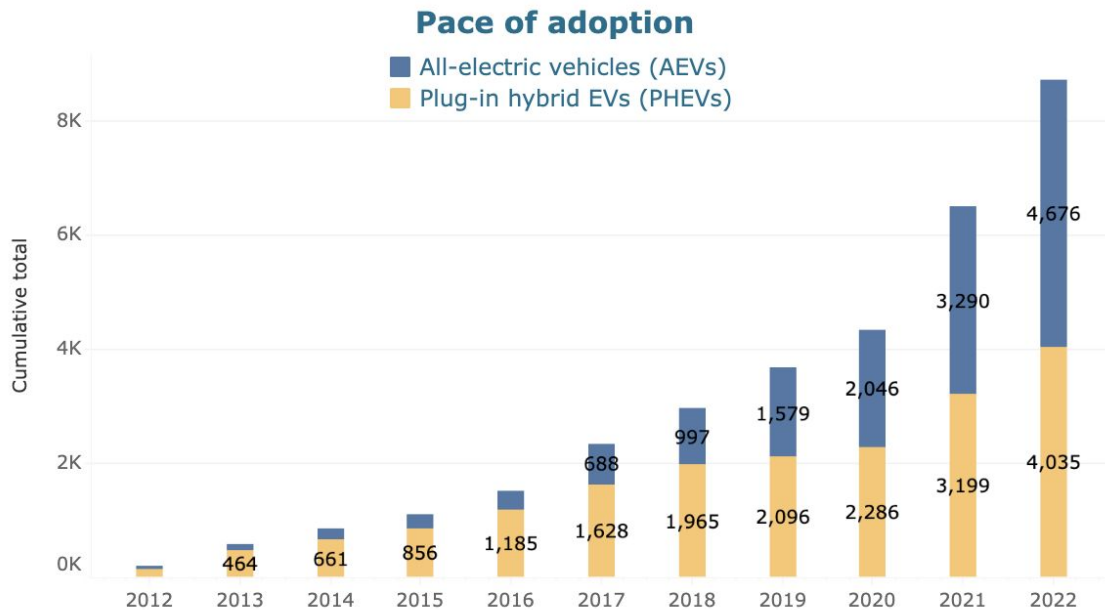


## Cold-climate heat pumps by county as of 2022

Click on a county to filter

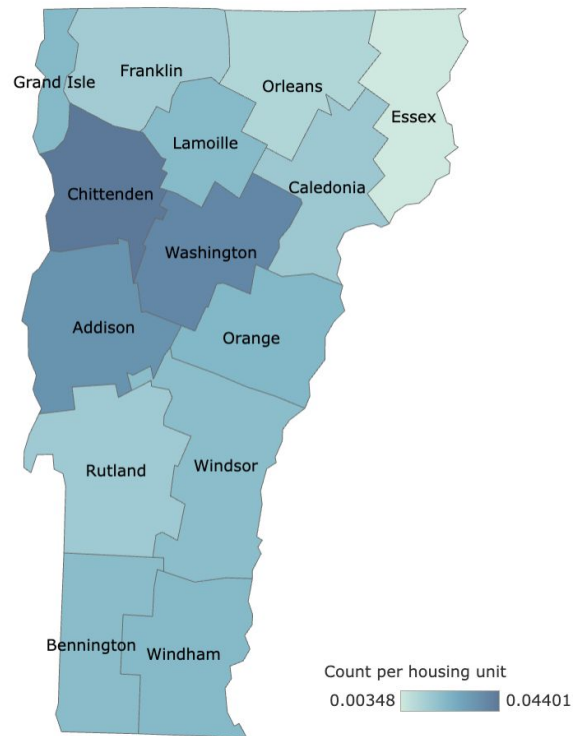


# Tracking adoption of key climate pollution reduction strategies

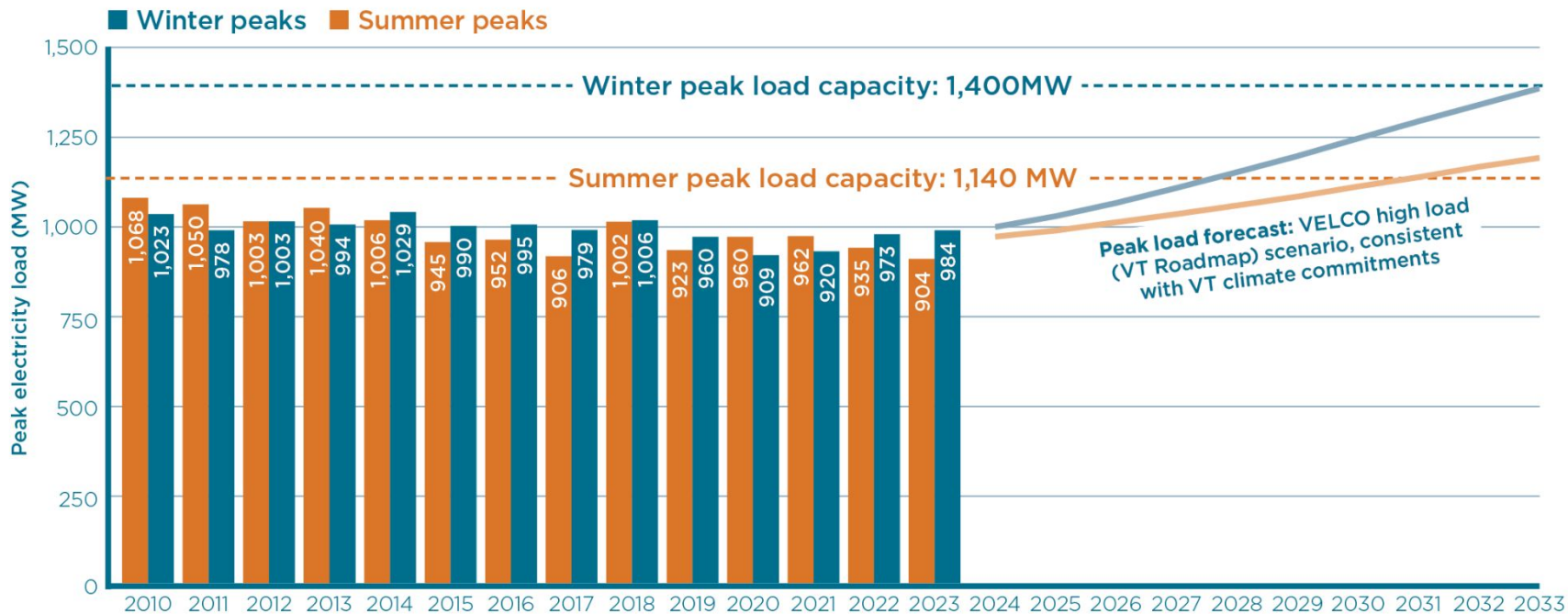


## Electric vehicles by county as of 2022

Click on a county to filter

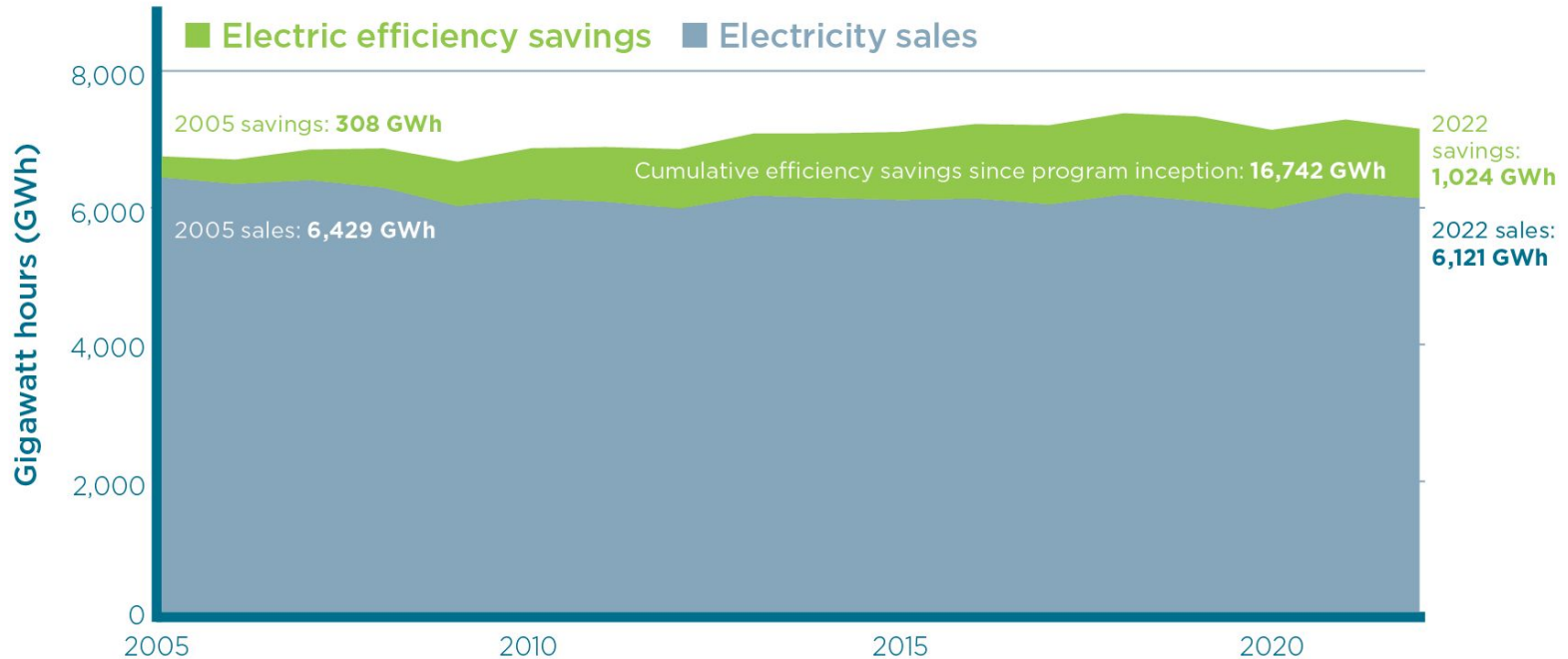


# Vermont historical and forecasted peak loads



Source: VELCO, “2024 Vermont Long-Range Transmission Plan,” 2024. Note: Peak load forecast shown is for a high growth scenario consistent with Vermont climate commitments.

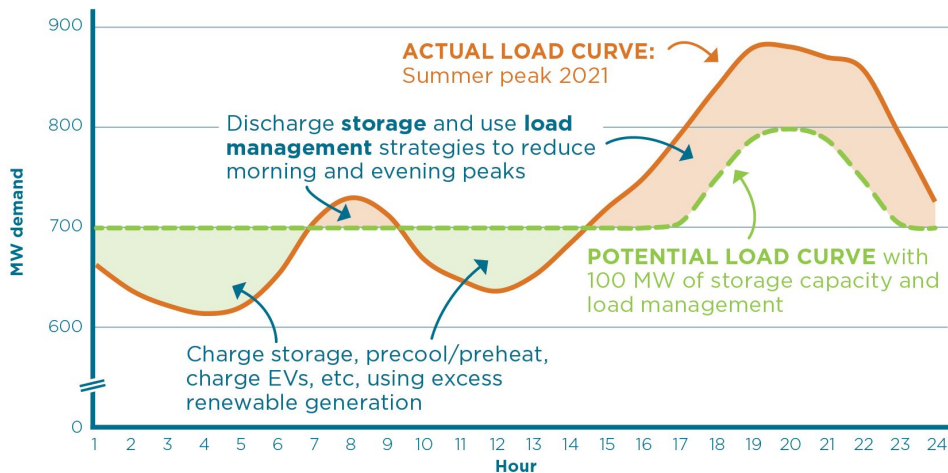
# Electricity savings from Vermont electric efficiency utilities, 2005–2022



**Source:** Vermont Department of Public Service, "Annual Energy Report," 2024. Data includes Efficiency Vermont and Burlington Electric Department. **Note:** Efficiency Vermont programs began in 2000 and Burlington Electric Department programs began in 1990.



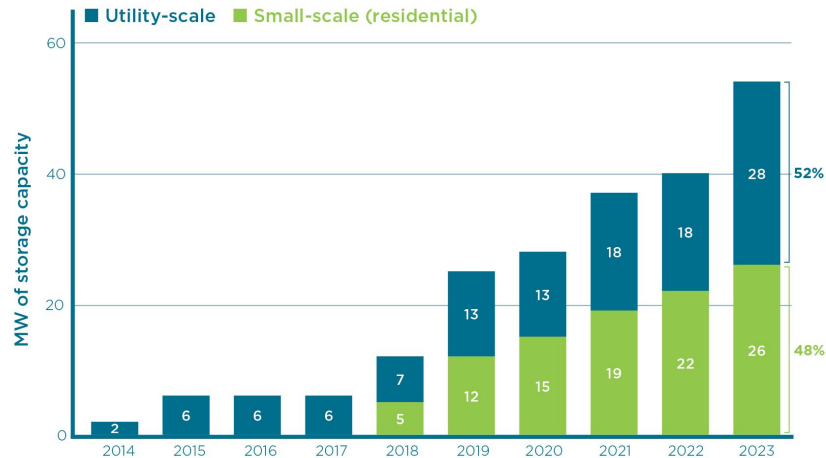
## Flexible load management and energy storage: Scenario to flatten VT's load curve



Source: ISO-NE, Hourly load reports for Vermont, 2023. Note: Aside from the actual load curve, the other portions of this graph are illustrative.



## Installed battery storage capacity in Vermont, 2014-2023



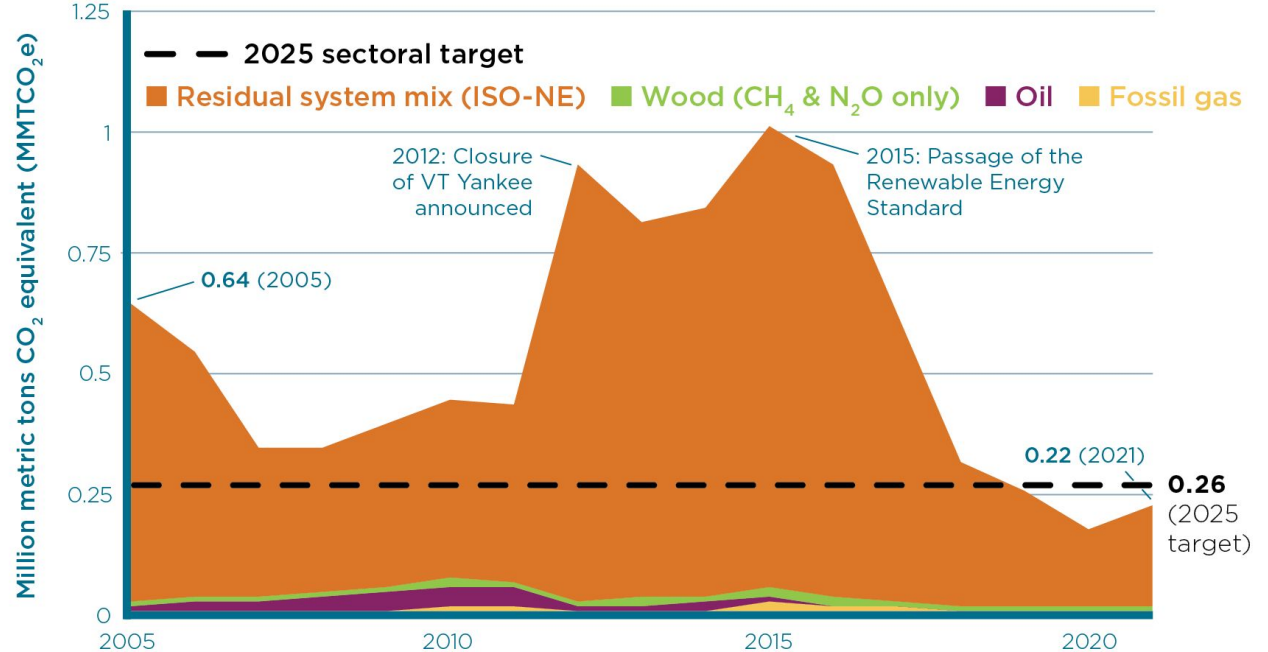
Source: Vermont Department of Public Service, 2023.



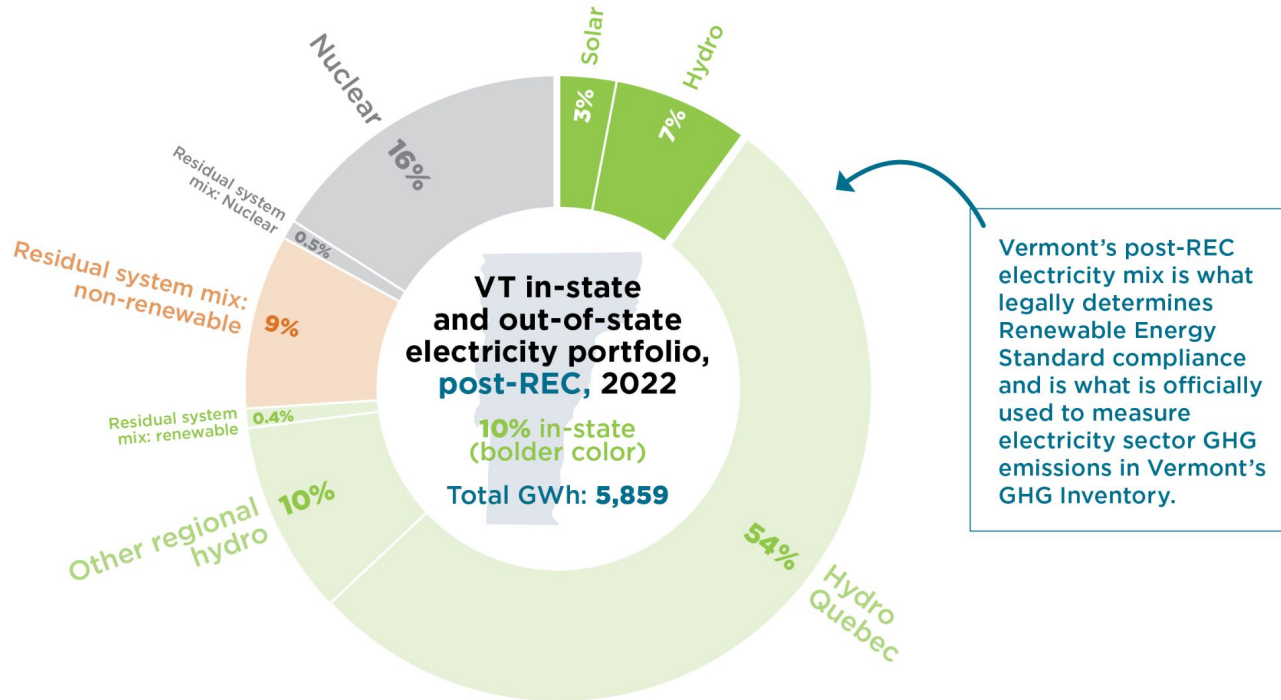


Electric sector GHG emissions decreased by 66% between 2005 and 2021

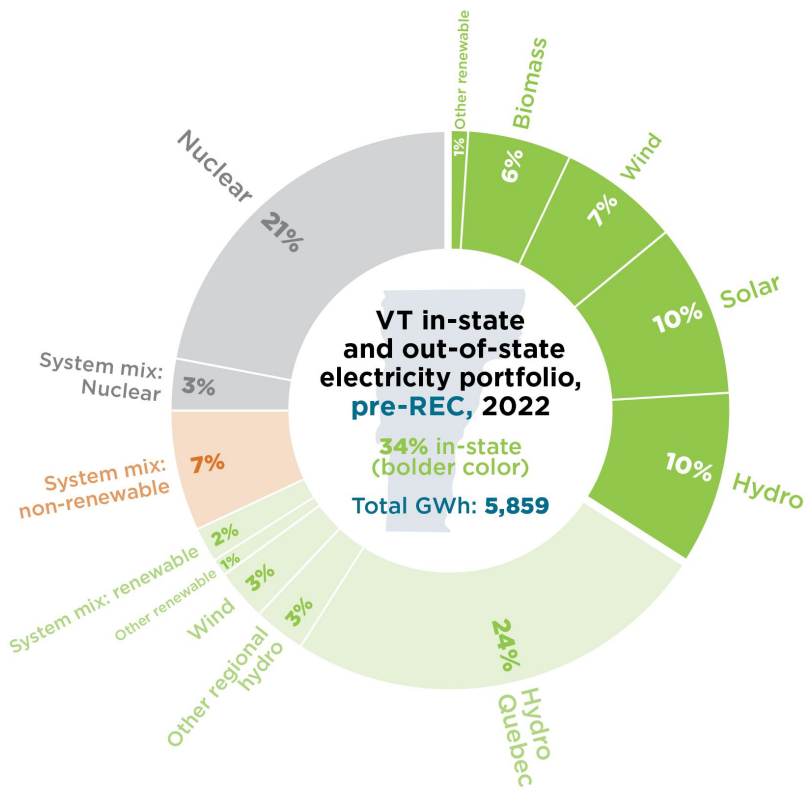
## VT electricity GHG emissions (2005–2021) vs 2025 sectoral target



# Vermont's electricity sector GHG emissions are based on retirements of Renewable Energy Credits (RECs)



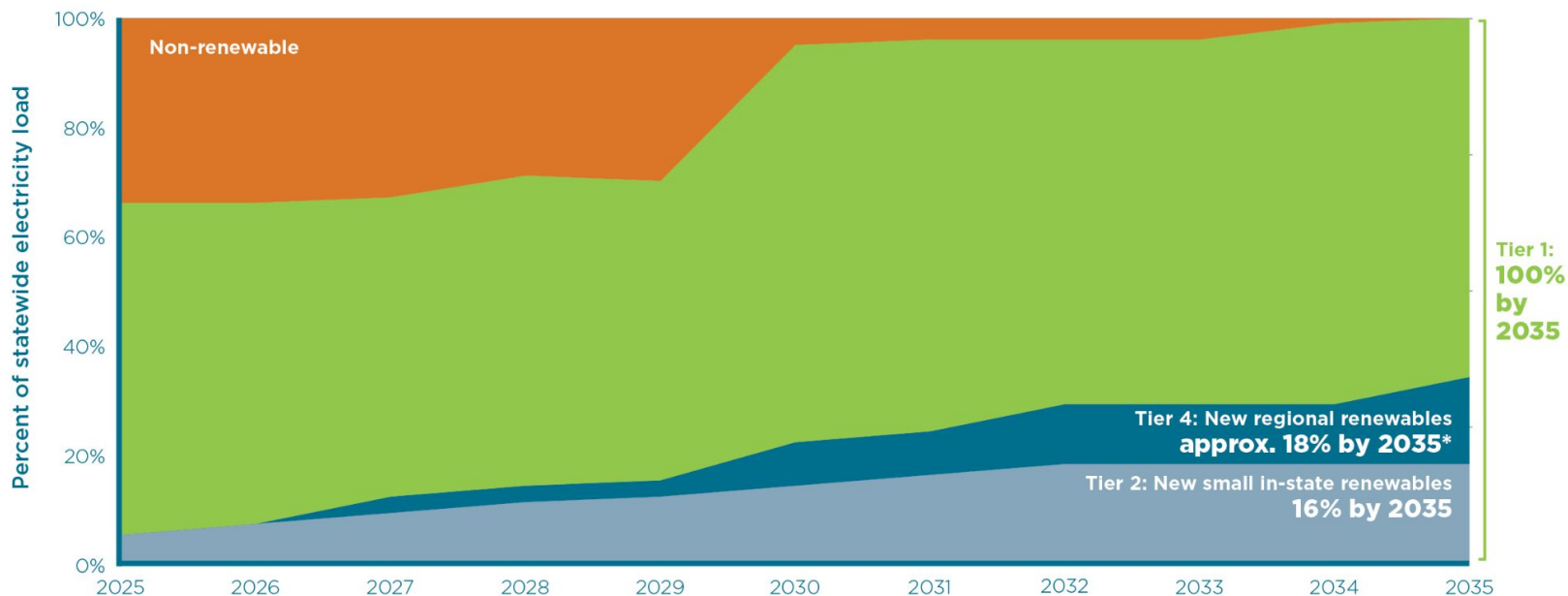
**Sources:** Vermont Department of Public Service, 2022 Electric Utility Resource Survey; NEPOOL GIS Residual Mix, 2022.  
**Notes:** Non-renewable is primarily energy from fossil fuels. Totals do not add up to 100% due to independent rounding.



**Sources:** Vermont Department of Public Service, 2022 Electric Utility Resource Survey; ISO-NE, "Net Energy and Peak Load by Source Report," 2023. **Notes:** Non-renewable is primarily energy from fossil fuels. Totals do not add up to 100% due to independent rounding.

# Act 179 of 2024: 100% renewable by 2035

## Updated Vermont Renewable Energy Standard (Act 179) requirements



**Source:** Vermont General Assembly, Act 179, 2024. **Notes:** Actual requirements in the updated RES vary by utility. Percentages shown for each tier are estimates based on the current size of the load served by each utility relative to Vermont's total electricity load. \*There are provisions in the RES that reduce the Tier 2 requirement to slightly lower than 20%

Thank you!

## Questions?

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