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House Environment & Energy
Committee

March 21, 2023



ANNUAL PROGRESS REPORT

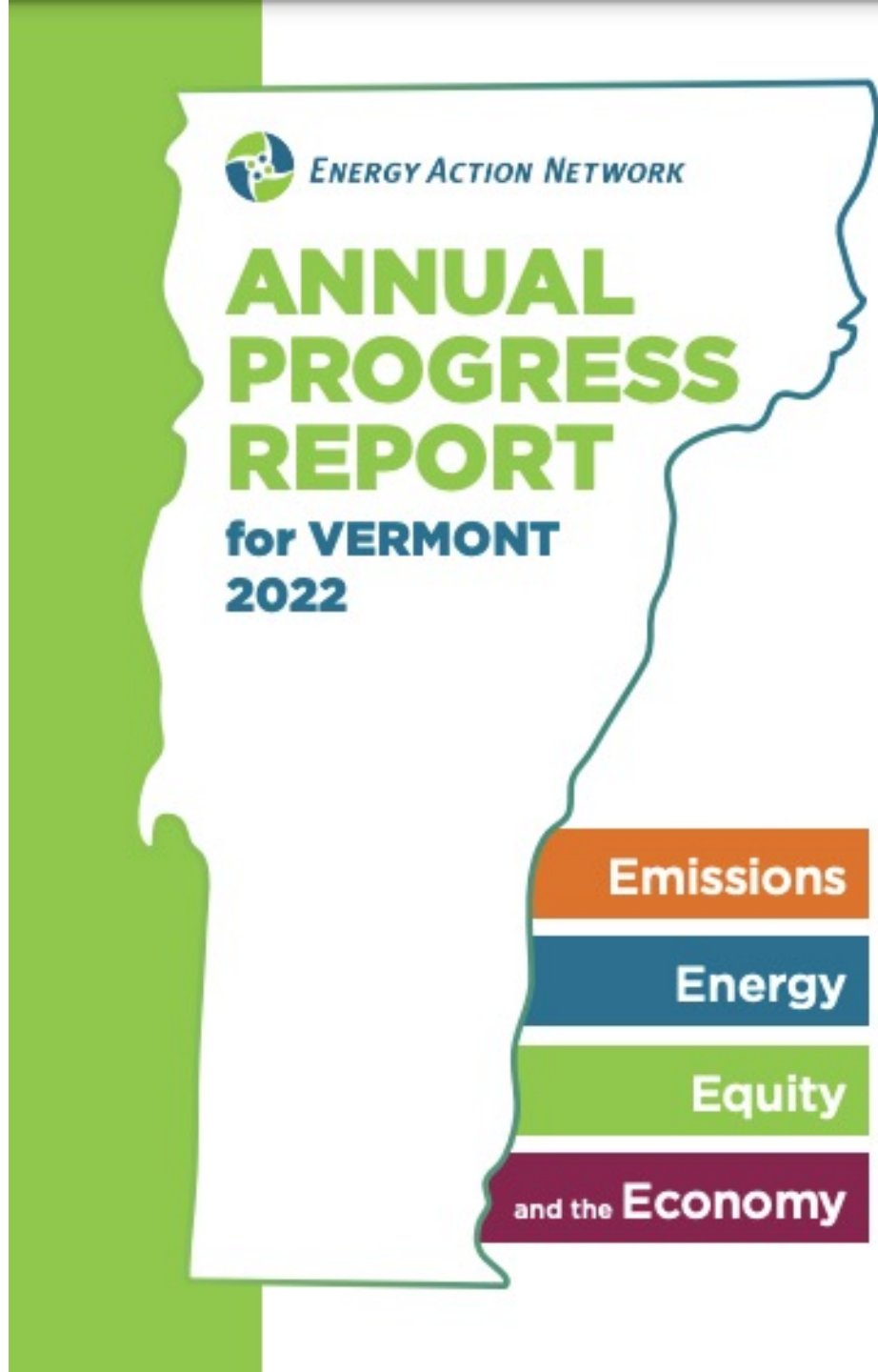
**for VERMONT
2022**

Emissions

Energy

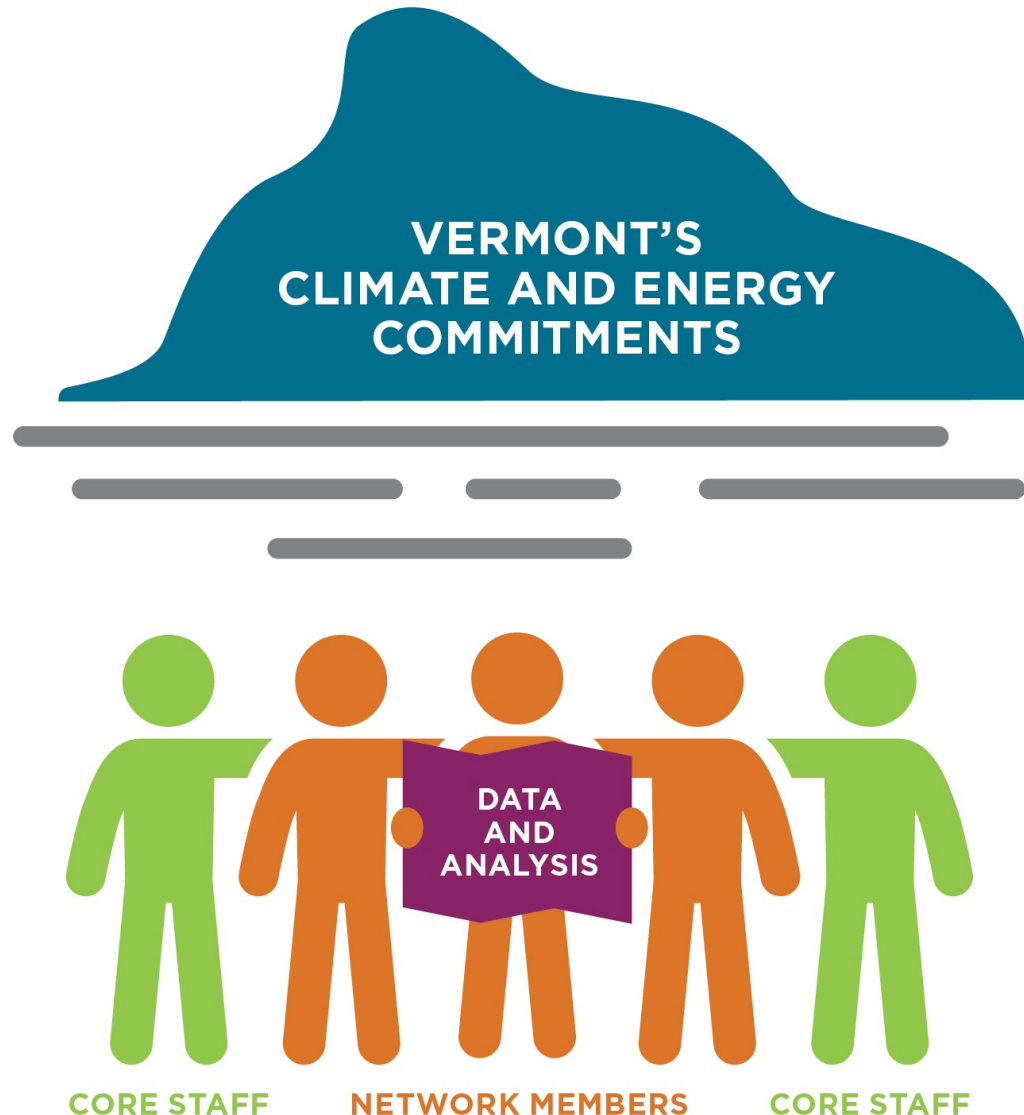
Equity

and the Economy





Role of EAN the Non-Profit Organization

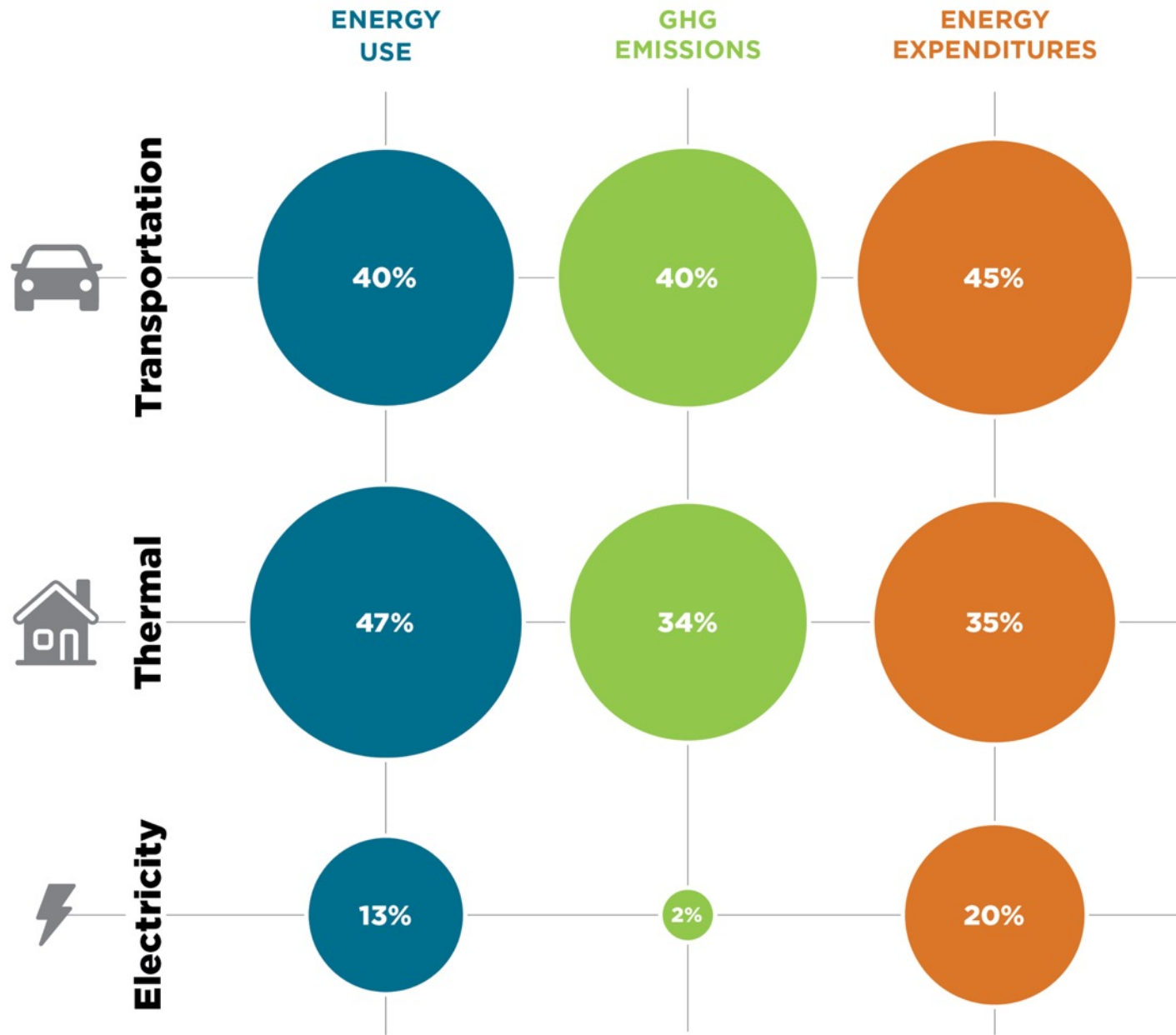


- **Collect, analyze, and report on emissions energy, equity, and economic data** (ex. EAN Annual Progress Reports)
- Support **data-informed and evidence-based energy conversations** in Vermont



Some Key Takeaways from the 2022 EAN Annual Progress Report for Vermont

- VT now has legal obligations to **reduce GHG emissions** - - not goals.
- We are **not on track to meet the legal obligations for 2030**.
- **VT has not passed the policies** that could give us confidence that we could be on track, as **recommended in the Climate Action Plan**.
- Meeting our requirements can **save VTers money and strengthen the VT economy: \$6.4 billion in savings and avoided damages by 2050**.
- Nearly $\frac{3}{4}$ of our climate **pollution comes from transportation and thermal** – yet we have no sector wide policies to reduce emissions in those sectors, like we do with electricity.



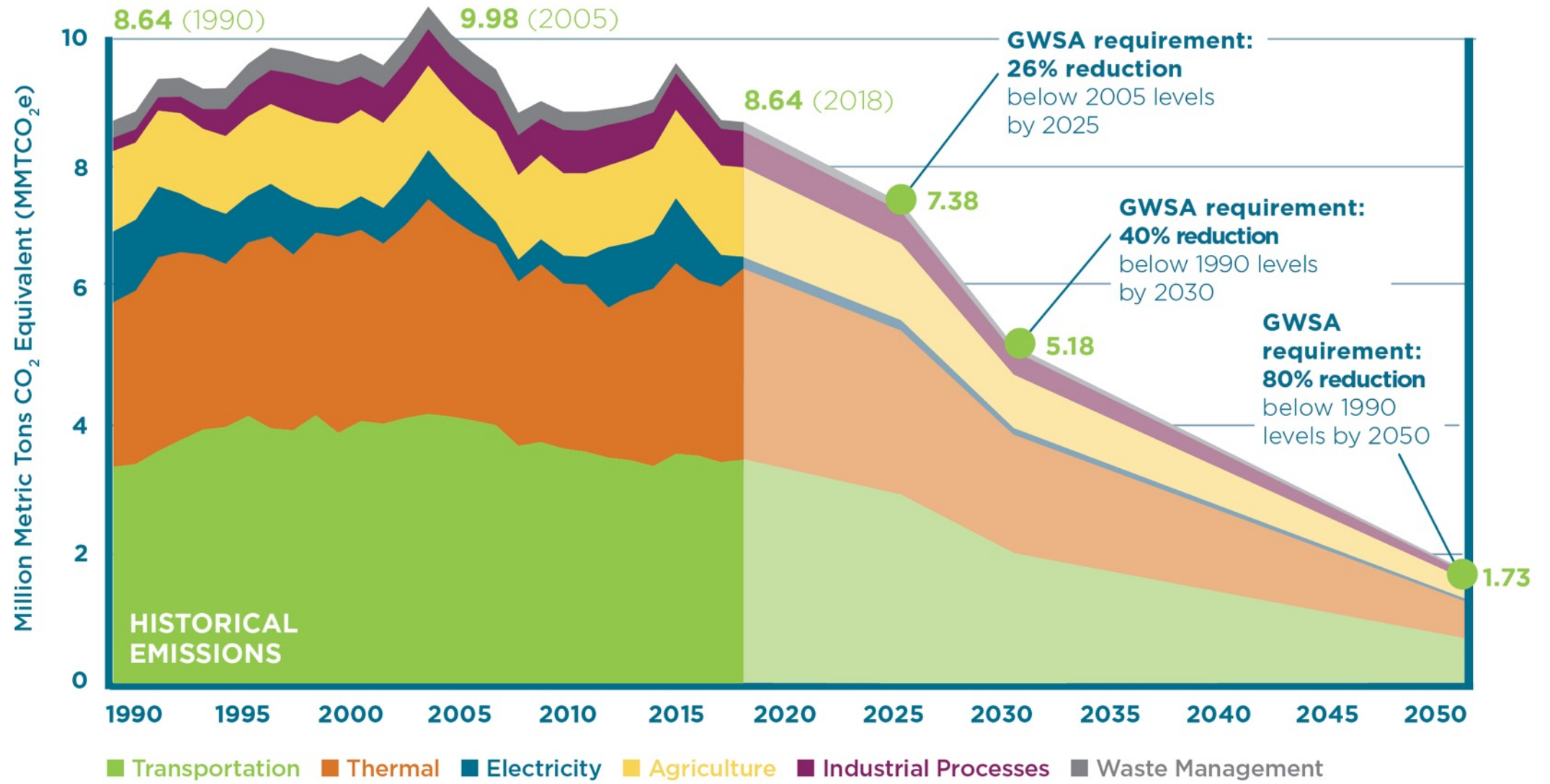
Source for Energy Use: Thermal and transportation based on EIA 2019 site energy; electricity from PSD site energy, after accounting for RECs.

Source for Emissions: VT Agency of Natural Resources, 2021. GHG Emissions Inventory, 1990-2018.

Source for Energy Expenditures: Vermont Energy Burden Report, VEIC (October 2019).



Vermont's historical GHG emissions and future requirements

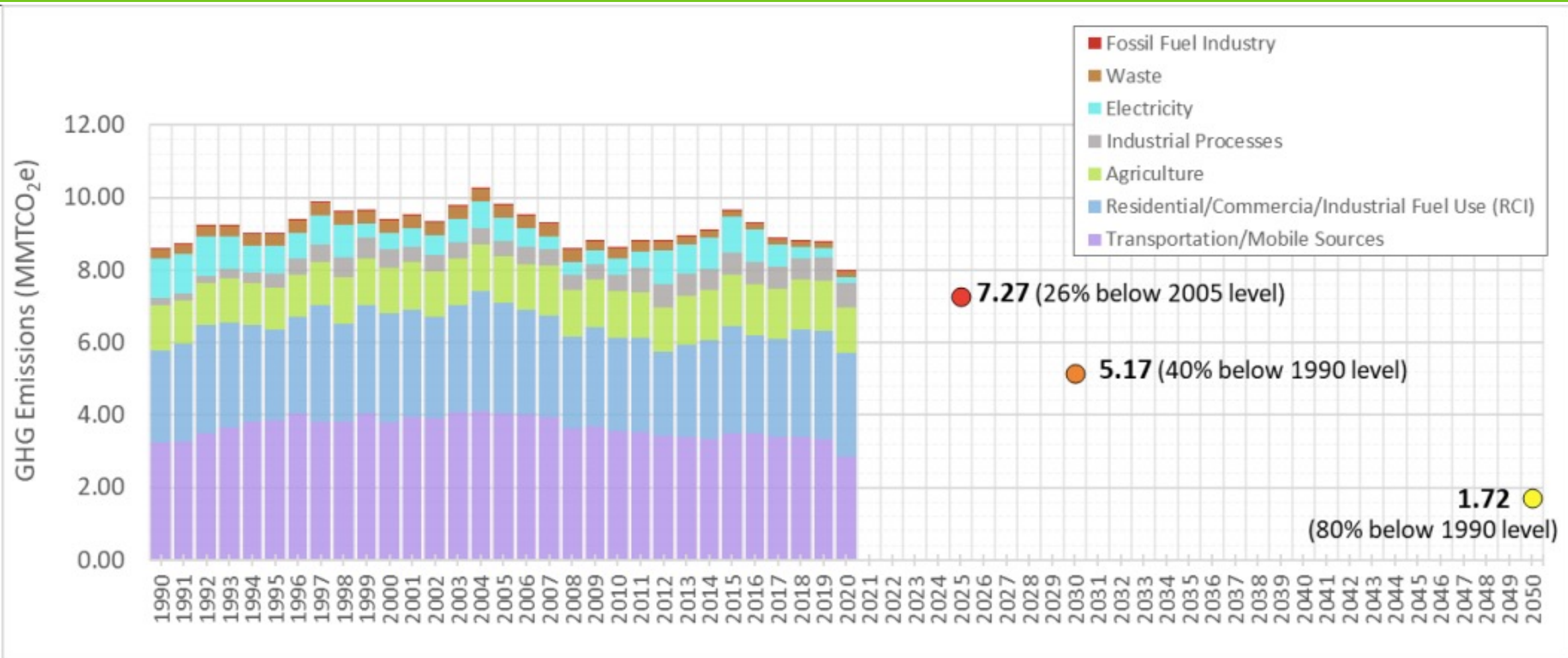


Source: Vermont Agency of Natural Resources, Vermont GHG Emissions Inventory and Forecast (1990-2017), 2021.



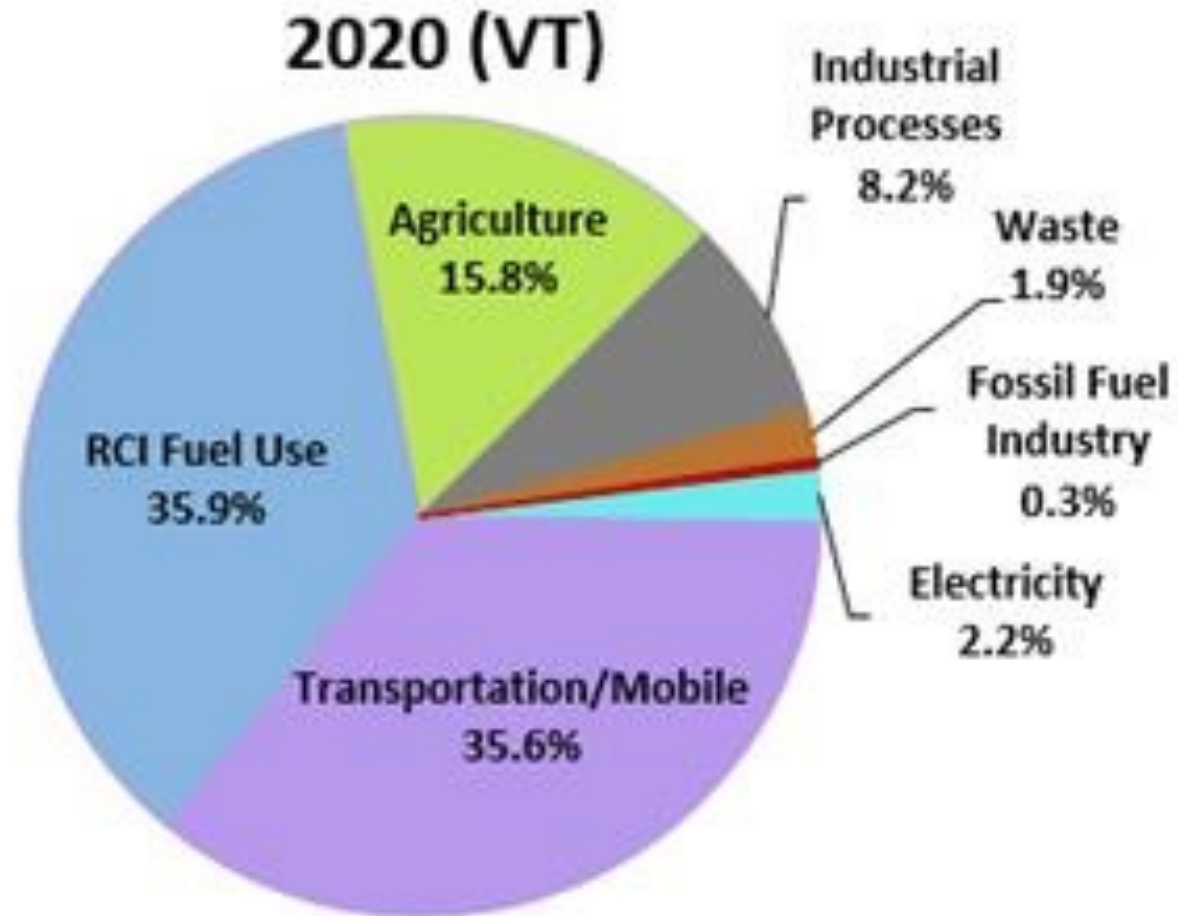


DRAFT 2020 VT GHG Inventory Figures from ANR/PSD





DRAFT 2020 VT GHG Emissions by Sector from ANR/PSD





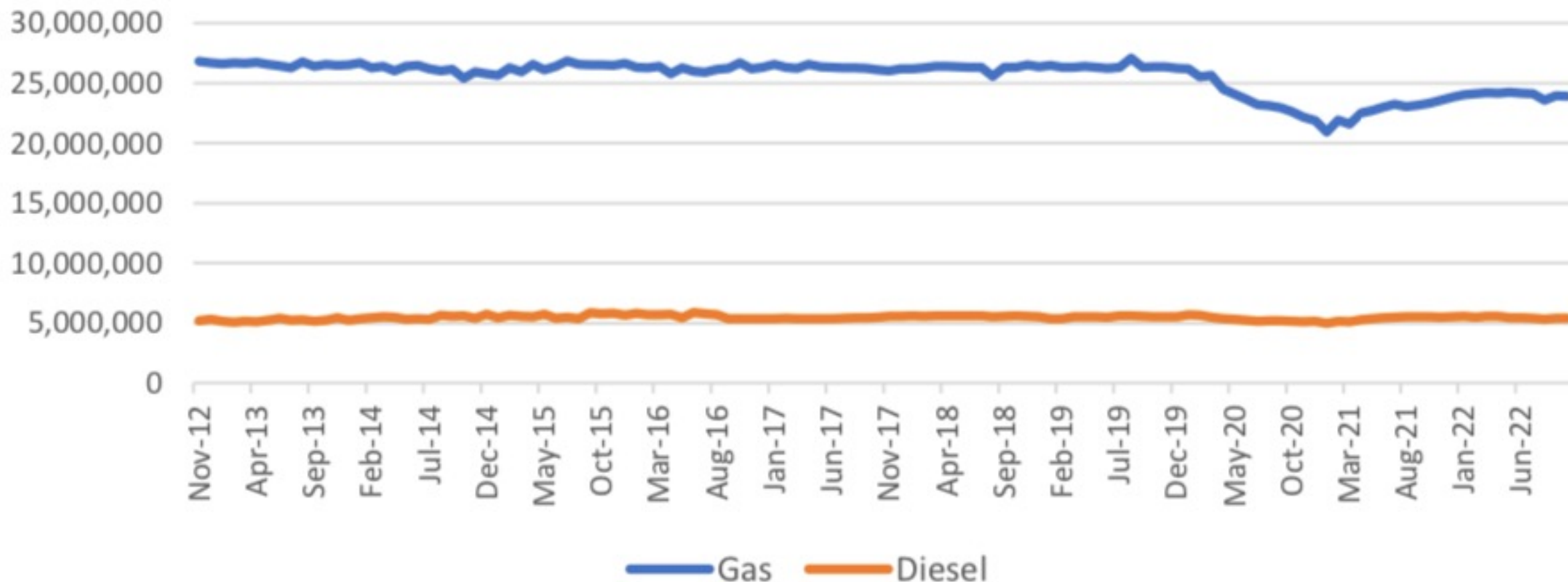
Note of Caution: Be Careful with 2020 Data

- The onset of the **pandemic** in March of 2020 created significant changes in VT energy use and emissions.
- Example: In 2020, **gasoline sales in VT dropped by 17%** (over 52 million gallons) and **diesel sales dropped by 7%** (4.5 million gallons). The combined effect was a **15% decline in VT transportation emissions in 2020**, compared to 2019.
- To what degree is 2020 data an **outlier**, subject to a **snap-back effect**?
- To what degree might some of the trends that emerged in 2020 prove more durable (i.e., an increase in remote/virtual work leading to less commuter miles?).
- To disentangle this carefully, we need to wait for 2021 and 2022 data.
- In the meantime, **be wary of drawing future year conclusions based on 2020 data.**



An Early Look from PSD's Annual Energy Report – Transportation Emissions Rebounding

Gas and Diesel Monthly Sales (12-Month Rolling Avg.)





Equating Reductions below 1990 and 2005 levels

<u>Year</u>	<u>VT GHG Emissions (MMTCO₂e)</u>	<u>% reduction below 1990</u>	<u>% reduction below 2005</u>
1990	8.62		
2005	9.82		
2025	7.27	16%	26%
2030	5.17	40%	47%
2050	1.72	80%	82%
Sources:	<u>Emissions</u> : VT PSD 2023 Annual Energy Report (via ANR draft Inventory through 2020)		
	<u>Legal Requirements</u> : Vermont Global Warming Solutions Act		



Where do VT's emissions targets come from and why 1990 and 2005 Baselines?

- **Science-based targets**, roughly in line with international commitments made as part of the **UN Framework on Climate Change (UNFCCC)**, based on **Intergovernmental Panel on Climate Change (IPCC)** data
- Kyoto Protocol used 1990 emissions baseline
- Paris Agreement used 2005 baseline (U.S. committed to a 26-28% reduction below 2005 levels by 2025).
- President Biden's commitment: 50% below 2005 levels by 2030



Latest Intergovernmental Panel on Climate Change (IPCC) Report

03/20/2023 New York Times:

“Earth is likely to cross a critical threshold for global warming within the next decade, and nations will need to make an immediate and drastic shift away from fossil fuels to prevent the planet from overheating dangerously beyond that level, according to [a major new report released on Monday](#).

The report, by the Intergovernmental Panel on Climate Change, a body of experts convened by the United Nations, offers the most comprehensive understanding to date of ways in which the planet is changing. It says that global average temperatures are estimated to rise 1.5 degrees Celsius (2.7 degrees Fahrenheit) above preindustrial levels sometime around “the first half of the 2030s,” as humans continue to burn coal, oil and natural gas.

That number holds [a special significance in global climate politics](#): Under the 2015 Paris climate agreement, virtually every nation agreed to “pursue efforts” to hold global warming to 1.5 degrees Celsius. **Beyond that point, scientists say, the impacts of catastrophic heat waves, flooding, drought, crop failures, and species extinction become significantly harder for humanity to handle.**



Latest IPCC Report – New York Times Summary Continued

“But Earth has already warmed an average of 1.1 degrees Celsius since the industrial age, and, with global fossil-fuel emissions setting [records last year](#), that goal is quickly slipping out of reach.

There is still one last chance to shift course, the new report says. But it would require industrialized nations to **join together immediately to slash greenhouse gases roughly in half by 2030** and then stop adding carbon dioxide to the atmosphere altogether by the early 2050s. **If those two steps were taken, the world would have about a 50 percent chance of limiting warming to 1.5 degrees Celsius.**

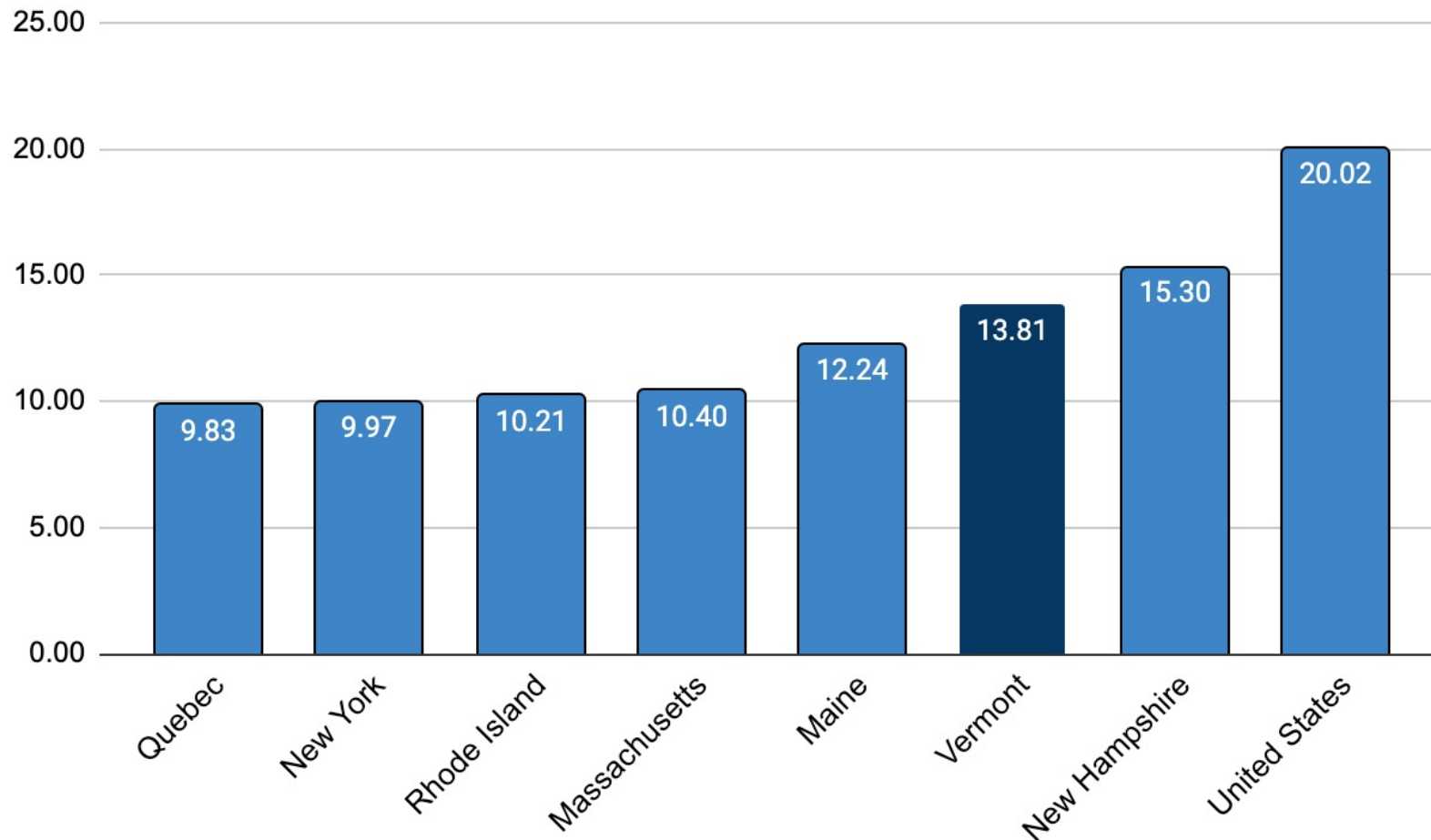
Delays of even a few years would most likely make that goal unattainable, guaranteeing a hotter, more perilous future.

“The pace and scale of what has been done so far and current plans are insufficient to tackle climate change,” said Hoesung Lee, the chair of the climate panel. **“We are walking when we should be sprinting.”**”

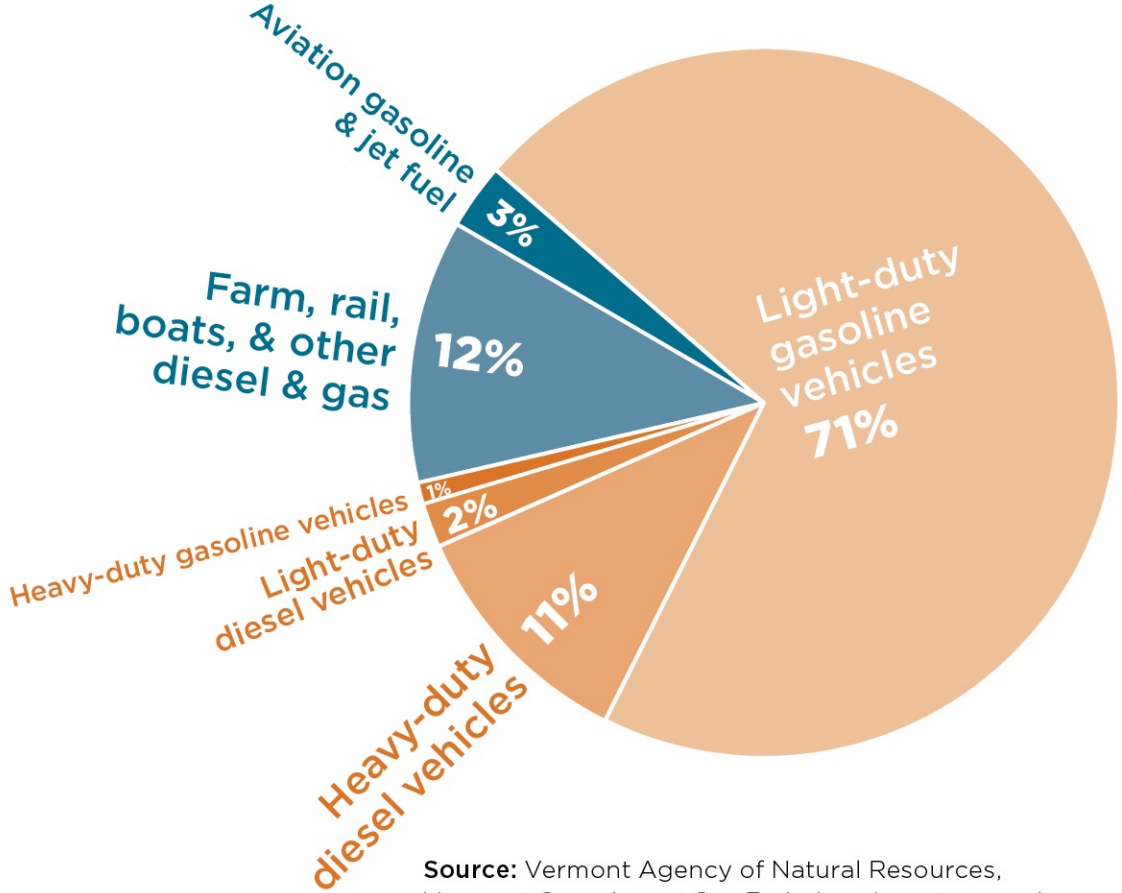


Comparing VT to our neighbors – per capita emissions

2019 Per capita GHG emissions (metric tons of CO₂e)



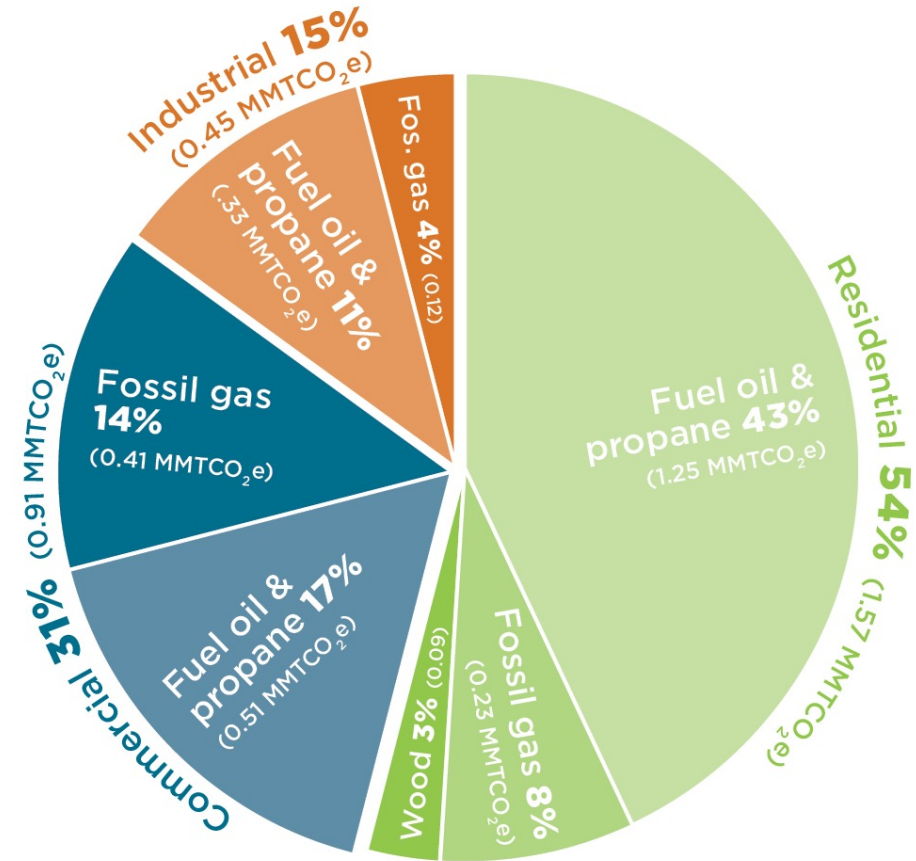
VT GHG emissions from transportation by type and fuel, 2017



Source: Vermont Agency of Natural Resources, Vermont Greenhouse Gas Emissions Inventory and Forecast (1990-2017), 2021.



Vermont thermal GHG emissions by sector and fuel type



Source: Vermont Agency of Natural Resources, Vermont Greenhouse Gas Emissions Inventory and Forecast (1990-2017), 2021. There is a small amount of emissions from wood heating in the commercial sector, but it is too small to show up on this pie chart



Status of the 3 Most Significant Climate Action Plan (CAP) Recommendations for GHG Reduction

1. Clean Heat Standard

- Expected share of total emissions reduction requirement by 2030: **34%**
- Status: **Not yet adopted**. (Vetoed by Governor, 1 House vote short of override in 2021).

2. Advanced Clean Cars II and Advanced Clean Trucks rules

- Expected share of total emissions reduction requirement by 2030: **14%**
- Status: **Adopted**. (Proposed by Agency of Natural Resources; approved by Legislative Committee on Administrative Rules; adopted as of Dec.16th, 2022).

3. Transportation and Climate Initiative Program (TCI-P)

- Expected share of total emissions reduction requirement by 2030: Approx. **10%**
- Status: **Stalled** ("regional viability", or at least 3 participating states moving forward to implement the program, no longer exists since the decisions of CT, RI, and MA to withdraw from TCI-P in late 2021. Future uncertain).

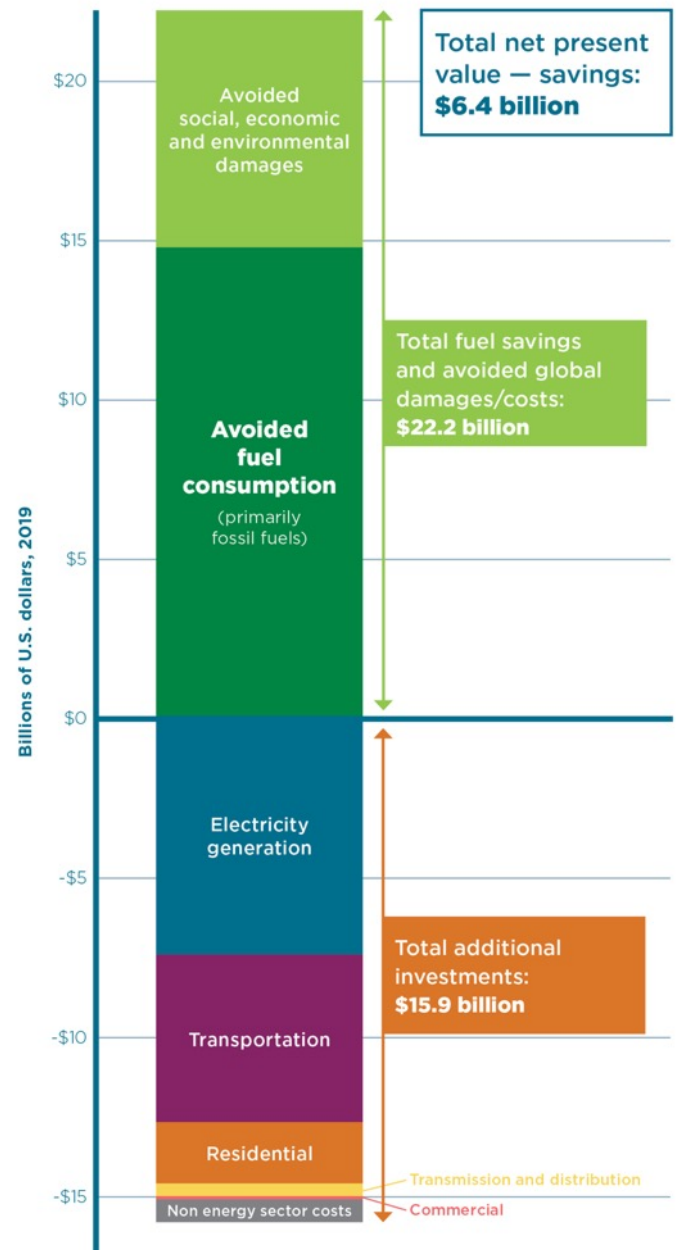


Addendum to the CAP re: Transportation Policy

“The only currently known policy options for which there is strong evidence from other states, provinces, and countries of the ability to confidently deliver the scale and pace of emissions reductions that are required of the transportation sector by the GWSA are one or a combination of:

- a) a cap and invest/cap and reduce policy covering transportation fuels
and/or
- b) a performance standard/performance-based regulatory approach covering transportation fuels.”

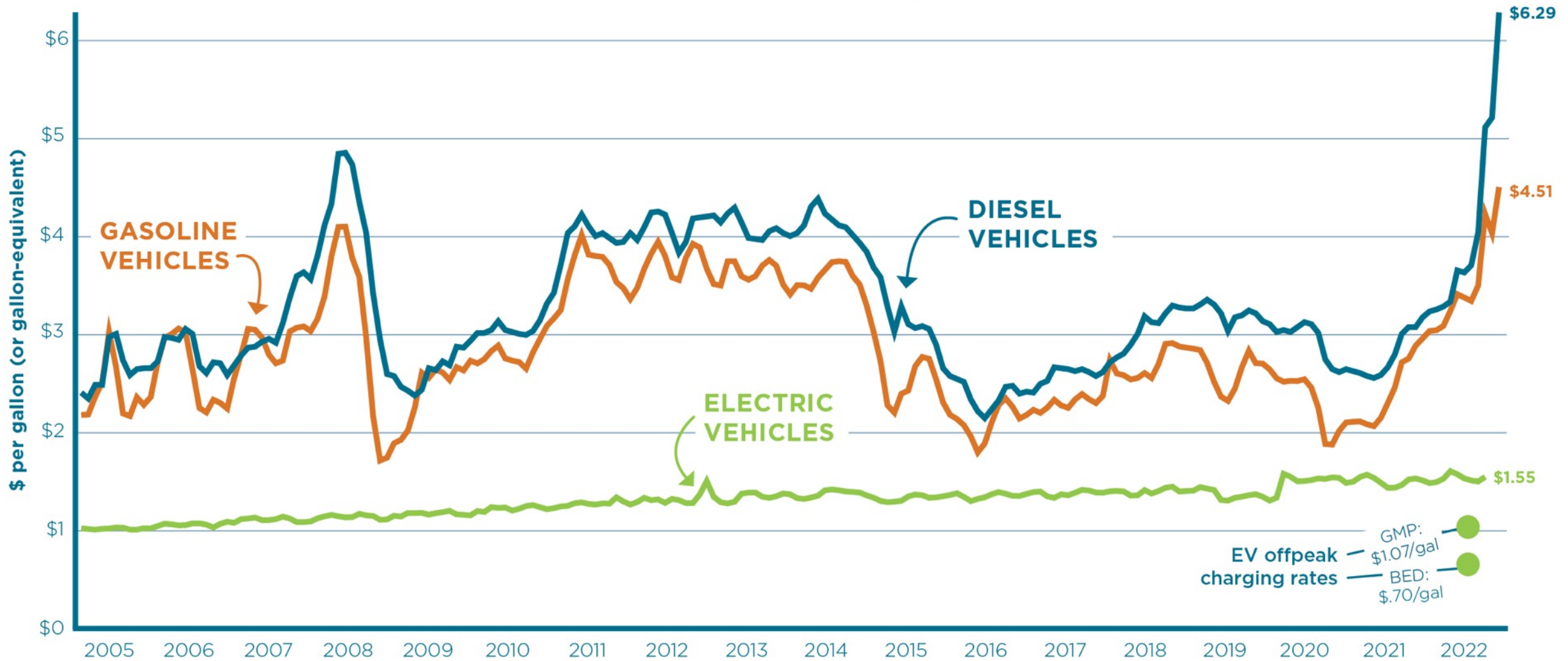
Climate Action Plan: \$ savings from pathways, net present value, 2015-2050



Source: Cadmus/EFG, Vermont Pathways Analysis Report 2.0, 2022.



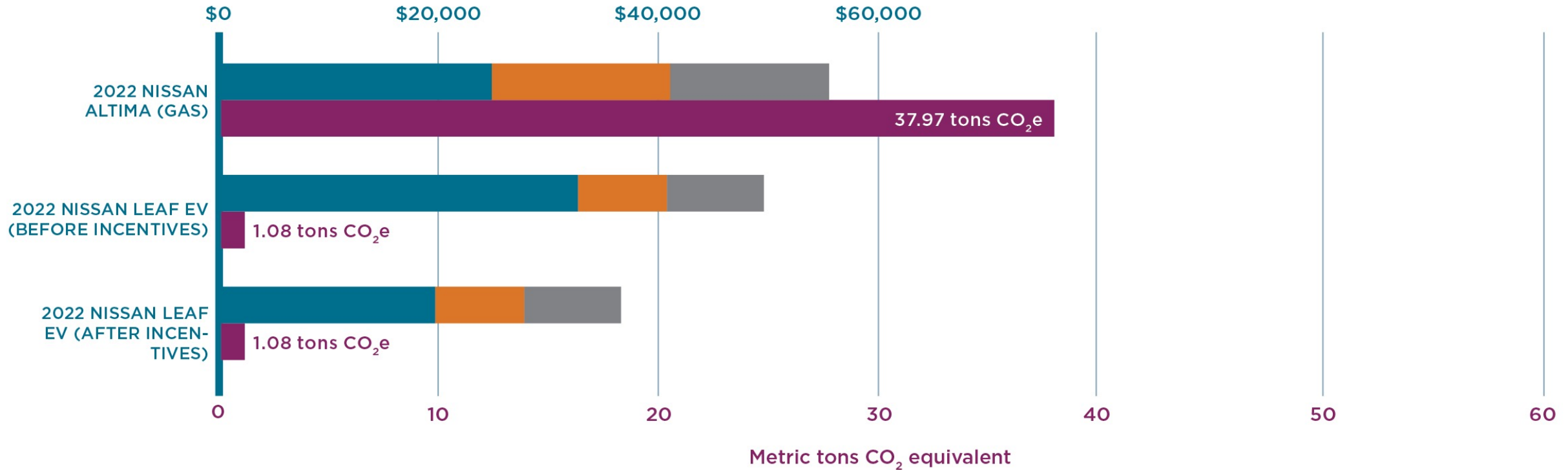
Gasoline and diesel vehicles are more expensive to drive than EVs



Sources: Gas and Electric — Drive Electric VT (via EIA); Diesel — Vermont Agency of Transportation (VTrans). Diesel and gas prices as of May 2022; electricity price as of March 2022.

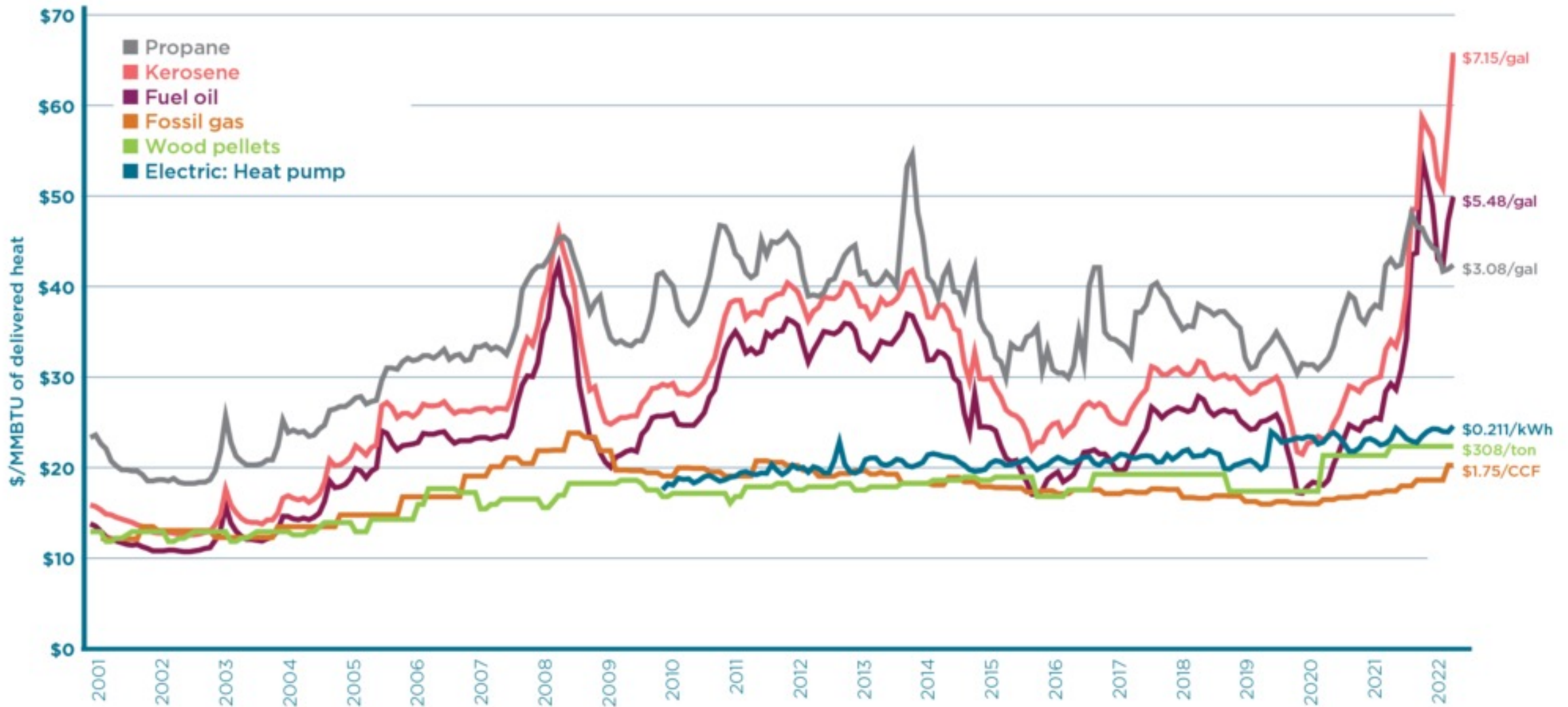
Costs and emissions of comparable gas vs EV passenger cars

■ Cost of vehicle ■ Fuel for 12 years ■ Maintenance for 12 years ■ GHG emissions for 12 years



Sources and notes: Fuel costs are based on the average from December 2021 to May 2022 of \$3.75/gallon of gasoline, and the May 2022, Green Mountain Power rate of \$0.177/ kWh of electricity. CO₂e value for VT electricity is 52 lbs/MWh. CO₂e value for gasoline is 19.4 lbs/gallon. For EV vs ICE costs: EPA, Alternative Fuels Data Center Cost Calculator, 2022. For EV vs ICE Maintenance costs: U.S. Department of Energy, "FOTW #1190, Battery-Electric Vehicles Have Lower Scheduled Maintenance Costs than Other Light-Duty Vehicles", 2021. For vehicle costs: Drive Electric Vermont, 2022. For CO₂e values of VT electricity: Vermont Agency of Natural Resources, 2021. For fossil fuel CO₂e values: EIA, 2022. For fuel costs: PSD, 2022. For electricity rates GMP 2022.

Cost comparison of different heating fuel options over time

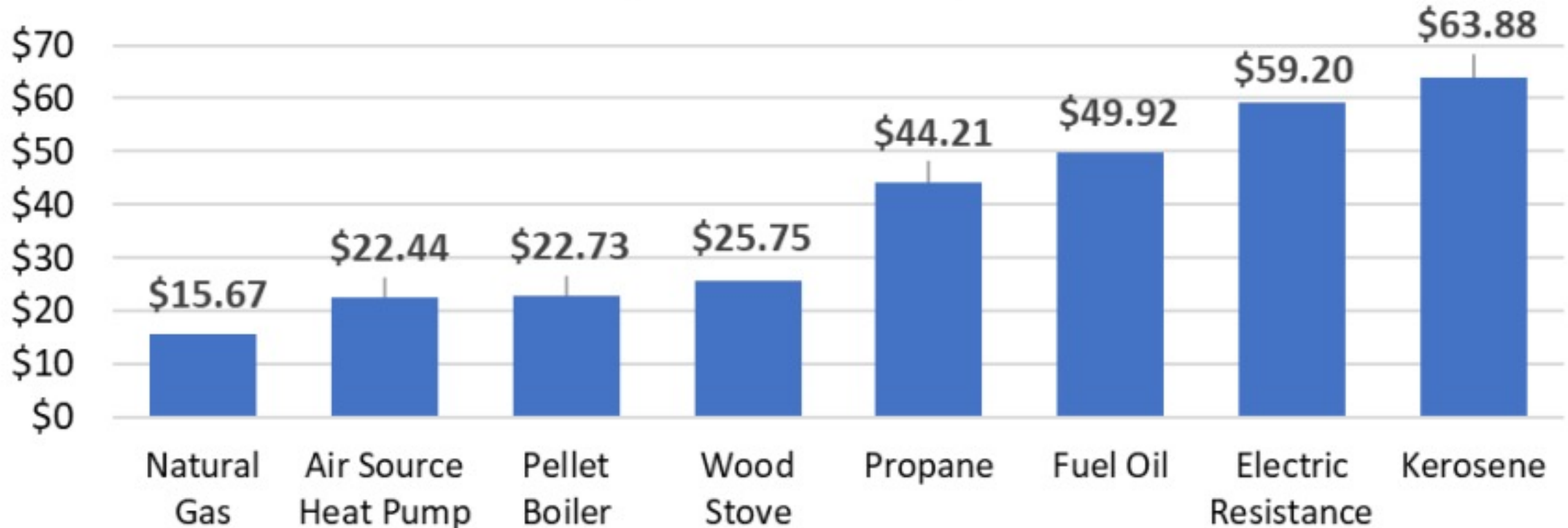


Sources: Fuel Oil, Propane: VT Department of Public Service, Fuel Price Report 2022. Fossil gas: VGS. Electricity: EIA, 2022. Wood Pellets: Biomass Energy Research Center, 2023. Note 1: Electricity prices presented here are a statewide average. Electricity prices vary by utility territory. Note 2: The reason propane is more expensive per MMBTU than fuel oil but less expensive on a per gallon basis is because propane has a lower energy content per gallon. Propane's energy content is only 66% that of fuel oil, by gallon (EIA).

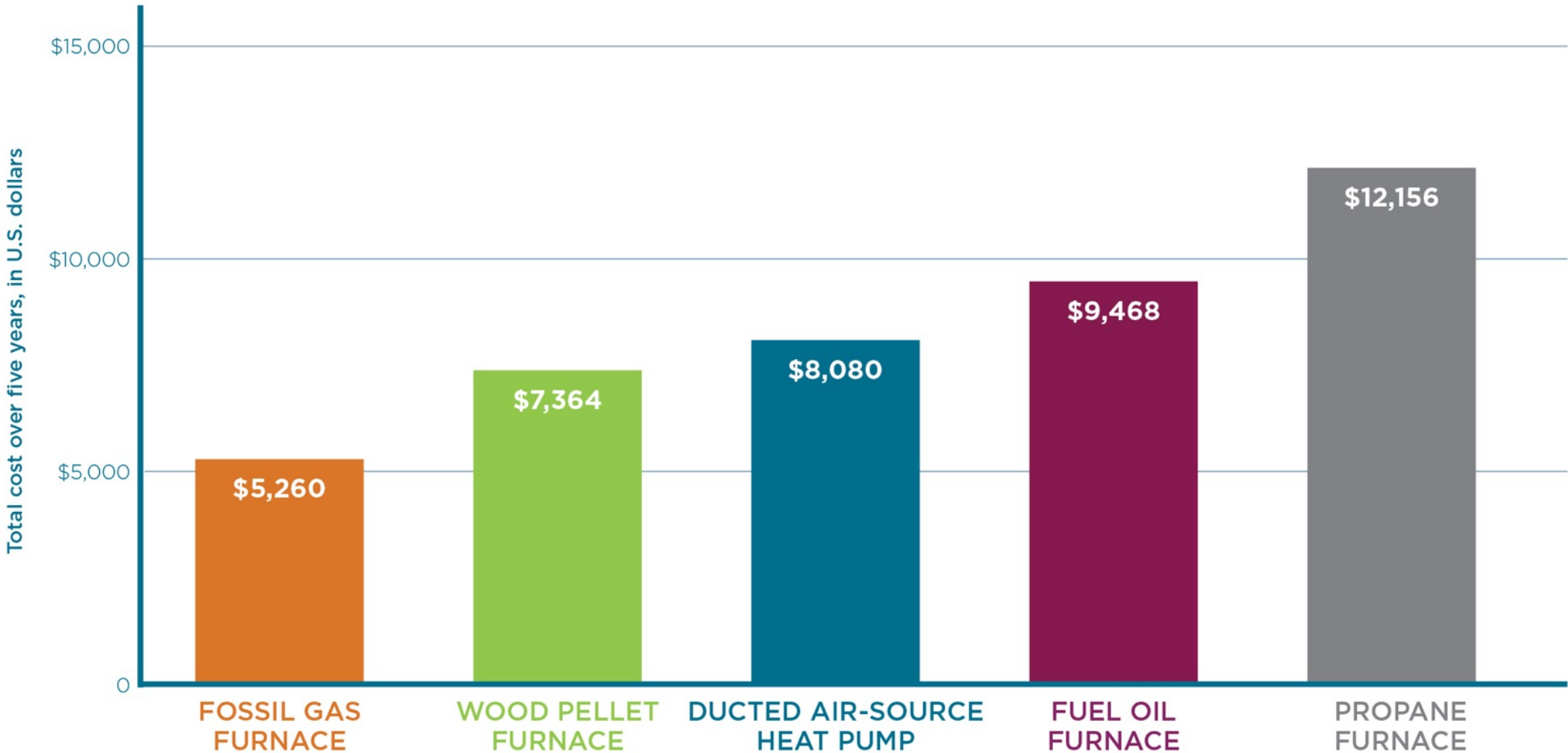


Another View on Heating Costs Comparison (PSD Annual Energy Report)

Residential Effective Cost per MMBTU Delivered
November 2022



Average total fuel costs over the last five years (2018–2022)

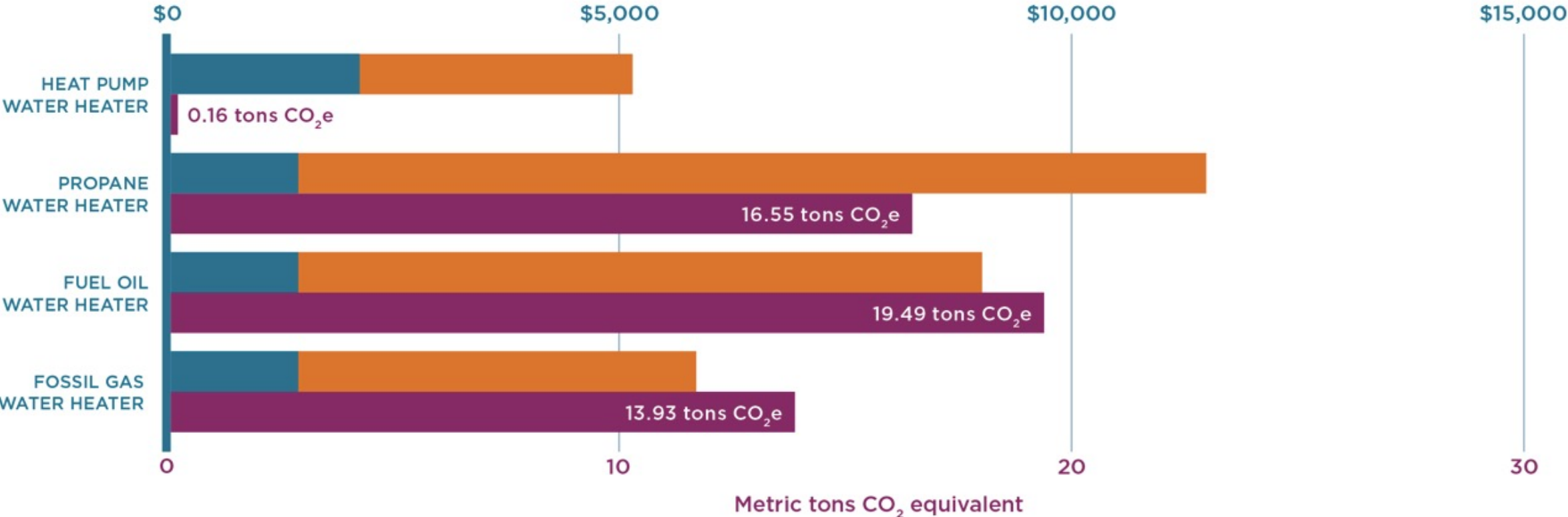


Sources: Propane and fuel oil prices: Vermont Department of Public Service Fuel Price Reports. Electricity prices: EIA. Fossil gas prices: VGS. Wood pellet prices: Biomass Energy Resource Center. Monthly heating degree days: NOAA/National Weather Service. Average efficiency rates of heating equipment types and average heating load of a VT household: 2021 TAG Tier III Technical Resource Manual.



Costs and emissions from home water heating

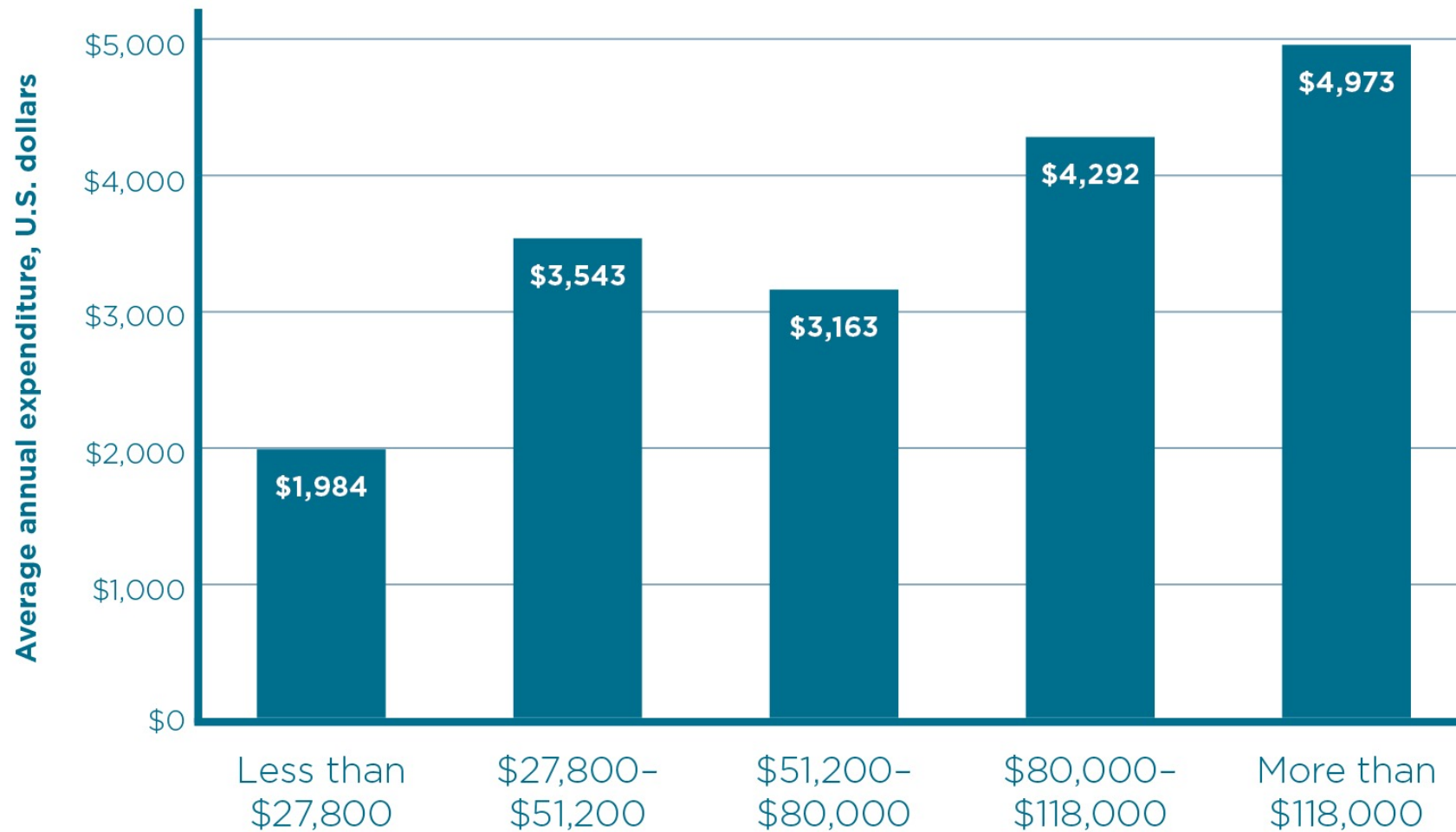
■ Equipment cost ■ Lifetime fuel cost (12 years) ■ GHG emissions in tons CO₂e for 12 years



Notes: Fuel costs used were the May 2022 Green Mountain Power rate of \$0.177/k@h, the average of the 2021/22 heating season for propane at \$3.16/gallon, fuel oil at \$3.61/gallon, and wood pellets at \$300/ton, and the listed rates for fossil gas from VGS for Aug 2022. **Sources:** For CO₂e values of VT electricity and wood pellets: Vermont Agency of Natural Resources, 2021. For fossil fuel CO₂e values: EIA, 2022. For fuel costs: PSD, 2022. For electricity rates GMP 2022. Equipment pricing from the TAG TRM where available. Additional pricing sources can be shared on request.

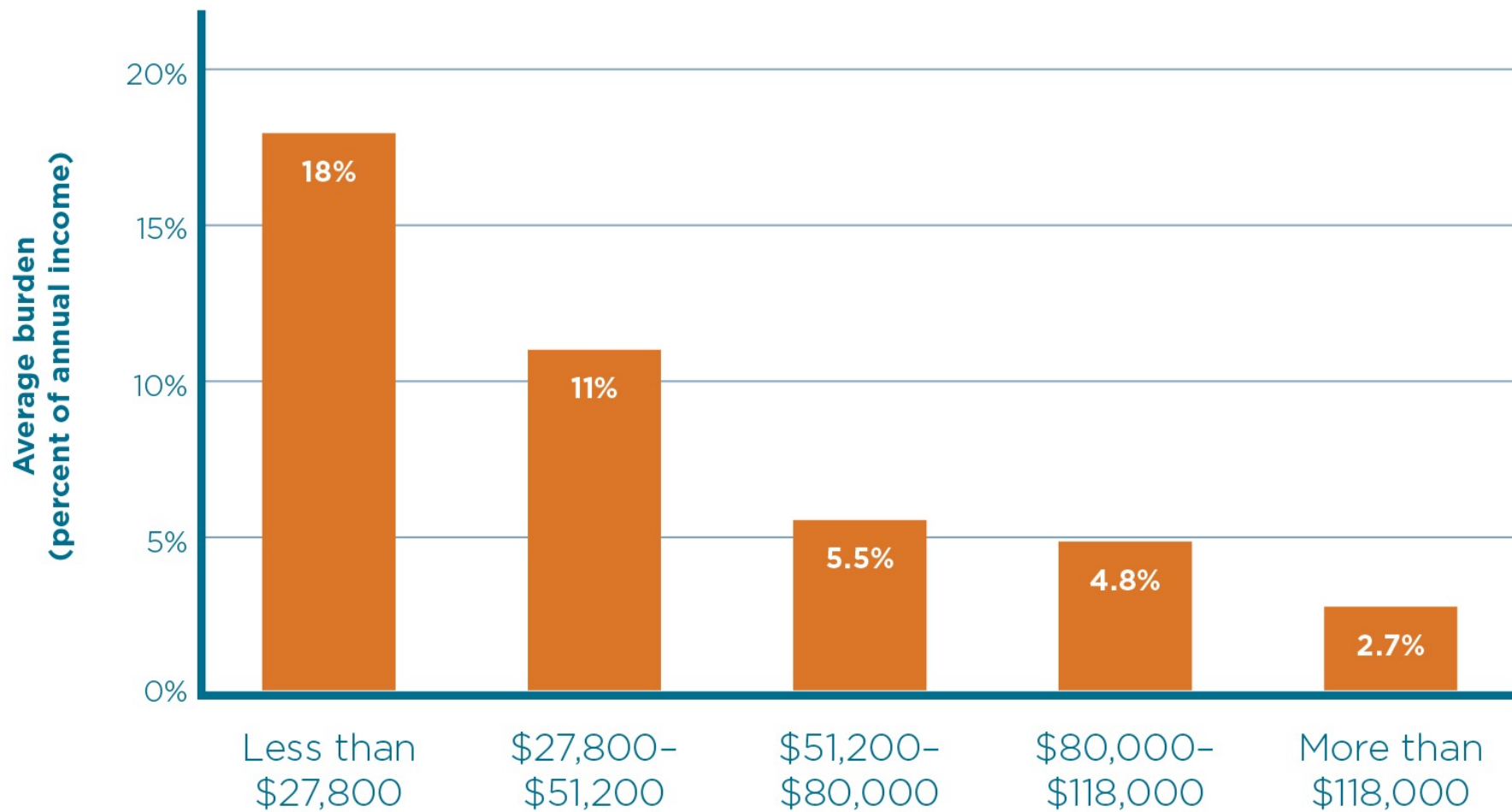


Combined heating and electricity expenditures in Vermont, by income quintile



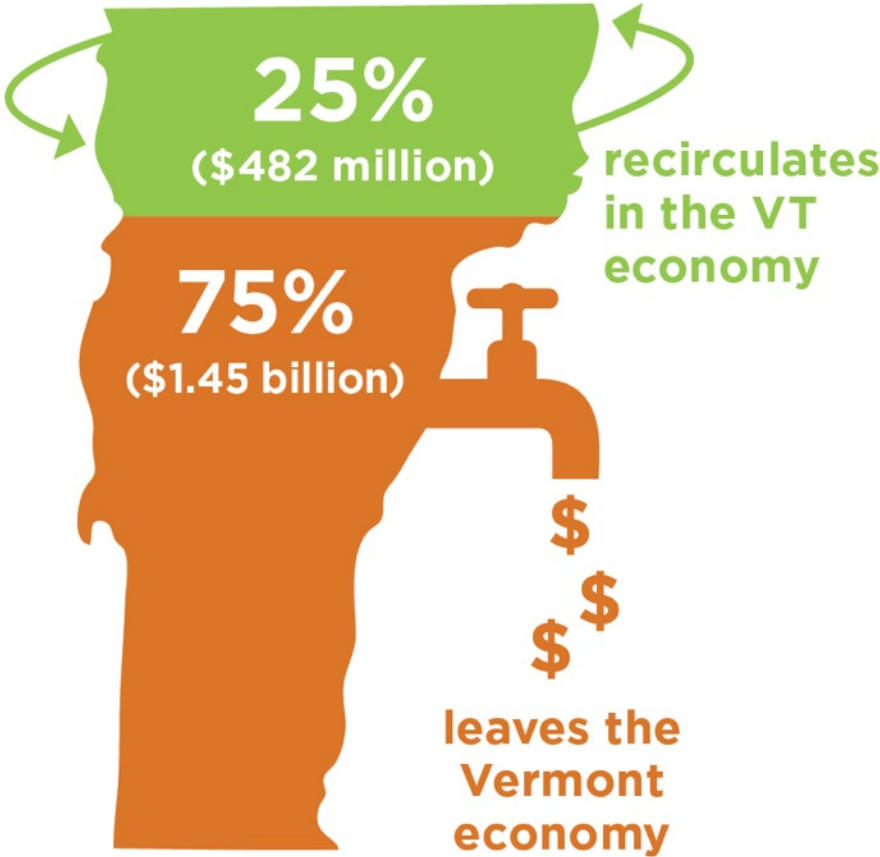
Source: U.S. Census Bureau, American Community Survey, 2018.

Combined heating and electricity energy burden in Vermont, by income quintile



Source: U.S. Census Bureau, American Community Survey, 2018.

Average annual fossil fuel spending in VT, 2010-2019

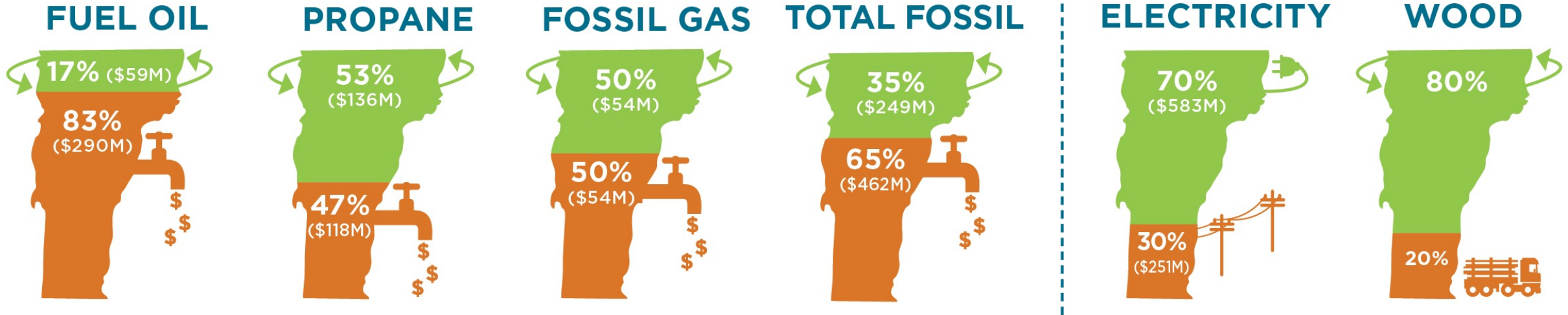


Source: Vermont Agency of Commerce and Community Development, 2022.



Thermal spending in VT, 2019

■ recirculates in the VT economy ■ leaves the VT economy

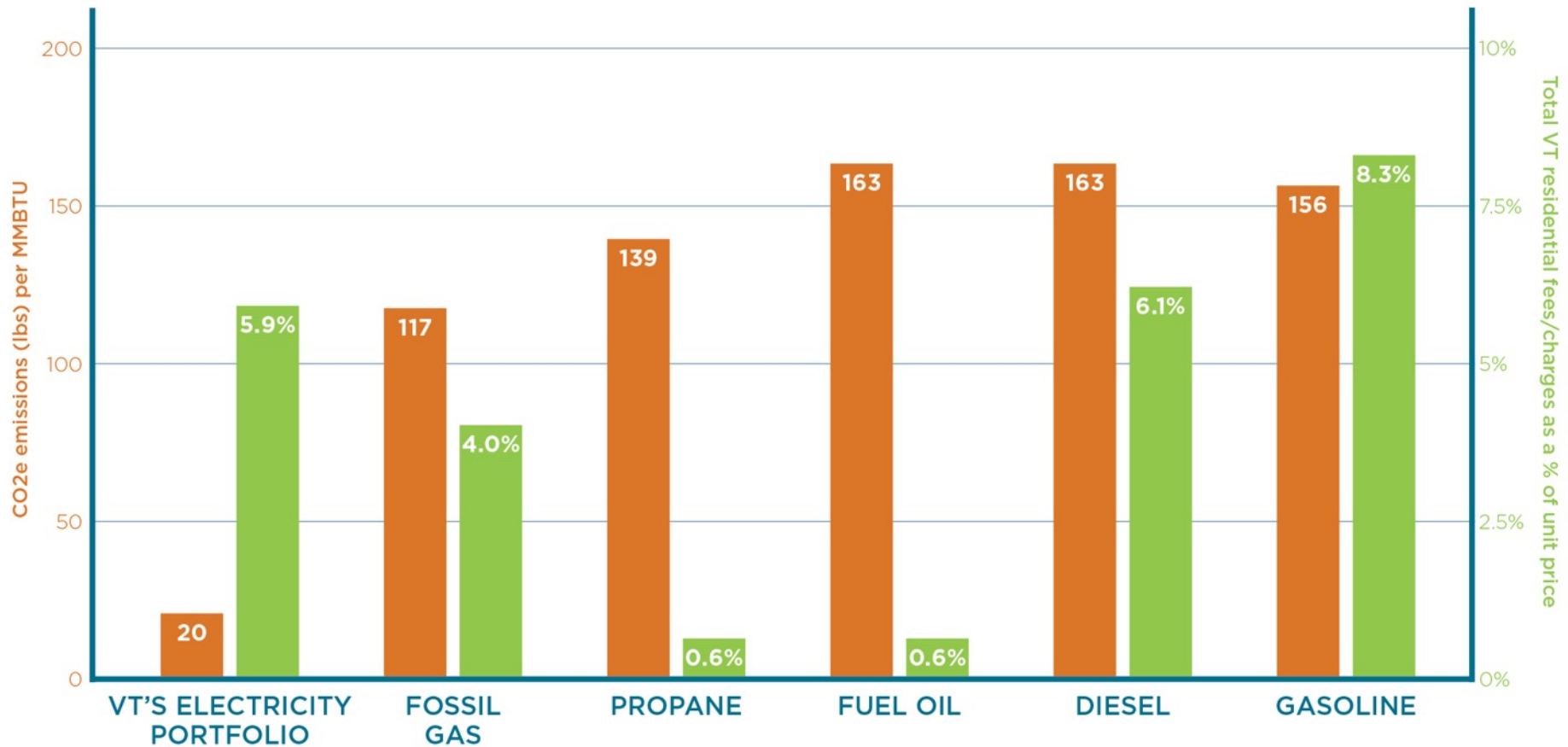


Source: Vermont Agency of Commerce and Community Development. 2022.



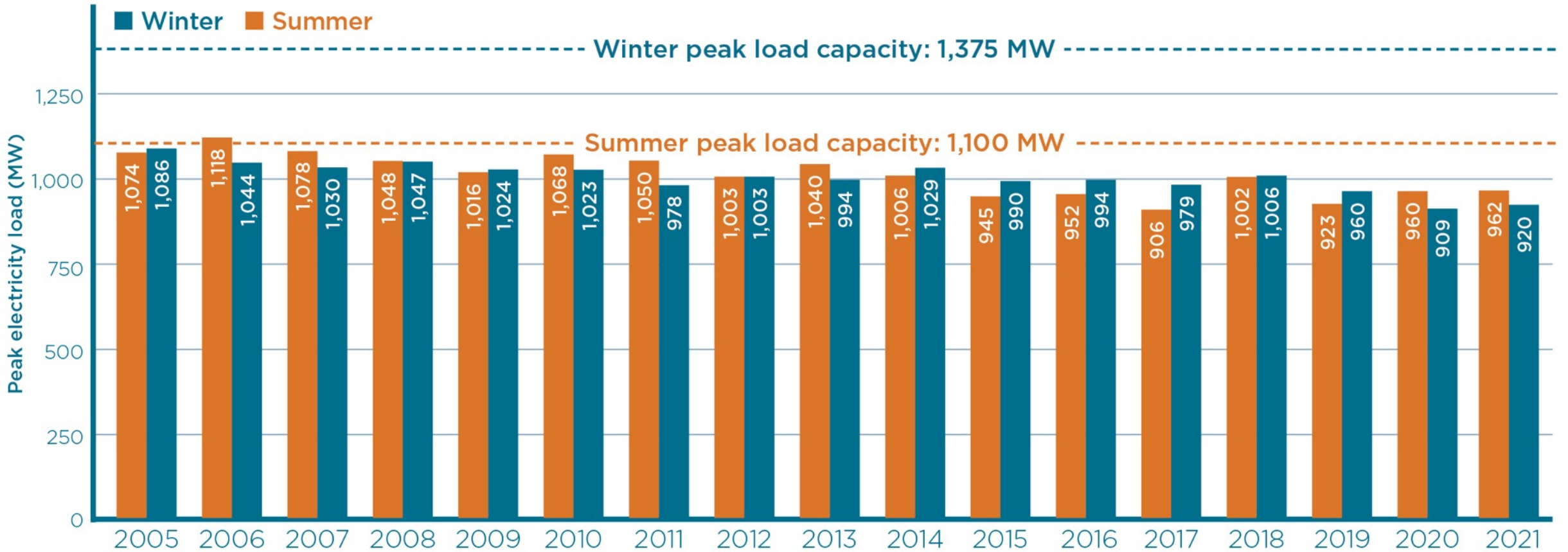
VT Fees, Taxes, & Charges for the Most Polluting Heating Sources are Far Lower than for Cleaner Energy Sources

Comprehensive fees, taxes, and charges vs emissions



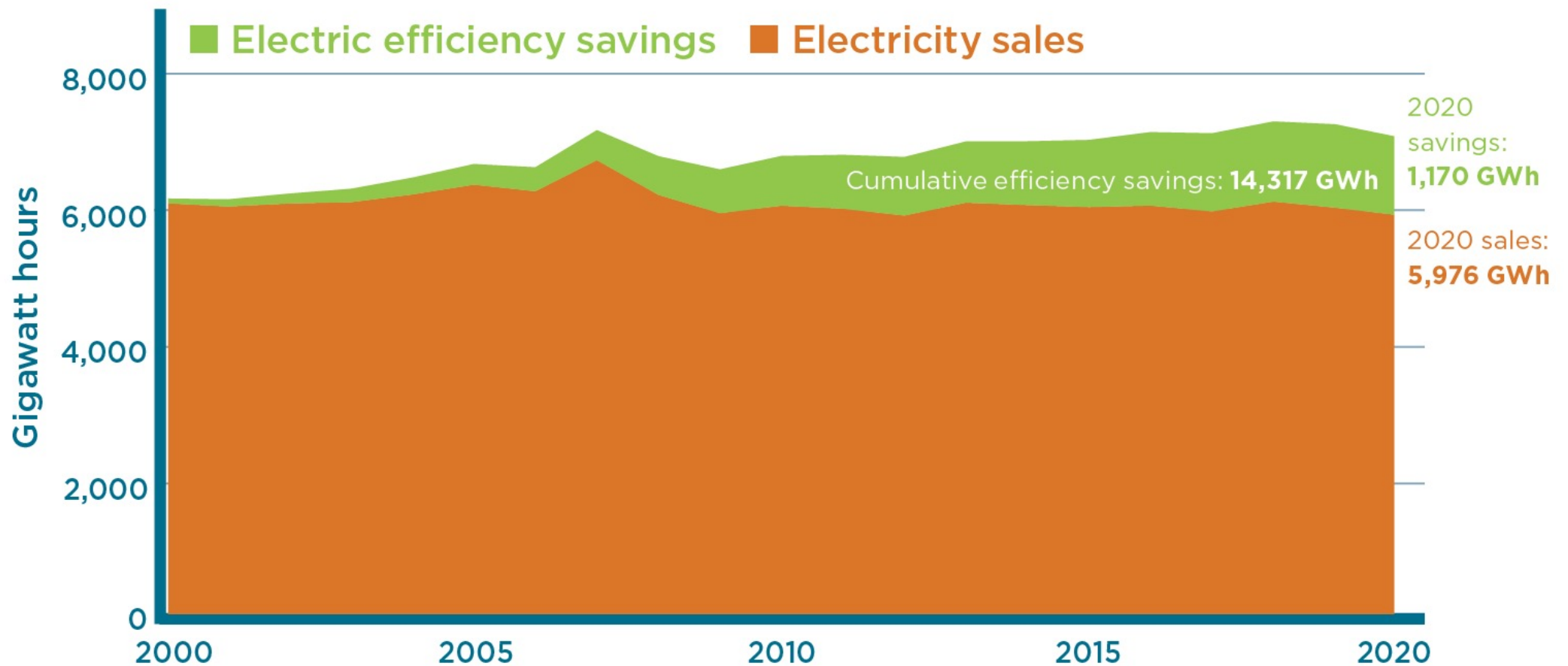
Sources: Emissions: For all fossil fuels: EIA, "Carbon Dioxide Emissions Coefficients". For VT's electricity portfolio: "Assessing the GHG Impact of Beneficial Electrification in Vermont," EAN, 2023. Fees, taxes, and charges: Vermont Department of Taxes, 2023. 2022 Energy Efficiency Charge rates for electricity and fossil gas: PUC Determination of 2022 Energy Efficiency Charge Rates. Gas and diesel taxes and fees: Vermont Motor Fuels Tax, VFDA, 2023. Unit price of fuels is based on the annual average in 2022.

Vermont seasonal peak electricity loads, 2005-2021



Source: VELCO, 2022. This data shows VELCO's VT Load actuals. In the 2020/21 EAN Report we instead showed the VT Billing Load from ISO-NE, which is different.

Electricity savings from electric efficiency utilities



Source: Vermont Department of Public Service, 2021 Annual Energy Report, 2021. Data includes Efficiency VT and Burlington Electric Department.





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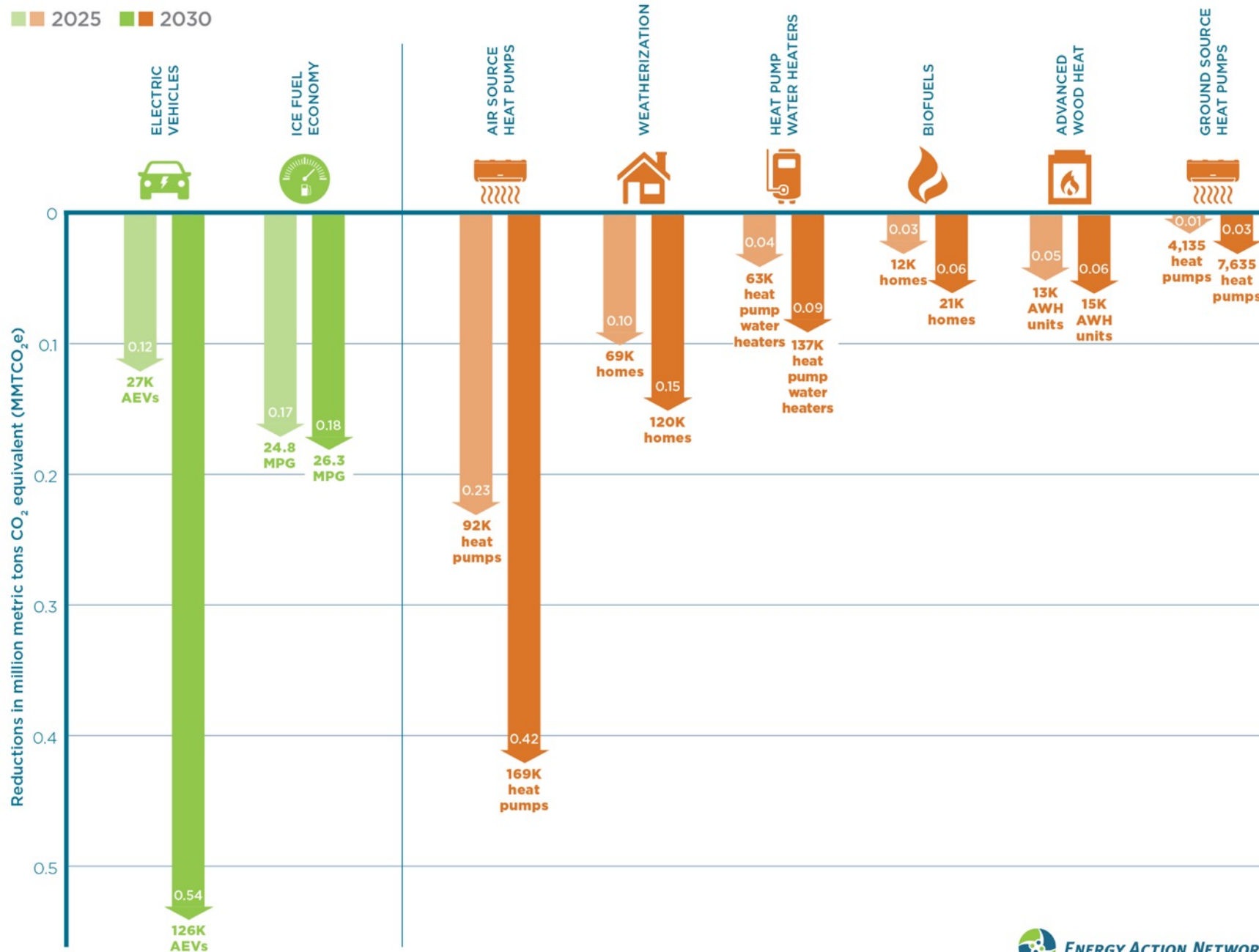
and the Economy

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Questions about the Report?
jduval@eanvt.org

Pathways emissions reductions, 2025 and 2030

2025 2030

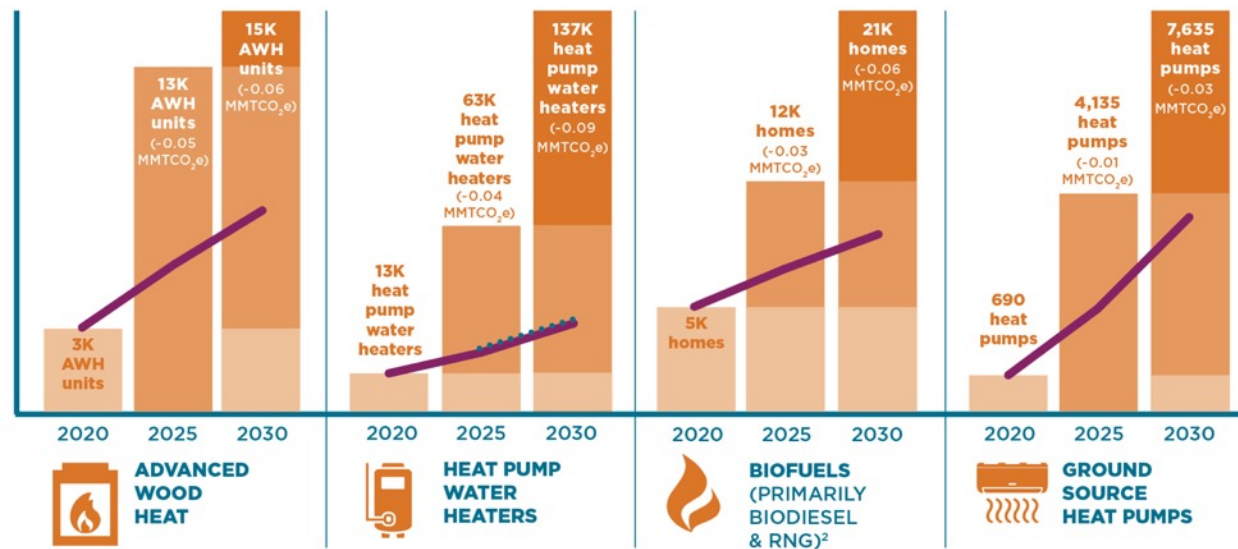
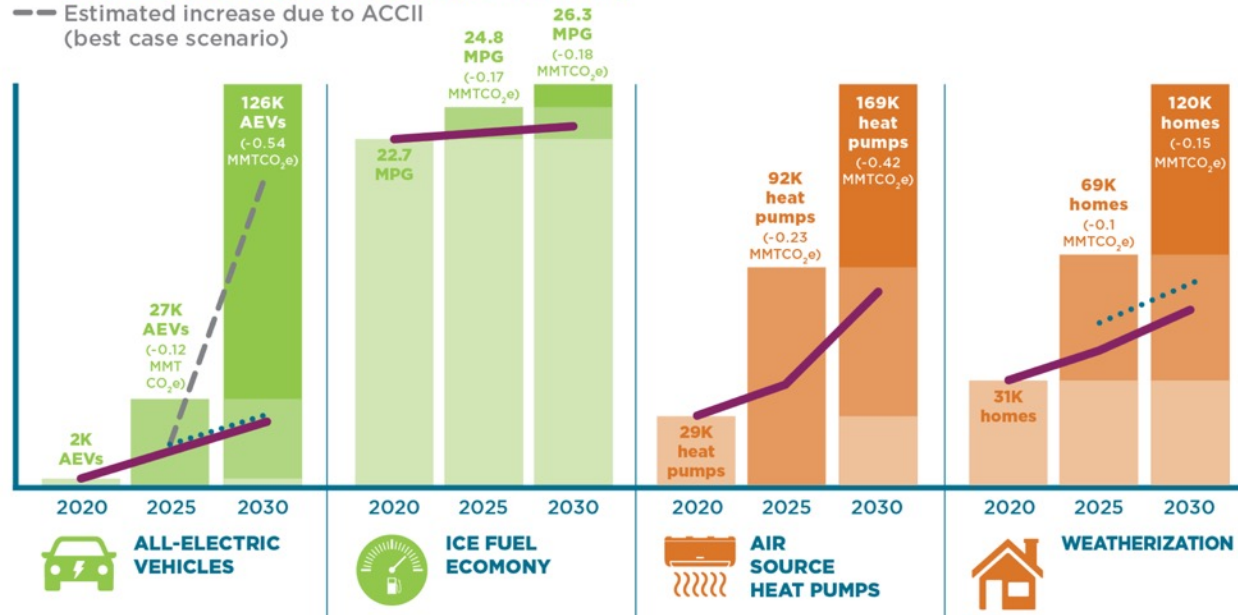


Top GHG reduction measures in Climate Council Pathways

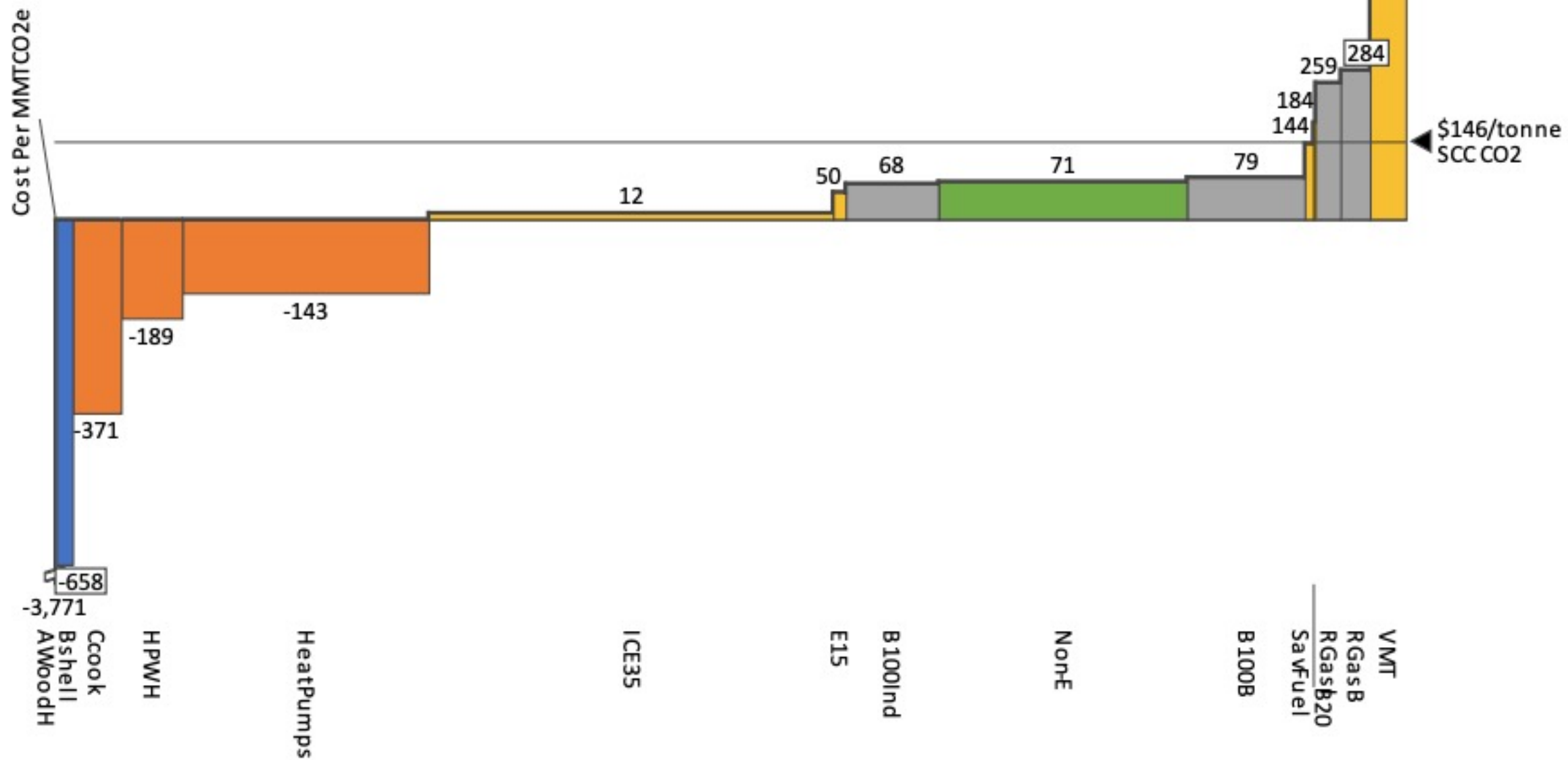
— Business-as-usual projection implied by existing policies as of fall 2021

•••• Estimated increase from FY23 budget investments¹

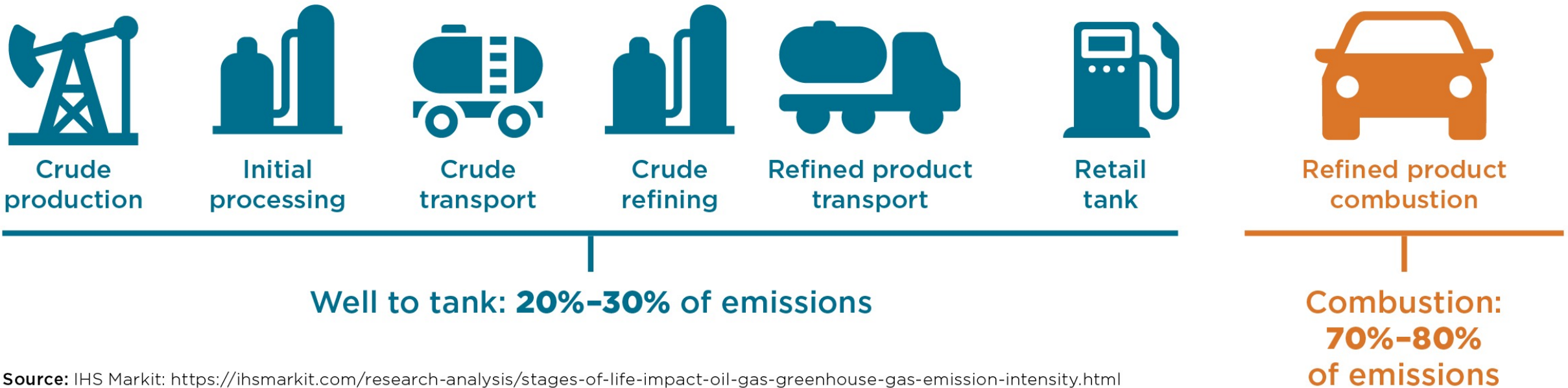
— Estimated increase due to ACCII (best case scenario)



Horizontal Axis: Cumulative Emissions Reduction for Measures Implemented Through 2030



Lifecycle GHG emissions analysis applied to fossil fuels



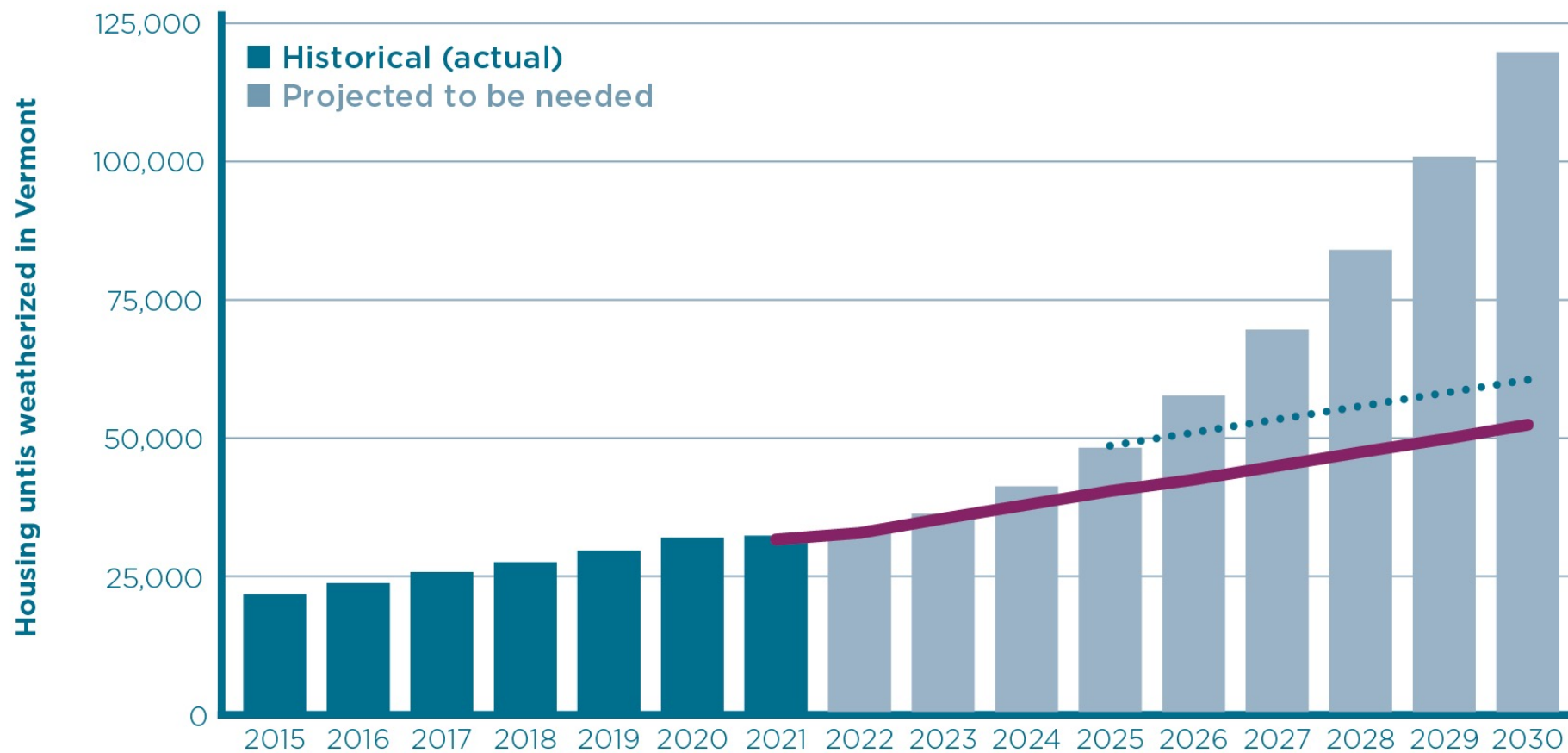
Source: IHS Markit: <https://ihsmarkit.com/research-analysis/stages-of-life-impact-oil-gas-greenhouse-gas-emission-intensity.html>

Weatherization in Vermont

Historical trends and Climate Council pathway projections

— Business-as-usual projection implied by existing policies as of fall 2021

••• Estimated increase from FY23 budget investments¹



Sources: Historical Data: EAN Energy Dashboard, 2021 (primarily from Efficiency Vermont); Future projections: Cadmus/EFG, Vermont Pathways Analysis Report 2.0, 2022.

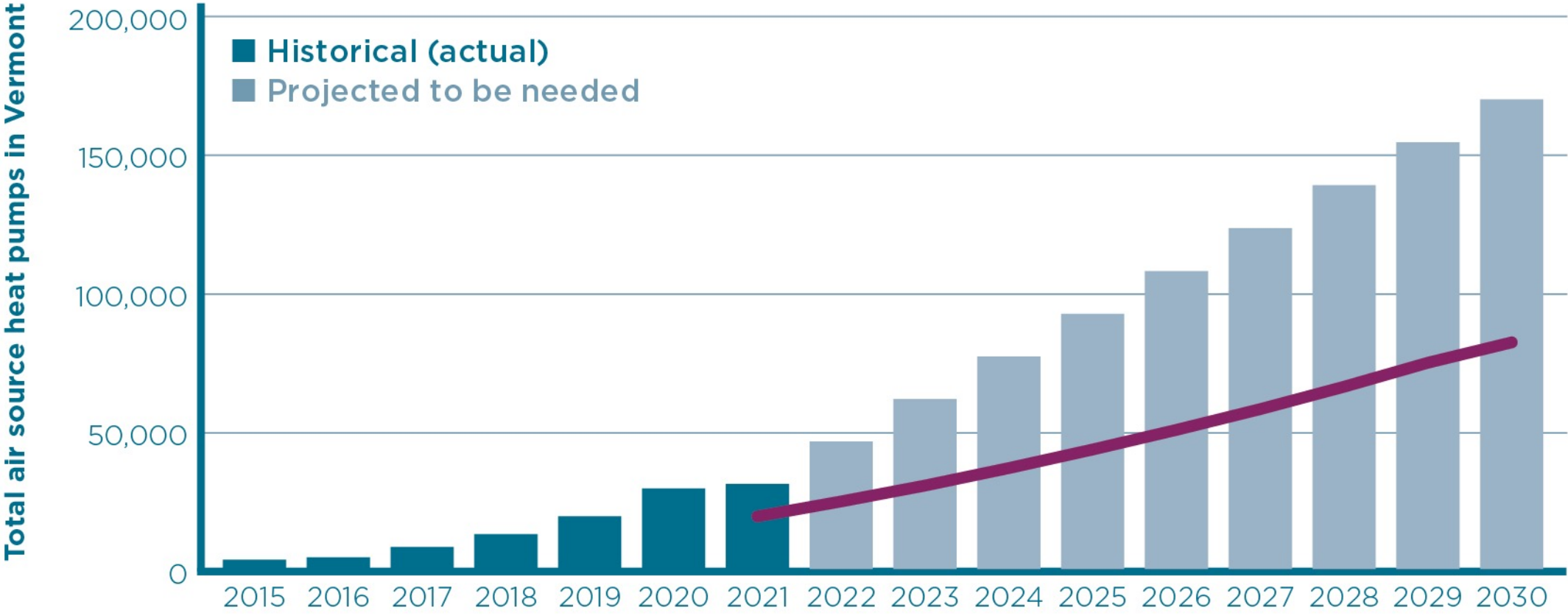
1. EAN analysis.



Air source heat pumps in Vermont

Historical trends and Climate Council pathway projections

Business-as-usual projection implied by existing policies as of fall 2021



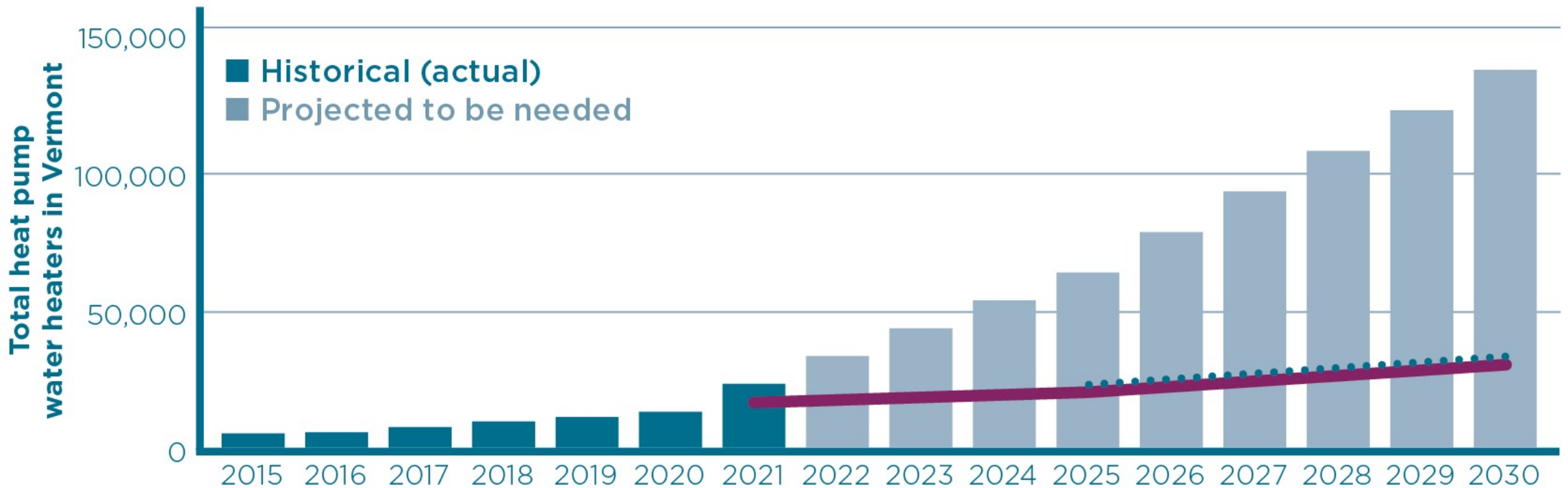
Sources: Historical Data: EAN Energy Dashboard, 2021 (primarily from Efficiency Vermont); Future projections: Cadmus/EFG, Vermont Pathways Analysis Report 2.0, 2022.



Heat pump water heaters in Vermont

Historical trends and Climate Council pathway projections

- Business-as-usual projection implied by existing policies as of fall 2021
- Estimated increase from FY23 budget investments¹



Sources: Historical Data: EAN Energy Dashboard, 2021 (primarily from Efficiency Vermont); Future projections: Cadmus/EFG, Vermont Pathways Analysis Report 2.0, 2022.
1. EAN analysis.

