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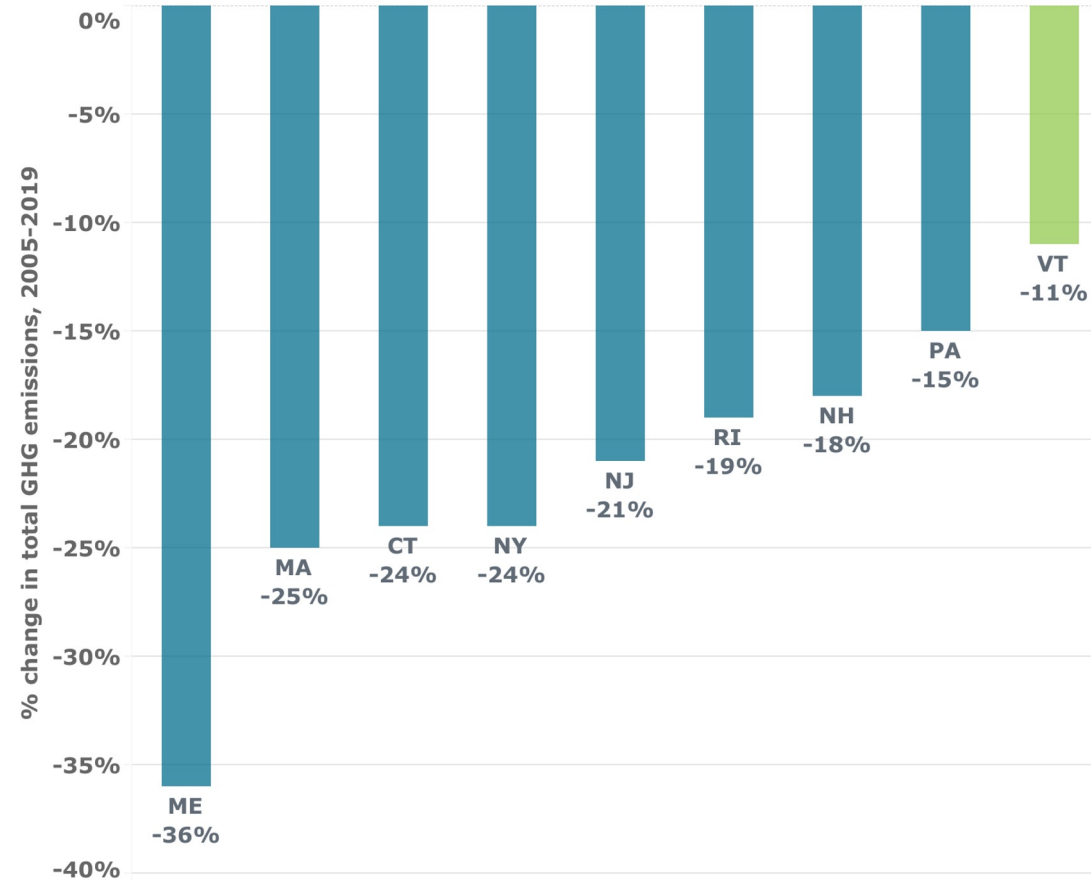
Testimony to Senate Natural Resources & Energy Committee,  
January 10, 2024

# Reducing climate pollution in Vermont

- **A moral responsibility**
- **A legal obligation**
- **An economic opportunity** (both to reduce energy costs and to strengthen Vermont's economy)

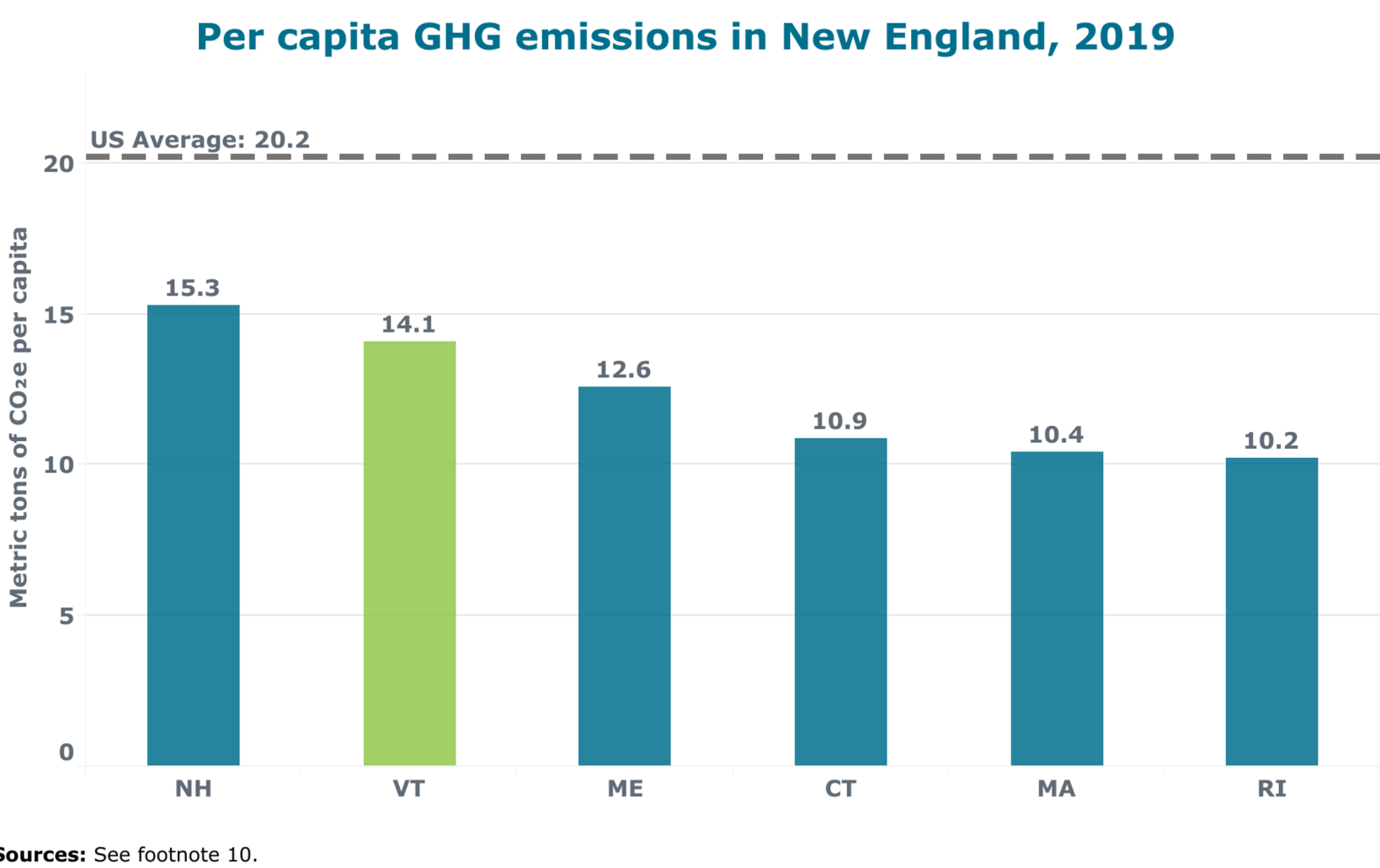
# Vermont: Least progress of any Northeastern state in reducing GHG pollution since 2005

Percent reduction in total GHG emissions, 2005-2019

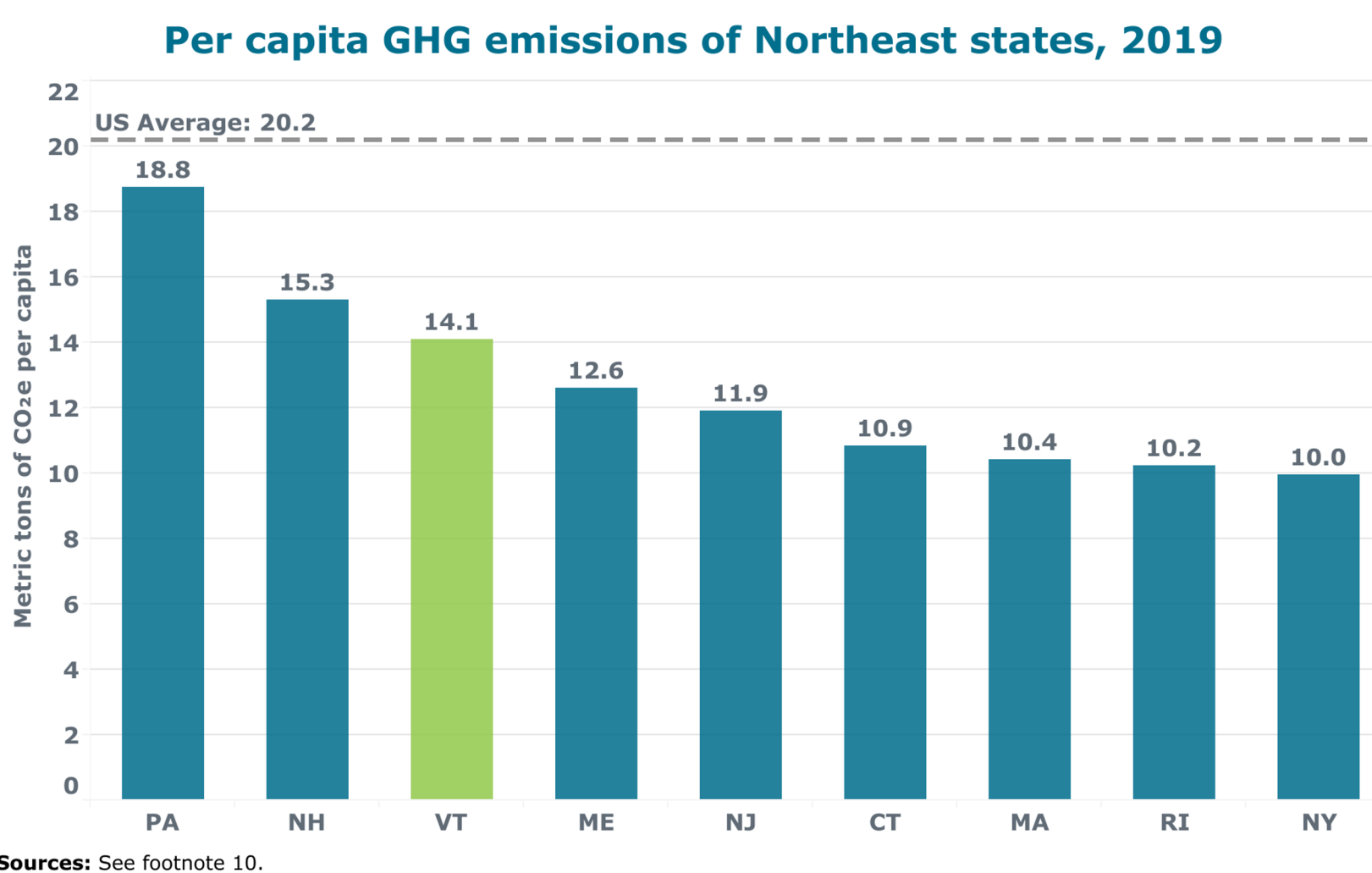


**Sources:** Vermont ANR, "Vermont Greenhouse Gas Emissions Inventory and Forecast: 1990 - 2020," 2023; Connecticut DEEP, "Connecticut Greenhouse Gas Emissions Inventory: 1990-2021", 2023; Maine DEP, "Ninth Biennial Report on Progress Toward Greenhouse Gas Reduction Goals", 2022; Massachusetts DEP, "Massachusetts Annual Greenhouse Gas Emissions Inventory: 1990-2020, with Partial 2021 & 2022 Data", 2022; OpenData NY, "Statewide Greenhouse Gas Emissions: Beginning 1990", 2023; Rhode Island DEM, "2019 Rhode Island Greenhouse Gas Emissions Inventory", 2022. Clean Energy NH, 2023; New Jersey DEP, "New Jersey Greenhouse Gas Inventory," 2022; Pennsylvania DEP, "Pennsylvania Greenhouse Gas Inventory Report," 2022; U.S. Census Bureau, "Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico", 2019.

# Vermont: 2<sup>nd</sup> highest climate pollution per capita in New England

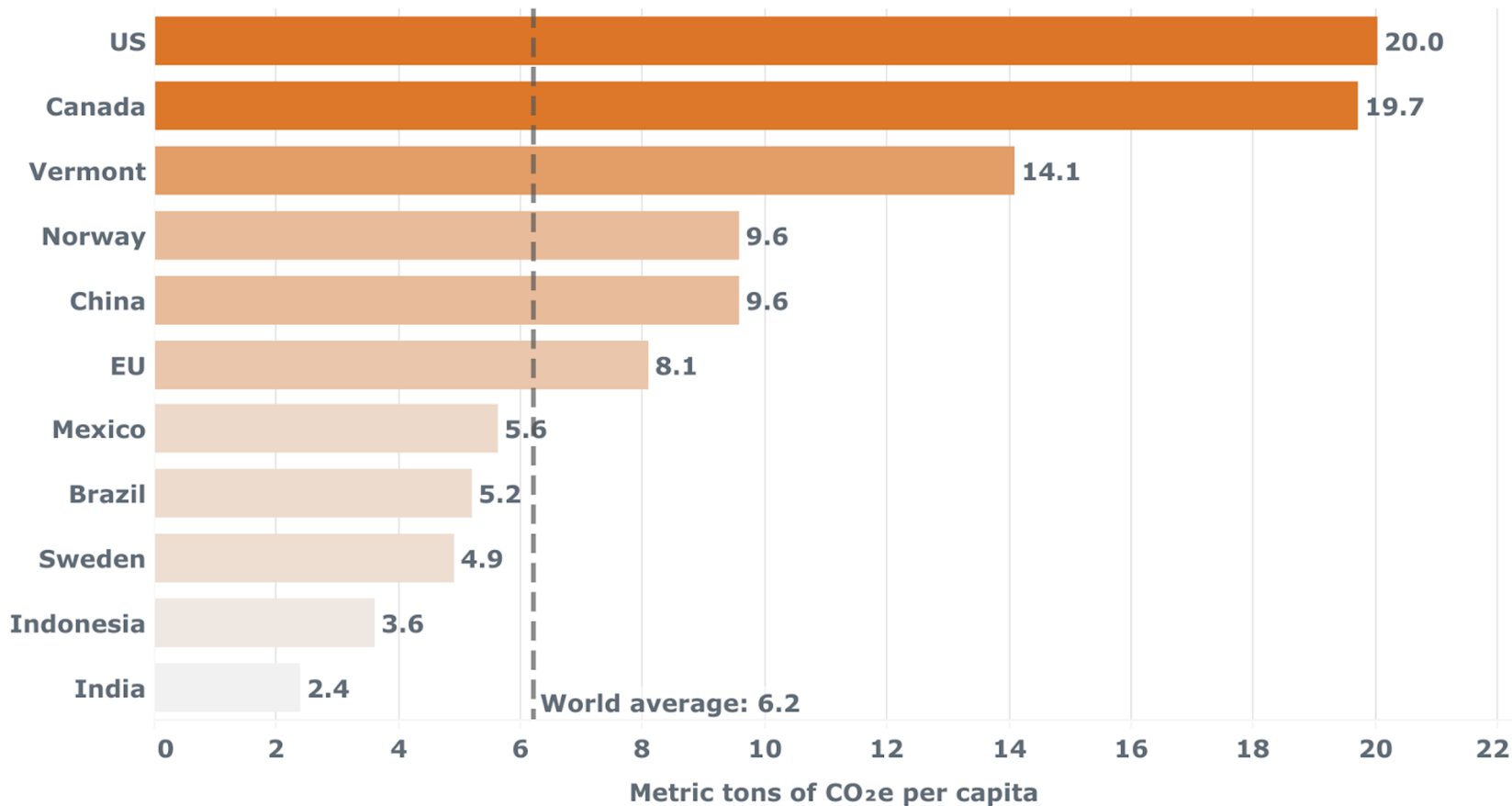


# Vermont: 3<sup>rd</sup> highest climate pollution per capita across the Northeast



# Vermont's per capita emissions in a global context

Per capita GHG emissions, 2019



Vermont's per capita emissions are more than 2x the global average.

Sources: Gütschow, J. & Pflüger, M., "The PRIMAP-hist national historical emissions time series v2.4 (1750-2021)", 2022 via Climate Watch; Our World in Data, 2023.

# Global Warming Solutions Act (Act 153 of 2020)

## § 593. RULES

**(d) The Secretary shall, on or before July 1, 2024, review and, if necessary, update the rules required by subsection (b) of this section in order to ensure that the 2025 greenhouse gas emissions reduction requirement pursuant to section 578 of this title is achieved. In performing this review and update, the Secretary shall observe the requirements of subsection (c) of this section.**

# Global Warming Solutions Act (Act 153 of 2020)

\* \* \* Greenhouse Gas Reduction Requirements \* \* \*

Sec. 3. 10 V.S.A. § 578 is amended to read:

§ 578. GREENHOUSE GAS REDUCTION ~~GOALS~~ REQUIREMENTS

(a) ~~General goal of greenhouse~~ Greenhouse gas reduction requirements. ~~It is the goal of the State to~~ Vermont shall reduce emissions of greenhouse gases from within the geographical boundaries of the State and those emissions outside the boundaries of the State that are caused by the use of energy in



# Global Warming Solutions Act (Act 153 of 2020)

~~Vermont in order to make an appropriate contribution to achieving the regional goals of reducing emissions of greenhouse gases from the 1990 baseline, as measured and inventoried pursuant to section 582 of this title, by:~~

(1) ~~25~~ not less than 26 percent from 2005 greenhouse gas emissions by January 1, ~~2012~~ 2025 pursuant to the State's membership in the United States Climate Alliance and commitment to implement policies to achieve the objectives of the 2016 Paris Agreement;

(2) ~~50~~ not less than 40 percent from 1990 greenhouse gas emissions by January 1, ~~2028~~ 2030 pursuant to the State's 2016 Comprehensive Energy Plan; and

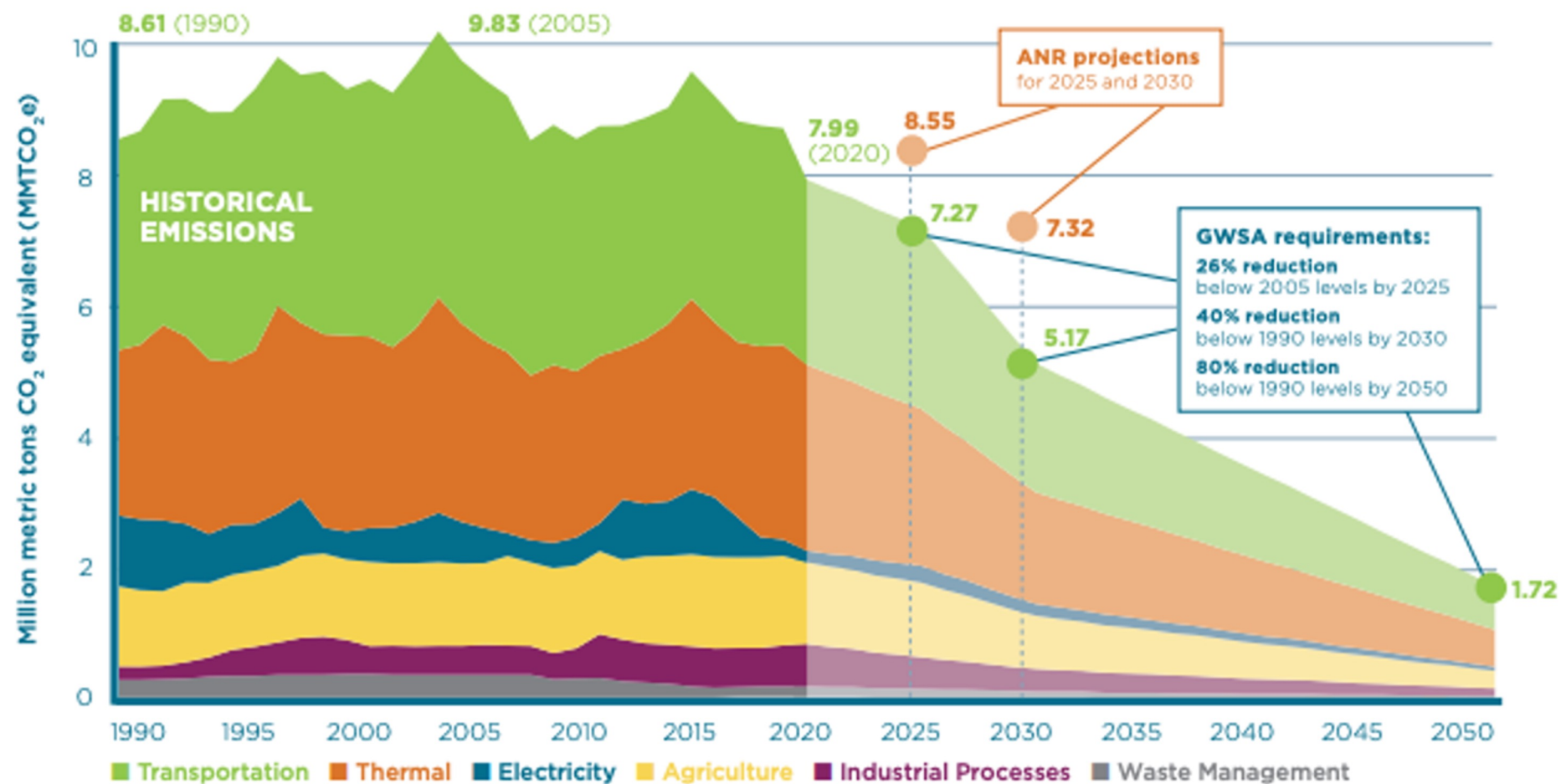
(3) ~~if practicable using reasonable efforts, 75~~ not less than 80 percent from 1990 greenhouse gas emissions by January 1, 2050 pursuant to the State's 2016 Comprehensive Energy Plan.

## Discussion

This report's findings confirm the understanding that attaining Vermont's GWSA requirements in the RCI sector depends fundamentally on four complementary activities, a) reduced demand through more efficient buildings, equipment and management, b) a supply of decarbonized electricity matched to loads, c) electrification of building and transportation end uses, and d) an increase in the use of biofuels as substitutes for fossil fuels.

While the updated BAU scenario narrows the gap between emissions reductions projected under current conditions and those required by the GWSA, without additional program and policy support compliance with GWSA emission reduction requirements is unlikely.

## Vermont's historical GHG emissions and future requirements



**Source:** Vermont Agency of Natural Resources, Vermont GHG Emissions Inventory and Forecast: 1990-2020, 2023. **Notes:** There is a small amount of emissions from the "fossil fuel industry" category (i.e. fugitive emissions from fossil gas pipelines in VT), accounting for 0.3% of Vermont's overall emissions in 2020, that does not show up on this graph. The ANR projections for 2025 and 2030 are from Vermont's 1990-2020 GHG inventory, published in 2023, and reflect a business-as-usual scenario, including the impact of ACCII.

<b>Year</b>	<b>Actual GHG Emissions (ANR Emissions Inventory)</b>	<b>Modeled BAU emissions</b>
2015	9.66	8.53
2016	9.31	8.32
2017	8.9	8.23
2018	8.83	8.24
2019	8.79	8.39
2020	7.99	7.06

Sources: ANR, Vermont Greenhouse Gas Emissions Inventory and Forecast: 1990 – 2020, published April 2023.

[https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/\\_Vermont\\_Greenhouse\\_Gas\\_Emissions\\_Inventory\\_Update\\_1990-2020\\_Final.pdf](https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2020_Final.pdf). BAU emissions from EFG/SEI/Cadmus team, [https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/x-sector%20and%20task%20group%20revised\\_baseline\\_results\\_6\\_15\\_2023.pdf](https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/x-sector%20and%20task%20group%20revised_baseline_results_6_15_2023.pdf).

# VT Fossil Fuel Sales - Transportation, 2015-2022

Year	Gasoline (gallons)	Diesel (gallons)	Gasoline + Diesel (gallons)	Change from previous year
2018	316,293,411	66,292,880	382,586,291	
2019	314,728,037	66,171,721	380,899,758	-0.44%
2020	262,417,698	61,703,853	324,121,551	-14.91%
2021	285,699,809	66,141,133	351,840,942	8.55%
2022	285,555,157	64,929,145	350,484,302	-0.39%
<b>% change (2018-2022)</b>	<b>-9.72%</b>	<b>-2.06%</b>	<b>-8.39%</b>	

Source: JFO/Vermont Department of Taxes

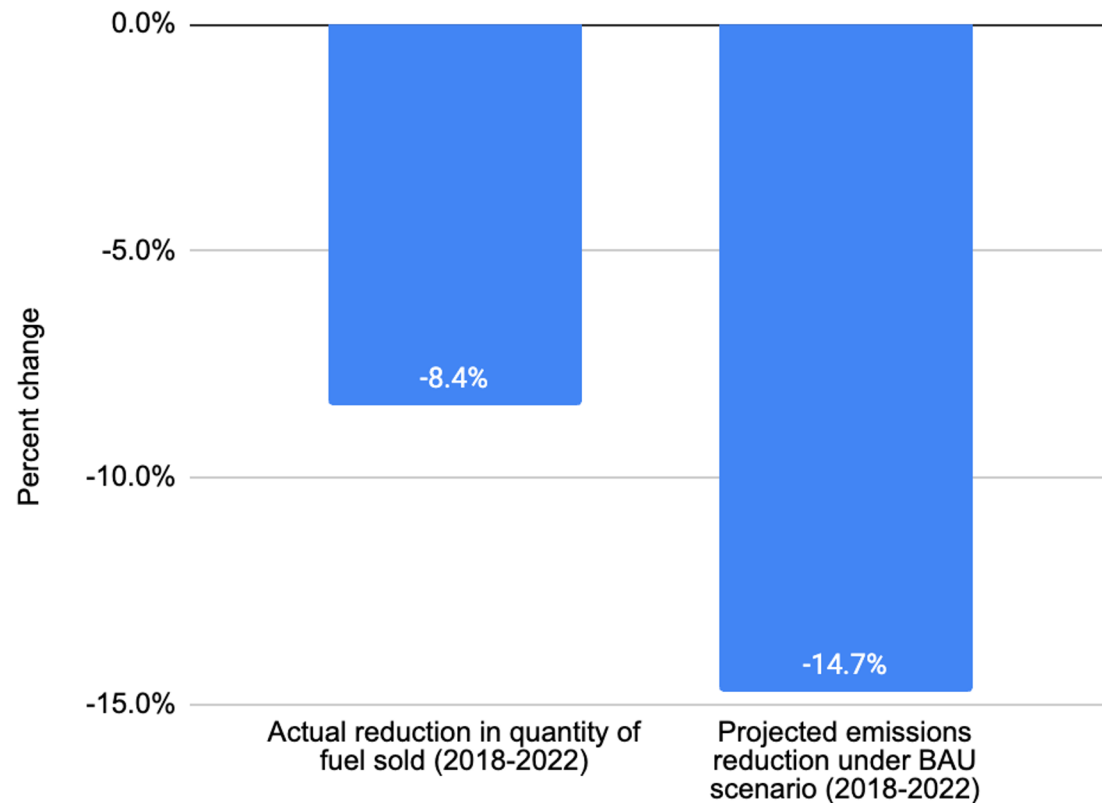
<https://ljfo.vermont.gov/search/filter/keywords/gallons+taxed>

# VT Fossil Fuel Sales - Thermal, 2018-2022

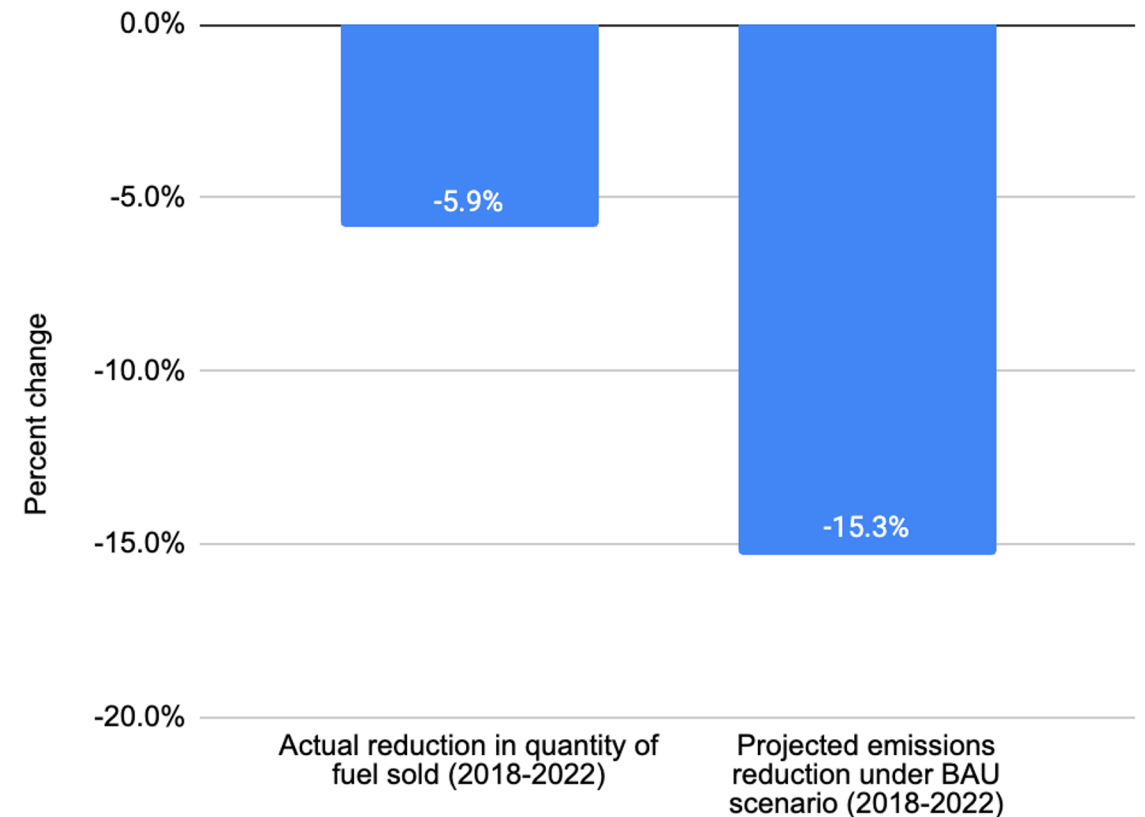
Year	Fuel oil		Propane		Fossil gas		Total MMBtu
	Gallons	MMBtu	Gallons	MMBtu	MMcf	MMBtu	
2018	142,761,000	19,772,399	105,640,000	9,660,989	13,732	14,226,352	43,659,740
2019	144,042,000	19,949,817	112,072,000	10,249,209	13,882	14,381,752	44,580,778
2020	138,114,000	19,128,789	96,993,000	8,870,204	13,043	13,512,548	41,511,541
2021	125,534,000	17,386,459	110,790,000	10,131,967	13,270	13,747,720	41,266,146
2022	121,495,000	16,827,058	113,180,000	10,350,537	13,433	13,916,588	41,094,183
<b>% change</b>		<b>-14.90%</b>		<b>7.14%</b>		<b>-2.18%</b>	<b>-5.88%</b>

Sources: For fuel oil and propane: Vermont Department of Taxes; for fossil gas: EIA

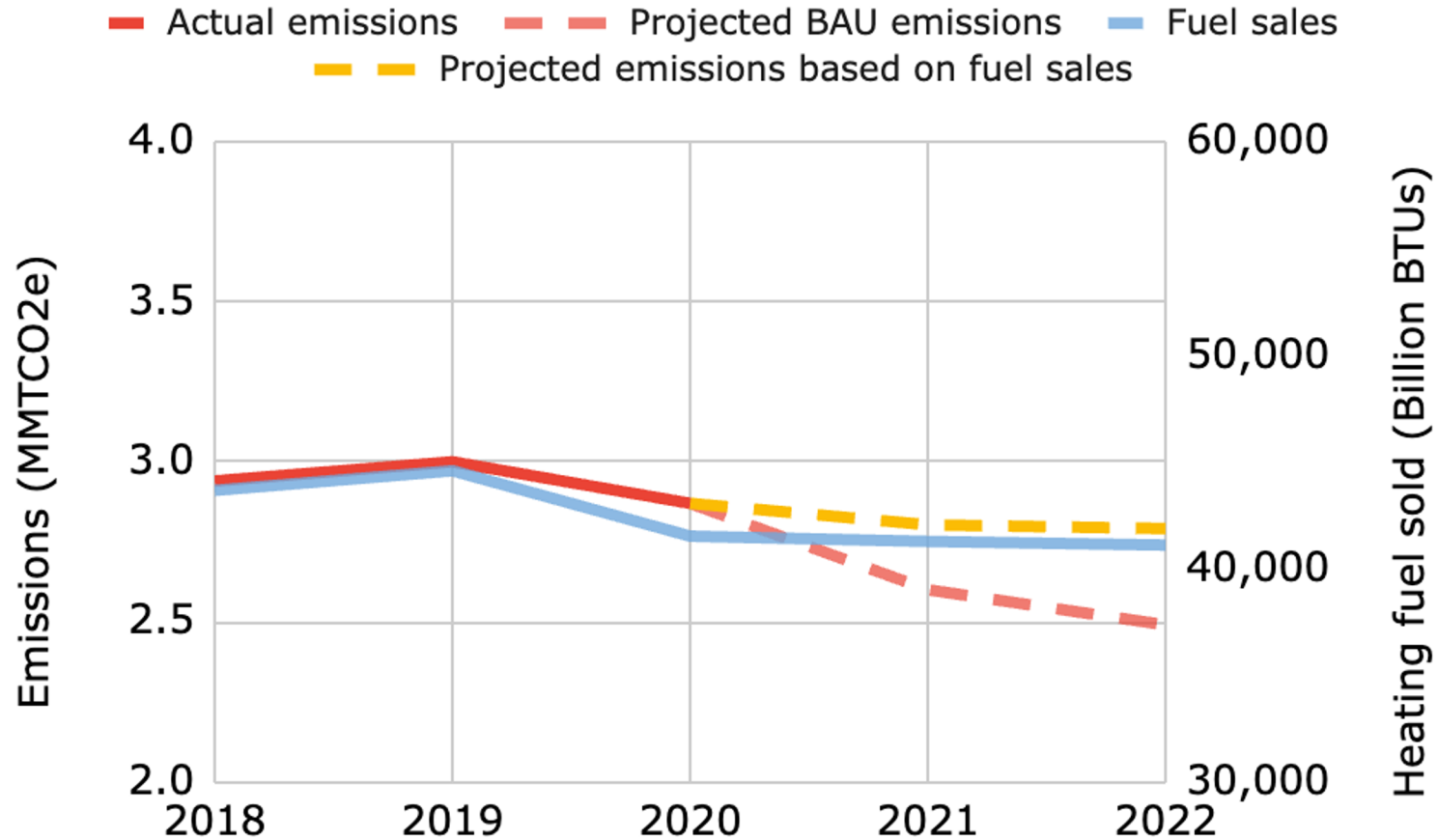
Percent change in thermal sector fuel sales vs projected emissions, 2018-2022



Percent change in transportation sector fuel sales vs projected emissions, 2018-2022

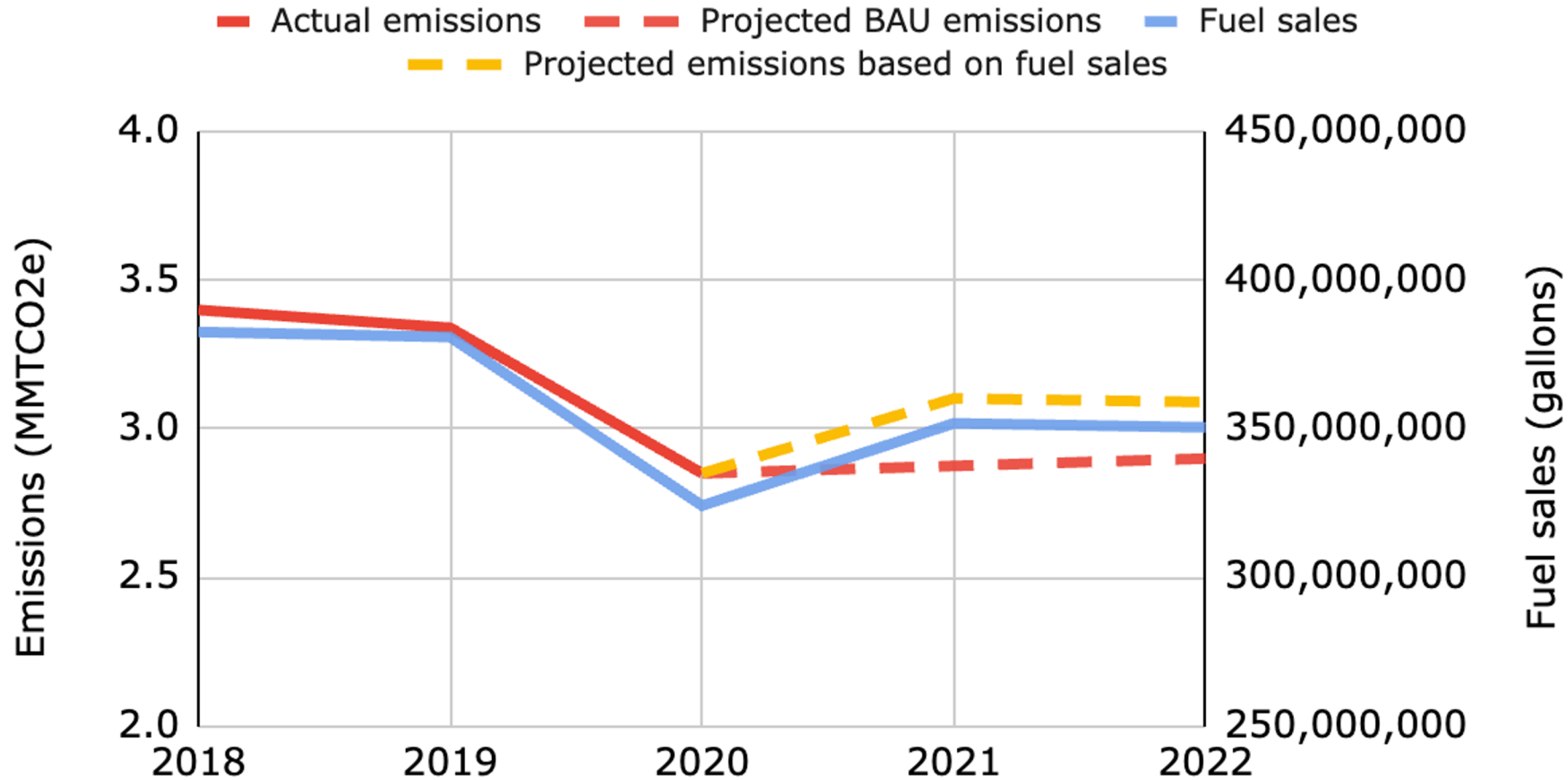


## Thermal fuel sales and emissions





## Transportation fuel sales and emissions



# There are examples of executive leadership at the state level

[Home](#) / [U.S. Climate Alliance Announces New Commitments to Decarbonize Buildings Across America, Quadruple Heat Pump Installations by 2030](#)



Press Release | September 2023

## U.S. Climate Alliance Announces New Commitments to Decarbonize Buildings Across America, Quadruple Heat Pump Installations by 2030

September 21, 2023

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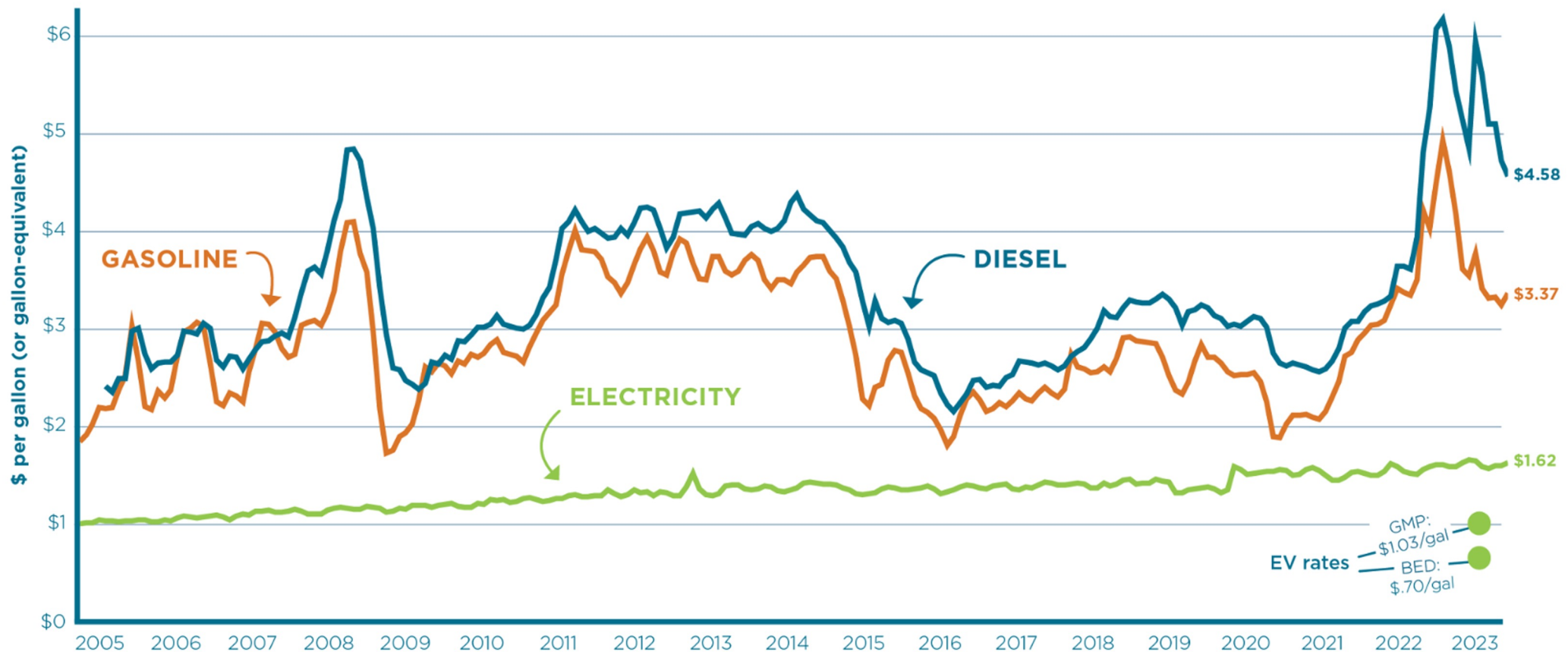
**NEW YORK, NY** – The U.S. Climate Alliance, a bipartisan coalition of 25 governors representing approximately 60 percent of the U.S. economy and 55 percent of the U.S. population, today announced a series of new commitments from its members to eliminate emissions from buildings, including collectively quadrupling heat pump installations by the end of the decade.

# From the U.S. Climate Alliance September 2023 Announcement

To further advance and accelerate building decarbonization efforts, several groups of Alliance members made additional commitments today, including:

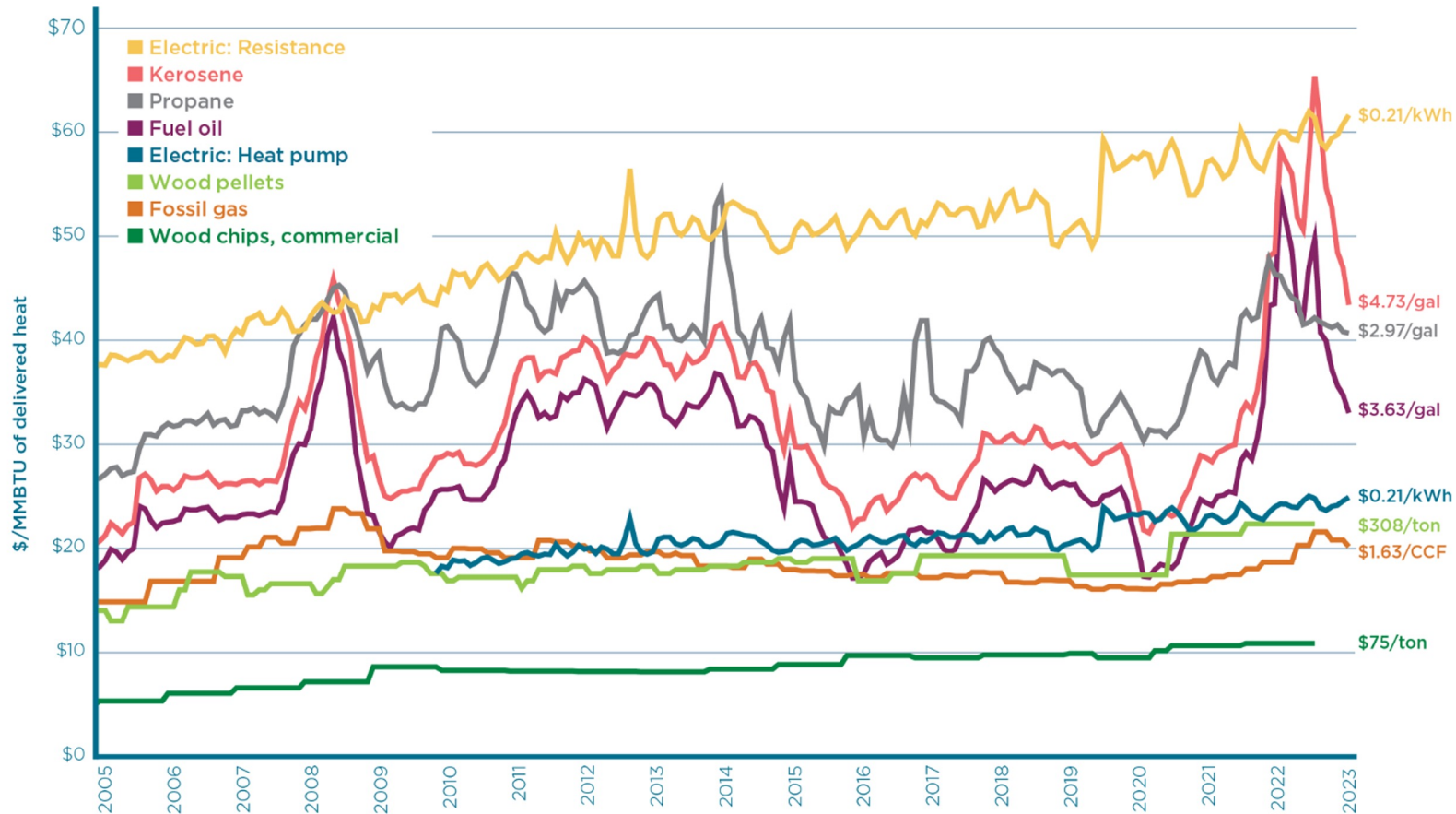
- Ten members will explore the adoption of zero-emission standards for space and water heating equipment (CA, CT, HI, MA, MD, NY, OR, PA, RI, WA).
- Eight members will explore the adoption of Building Performance Standards like those enacted in CO, MD, OR, and WA (CA, CT, HI, MA, ME, NY, PA, RI).
- Eight members will explore the development of clean heat standards (CT, HI, MA, MD, NJ, NY, PA, RI).
- Five members will work to phase out fossil fuel heating and cooling in new construction by 2027 (CA, MA, MD, NY, WA).
- Twelve members will support the development and adoption of advanced energy-efficient building codes that maximize opportunities for efficient electrification and support solar and electric vehicle readiness (CA, CO, CT, MA, MD, ME, NM, NY, OR, PA, RI, WA).
- Ten members will take actions to align buildings sector utility resource planning and procurement policies with state climate goals (CA, CT, HI, MA, MD, NJ, NY, OR, RI, WA).
- Two members will become partners in the U.S. Department of Energy's Better Climate Challenge, joining MD and other partners in committing to reduce scope 1 and 2 emissions from state facilities by at least 50 percent in the next 10 years (HI, ME).

## Cost comparison of different transportation fuels over time in VT



**Sources:** Gas and electric prices: EIA, 2023. Diesel: Vermont Agency of Transportation, 2023. EV rates: Green Mountain Power and Burlington Electric Department, 2023. **Note:** Prices only available through April 2023 at time of publication.

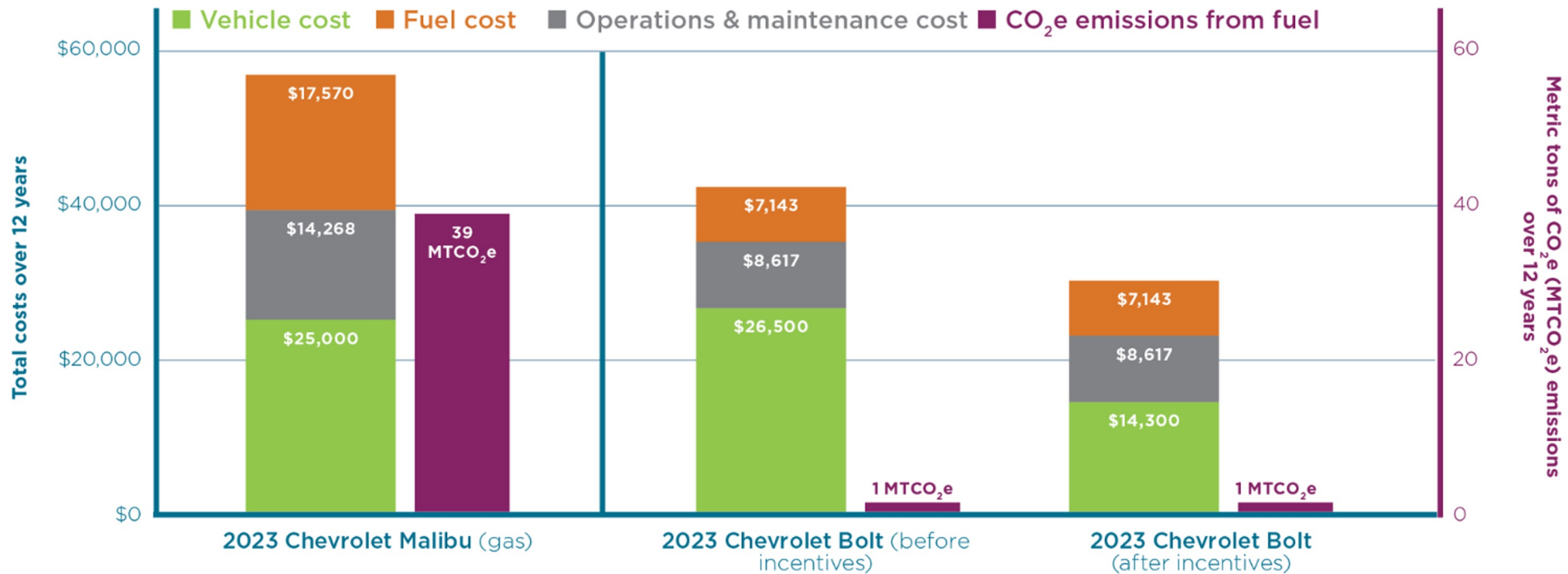
## Cost comparison of different heating fuel options over time



**Sources:** Fuel Oil, Propane, Kerosene: VT Department of Public Service, Fuel Price Report 2023. Fossil gas: VGS, 2023. Electricity: EIA, 2023. Wood Chips, Wood Pellets: Biomass Energy Research Center, 2023. **Notes:** Electricity prices presented here are a statewide average. Electricity prices vary by utility territory. 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). Prices reflect data availability at time of publication: through November 2022 for wood fuels and through May 2023 for all others.

# Cost Comparison of Comparable Gas vs. Electric Vehicles

## Lifetime costs and tailpipe emissions of comparable gas vs electric passenger cars

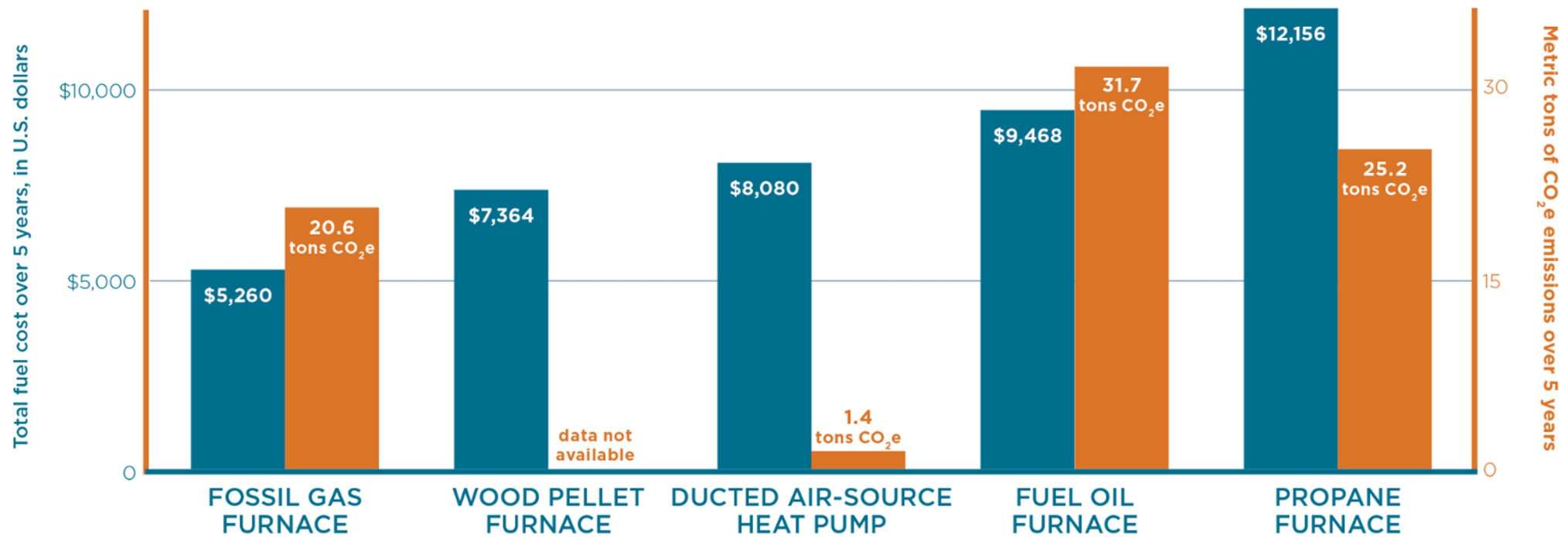


**Sources:** For vehicle costs: Drive Electric Vermont, 2023; and Chevrolet.com, 2023. For gasoline emissions: EIA, "Carbon Dioxide Emissions Coefficients". For electricity emissions: "Assessing the GHG Impact of Beneficial Electrification in Vermont," EAN, 2023. For fuel prices: Vermont Public Service Department, 2022, and GMP, 2023. For O&M costs: U.S. Department of Energy, "FOTW #1190, Battery-Electric Vehicles Have Lower Scheduled Maintenance Costs than Other Light-Duty Vehicles", 2021. **Notes:** Fuel costs are based on the 2022 average of \$3.98/gallon of gasoline, and the March 2023 Green Mountain Power rate of \$0.18/kWh of electricity. CO<sub>2</sub>e value for VT electricity is 71 lbs/MWh. CO<sub>2</sub>e value for gasoline is 19.4 lbs/gallon. Equipment costs represent the base MSRP for 2023 models. Fuel/charging costs can be even lower than presented with the use of EV charging rates offered by some utilities.



# Cost Comparison of Heating Fuel Options in Vermont, 2018-2022

## Average total 5-year heating costs and emissions by fuel in VT, 2018-2022



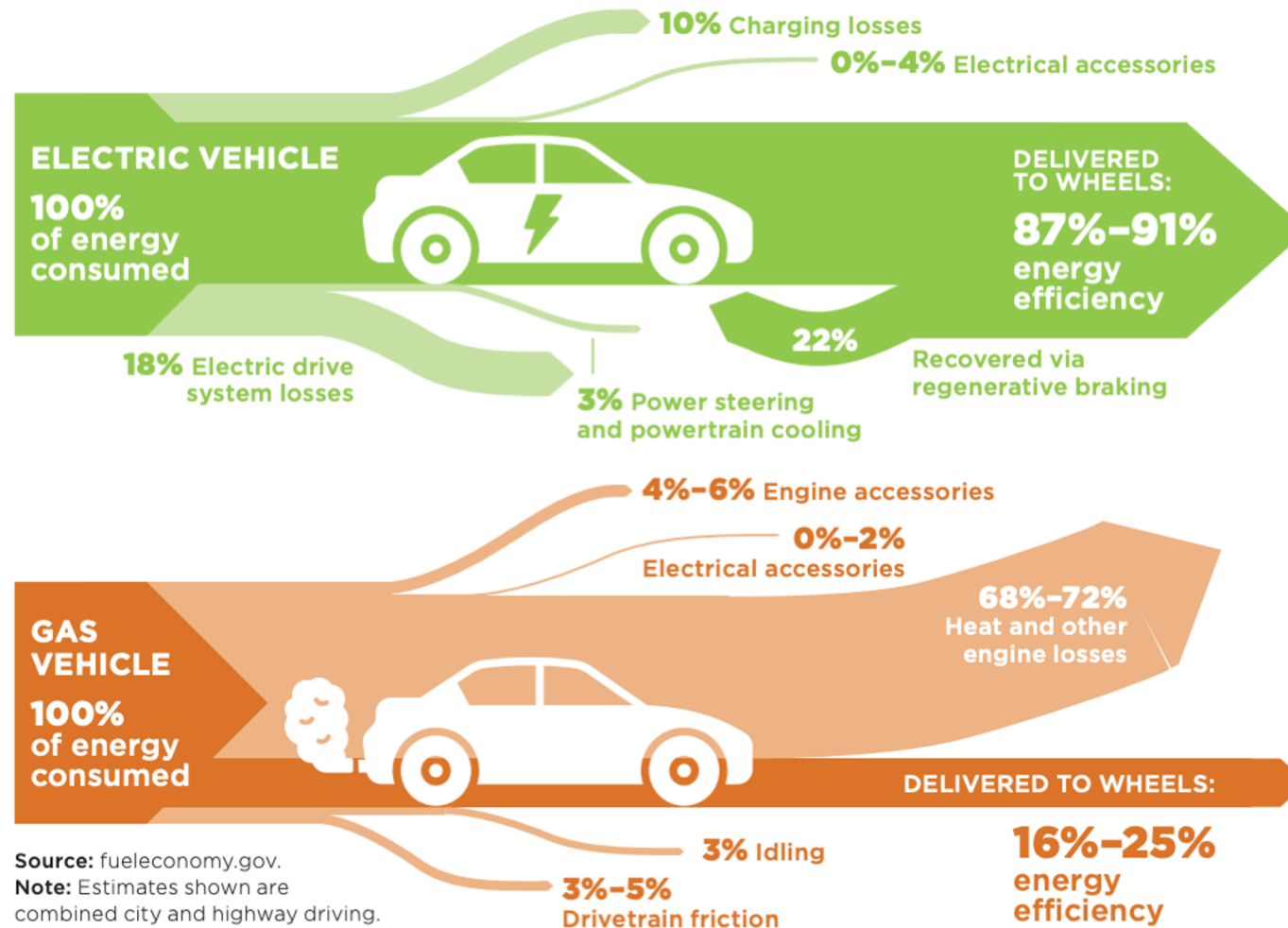
**Sources:** Propane and fuel oil prices: Vermont Department of Public Service, Retail Prices of Heating Fuels, 2023. Electricity prices: EIA, 2023. Fossil gas prices: VGS, 2023. Wood pellet prices: Biomass Energy Resource Center, 2023. Monthly heating degree days: NOAA/National Weather Service, 2023. Average efficiency rates of heating equipment and average heating load of a VT household: TAG Tier III Annual Report, 2021. Emissions factors for fossil fuels: EIA, 2023. Emissions factor for VT electricity: Vermont Agency of Natural Resources, Vermont GHG Emissions Inventory and Forecast: 1990-2020, 2023.





# Electrification lets us use less polluting energy – and less energy overall

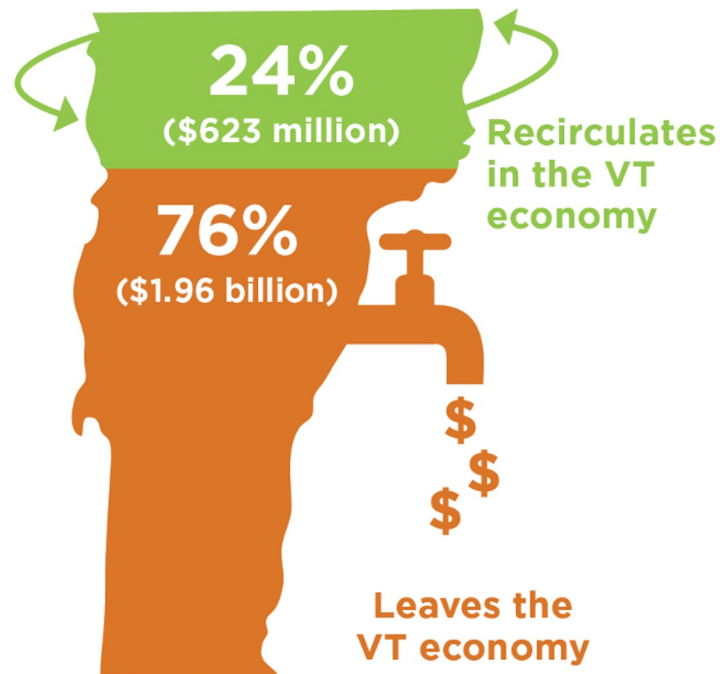
## Where the energy goes: Electric vehicles vs gas vehicles





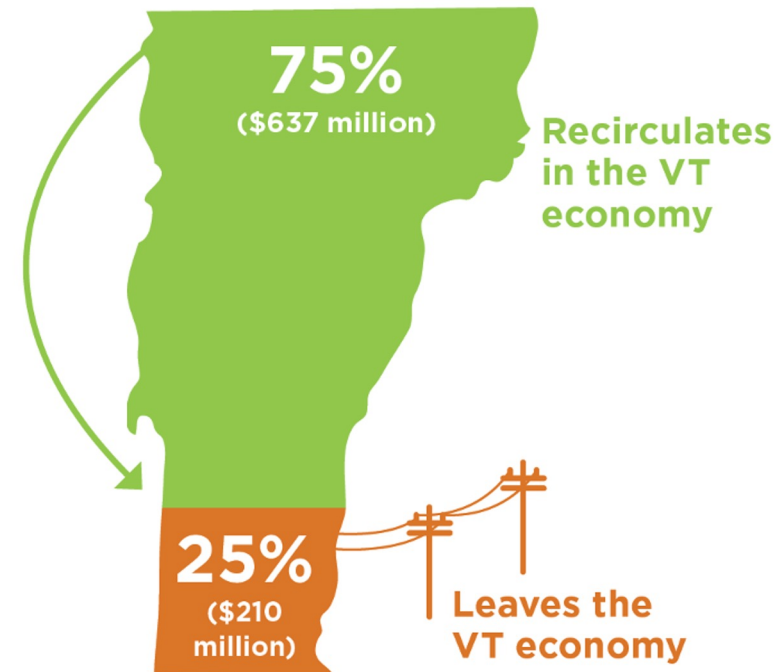
# Local \$ Recirculation of Different Energy Sources

## Vermont fossil fuel spending, 2022



**Sources:** Fossil fuel spending: Vermont Department of Taxes, 2023; VGS, 2023. Dollar recirculation share: EAN Senior Fellow for Economic Analysis, Ken Jones, 2023. **Note:** This graph includes spending on thermal and transportation fuels only.

## Vermont electricity spending, 2021



**Sources:** Electricity spending: Vermont Department of Public Service, 2021 Electric Utility Resource Survey; Dollar recirculation share: EAN Senior Fellow for Economic Analysis, Ken Jones, 2023