



Where We Stand Now... And What It Will Take to Get Where We Want to Go

Jared Duval, EAN Executive Director



Energy Action Network Members

Over 100 Network Members





Energy Action Network Public Partners

Over 100 Public Partners





The Mission of the Network

Energy Action Network (EAN) works to achieve Vermont's 90% renewable by 2050 **total energy commitment** and to **significantly reduce Vermont's greenhouse gas emissions** in ways that create a more **just, thriving, and sustainable** future for Vermonters.



EAN's Backbone Non-Profit Organization

How We Serve the Network and Public Partners

- Steward a Common Agenda
- Collect Data and Measure Results
- Coordinate Mutually Reinforcing Activities
- Facilitate Continuous Communication





- 1. Follow the data**
- 2. Listen to evidence-based expertise**
- 3. Share careful, honest, and actionable analysis**

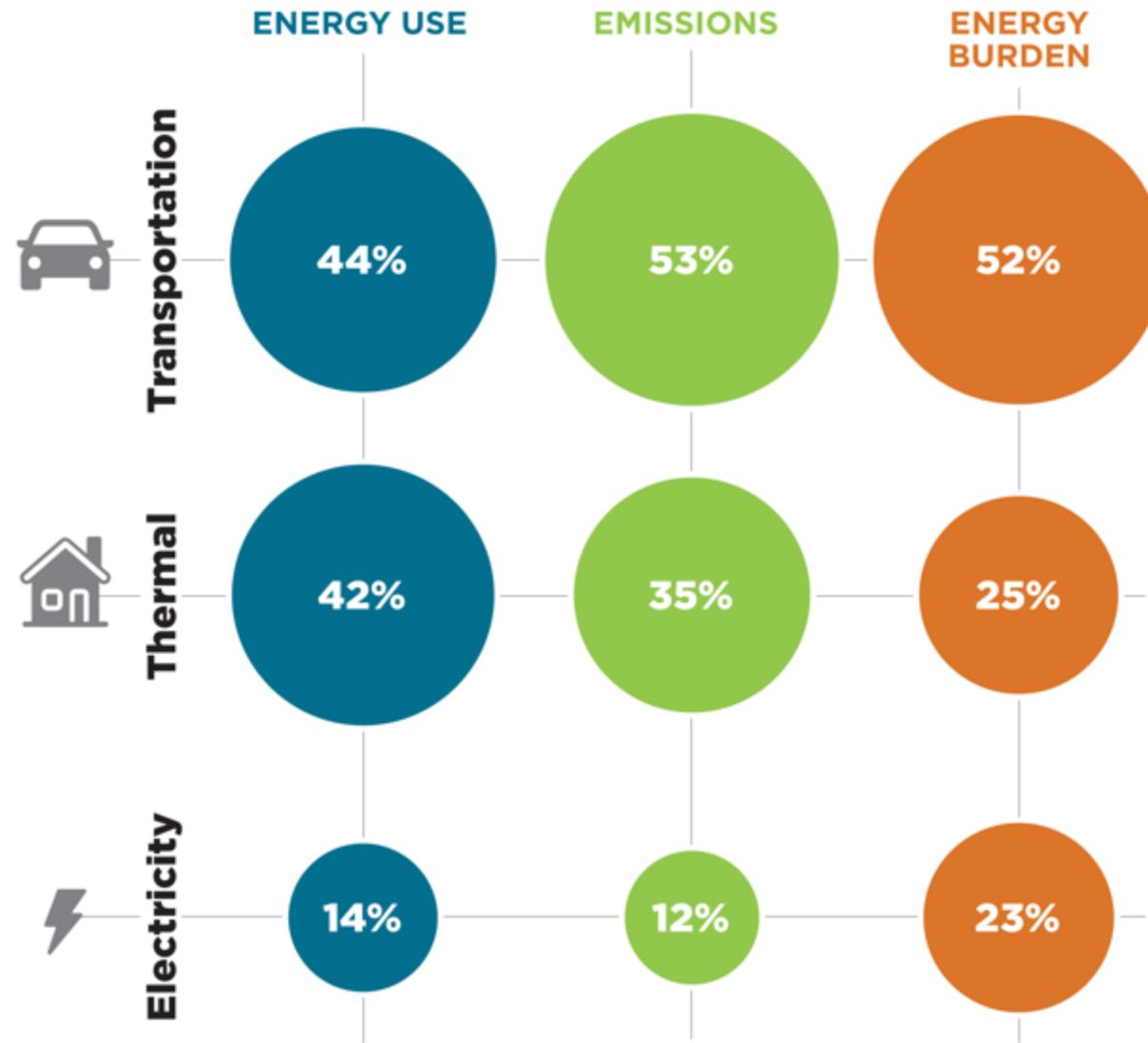


The Four Es of This Presentation

- **Emissions**
- **Energy**
- **Equity**
- **Economy**



The energy conversation is a climate — and an equity — conversation

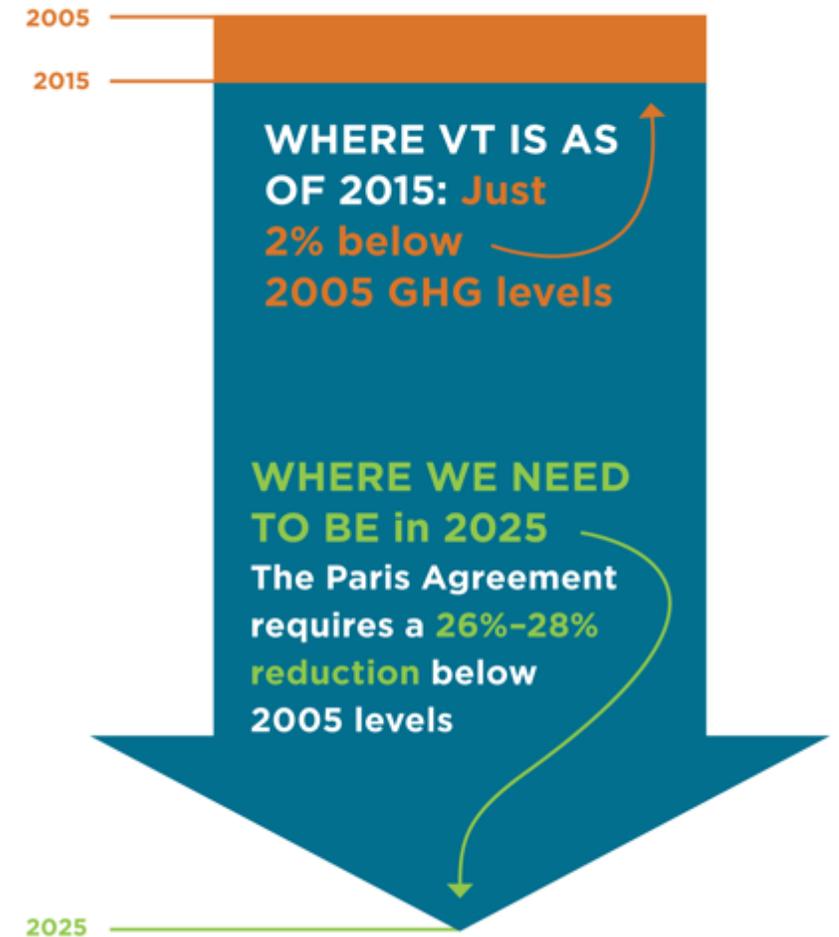
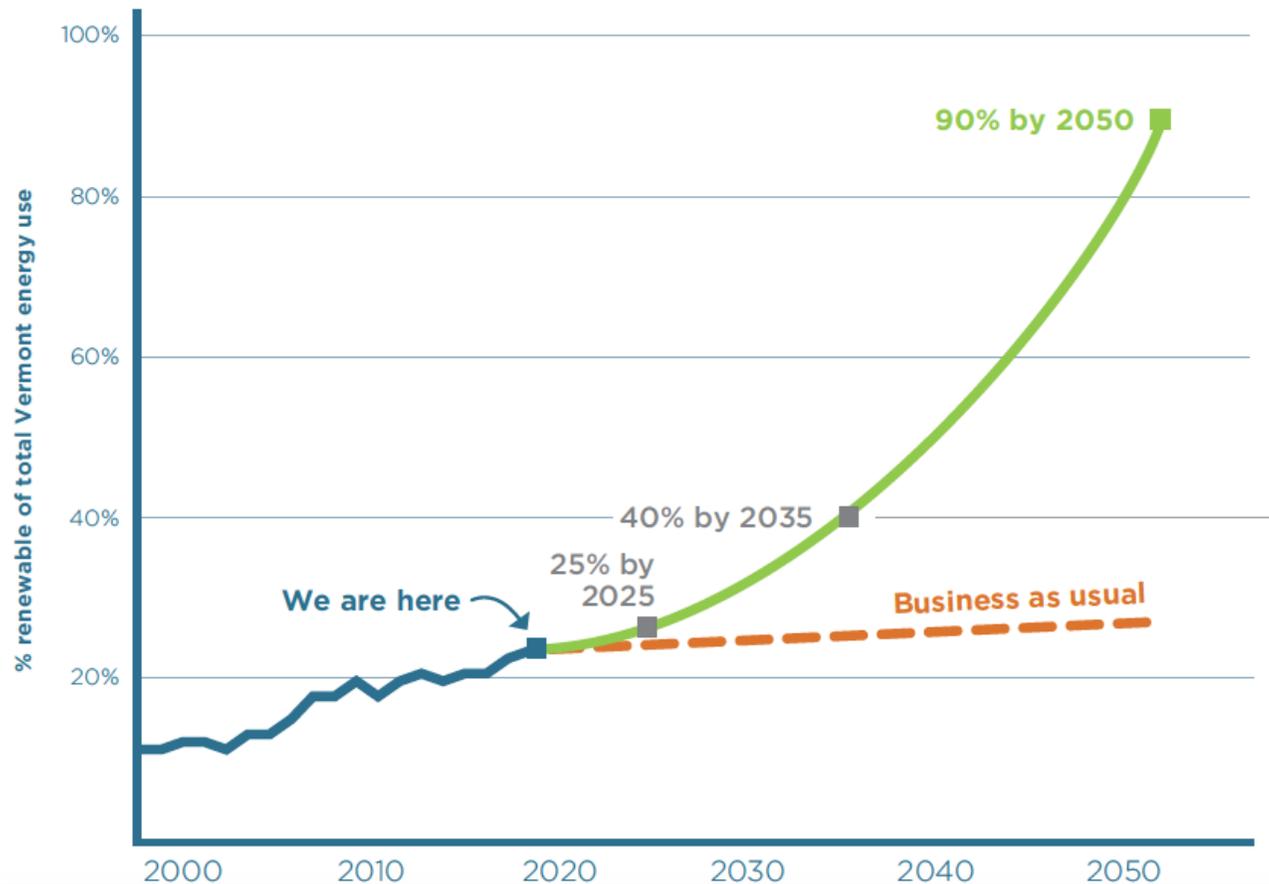


Sources: Thermal and transportation based on Energy Information Administration 2016 site energy; Electricity based on Department of Public Service 2017 site energy, after accounting for RECs; Emissions based on 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. Percentage based on energy emissions; Energy burden based on Mapping Total Energy Burden in Vermont, Justine Sears, Vermont Energy Investment Corporation (July 2016); Note: VEIC only considered fuel or electricity related costs (not equipment or maintenance costs).



What do we have to do by 2025?

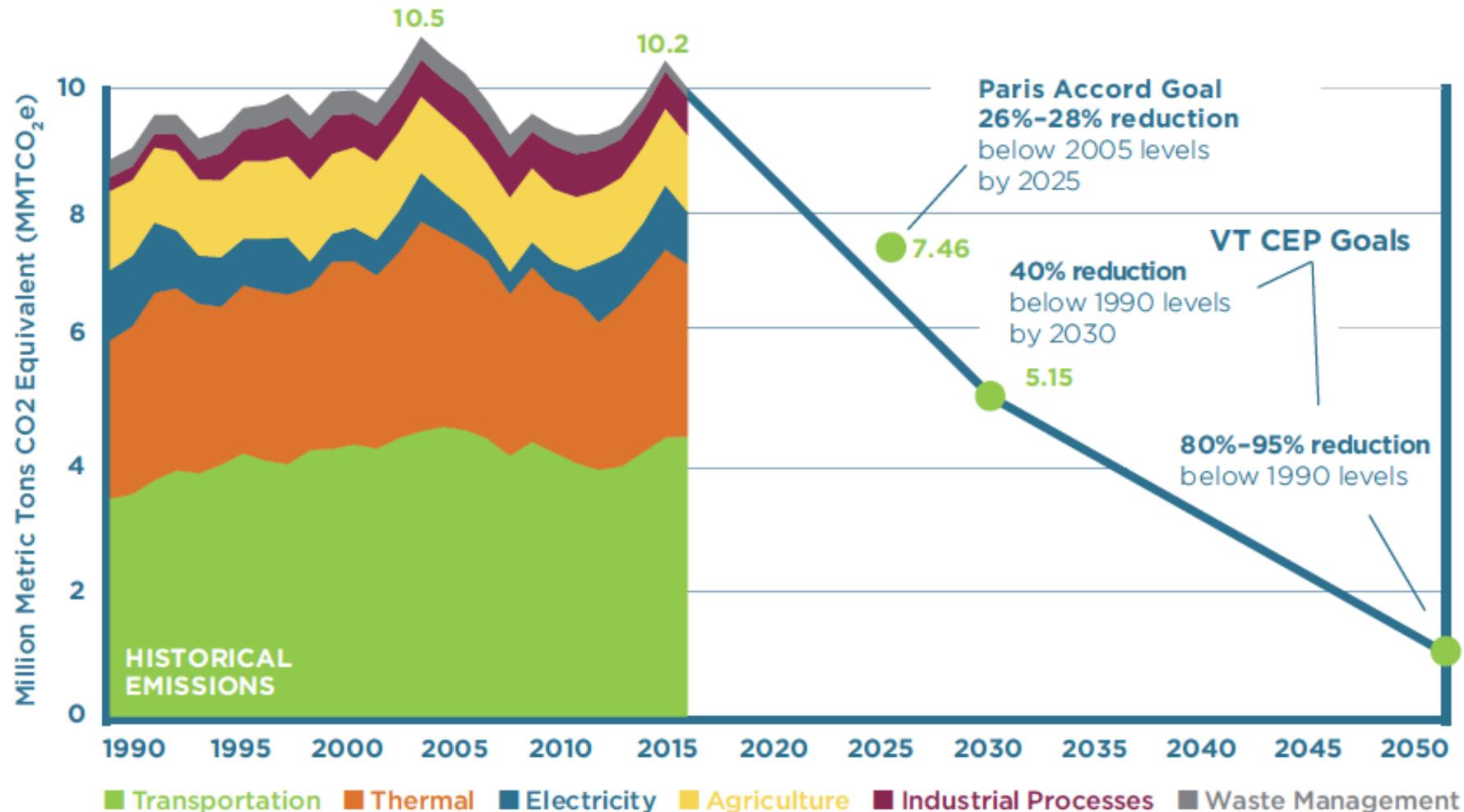
Business as usual will not get us to 90% by 2050¹





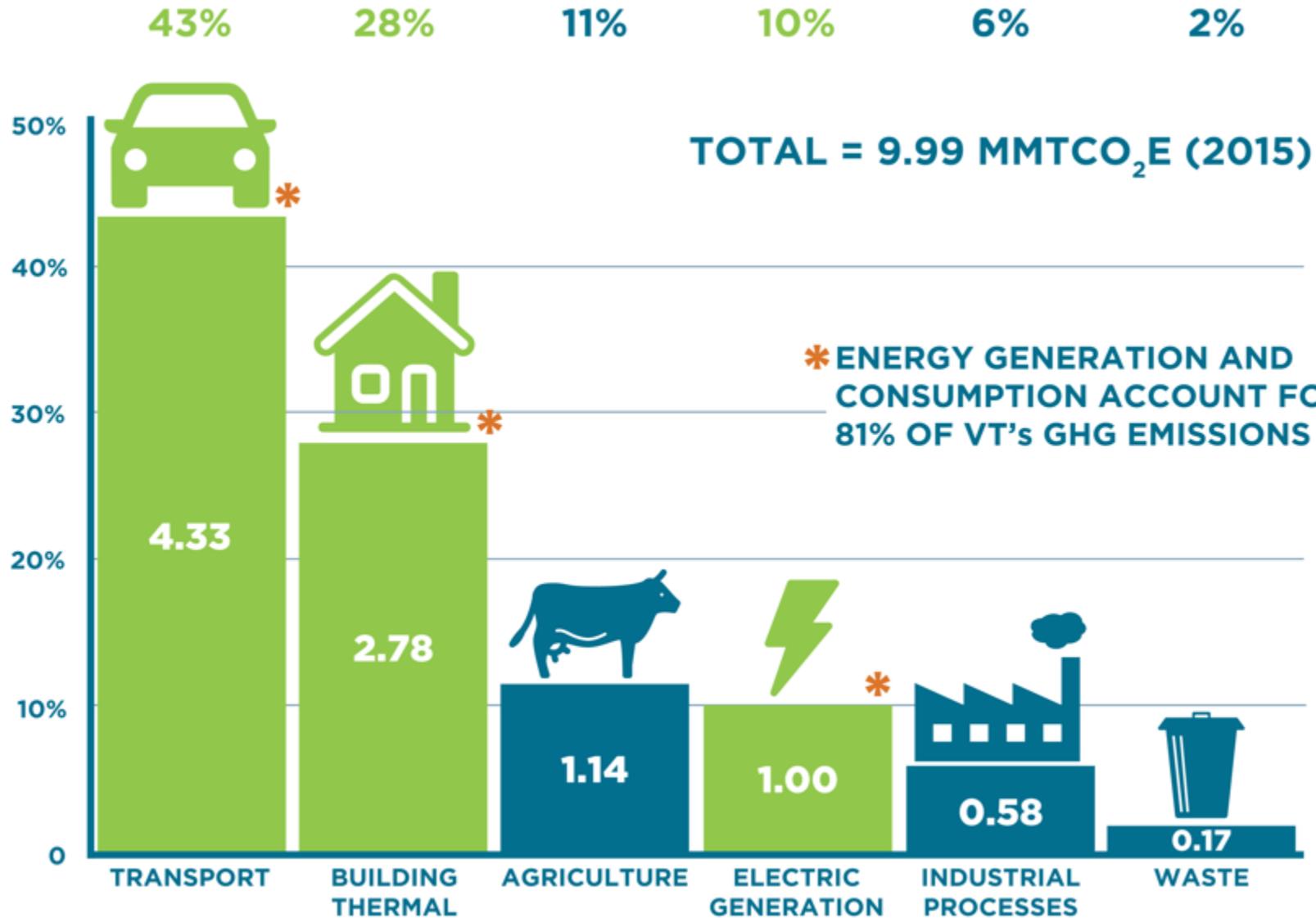
VT Needs a Rapid and Sustained Emissions Decline to Meet Commitments

Now is the time for rapid emissions reductions





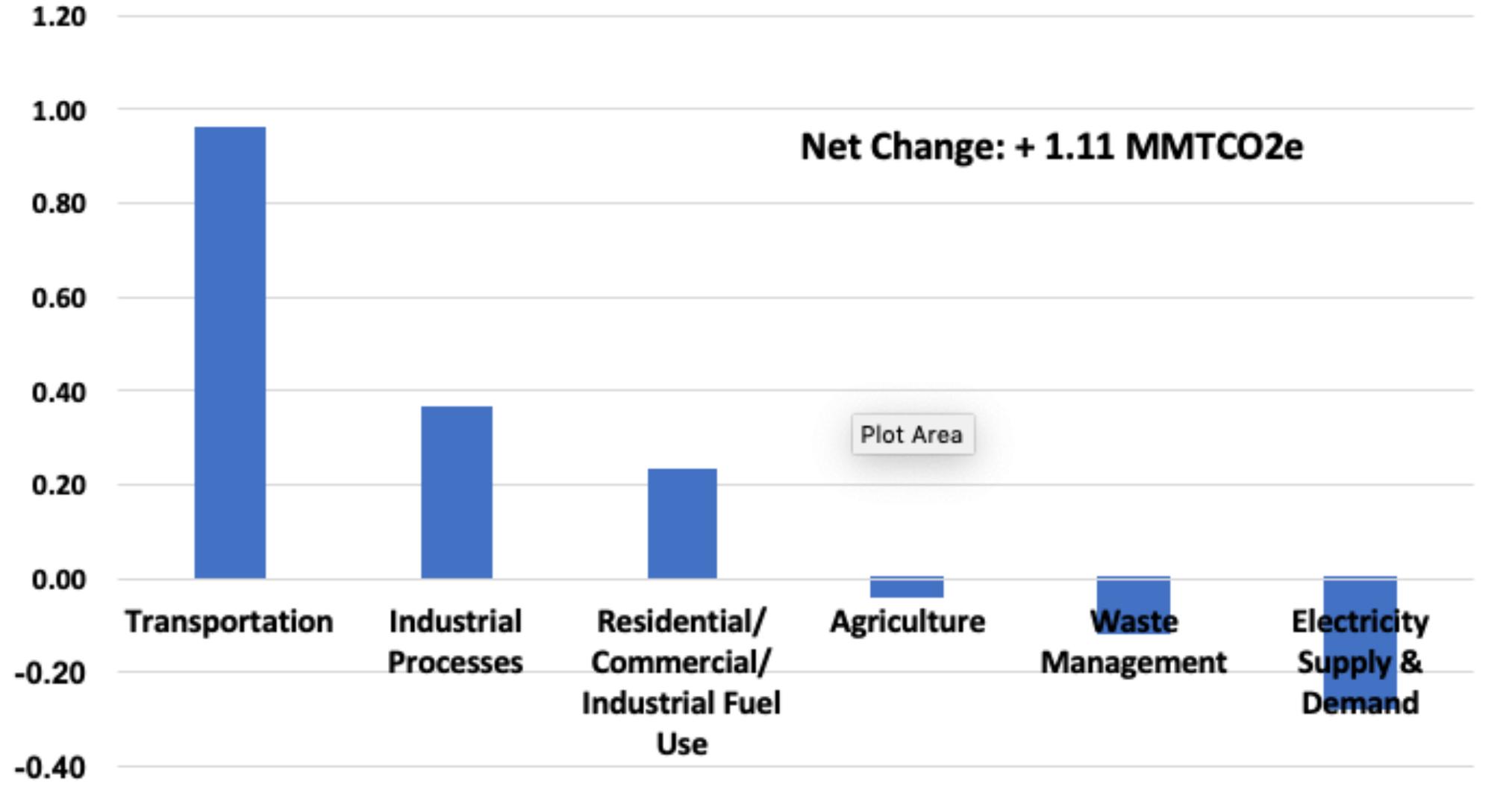
Vermont's GHG emissions by sector



Source: 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources.

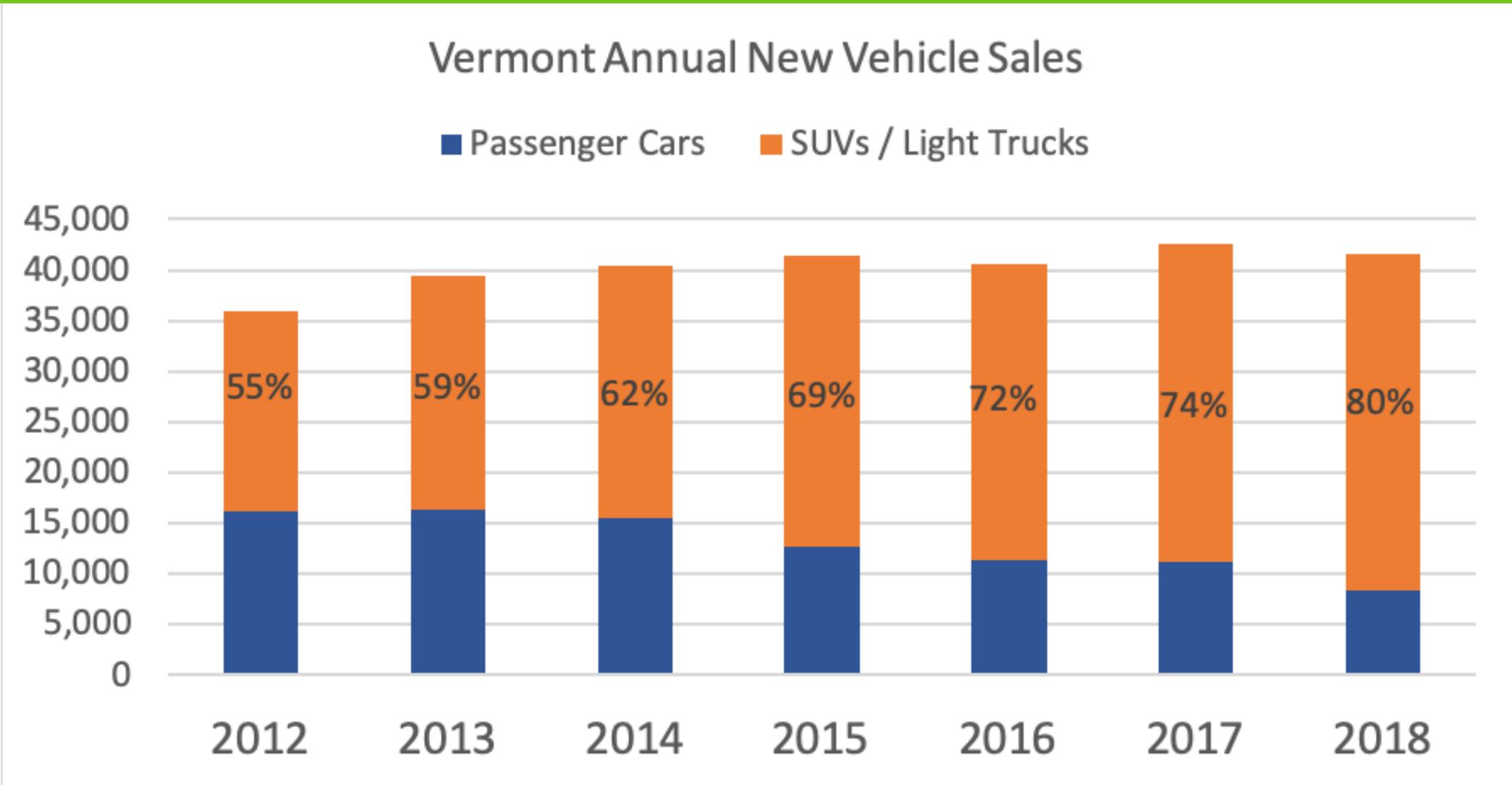


Net Change in VT GHG Emissions by Sector, 1990 vs 2016 (MMTCO₂e)





Vermont Annual New Vehicle Sales





US vs VT GHG Emissions by Sector

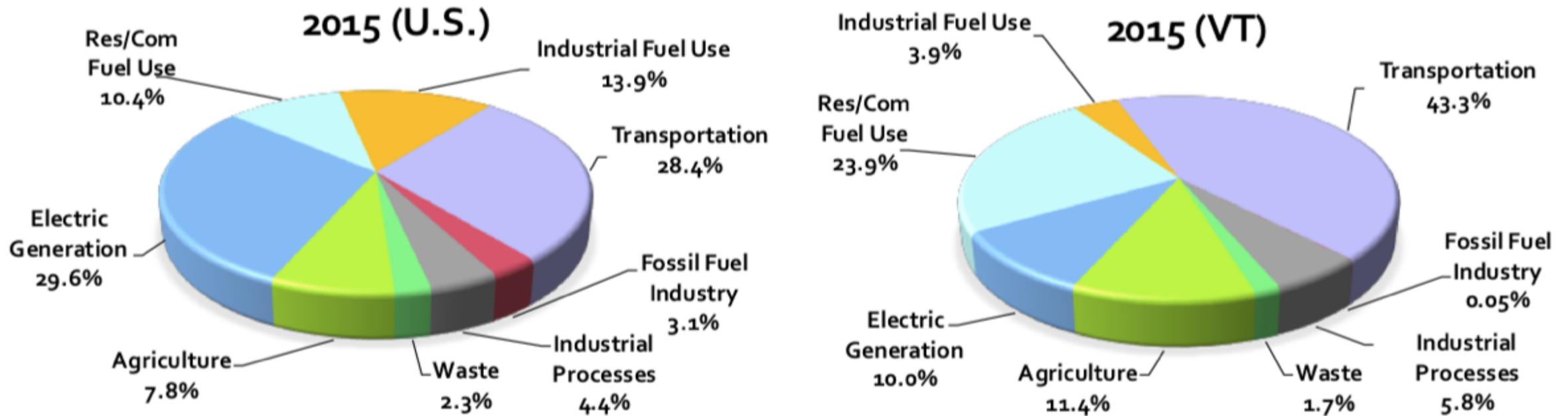
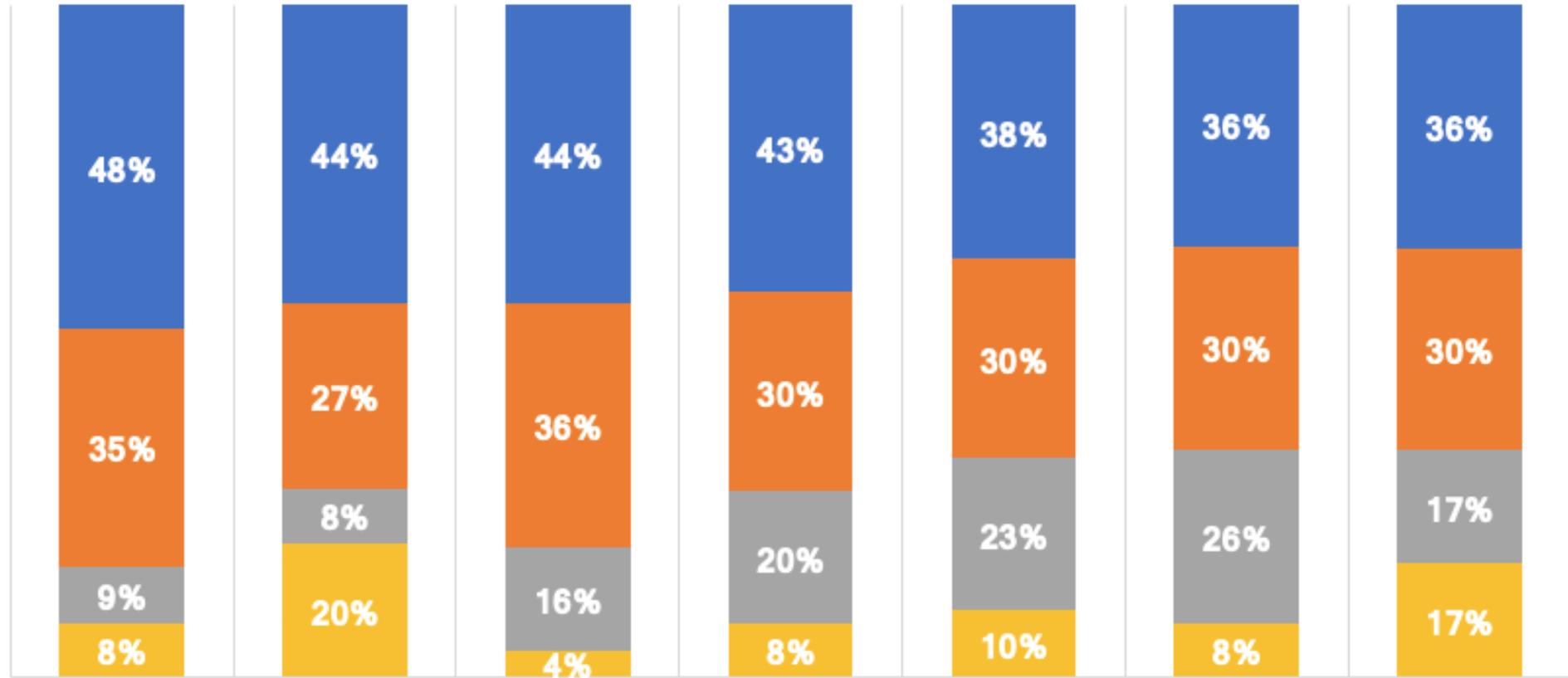


Figure 5. Sector Emissions Contribution Percentages Comparison (2015) – U.S. and Vermont¹²



SHARE OF GHG EMISSIONS BY SECTOR: 2016

■ Other
 ■ Electricity
 ■ Building Fuel Use (RCI)
 ■ Transportation



**Total Emissions
(MMTCO₂e)**

State	ME	VT	NH	MA	CT	RI	NY
Total Emissions (MMTCO ₂ e)	18.37	9.76	15.22	74.2	41.1	11.02	205.6

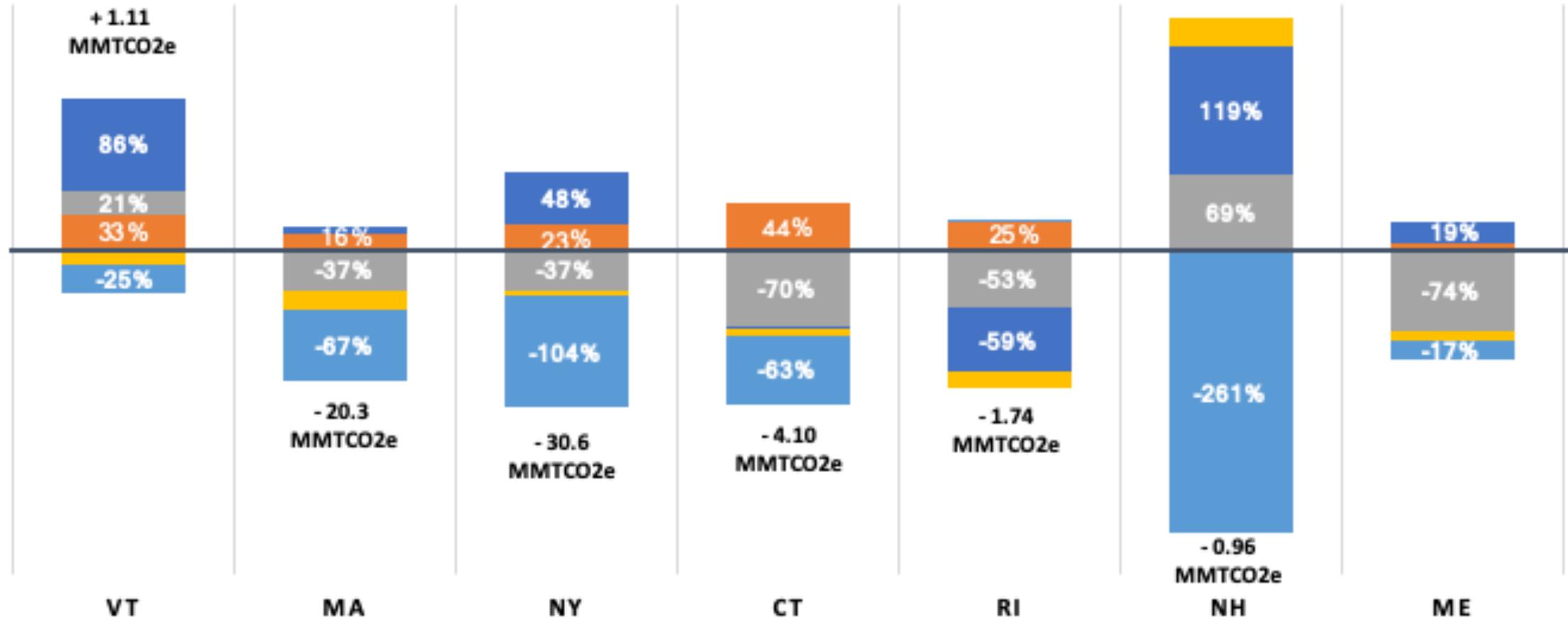
**Net Change since
1990**

Net Change since 1990	- 13%	+ 13%	- 6%	- 21%	- 9%	- 14%	- 13%
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% SHARE OF NET CHANGE IN GHG EMISSIONS, BY SECTOR, 1990 VS 2016

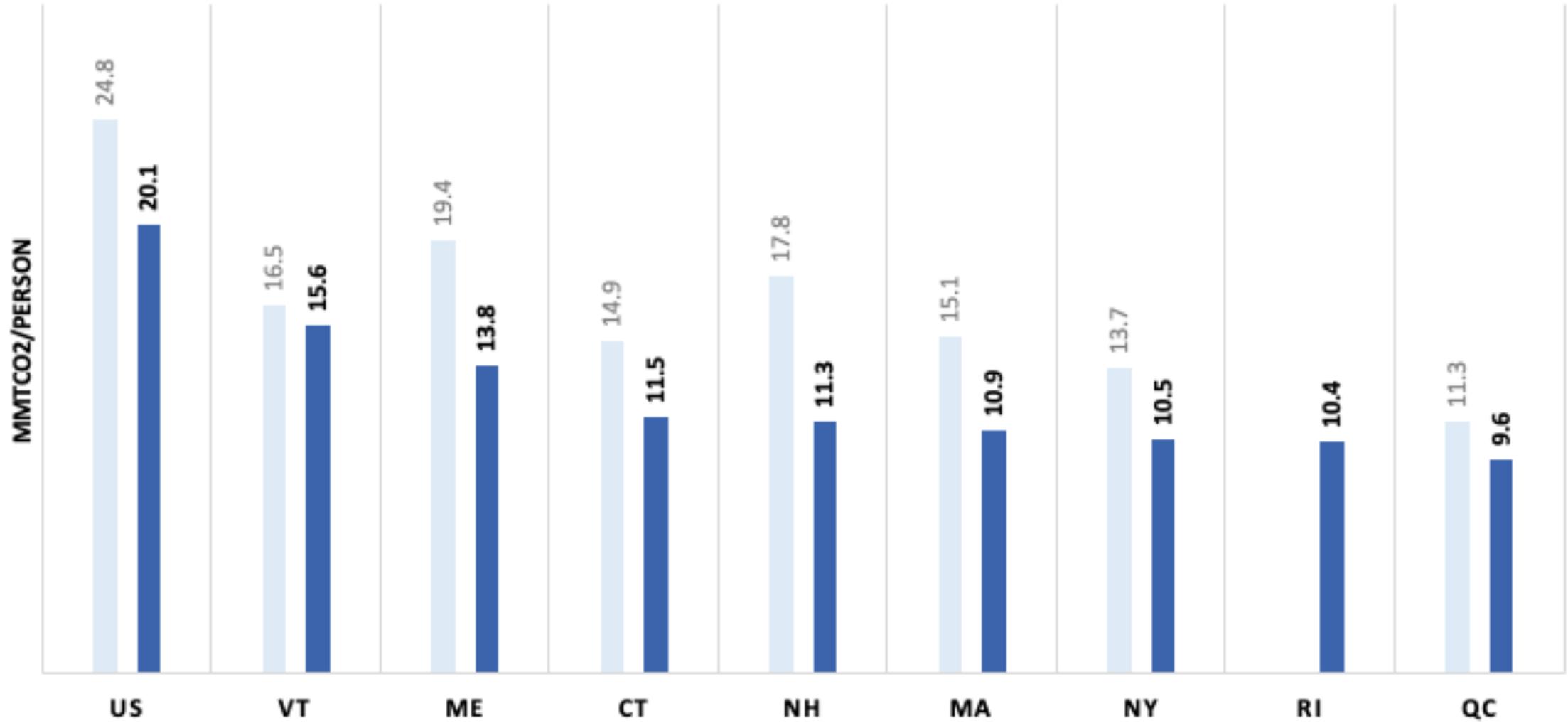
Industrial Processes RCI Fuel Use Transportation Other Electricity





PER CAPITA EMISSIONS (MMT_{CO2}/PERSON)

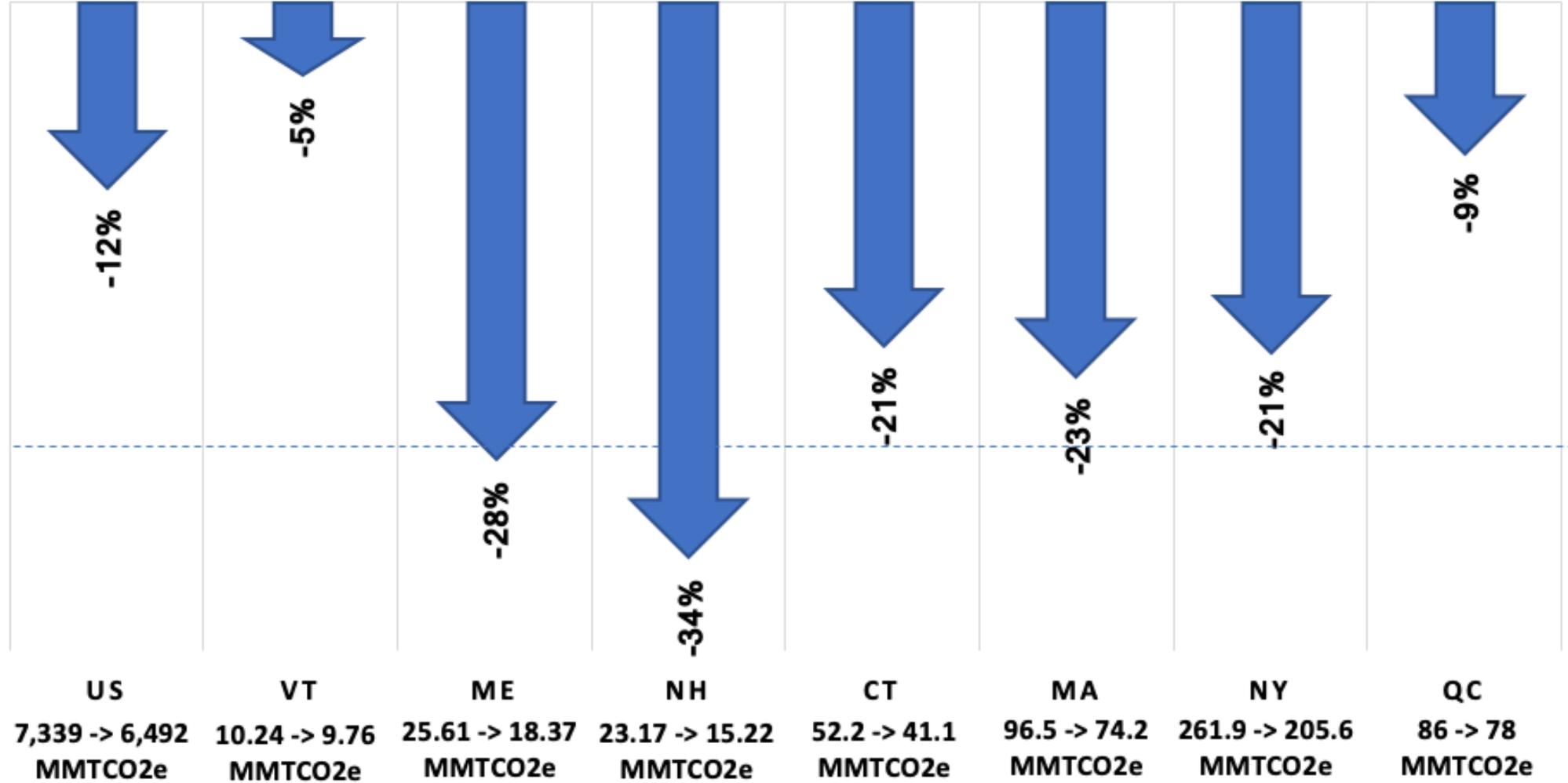
■ 2005 Per Capita GHG Emissions ■ 2016 Per Capita GHG Emissions





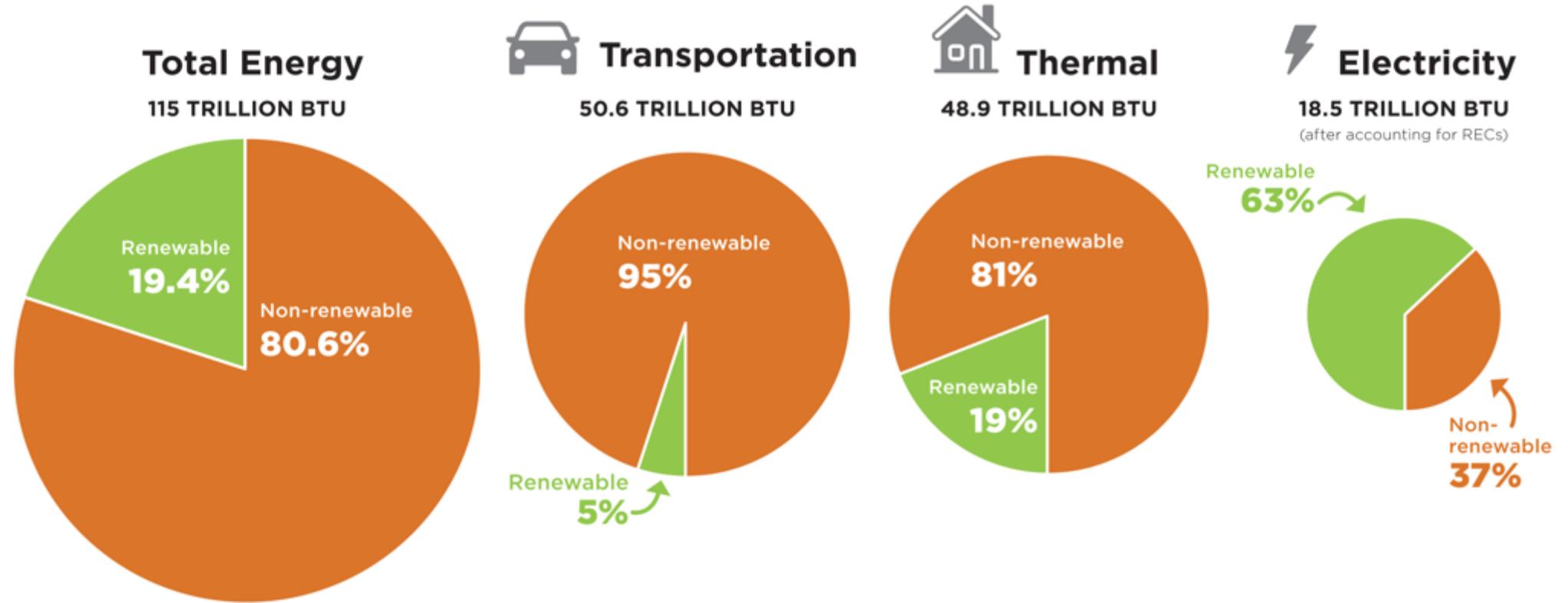
PROGRESS TO PARIS

% DECREASE IN OVERALL GHG EMISSIONS BELOW 2005 LEVELS, AS OF 2016





How renewable is Vermont today?



Source: Thermal and transportation based on Energy Information Administration 2016 site energy; Electricity based on Department of Public Service 2017 site energy, after accounting for RECs.



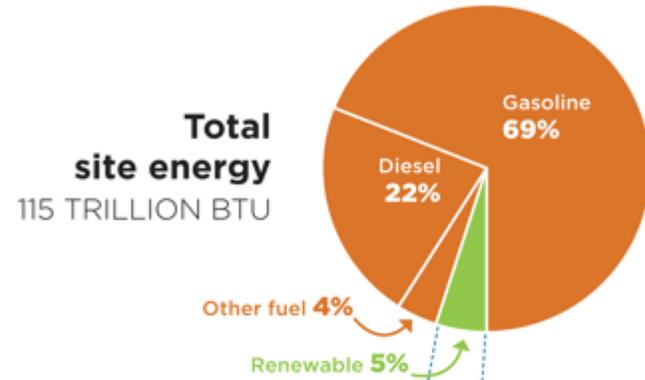


Breaking it down by sector



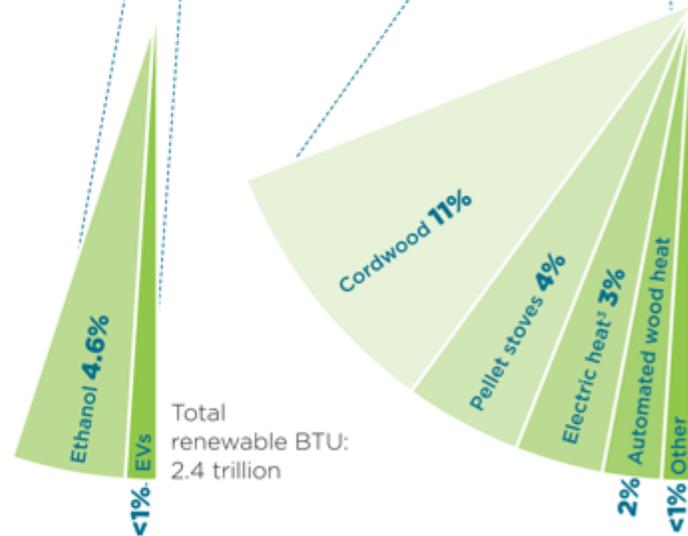
Transportation

50.6 TRILLION BTU



Total site energy
115 TRILLION BTU

SITE ENERGY
Renewable sources

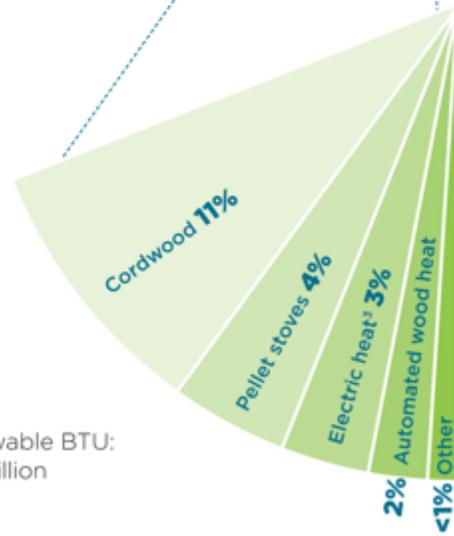
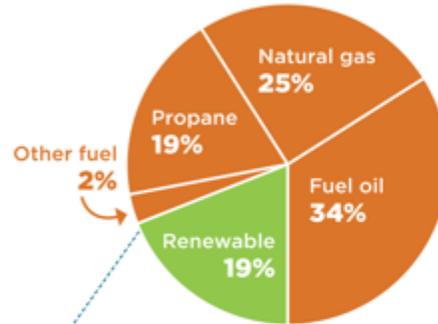


Total renewable BTU:
2.4 trillion



Thermal

48.9 TRILLION BTU



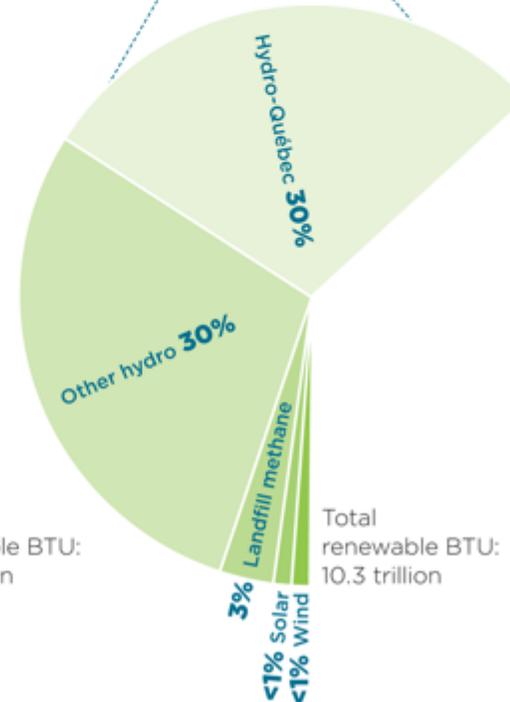
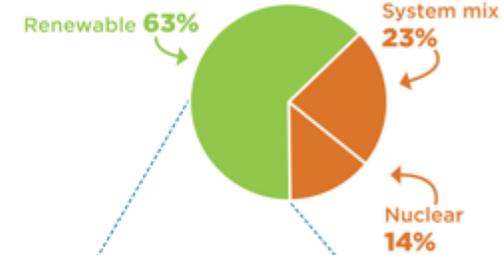
Total renewable BTU:
9.5 trillion



Electricity

18.5 TRILLION BTU

(after accounting for RECs)



Total renewable BTU:
10.3 trillion

Source: Energy Information Administration (2016); Department of Public Service (2017). Note: Electric heat includes the renewably powered portions of heat pumps and electric resistance heat. Heat pumps are significantly more efficient than electric resistance heat.



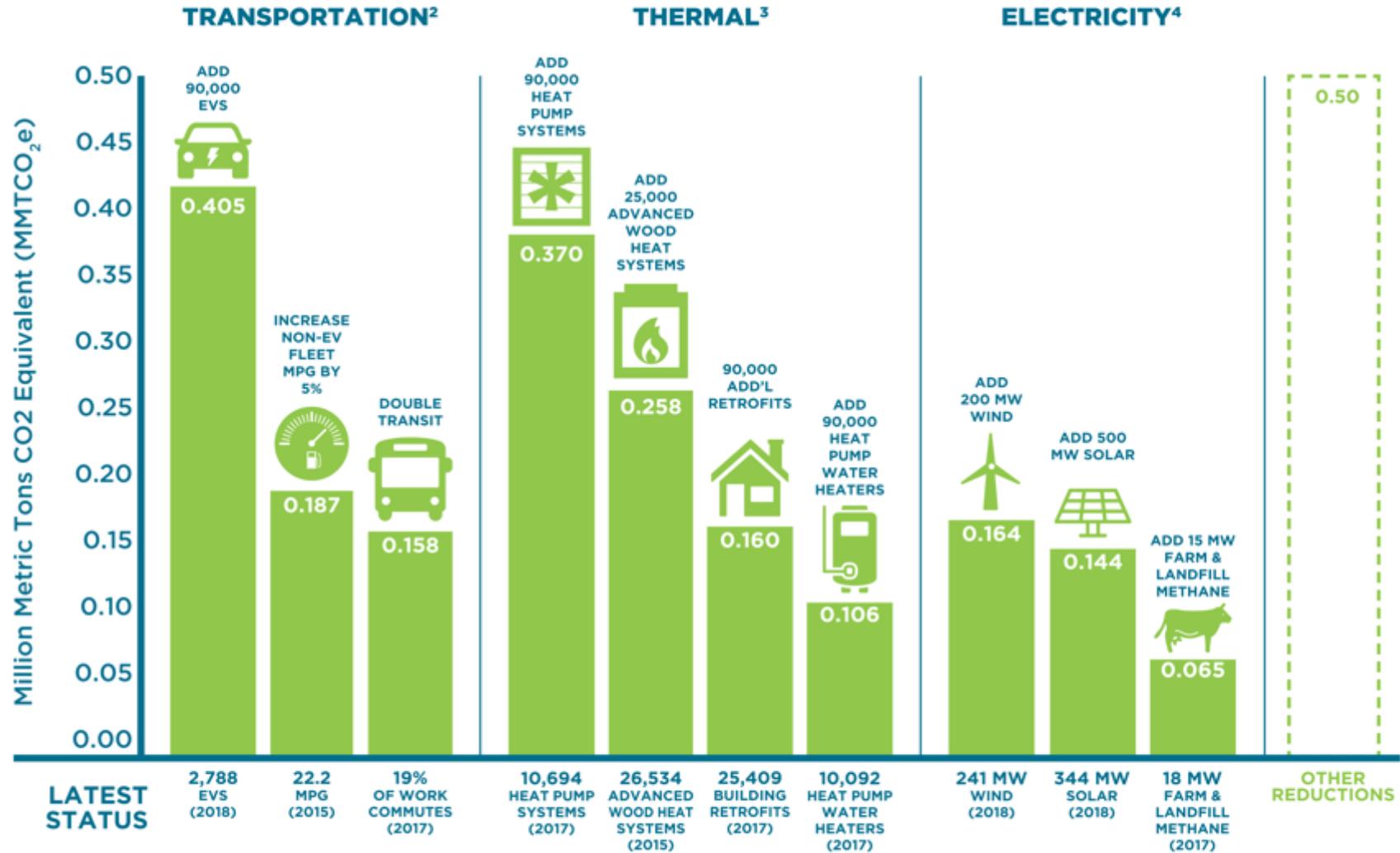
Path to Paris

Two horizontal bars are positioned below the title: a shorter orange bar on top and a longer green bar below it.

What will it take to meet our Paris Climate Agreement
commitment?



2.53 MMTCO₂e reduction by 2025 is required to meet the Paris Agreement¹

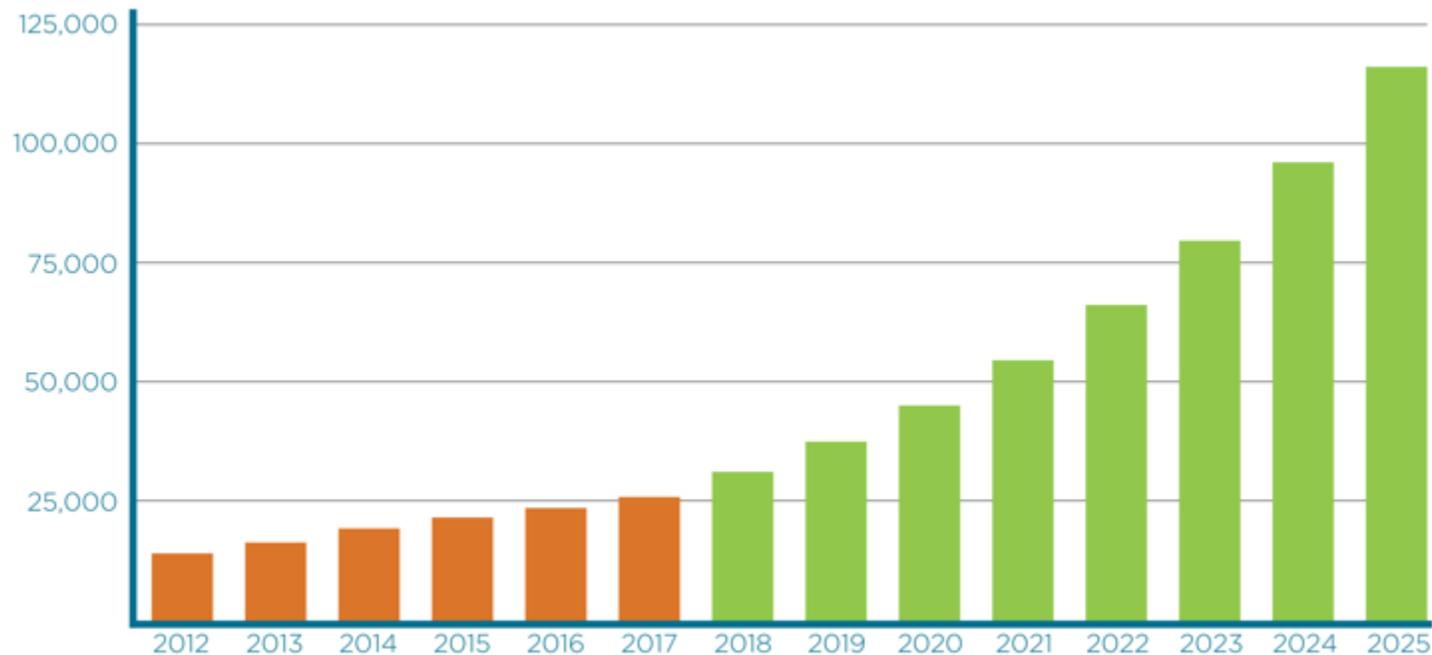


Sources and Notes: 1. EAN calculations based on relative emissions reductions in MMTCO₂e based on 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. 2. EVs assumes 50% AEV and 50% PHEV. Transit includes direct reduction of single occupancy vehicle commutes through buses, trains, rideshare, vanpool, etc. 3. Heat pumps and heat pump water heaters assume switching from oil or propane heaters to 75% renewable electricity. Advanced wood heat includes automated, central wood heat systems and pellet stoves. Weatherization assumes project results in 25% reduction in energy use (the statutory goal). 4. Wind includes imported wind, since there are no plans to build wind in Vermont prior to 2025.



What does that look like over the next six years?

Vermont homes weatherized



Source: Department of Public Service, 2018 Building Energy Report.

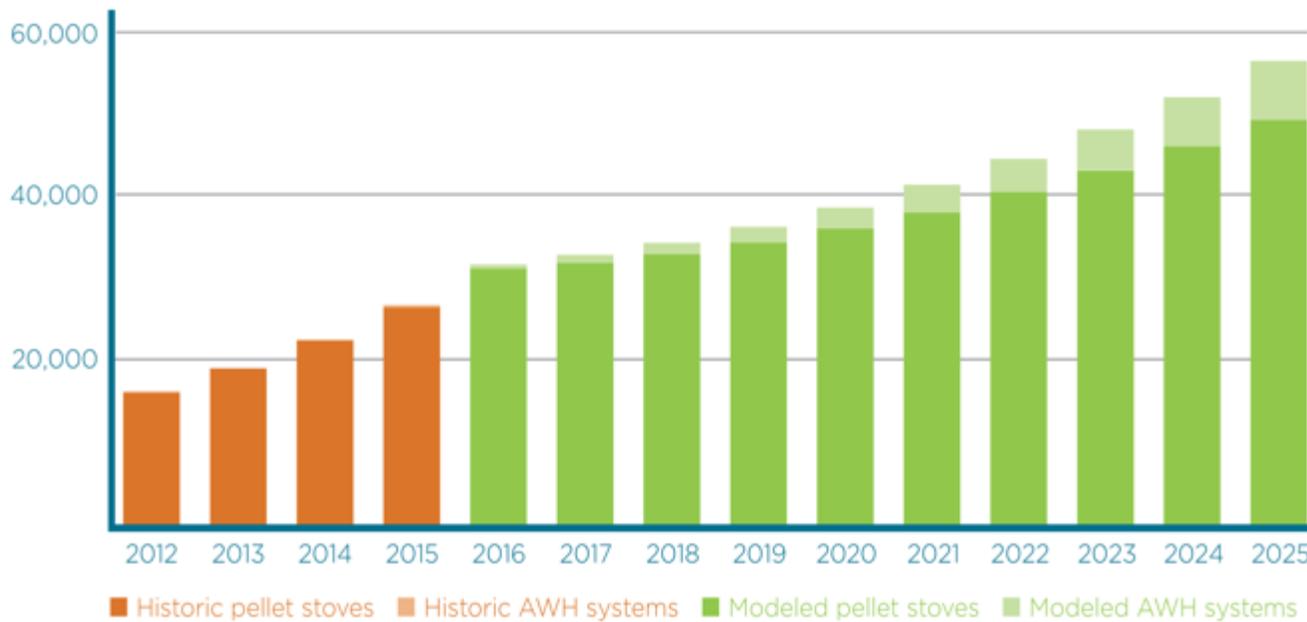


Year	# of add'l homes weatherized/year
2019	6,393
2020	7,725
2021	9,333
2022	11,277
2023	13,626
2024	16,463
2025	19,892



What does that look like over the next six years?

Advanced wood heat (AWH) systems in Vermont



Source: Historic and modeled data from the Biomass Energy Resource Center (BERC).

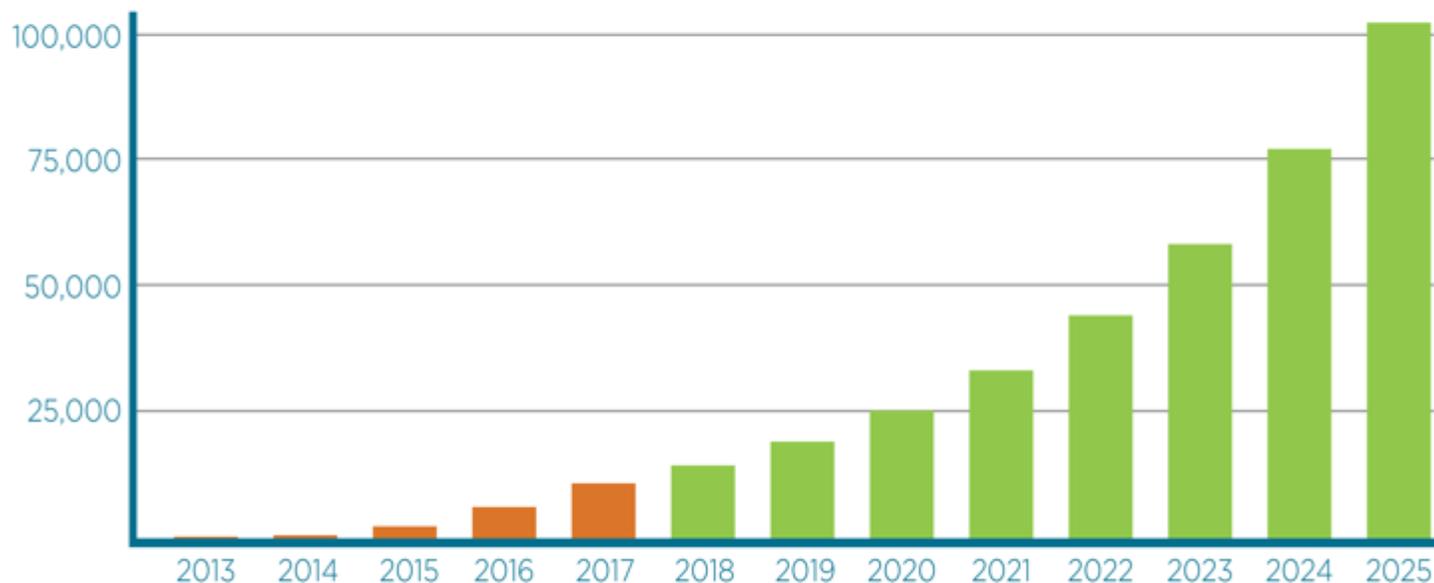


Year	# of add'l pellet stoves/year	# of add'l boilers or furnaces/year
2019	1,395	543
2020	1,705	634
2021	2,015	725
2022	2,325	815
2023	2,635	906
2024	2,945	996
2025	3,255	1,087



What does that look like over the next six years?

Heat pump systems in Vermont



Source: Historic heat pump data extrapolated from Efficiency Vermont rebate data and assumes rebates capture 75% of statewide installations.

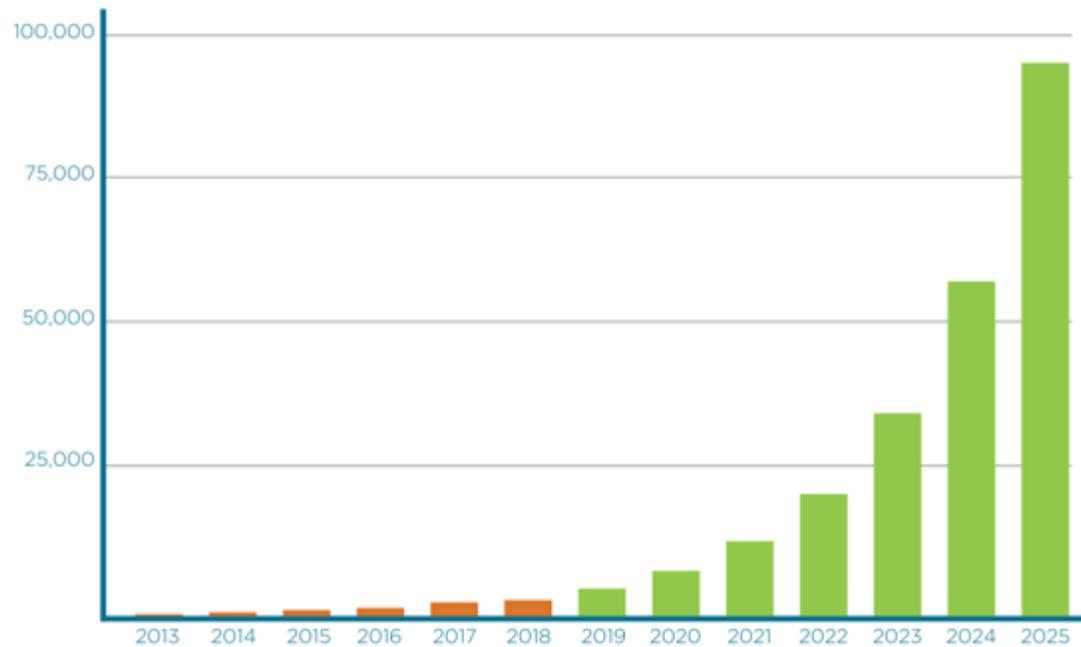


Year	# of add't'l heat pumps/ year
2019	4,579
2020	6,060
2021	8,020
2022	10,615
2023	14,049
2024	18,593
2025	24,608



What does that look like over the next six years?

Electric vehicles in Vermont



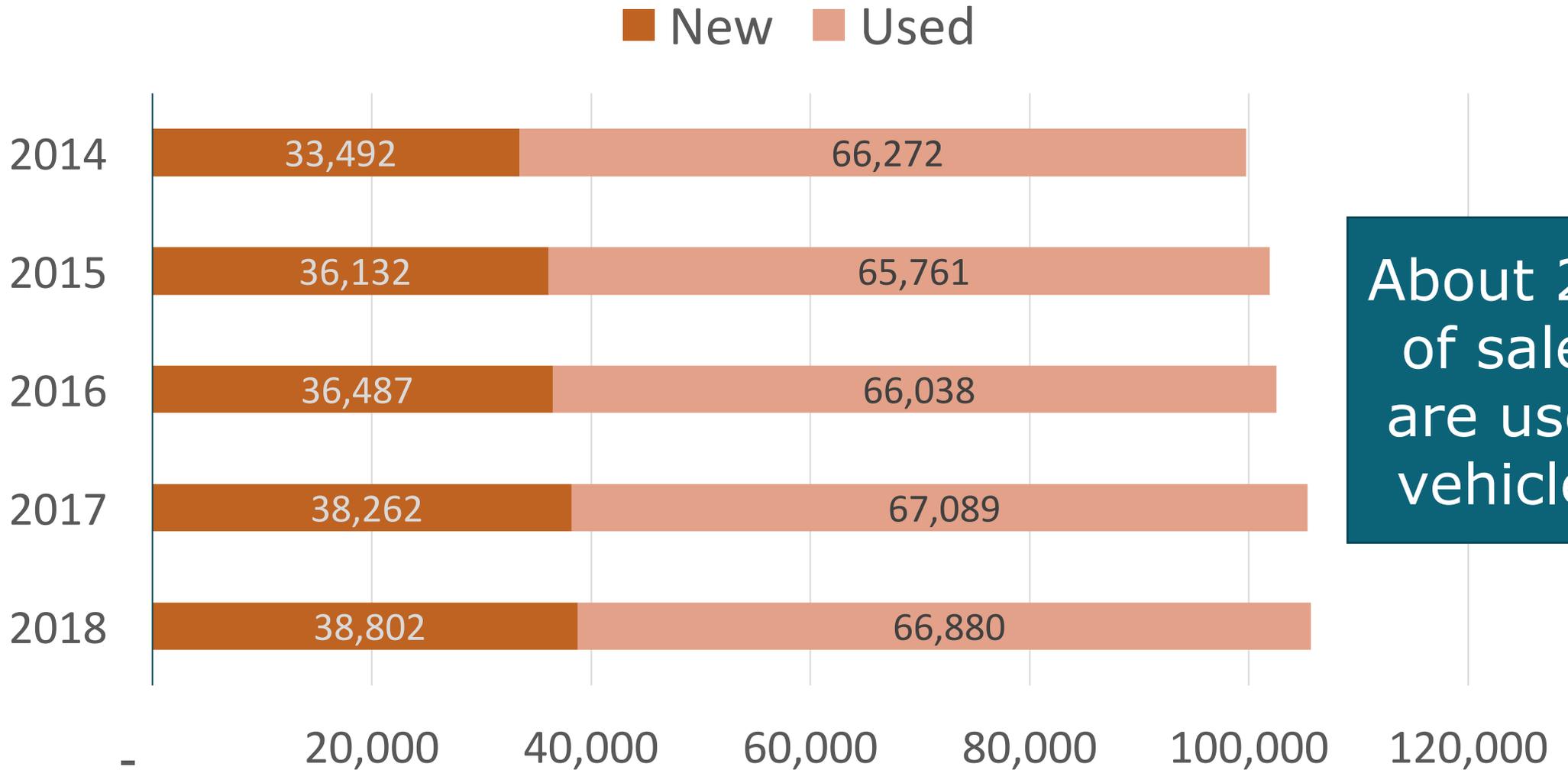
Source: Historic data from Drive Electric Vermont. Modeled data assumes 50% All-Electric Vehicles (AEVs) and 50% Plug-in Hybrid Electric Vehicles (PHEVs) in 2025.



Year	# of additional electric vehicles /year
2019	1,812
2020	2,989
2021	4,932
2022	8,138
2023	13,427
2024	22,153
2025	36,550



Vermont Annual Vehicle Sales

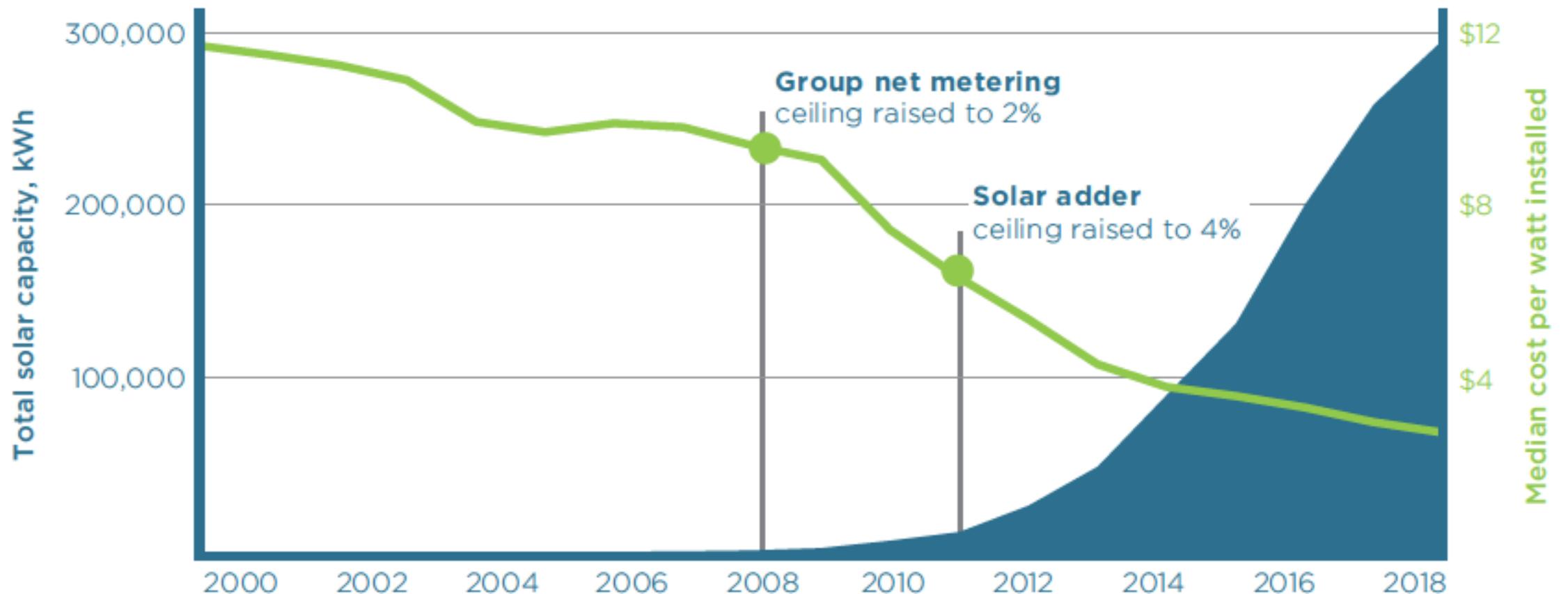


About 2/3 of sales are used vehicles



We've Already Done This For One Form of Energy...

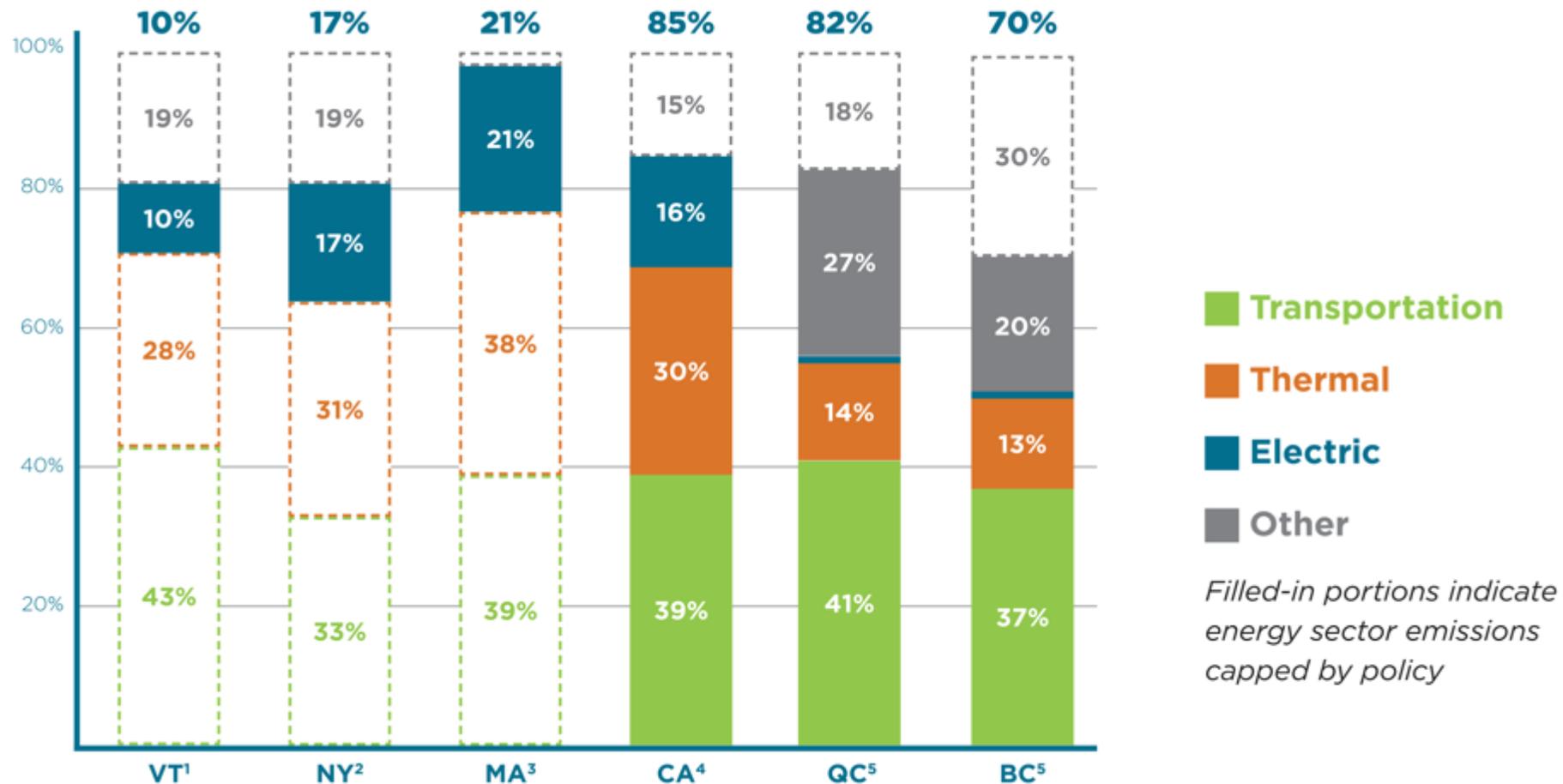
Total VT solar capacity and cost





What does economy-wide mean?

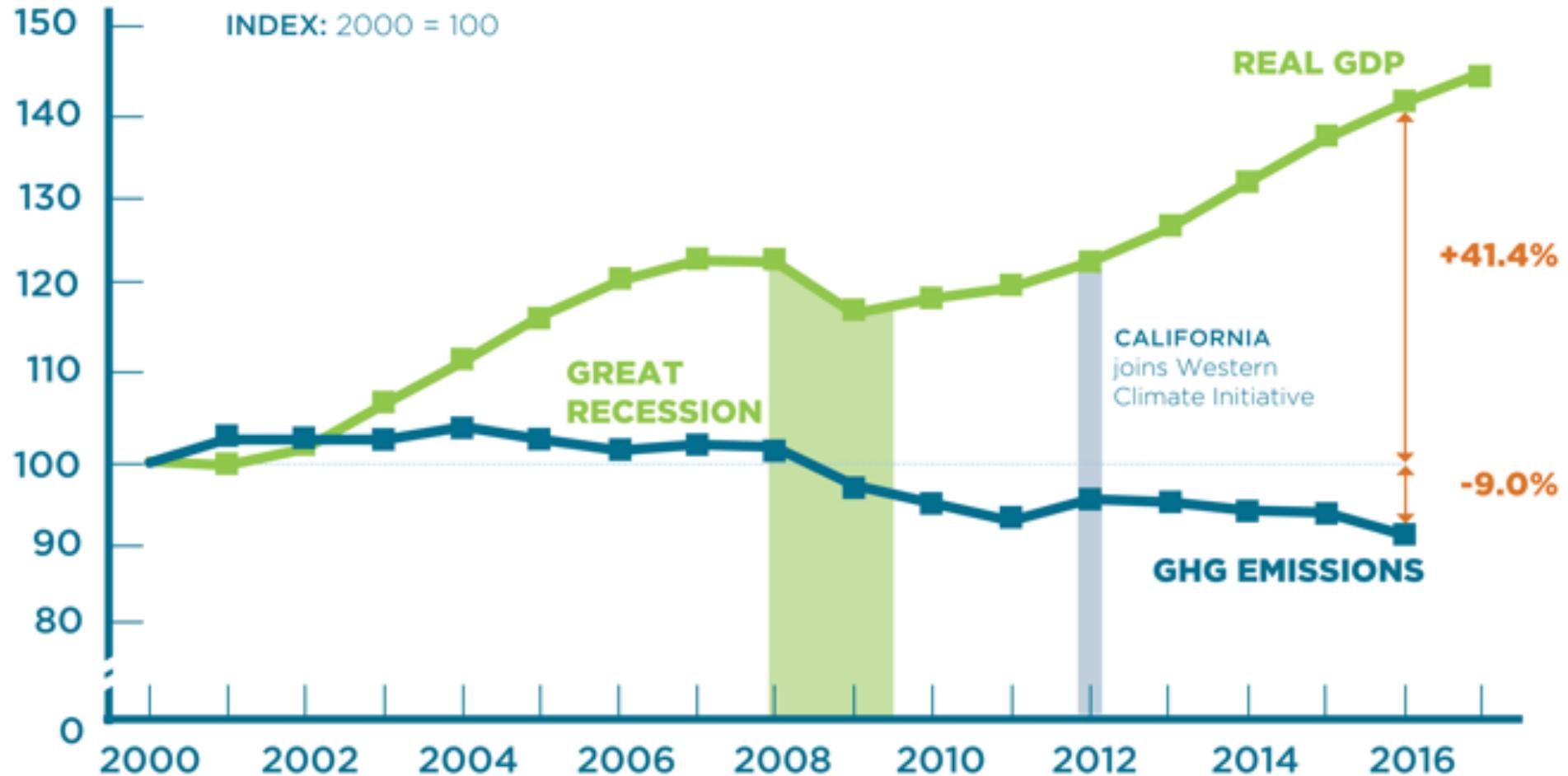
Percent of emissions covered by statewide decarbonization program



Sources and Notes: 1. 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. 2. New York State Greenhouse Gas Inventory: 1990-2015, NYSERDA. 3. MA GHG Emission Trends, Executive Office of Energy and Environmental Affairs. 4. California Greenhouse Gas Emissions Inventory - 2018 Edition, California Air Resources Board. 5. Canada's greenhouse gas inventory, Environment and Climate Change Canada.



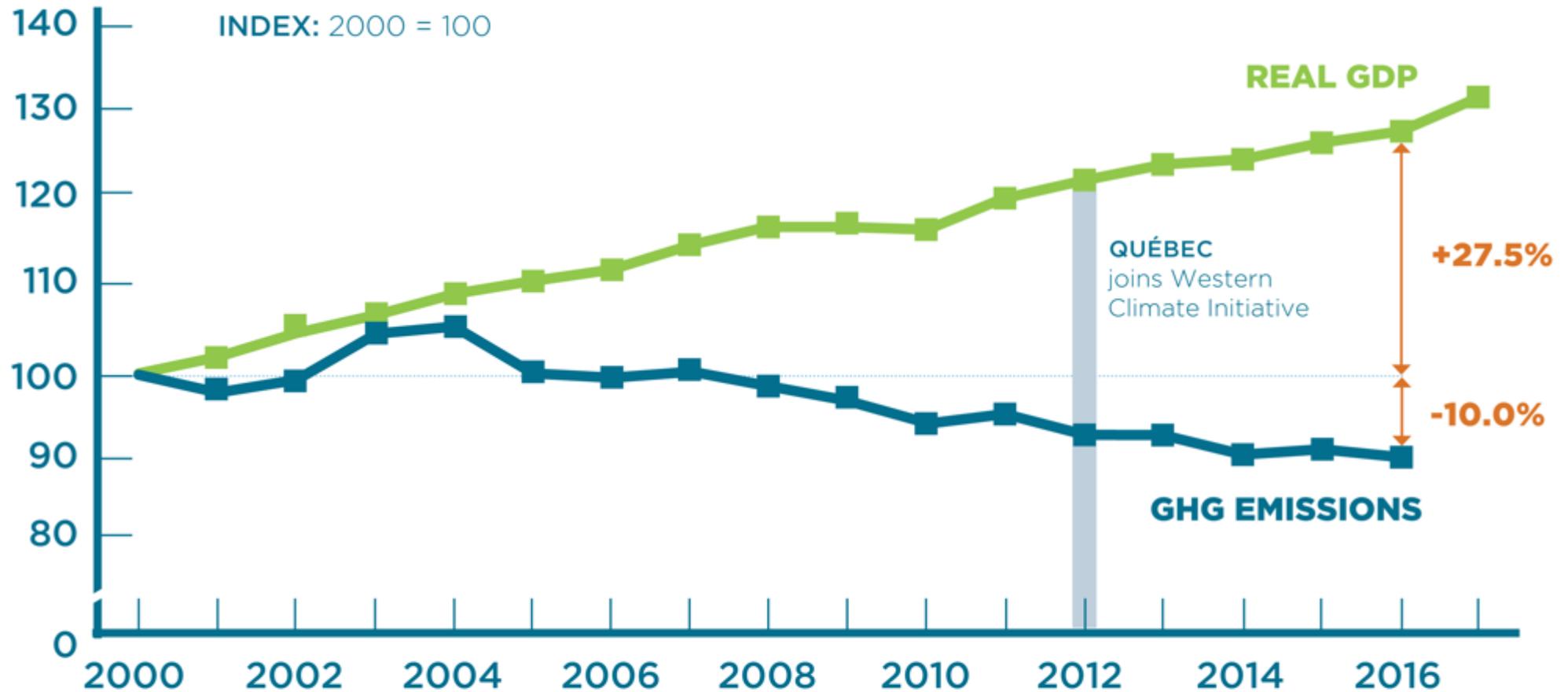
California has decoupled emissions and economic growth (2000-2017)



Source: Emissions: California Air Resources Board Greenhouse Gas Inventory, GDP: Federal Reserve Economic Data.



Québec has decoupled emissions and economic growth (2000-2017)



Source: Emissions: Environment and Climate Change Canada, GHG Emissions by Province and Canadian Economic Sector, 1990-2016; GDP: Statistics Canada, NWT Bureau of Statistics.

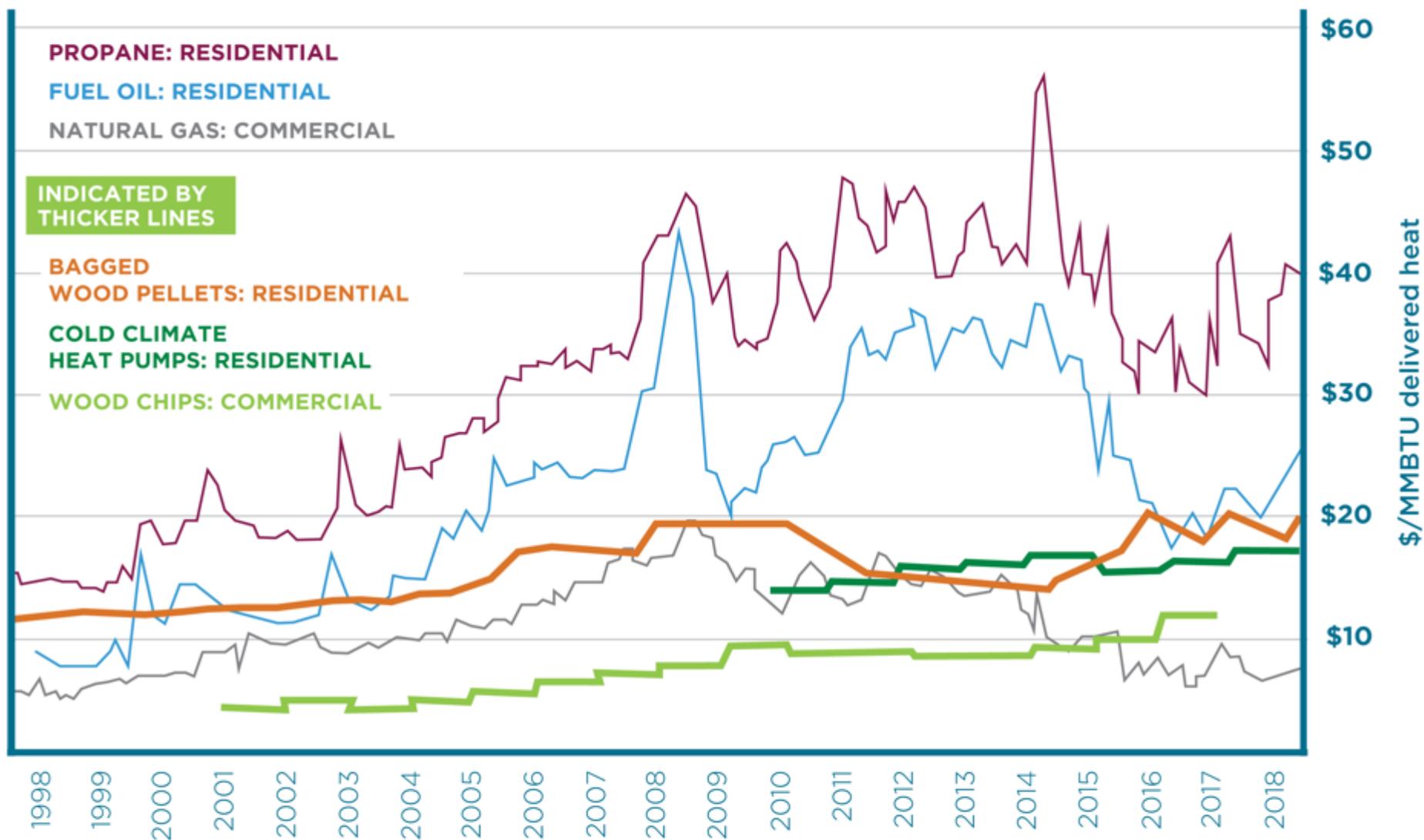


Benefits

Meeting our commitments will improve Vermonters' health, save them money, and boost our local Vermont economy



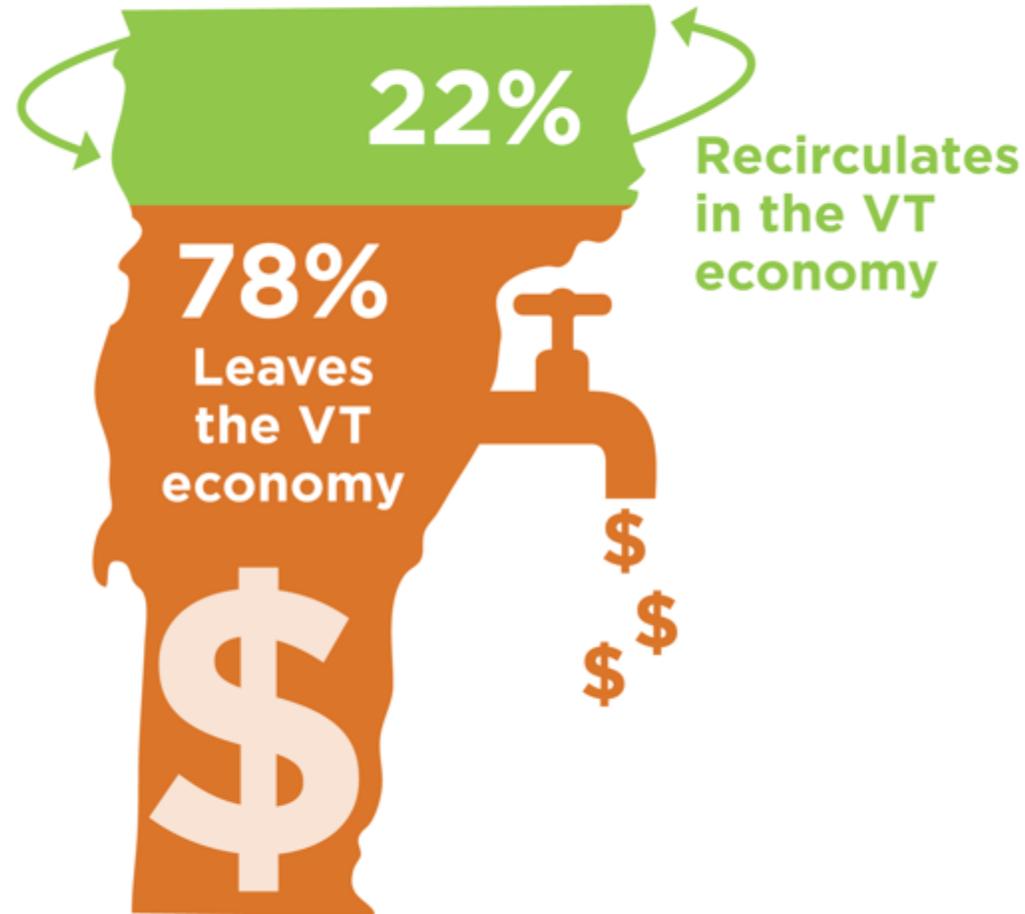
Average heating fuel pricing (1998-2018)



Source: Compiled by Biomass Energy Resource Center (2018) using data from Vermont Department of Public Service and the US Energy Information Administration.

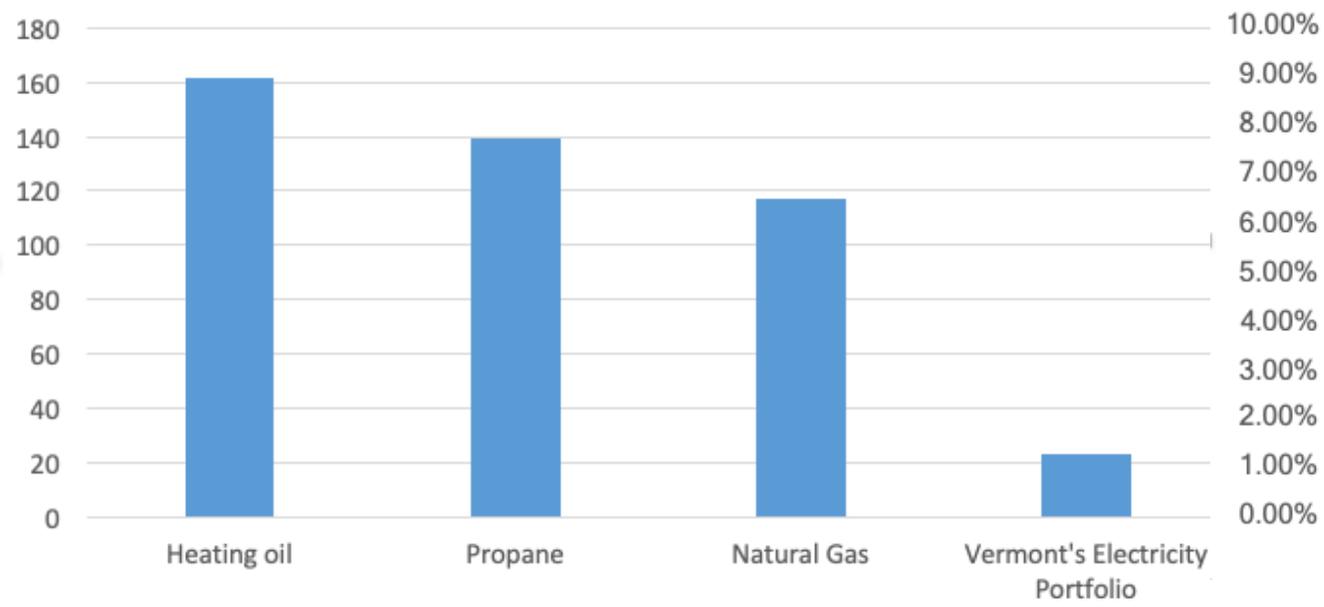


Dollars Spent on Fossil Fuels

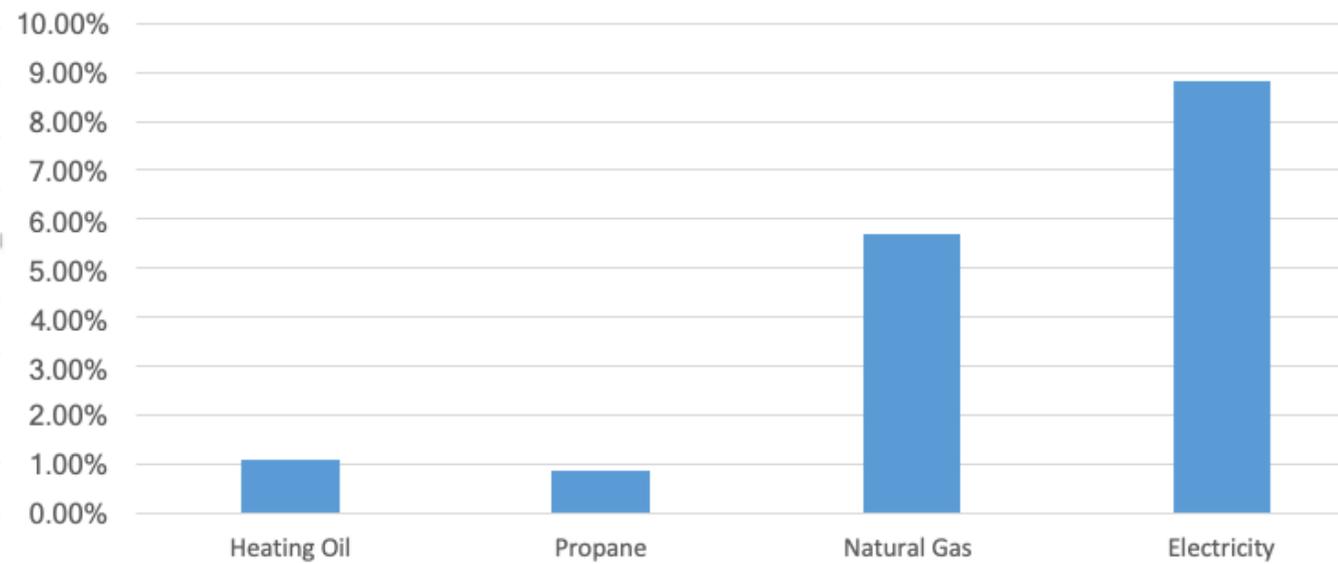


Source: Vermont Agency of Commerce and Community Development (2018).

Pounds of CO2 Emissions per MMBTU

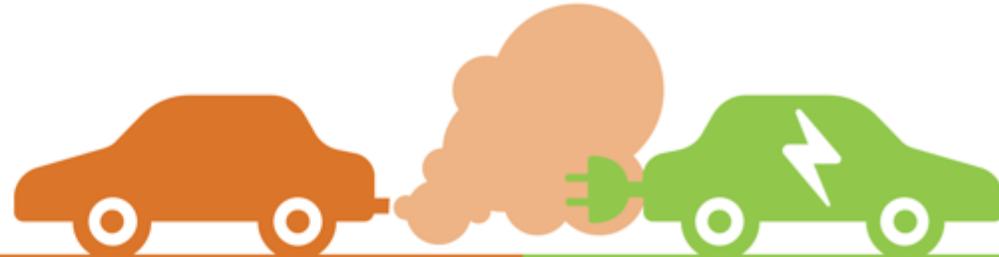


Vermont Taxes & Fees as % of Unit Cost





Going electric saves money

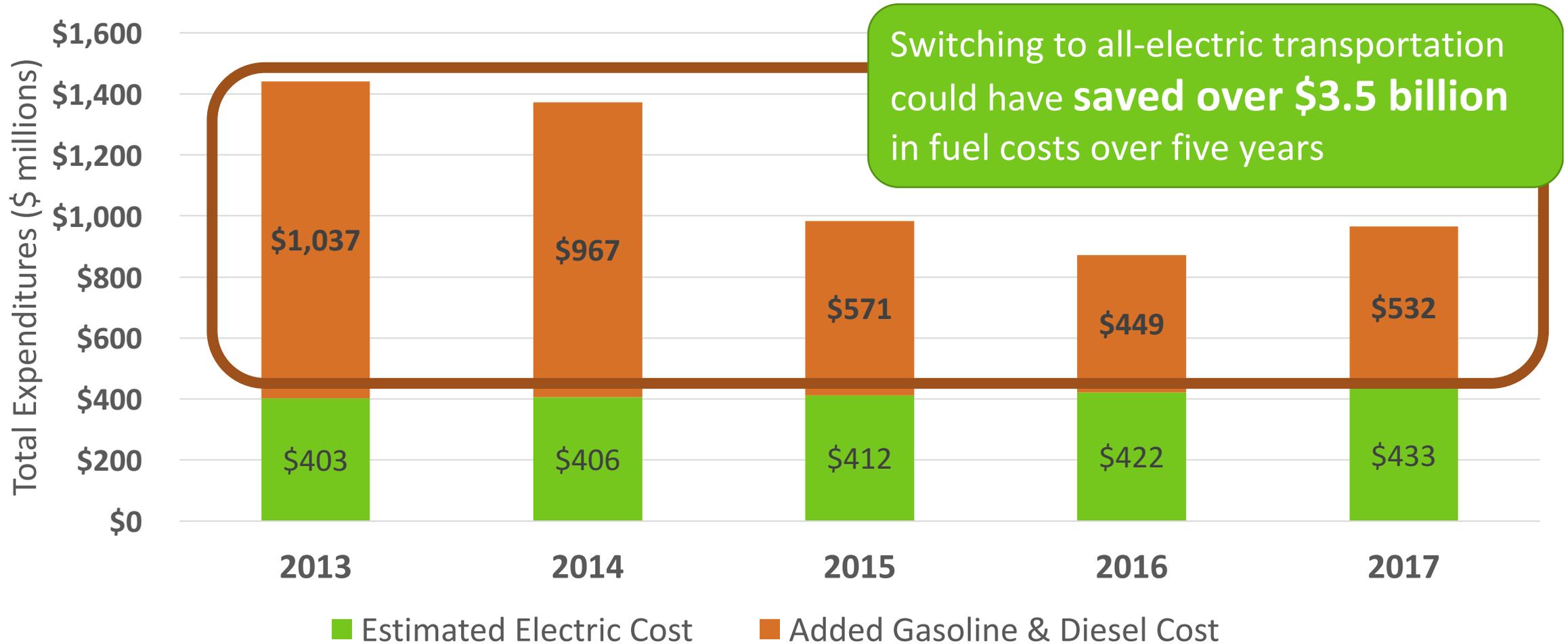


	GAS VEHICLE	ELECTRIC VEHICLE
Fuel	\$2.74/gallon ²	\$1.50/gallon equivalent ³
Oil Changes & Filter Replacement	\$900	None
Tire Changes	\$600	\$600
Engine Air Filter Replacements	\$207	None
Cabin Air Filter Replacements	\$273	\$273
Spark Plug Replacements	\$439	None
Coolant Flush and Replacement	\$110	\$110

Sources and Notes: Fuel costs from Energy Information Administration, 2018 average Regular gas price in New England. Electric costs from Drive Electric Vermont. Note: does not account for rate design or other programs that may reduce charging costs. Maintenance costs adapted to Vermont from Going from Pump to Plug, Union of Concerned Scientists, 2017. Compares the cost of the manufacturer's recommended services for a Chevrolet Bolt EV and a Chevrolet Sonic over 150,000 miles.

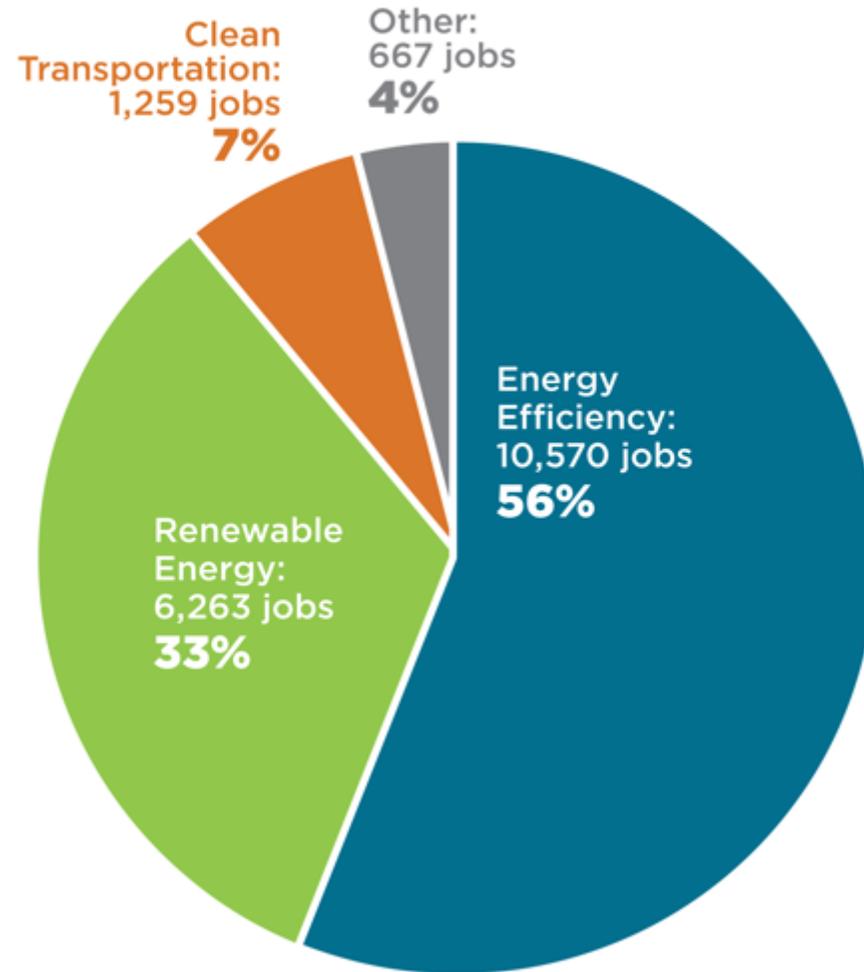


Statewide EV Fuel Cost Savings





Vermont share of clean energy jobs by sub-sector



Source: Vermont 2018 Clean Energy Industry Report, Clean Energy Development Fund, VT Department of Public Service.





Vermont Energy Future Initiative Members



Stephanie Yu

Policy Analyst with Public Assets
Institute



Tom Torti

President and CEO of the Lake
Champlain Regional Chamber of
Commerce



Darren Springer

Chief Operating Officer and
Manager for Strategy and
Innovation at Burlington Electric
Department



Patricia Moulton

President of Vermont Technical
College



Johanna Miller

Energy & Climate Program
Director, VNRC



Linda McGinnis

Economist and Policy Analyst
Fellow, Energy Action Network



April Salas

Executive Director of the Revers
Center for Energy



Tiana Smith

Energy Services Manager for
Vermont Gas



Laural Ruggles

Director, Community Health
Improvement, Northeastern VT
Regional Hospital



Geoff Martin

Energy Coordinator for the Town
of Hartford



Dave Laforce

Owner, Built by Newport



Dr. Tara Kulkarni, P.E.

Associate Professor, Norwich
University



Vermont Energy Future Initiative Members



Kerrick Johnson
Director of Strategy and Public
Affairs at VEIC



Justin Johnson
Head of Global Strategic Markets,
MMR



Phil Huffman
Director, Government Relations
& Policy, The Nature Conservancy



Maura Collins
Executive Director, Vermont
Housing Finance Agency (VHFA)



Nick Charyk
Communications & Public Affairs
Manager, AllEarth Renewables



Elizabeth Chant
Managing Consultant at Optimal
Energy, Inc



Brian Gray
General Manager, Energy Co-op of
Vermont



Karen Glitman
Market Dev. & Policy, Center for
Sustainable Energy (CSE)



Kate Desrochers
Projects and Initiatives Manager
for Packetized Energy



Josh Castonguay
VP and Chief Innovation Executive,
Power Supply



**Olivia Campbell
Andersen**
Executive Director of Renewable
Energy Vermont



Where Do We Most Need Focus Now?

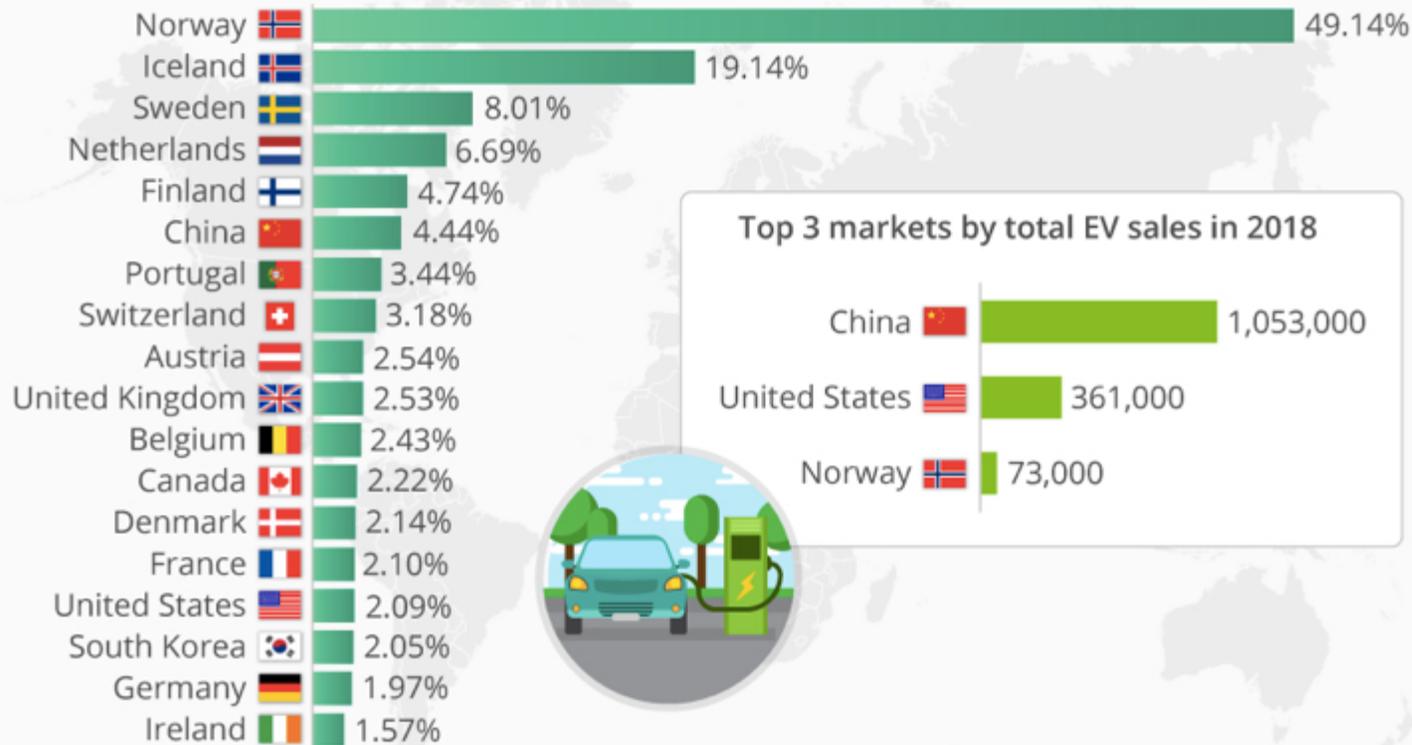
	Electricity Generation	Transportation	Thermal
Policy & Regulatory Reform	?	?	?
Public Engagement	?	?	?
Technology Innovation	?	?	?
Capital Mobilization	?	?	?



Case Study of Transportation Transformation: Norway

Electric Mobility: Norway Races Ahead

Countries with the highest share of plug-in electric vehicles in new passenger car sales in 2018*



How did they do it?

- **Charged fees to account for the social and environmental cost of the purchase of new fossil fuel vehicles**
- **Heavily subsidized and promoted EV purchases instead**



@StatistaCharts

* including plug-in hybrids and light vehicles, excluding commercial vehicles

Sources: ACEA, CAAM, InsideEVs, KAIDA

statista



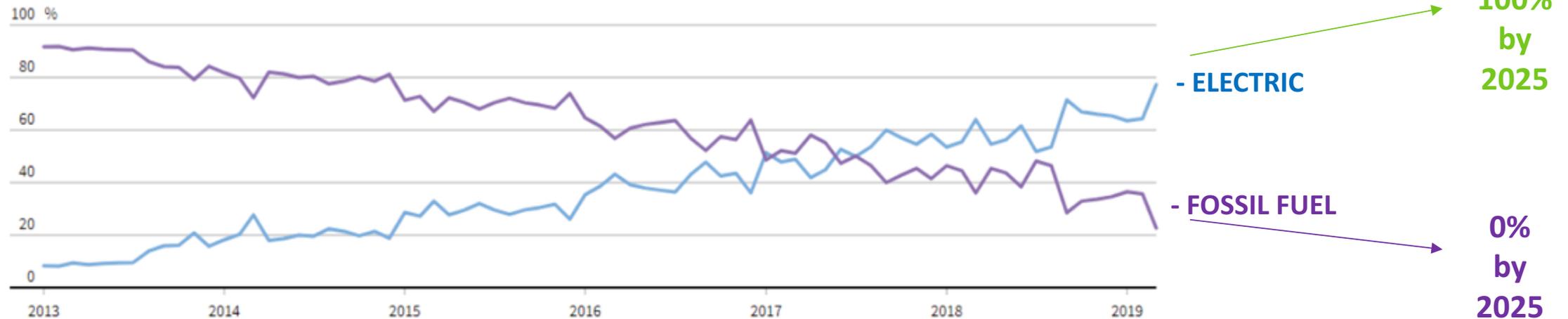
Norway – Policy Goals

How did Norway do it?... First, set strong requirements with funding

- By 2020 - 50,000 ZEVs on Norwegian roads (surpassed in Dec. 2017)
- By 2025 – 100% new vehicle sales must be ZEV – *including cars, urban buses and light commercial vehicles*
- By 2030 - all heavy-duty vans, 75% of new long-distance buses, and 50% of new trucks must be ZEV

Turning Point - Norway EV sales reached 58% of total sales (March 2019)

Market share based on car registration data



Source: Norwegian Road Federation

By Lea Desrayaud and Nerijus Adomaitis | REUTERS GRAPHICS



Case Study of Thermal Transformation: Upper Austria

- **47% of heating is from renewable sources, primarily sustainably managed biomass via automated wood pellet boilers (VT thermal sector only 19% renewable).**
- **Population approx. 2x Vermont**
- **How did they do it? “Sticks, carrots, and tambourines.”**





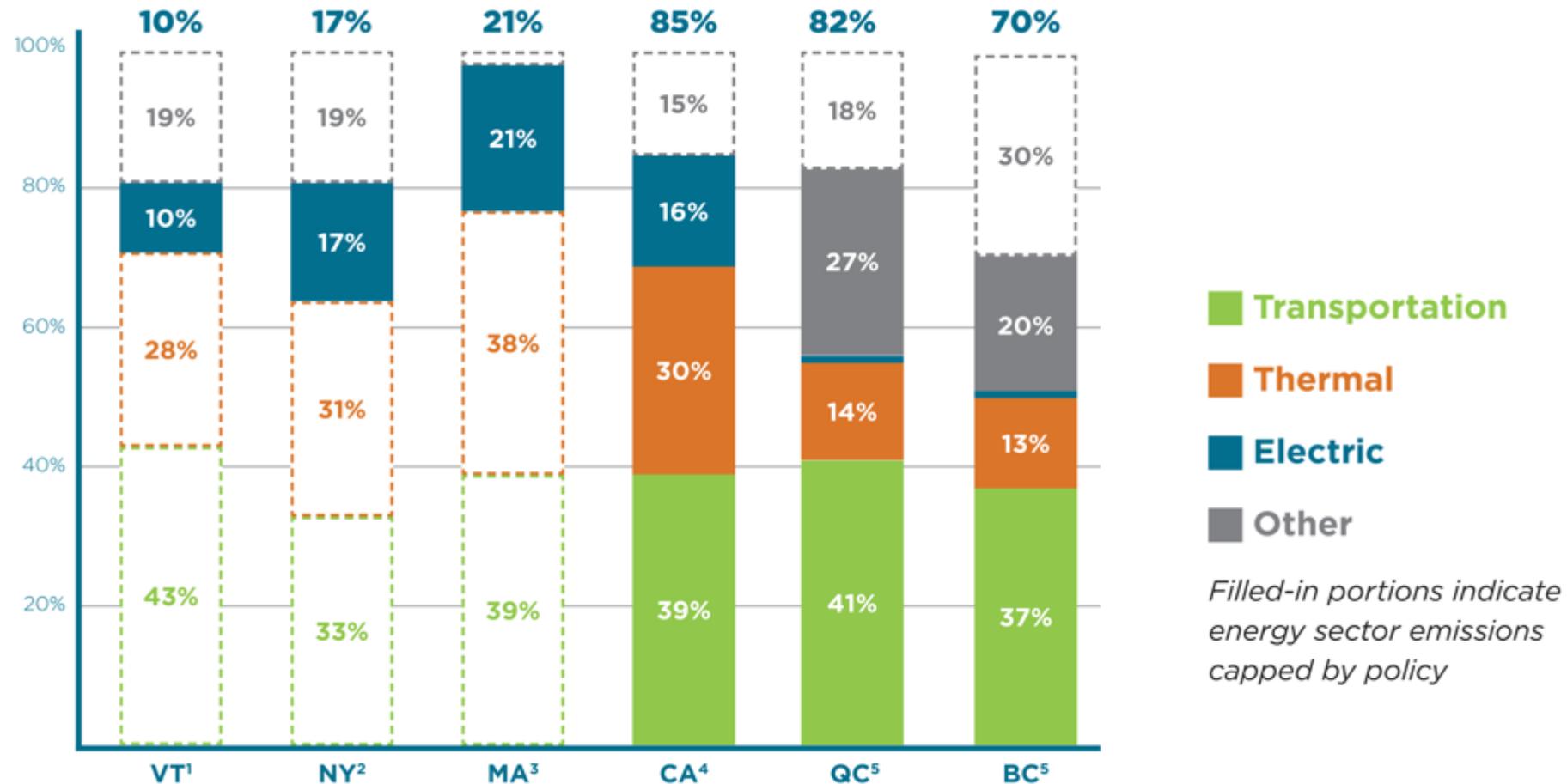
Where We Most Need Focus & Action Now

	Electricity Generation	Transportation	Thermal
Policy & Regulatory Reform		*	*
Public Engagement		*	*
Technology Innovation			
Capital Mobilization			



What does economy-wide mean?

Percent of emissions covered by statewide decarbonization program



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Summary



Learn more, and spread the word!



Top 5 Takeaways

1. Today, **our work needs to focus on transportation and thermal** – those two sectors emit the most, use the most fossil fuel, and are most expensive for Vermonters.
2. We **have solutions** to get Vermonters off of fossil fuels for transportation and heating and to lower costs: renewable heat, EVs, and more.
3. In order to even meet our commitment to the Paris Agreement, **we need to start immediately ramping up those solutions** for Vermonters. Business as usual will not get us anywhere close to that commitment.
4. That will take **economy-wide action**: using revenue from carbon policies to incentivize these key solutions across the economy.
5. If we do this right, and bring **everyone** along, then we stand **to improve our health, increase energy affordability, strengthen our economy, and protect our natural environment.**



Together, we can do this





Learn More

Visit www.eanvt.org to download the full Annual Progress Report and additional graphics

Questions or Comments? Email Jared Duval (jduval@eanvt.org) or Carolyn Wesley (cwesley@eanvt.org)