

# The UVM Transportation Research Center

*Research-informed insights to support more sustainable, equitable and resilient transportation systems and policy in Vermont.*

Vermont State Senate Committee on Transportation  
February 26, 2021

**Dr. Gregory Rowangould**

Director, Transportation Research Center

Associate Professor, Civil & Environmental Engineering

University of Vermont



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RESEARCH CENTER**

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# UVM Transportation Research Center

- Established in 2006 with \$16 million grant from US DOT
- Located in the College of Engineering and Mathematical Sciences
- 12 core faculty and research staff + many additional affiliated researchers from across campus
- Provides research opportunities for undergraduate, MS and PhD students
- Home to several affiliated transportation research and outreach programs
  - National Center for Sustainable Transportation (<https://ncst.ucdavis.edu/>)
  - Transportation Infrastructure Durability Center (<https://www.tidc-utc.org/>)
  - Vermont Clean Cities Coalition (<https://vtccc.w3.uvm.edu/>)
  - Northeast Transportation Workforce Center (<http://netwc.net/>)

<https://www.uvm.edu/cems/trc>



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# Sustainability and Equity is Our Mission

“Our mission is to serve as a hub for cutting edge, multidisciplinary transportation research with a focus on sustainable and equitable solutions for smaller cities and rural communities in Vermont, New England, and beyond.”

- **Sustainability** includes the environment and economy
- **Equity** has many dimensions and includes fairness across socioeconomic groups and urban and rural communities.
- Our goal is to be a **national leader** on sustainable transportation research for smaller and rural communities *AND be a comprehensive resource to address Vermont's* transportation research needs.



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# Transportation Challenges in Vermont

- Reducing greenhouse gas (GHG) emissions.
  - Meeting Act 153 (Global Warming Solution Act) greenhouse gas emission reduction targets
  - Accelerating electric vehicle adoption
  - Managing travel demand
- Understanding short to long term impacts of COVID-19 experience on travel demand, development patterns, and transportation needs.
- Preparing for autonomous vehicles to maximize benefits and avoid potential problems.
- Improving access to goods and services in small and rural communities.
- Infrastructure maintenance and financing – alternatives to the gas tax.



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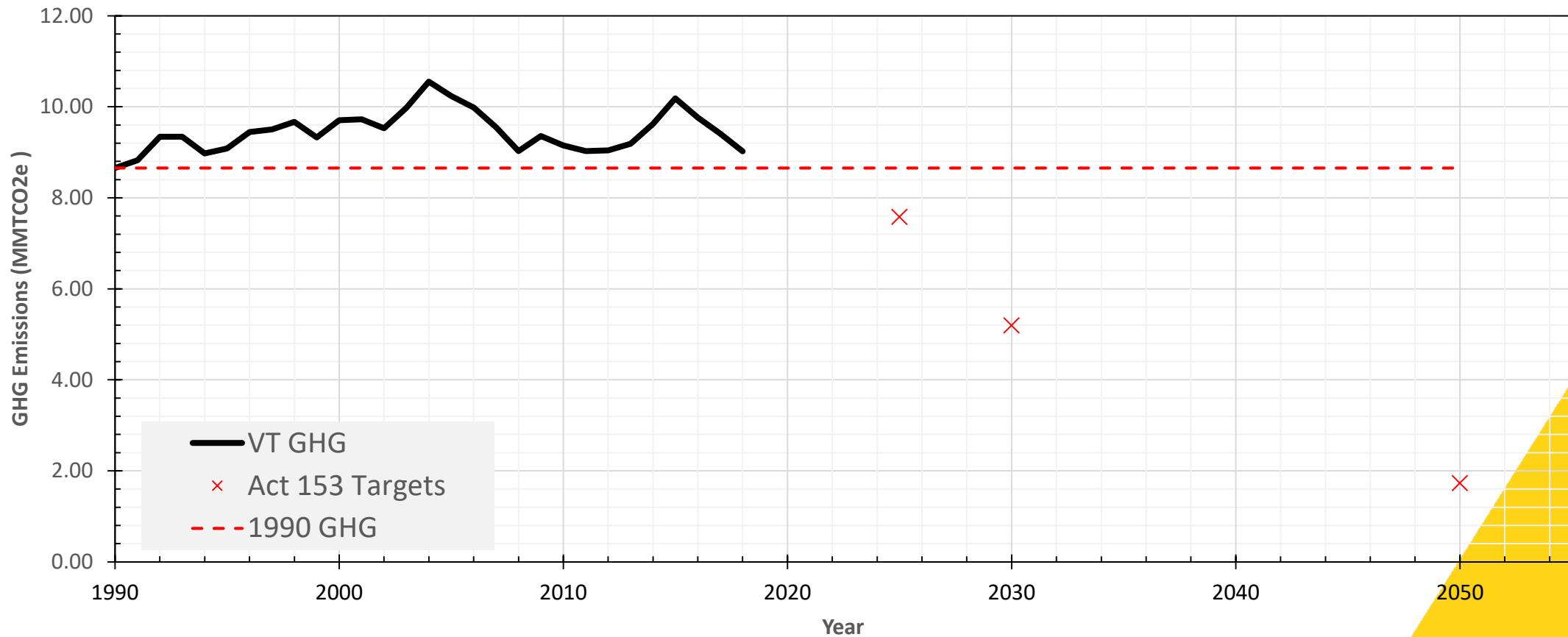
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# TRC Research and Policy

## GHG Mitigation Example



# VT GHG Emission Trends & Mitigation Targets

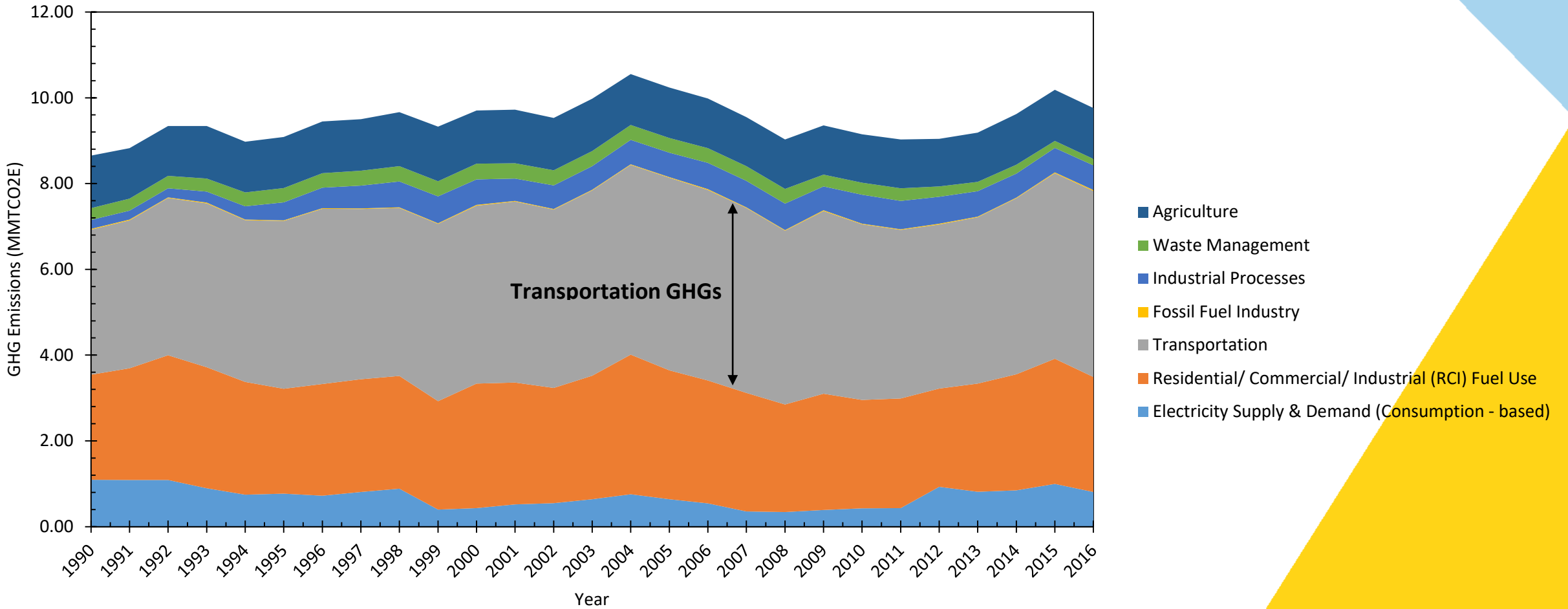


Data from Vermont Agency of Natural Resources GHG Inventory and Forecast 1990-2016  
Targets calculated by UVM-TRC



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# VT GHG Emission Trends



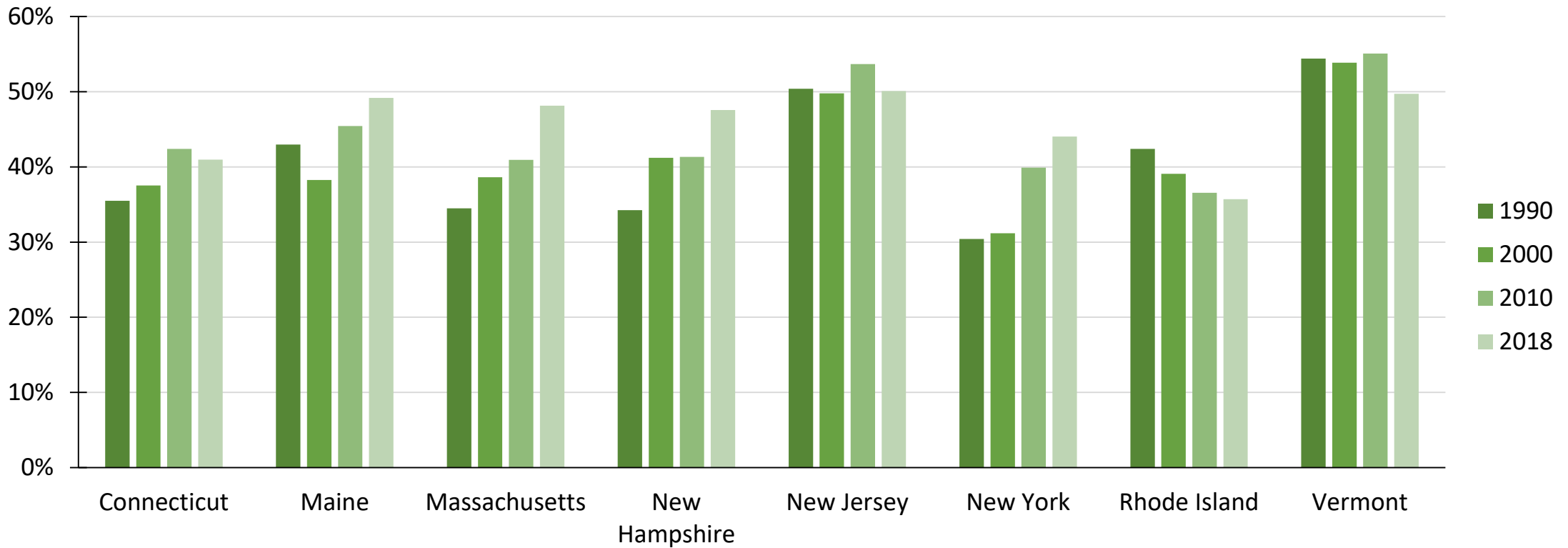
Data from Vermont Agency of Natural Resources GHG Inventory and Forecast 1990-2016



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# Most of Vermont's GHGs are from transportation

Percentage of GHGs from Transportation



Figures derived from US EPA GHG inventory data:  
<https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion>

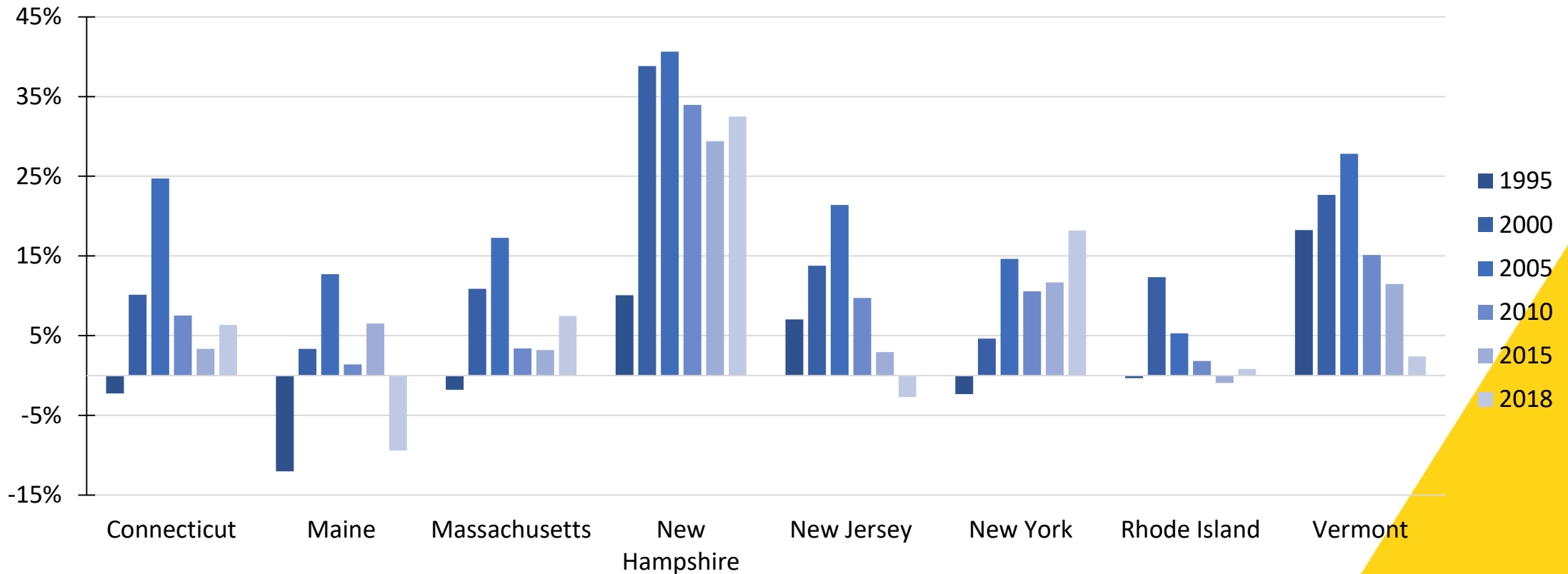


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# Signs of GHG Mitigation Progress in Vermont

Change in Transportation GHGs Since 1990



Figures derived from US EPA GHG inventory data:  
<https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion>



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# Transportation GHGs per Capita

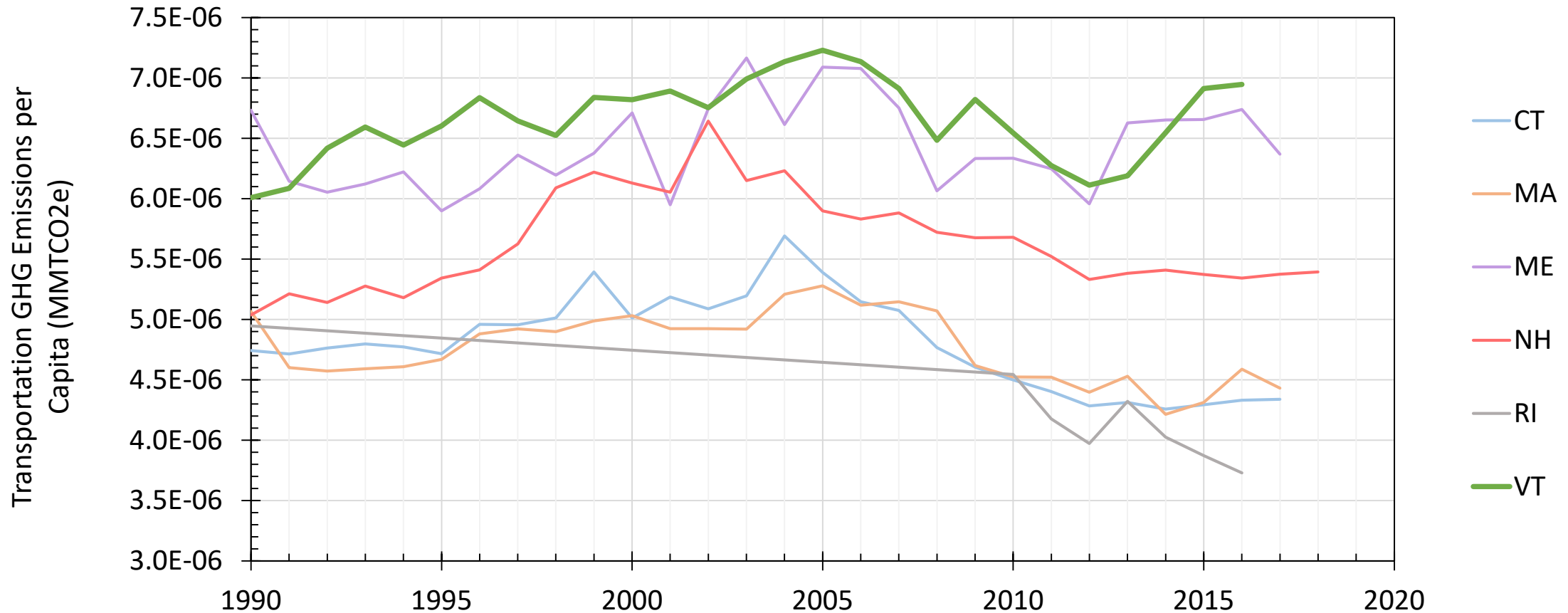
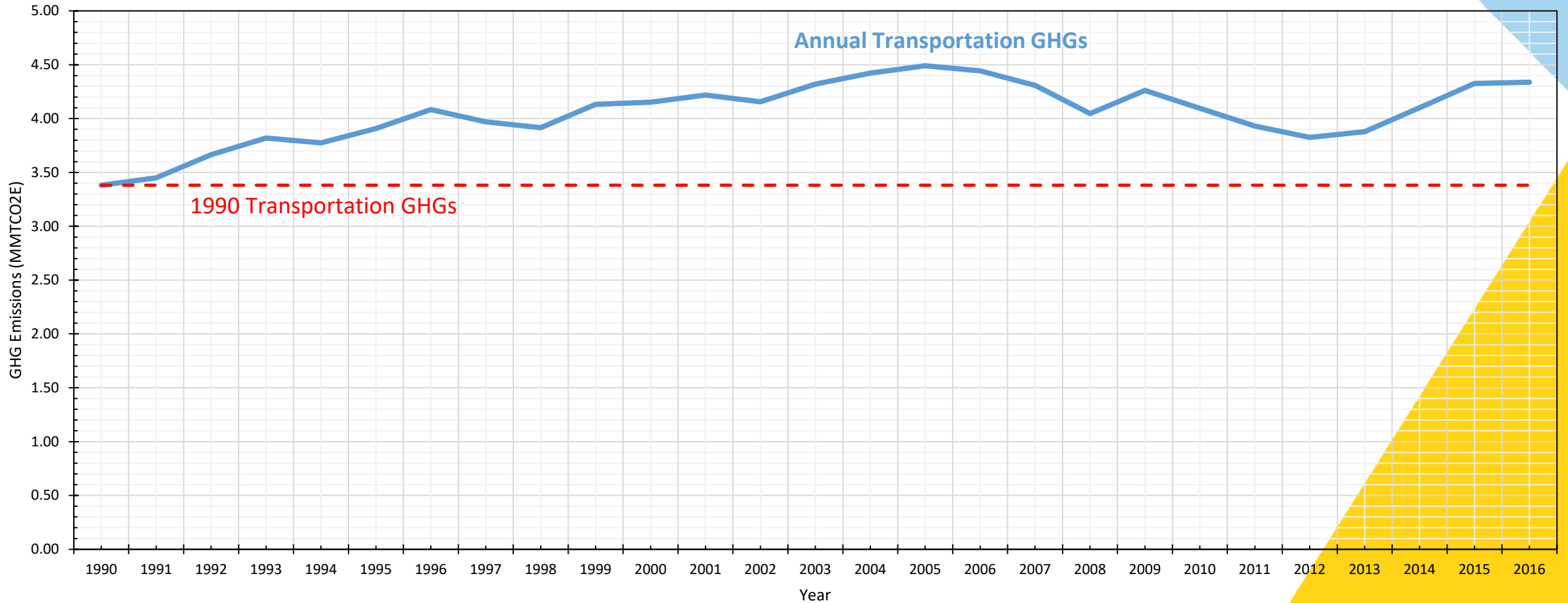


Figure data compiled by the University of Vermont Transportation Research Center from various state and federal agency sources.



# VT GHG Emissions from Transportation



Data from Vermont Agency of Natural Resources GHG Inventory and Forecast 1990-2016



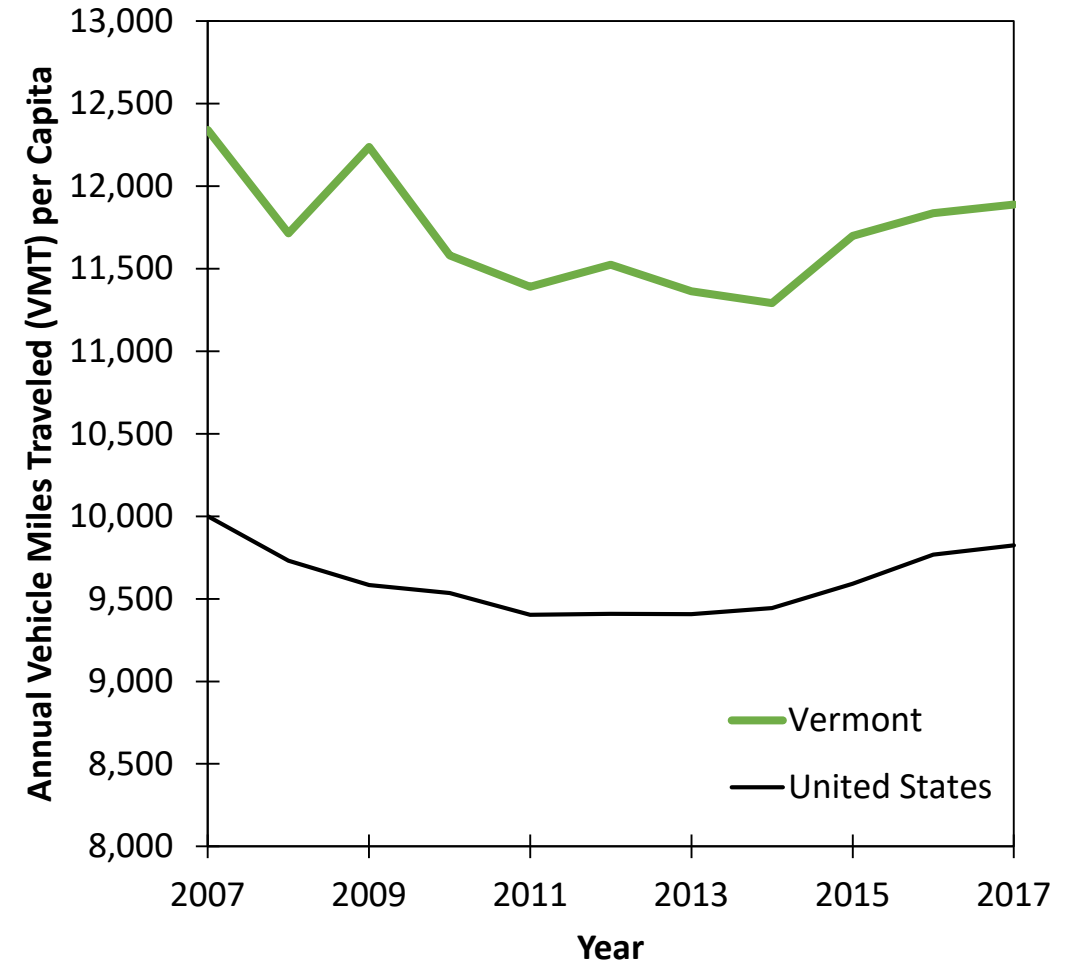
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# Automobile Dependence

Table 2-4. Comparison of Commuter Mode Share (%) for Vermonters, 2009 – 2017

Commuting Modes	ACS (5-Year Estimates)								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Drove Alone</b>	79.3%	79.4%	79.5%	79.7%	80.1%	80.5%	80.7%	81.0%	81.4%
<b>Carpool</b>	11.4%	11.3%	11.1%	11.0%	10.8%	10.4%	10.1%	9.8%	9.5%
<b>Walk</b>	6.6%	6.6%	6.4%	6.4%	6.1%	6.0%	6.2%	6.1%	6.0%
<b>Public Transportation</b>	1.0%	1.1%	1.2%	1.2%	1.3%	1.3%	1.3%	1.3%	1.3%
<b>Bicycle</b>	0.6%	0.6%	0.8%	0.9%	0.9%	0.9%	0.9%	0.9%	0.8%
<b>Other</b>	1.1%	1.0%	1.1%	1.0%	0.9%	0.9%	0.9%	1.0%	1.0%

Source: ACS, 2011-2019



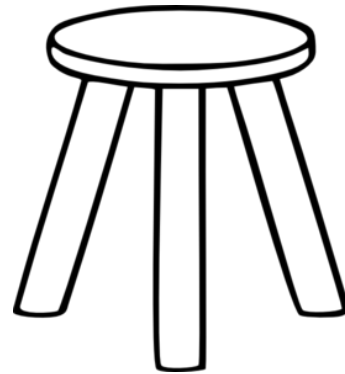
Source: *The Vermont Transportation Energy Profile*, Vermont Agency of Transportation, 2019



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# Transportation GHG Mitigation

*necessary but  
challenging in VT*

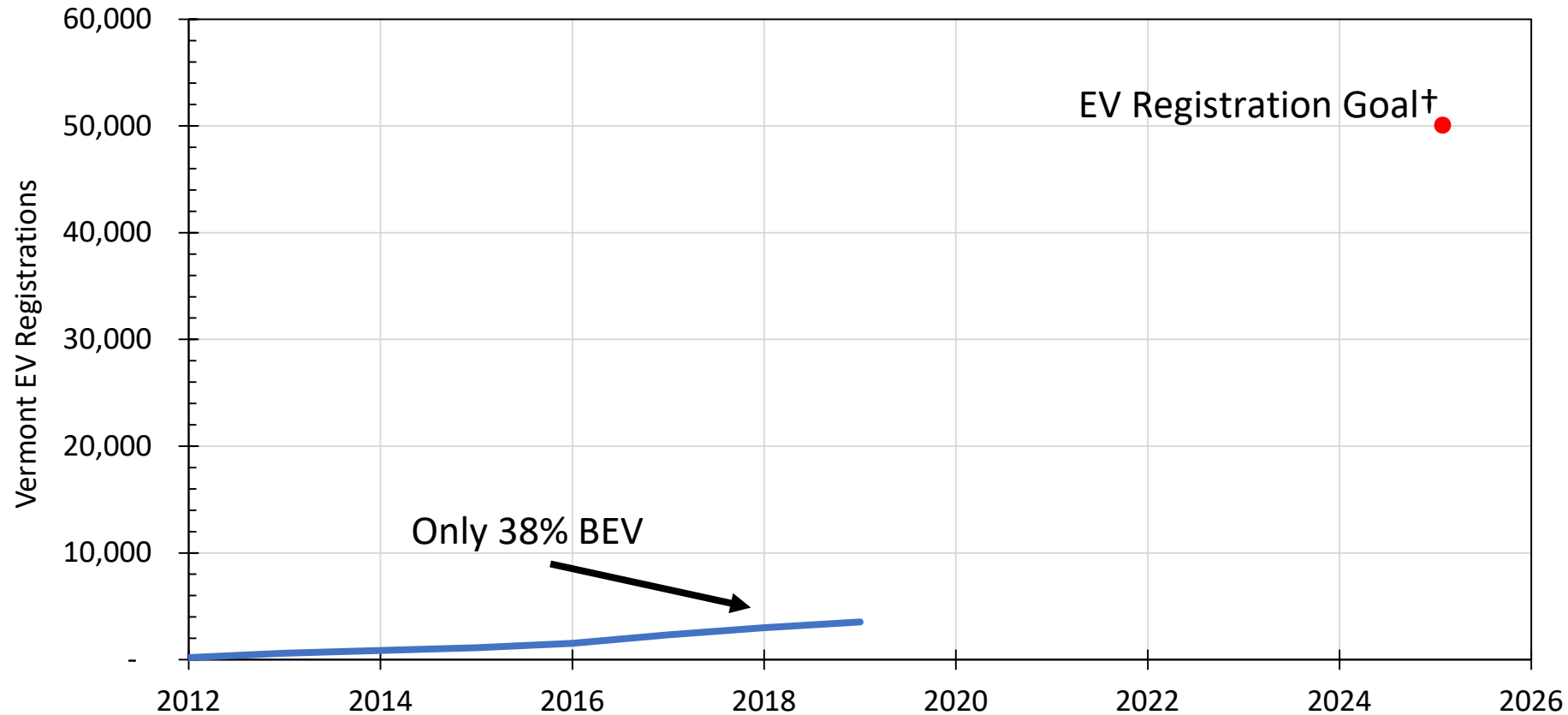


*electric vehicles*

Reduce Travel Demand + Increase Energy Efficiency + Reduce Emission Intensity



# Meeting EV goals will also be very challenging



† 12/16/2019 press release from Governor Scott & Comprehensive Energy Plan Goal

EV data source: *The Vermont Transportation Energy Profile*, Vermont Agency of Transportation, 2019

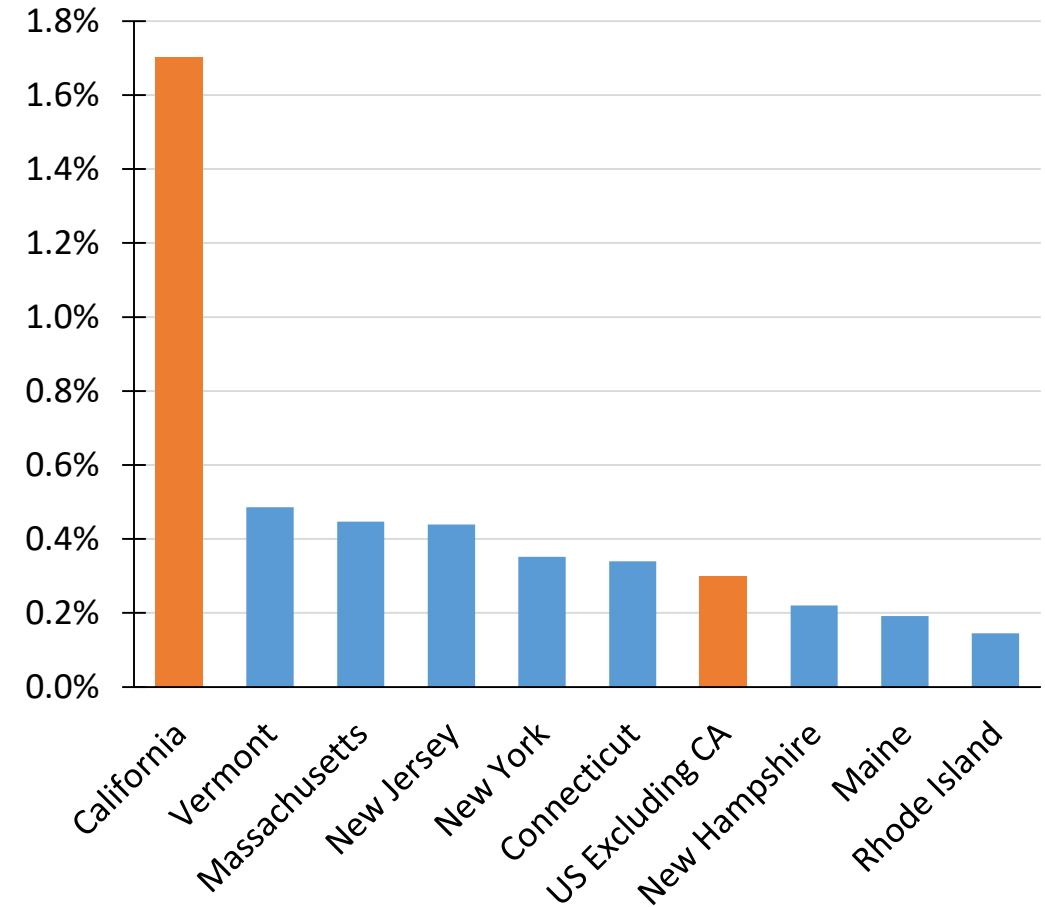


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# EV Rebates in the Northeast

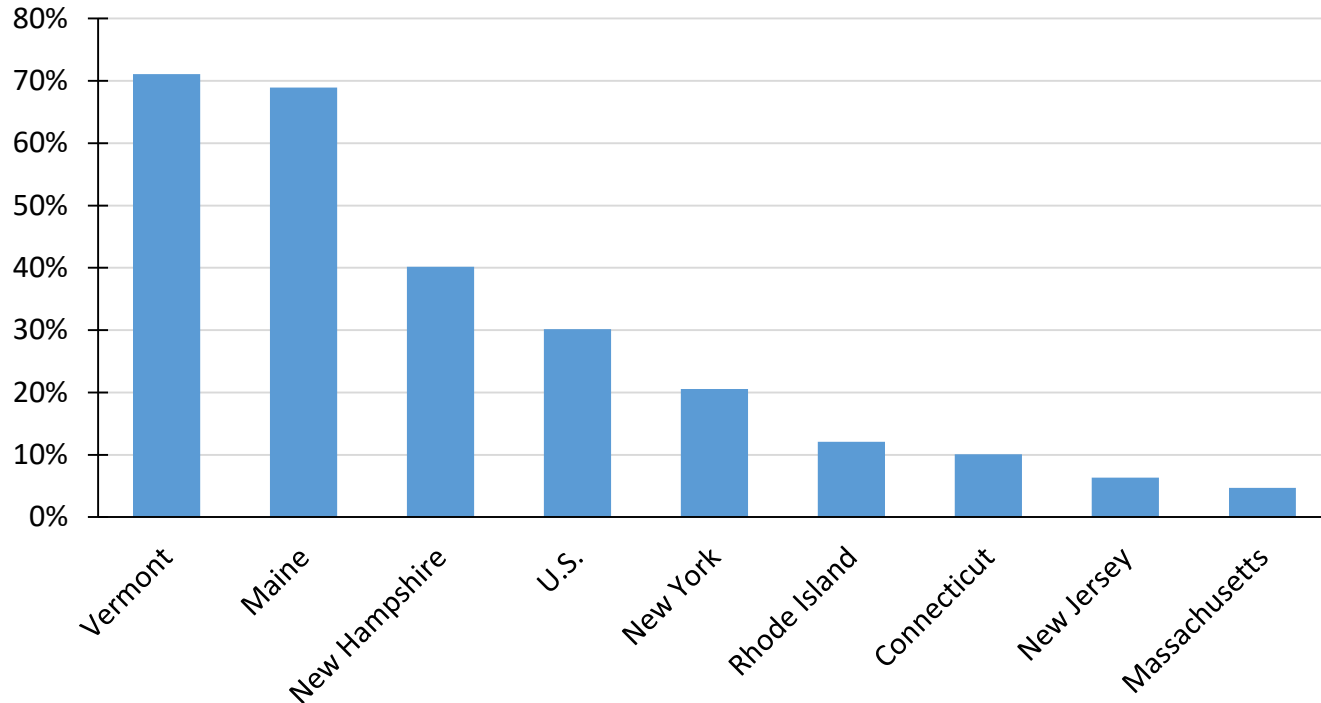
State	EV Rebate	Vehicle Type	Limitations
VT	\$4,000	BEV	< \$50,000 annual income, MSRP < \$40,000
	\$2,500	BEV	< \$125,000 annual income, MSRP < \$40,000
	\$3,000	PHEV	< \$50,000 annual income, MSRP < \$40,000
	\$1,500	PHEV	< \$125,000 annual income, MSRP < \$40,000
MA	\$2,500	BEV or FCEV	MSPR < \$50,000
	\$1,500	PHEV > 50mi EV range	MSPR < \$50,000
NJ	up to \$5,000	BEV/PHEV	Rebate depends on EV range
	up to \$2,000	BEV/PHEV	Rebate depends on EV range, \$500 incentive MSRP > 60,000
NY	\$2,000	BEV/PHEV	
CT	None		
NH	None		
ME	\$2,000	BEV or FCEV	MSPR < \$50,000
	\$1,000	PHEV	MSPR < \$50,000
	\$5,500	BEV	Qualified for Low Income, MSPR < \$50,000
	\$4,000	PHEV	Qualified for Low Income, MSPR < \$50,000
	\$2,500	Used BEV	Qualified for Low Income, MSPR < \$50,000
	\$2,500	Used PHEV	Qualified for Low Income, MSPR < \$50,000
RI	None		

All-Electric EV Registrations  
(as % of 2018 light duty vehicle registrations)

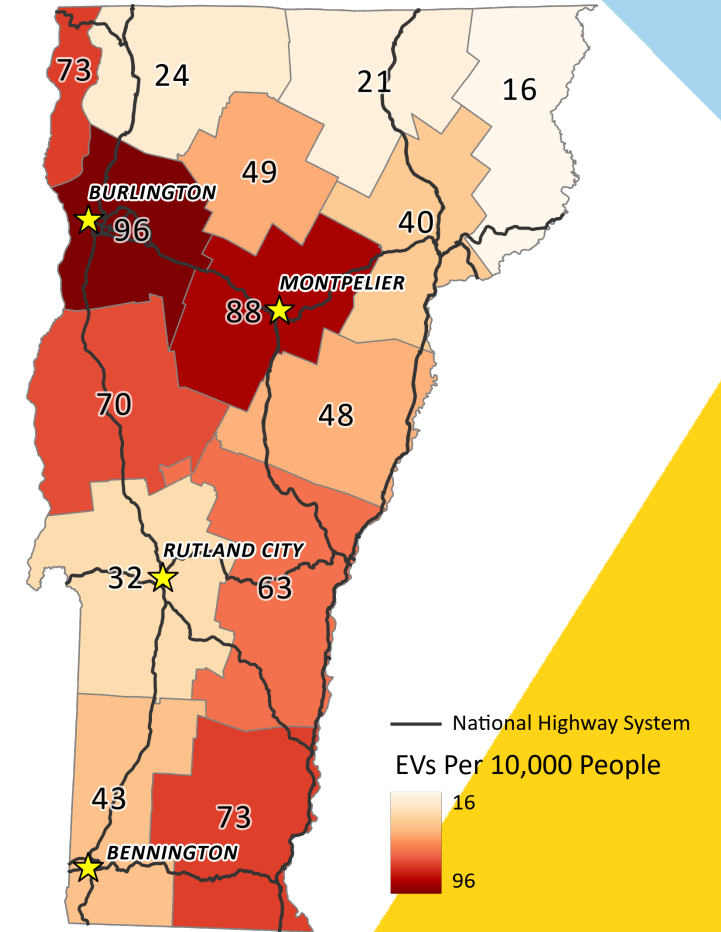


# Challenge – Rural Equity

Percentage of Vehicle Miles Traveled in “Rural” Areas



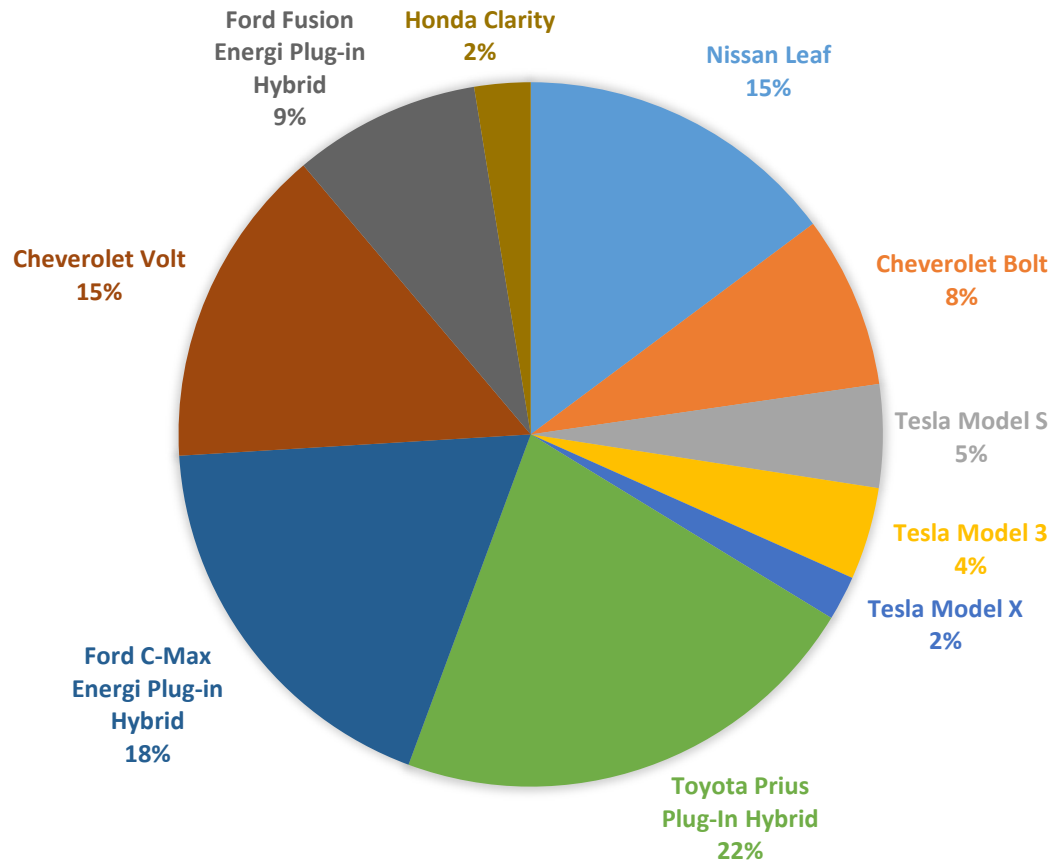
Vermont Electric Vehicles Per 10,000 People Per County as of July 2020



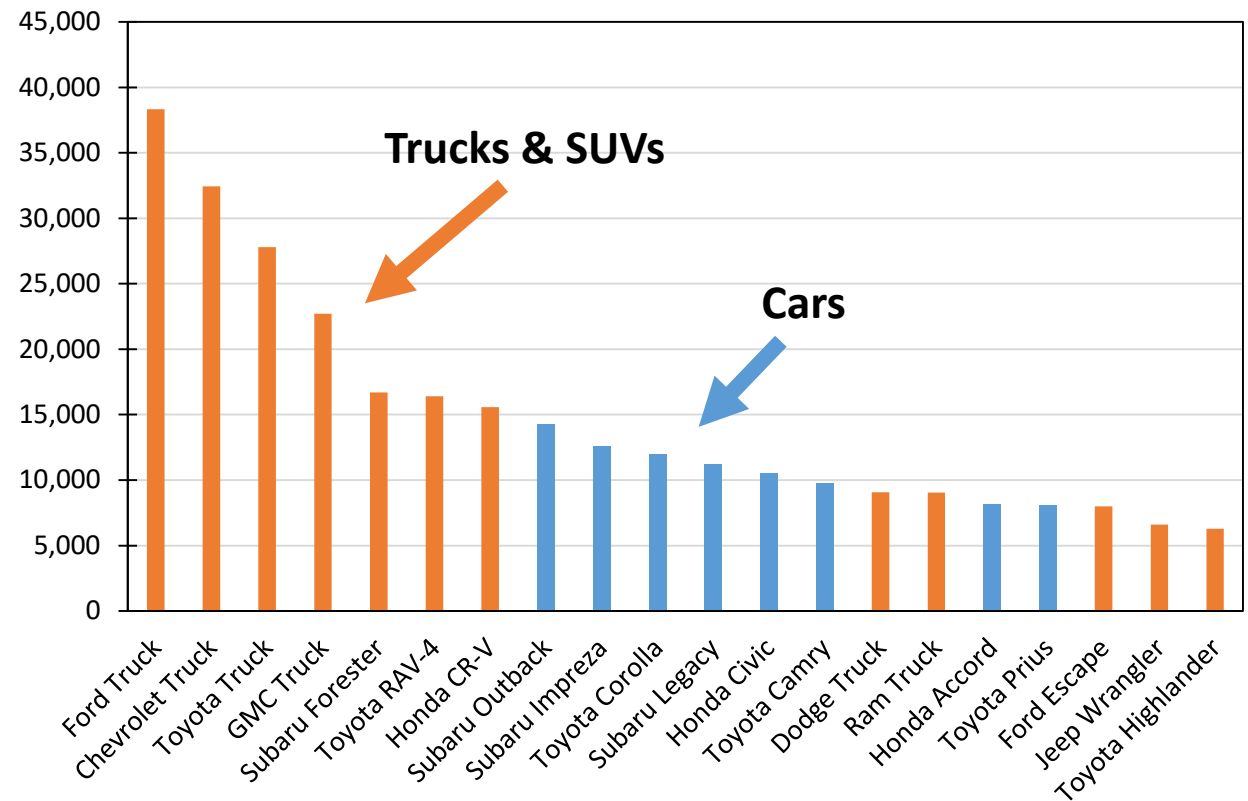
Map data from Drive Electric Vermont:  
[https://www.driveelectricvt.com/Media/Default/docs/maps/vt\\_ev\\_registration\\_trends.pdf](https://www.driveelectricvt.com/Media/Default/docs/maps/vt_ev_registration_trends.pdf)



# Rural Challenge – Vehicle Preferences and EV Availability



**Top 20 Light Duty Vehicles in Vermont (2019)**



Figures derived from data in the: *The Vermont Transportation Energy Profile*, Vermont Agency of Transportation, 2019



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# The Challenge

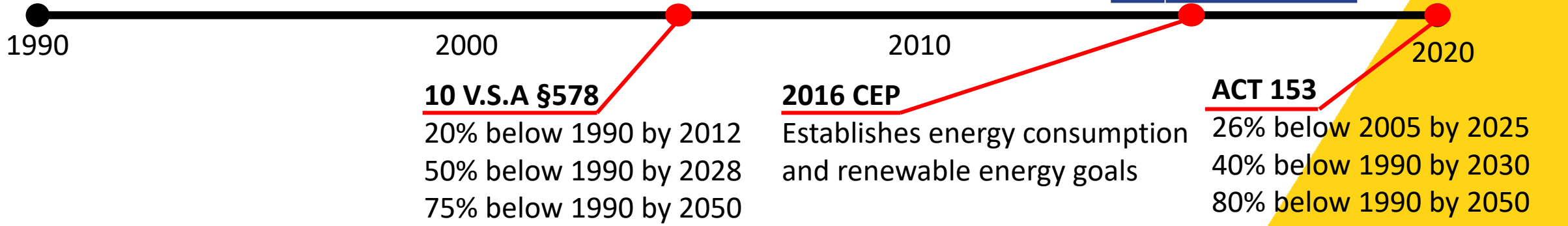
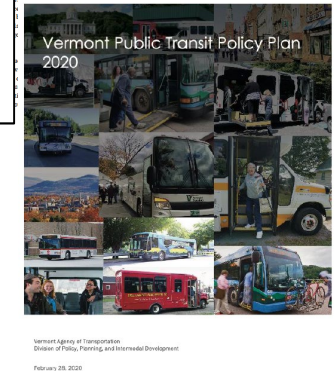
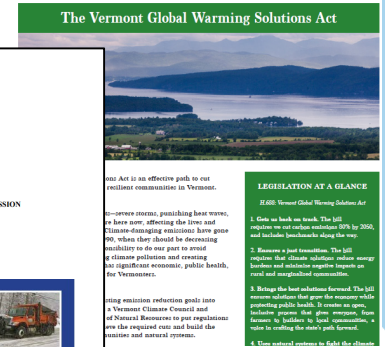
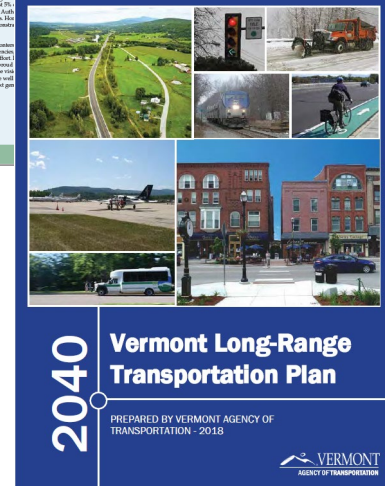
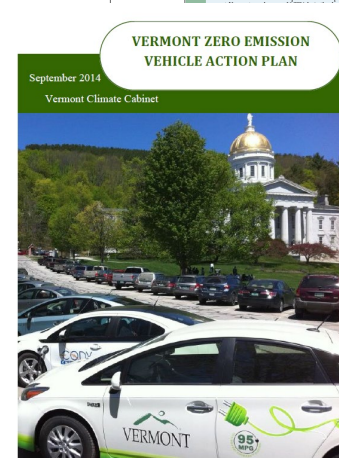
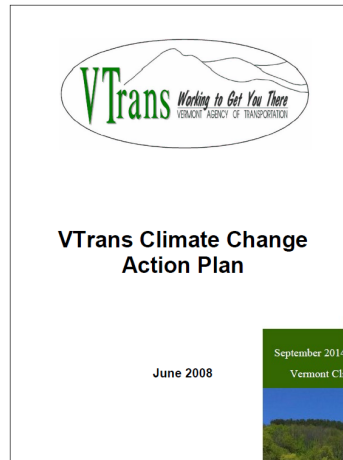
Concluding remarks of the **Transportation Research Board of the National Academies 2<sup>nd</sup>** Strategic Highway Research Program study<sup>†</sup> on GHG mitigation decision making:

**“By far, and not surprisingly, most of the research on GHG emissions reduction strategies has focused on metropolitan areas or at the national and state levels.” and that “...very little attention has been given to nonurban areas.”**

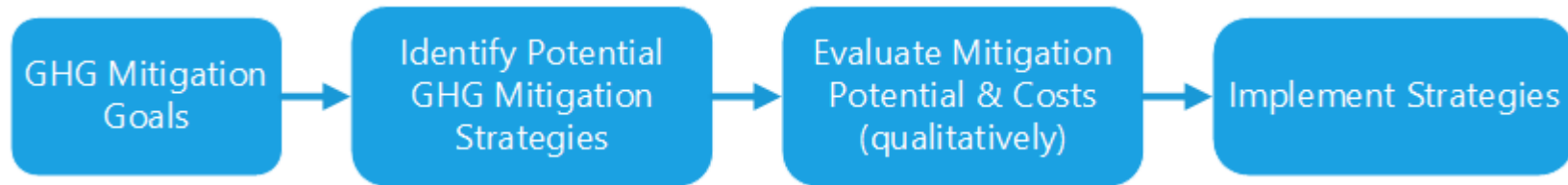
<sup>†</sup>TRB. *Incorporating Greenhouse Gas Emissions into the Collaborative Decision-Making Process*. Transportation Research Board of the National Academies, Washington D.C., 2013.



# GHG Mitigation Goals & Plans



# Current Process (simplified representation)



## ■ Key Mitigation Strategy and Policy Questions

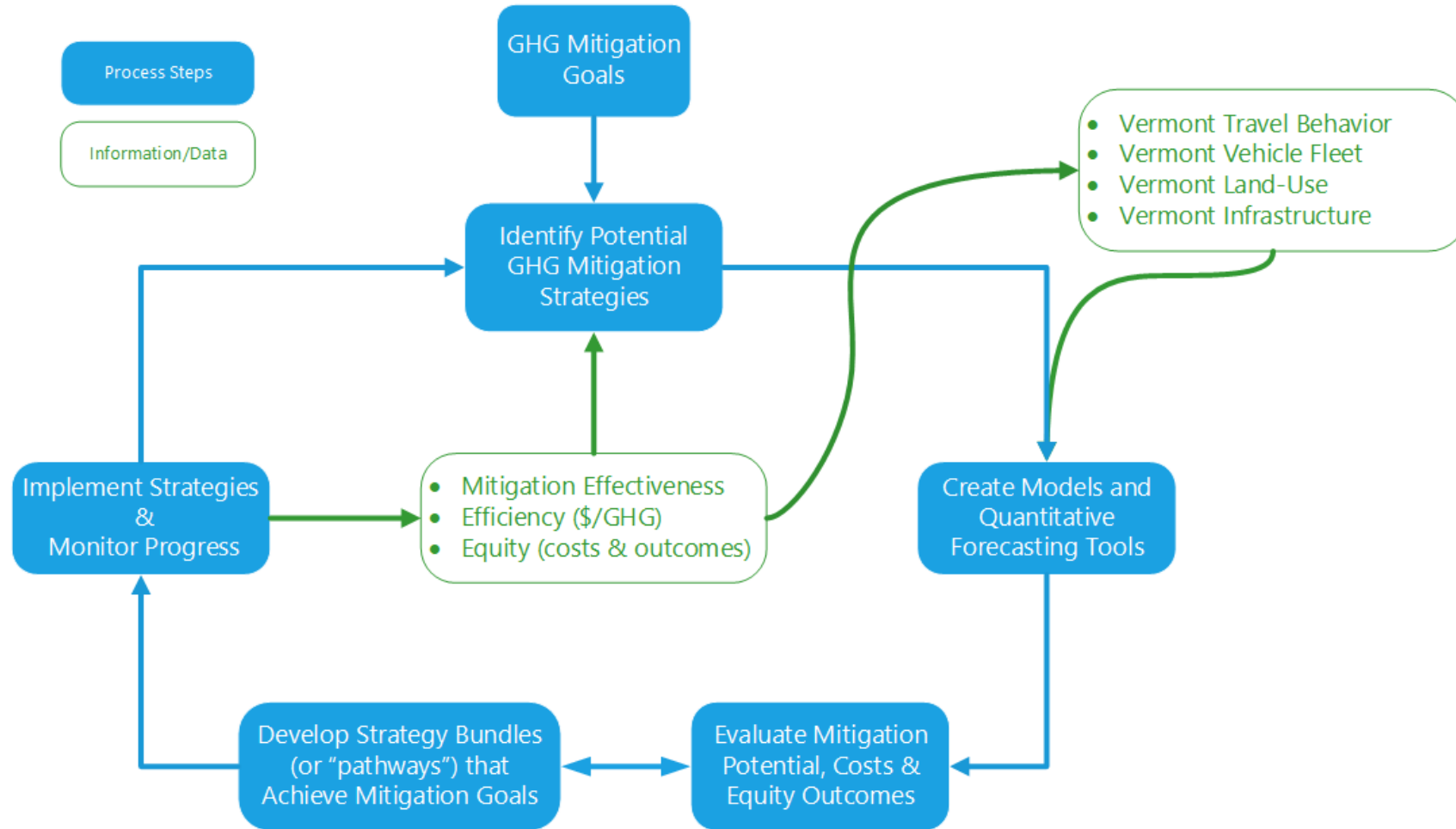
- **Effectiveness** – tons of GHGs mitigated/on path to reach climate goals
- **Efficiency** – cost effectiveness (\$/ton of GHG mitigated)
- **Equity** – distribution of costs and outcomes (good and bad) across regions (urban/suburban/rural) and socioeconomic groups (income, BIPOC, age, etc.)

## ■ Current Analysis Limitations

- Vermont **travel behavior data** (e.g., price responsiveness, factors affecting vehicle, mode and housing location choice and travel demand, etc.)
- **Models** for evaluating potential strategies and forecasting their mitigation potential, efficiency and equity implications.



# Data Driven Process with Feedback & Learning



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# Partial List of Vermont Transportation Research & Data Needs:

## Vehicle choice modeling

- Forecast GHG reductions from feebates, EV subsidies, charging network design
- Evaluate incentive program equity (e.g., low income, rural vs. urban)

## Estimate travel demand and fuel consumption price sensitivity (i.e., “price elasticities”)

- Forecast GHG reductions from TCI, other market based GHG mitigation policies
- Evaluate revenue and change in VMT from gas tax alternatives needed for EVs

## Transit choice modeling/on-board transit surveys

- Understand factors driving ridership trends and evaluate new transit strategies

## Longitudinal & disaggregate VMT, GHG and vehicle purchase data

- Evaluate policy and strategy effectiveness
- Refine forecasts and forecasting models
- Identify equity concerns related to program and outcomes (both positive and negative)

## Integrated land use & travel demand modeling

- Understand GHG mitigation potential for compact development & smart growth strategies in Vermont
- Evaluate impact of Autonomous Vehicles on land-use and travel demand/GHG



# What does sustainable transportation look like in Vermont and its many small and rural communities?



Image Source: Google Earth



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# Questions/Discussion

<https://www.uvm.edu/cems/trc>

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