ELECTRIC VEHICLES STATUS AND UPDATES IN VERMONT

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Deputy Commissioner, VT Department of Public Service

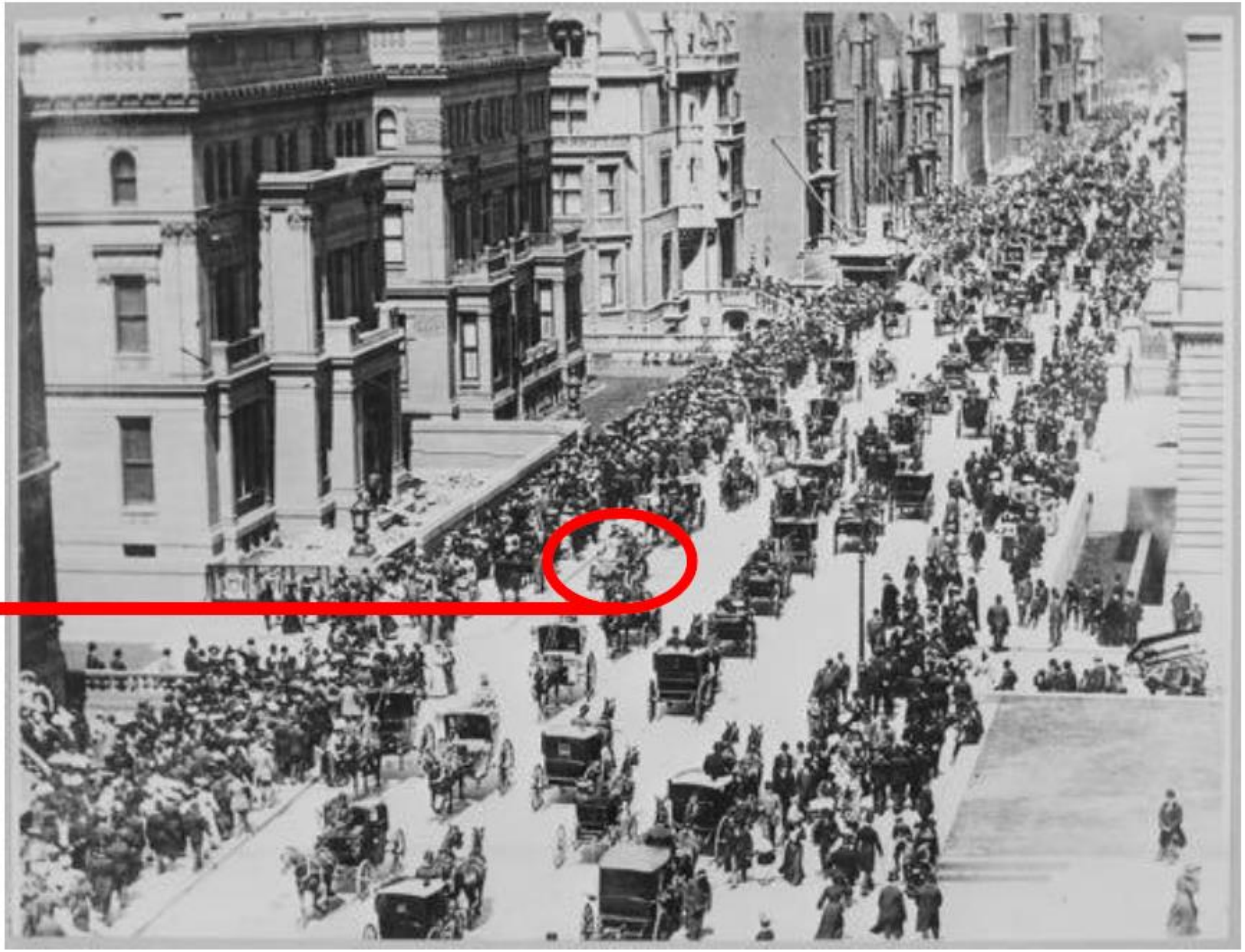
February 12, 2019

Rapid Technological Change Is Possible

1900

5th Avenue
NYC

Where is the Car?



Rapid Technological Change Is Possible

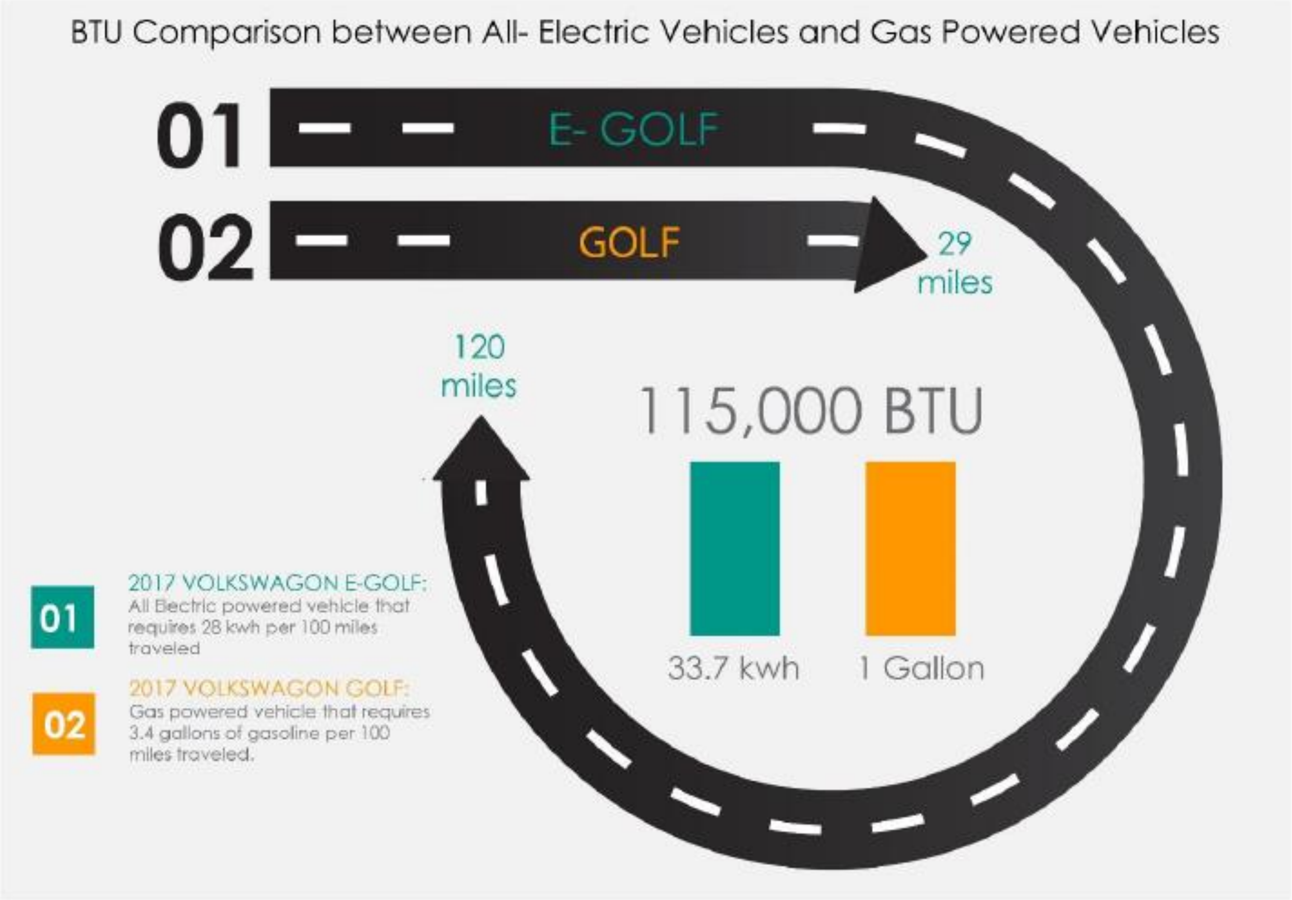
1913

5th Avenue

NYC

Where is the Horse?

EVs Are More Efficient



Electric cars can travel further than gasoline with the same amount of energy

Estimated Annual Energy Cost Savings from Complete Fleet Conversion

$740 Million*

* Excludes higher purchase price that is expected to be at parity in roughly 5 or 6 years.

Goals and Progress Related to Transportation

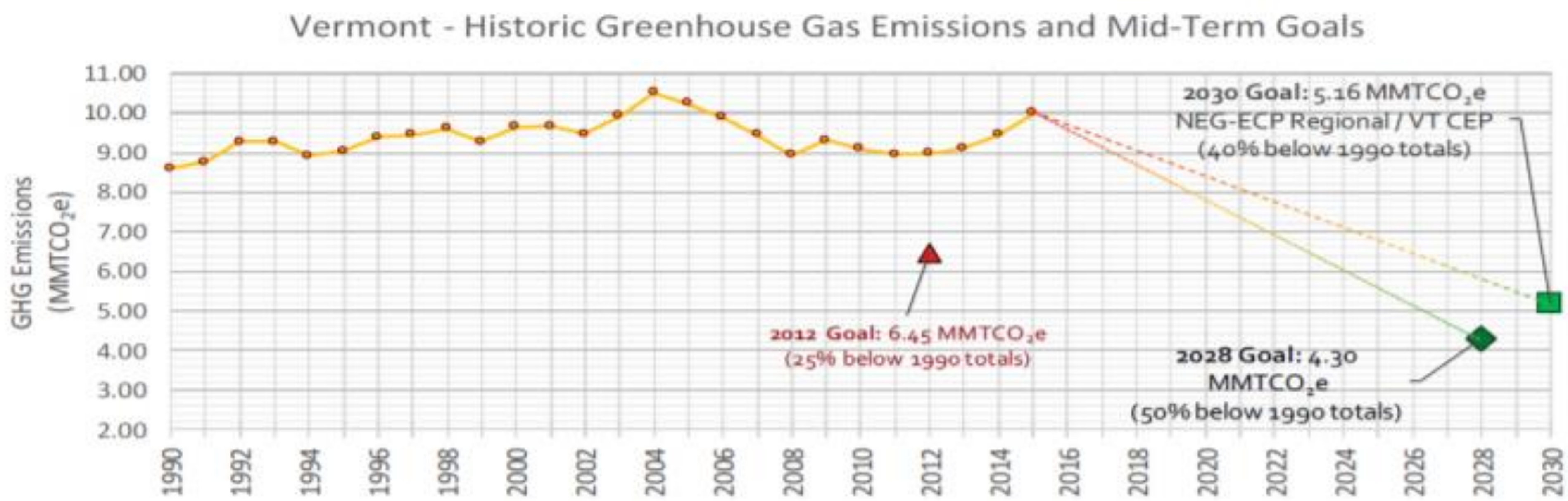
Vermont Goals Related to Transportation

Table 1: 2016 Comprehensive Energy Plan Goals

Sector	Goal
Total Energy	90% by 2050
	40% by 2035
	25% by 2025
	Reduce consumption per capita by 15% by 2025 and by more than 33% by 2050
Electricity	67% Renewable by 2025
Thermal	30% Renewably by 2025
Transportation	10% Renewable by 2025
Greenhouse Gases	40% below 1990 levels by 2030
	80-95% below 1990 levels by 2050

Source: VtPSD, 2019 Annual Energy Report, 1/15/19

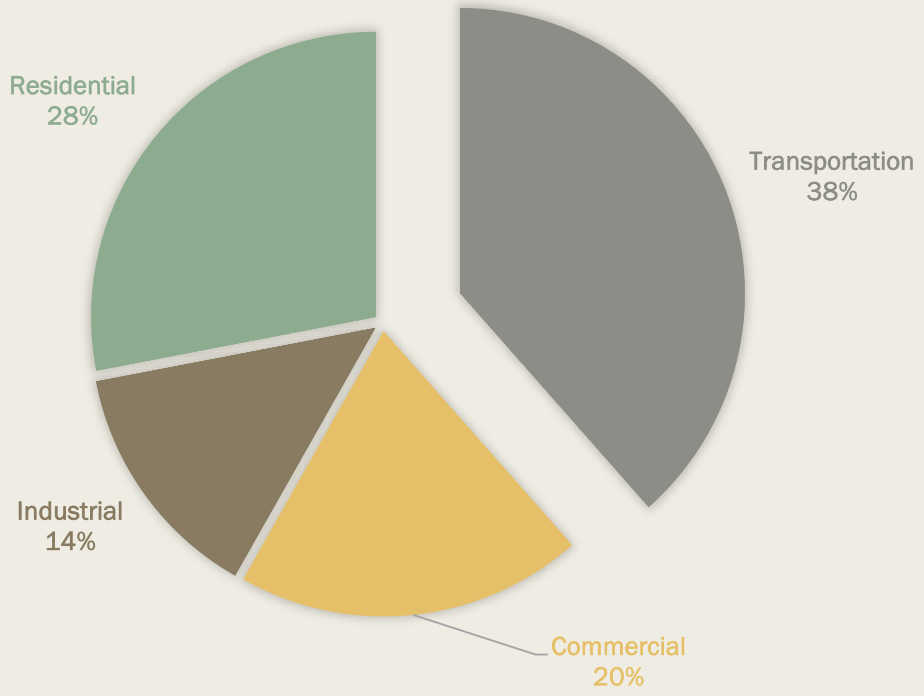
Figure 1: Vermont Greenhouse Gas Emissions and Mid-Term Goals[1]



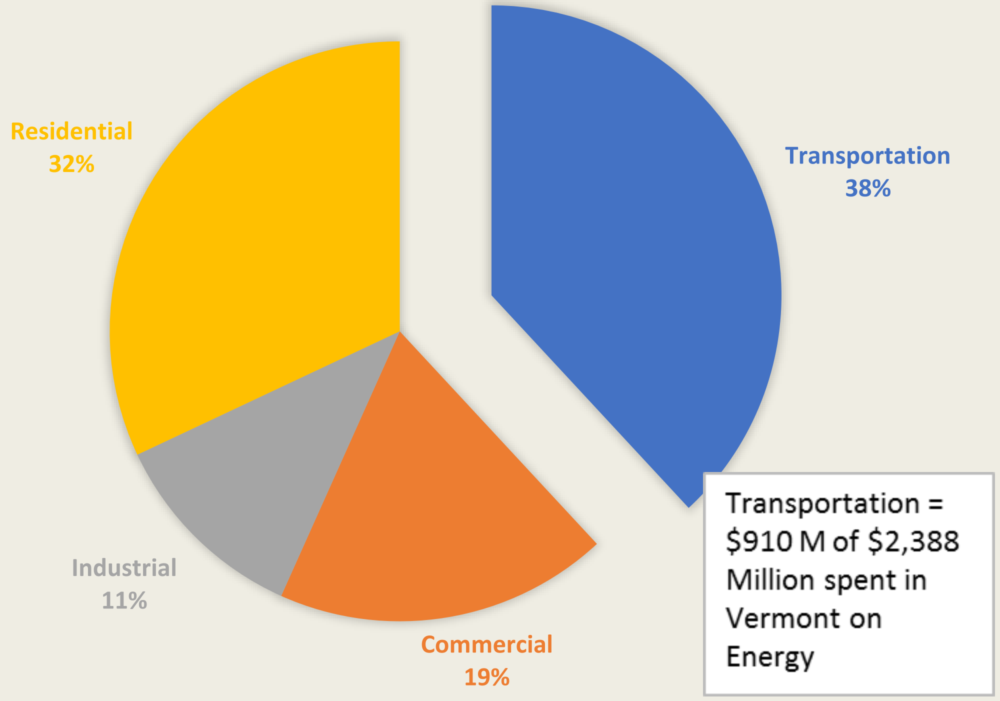
- **Statutory greenhouse gas reduction goals** – a 50 percent reduction of greenhouse gas emissions by January 1, 2028 and a 75 percent reduction by January 1, 2050.
- **Comprehensive Energy Plan goals** – 25 percent by 2025, 40 percent by 2035 and 90 percent of all energy needs through renewable supplies by 2050, while reducing energy consumption per capita by more than one third by 2050.
- **U.S. Climate Alliance –** a 26-28 percent reduction of greenhouse gas emissions below 2005 levels by 2025.

Source: Vermont Climate Action Commission, Report to the Governor, July 31, 2018

VERMONT ENERGY DEMAND 2016 (BTUS IN %)

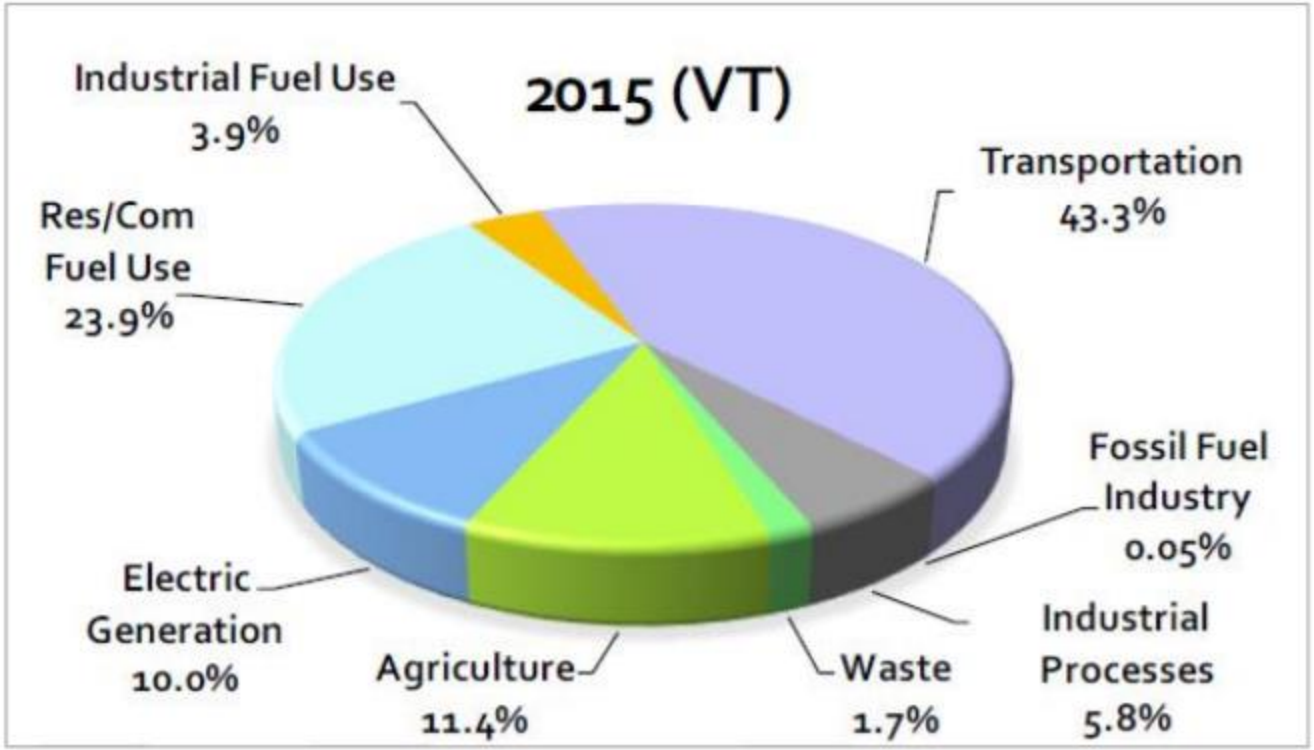


VERMONT ENERGY EXPENDITURES $ FOR 2016



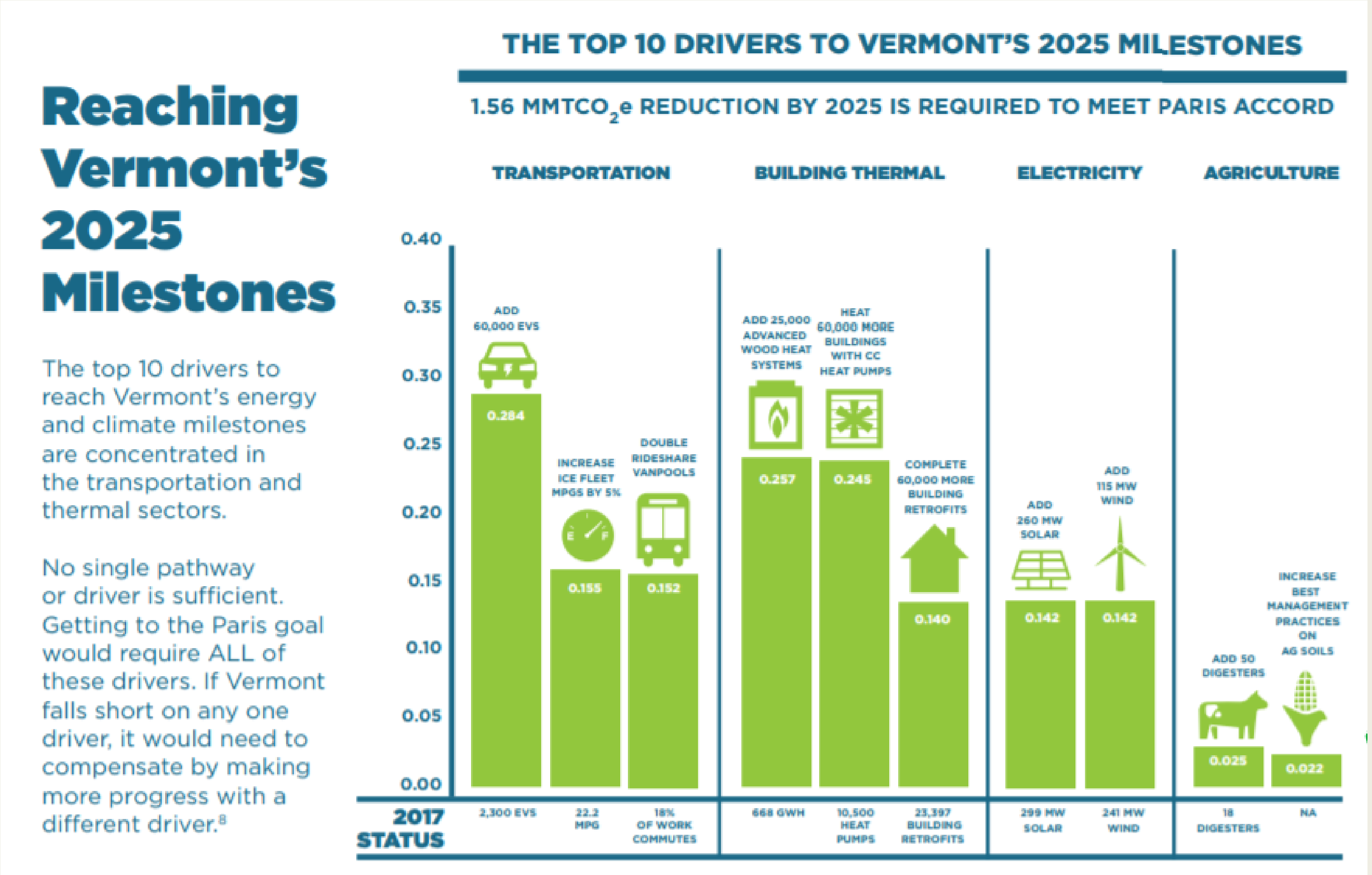
Source: EIA, SEDS, 2016 data

Figure 3: Greenhouse Gas Emissions by Sector through 2015[2]



Source: Vermont Climate Action Commission, Report to the Governor, July 31, 2018

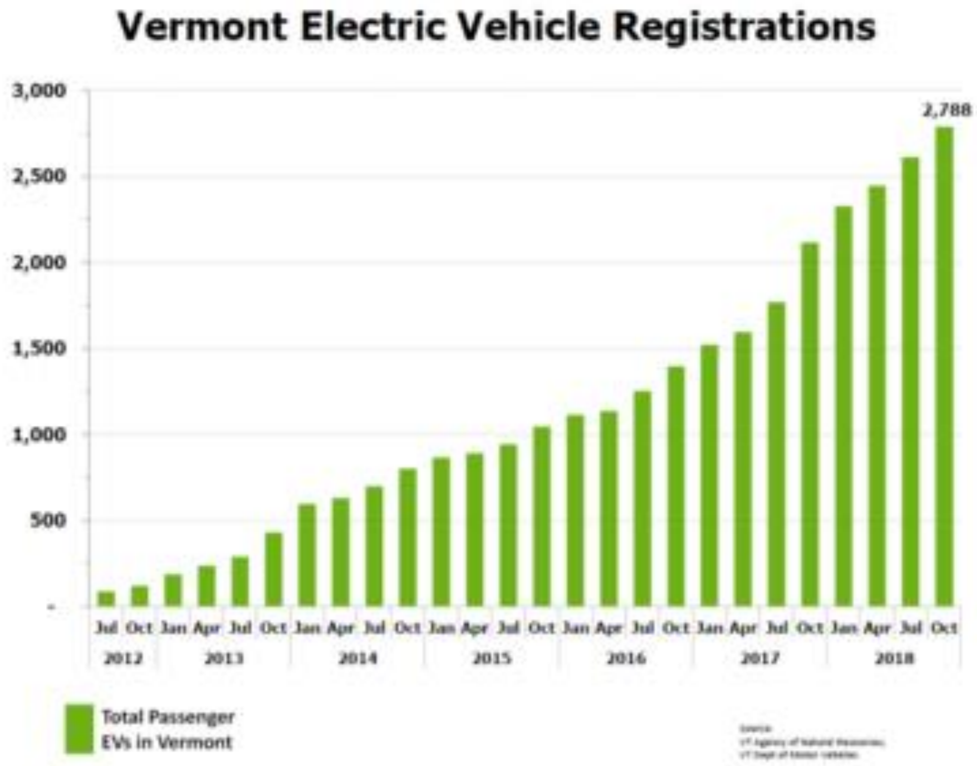
Transportation Electrification Typically Ranks Among the Most Promising Pathways

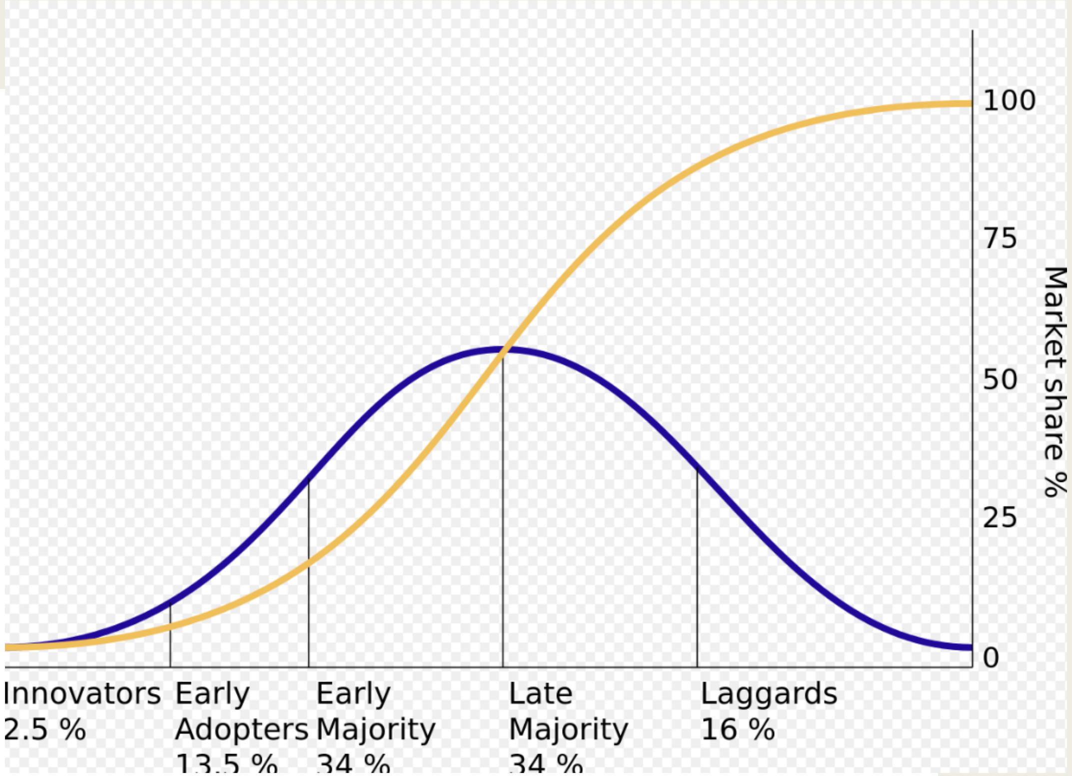


Source: EAN, 2017 Annual Report

Current Status

Figure 15: EVs Registered in Vermont, 2012-2018

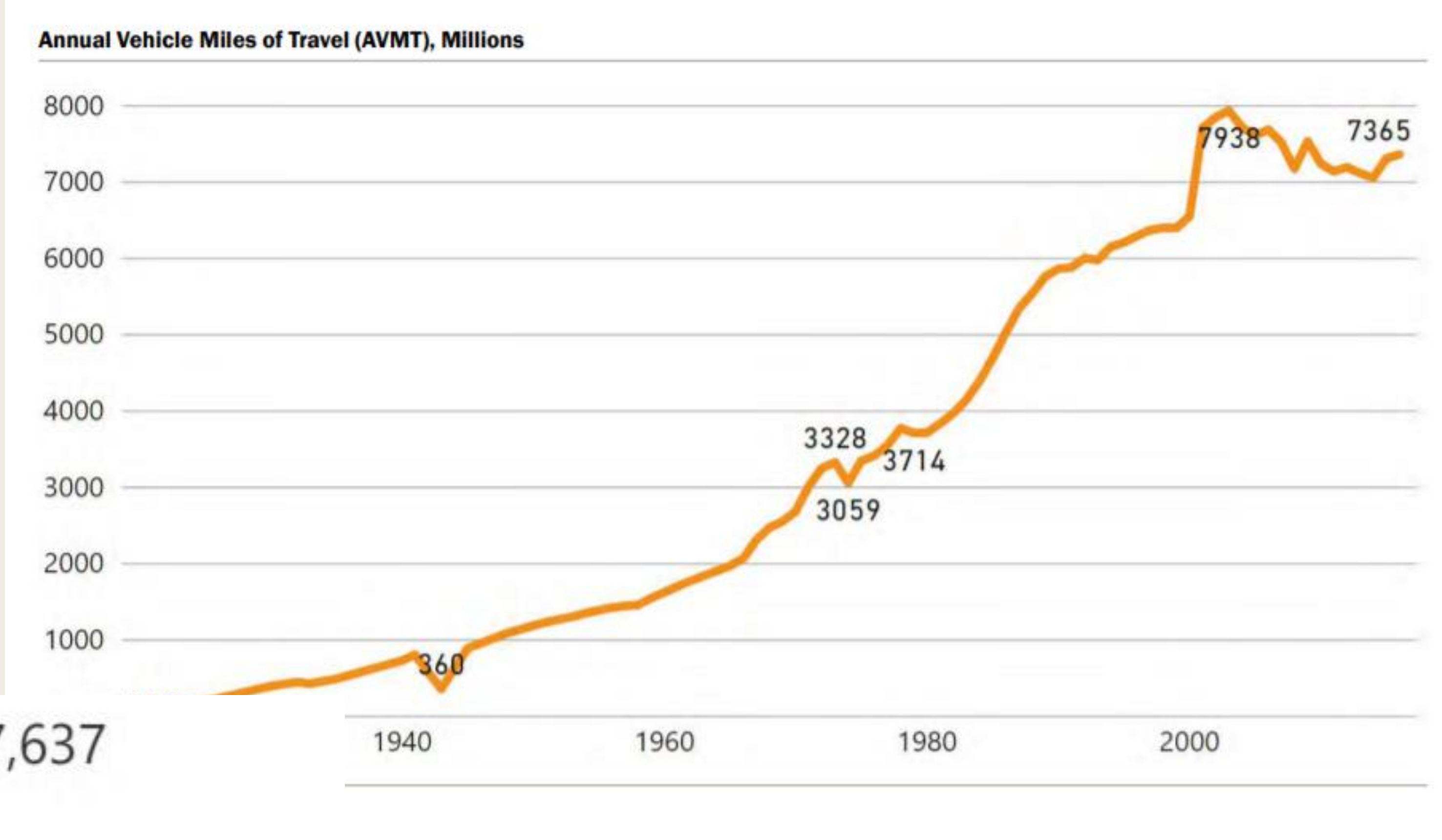


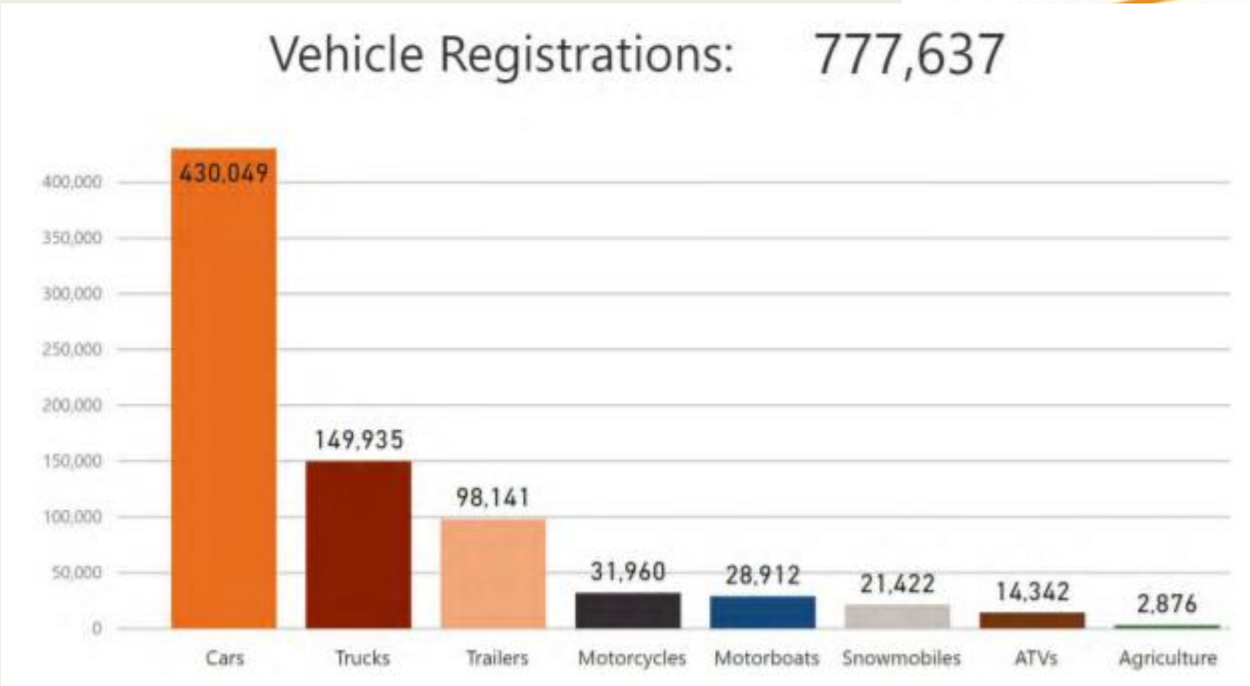


Source: VtPSD, 2019 Annual Energy Report, 1/15/19

Current Status

- Approximately 2,800 EVs as of last count
- Approximately 200 publicly available charging stations around the state
- Much, much more is needed to achieve our Energy and GHG Goals





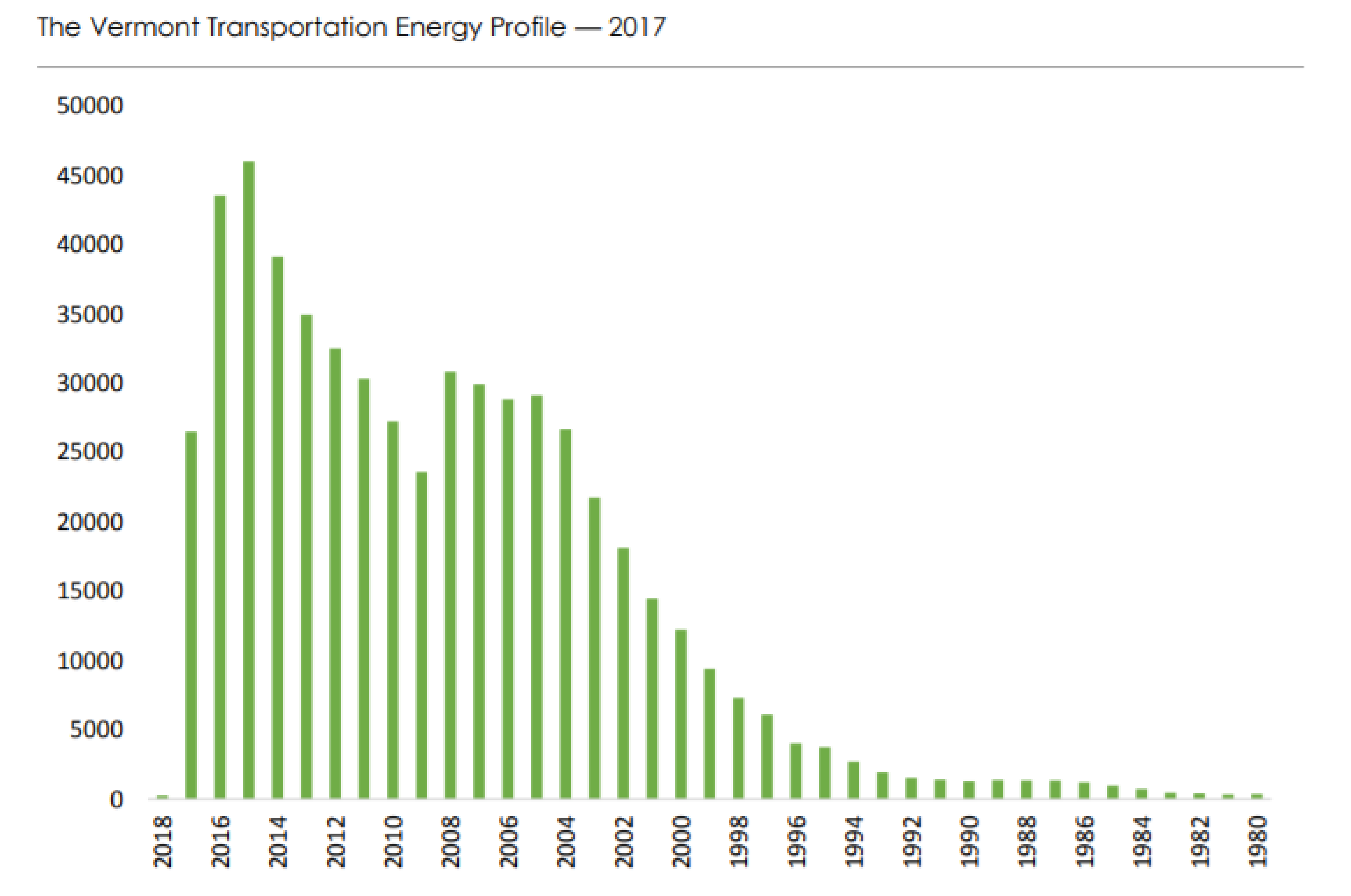


Figure 3-5. Distribution of Model Years for Vehicles in Vermont, 2017 (VDMV, 2017)

Source: The 2017 Vermont Transportation Energy Profile, 9/2017

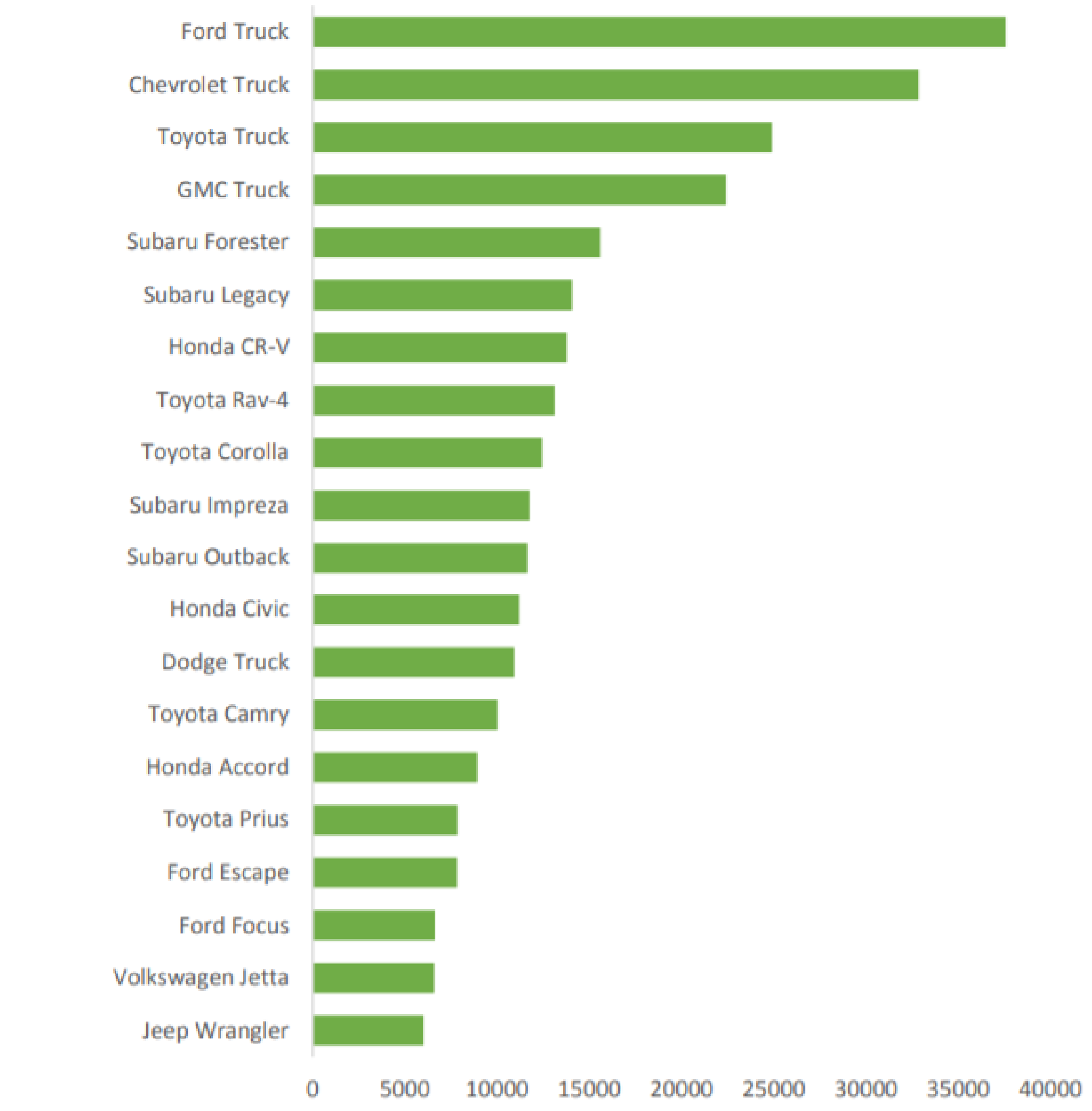
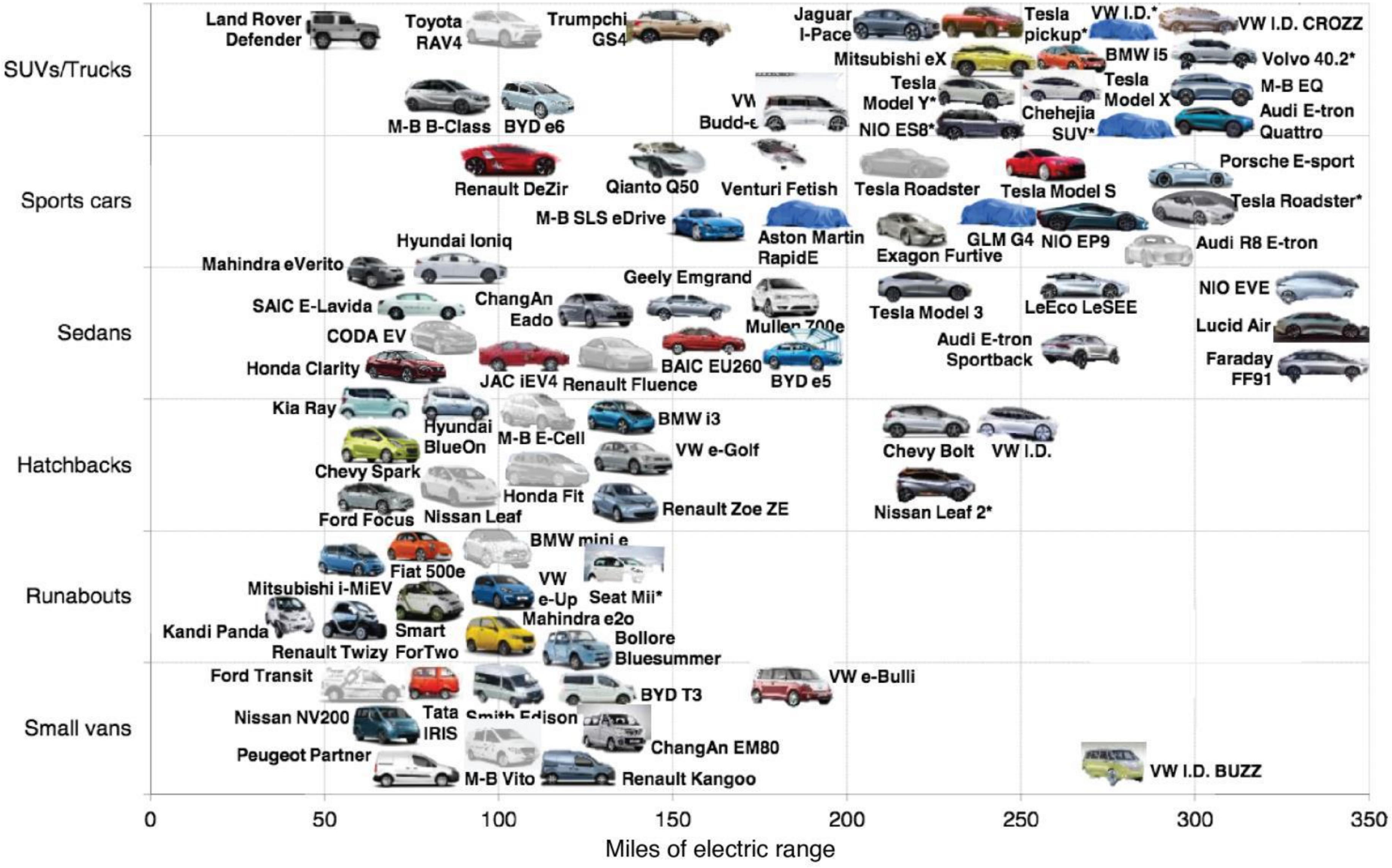


Figure 3-3. Top 20 Vehicle Models Registered in Vermont, 2017 (VDMV, 2017)

Source: The 2017 Vermont Transportation Energy Profile, 9/2017

Electric-Car Boom

Models by style and range available through 2020



Brief Overview of PUC EV Investigation

PUC EV Investigation (Case No. 2660)

- Act 158 of 2018 is signed by the Governor. Section 25 directs the PUC to conduct and investigation and submit a report by July 1, 2019 concerning issues related to the charging of EVs
- July 9, 2018 – PUC Opens Case No. 18-2660-INV
- January 23, 2019 – The Commission sends a letter to the legislature regarding matters of jurisdiction – recommends that the state “largely exclude charging stations from the Commission and Public Service jurisdiction”
- In an Order of December 20, 2018, the PUC sought information in relation to payments for the State’s Transportation fund. It now seeks further information on two pathways, including a VMT fee and a per kWh fee. Responses due by February 18.
- On February 4, the Commission sought information on EV charging and rate design.

Interagency Approach to Addressing Transportation Fund Shortfalls

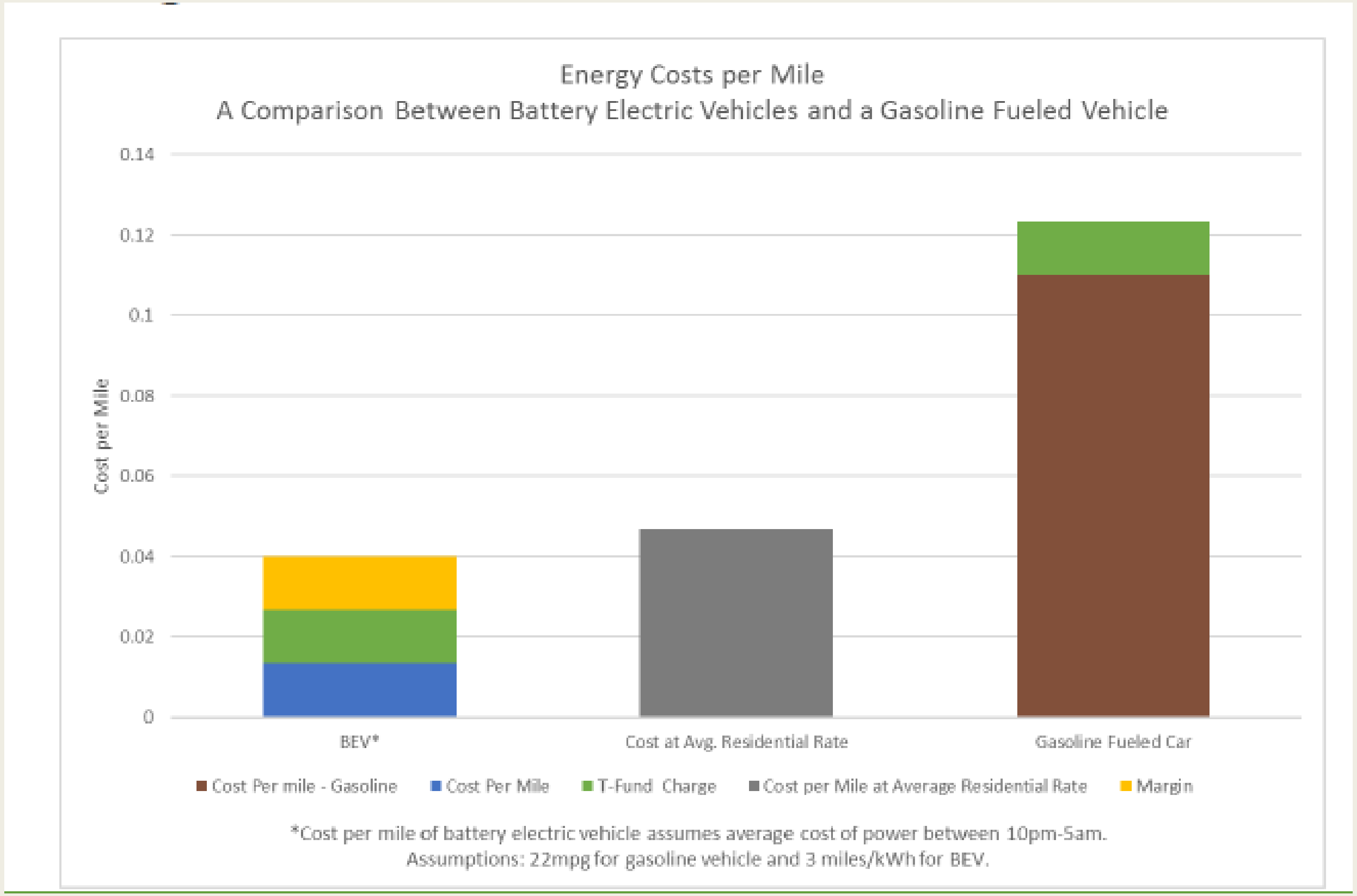
Alternatives

VMT fee

- $155 annual average registration fee annually

Per kWh fee

- About 1.3 cents/VMT to be offset by lower kWh price for EVs



Utility Rate Design Matters (example)

- Utility base residential rate is $0.148 cents/kWh, but offers an EV credit of $0.068 cents/kWh.
- <u>Effective rate is $0.08 cents/kWh.</u> Cost per mile is about 2.3 cents per mile ((8 cents/kWh)/(3.5 VMT/kWh)). This compares with a cost per mile of roughly 13.75 cents per mile ($2.75 per gallon/20 miles per gallon).
- Approximate reduction in energy costs is about <u>$837 million</u> (11.45 cents/mile X 7310 M miles) or roughly <u>$1363 per registered vehicle</u> annually ($837 M/614 K). (offsetting this is the higher purchase price that is expected to achieve price parity in roughly 5-6 years).
- Taxes approximately $97 M. For a net savings of about $740 million.

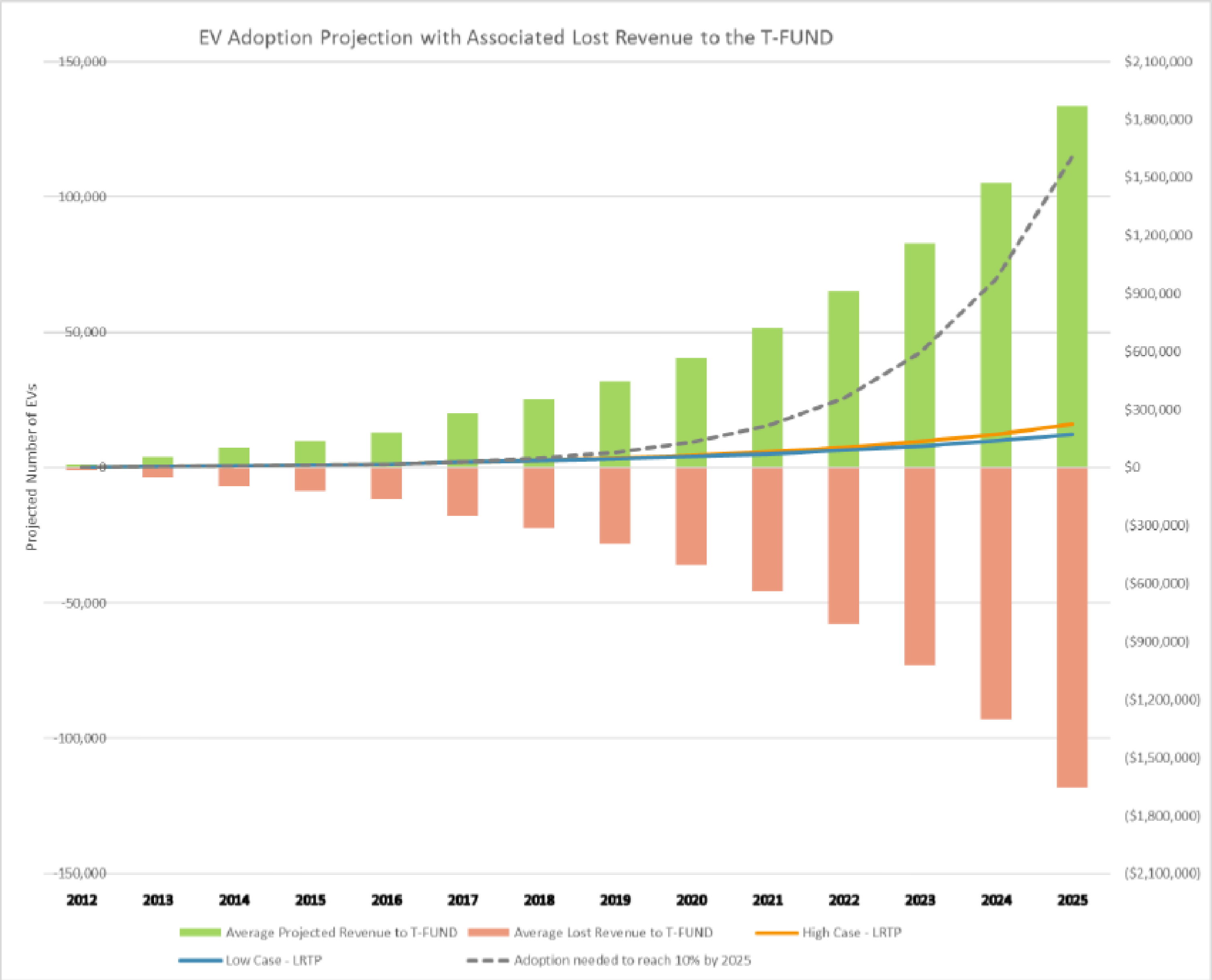
Why per/kWh charge

1. *Usage based (fairness)*
2. *Captures greater impact from heavier vehicles – due to increased amount of energy needed to travel same distance*
3. *Parity with gasoline tax*
4. *Out-of-state travelers are also cost causers and would help share the burden*

How would it occur?

- <u>Sound Rate Design</u> -- Need to establish a distinguishable rate for EVs…, likely a discounted rate to reflect the beneficial character to the system of flexible loads, and potentially lower markets to reflect the price sensitivity of these loads and policy priority of cleaner fuel.
- <u>Submetering Technology</u> -- Fees would have to be recovered using submetering, and collection of revenues on customer electric bills similar to current collection of energy efficiency charge, weatherization fee, and gross receipts tax.

Why Now?



Can be introduced in conjunction with improvements in rate design that lower rates, and introduced before EVs present a formidable challenge to cover the costs of roads and highways.

Demand Charges

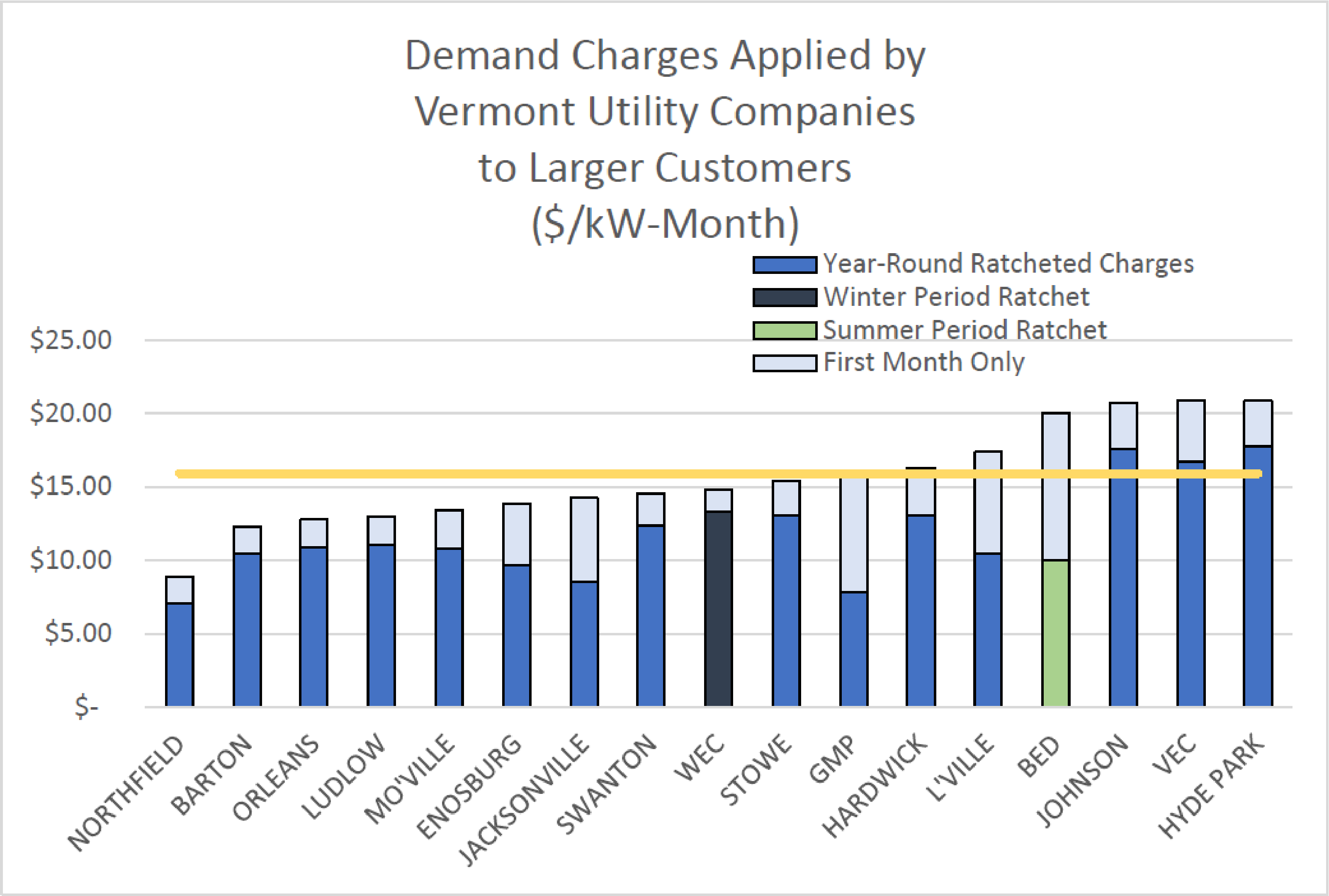


Figure 2: Existing demand charges by electric utility – large commercial and industrial rates[1]

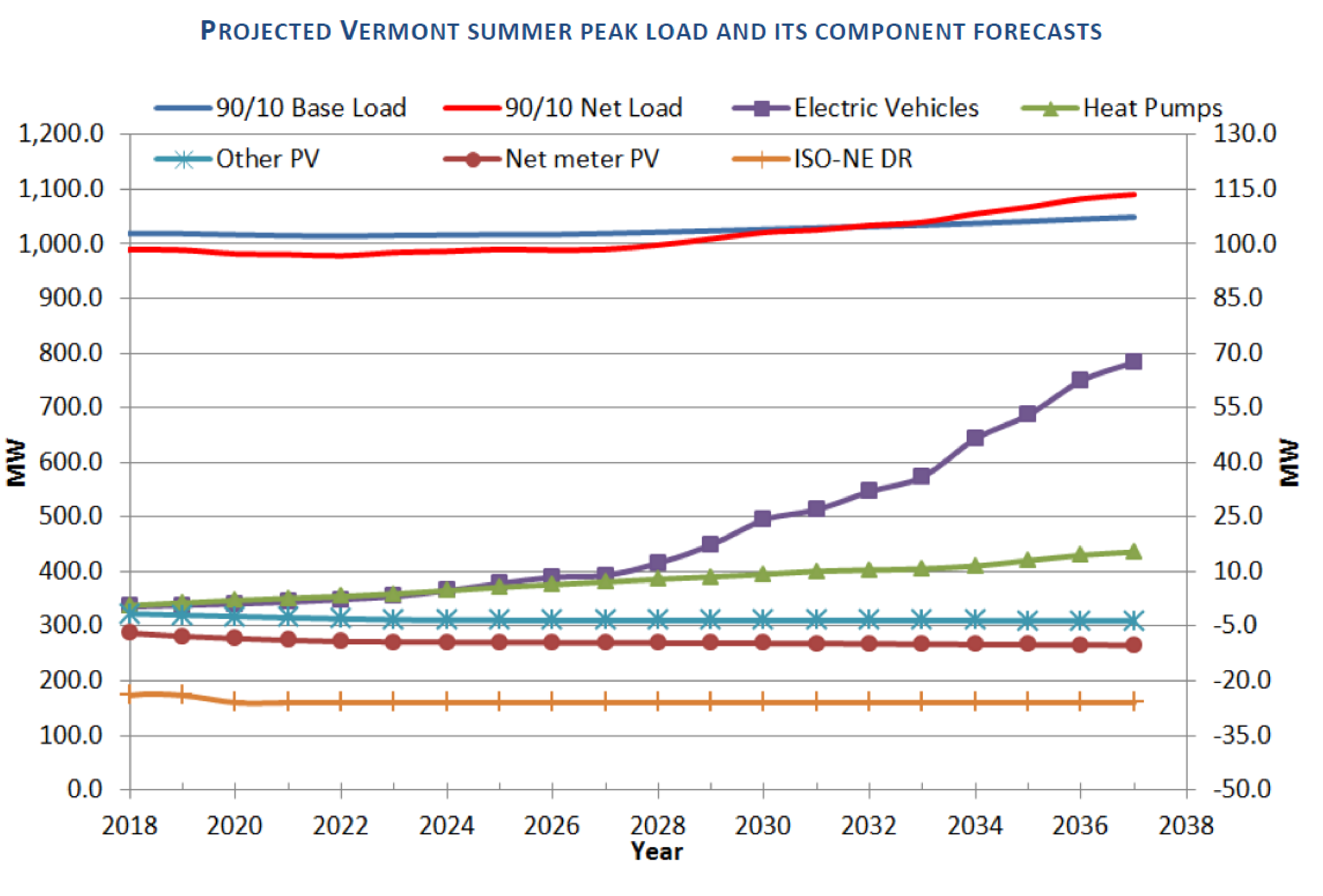
Demand charges, in their current form can be a barrier to entry of commercial EV charging stations, especially Level 3 HVDC charging

Recommendations for restructuring demand charges are in the legislative report, including a preferential rate for public charging.

Source: PSD, Demand Charges, Analysis and Recommendations, 1/31/19

Potential Options to EV Demand Charges

- Embed the demand charge in the energy rate.
- Send sharper price signals at likely monthly and annual peaks.
- Place some restrictions on peak draw during annual peaks.

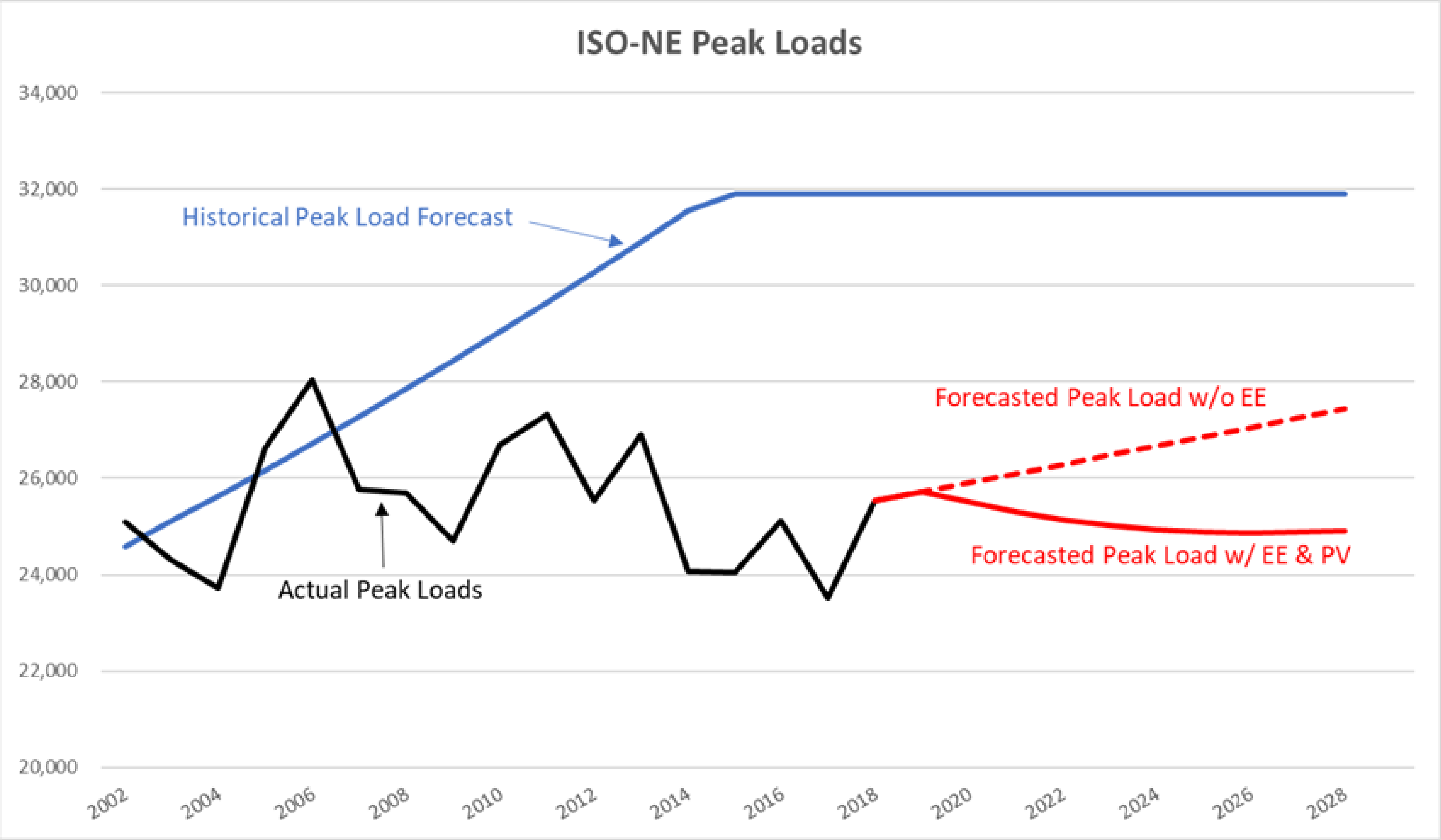


Source: VELCO, LRTP

Questions

Grid Opportunities

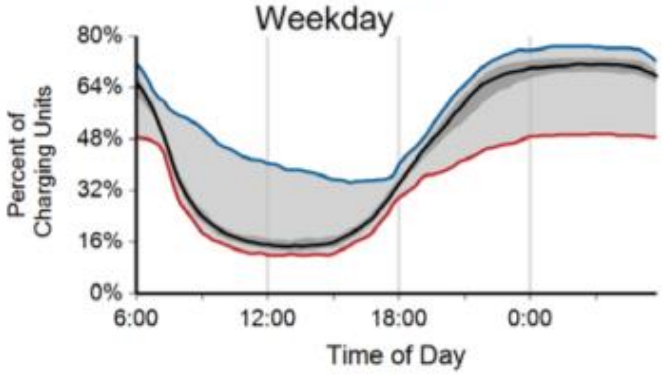
New England has plenty headroom even for new loads without triggering bulk transmission investment



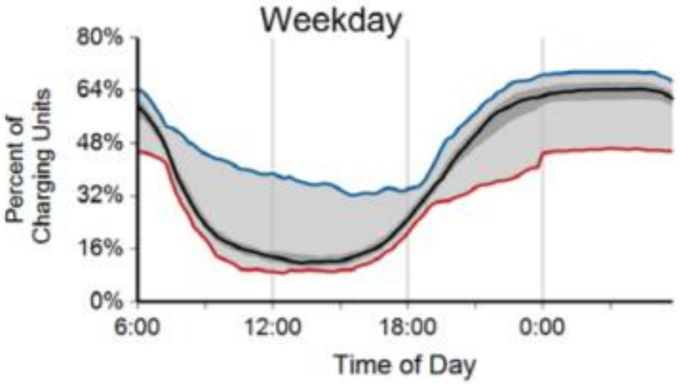
… but EV loads are flexible and should be readily managed for the economic benefit of the system, integration of EVs, and even better integration of renewable energy

- **San Diego and San Francisco, with Residential L2 Time-of-Use (TOUI) rates, are similar to other regional EVSE connect profiles**

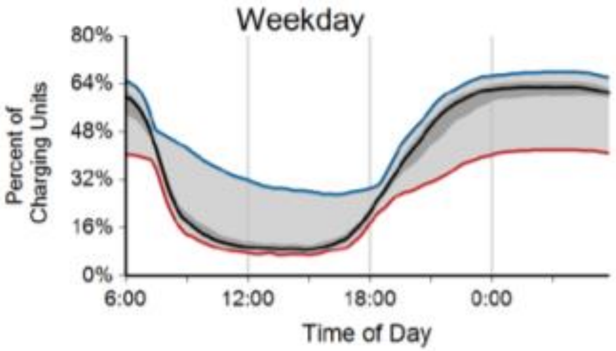
San Diego



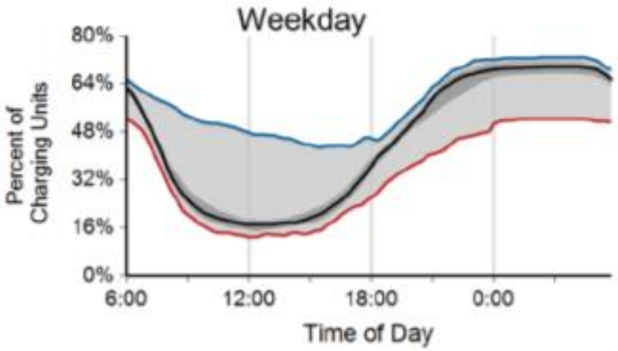
Los Angeles



San Francisco



Washington State

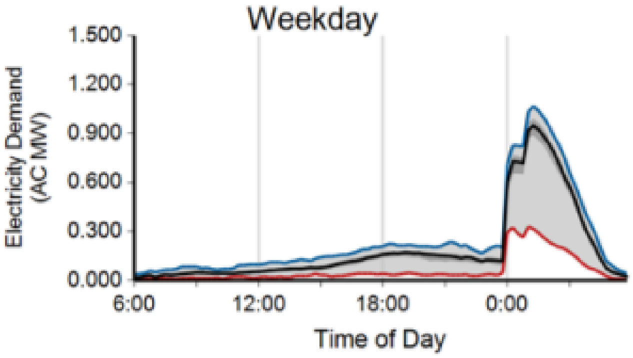


Legend: 92 day reporting quarter. Data is max (blue line), mean (black line) and minimum (red line), for the reporting period. Dark gray shaded is plus and minus 25% quartile.

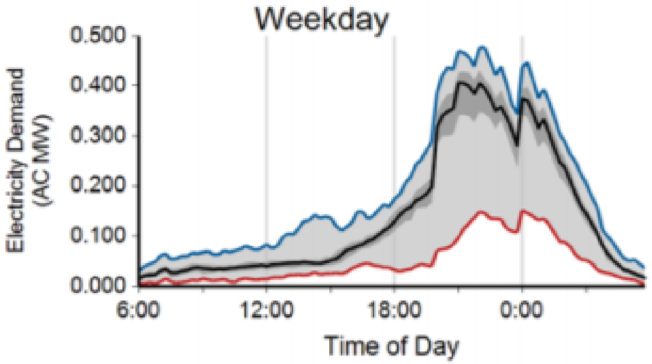
Source: P.I. – James Francfort Idaho National Laboratory June 20, 20142014 DOE Vehicle Technologies Office Review - EV Project Data & Analytic Results

- **Time of use rates in San Diego and San Francisco clearly impact when vehicle charging times are set**

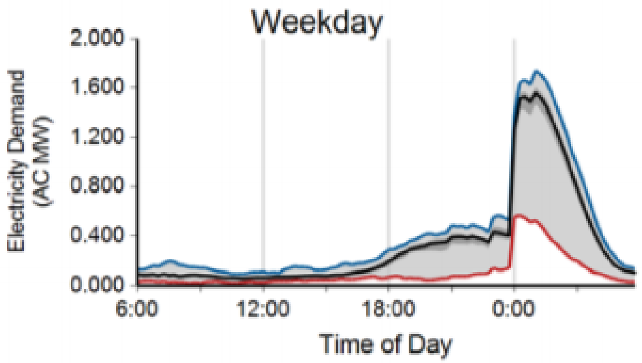
San Diego



Los Angeles



San Francisco



Washington State

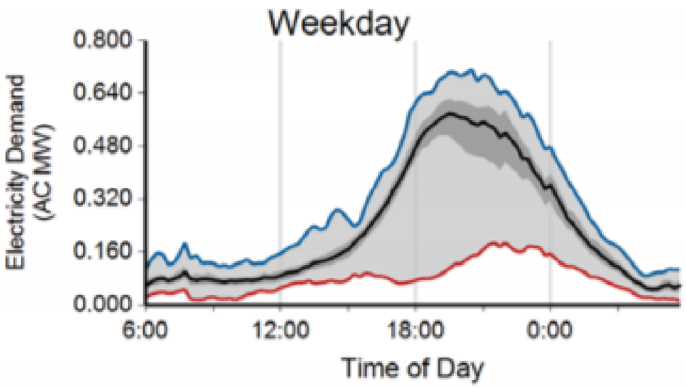


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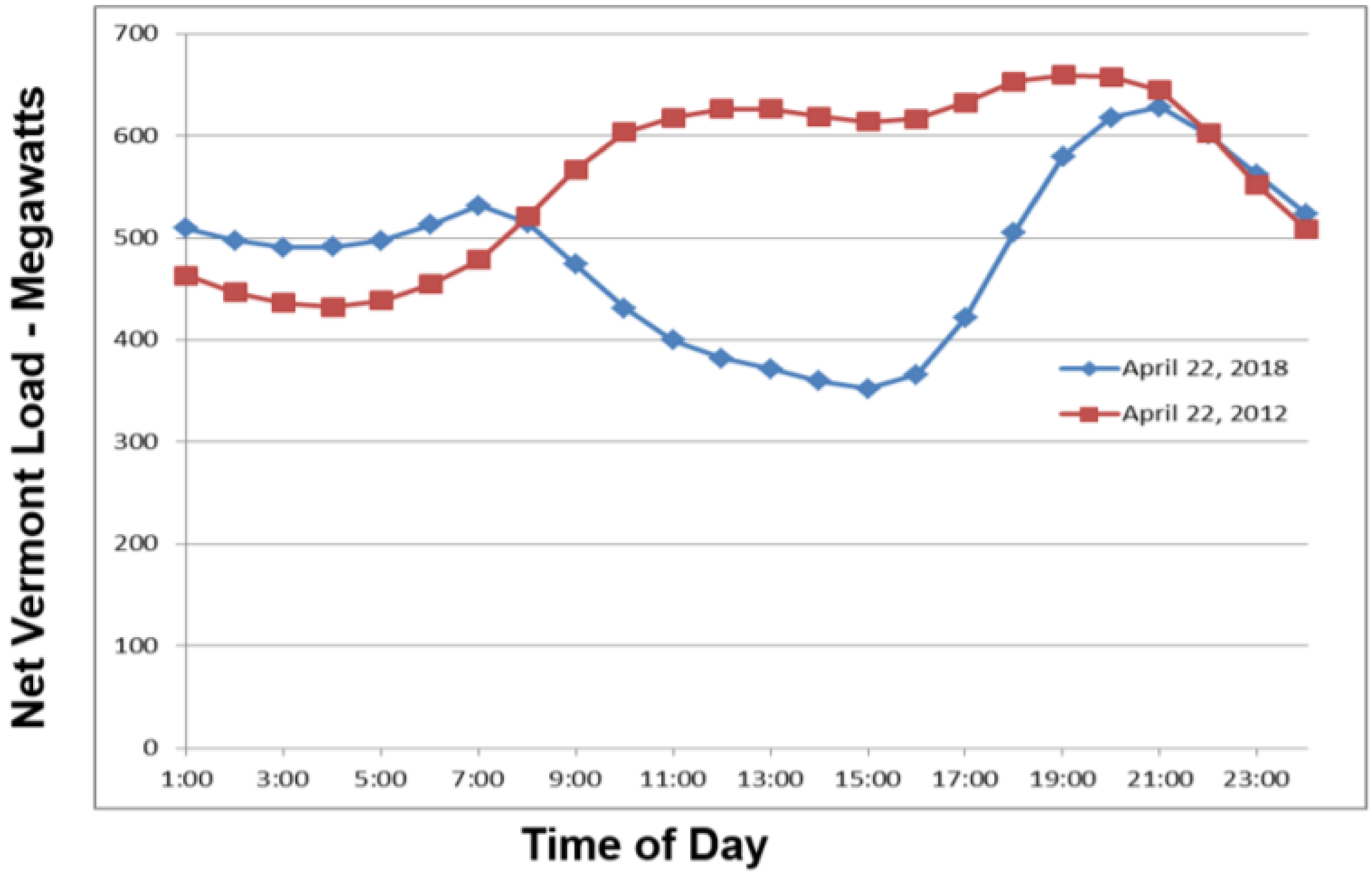
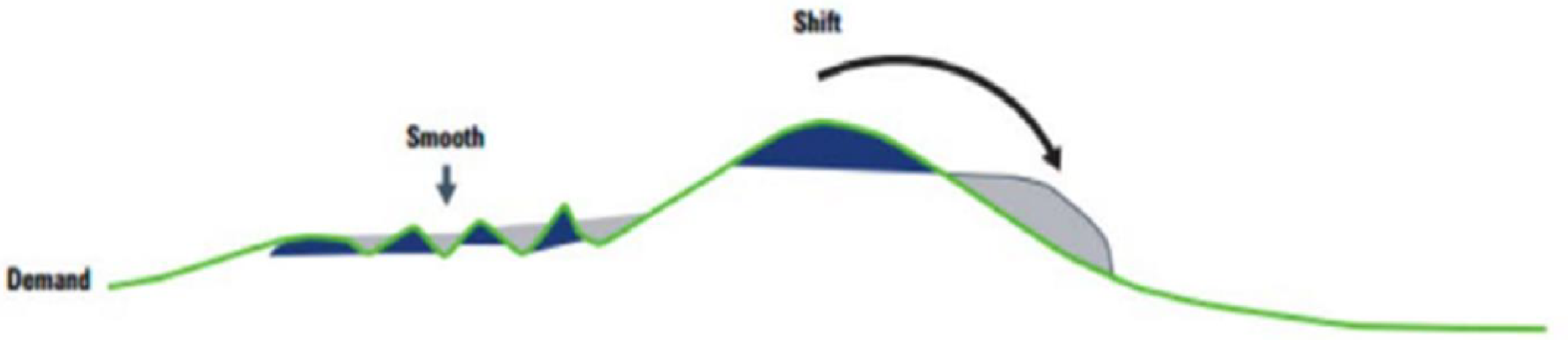
Figure 8: The Champ Curve[14]



Source: VtPSD, 2019 Annual Energy Report, 1/15/19

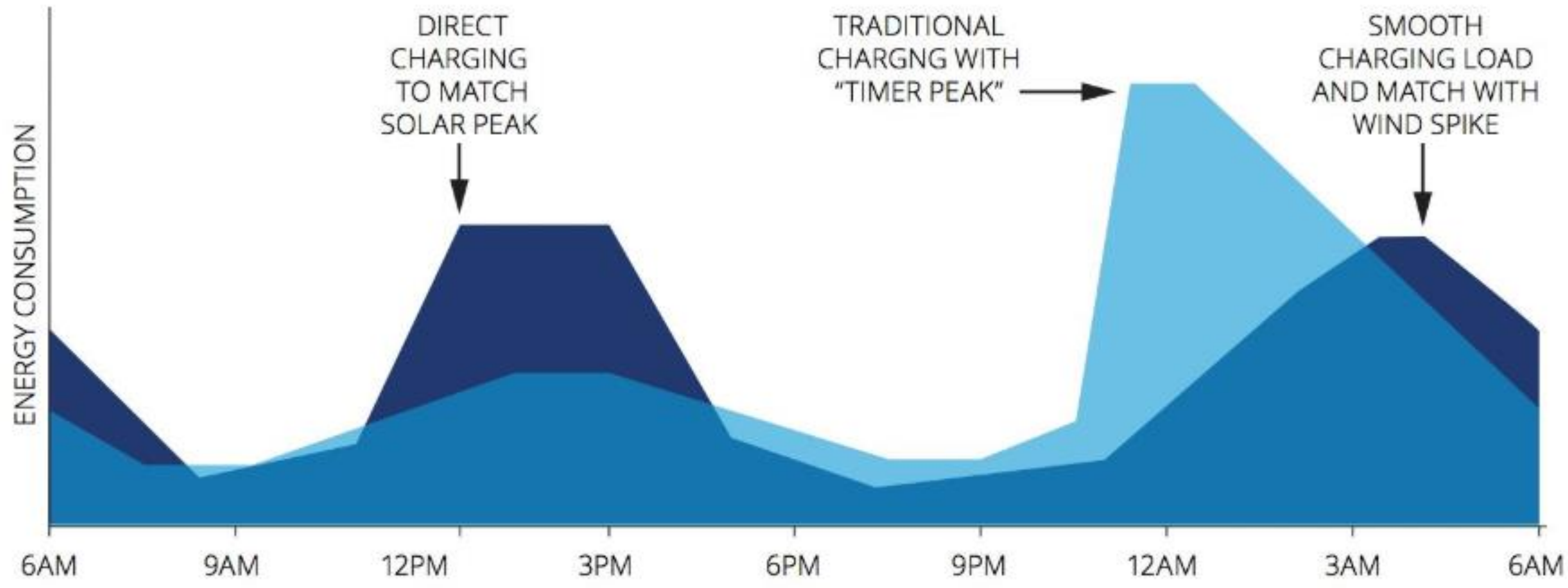
EVs Can Provide Beneficial Electrification

1) Save Consumers Money
2) Reduce Environmental Impacts
3) Enable Better Grid Management



Source: Regulatory Assistance Project

Rate Design to for Improving System Economics and Integration of EVs (and Renewables)



Source: BMW of North America, 2016[27] with edits by Smart Electric Power Alliance, 2017

Note: The light blue area illustrates the impacts of a hypothetical TOU residential charging rate with the lowest rate period beginning at 11 pm. The dark blue area shows how managed charging could distribute charging loads with peaks in renewable energy generation.

Recommend that Vermont distribution utilities establish rates for flexible loads starting with EVs

Data and Assumptions for Options

FY 2019

$78.0 million from gasoline tax

$18.6 million from diesel tax

Total $96.6 million

Source: JFO, fiscal facts, and AOT

Fuel Sales for Ground Transport

Gasoline – 315.7 Million Gallons (2016)

Diesel – 64.1 Million Gallons (2016)

Gasoline and Diesel – 380 M Gallons

VMT 7,365 Million

19.4 Miles/gallon (7,365/(315.7+64.1)

$0.25/gallon ($96.6 M/380 M gallons) or 1.3 cents/mile

Average miles/kWh ~ 3.5

11,906 VMT per registered vehicle

614 thousand registered vehicles

EVs Can Advance Several State Goals

Clean Air

Energy

Affordability

Climate Change

Table 3: Vermont System Peaks 2014-2017 (MW)[4]

2014			
MONTH	DATE	HOUR	VELCO PEAK (MW)
JAN	1/2/2014	18	1,004
FEB	2/11/2014	19	905
MAR	3/3/2014	19	874
APR	4/9/2014	21	763
MAY	5/15/2014	21	735
JUN	6/30/2014	19	871
JUL	7/2/2014	14	945
AUG	8/11/2014	19	845
SEPT	9/2/2014	20	897
OCT	10/16/2014	19	808
NOV	11/18/2014	18	884
DEC	12/8/2014	18	947

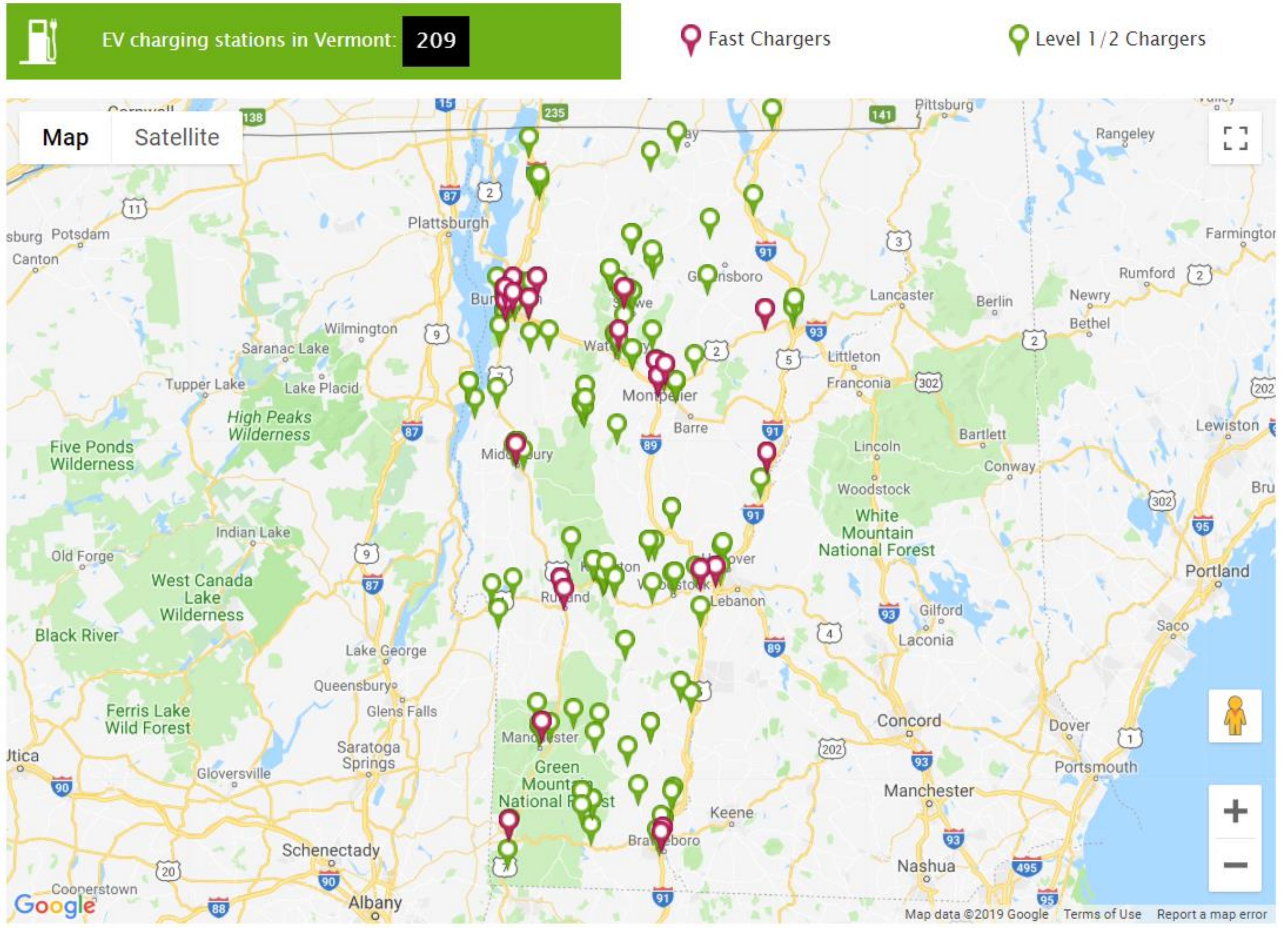
2015			
MONTH	DATE	HOUR	VELCO PEAK (MW)
JAN	1/8/2015	18	956
FEB	2/15/2015	19	937
MAR	3/5/2015	19	877
APR	4/9/2015	21	776
MAY	5/27/2015	16	822
JUN	6/23/2015	19	793
JUL	7/29/2015	18	905
AUG	8/19/2015	21	904
SEPT	9/8/2015	20	913
OCT	10/19/2015	19	775
NOV	11/30/2015	18	856
DEC	12/28/2015	18	930

2016			
MONTH	DATE	HOUR	VELCO PEAK (MW)
JAN	1/4/2016	18	961
FEB	2/14/2016	19	935
MAR	3/2/2016	19	836
APR	4/4/2016	21	772
MAY	5/28/2016	21	774
JUN	6/20/2016	21	825
JUL	7/13/2016	19	874
AUG	8/11/2016	21	918
SEPT	9/8/2016	20	862
OCT	10/26/2016	19	774
NOV	11/21/2016	18	863
DEC	12/19/2016	19	945

2017			
MONTH	DATE	HOUR	VELCO PEAK (MW)
JAN	1/9/2017	18	901
FEB	2/9/2017	19	873
MAR	3/4/2017	19	856
APR	4/6/2017	20	736
MAY	5/18/2017	20	737
JUN	6/19/2017	15	817
JUL	7/19/2017	21	804
AUG	8/22/2017	18	855
SEPT	9/26/2017	20	871
OCT	10/9/2017	19	750
NOV	11/10/2017	18	841
DEC	12/29/2017	18	973

[4] Source: VELCO. Note that blue shaded areas represent winter peaks and the orange shaded areas represent summer peaks.

Source: VtPSD, 2019 Annual Energy Report, 1/15/19



Public Charging Stations in Vermont

Source: Drive Electric Vermont