



Vermont IEEE PES Drive Electric Vermont Update

February 19, 2015

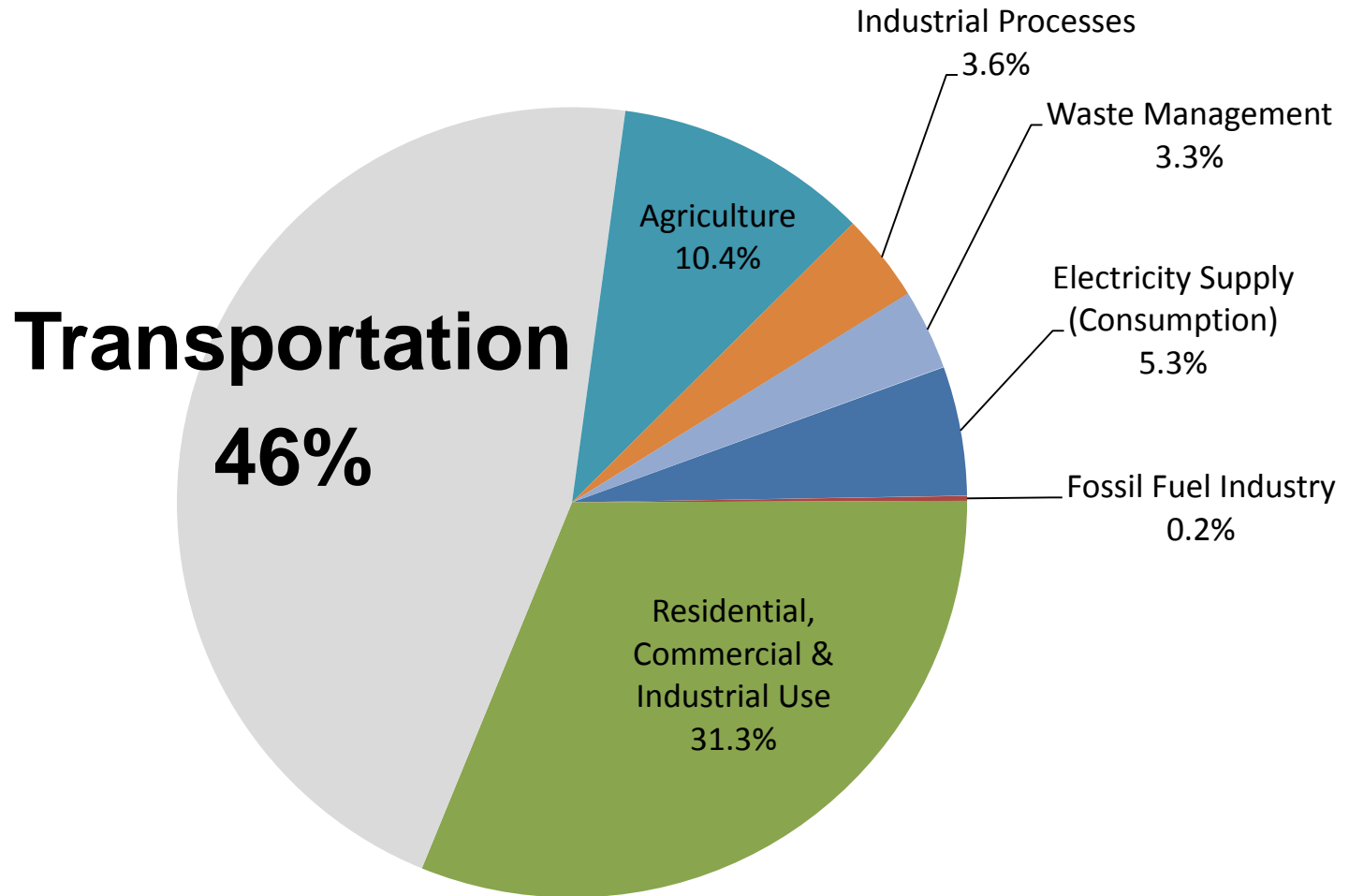
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Agenda

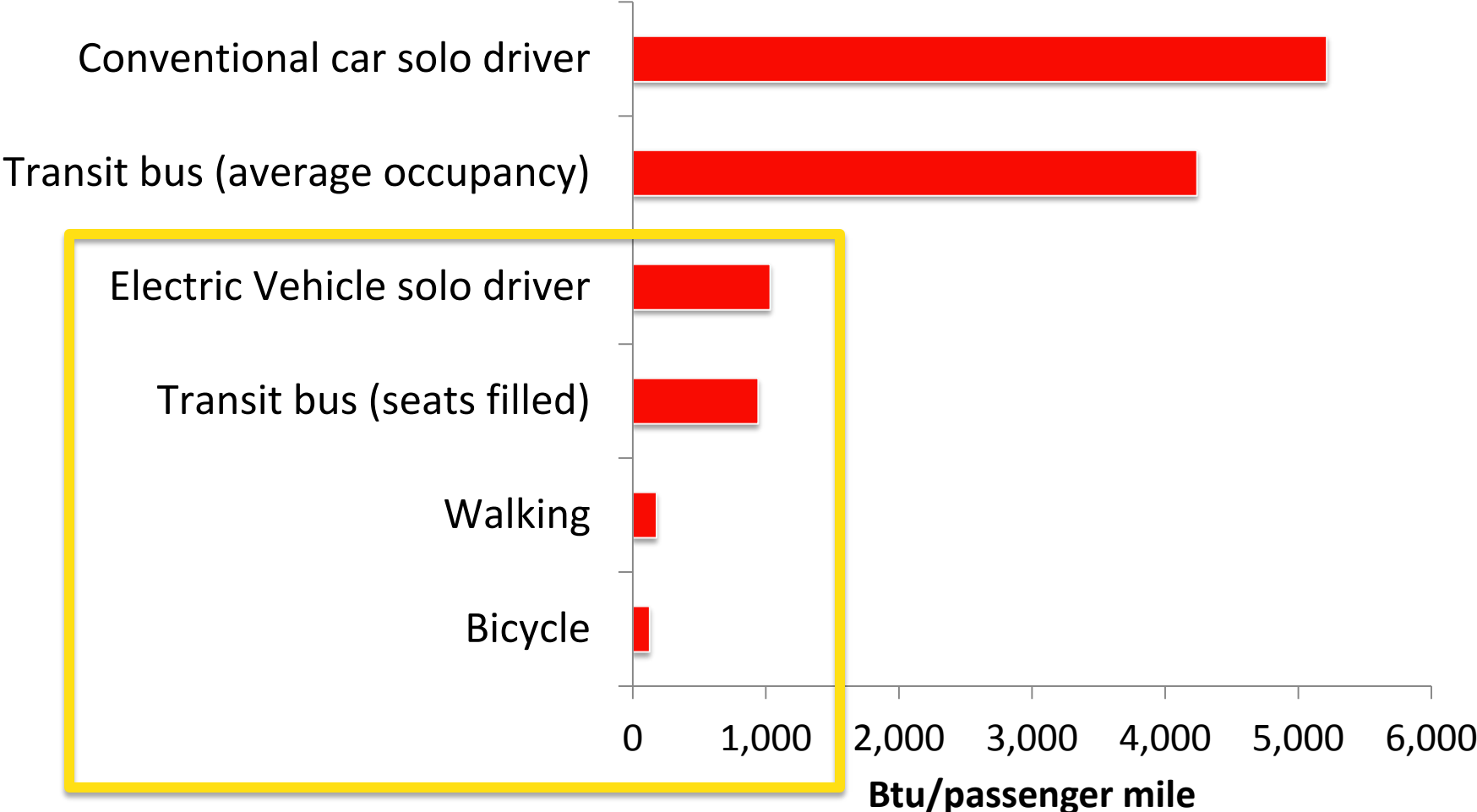
1. Transportation Efficiency Policy
2. Types of EVs
3. EV Characteristics
4. EV Charging
5. Drive Electric Vermont
6. Grid Integrated Vehicles



Vermont Greenhouse Gas Emissions 2011



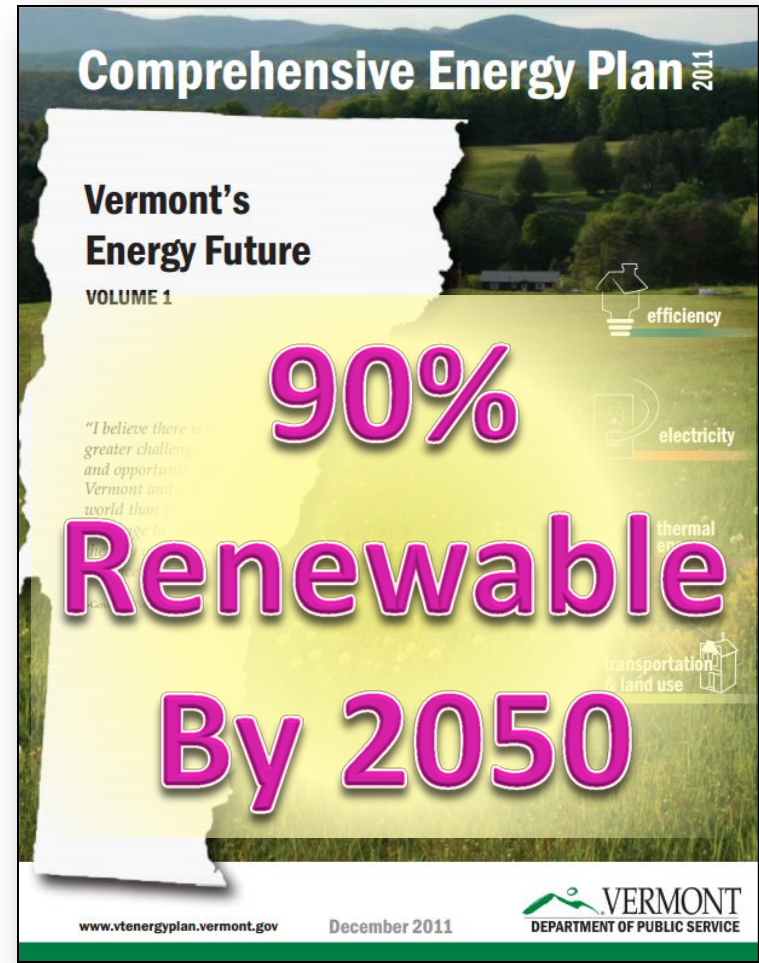
Transportation Efficiency



Comprehensive Energy Plan

Transportation Strategies

- Increase Consumer Choices
 - Non-SOV travel
- Deploy New Technology
 - Efficient vehicles, including plug-in electric vehicles



Introduction to Electric Vehicles

- All Electric Vehicle
 - Powered solely by electric energy stored in a battery
- Plug-in Hybrid Electric Vehicle
 - Powered by battery and gasoline for extended range



Automaker Offerings

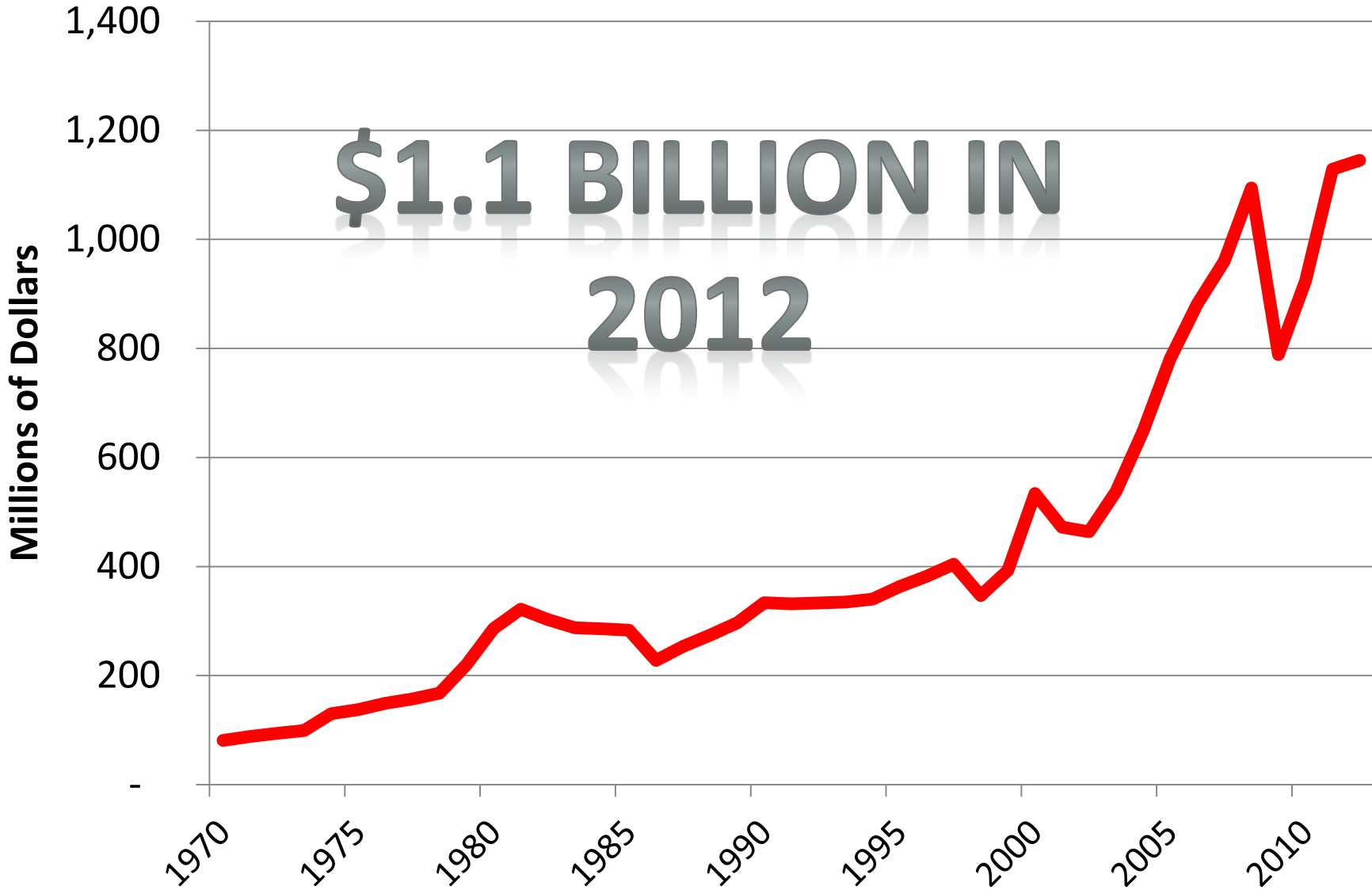
OEM	Current EVs	Upcoming Models	Goals/Targets
BMW	i3 (AEV/PHEV), i8 (PHEV)	X5 eDrive (PHEV)	
Chrysler / Fiat	500e (AEV)		
Ford	Focus (AEV), Fusion (PHEV), C-Max (PHEV)		10-25% of 2020 sales electric
GM	Volt (PHEV), Spark (AEV), Cadillac ELR (PHEV)	Bolt (AEV)	10% of 2020 sales electric, hybrid
Honda	Fit (AEV), Accord (PHEV)		
Hyundai		Sonata (PHEV)	
Kia	Soul (AEV)		
Mercedes	Smart ED (AEV), B Class Electric (AEV)	S500 (PHEV), C350e (PHEV)	
Mitsubishi	i-MiEV (AEV)	Outlander (PHEV)	20% electric and hybrid by 2020
Nissan	Leaf (AEV)	e-NV200 (AEV), Infinity LE (AEV)	10% of 2020 sales electric
Tesla	Roadster , Model S (AEV)	Model X (AEV), Model III (AEV)	N/A (all electric)
Toyota	Prius Plug-in (PHEV)		30% of 2020 sales electric and hybrid
VW / Audi / Porsche	E-Golf (AEV)	A3 E-Tron (PHEV), Q7 E-Tron (PHEV), Panamera (PHEV), 918 (PHEV)	

EV Benefits

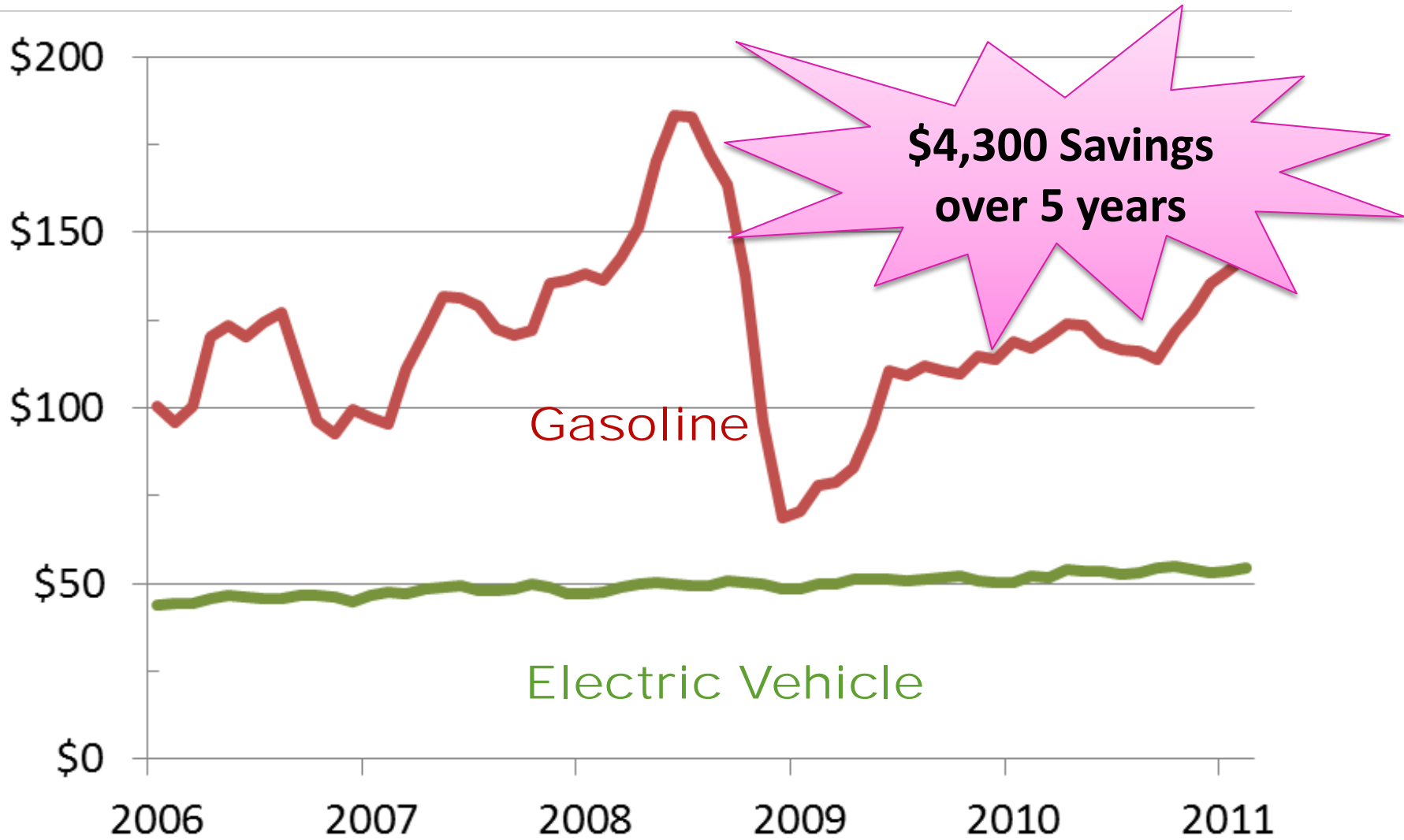
- Save money
- Great performance
- Luxury features
- Reduced emissions
 - AEVs have no tailpipe
 - “Well-to-Wheels” Benefits
 - Health Benefits



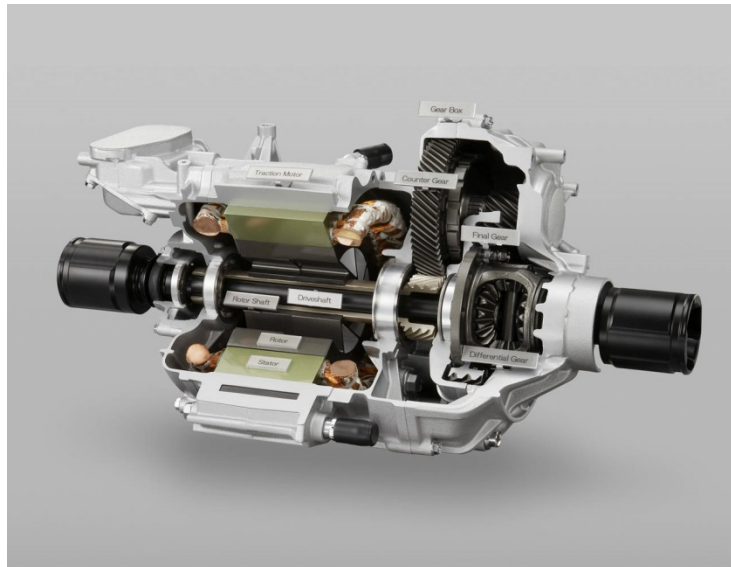
Vermont Gasoline Expenditures



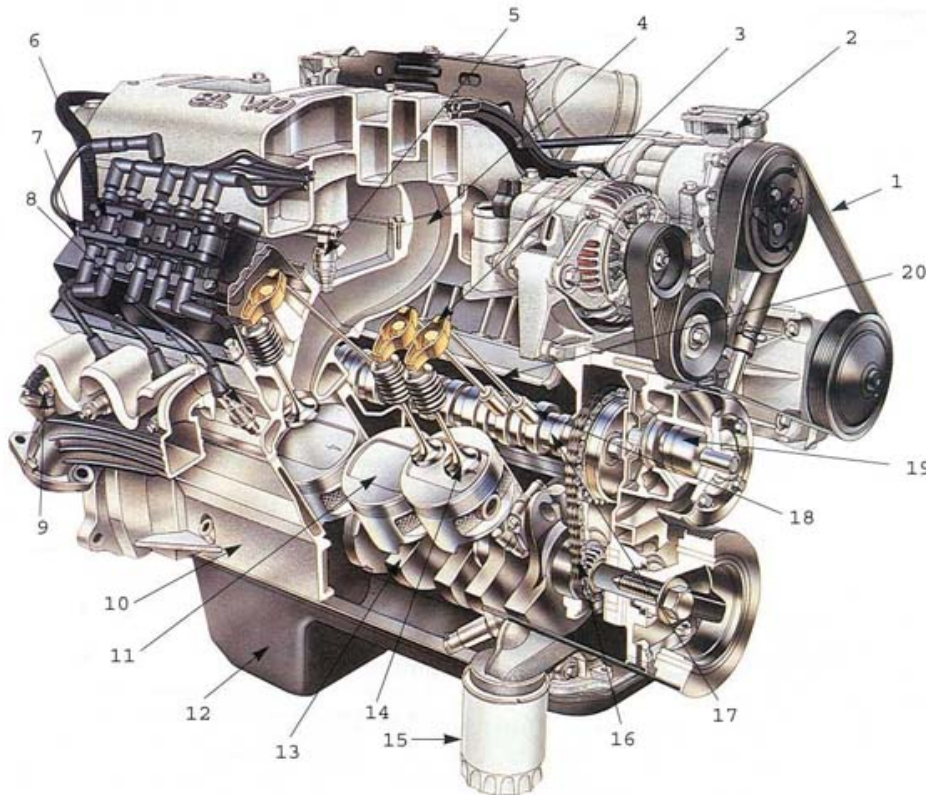
Monthly Transportation Energy Cost



Reduced Maintenance



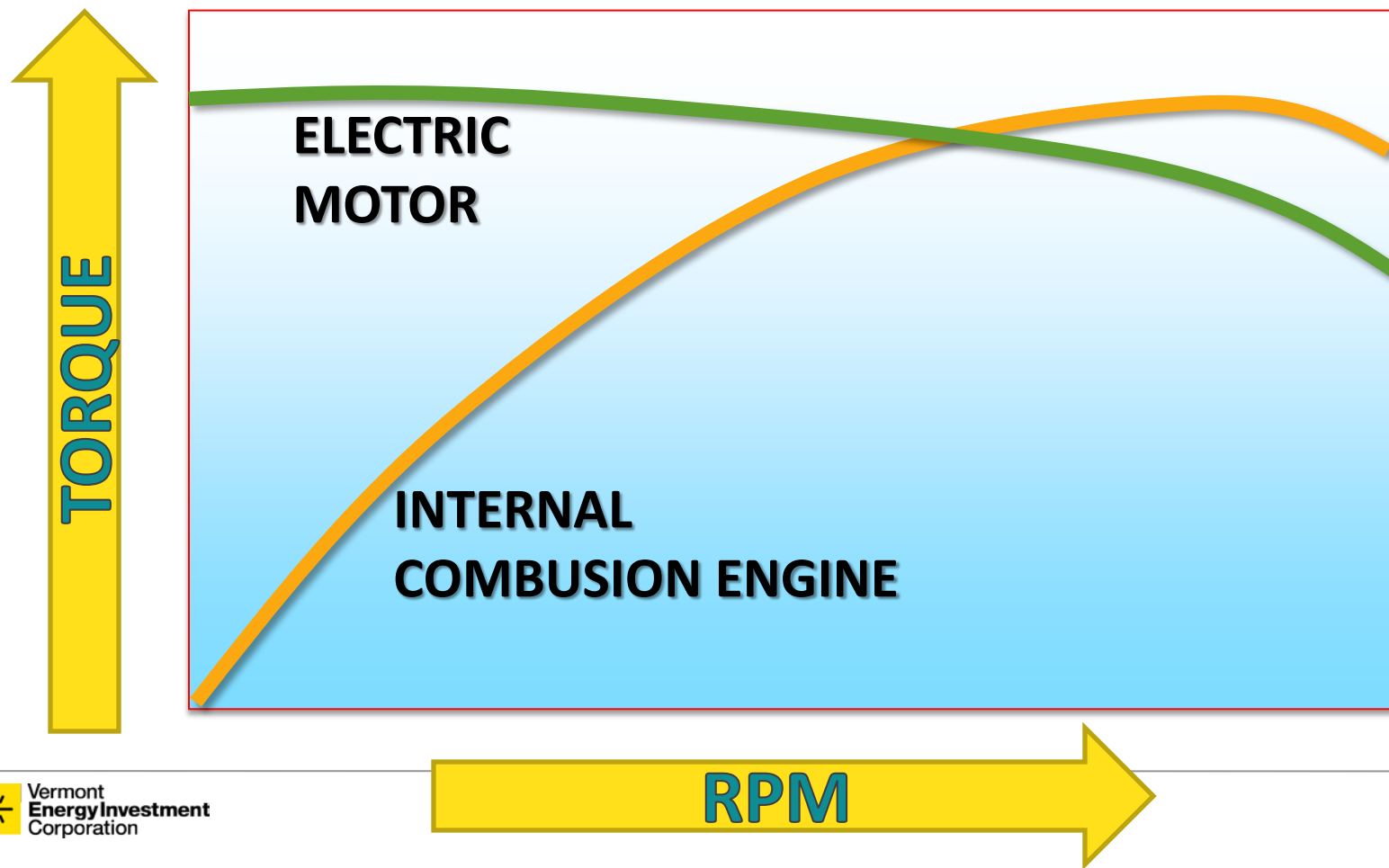
**ELECTRIC
MOTOR**



**INTERNAL
COMBUSTION ENGINE**

Performance

- Less Gas = More Fun



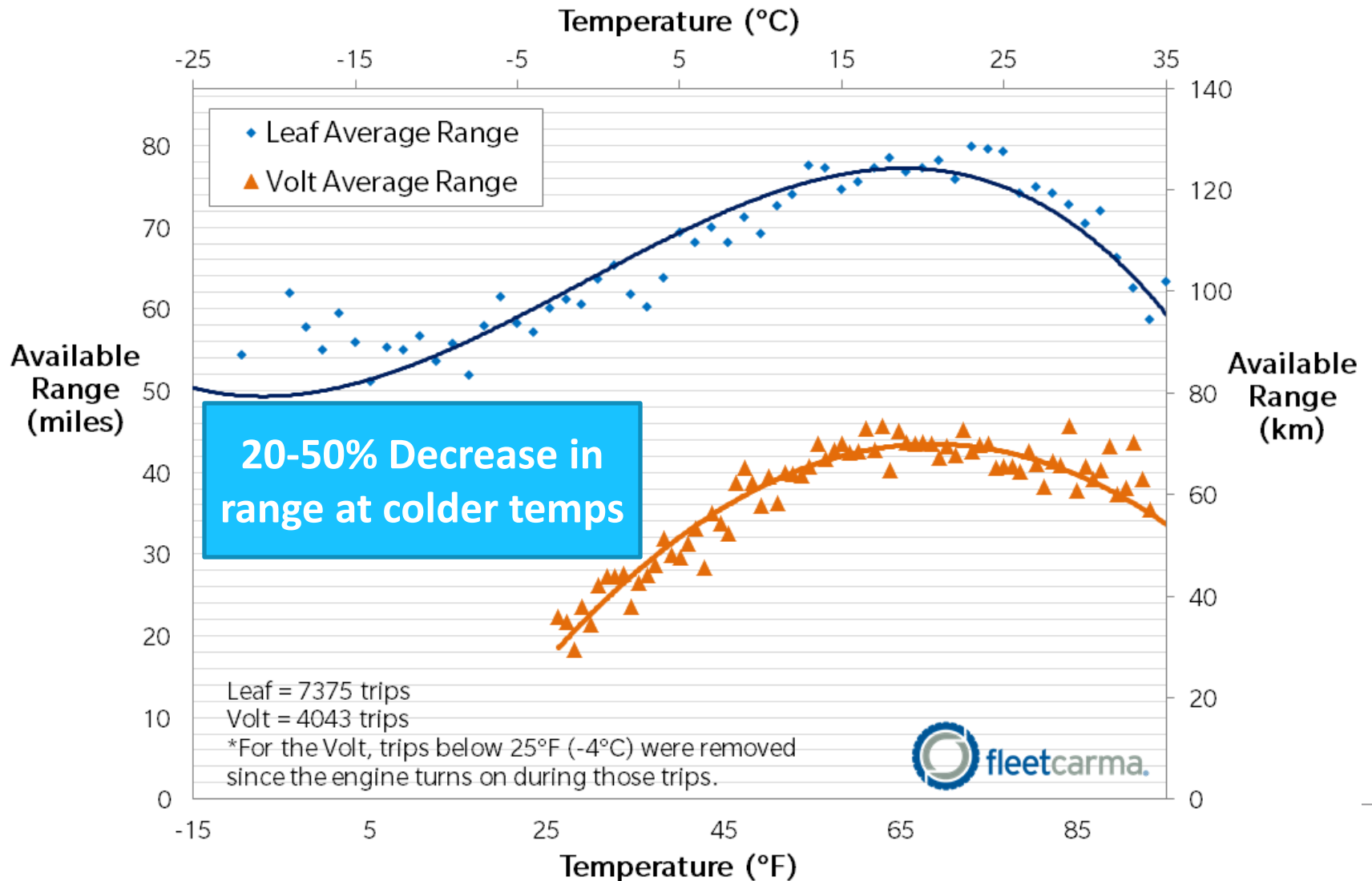
Performance - UVM Racing



Cold Weather Operation

Nissan Leaf & Chevrolet Volt: Range vs. Temperature

Spanning All Model Years in the FleetCarma Database



Safety

- Crash Ratings
- Vehicle fires



187,500 fires in 2011
+5,000 at fueling



< 10 as of Feb 2015

- First responder trainings
 - Decal requirements

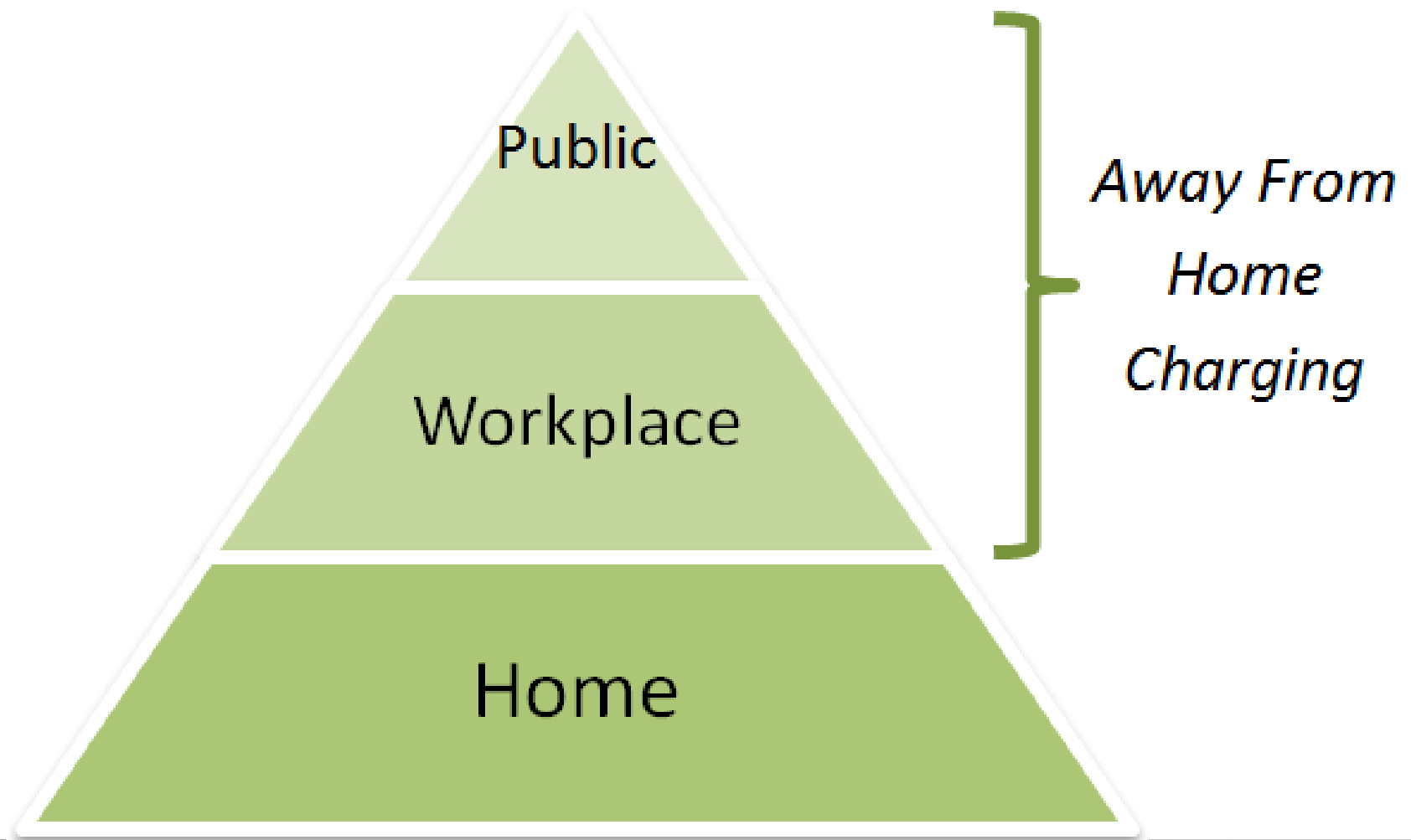
Leasing Options

- 90% of EVs in the USA are Leased
- Federal incentive passed through by leasing company
- Technology is rapidly changing
- Protected from depreciation
- Accelerate used vehicle availability

- High mileage customers may have issues with leasing



EV Charging



Charging Equipment

Level 1 charging
120V



Level 2 charging
208/240V



DC fast charging
208-480V



Brattleboro Tesla Supercharger



Charging Speed

Level 1 charging

120V

20A

Level 2 charging

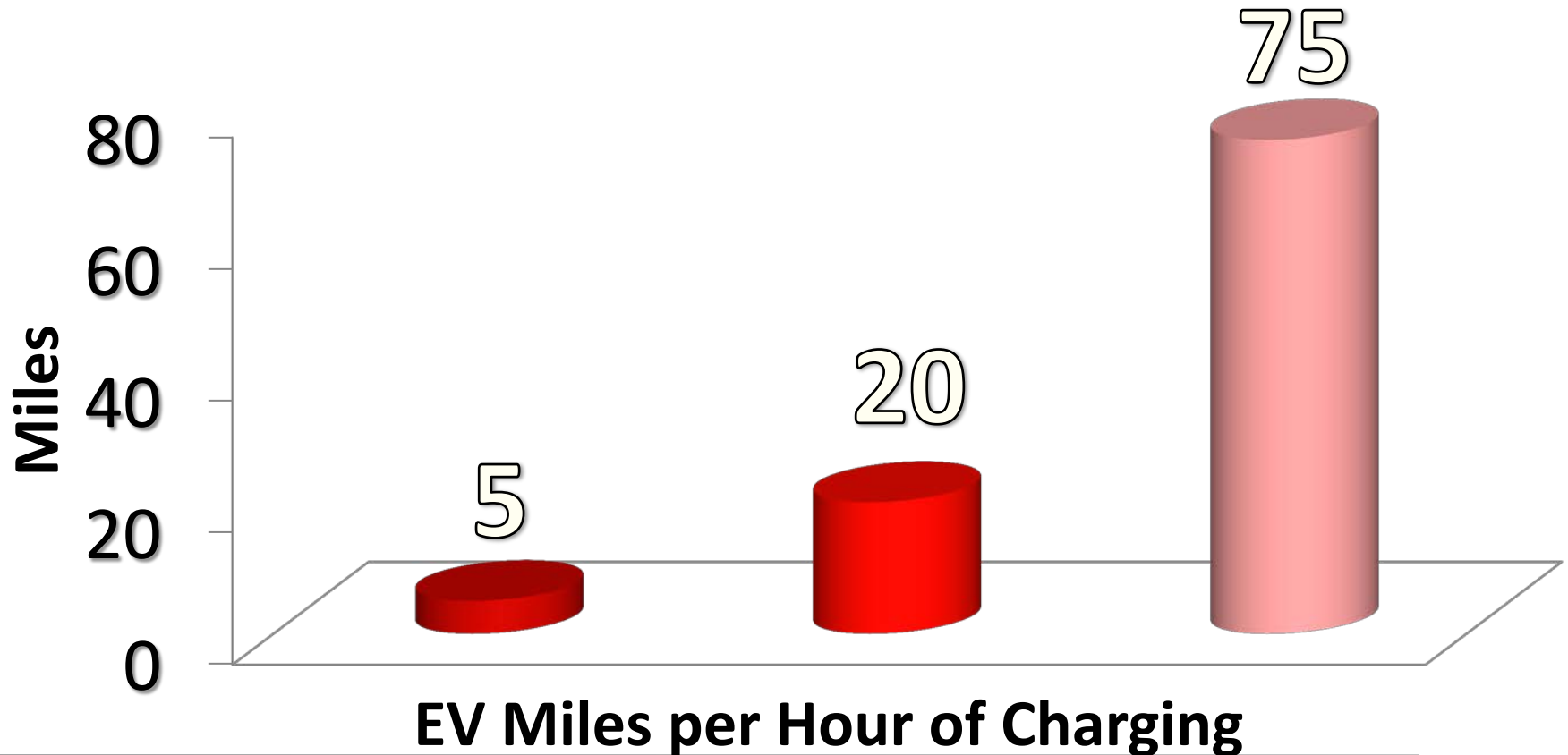
208/240V

15-80A

DC fast charging

208-480V

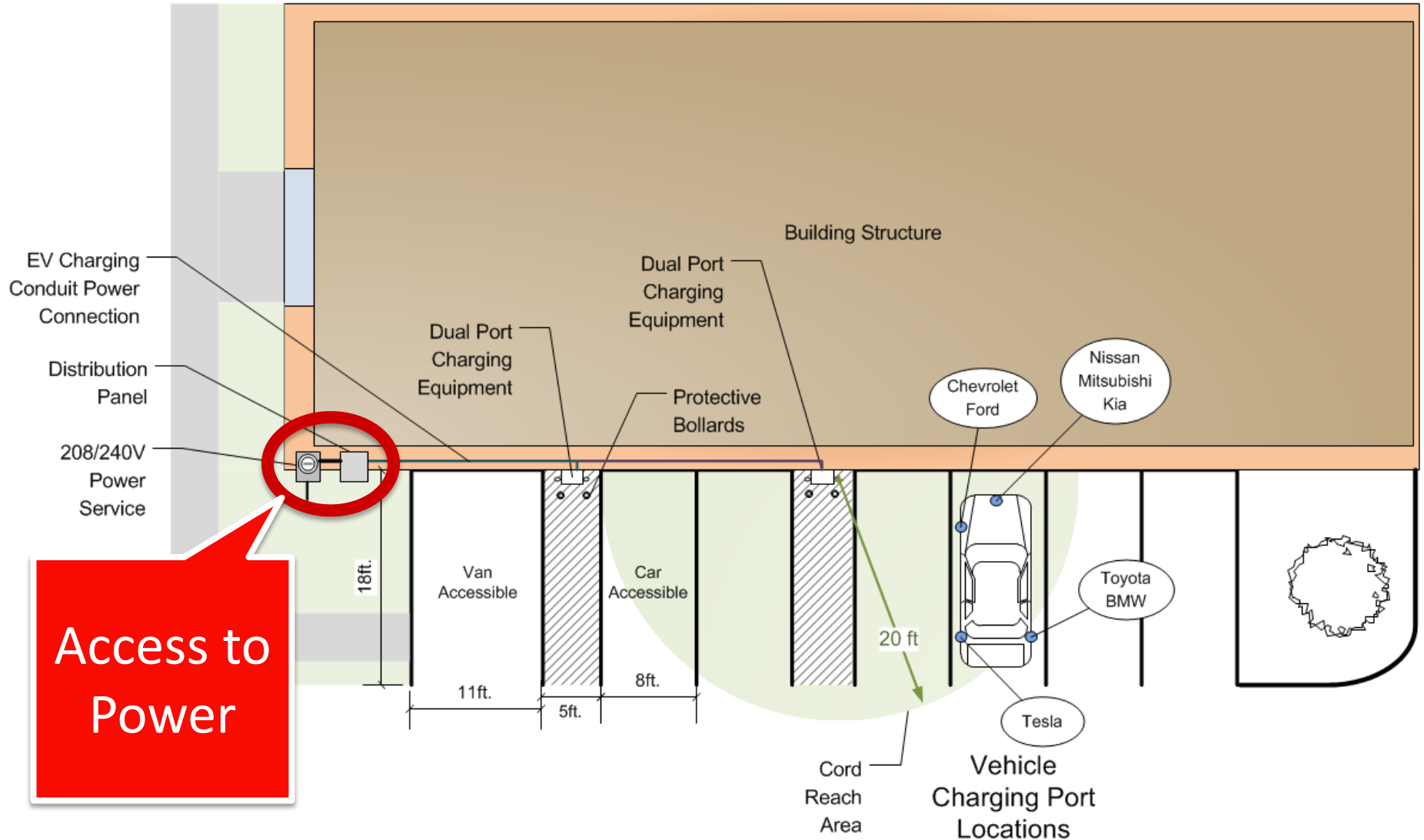
Up to 200A



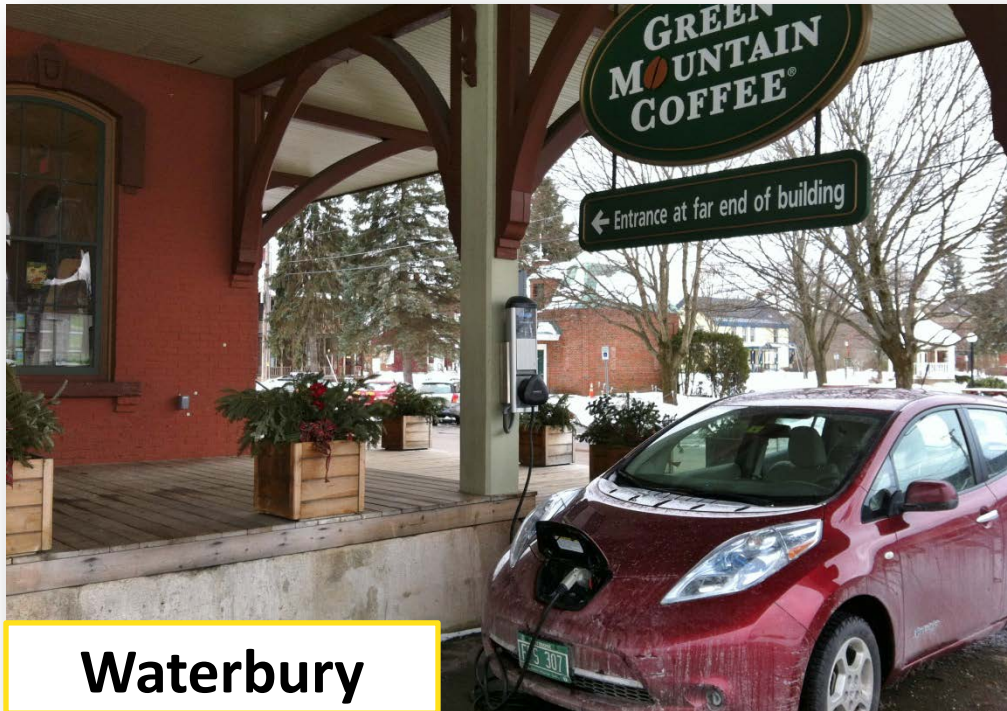
Charging Station Installation Costs

	Level 1	Level 2	DC Fast
Charge Duration	6-10 hours	1-3 hours	15-30 minutes
Equipment	\$30 – 900	\$600 – 9,000	\$15,000 – 60,000
Installation	\$200 – 450	\$1,000 – 12,000	\$10,000 – 25,000
Total	\$230 – 1,350	\$1,600 – 21,000	\$25,000 – 85,000

Charging Station Planning



Public EV Charging Equipment



Waterbury



S Burlington



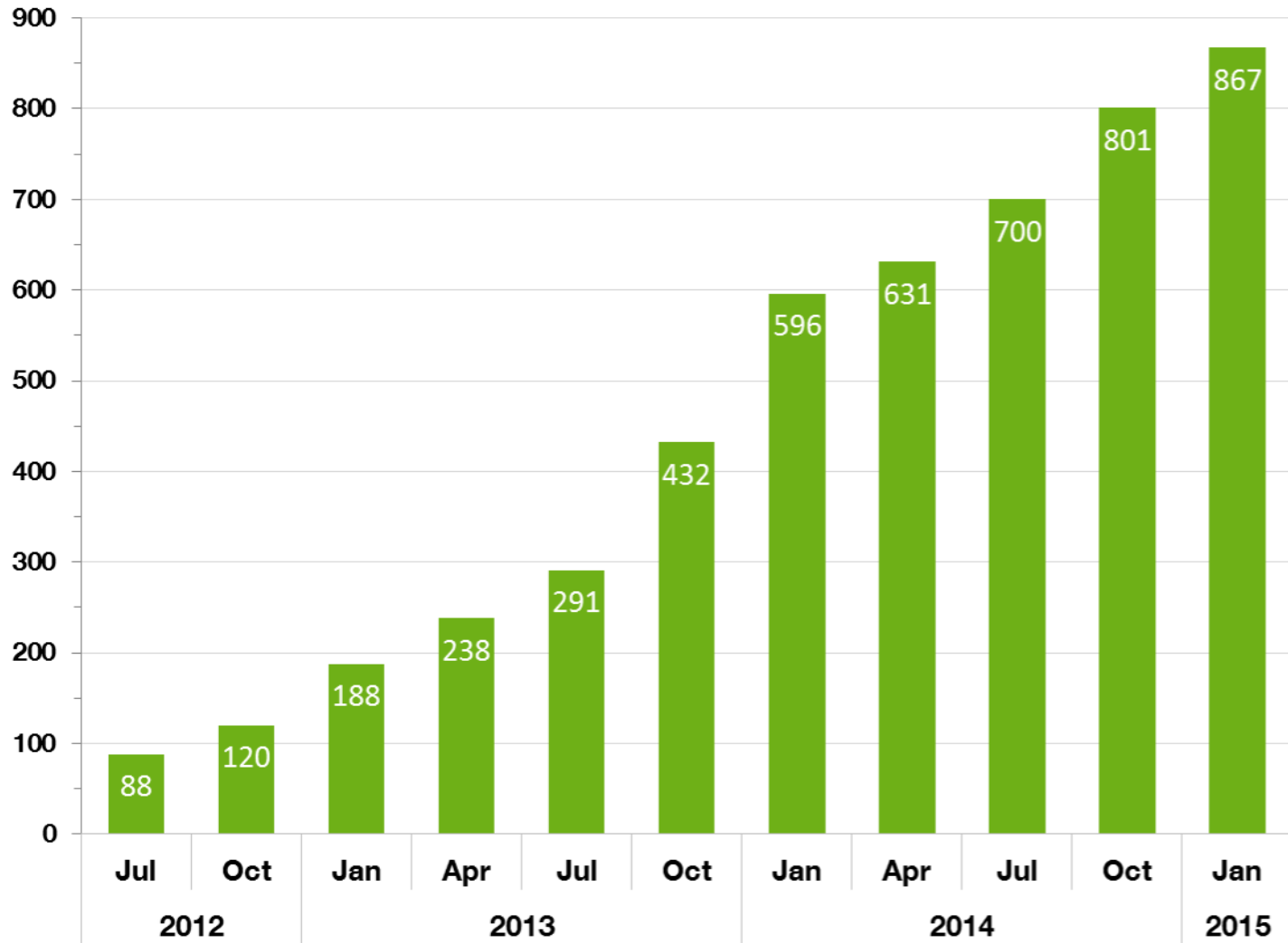
Montpelier


Vermont EV Policy



- Stakeholder group coordinating public-private investments
 - Vehicle and charging station outreach
- Pilot incentive program at point of purchase with dealer participation
- Downtown charging station grants
- State Infrastructure Bank low interest loans for charging
- Clean Fuels / Fossil Fuel Reduction programs

VERMONT ELECTRIC VEHICLE REGISTRATIONS

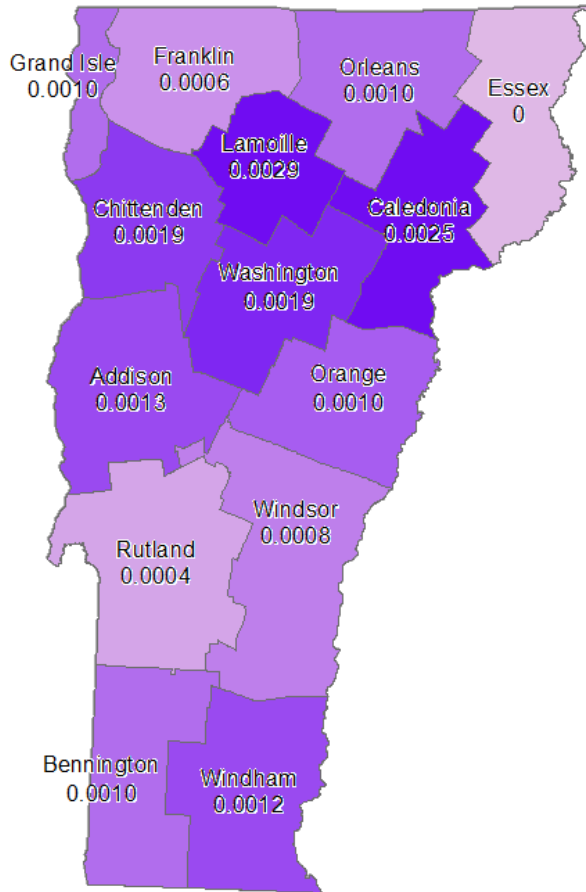


 Total Passenger EVs in Vermont

Source:
VT Agency of Natural Resources;
VT Dept of Motor Vehicles

EV Adoption Rates

Electric Vehicles Per Capita in Vermont Counties As of January 2015



County	Population	All Electric	Plug-in Hybrid	Total EVs	Plug-ins per Capita
Lamoille	24,475	4	68	72	0.0029
Caledonia	31,227	2	77	79	0.0025
Washington	59,534	17	99	116	0.0019
Chittenden	156,545	99	191	290	0.0019
Addison	36,821	17	30	47	0.0013
Windham	44,513	11	41	52	0.0012
Orange	28,936	9	21	30	0.0010
Grand Isle	6,970	3	4	7	0.0010
Orleans	27,231	2	25	27	0.0010
Bennington	37,125	5	31	36	0.0010
Windsor	56,670	19	28	47	0.0008
Franklin	47,746	6	24	30	0.0006
Rutland	61,642	2	22	24	0.0004
Essex	6,306	0	0	0	0.0000

Data Source:
 Vermont Dept of Motor Vehicles vehicle registration database as of 12/24/2014.
 Data processed by Vermont Agency of Natural Resources Dept of Environmental Conservation. EVs distinguished by fuel type, model and/or VIN.
 County data summarized from zip code geography. Population from 2010 US Census.
 Does not include 10 vehicles with registrations zip codes outside of Vermont.

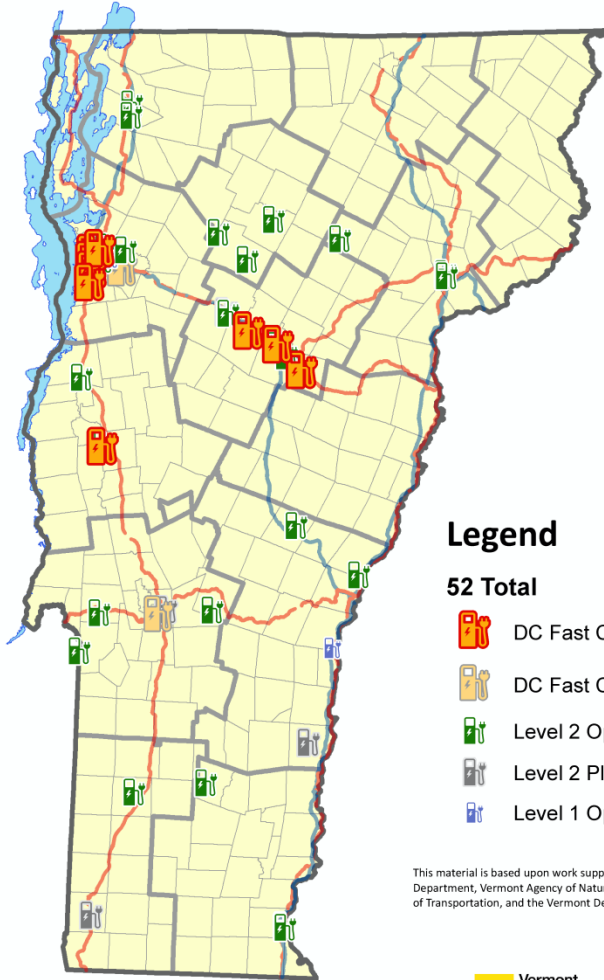
This material is based upon work supported by the Vermont Public Service Department, Vermont Agency of Natural Resources, Vermont Agency of Transportation, and the Vermont Department of Buildings and General Services



EVs in Vermont






Public Electric Vehicle Charging Locations

As of January 15, 2015



Legend

52 Total

-  DC Fast Charging Operational (9)
-  DC Fast Charging Planned (2)
-  Level 2 Operational (34)
-  Level 2 Planned (5)
-  Level 1 Operational (2)

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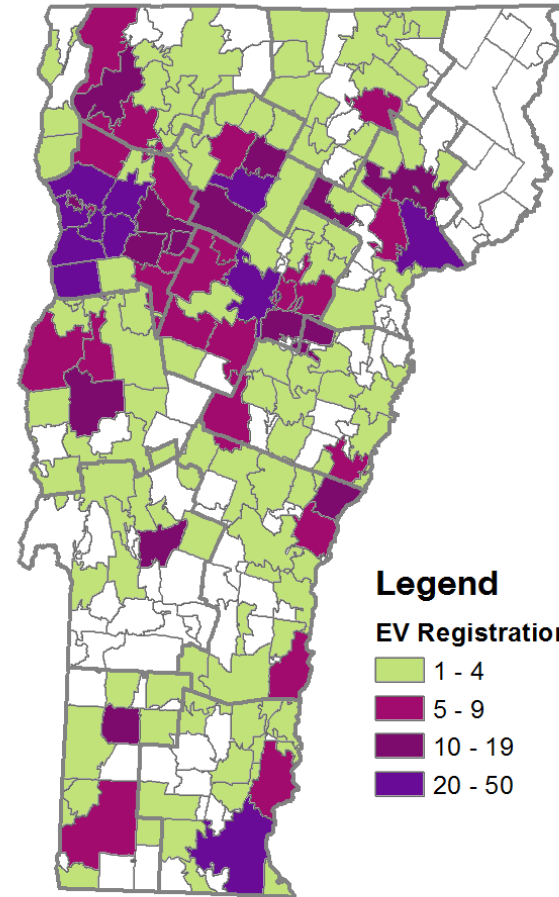


Data Sources:
 US Department of Energy Alternative Fuel Vehicle Station Locator - <http://goo.gl/ETSCo>
 ChargePoint
 Green Mountain Power

1/15/2015





Electric Vehicles Registered in Vermont

As of January 2015



Legend

EV Registrations in Zip Code

-  1 - 4
-  5 - 9
-  10 - 19
-  20 - 50

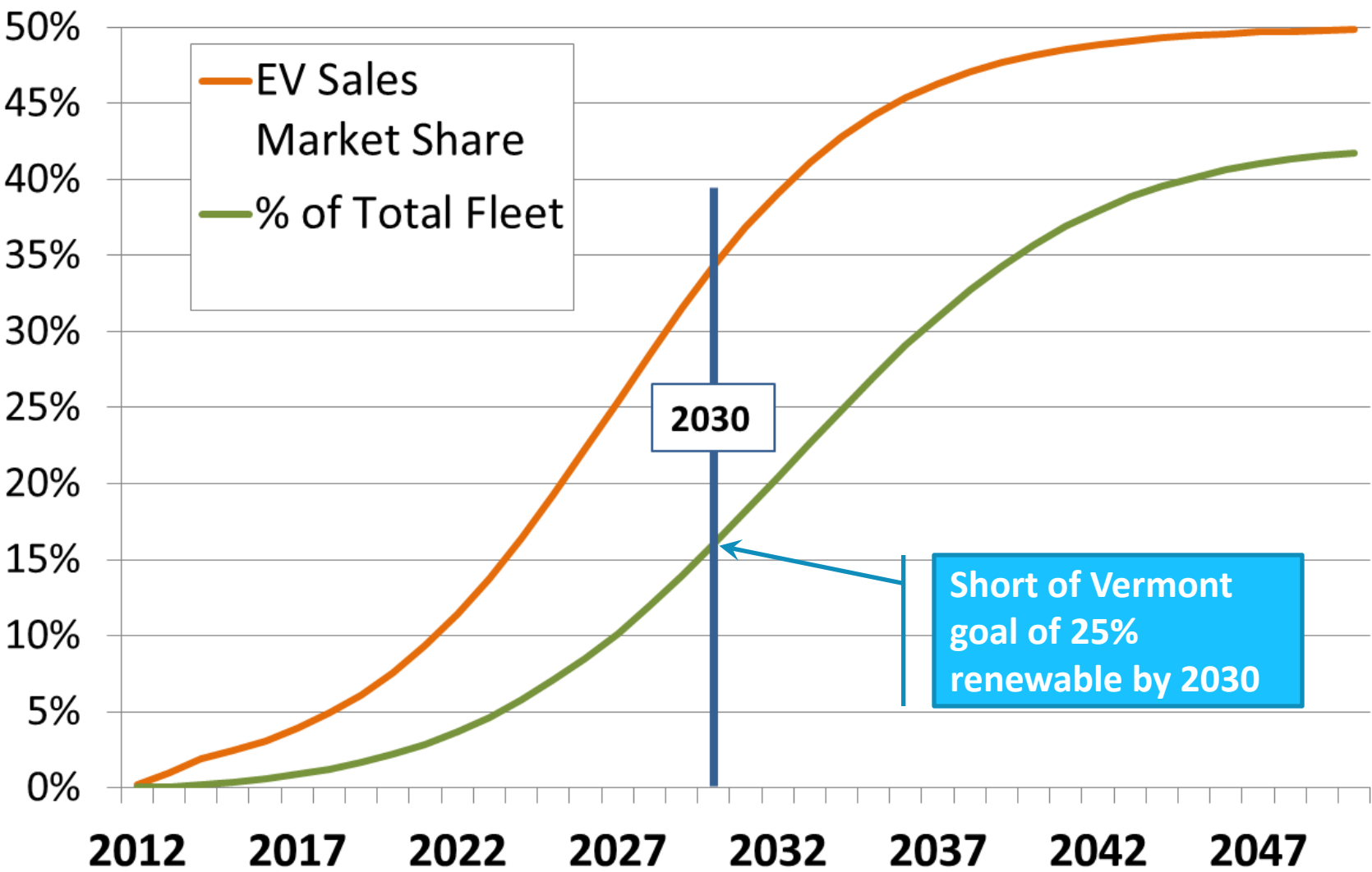
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Data Source:
 Vermont Dept of Motor Vehicles vehicle registration database as of 12/27/2014.
 Data processed by Vermont Agency of Natural Resources Dept of Environmental Conservation. EVs distinguished by fuel type, model and/or VIN.



1/15/2015

Potential Growth Scenario



Fleets

- State of Vermont will have more EVs in the fleet
- Several municipalities and CCRPC have leased / purchased
- Utilities and businesses



Solar PV and EVs

- EVs typically travel 3-4 miles per kWh
- Driving 12,000 miles per year will require 3,000-4,000 kWh

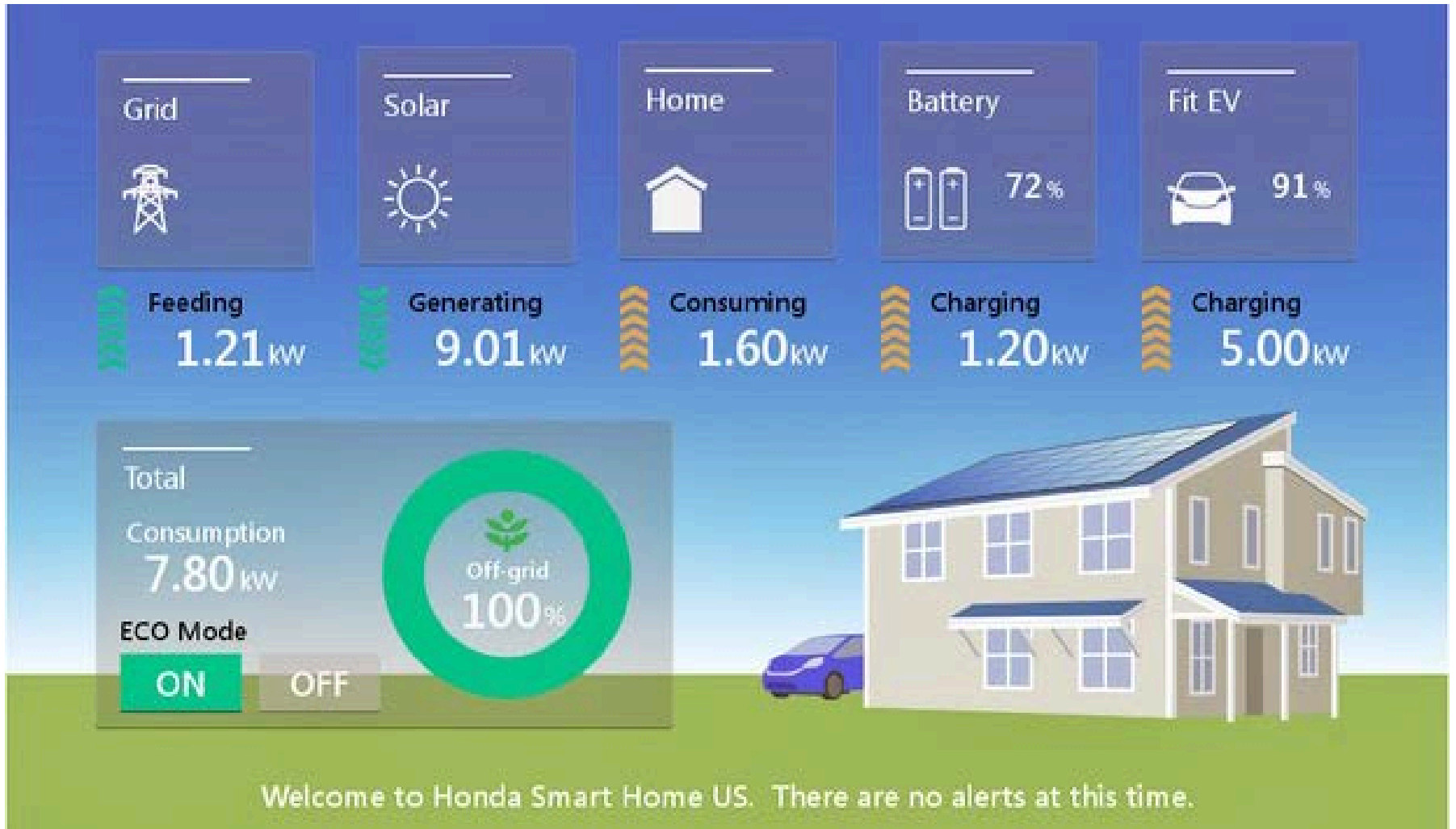


Oak Ridge National
Lab

Vehicle to Grid / Vehicle to Building



Honda Smart Home Demonstration



Electric School Buses

LAVALnews.ca

Laval's English newspaper since 1993.
Journal anglais de Laval depuis 1993.

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Home

School Buses

Quebec pins hopes on all-electric school bus unveiled in Laval

By Martin C. Barry | Fri, 11/14/2014 - 12:45



Quebec Transport Minister Robert Poëti is seen here connecting the all-electric school bus for recharging with Mille-Îles Liberal MNA Francine Charbonneau and Minister of Sustainable Development David Heurtel.

Quebec's Liberal government is hoping that a 100 per cent electric school bus unveiled in Laval and which is regarded as a first of its kind in North America will sell briskly to transportation companies and school boards and return at least some of the investment Quebec made in its development.

A Lion of a bus

Quebec Transport Minister Robert Poëti

joined Sustainable Development Minister David Heurtel and Minister Responsible for the Laval Region Francine Charbonneau with Chomedey Liberal MNA Guy Ouellette at school transportation specialist Chartrand Inc.'s depot on Montée Masson in Laval's east end on Nov. 7 for the official unveiling of the 72-seat C-type E-Lion school bus made entirely in Quebec by Lion Bus

Google Launches Free EV Shuttle Service in Mountain View, CA

February 5th, 2015 by [Aisha Abdelhamid](#)

Four new 100% electric community shuttle buses have hit the road in the beautiful Silicon Valley city of Mountain View, California. The four electric shuttles are free to the public, thanks to Google, and are equipped with seating for 16 passengers, a wheelchair lift, space for two wheelchairs, Wi-Fi connectivity, and bicycle racks on the outside of the shuttle. This sounds more tempting to me than a Tesla.



Outreach

- Event recommendations for demos
- Newsletters or other outlets
- DEV stakeholder meetings
- EV charging priorities
 - Projects with construction activity in parking areas
 - Major employers
 - Multifamily properties
 - State Infrastructure Bank opportunities



IEEE Transportation Electrification

The screenshot shows the IEEE Transportation Electrification website. At the top left is the logo for IEEE Transportation Electrification, and at the top right is the IEEE logo. Below these is a navigation menu with links for Home, About, What's New, Standards, Calendar, Publications, Media, Resources, and Education. A search bar is located below the navigation menu, with a 'Search' button and a 'Google Custom Search' option. To the right of the search bar are social media icons for Facebook, Twitter, LinkedIn, and YouTube, along with buttons for 'TE FLYER', 'JOIN TE COMMUNITY', and 'READ TE NEWSLETTER'. The main content area features a large banner image of a TOTE Maritime ship and an airplane, with the text 'IEEE TRANSPORTATION ELECTRIFICATION' and 'January / February 2015 eNewsletter'. Below the banner is a featured article titled 'The Solar Assisted Rickshaw Van: A Complete Off-Grid Solution' by AKM Abdul Malek Azad. To the left of the article is a sign-up form for the newsletter, and to the right is a section titled 'About the IEEE EV Newsletter'.

IEEE TRANSPORTATION ELECTRIFICATION

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IEEE TRANSPORTATION ELECTRIFICATION

January / February 2015 eNewsletter

The Solar Assisted Rickshaw Van: A Complete Off-Grid Solution

by: AKM Abdul Malek Azad For some countries, Rickshaws are intrinsic elements of a national transportation system. As much as one enjoys a rickshaw ride, however, there is no overlooking the significant amount of labor and effort exerted by the rickshaw puller. Battery-powered, 'electric' rickshaws pioneered by companies like Beevatech Ltd seemed to be a very popular solution when they were first introduced. However, there were a number of drawbacks [1,2] ...

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Archives

About the IEEE EV Newsletter

The Transportation Electrification eNewsletter studies topics that span across four main domains: Terrestrial (land based), Nautical (Ocean, lakes and bodies of water), Aeronautical (Air and Space) and Commercial-Manufacturing. Main topics

Resources

- Drive Electric Vermont
 - <http://driveelectricvt.com>
 - <https://www.facebook.com/DriveElectricVT>
- National EV websites
 - <http://www.afdc.energy.gov/fuels/electricity.html>
 - <http://goelectricdrive.com>
 - <http://www.pluginamerica.org>
 - <http://www.northeastevs.com>
 - <http://www.greencarreports.com/>

Electric Vehicle Greenhouse Gas Emissions

