Electric Cars
In-Depth
Upper Valley EV Expo

SEPTEMBER 9, 2017

It’s time.
PLUG IN, VERMONT

Drive Electric Vermont
Why Electric Cars?

- Clean Air
- Energy
- Climate Change
- Affordability
Overview

1. Transportation Energy in Vermont
2. EV Policy Issues
3. Supporting EV Adoption
Vermont Transportation Context

**Economy**
- $1.4 Billion in annual vehicle fuel purchases
- Access to jobs / markets

**Energy**
- 48 trillion Btu
- 35% of Total Energy

**Environment**
- 45% of Greenhouse Gases
- $347 Million in Climate and Health Costs
Vermont Greenhouse Gas Emissions

- Transportation: 45%
- Residential & Commercial Use
- Agriculture
- Industrial Processes
- Waste Management
- Electricity Supply
- Industrial Fuel

Vermont Agency of Natural Resources, 2015
2016 Comprehensive Energy Plan

$1.5 billion in annual gasoline and diesel fuel purchases

Transportation Goals
- 20% reduction in transportation energy use by 2025
- 10% renewable transportation by 2025

90% Renewable by 2050 across all sectors
Light Duty Vehicles

Electric cars are 2-3 times more efficient than gasoline.
New England regional grid mix provides 103 MPG equivalent
Types of Plug-in Vehicles

All Electric

- Battery
- Electric Motor

70 - 300 Mile Range on Battery

Plug-in Hybrid

- Gasoline Tank
- Combustion Engine
- Battery
- Electric Motor

15 - 80 Mile Range on Battery + 300 or More Miles on Gasoline
All Electric Vehicles in Vermont

Compact to Full Size

Many Automakers

- Nissan
- Tesla
- Volkswagen
- Mitsubishi
- +4 others
Plug-in Hybrid Vehicles in Vermont

Wide range of models

Popular Automakers
- Ford
- Toyota
- Chevrolet
- BMW
New arrivals

2017

Chevrolet Bolt

Late 2017

Tesla Model 3

Chrysler Pacifica Hybrid

30+ additional models in next 5 years
Other Electric Options

Electric Buses

Electric Bikes
Hydrogen Fuel Cell Vehicles
EVs in Vermont Conditions

Cold weather reduces electric range 20-40%
Safety

2017 Chevrolet Volt
Small car

2017 TOP SAFETY PICK+

2017 Chevrolet Volt

IIHS 2017 Top Safety Picks
Cost of Ownership

$3,700 Savings over 5 years

Source: US Energy Information Administration and VEIC
Assumptions: 25 mpg gasoline vehicle; 3 mile per kWh EV; 1,000 miles per month
EV Charging

- Public
- Workplace
- Home

Away From Home Charging
## Charging Equipment

<table>
<thead>
<tr>
<th>Level 1 Charging</th>
<th>Level 2 Charging</th>
<th>DC Fast Charging</th>
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<tbody>
<tr>
<td>120V</td>
<td>240V</td>
<td>480V</td>
</tr>
<tr>
<td>5 miles range / hr</td>
<td>10-20 miles / hr</td>
<td>70+ miles / hr</td>
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</tbody>
</table>

![Level 1 Charging](image1)
![Level 2 Charging](image2)
![DC Fast Charging](image3)
EV Charging Power

Level 1 Charging
120V @ 1.2 kW
5 miles range / hr

Level 2 Charging
240V @ 3-20 kW
10-20 miles / hr
DC Fast Charging Plugs

- SAE Combo
- CHAdeMO
- Tesla Supercharger
EV Public Charging Availability

September 2017

- About 160 Public Locations
- 23 with DC Fast Charging
DC Fast Charging Along Corridors
EV Policy Issues

- Greenhouse Gas Reductions
- Health Benefits
- Economic Benefits
- Grid Benefits
- Pollution Regulations
Potential Pathway to 95% Reduction

Annual Energy-Related GHG Emissions (Millions of Tons)

2015  2020  2025  2030  2035  2040  2045  2050

Greenhouse Gas Reductions

Vermont Agency of Natural Resources, 2017

Very Efficient Vehicles
Less Driving
75% Renewable Energy

Significant Weatherization and Heating Conversion
100% Renewable Energy
Deeper Weatherization & More Efficient Heating
Double Share of Wood Heat

Ultra Efficient Fleet
Electric vehicles become the large majority of our transportation fleet.
Health Impacts

Those who will suffer most from climate change are children, the elderly and those in communities that do not have resources to withstand climate related stressors.
EV Health Benefits

$313 million reduction in annual climate and health costs in Vermont if two thirds of vehicles are EVs by 2050
EV Health Benefits

Health and Climate Impacts per 16-Gallon Tank of Gas in 2015

Every fill-up costs society over $18 more than what is paid at the pump.
Petroleum Costs Leaving VT

$1.4 Billion

is what Vermonters spent on petroleum transportation fuels in 2014

EVs could cut this by more than $500 million
Economic Impact of Car Dealers

16% of Retail Sales in State - 9,900 Jobs
EVs and the Grid
Renewably Powered EVs

Power your next adventure with solar.

- About 3 miles per kWh
- [http://www.driveelectricvt.com/solar](http://www.driveelectricvt.com/solar)
Vermont Zero Emission Vehicle Action Plan

State Priorities
- Marketing & Outreach
- Incentives
- Fleet Use
- Charging Infrastructure
- +7 more actions
EV Impact on Transportation Funding

60% of funding is from non-gas tax sources.
2016 VTrans Study
Institute EV fees in Vermont when EVs reach 15% of new vehicle sales

EV Market Trends

- Costs decreasing
- Used EV availability growing
- 30-40% annual growth in EV registrations
Vermont EV Registrations

Total Passenger EVs in Vermont

- 2012
- 2013
- 2014
- 2015
- 2016
- 2017

VT ANR, VT DMV, DEV
EVs per 10,000 People by County

Highest Ownership Rates
As of July 2017
1. Lamoille
2. Washington
3. Chittenden
4. Caledonia
5. Grand Isle
Regional EV Market Trends

EV Sales Share - July 2016-June 2017

[Map showing EV sales share percentages by state.]
Supporting EV Adoption

- Increasing affordability
- Used EV availability growing
- Need to increase purchase consideration
EV Consumer Barriers

VTrans 2016 Statewide Transportation Survey -
Barriers to Purchasing an Electric Vehicle

- Price: 71%
- Charging Availability: 51%
- Limited Range: 45%
- Performance: 27%
- Seating / Cargo Capacity: 24%
- Reliability: 19%
- Safety: 15%
- I don't see any obstacles: 8%
EV Incentive Programs
Vermont EV Market Enablers

1. Incentives
2. Marketing / Consumer Awareness
3. Workplace Charging
4. Public Charging Corridors
5. Electric Utility Investments
6. Public and Private EV Fleet Vehicles
VW Settlement Opportunities

- Electric Buses
- Other Heavy Duty EVs
- EV Charging

Vermont Comments
http://dec.vermont.gov/air-quality/vw

New Hampshire Comments
Discussion

Clean Air

Energy

Affordability

Climate Change