



**Northeast
Utilities**

Electric Vehicles: Updates and Industry Momentum

CPES Meeting
Watson Collins
March 17, 2014

Northeast Utilities launched an EV Tech Center to answer questions and help EV drivers get connected

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Get connected!

A new generation of plug-in vehicles (EVs) has arrived here in the northeast. The extended-range Chevy Volt, the all-electric Nissan Leaf and several other models are now available to purchase, lease or test drive at area dealerships.

Our "Plug My Ride" website is a resource for you with the information you need about electric vehicles and electric vehicle charging technology to make informed decisions that will benefit your family, business and community.



News and Events

CT Dept. of Energy & Environmental Protection is accepting applications to fund publically accessible EV charging stations.

MA municipalities can apply for grants from Dept. of Environmental Protection to purchase EVs and charging stations.

Resources

[Charging Station Locator](#)[Electric Car Cost Calculator](#)

Websites

[Electric Generation - Share your story!](#)[EV Connecticut](#)[Massachusetts Department of Energy Resources](#)

Tweets

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Plug My Ride @PlugMyRide 15h



\$699 Cadillac ELR Lease Hopes To Spur Sales [bit.ly/1i8PBeO](#)
[Show Summary](#)



Plug My Ride @PlugMyRide 18h

2015 BMW i8 Production Starts, Final Specs

www.PlugMyRide.org

or

855-463-6438

(Monday through Friday 8 a.m. - 5 p.m.)

Many of the States in the Northeast follow California's Zero Emission Vehicle program



ZEV Program

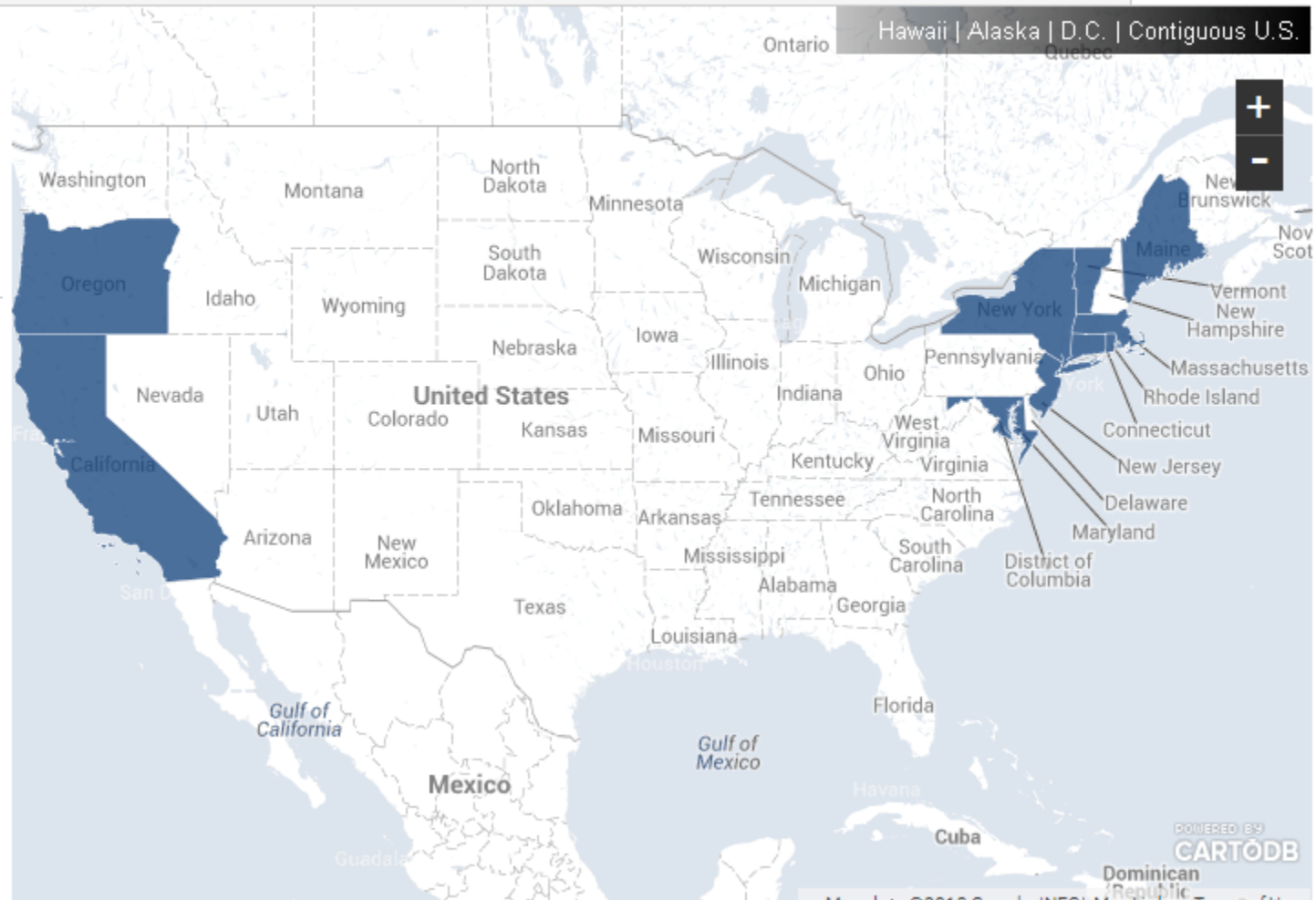
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LEGEND

▼ ☒ ZEV Program

■ ZEV Program (10 states)

[View data table](#)



Governors From 8 U.S. States Sign MOU to Put 3.3 Million ZEVs on the Road by 2025

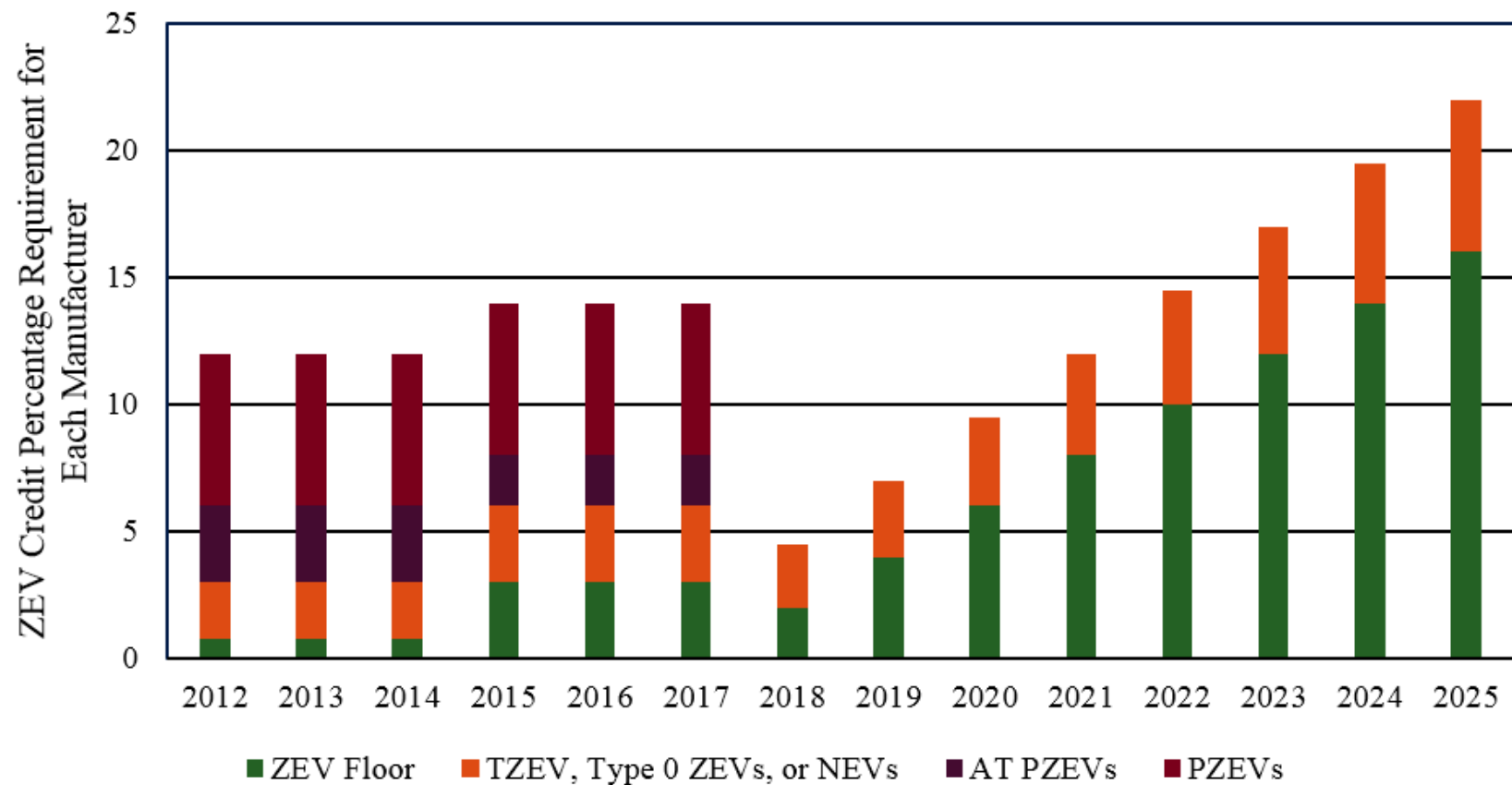


State Zero-Emission Vehicle Programs Memorandum of Understanding

WHEREAS, the Signatory States have adopted regulations requiring increasing sales of zero-emission vehicles (ZEVs), or are considering doing so; and

WHEREAS, accelerating the ZEV market is a critical strategy for achieving our goals to reduce transportation-related air pollution, including criteria air pollutants, mobile source air toxics and greenhouse gas emissions (GHGs), enhance energy diversity, save consumers money, and promote economic growth; and

ZEV requirements will require about 200,000 EVs in Connecticut by 2025



The states agreed to collaborate on the following

1. Multi-state ZEV Program Implementation Task Force
2. Work together to establish a fueling infrastructure that will adequately support this number of vehicles
3. Agency coordination
 - › consistent statewide building codes and standards
 - › developing streamlined metering options
 - › time-of-use electricity rates and net metering for electric vehicles
4. Public fleet purchases and fueling stations
5. Incentives for ZEVs
6. Shared standards
 - › universal signage
 - › common methods of payment and interoperability of electric vehicle charging networks
7. Public – Private Partnerships
8. Research, Education and Outreach
9. Hydrogen-powered vehicles and infrastructure study



Connecticut: Focused on eliminating range anxiety

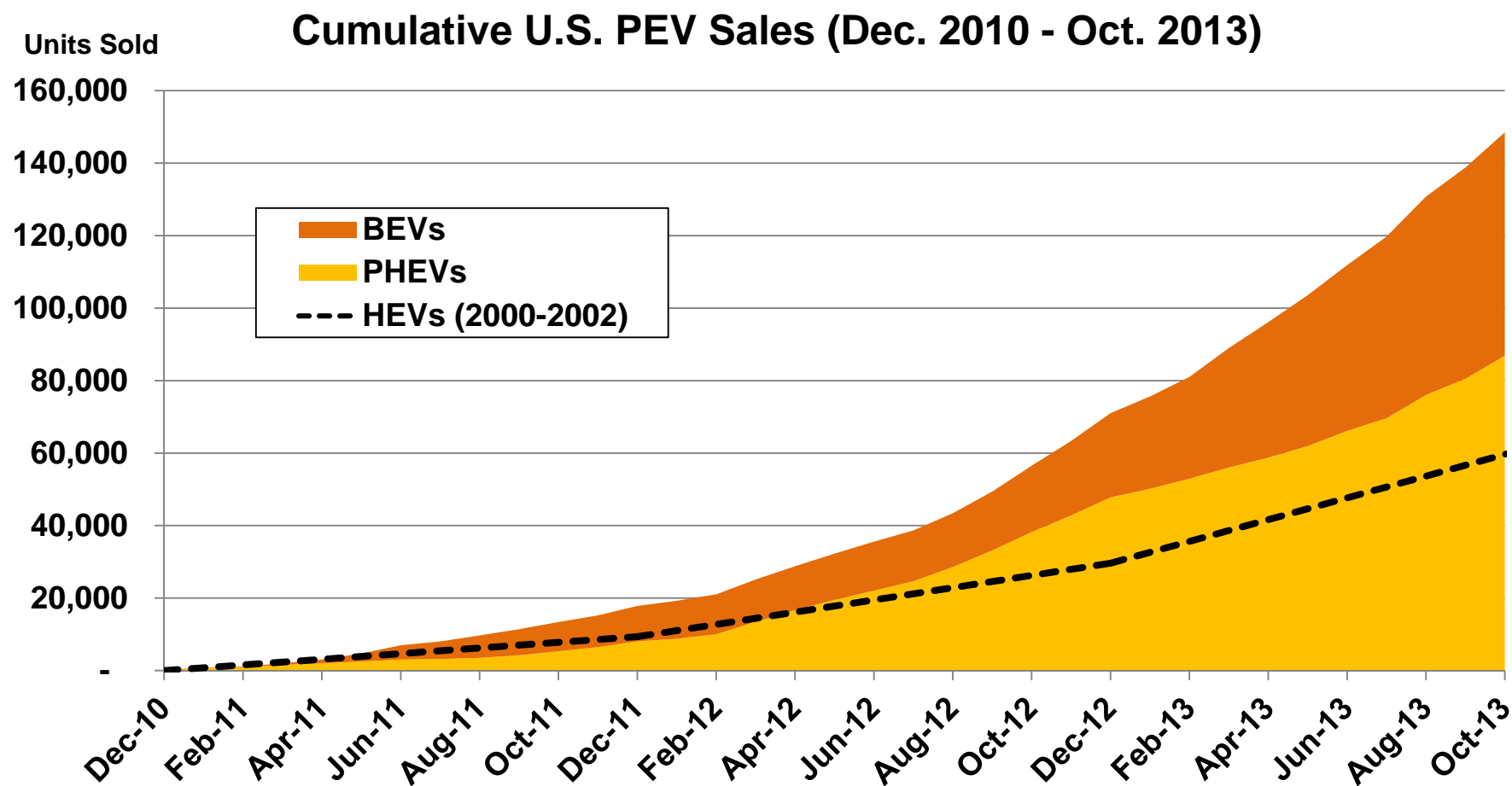


“Connecticut Setting
Groundwork To Become First
EV Friendly State”

“We will be the first state to be
able to declare an end to range
anxiety, because you’ll always
have a charging station within
10 or 15 minutes”

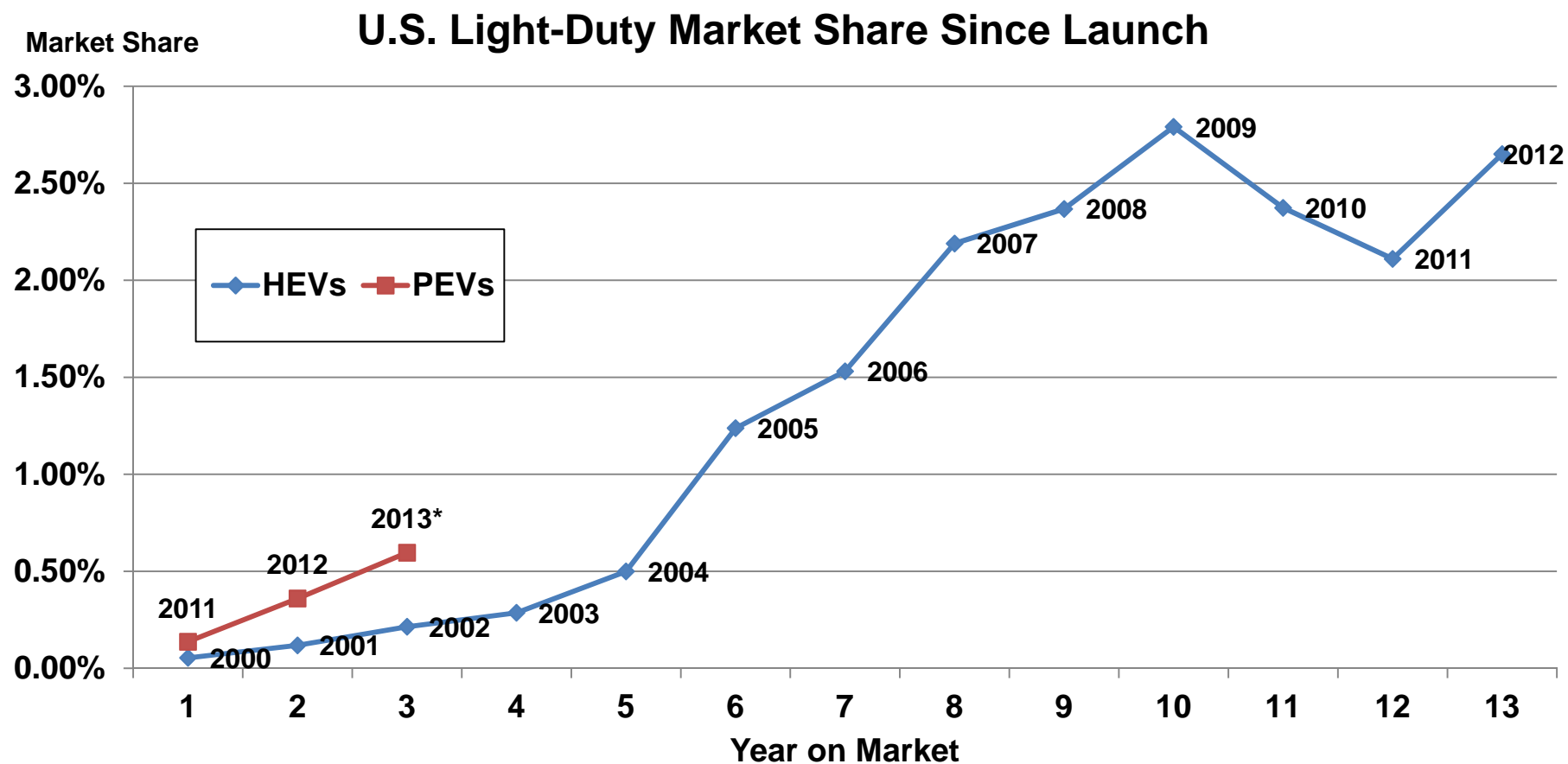
- > State has identified the advancement of EVs as an important public policy objective
- > Eliminating “Range Anxiety” is the foundation of the plan
- > State using funds from Northeast Utilities, identified in a settlement agreement, to fund infrastructure grants and investments
- > CL&P has a filing before regulators to modify rates for DC Fast Chargers
 - › DC Fast Chargers are an important / effective part of the infrastructure needs
 - › DC Fast Chargers have a load profile that is unique in comparison to typical customers (less than 5% load factor)
 - › Expected usage profile results in electric bills with disproportionate demand charges

PEV sales are off to a good start



Source: Manufacturer Data

PEV market share outpacing HEVs



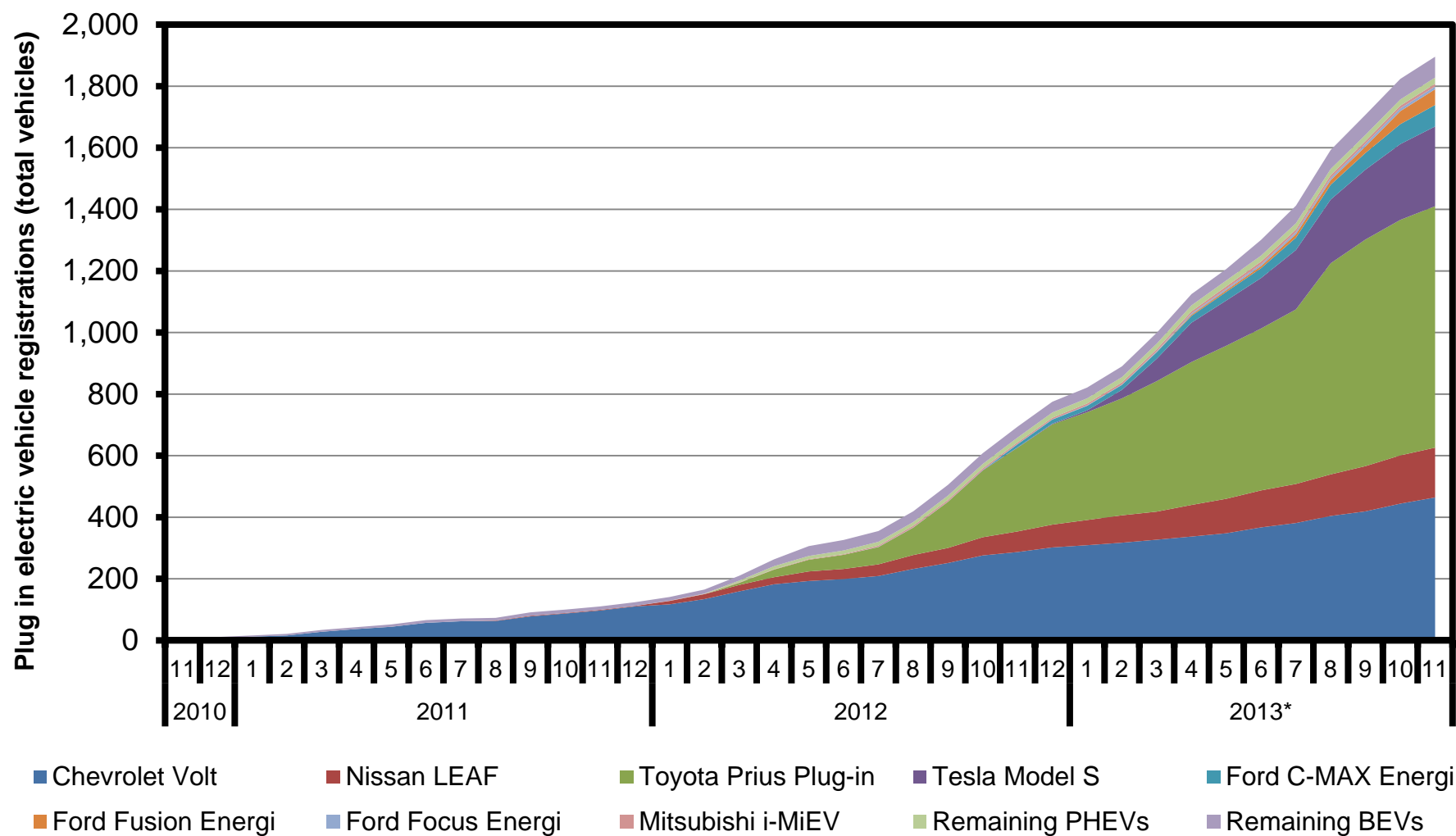
*2013 projected

Source: PEV sales: Manufacturer data; Annual sales totals: NADA; HEV sales: Alternative Fuels Data Center (DOE)






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Connecticut Plug-in Vehicle Registrations (through November 2013)



Two plug-in technologies (choose what fits driving habits)

Battery Electric Vehicle		Plug-in Hybrid Electric Vehicle
	Drivetrain	 
70 – 240 miles	Electric Range	15 – 40 miles
Commuting, fixed routes, short routes, etc.	Driving Patterns	Irregular driving patterns, highway driving, long routes
Purists, principled, making statement, technology driven, 2 nd vehicle, etc.	Expected Profile of Vehicle Owners	Primary vehicle, pragmatic consumers, expect same performance, no loss of convenience, etc.
Level 2 and DC Fast Charging	Recharging Equipment Sizes	120 v outlets and Level 2
Home , work & public	Recharging Locations	Home & work

Top Selling Current EV Models



Other EV Models Currently Available



EVs coming to market soon



Benefits of PEVs to utilities

- System utilization means downward pressure on price
 - In general: $rate (\$/kWh) = \frac{cost\ of\ service + rate\ of\ return}{kWh\ sales}$
- Flexible/shapeable load
 - Unlike many loads, charging characteristics (time, rate, location) are flexible and can be shaped with behavior
- Unlocks new opportunities
 - Near-term: demand-response, integration of renewable resources
 - Longer-term: distributed storage (V2G)
- Win-win situation

Utilities supporting the market

- Education and outreach
 - PEV information on websites draw heavy traffic
 - Employee programs, fleets, ride-and-drive events
- Incentives and pilot projects
 - Offset EVSE installation costs
 - Data-gathering projects
- EV rates
 - Time-of-use rates to shift off-peak

The screenshot shows the 'Plug-in Car Rate Assistant' web form from Edison. The main heading is '01. What is your average daily power usage?'. Below this is a text input field for 'Daily Power Usage*' with a value of '0.?' and a unit of 'kWh'. To the right, there is a 'SAMPLE' bar chart titled 'Average Daily Electricity Usage (kWh) Location on Your Electricity Bill' showing a peak of 14.43 kWh. A 'Next' button is at the bottom right. At the bottom of the form, there is a progress bar with six steps: 1. Power usage (highlighted), 2. Vehicle type, 3. Miles per year, 4. Gasoline price, 5. Charging time, and 6. Priority.

Need for education and awareness

- PEV awareness remains low:
 - November 18: "Consumers Have Favorable Views of Electric Vehicles, but Awareness Remains Low"¹
 - November 13: "Survey: Most Americans unaware of financial advantages of owning an electric car"²
- The Electric Generation
 - (theelectricgeneration.org)



¹ <http://www.navigantresearch.com/newsroom/consumers-have-favorable-views-of-electric-vehicles-but-awareness-remains-low>

² <http://news.indiana.edu/releases/iu/2013/11/electric-vehicle-survey.shtml>

Plenty of grid capacity

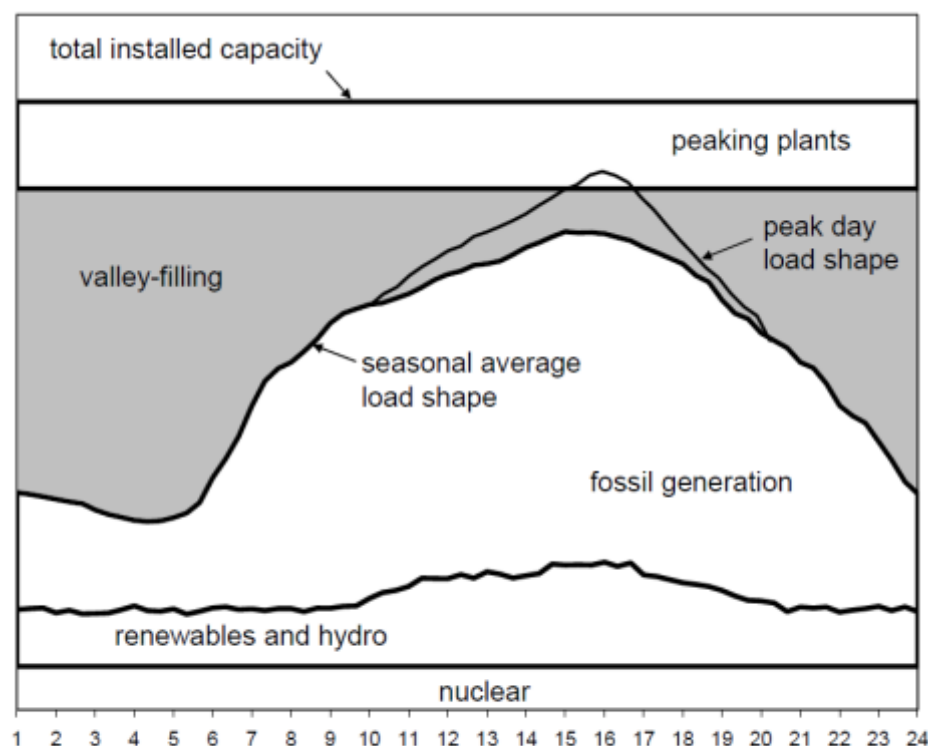
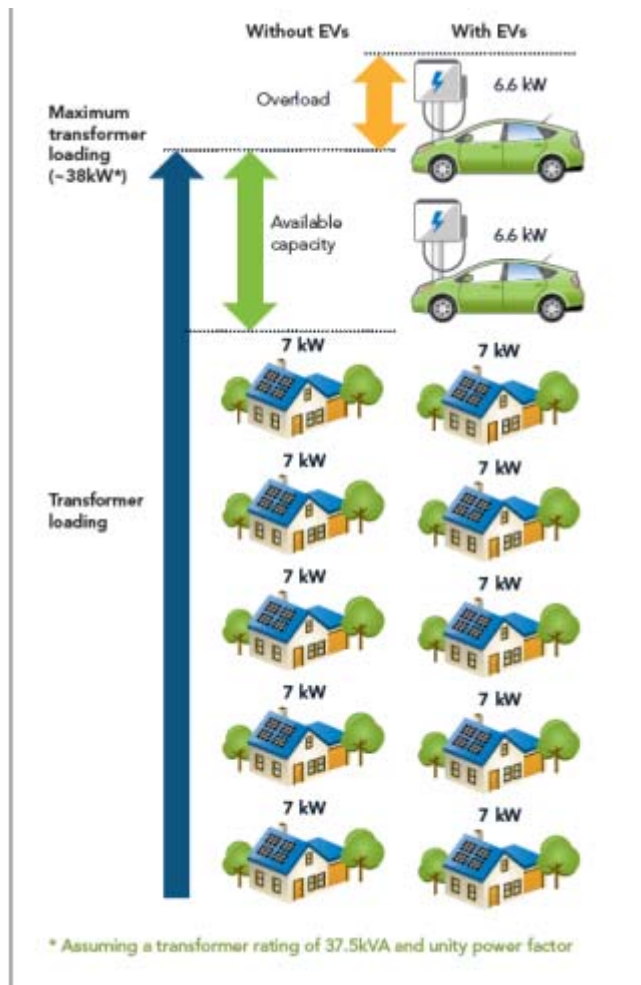


Figure 2: Stylized Load Shape for 1 Day During Peak Season, Generation Dispatch, and Installed Capacity

- 73% of the light-duty vehicle fleet could be supported by the existing grid
- Such a market penetration would displace 6.5 million gallons of oil per day, or 52% of U.S. oil imports
- Modeling shows essentially no generation or transmission impact through 2030

Source: Pacific Northwest National Laboratory, *Impacts Assessment of Plug-In Hybrid Vehicles on Electric Utilities and Regional Power Grids*

Impact on distribution is manageable



- Transformer level distribution is where impact will be more evident
- To date, only tiny fraction of transformer upgrades due to PEVs
- Utilities closely monitoring PEV adoption
- Rising power levels could be a concern

Source: Silver Spring Networks, *How the Smart Grid Enables Utilities to Integrate Electric Vehicles*

Cars spend most of time at home

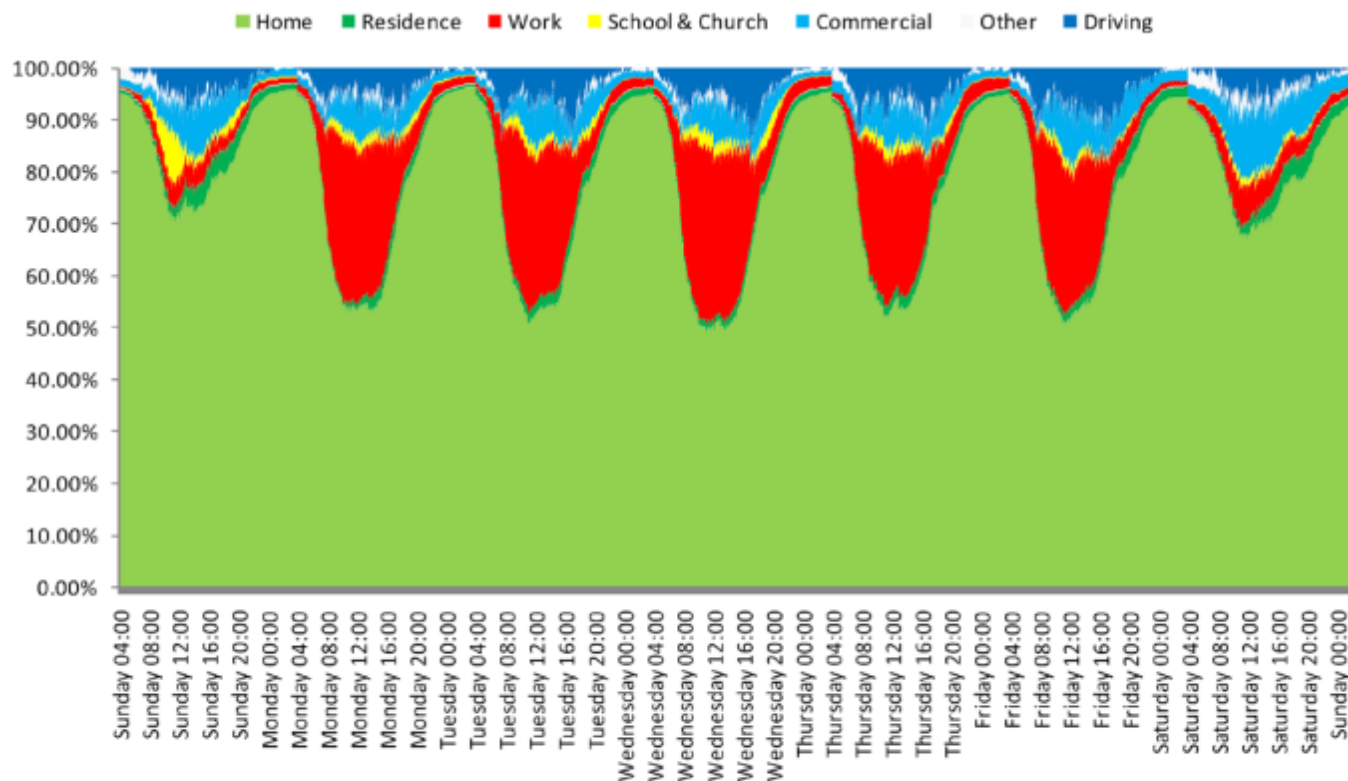


FIGURE 3-5 Distribution of vehicle locations throughout the week on the basis of data from the 2001 National Household Travel Survey. SOURCE: Tate and Savagian (2009). Copyright 2009 by SAE International. Reprinted by permission.

Source: National Research Council, *Overcoming Barriers to Electric-Vehicle Deployment, Interim Report*



EV Charging Equipment

Charging Level	Electrical Wiring	Charge Rate (kW)	Equipment Required
Level 1	120v, 15a	1.44 kW	NEMA 5-15 outlet, Cordset provided with vehicle
Level 2	240v, 20 - 100a	3.6 – 19.2 kW	EVSE* installed at site
DC Fast Charging	3 phase	50 kW	External battery charger installed at site

120V Portable Cordset



240V Home EVSE



DC Fast Charger



For commuters, 8 hours provides enough time to satisfy their typical charging requirements

Charging Level	Electrical Wiring	Charge Rate (kW)	Potential Miles Provided by Charging in an 8 Hour Period *
Level 1	120v, 15a	1.44 kW	32 miles
Level 2 (low)	240v, 20a	3.6 kW	80 miles
Level 2 (med.)	240v, 40a	7.2 kW	160 miles
Level 2 (High)	240v, 100a	19.2 kW	427 miles
DC Fast Charging	3 phase	50 kW	1,111 miles

* Based on the Chevy Volt EPA rating of 36 kWh / 100 miles and no charge rate modulation

Charging infrastructure

- Charging priority:
 - 1) home charging
 - 2) workplace
 - 3) public
- Keeping costs down to drive market
- Public charging should be located intelligently
- Multi-Family Dwellings present a challenge

Open issues

Sale and Resale (i.e. third-party networks)



Source: NRG eVgo (www.evgonetwork.com/chevy-volt-charging-less-than-5-per-month/)

Interoperability (example: SAE Combo vs. CHAdeMO)

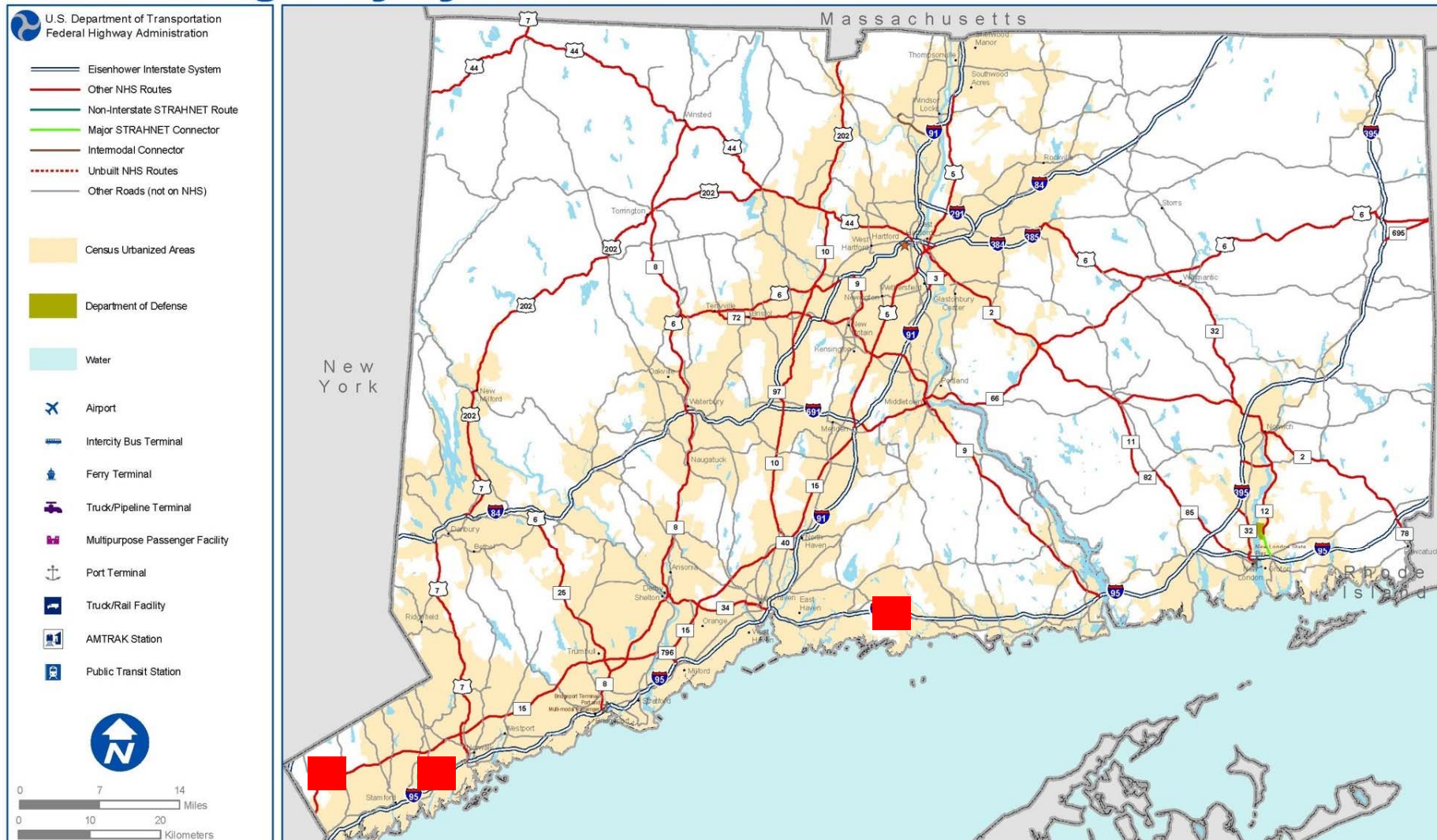


Source: Argonne National Lab
(blogs.anl.gov/greenlab/2013/08/12/electric-vehicle-fast-chargers-slow-to-adapt/)

Flexibility is key

NU is working with the State of Connecticut to develop DC Fast Charging Stations

National Highway System: Connecticut



DC Fast Chargers at Darien Southbound Service Plaza



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Thank You

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<http://www.youtube.com/watch?v=0NaI9SYhN34>

