



Northeast
Utilities

Plug-in Electric Vehicles: Putting the Fundamentals in Place

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<http://www.plugmyride.org/>



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Edison Electric Institute's Electric Transportation Working Group

- > 45 participating utilities
 - › Representing all 19 launch states of the Chevy Volt / Nissan Leaf (AL, AZ, CA, CT, DC, FL, GA, HI, MD, MA, MI, NJ, NY, NC, OR, SC, TN, TX, VA, WA)
 - › 5 issue teams: Infrastructure, Rates & Regulatory, Policy, Codes & Standards, Communications & Media

- > Collaborative approach to understanding and supporting the emerging EV industry
 - › Automakers, charging station equipment suppliers, policy leaders, state/local agencies

- > Developing and implementing strategies to be “plug in ready” and integrate EVs into electric system
 - › ... building the last 20 feet of the existing infrastructure

Overview of NU's plug-in electric vehicle efforts



- > Worked to ensure vehicles arrive in NU's service territory
 - > Connecticut one of seven states for Volt launch
 - > Connecticut one of five markets for BMW Active E pilot
 - > Connecticut & Massachusetts signed MOUs with Nissan

- > Member of Connecticut's Electric Vehicle Infrastructure Council, established in 2009 by an executive order from the Governor of CT.

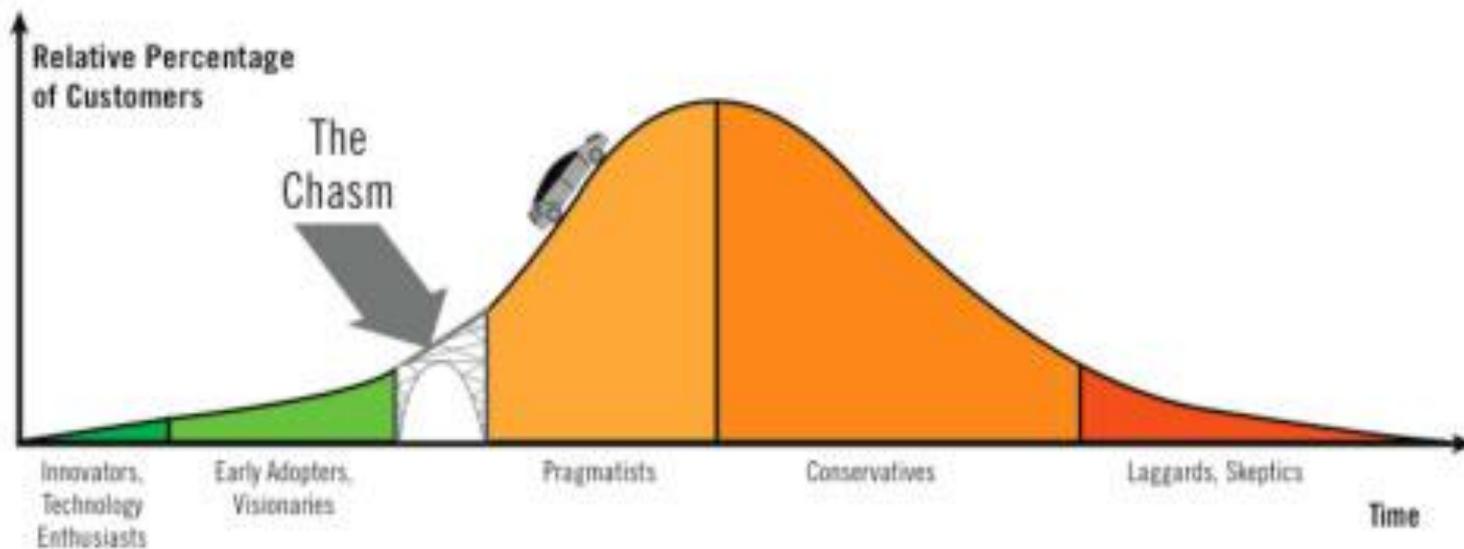
- > Founder and chair of the Regional Electric Vehicle Initiative (REVI) along with NSTAR, National Grid, UI, CMEEC, MMWEC. Group developing a paper on metering electric use of plug-in electric vehicles.

- > Installed six Level II (240 V) charging stations at NU facilities.

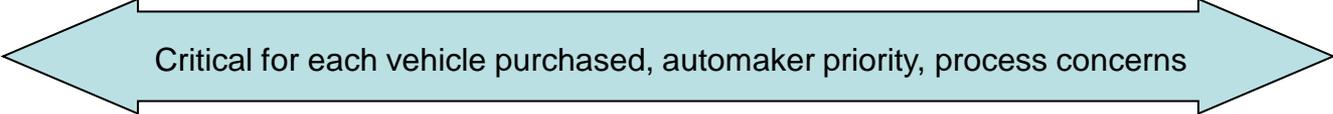
- > Pursuing a comprehensive & multi-phase utility research program.
 - > Current research project focused on away-from-home charging
 - > Future pilot testing to include residential charging
 - > Proposed study of charging in large metropolitan area (w/NStar)

What exactly is broad market adoption of EVs and why is it important?

- > NGVs and prior EV launches never moved past Innovator / Early Adopter stages
- > EVs have captured the attention of innovators and early adopters
- > However, mass market acceptance of electric vehicles will be necessary in achieving greenhouse gas and petroleum reduction goals associated with the technology

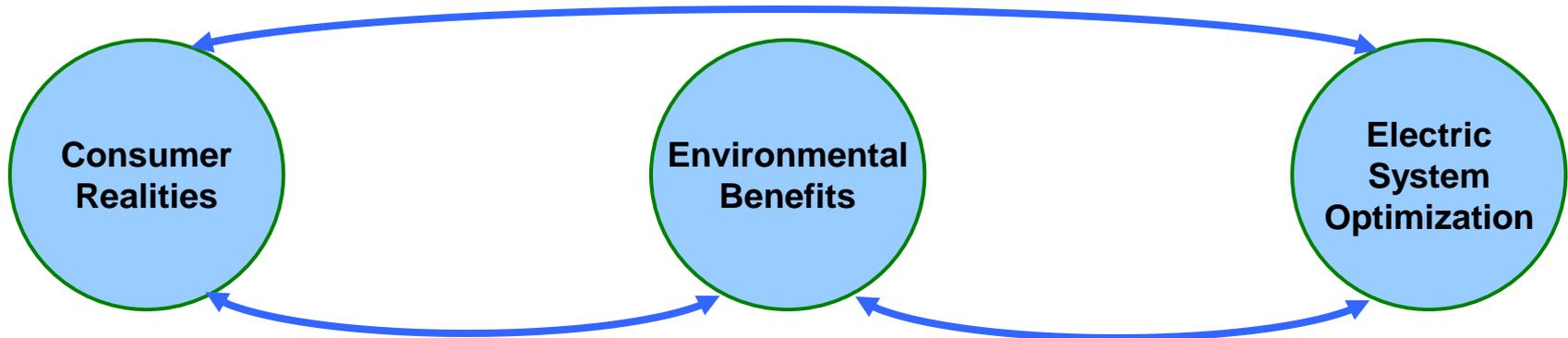


Perspectives on electric vehicle market over time

	Now (2010-2011)	Soon (2012-2014)	Future (2015 or later)
Vehicles in NE	Niche customers, Limited EV supply (~500-1,000 cars)	“Green” customers, Vehicle cost premium may impact adoption (~5,000 cars / yr)	Mass Markets?, Sustainable & sizable market? (10,000 – 20,000 cars / yr)
Home Charging Infrastructure	 <p>Critical for each vehicle purchased, automaker priority, process concerns</p>		
Public Charging Infrastructure	Some amount for EV awareness but limited due to number of cars	Additional locations, lessons learned	Uncertain need (# of locations, utilization), business model (financial viability) and standards
Charging Equipment	Buzz, federal grants in select markets (suppliers are framing policy dialogue)	Competition among multiple suppliers	Commodity pricing

The synergy of plug-in vehicle recharging: Overnight recharging

Recharging overnight is the common denominator



Consumer Realities

- > Daily driving is typically less than 40 miles total
- > Parked for hours while you sleep

Environmental Benefits

- > Plug-in vehicles have low emissions
- > The emissions profile of electricity generation varies by region, time-of-day and season (New England is cleaner than average)

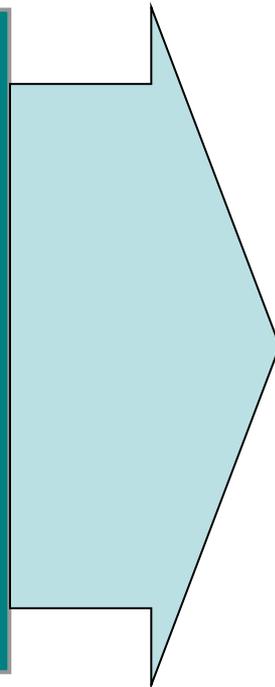
Electric System Optimization

- > Given the existing infrastructure, only the last 20 feet need to be built
- > Capacity exists on the utility system in overnight periods
- > Plug-in vehicle recharging can reduce electric rates if done right (broader cost allocation)

Moving from concept to implementation: Fundamentals of PEV recharging

Fundamentals

- **Optimizing the use of the existing utility system and the value proposition to consumers**
- **Cost and location of infrastructure matched to consumer needs**
- **Environmental policies related to PEV recharging**



Future Opportunities

- **Mainstream consumer adoption of vehicles (most important)**
- **V2G or other grid services**
- **Battery swapping**
- **Pathway recharging (e.g., highway stops)**
- **etc..**

The time is now to address the fundamentals of PEV infrastructure. The “go fast” proponents and other future opportunities are relying on this work being done.

Environmental Policy Fundamentals: Securing the environmental benefits

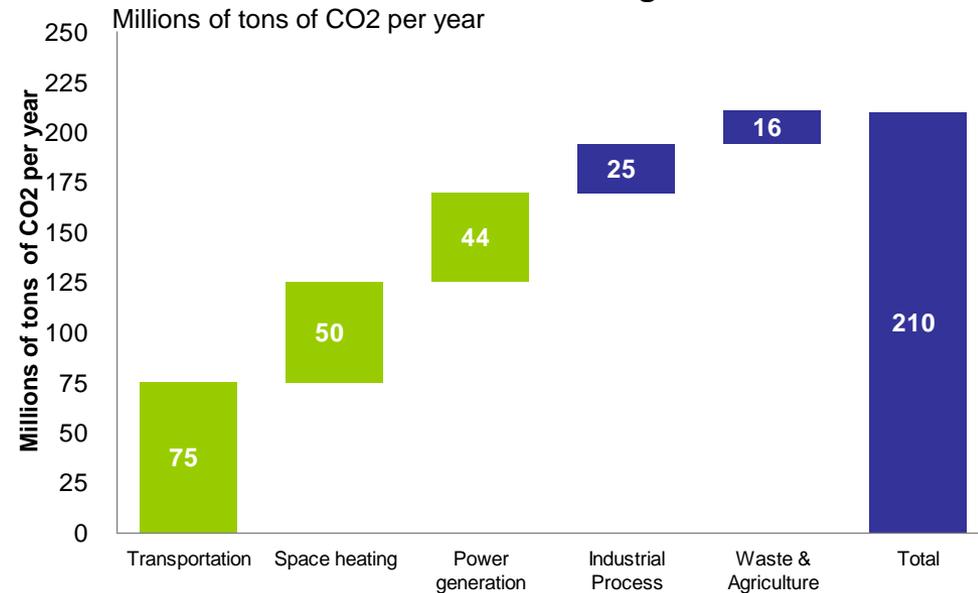
#1 – Transportation policies

- › Low Carbon Fuel Standards (in development) will create market-based incentives for low-impact alternative fuels in the transportation sector.

#2 – Policy coordination

- › Many programs could be involved in plug-in vehicles.
 - › Renewable Portfolio Standards (RPS)
 - › Regional Greenhouse Gas Initiative (RGGI)
 - › Zero Emission Vehicle mandates (ZEV)
 - › Corporate Average Fuel Economy standards (CAFÉ)
- › Opportunities to evolve existing policies, such as RPS, to benefit the PEV industry and consumers.
- › Coordination of sector specific programs, being sensitive to secondary impacts that come from the sector shift in emissions.
- › Incentives need visibility of benefiting consumers.

2005 Carbon Emissions in New England



Source: Environment Northeast and NU analysis.

Utility Fundamentals: Optimizing existing utility investments

#1 - Capacity of chargers

- › Lower capacity chargers (1.4kW and 3.3kW) are not likely to cause significant utility impacts. However, the placement of the high capacity (10kW and above) chargers in residential locations is likely to impact the utility system.
- › Ratemaking policy for distribution upgrades associated PEV recharging and utility demand charges may need to address high capacity charging locations.

#2- Metering & 'Smart' charging

- › Metering approaches defined (submeter, facility meter, etc.)
- › Off-peak recharging approach needs to be tested: Information based with price signals to consumers (TOU rates) or “centrally controlled”
- › Time-of-use rates for just the vehicle or whole house

#3 – Interoperability

- › The franchise utility can't interface with multiple 'closed' systems. 'Open' systems based on common standards needed.

#4 – Utility notification of charging locations

- › Utilities can accommodate if we know when and where.

#5 – Consumer protection

- › Important to preserve the fuel cost advantage of electric vehicles for consumers, given the high first cost of the vehicles and various recharging issues.

Recharging Fundamentals: Supporting the natural driving patterns of consumers

#1 – Home-based recharging

- › Industry consensus on the importance of home-based recharging
- › Now addressing permitting, safety and cost issues

#2 – Multi-dwelling unit recharging

- › Infrastructure to support drivers who do not have control of the property they park at every night (apartments, condos, etc.)

#3 – Drivers without garages

- › Highly urbanized areas face unique challenges because they may not park in the same space every night

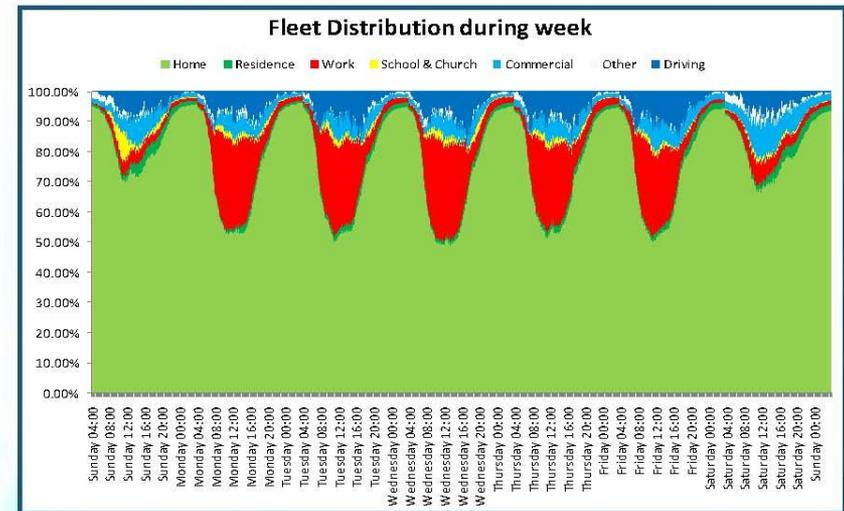
#4 – Businesses

- › Many 'early adopter' businesses are deploying infrastructure for the benefit of their customers and employees

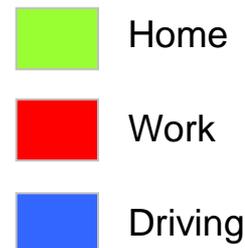
#5 – Pathway and Public recharging

- › The speed and convenience of the “fast options” vis-à-vis gasoline stations may never converge
- › Other approaches may also solve the range issue (car sharing, car moving services, portable recharging, etc.)

Where Are the Cars?



Source of Data - 2001 National Household Travel Survey ; GM Data Analysis (Tate/Savagian) - SAE paper 2009-01-1311



Recharging Fundamentals: Understanding the relative infrastructure costs and benefits

Center of public dialogue (newsmakers)

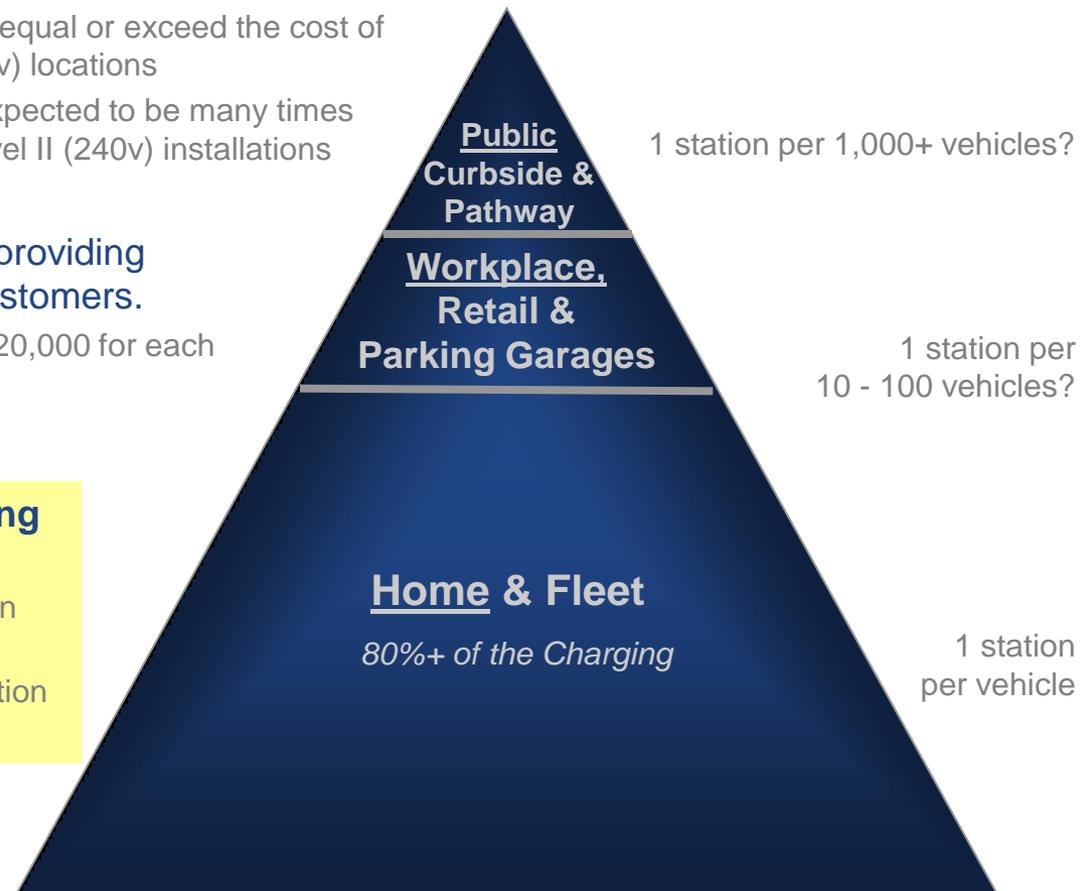
- › Level II (240v) cost to equal or exceed the cost of business Level II (240v) locations
- › Fast DC recharging expected to be many times greater the cost of Level II (240v) installations

Many businesses have an interest in providing charging station availability to their customers.

- › Our experience indicates \$10,000 to \$20,000 for each Level II (240v) station

Home installations are required for recharging and are the least cost

- › Level 1 (120v) recharging outlets may already be in place
- › Automaker programs plan around \$2,000 per location for Level II (240v) installations



Common ground: Overnight recharging is the cornerstone of advancing plug-in electric vehicles

- > The overall economics for consumers will be a significantly influence vehicle adoption
 - › The first cost of the vehicles is currently a hurdle, which the infrastructure side can't change
 - › Fuel cost savings will be a significant motivation for consumers to buy plug-in vehicles
 - › Some recharging approaches may increase electricity prices to plug-in electric vehicle drivers, mute price signals and pose interoperability hurdles
- > Take advantage of the room on the utility system (overnight low demand) to accommodate plug-in electric vehicle recharging.
 - › Matches up well with consumer driving patterns, infrastructure costs are lower, coincides with periods of lower generation emission rates
 - › Benefits customers since utility system is optimized
- > Beyond the fundamentals, recognize that longer-term decisions and 'go fast' desires should be guided by the lessons yet to be learned in the next few critical years.



Next Steps



- > Pursuing a comprehensive & multi-phase utility research program.
 - > Current research project focused on away-from-home charging
 - > Future pilot testing to include residential charging
 - > Proposed study of charging in large metropolitan area (w/NStar)
- > Work with us on the testing and data gathering. Meters will track charging station usage and help inform local, state and regional decisions.
- > Inter-related regulatory and legislative progress is needed to ensure the fundamentals are in place.