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EV Charging Infrastructure: Beyond Niche to Mainstream

Connecticut Electric Vehicles Infrastructure Council

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Regulatory Process Perspectives

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Connecticut Light & Power

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Agenda

CL&P Vision and Roadmap

- EVIC's Draft Report proposes a goal of 50,000 electric vehicles (EVs) on the road in Connecticut by 2020
  - The proposed goal is intended to approach mass market adoption
- CL&P's goal is to take steps to make EVs a mainstream transportation option and not simply a niche technology
  - Regulated electricity pricing creates savings to offset cost premium of new EVs
  - Utilities have a role in developing low-cost universal access charging infrastructure to achieve this mainstreaming goal
- CL&P's recommended actions
  - DPUC docket to fully address the regulatory issues associated with EV charging
  - Regulatory support of utility research projects
  - Other recommendations

Supporting Perspectives

- Will the utility system support adoption of EVs?
- Do we need to establish new electric rates for EVs?
- What is California doing and what are the key issues there?
- What could the "Utility EV Service Option" look like?
- What is the role of 3rd party infrastructure providers?
- Are manufacturers of charging station equipment aligning their pricing with market needs?
- What are the options to manage billing for away-from-home charging stations?
- What would be the purpose of a second meter?

Other EV References

- Why is mass market adoption important?
- How big an impact will EVs make on CO2 emissions?
- Where will consumers want to charge their cars?

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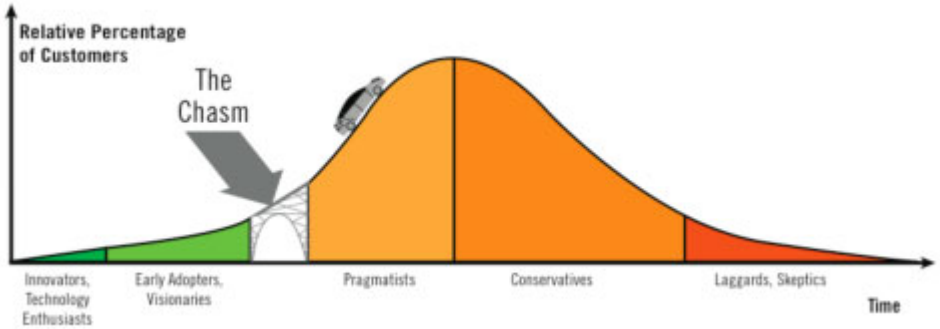
CL&P's goal is to take steps to make EVs a mainstream transportation option and not simply a niche technology

- The proposed goal of 50,000 EVs by 2020 puts Connecticut on the path to reaching mass market adoption
- EVs have captured the attention of innovators and early adopters



- However, mass market acceptance of electric vehicles will be necessary in order to achieve greenhouse gas and petroleum reduction goals associated with the technology
- NGVs and prior EV launches never moved past innovator / early adopter stages
- To move beyond niche markets, the automobiles and charging infrastructure together must successfully address consumer needs
- Getting the fundamentals correct is especially important in the early stages of this market

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Why are energy cost savings important to reaching mass market adoption?

Connecticut's per capital expenditures on gasoline and diesel equal

$1,752 per year

Sources:
http://www.eia.doe.gov/emeu/states/sep_fuel/html/pdf/fuel_mg.pdf
EIA Table F1: Motor Gasoline Consumption, Price, and Expenditure Estimates by Sector, 2008

http://www.eia.doe.gov/emeu/states/sep_fuel/html/pdf/fuel_pr_df.pdf
EIA Table F4b: Distillate Fuel Oil Price and Expenditure by Sector, 2008

http://quickfacts.census.gov/qfd/states/09000.html
U.S. Census Bureau Quickfacts

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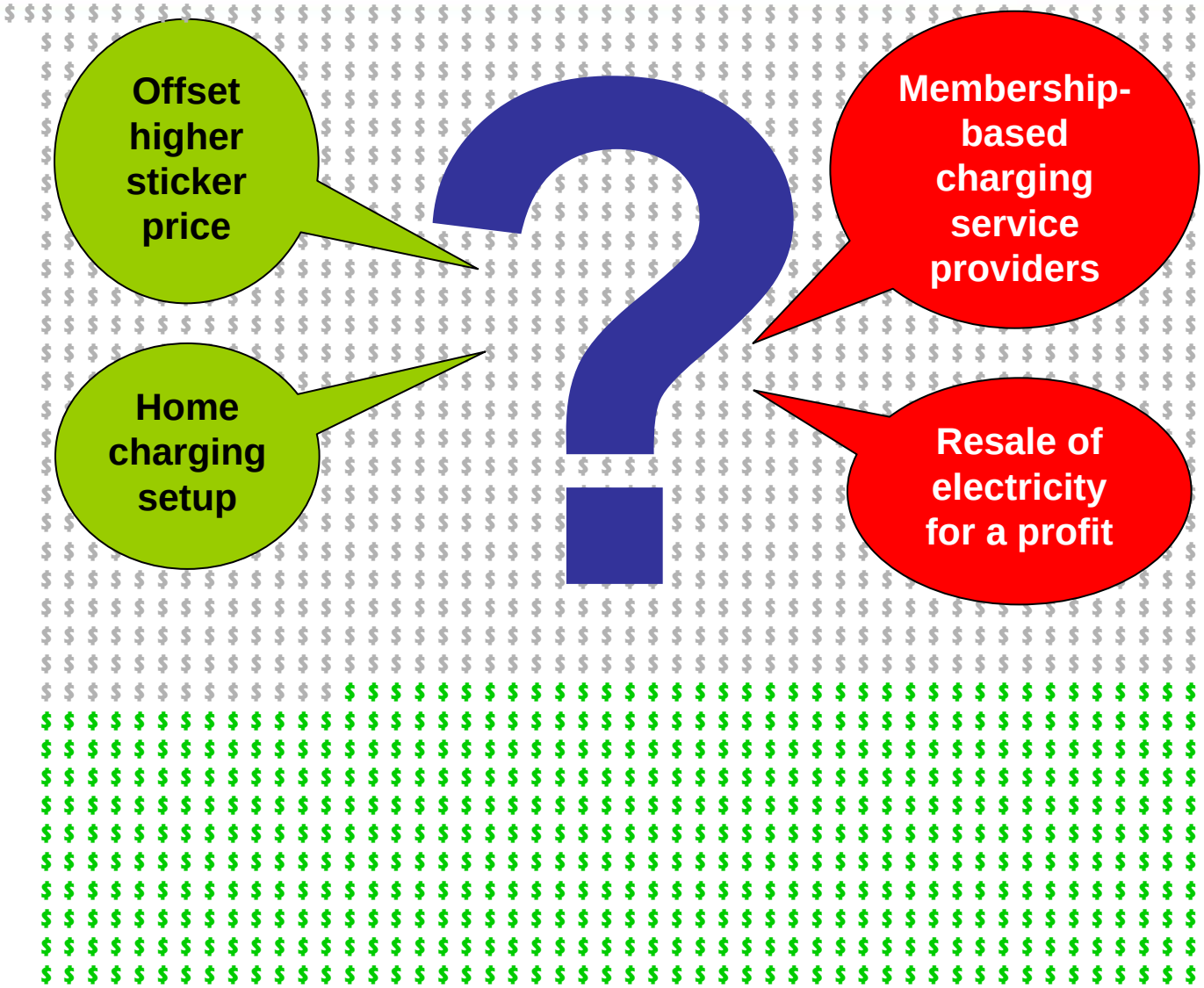
Where will the savings go?
Customers should be rewarded for choosing an EV



Owning an EV can save its owner over $1,200 per year in fuel savings…

Will the market allow these savings to pass through to the consumer?

Assumptions:
For transportation - 1 gallon of gasoline converts to 5.5 kWh of electric (25 MPG car & 4.55 kWh per mile car)

Rate 1 - 17.1033 ¢/kwh marginal price of electricity

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Mainstreaming EVs: A 5-point policy platform

Fair and Transparent Pricing

Consumer protections will ensure fair and transparent pricing of public charging services

- Regulated electricity pricing creates savings to offset cost premium of new EVs
- This isn't a market until the market is more evolved, and it won't evolve without fair and transparent regulated pricing
- 3rd party EV service providers will likely resist providing transparent electric pricing unless mandated to do so

Open Standards and Universal Access

Consumers deserve open standards and universal access

- Proprietary networks alone would inhibit market development and limit consumer convenience for travel beyond local borders
- Infrastructure should follow regulated utility universal access principles

Utility EV Service Option

The "Utility EV Service Option" is an important component of the drivers' charging network

- Utility-linked charging stations will help the market develop and move toward mainstream consumer acceptance
- Utility-based pricing provides market discipline and establishes baseline pricing for consumer fuel savings

Phased-in Investments

Investments in infrastructure should be phased in over time

- Infrastructure should be appropriately sized to keep pace with the timing and number of vehicles projected to be on the road (not too many charging locations and not too few)

Funding From CO2 Programs

Programs developed to support greenhouse gas reduction goals should be a key funding source for the deployment of charging stations

- Policies like the Low Carbon Fuel Standard should be structured to help partially fund the network of charging stations

CL&P's recommended actions

- Establish a DPUC regulatory docket to address the following:
  - Market oversight
  - Rate design policy to maximize overnight charging behaviors (deep off-peak, incentives, etc.)
  - Work toward mutual agreement for shared cost-recovery policy (pilots and roll-out)
  - Determine metering requirements

- Proceed with a 3-stage utility-supported charging station deployment plan
  - CL&P Research Project (next 6 to 8 months)
  - CL&P Pilot Program (8 to 12 months)
  - Collaborative roll-out of "Utility EV Service Option" (12+ months)
  - Periodic assessment of utility role (ongoing)

- Consider legislative initiatives to provide incentives to support early market progress
  - Legislation can keep pace with the level of consumer interest

- Seek financial support for EV charging stations in the model rule development of the Low Carbon Fuel Standard and other petroleum reduction and greenhouse gas reduction programs

EV charging services and mass market potential call for DPUC oversight to ensure benefits go to customers

Taking the time to get it right now will avoid problems later and minimize consumer confusion

- Low Cost Energy
- Low Cost Equipment
- Access to Stations
- Easy-to-use Stations
- Reliability of Stations
- Safety of Stations

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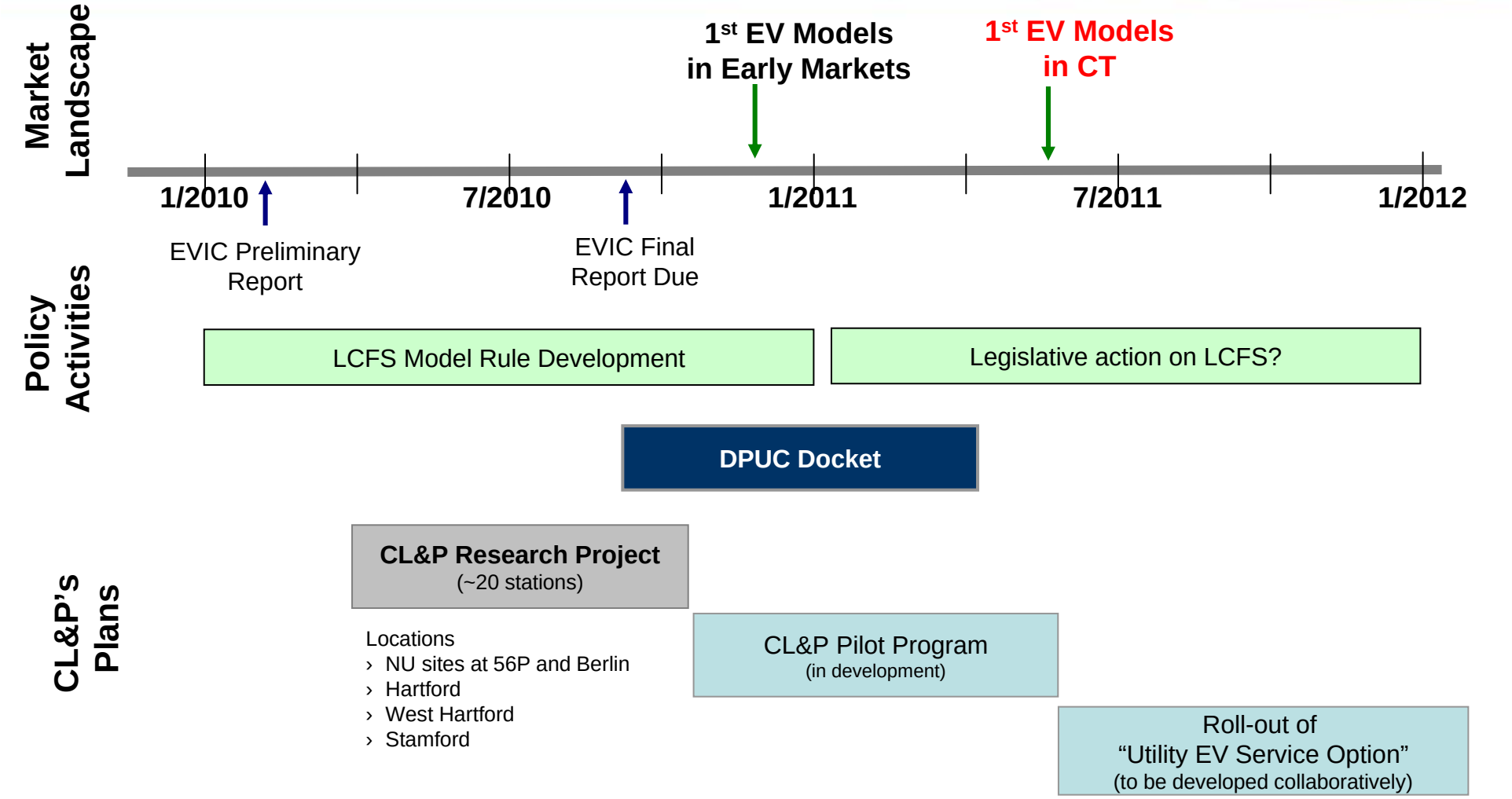
Immediate focus areas for DPUC Docket

- Near-term needs
  - Ensure benefits go to customers
  - Rate design
    - Time-of-use rates to shape EV owner's preference for overnight charging
    - Smart charging can be enabled by AMI
  - New treatment of 3rd party intermediaries that provide charging station infrastructure on sites owned by others
  - Treatment at multi-family locations; new meter, sub-metering (with "Average Cost" provisions) or unmetered (with pricing guidelines)

- Work toward mutual agreement for shared cost-recovery policy
  - Research and Pilot projects – necessary to gain practical experience at a variety of location types
  - Utility EV Service Option – explore, test and determine funding model

- Evaluate options to avoid installing a second meter
  - Additional cost would need to be justified by LCFS funding or isolated rate

Automakers' timing now sets the pace of getting "Plug-in Ready"– Initiatives should be staged for mid-2011 EV arrivals in CT



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Supporting Perspectives

- **Will the utility system support adoption of EVs?**
- **Do we need to establish new electric rates for EVs?**
- **What is California doing and what are the key issues there?**
- **What could the "Utility EV Service Option" look like and what is the purpose of it?**
- **What is the role of 3rd party infrastructure providers?**
- **Are manufacturers of charging station equipment aligning their pricing with market needs?**
- **What are the options to manage billing for away-from-home charging stations?**
- **What would be the purpose of a second meter?**

Will the utility system support adoption of EVs?

- The 2010 Integrated Resource Plan reports “Even an optimistic view of PEV penetration in New England over the next two decades is unlikely to pose any unmanageable issues for maintaining reliable electric service.”
  - Rule of thumb: A 5% penetration rate of EVs increases total kWh volume by less than 1%.

- For impacts on the local distribution system, CL&P’s Transformer Load Management program will address customer electrical demands on distribution transformers.

- Further technical data will be available soon from EPRI’s Distribution Impact Study customized for CL&P.

- Smart Meters / AMI functionality is not required for the early stages of EV market development.
  - Over time, both EVs and Smart Meters / AMI will become prevalent and have a symbiotic relationship.

Do we need to establish new electric rates for EVs?

- This issue doesn't have the same urgency here as it does in California
  - California has inclining block pricing; the marginal rate for EV charging can be above 40¢ / kWh
- CL&P has experience implementing Time-of-Use Rates to provide price differentials between on- and off-peak energy, but current rates may not be optimal for EV charging
- Additional rate options are worth exploring
  - "Deep" off-peak pricing, with new choices available through AMI development?
  - "EV only" rate separate from home rate?
  - Potential rate incentives to customers commensurate with / in lieu of direct tax credits to EV owners?
    - Effectively drives desired consumer charging habits
    - CL&P would need cost-recovery mechanisms to be in place

What is California doing?

In 2009, the California PUC released a white paper to serve as a preliminary scoping tool and elicit stakeholder input on potential policies that might support vehicle electrification.

CPUC TIMELINE	
May 2009	CPUC releases comprehensive White Paper on Electric Vehicles (and then asks relevant 3rd parties to comment)
June/July 2009	3rd Party Comments to the White Paper are submitted
August 2009	CPUC issues Order Instituting Rulemaking (OIR) to consider alternative-fueled vehicle tariffs, infrastructure needs (and policies to support California's greenhouse gas emissions reduction goals).
October/November	3rd Party Comments to the OIR (more than 20 parties commented)
January 2010	CPUC issues a "Scoping Memo" developing a procedural schedule for a ruling and establishes Phase 1 and Phase 2. Phase 1 covers: Charging Installation Streamlining, the question of whether Charging Stations should be regulated, and a review of the capital costs for EV related infrastructure needs. Phase 2 covers: Rate Design Policy and Direct Charging Management, Separate Metering for Electric Vehicles, and Utility Cost Recovery Policy
Februaury 2010	3rd party initial comments to the Scoping Memo
March 2010	3rd party reply briefs (lengthy comments) for Phase 1 due
April 2010	Estimated Date for Phase 1 Decision
TBD 2010	Date for Phase 2 Decision

What are the key issues in California?

- The California PUC "Scoping Memo" issued in January 2010 identified the most pressing issues needing immediate attention, set forth in two phases.

- Phase 1's comment period concludes March 2010 and covers:
  - Streamlining of home (240V) plug installations
  - Determination of commission regulatory authority over charging stations and 3rd party providers
  - A request that utilities shed light on what the capital costs associated EV build-out are likely to be (and how might those expenses might be recovered from ratepayers)
  - A decision from the commission regarding Phase 1 is expected in April

- Phase 2 will also cover a number of critical issues:
  - Rate Design Policy and Direct Charging Management
  - Separate Metering for Electric Vehicles
  - Utility Cost Recovery Policy

- **The Scoping Memo suggests that "the commission would not have regulatory authority regarding the price that an electric vehicle charging facility operator charges for charging services or other aspects of the operation of such facilities."**
  - **NU disagrees and believes that cost-of-service principles are important for EV charging.**

Reference: http://docs.cpuc.ca.gov/efile/RULC/112302.pdf

What could the “Utility EV Service Option” look like?

Utility EV Service Option

On Premise Wiring

- Installed by electrical contractor selected by customer
- Customer responsible for wiring costs
- Potential to integrate with CL&P-supported financing program if appropriate

Electric Vehicle Supply Equipment (EVSE)

- CL&P provided or approved EVSE
- Possible inclusion in rate base or new tariff class
- Available to residential, multi-family, commercial, industrial and public customers
- Optional Smart card / Parktel system where required

AMI / Smart Charging communications

Optional vehicle communications

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What is the purpose of the “Utility EV Service Option?”

- Lowers consumer financial hurdle to get charging equipment installed
- Utility will be able to pursue volume purchase of Electric Vehicle Supply Equipment (EVSEs) at better prices than individual customers
- Approach to better ensure EVSEs have the capability to interact with AMI meters
- Minimal rate base impact for significant consumer impact (guestimate of $5-10 million for 50,000+ EVSEs over 10 years)
- Utility’s involvement with EVSEs helps with longer-term system planning issues

What is the role of 3rd party infrastructure providers?

Electric Service

Charging Station
(private, utility, municipal or 3rd party)

Vehicle Owner

New businesses are interested in providing 3rd party charging stations for a fee to consumers

- The business model attempts to capture the economic advantage electricity has over gasoline
- The 3rd party provider would be reselling electricity, using different pricing schemes (bundling and/or subscription model)

Industry support of the 3rd party business model varies

- Automakers are seeking out utilities and not 3rd party infrastructure providers
- There is uncertainty about the regulatory status of 3rd party infrastructure providers

What happens to customer savings with 3rd party infrastructure providers?

The high profit margin being sought by 3rd party infrastructure providers means less savings for consumers.

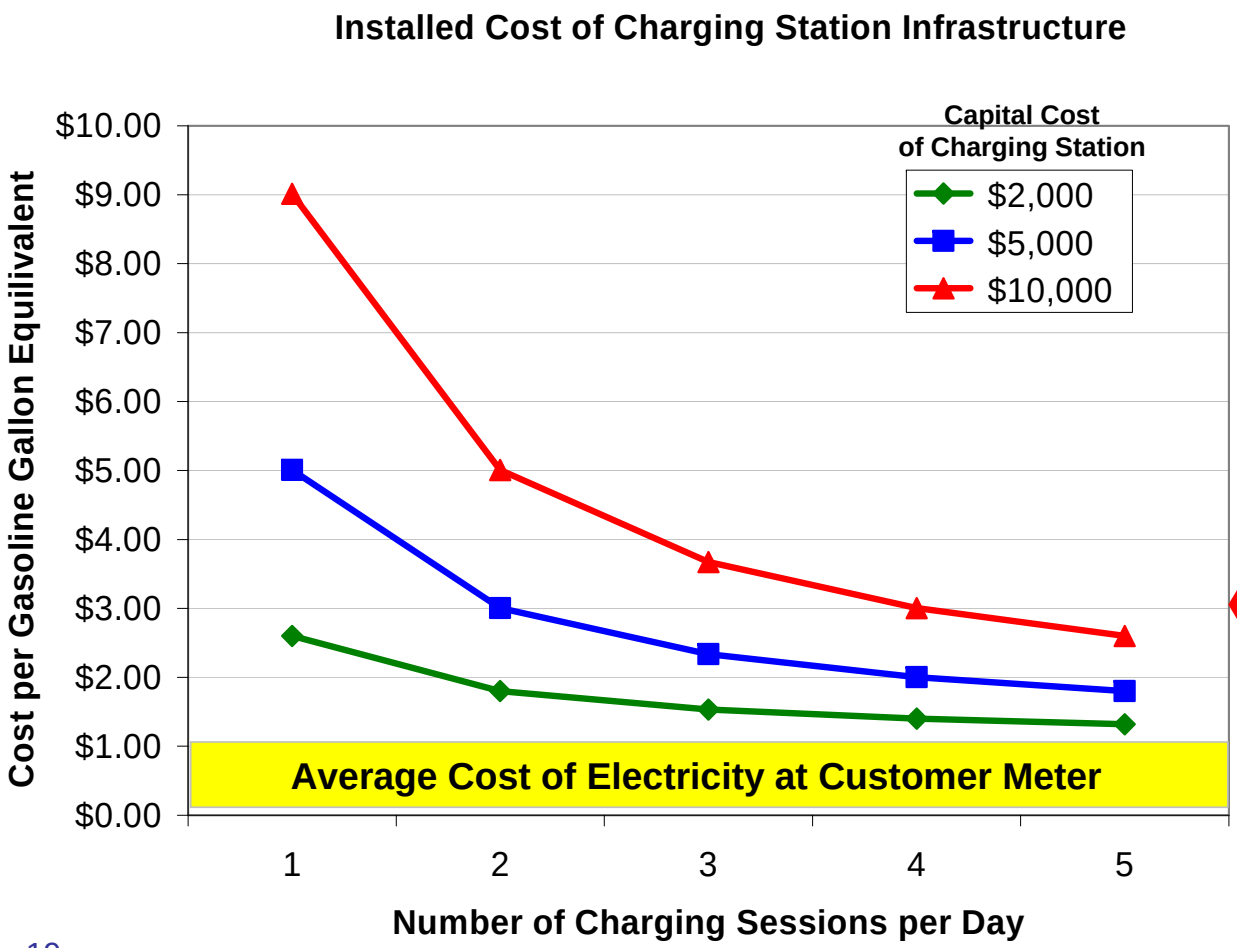
A news report quoted the founder and CEO of a global charging service provider as follows
http://www.haaretz.com/hasen/spages/1146359.html

" We can get to that market share with profit margins of 40% to 50%."

"I buy a battery and electricity, and I sell kilometers. On the way I've laid a lot of infrastructure in order to translate one into the other .... And my profit margins are constantly improving and eventually become very large because batteries keep getting cheaper and electricity keeps getting cheaper, while the price of a kilometer increases since there isn't much cheap fuel left in the world."

Are manufacturers of charging station equipment aligning their pricing with market needs?

Not yet. At current prices, charging equipment is twice the price of electricity and would result in an all-in cost of charging your EV that equates to buying gasoline at $9/gallon.



Assumptions

- Infrastructure provider seeks to recover all costs of infrastructure
- 20¢ per kWh electricity
- 6 kWh per charging session
- 5 days per week
- 25% annual carrying cost (return on capital - 10%, debt service, O&M, taxes, etc.)
- 5 kWh per mile EV applied to 25MPG gasoline vehicle

Consumer "Reference Price"
(the price of the gasoline alternative)

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What are the options to manage billing for away-from-home charging stations?

Smart Cards and Cell Phones appear to meet the need for low-cost implementation, ease of use and open access requirements.

Smart Cards

Cell Phones

Patent Pending

Utilities will need regulatory approval in order to accept these alternative payment mechanisms.

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What would be the purpose of a second meter?

Advantages of a second meter

- Provides quantifiable data to accurately determine vehicle emission reductions
- Captures usage for future discussion of excise taxes on motor vehicle fuels
- Potentially enables innovative rate design (off-peak, deep off-peak, incentive rates)

Disadvantages of a second meter

- Added cost (to consumers, utilities, and O&M)
- Potentially adds time to installation process
- Potential aesthetic concerns associated with multiple meters
- Can utilize time-of-use meters instead in the interim

Other EV References

- **Why is mass market adoption important?**
- **How big an impact will EVs make on CO_2 emissions?**
- **Where will consumers want to charge their cars?**

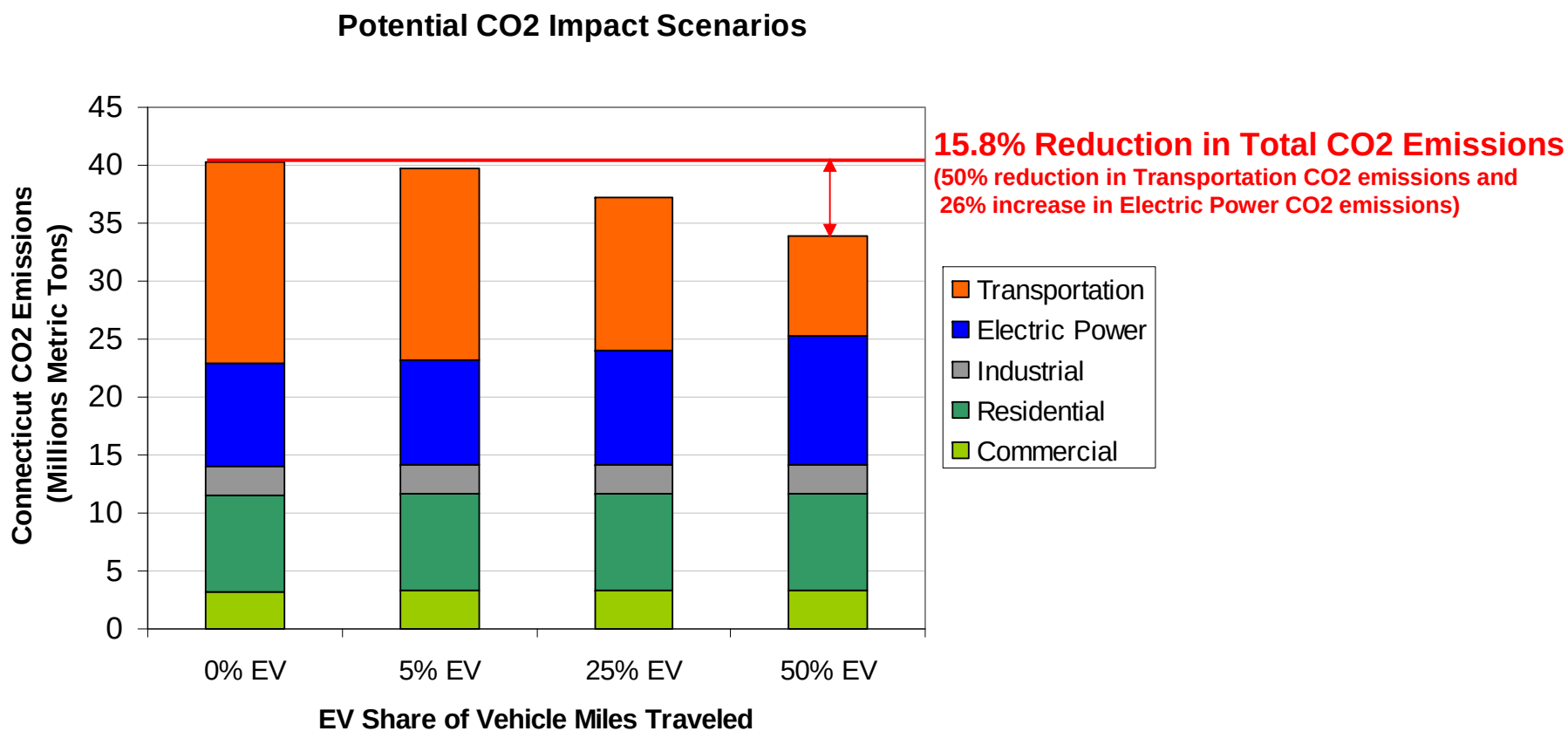
Why is mass market adoption important?

- CO2 reductions come only with mass market acceptance
- Petroleum reductions come only with mass market acceptance
- More consumers will have lower fuel costs
- Economies of scale for automakers and battery manufacturers result in lower retail prices
- Opportunities for green jobs are likely with new transportation paradigm

According to market research firm GfK Group "Americans' attitude towards environmentalism is shifting away from altruistic motivations towards more practical drivers such as saving money, health, getting value and promoting safety."

How big an impact will EVs make on CO2 emissions?

Significant CO2 reductions are possible for Connecticut if high penetration levels of EVs are achieved



Reference: http://www.eia.doe.gov/.../tbl_statesector.xls

Assumption: 5.3 lbs CO2 for a conventional vehicle translate to 1.4 lbs of CO2 for an EV

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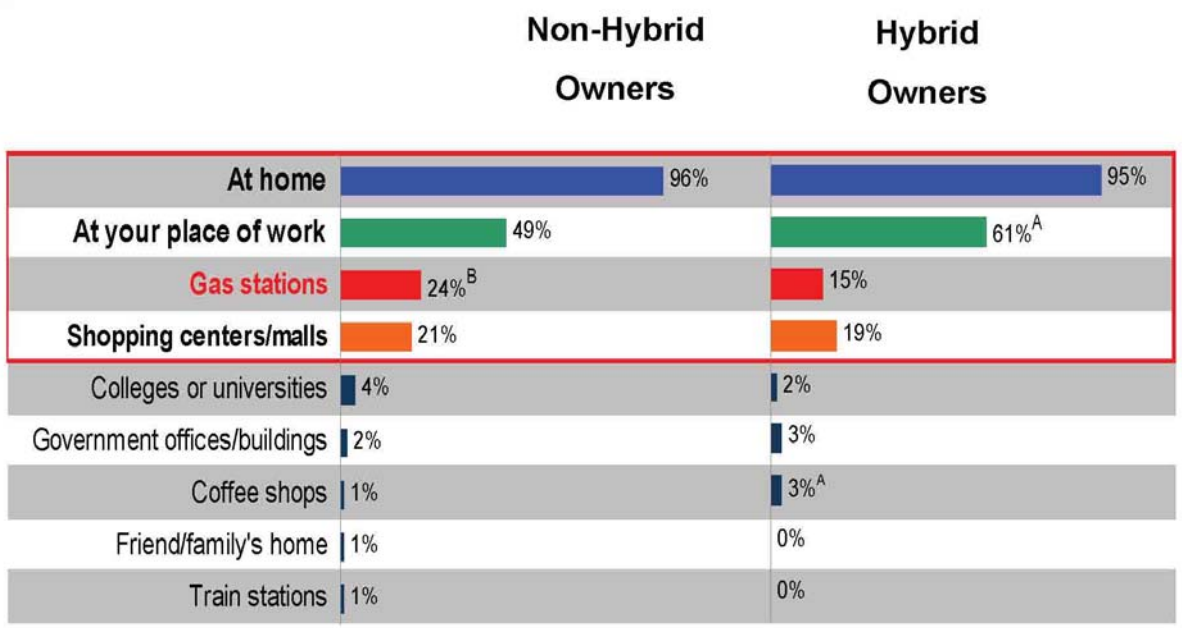
Where will consumers want to charge their cars?

Consumer Charging Preferences

Charging Location Preferences



Consumer research indicates that home and workplace charging will be the two preferred locations for EV charging.

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Source: Electric Power Research Institute and Southern California Edison

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