Public Charging Infrastructure for Plug-in Electric Vehicles: What is it worth?

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While the majority of plug-in electric vehicle (PEV) charging is expected to come from residential plugs, a network of **public chargers** provides tangible and intangible values:

- Support adopters that cannot reliably charge home/work
- Enable long-distance travel
- Cope with range anxiety (safety net)
- Build confidence in the future of the EVs

Infrastructure plays a big role in enabling/supporting EV adoption and is being supported:
- Government (e.g., CA)
- Utilities/Automakers
- EV charging companies
Research Question

What is the value of public EV charging?

We estimate the tangible value of the existence of public charging infrastructure to the consumer, apart from any charge for using it. In this sense, our estimates correspond to the economic concept of willingness to pay (WTP) in a discrete choice model.

Previous estimates of willingness to pay (WTP) based on stated preference surveys are limited by consumers’ lack of familiarity with PEVs. Instead, we focus on quantifying the tangible value of public EV chargers:

- **PHEV**: ability to displace gasoline use for PHEVs
- **BEV**: enable additional electric (e-) vehicle miles, thereby mitigating the limitations of shorter range and longer recharging time.
Approach

Simulation Analyses
- Ability to displace gasoline use for PHEVs
- Estimate e-miles enabled by public chargers (effect of chargers on e-miles, decreasing with vehicle range)

Econometric Analyses
- Estimate willingness to pay for enabled mile of travel (based on WTP for vehicle range, which also enables additional e-travel)

WTP functions
- As a function of vehicle range and charging availability
- Heterogeneity: income (marginal utility increase & value of time), annual VMT and daily distribution, charger type

Caveat: Awareness of public charging infrastructure differs from its actual availability, especially during early PEV adoption.
The tangible value of DCFC increases as charging availability increases with diminishing returns, for both intra- and inter-regional travel.

2017 CA case study: to the purchaser of a new BEV with a 100-mile range and home recharging, existing public fast chargers are worth about $1,500 for intraregional travel, and fast chargers along intercity routes are valued at over $6,500.
Conclusions

**Scope:**

Quantifying the value of public charging infrastructure is essential to weighing its benefits and costs, and predicting its impact on future PEV sales.

**Results:**

Alternative perspective to stated preference choice experiments that is grounded in detailed vehicle use data and plausible estimates of the value of an additional mile of vehicle travel.

Functions are synthesized that estimate the WTP for public charging infrastructure by PHEV and BEV, conditional on vehicle range, annual vehicle travel, pre-existing charging infrastructure, energy prices, vehicle efficiency, and household income.

**Insights:**

A 2017 California based case study indicates that, to the purchaser of a new BEV with a 100-mile range and home recharging, existing public fast chargers are worth several $1,000s.
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References:

Greene et al., “Public Charging Infrastructure for Plug-in Electric Vehicles: What is it worth?” Forthcoming
Thanks! Questions?

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The National Renewable Energy Laboratory (NREL) spearheads transportation research, development, and deployment to accelerate the widespread adoption of high-performance, low-emission, energy-efficient passenger and freight vehicles.

NREL is assessing the potential for energy diversification in transportation (CNG, biofuels, hydrogen and electrification) and related infrastructure requirements and providing technical support to national, state, and local entities to:

✓ Assess long-term electrification opportunities across different transportation segments & evaluate policy/technology scenarios for alternative fuel vehicle adoption

✓ Estimate infrastructure requirements to support vehicle electrification

✓ Understand EV charging costs (affordability) and optimize DCFC station design

✓ Explore opportunities for EV integration with buildings and the electric grid