DC FAST Charging: Who? When? Why?

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DC Fast Motivations and Modeling Approaches

Motivations:
• Long trips / corridor charging
• MUD and others without home charging
• Incidental

Modeling Approach:
• Housing Density
• Corridors long trips
• Coverage
Corridor Coverage model

Charge Window Illustration

Figure 12. Interstate corridor network (thick red lines) considered in this analysis (70-mile radius red buffer approximates areas that would be served by the proposed DCFC network). Included for reference: yellow polygons represent cities, purple points represent towns, and thin black lines represent the national highway system.

(Satellite imagery credit: © 2017 Google, Map Data © 2017 Tele Atlas)

Wood et al. 2017
The charging story 2017
How often do PEV drivers charge?

Charging event per week

- L1
- L2
- DC Fast
Home Charging 2013-2017

2013 Survey
Nissan LEAF Level 2 home Charging 86%

2015 Survey
Nissan LEAF Level 2 home Charging 60%

2017 Survey
Nissan LEAF Level 2 home Charging 42%
About half have workplace charging, but is it congested?

- 56.6% Not Congested
- 13.6% 1 day per week
- 11.2% 2 days per week
- 7.1% 3 days per week
- 3.3% 4 days per week
- 8.2% always
Who is using DC Fast?

- Nissan Leaf: 67% No, 33% Yes
- Tesla Model X: 67% No, 33% Yes
- Tesla Model S: 69% No, 31% Yes
- Volkswagen e-Golf: 88% No, 12% Yes
- Chevrolet Bolt EV: 100% No
- BMW i3: 100% No
How often do drivers use DC fast?

- About 60% not using DCFC at all
- Many users did less than 2 events after signing for a provider
- 10-15% are “regular users” N>2

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<th>Mean</th>
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Days between charging events for N>2
Most usage happens near home
BEVs and Long Road Trips: It’s not about miles per day

- The longest road trip per year takes more than 5 days over 700 miles and in half the trips have more than 2 passengers in the car
- BEV households use other cars for the task
- Bigger vehicles
- AWD vehicles
- Rentals
- Or a Tesla if they have one.
Modeling DCFC
UC Davis EV Toolbox Modules

- Market tool (PEV owners home location by vehicle type)
- Workplace tool (PEV owners commute pattern and the derived demand for Charging)
- Corridor tool (estimating the demand for DC fast charging from long trips)
- Shared mobility (Adding shared mobility demand to home and work modules)
- Demand output (combined demand by location in terms of kwh and charging events)
- Charge Cost (estimating demand charges and per kwh cost per location)
Demand is a combination of all 3 sources of demand (corridor, home and work)
Graduated Demand Allocation. Potential Demand Drops Gradually with Distance with different sensitivity for home and work replacement.

- 100% of Potential Demand within 1 mile
- 50% of Potential Demand at 2 miles
- 0% of Potential Demand at 3 miles
Demand Scenario: 2025 with Low Corr. Demand for BEV 80. 1.5 Million vehicles.
Nobody goes there anymore. It's too crowded

- DCFC is being used mostly within the vehicle range
  - Not expected to change
  - Pricing has a major impact
- We don’t know who is not using the chargers
  - But we know it’s not dependable
- Multi-Use Chargers are the best way to get higher utilization rate
- Don’t yet know the impact of shared mobility
Coverage first or Dependable first?

• Can you trust the network?
  • Coverage
  • Technical Reliability
  • Congestion

Planning options:
1. Clustering vs coverage
2. Redundancy
3. Paid vs “all you can eat”
4. Consolidated report system (and reservations) in apps
Thank you

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