MID-ATLANTIC ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

DC Fast Charging

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Who is using DC Fast Chargers? once or more in the last 30 days (CA 2018)

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nissan Leaf</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td>Tesla Model X</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Tesla Model S</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Volkswagen e-Golf</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Chevrolet Bolt EV</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>BMW i3</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>
Days between charging events

<table>
<thead>
<tr>
<th></th>
<th>Leaf</th>
<th>Model S</th>
<th>RAV4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Days/Session</td>
<td>1.3</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Average Days/Session DCFC</td>
<td>14.0</td>
<td>11.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Average Days/Session L1&amp;L2</td>
<td>1.5</td>
<td>1.6</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Distance from home of DCFC charging

Leaf home distance from DCFC charging location (As the crow flies in KM)

Model S home distance from DCFC charging location (As the crow flies in KM)
Average kWh/Session and Charging Duration (minutes)

- Bolts have longer DCFC sessions compared to Tesla
- On board power electronics limits on rated kW between BEVs
Most usage happens near home

Distance Home to Charger (mi)

- Nissan Leaf 24kWh Free-Prepaid Charging
- 10-20 cents per min

Distance Home to Charger (mi)

- Nissan Leaf 24kWh Paid Charging
- 10-20 cents per min

Distance Home to Charger (mi)

- Chevrolet Bolt
- Paid Charging
- 10-20 cents per min
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

Days between charging events for N>2
DCFC demand for 200+ miles range BEVs with free charging

- 30% used the charger in the last 30 days
- With an average of once every 11 days (10% per day)
- Half of the charging event happened within 50 miles from home with enough range to get home
- 70% of those trips after charging ends at home
- Expected charging rate for paid charging 1%-3% per day.
- Expected charging for long trip (corridor charging) 0.5%
Charger Choices in San Diego

Legend

Wanted Chargers
Choice 1
- DC Fast
- Level 2
Charger Choices in San Diego

Legend

Wanted Chagers
Choice 1-2

- DC Fast
- Level 2
Charger Choices in San Diego

Legend
Wanted Chagers Choice 1-3
- DC Fast
- Level 2
Charger Choices in San Diego

Legend

Wanted Chagers
Choice 1-5

- DC Fast
- Level 2
Given Only 5 Choices, Priority is Home Area
Leaf DC fast charging Desired vs needed vs actual

Cumulative Distance Distribution of Desired, Modeled and Used Chargers by LEAF Drivers

- Desired DC Fast: Leaf Survey
- Modeled BEV 100 Choices Scaled to Frequency
- Used Chargers for Leafs
US 2 - Seattle Wenatchee Corridor
Cold day and heavy car

Average miles left

Range Scenario (Travel East)
Range Scenario (Travel East)
Elevation profile
DC Fast Charger location

Charger location
(from Seattle) | Travel East | Travel West
---|---|---
chrager 1: 40 miles | X | X
chrager 2: 60 miles | X | 
chrager 3: 90 miles | X | X
chrager 4: 120 miles | X | X
Sacramento to Bakersfield
I-5 or Hwy 99?
Charging for on a long corridor is not practical ...based on Value of time
D = 85 mile tour
Charge window on D is mile 37-64
A = 4 customers
B = 3 customers
C = 6 customers
DCFC charging demand for private use will result from none routine user

- Substitute for home charging
- Substitute for work charging
- Unexpected additional travel need
- Trips longer than vehicle range
Demand Scenario 2. 2025 with PG&E inputs.
1.5 Million vehicles With Apartment Sensitivity.
Work Charging Based on Market Scenario

Market Forecast Using Census Data

EV Planning Toolkit

- Market Tool
- Workplace Charging Tool
- DCFC Tool

ArcGIS Interface Allows You To Make Your Own Scenarios

Fast Charging - Estimates Take into Account Existing Chargers

Source: UC Davis, 2017
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Thank You!