Differences in Public Level 2 EVSE and DC Fast Charger Use Patterns

Jim Francfort

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EVSE and DCFC Data From The EV Project

• 12,356 Blink electric vehicle supply equipment (EVSE) and DC fast chargers (DCFC) stations were deployed during The EV Project.
Use Patterns Observed At Highly Utilized DCFC

• 100 DCFC stations were deployed during The EV Project
• 20 of the most highly utilized DCFC stations were examined
• The 20 DCFC stations averaged 33 charge events per week, with a range of 21 to 66 charge events per week on average
DCFC Day of Week Use – Full EV Project

- On Sundays, DCFC use was lowest
- Fridays and Saturdays had highest usage
DCFC Day of Week Use With Fees, Last 6 Months of 2013

- Fees at DCFC were introduced the last 6 months of the project
- Tuesday, Wednesday and Thursday had highest use rates
**DCFC Hourly Use - Last 3 and 6 Months of 2013**

- Fees were imposed starting last 6 months, fully imposed last 3 months
- Fees reduced usage somewhat during the last three months
- Most charging occurs 4 to 7 p.m., and around noon
DCFC Hourly Use, Last 6 Months of 2013 and EV Project Life

- Between 4 and 7 p.m. was highest use rates
- There also was a bit of an increase in use around noon
Leaf Drivers DCFC Use - Miles From Home Full EV Project

- 87% of all fast charging throughout The EV Project took place within 30 miles of the Leaf driver’s home base
- Less than 4% of all fast charging throughout The EV Project took place more than 50 miles from home
- Suggests that few Leaf drivers were willing to take a long trip while relying on DCFC events
Leaf Drivers DCFC Use - Miles From Home Last 6 Months of 2013

- Most used DCFCs were used by Leaf drivers who were an average of 17.1 miles away from their home base.
- With fees, average distance from home when DCFC charging increased to 20.7 miles.
- Significant percentage (37.9% of DCFC) still occurred within 10 miles of home.
- Charging within 30 miles of home represents 86% of all DCFC events.

![Distance from Home (miles)](chart.png)
DCFC Conclusions

• Leaf drivers used DCFC
  – When needed regardless of the day of the week
  – At consistently lower initial state of charger percentage (SOC%) than at public AC Level 2 EVSE
  – Most frequently near the end of the work day when either headed home or to ensure sufficient SOC% for other evening plans
AC Level 2 Study

- 3,100 AC Level 2 EVSE installed at publicly accessible locations
- Workplace EVSE is excluded
AC Level 2 Day of Week Usage

- Leaf drivers used AC Level 2 EVSE with less than 10% variation during the work week.
- Volt drivers had higher use rates towards the end of the work week, with Mondays 30% less than Fridays.
AC Level 2 Day of Week Usage by Leaf Drivers

- Leafs are most frequently charged at the beginning of the work day
- Above average Leaf use at lunchtime and at the end of the workday

- Suggests that Leaf drivers plug in as soon as they arrive at their public destination
AC Level 2 Day of Week Usage by Volt Drivers

- Volts are most frequently charged at the beginning of the day, but not as distinctly as Leafs
- Volt drivers charged more uniformly throughout the day (0700 to 1600)
- Drivers of both vehicles rarely initiate their away-from-home charging before 6 a.m. or after 7 p.m.
Leaf SOC At End Of AC Level 2 Charge Event

- LeafS charging to 80% SOC is most likely due to the vehicle’s full charge default being set to 80 unless drivers change it
- 76% Leafs SOC at 70% or greater at end of charge
Volts SOC At End Of AC Level 2 Charge Events

- 71% Volts SOC at 70% or greater at end of charge
SOC At Start And End of Leaf and Volt AC Level 2 Charge Events

- Although the majority of charges go to full charge, nearly half end below a full charge, supports convenience aspect of public EVSE
- 80% SOC end of charge for Leafs can be seen
AC Level 2 Conclusions

- The average battery SOC at the start of charging at public AC Level 2 EVSE was 49% for Leaf drivers and 39% for Volt drivers
- Most charging events at public AC Level 2 EVSE concluded with the battery SOC over 80%
**AC Level 2 And DCFC At Start Of Charge Events**

- Based on SOC at the start of charge events, DCFCs appear to often times be a charging destination, while AC Level 2 charging is done when convenient to a destination.

- Average SOC at the start of AC Level 2 charging at public EVSE is 49% for Leafs and 39% for Volts.

- The average Leaf SOC was 35.3% when DCFC event was initiated.
AC Level 2 And DCFC Conclusions

• AC Level 2 use occurs most often early in the work day, while DCFC use is done more frequently at the end of the work day.

• The average SOC% of the Leaf battery when a charge is initiated at an AC Level 2 EVSE is 40% higher than the average SOC% at the start of DCFC use (i.e., 49% SOC for AC Level 2 and 35% for DCFC).
Comparing Level 2 and DCFC EV Project Last Year

Number of Units Reporting data

- Level 2 EVSE 97%
- DCFC 3%

Number of Charging Events

- Level 2 EVSE 74%
- DCFC 26%

AC MWh Consumed

- Level 2 EVSE 74%
- DCFC 26%

Average kWh Consumed / Charge Event

- Level 2 EVSE 2.3 Hours
- DCFC 21 Minutes
**Nissan Leaf Charging Behaviors During Outings**

- An Outing is a trip or series of trips a PEV driver takes after leaving a private residence and before they return to the private residence.
- 1,292,310 Nissan Leaf Outings studied during The EV Project:
  - No charging events: 1,170,785 (90.6%)
  - AC Level 1 or 2 charge event: 112,700 (8.7%)
  - DCFC charge event: 8,825 (0.7%)
- Outing events were used to identify public charging infrastructure’s contribution to additional eVMT (electric Vehicle Miles Traveled).
Leaf Public Level 1 & 2 Charges & Miles per Outing

- 112,700 total Level 1 and 2 charge events
Leaf Public DCFC Charges & Miles per Outing

- 8,825 total DCFC charge events
Summary Public Charges And Miles per Outing

- DCFC clearly enables longer distances, but only for a small minority of the outings
Thank You

For additional information see:

http://avt.inl.gov