Battery Power 2012

September 18-19, 2012 (3:15-4:00 pm)
Speaker: Colin Read
Location: Hyatt Denver Tech Center, Denver, CO

Battery Power 2012, an international conference highlighting the latest developments and technologies in the battery industry, being held September 18-19, 2012 in Denver, CO. This 10th annual event features more than 40 presentations on portable, stationary and automotive battery technology, as well as battery manufacturing, materials and research & development. Topics include new battery designs, emerging technologies, battery materials, power management, charging and testing systems, battery health, as well as the latest market trends affecting the industry.

September 2012

ecotality™

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The leader in clean electric vehicle transportation.

Safe Harbor Statement

As provided by the "Safe Harbor Statement under the Private Securities Litigation Reform Act of 1995," ECOtality, Inc. cautions the audience that this presentation includes forward-looking statements. Actual results might differ materially from those projected in the forward-looking statements. Additional information concerning factors that could cause actual results to materially differ from those in the forward-looking statements in ECOtality's financial statements filed with the Securities and Exchange Commission.

Agenda

- ECOtality Overview
  - Blink Chargers
- The EV Project Introduction
- LEAF vs. Volt
- Initial macro trends
- Residential Lessons Learned
  - Installation and Permitting
  - Impacts of TOU pricing
- Commercial Lessons Learned
  - Installation and ADA
  - DC Fast Charging

ECOtality Overview

- **Unmatched market experience and insights**
  - 20 year history as leading EV consultant and fast-charger supplier
  - 12+ million miles of vehicle testing on more than 200 advanced fuel vehicles
  - 38 million miles of data collection in The EV Project to date (August 2012)
- **Largest network of EV smart chargers**
  - The EV Project (valued at ~$230M) is funding initial development of Blink Network
  - 8,500+ chargers installed as of August 2012 (~5,500 residential)
- **Intelligent and Connected Charging Solutions**
  - Most advanced EVSE currently on the market
  - Iconic design capable of branding and real time media and messaging
- **Commercial relationships with leading national retailers and restaurants**
  - Walmart, Best Buy, Kroger, Macy's, Sears, IKEA and others
- **Fast charging history for industrial and Airport GSE**
  - 6,000+ chargers installed over the 14+ years
  - 20 international airports

Blink Chargers

Level 2 Residential

Level 2 Commercial

DC Fast Charger

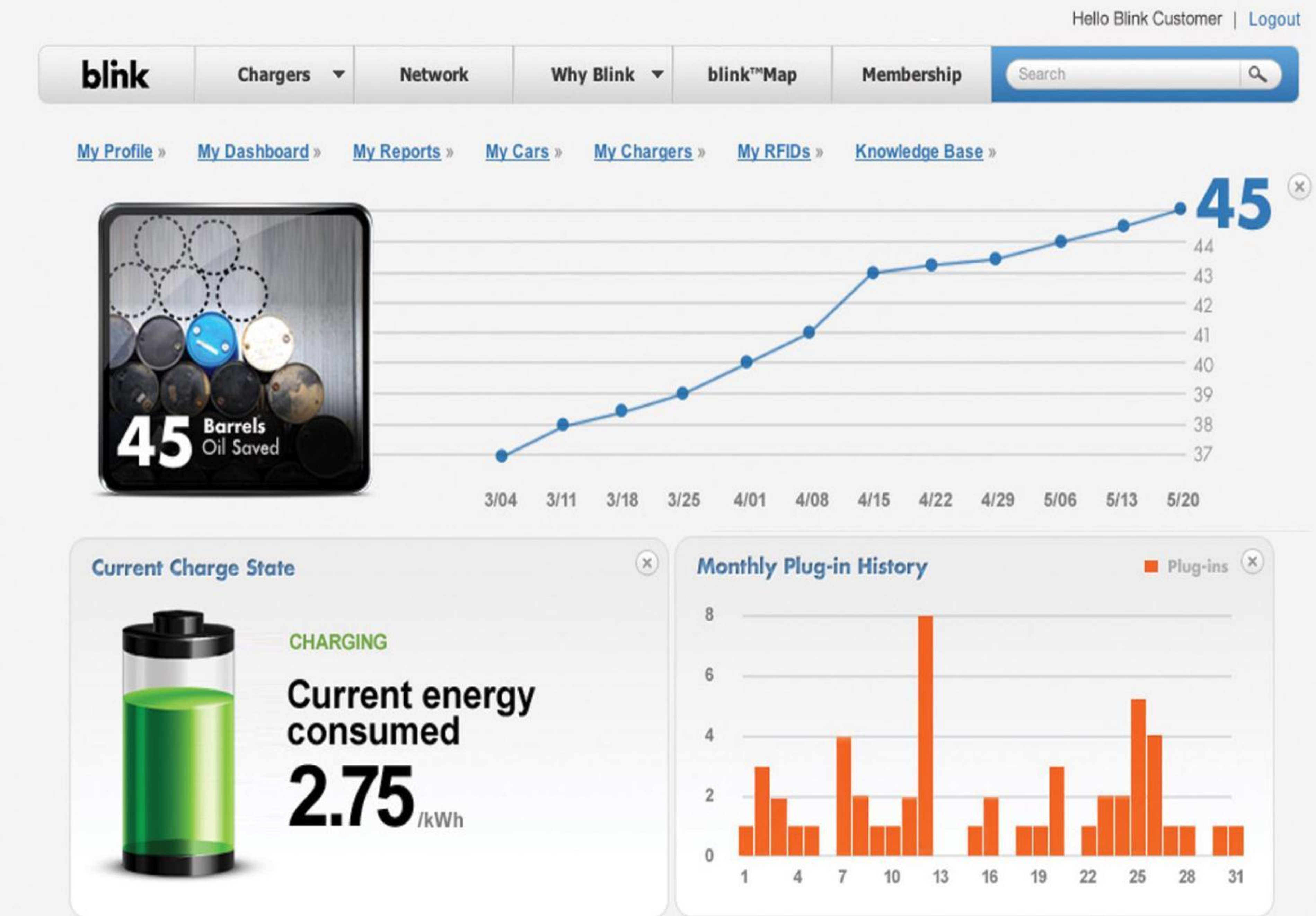
Blink Connected Chargers

Blink Level 2 & DC Fast Chargers

The Blink Network of residential and public chargers allows connectivity demanded in today's market and data consolidation for the consumer

- Smartest EVSE with internet connectivity
- Unique and convenient (installation flexibility) binary design
- Level 2 uses J1772 standard EV connector
- DC Fast Charger utilizes CHAdeMo connector
- Smart meter capability
- Touch screen interface
- Multiple modes of communications
    - Wi-Fi, cellular (CDMA), 802.15 protocol, LAN
- Blink Mobile app for locating chargers/viewing status
- Access fees for all commercial level 2 EVSE
- DC Fast Charger features a LCD Display for media & advertising

Blink End User Features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41
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39
38
37
3/04 3/11 3/18 3/25 4/01 4/08 4/15 4/22 4/29 5/06 5/13 5/20
Current Charge State
CHARGING
Current energy consumed
2.75 /kWh
Monthly Plug-in History
Plug-ins
8
6
4
2
0
1 4 7 10 13 16 19 22 25 28 31

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Chargers
Network
Why Blink
blink™Map
Membership
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My Profile »
My Dashboard »
My Reports »
My Cars »
My Chargers »
My RFIDs »
Knowledge Base »
Last Charge Summary
Total
34.2 /kWh
Started
04/01/2011 (10:53am)
Charge Time
06:12:32
12
9
6
3
0
0hrs 2 4 6 8 10 12 14 16 18 20 22
Weekly Usage Profile
MON
TUE
WED
FRI
SAT
Monday
35.3 kWh
Total
245 /kWh
Weekly Charge Hours
Hours
12
9
6
3
0
Mon Tue Wed Thu Fri Sat Sun
Location Charge History
14 Inverness Dr.
2435 Blake St.
483 Dacono Rd.
143994 Swan Dr.
14 Inverness Dr.
2435 Blake St.
483 Dacono Rd.
143994 Swan Dr.
143994 Swan Dr.
483 Dacono Rd.
Greenwood Village
E Arapahoe Rd
88
25
S Havana St

The EV Project

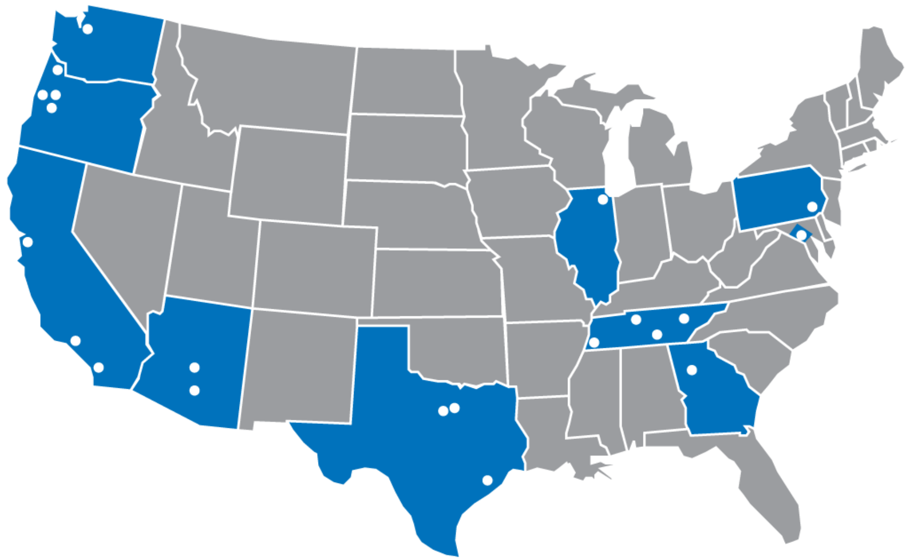
60+ EV Project Partners Include:

U.S. DEPARTMENT OF ENERGY

NISSAN

Idaho National Laboratory

Zero Emission



Washington
Seattle

Oregon
Portland
Eugene
Corvallis
Salem

California
San Francisco
Los Angeles
San Diego

Arizona
Phoenix
Tucson

Texas
Dallas
Fort Worth
Houston

Tennessee
Memphis
Nashville
Knoxville
Chattanooga

Washington, D.C.

Illinois
Chicago

Georgia
Atlanta

Pennsylvania
Philadelphia

Objectives

- Collect & analyze data on EV use
- Establish a scalable & viable infrastructure
- Pilot various revenue models

EVP Data Overview

EVP to date: February 2011 - August 2012

- 38+ million miles of data collection in The EV Project to date
  - 113,000 miles per day
  - 1.3 miles per second
- More than 1 million charge events
- Over 1.7 million gallons of gas saved
- Over 2,900 metric tons of CO2 avoided
- Over 8,080 MWh charged residentially
- Over 570 MWh charged commercially

Q2 snapshot (April 1- June 30)

- 4,963 vehicles enrolled (4,322 LEAF & 676 Volts)
- 7,086 residential & publicly EVSE

The EV Project Lessons Learned

THE EV Project

ecotality ecotality NORTH AMERICA NISSAN U.S. DEPARTMENT OF ENERGY INL

The largest deployment of EVs and charge infrastructure

home | overview | charging maps | partners | education | sign up | media | contact

EV Project Documents

PARTNER WEB LINKS

FAQs

EV PROJECT DOCUMENTS

EV Project Quarterly Reports

- EV Project EVSE and Vehicle Usage Report: 2nd Quarter 2011
- EV Project EVSE and Vehicle Usage Report: 3rd Quarter 2011
- EV Project EVSE and Vehicle Usage Report: 4th Quarter 2011
- EV Project EVSE and Vehicle Usage Report: 1st Quarter 2012
- EV Project EVSE and Vehicle Usage Report: 2nd Quarter 2012

Lessons Learned Reports

- DC Fast Charge-Demand Charge Reduction (May 2012)
- The EV Micro-Climate Planning Process (May 2012)
- Signage (April 2012)
- Greenhouse Gas (GHG) Avoidance and Fuel Cost Reduction (June 2012)
- First Responder Training (March 2011)
- Accessibility at Public EV Charging Locations (October 2011)
- Battery Electric Vehicle Driving and Charging Behavior Observed Early in The EV Project (April 2012)
- A First Look at the Impact of Electric Vehicle Charging on the Electric Grid in The EV Project (May 2012)

Presentations

- Clean Cities Webinar (June 2012)

Lessons Learned White Papers

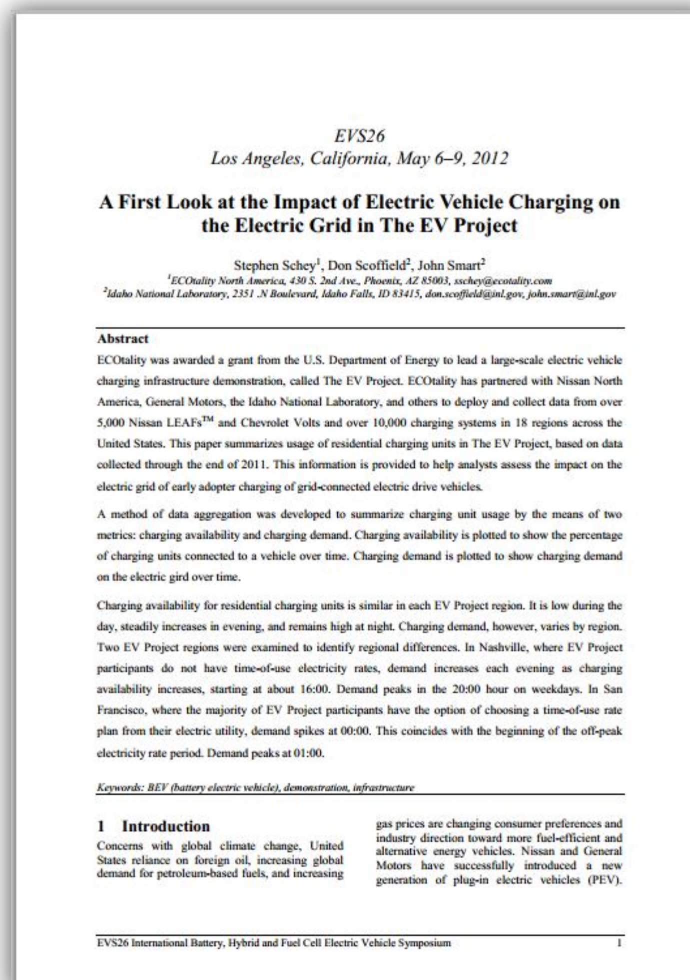
- *DC Fast Charge-Demand Charge Reduction* (May 2012)
- *The EV Micro-Climate Planning Process* (May 2012)
- *Signage* (April 2012)
- *Greenhouse Gas (GHG) Avoidance and Fuel Cost Reduction* (June 2012)
- *First Responder Training* (March 2011)
- *Accessibility at Public EV Charging Locations* (October 2011)
- *Battery Electric Vehicle Driving and Charging Behavior Observed Early in The EV Project* (April 2012)
- *A First Look at the Impact of Electric Vehicle Charging on the Electric Grid in The EV Project* (May 2012)

Lessons Learned

More to come…

- Need for Commercial Charging
- Pricing of Commercial Charging
- Residential Installation Process
- Commercial Installation Process
- EV Energy Metering
- Residential Permitting
- Commercial Permitting

www.TheEVproject.com/documents



EVS26
Los Angeles, California, May 6–9, 2012

A First Look at the Impact of Electric Vehicle Charging on the Electric Grid in The EV Project

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Abstract

ECOtality was awarded a grant from the U.S. Department of Energy to lead a large-scale electric vehicle charging infrastructure demonstration, called The EV Project. ECOtality has partnered with Nissan North America, General Motors, the Idaho National Laboratory, and others to deploy and collect data from over 5,000 Nissan LEAFs™ and Chevrolet Volts and over 10,000 charging systems in 18 regions across the United States. This paper summarizes usage of residential charging units in The EV Project, based on data collected through the end of 2011. This information is provided to help analysts assess the impact on the electric grid of early adopter charging of grid-connected electric drive vehicles.

A method of data aggregation was developed to summarize charging unit usage by the means of two metrics: charging availability and charging demand. Charging availability is plotted to show the percentage of charging units connected to a vehicle over time. Charging demand is plotted to show charging demand on the electric gird over time.

Charging availability for residential charging units is similar in each EV Project region. It is low during the day, steadily increases in evening, and remains high at night. Charging demand, however, varies by region. Two EV Project regions were examined to identify regional differences. In Nashville, where EV Project participants do not have time-of-use electricity rates, demand increases each evening as charging availability increases, starting at about 16:00. Demand peaks in the 20:00 hour on weekdays. In San Francisco, where the majority of EV Project participants have the option of choosing a time-of-use rate plan from their electric utility, demand spikes at 00:00. This coincides with the beginning of the off-peak electricity rate period. Demand peaks at 01:00.

Keywords: BEV (battery electric vehicle), demonstration, infrastructure

1 Introduction

Concerns with global climate change, United States reliance on foreign oil, increasing global demand for petroleum-based fuels, and increasing gas prices are changing consumer preferences and industry direction toward more fuel-efficient and alternative energy vehicles. Nissan and General Motors have successfully introduced a new generation of plug-in electric vehicles (PEV).

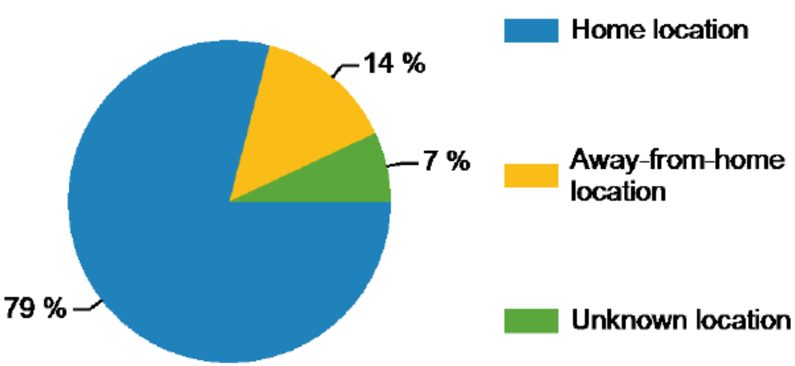
EVS26 International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium 1

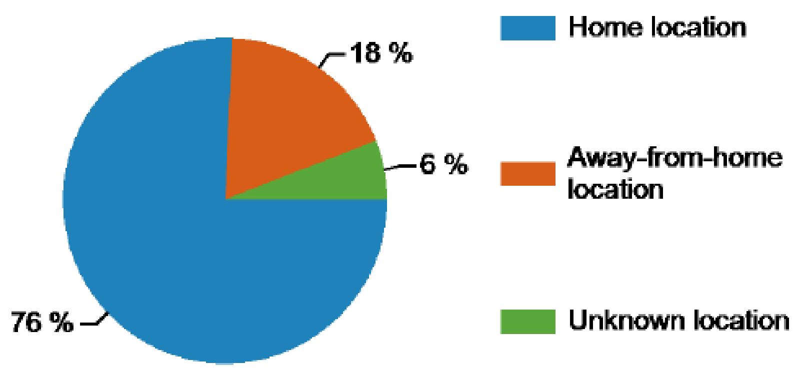
LEAF vs. Volt

Nissan LEAF vs. Chevrolet Volt

- Avg distance traveled per day (mi): 39.6
- Avg trip distance (mi): 8.0
- Avg # of trips between charging: 3.2
- Avg distance between charging (mi): 26.0
- Avg # of charging events/day: 1.5

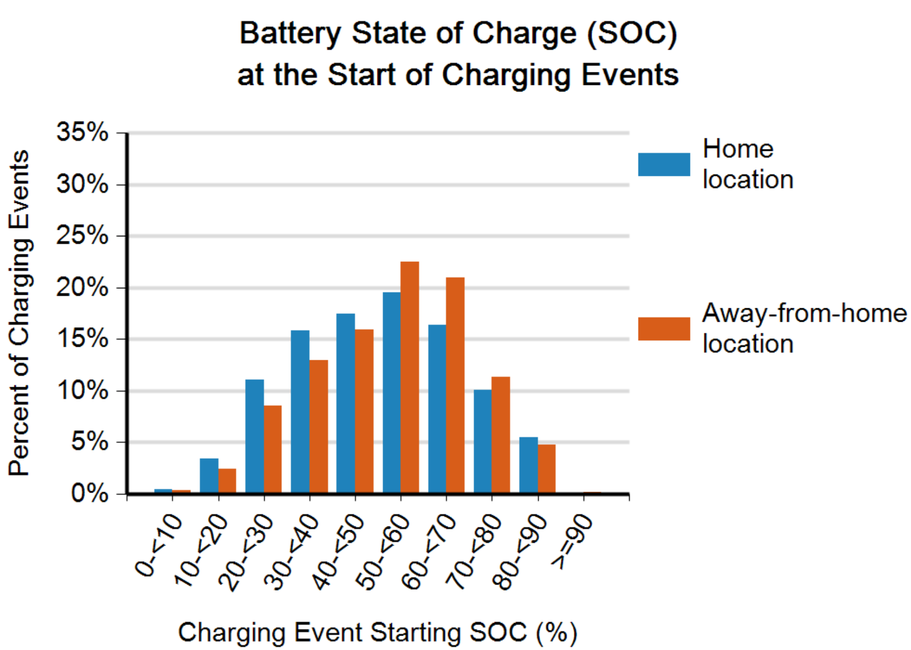
- Avg distance traveled per day (mi): 30.6
- Avg trip distance (mi): 7.2
- Avg # of trips between charging: 3.9
- Avg distance between charging (mi): 28.1
- Avg # of charging events/day: 1.1

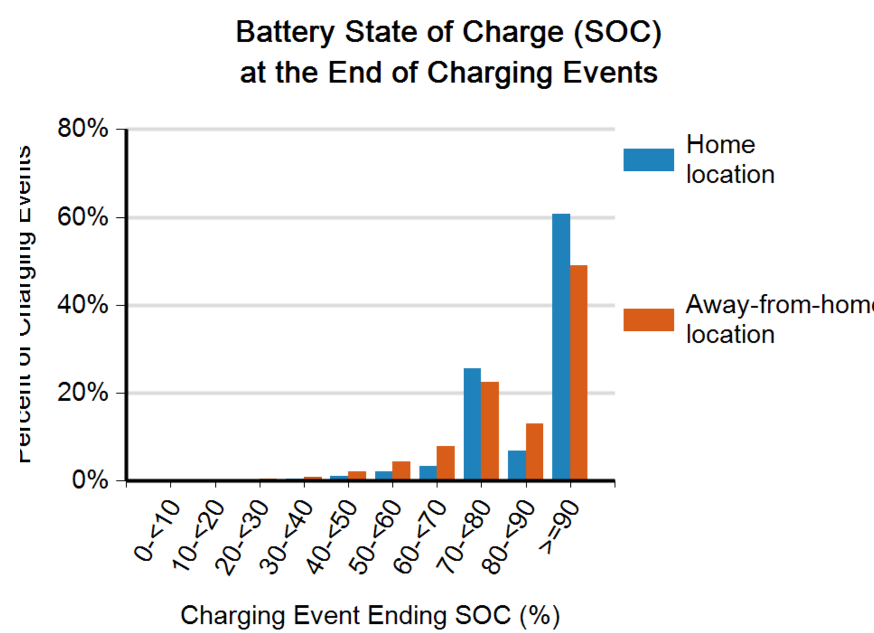




Battery State of Charge (SOC) - LEAF

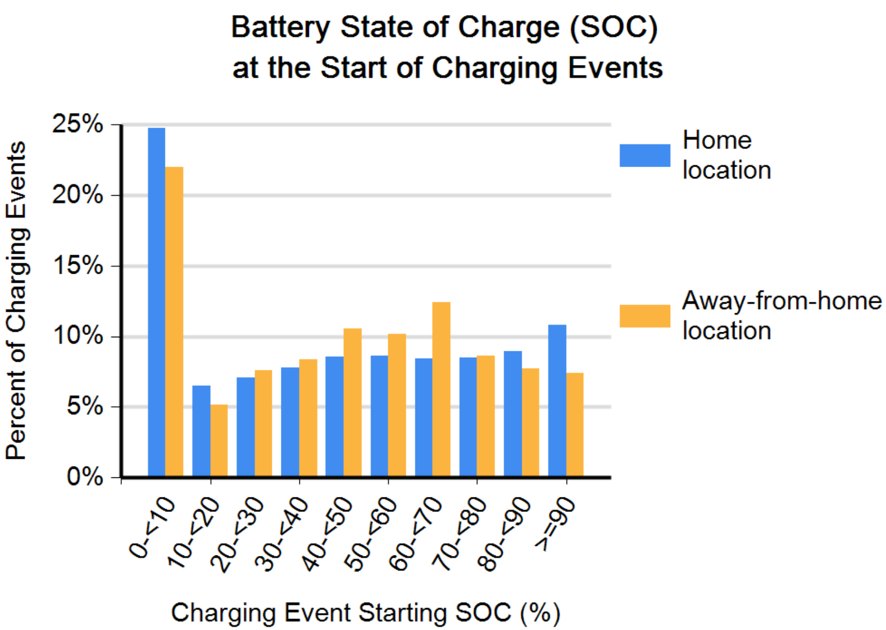
- Range Anxiety
  - LEAFs plug-in away from home at a higher SOC than at home
  - Average SOC at start of commercial plug-in is ~15% higher than at home
- Majority of all commercial charge events end at a full state of charge

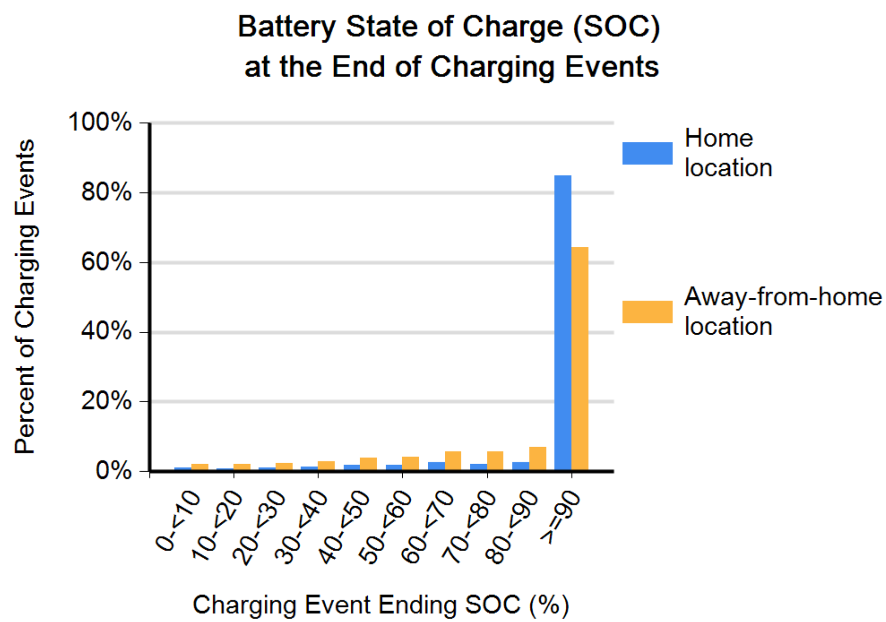




Battery State of Charge (SOC)- Volt

- "Gas Anxiety" – Volt/PHEV drivers are showing an aversion to using gasoline
- Largest portion of starting SOC is 0-10%
- End SOC is almost always a full (90-100%)
- Little difference from residential to commercial charging behavior
- Drivers are fully depleting their electric range and plugging in often





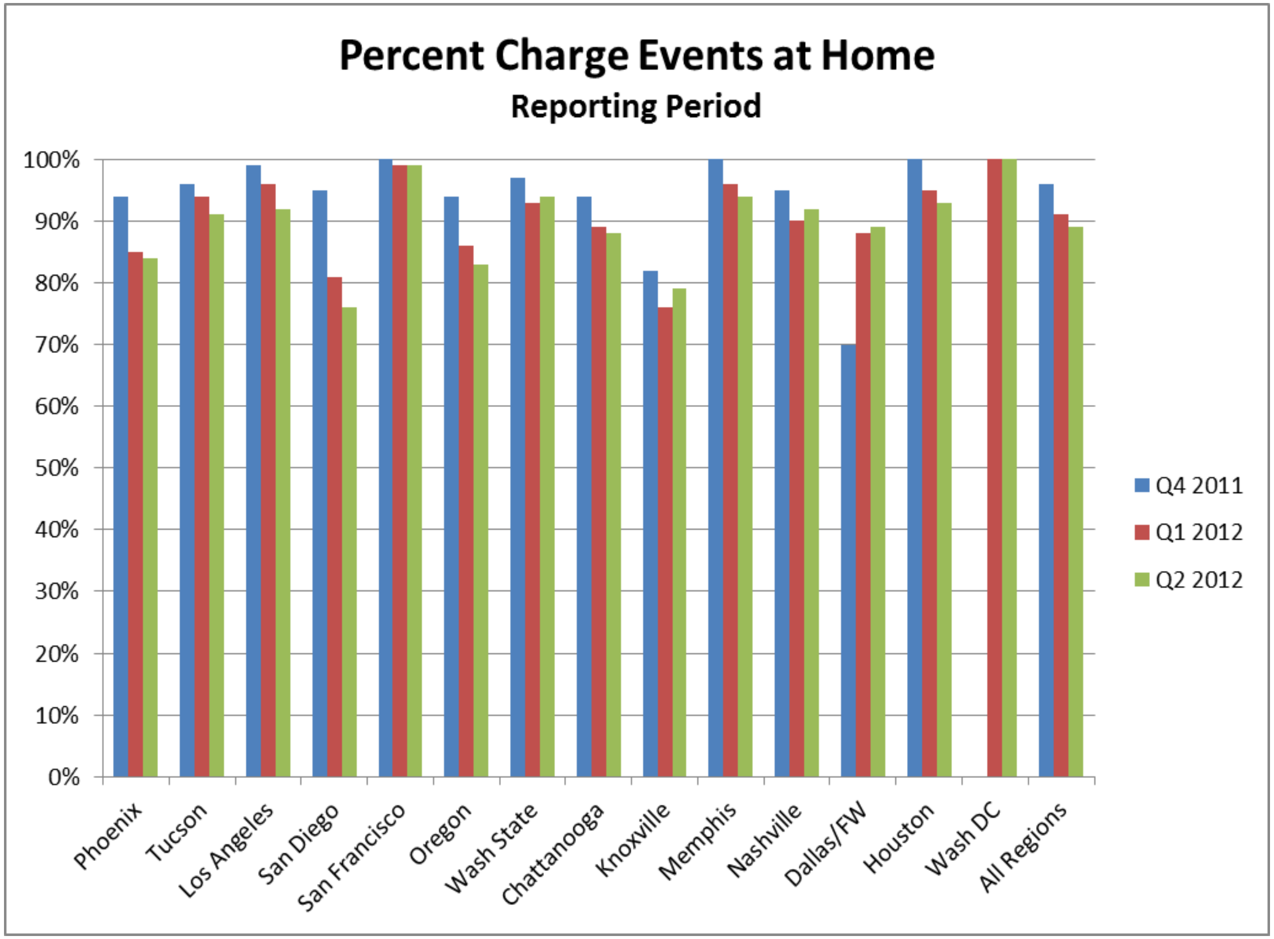
Macro Trends

Initial Trends

Residential	Weekday	Weekend	Overall
% of time with EV connected to EVSE	35%	38%	36%
% of time EV drawing power from EVSE	8%	7%	7%
Avg time with EV connected per charge event (Hr)	11.6	11.6	11.6
Avg time with EV drawing power per charge event	2.5	2.1	2.4
Avg electricity consumed per charge event (AC kWh)	8.7	7.5	8.4
Avg # of charge events per EVSE per day	0.78	0.70	0.75

Commercial	Weekday	Weekend	Overall
% of time with EV connected to EVSE	6%	4%	6%
% of time EV drawing power from EVSE	3%	2%	2%
Avg time with EV connected per charge event (Hr)	6.1	4.1	5.7
Avg time with EV drawing power per charge event	2.3	2.2	2.3
Avg electricity consumed per charge event (AC kWh)	7.7	7.7	7.7
Avg # of charge events per EVSE per day	0.28	0.16	0.25

Home Charging Decreasing



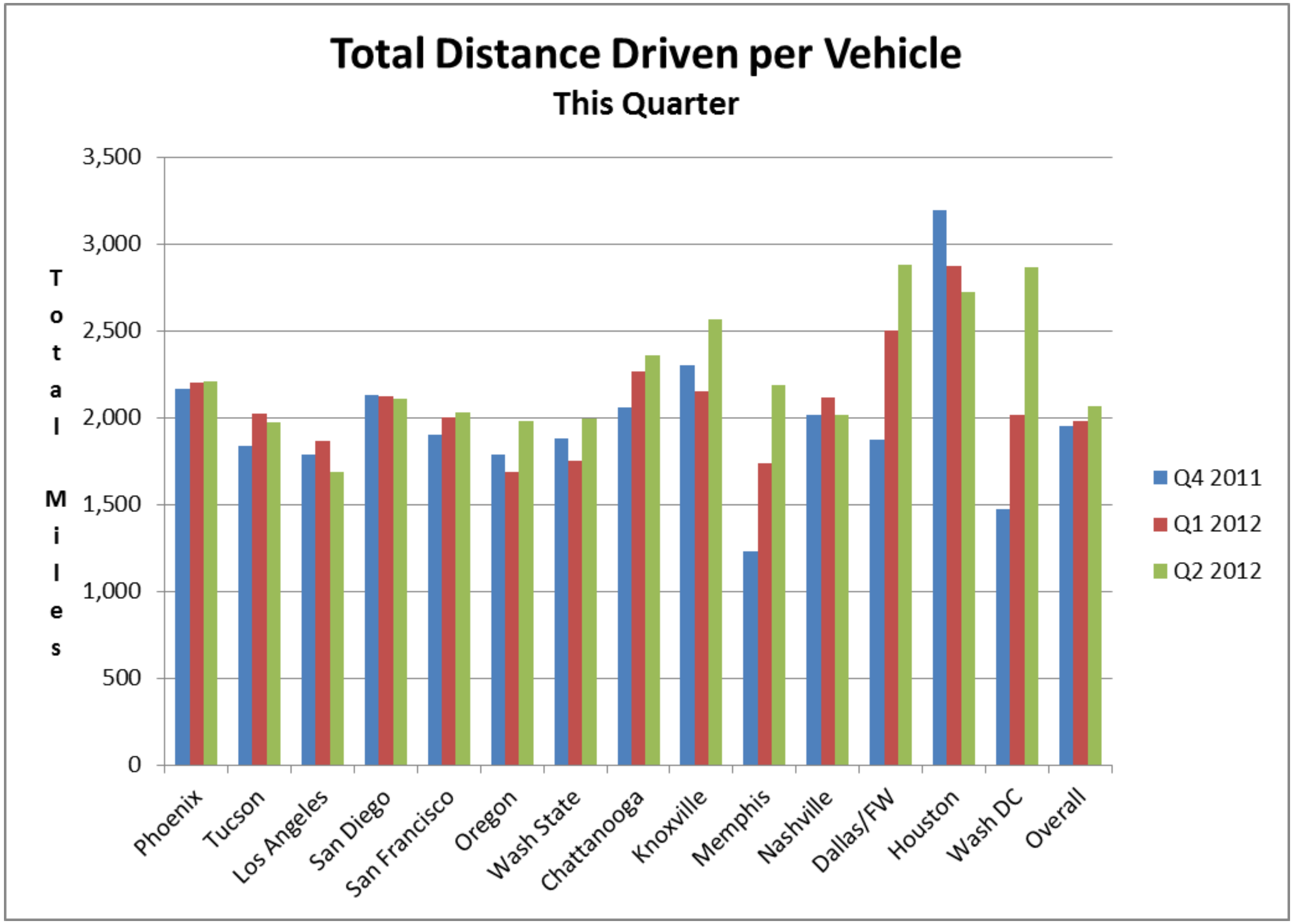
% Charging @ Home

	LEAF / Volt
Q4:	78% / 72%
Q1:	74% / 54%
Q2:	76% / 79%

% Charging @ Away

	LEAF / Volt
Q4:	22% / 28%
Q1:	27% / 47%
Q2:	24% / 21%

Driving distance is steadily increasing



LEAF Driving Distance

Q4: 30.0 (mi)

Q1: 30.2

Q2: 30.6

Volt Driving Distance

Q4: 38.0 (mi)

Q1: 36.4

Q2: 39.6

Lessons Learned: Residential

Residential Install Costs

- Average residential installation cost ~$1,375
- Individual installations vary widely
- Some user bias to lower costs

Marlets In Ascending Order Of Residential Installation Cost	Number of Installations	Average Installation Cost	Variation From Project Average
Tennessee (entire State)	542	$ 1,113.07	-19.0%
Arizona (Phoenix & Tucson)	357	$ 1,148.88	-16.4%
Washington DC	3	$ 1,197.44	-12.9%
Oregon (Portland, Eugene, Coralvls & Salem)	465	$ 1,229.06	-10.6%
Washington (Seattle & Olympia)	730	$ 1,289.56	-6.2%
Maryland	39	$ 1,311.75	-4.5%
Washington	80	$ 1,321.36	-3.8%
Virginia	38	$ 1,341.01	-2.4%
San Fransisco	1254	$ 1,386.13	0.9%
Texas (metro Houston & Dallas)	128	$ 1,422.77	3.5%
San Diego	726	$ 1,593.91	16.0%
Los Angeles	415	$ 1,794.64	30.6%

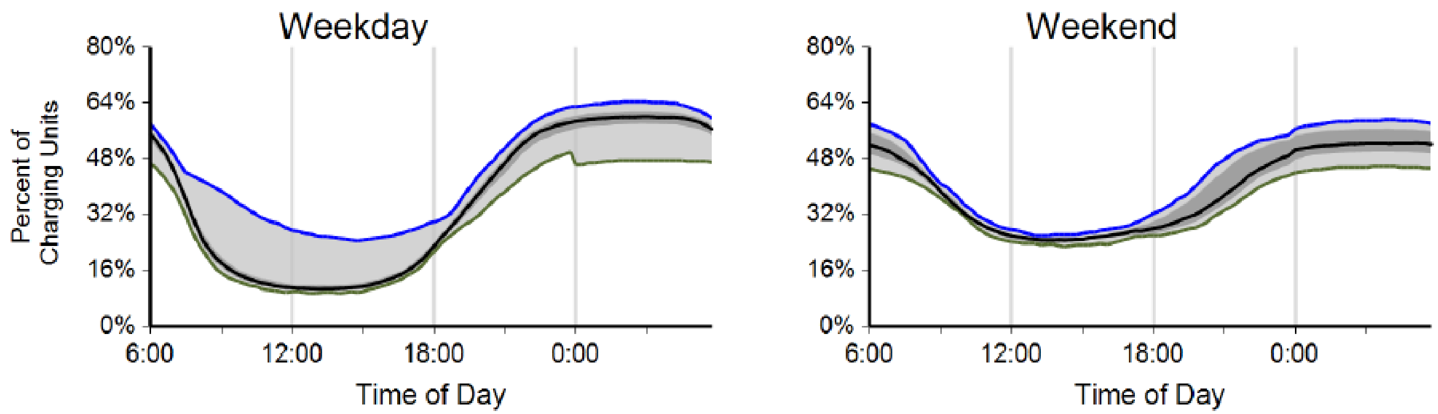
Residential Permits

- Permit timeliness has not been a problem
- Majority are over-the-counter
- Permit fees vary significantly

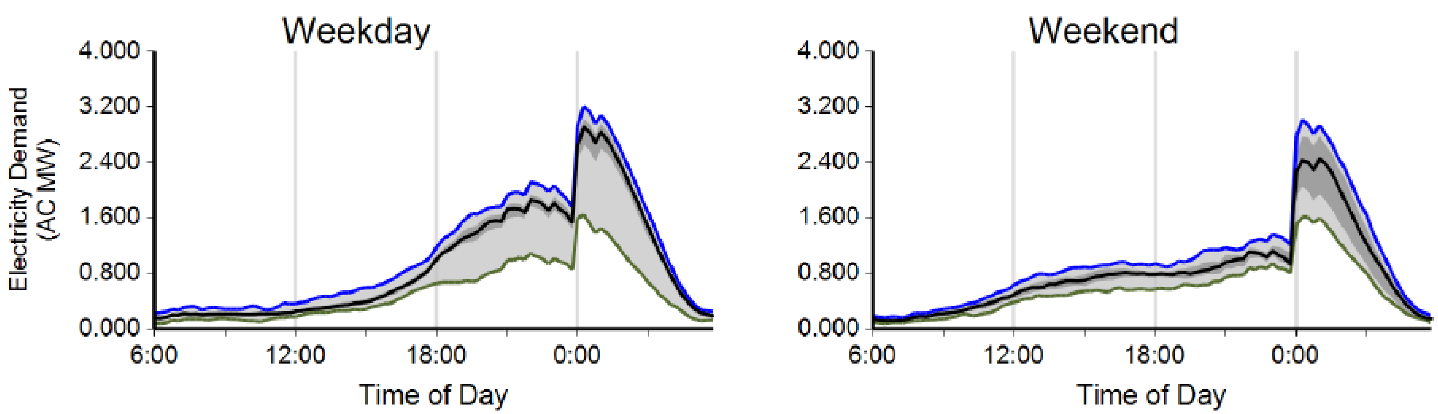
Region	Count of Permits	Average Permit Fee	Minimum Permit Fee	Maximum Permit Fee
Arizona	66	$96.11	$26.25	$280.80
Los Angeles	109	$83.99	$45.70	$218.76
San Diego	496	$213.30	$12.00	$409.23
San Francisco	401	$147.57	$29.00	$500.00
Tennessee	322	$47.15	$7.50	$108.00
Oregon	316	$40.98	$12.84	$355.04
Washington	497	$78.27	$27.70	$317.25

Residential: Availability / Demand

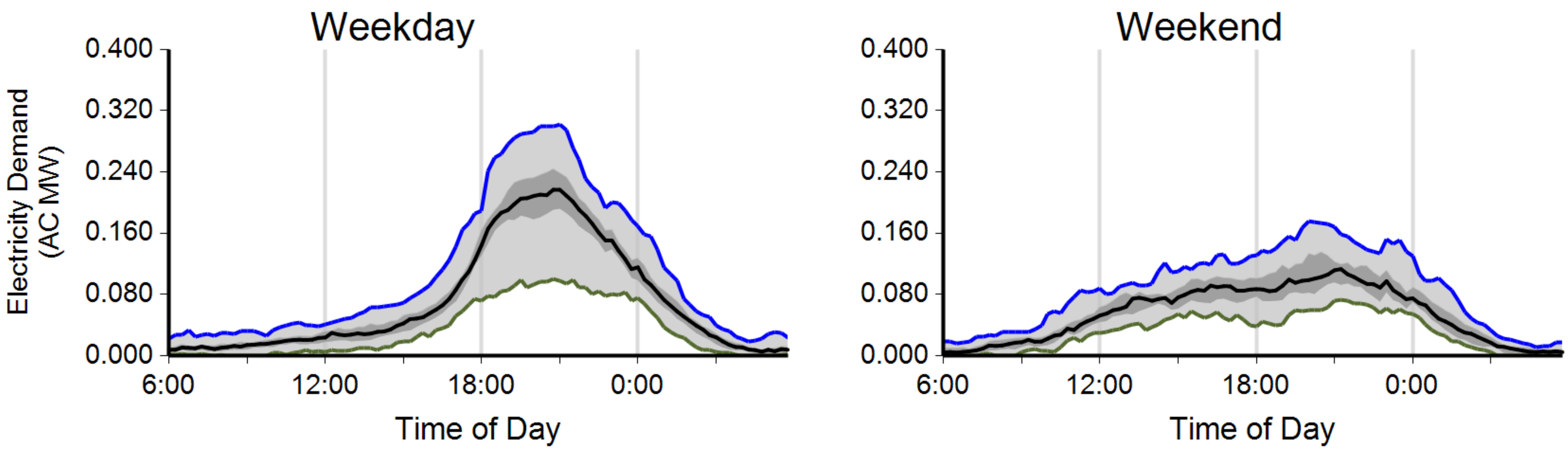
Range of % of EVSE with EV Connected vs. Time of Day



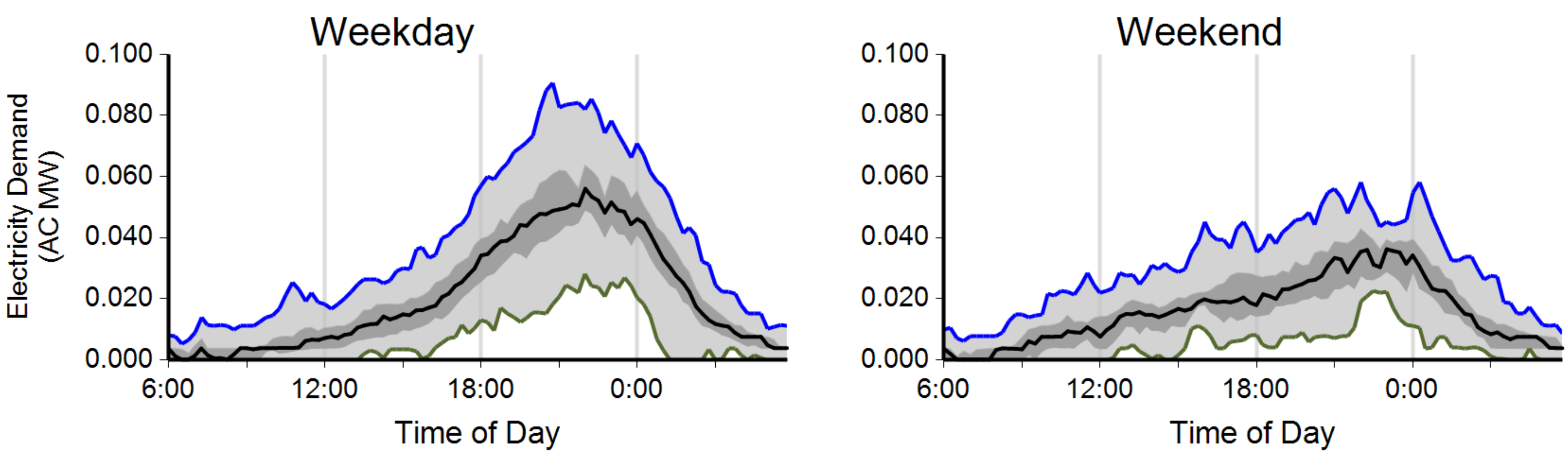
Range of Aggregate Electricity Demand vs. Time of Day



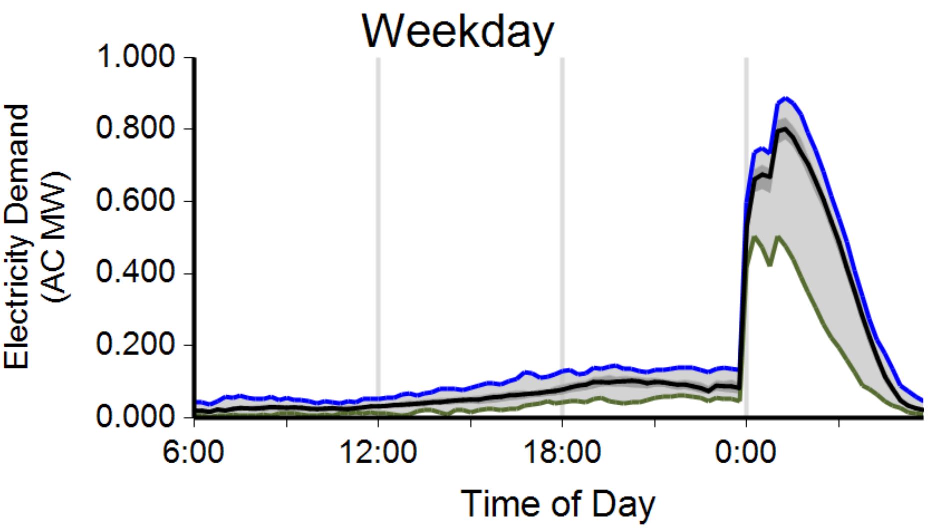
Nashville

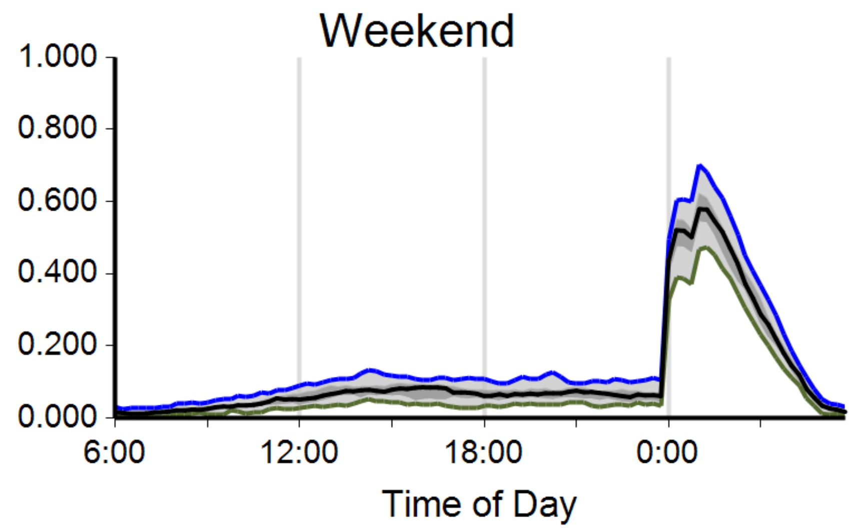


Knoxville

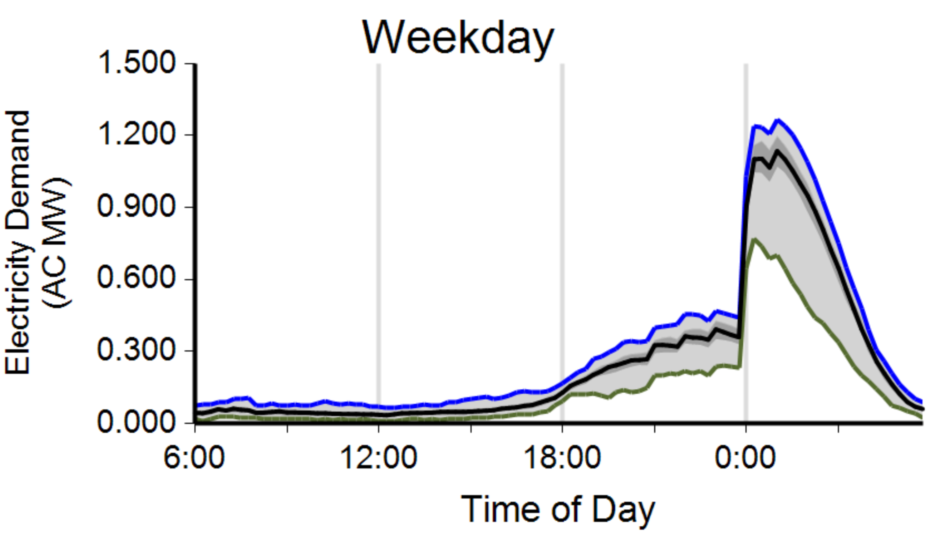


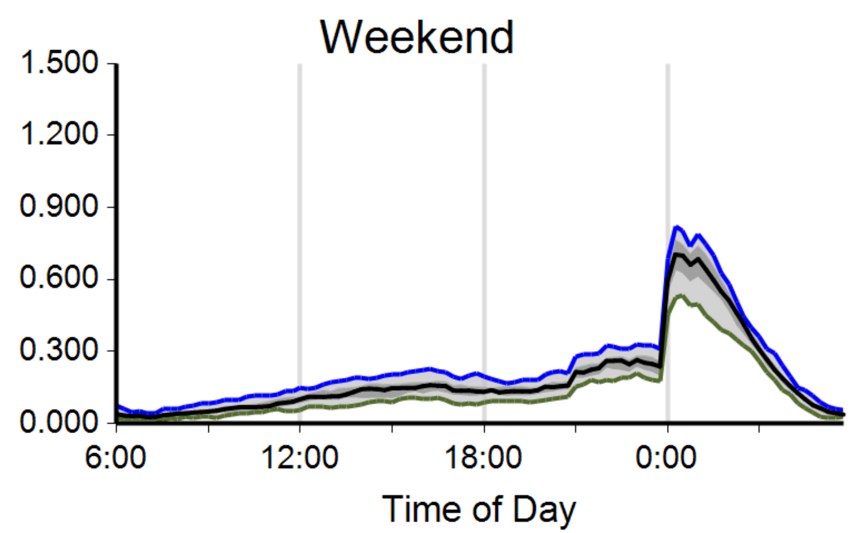
San Diego (SDG&E)





San Francisco (PG&E)

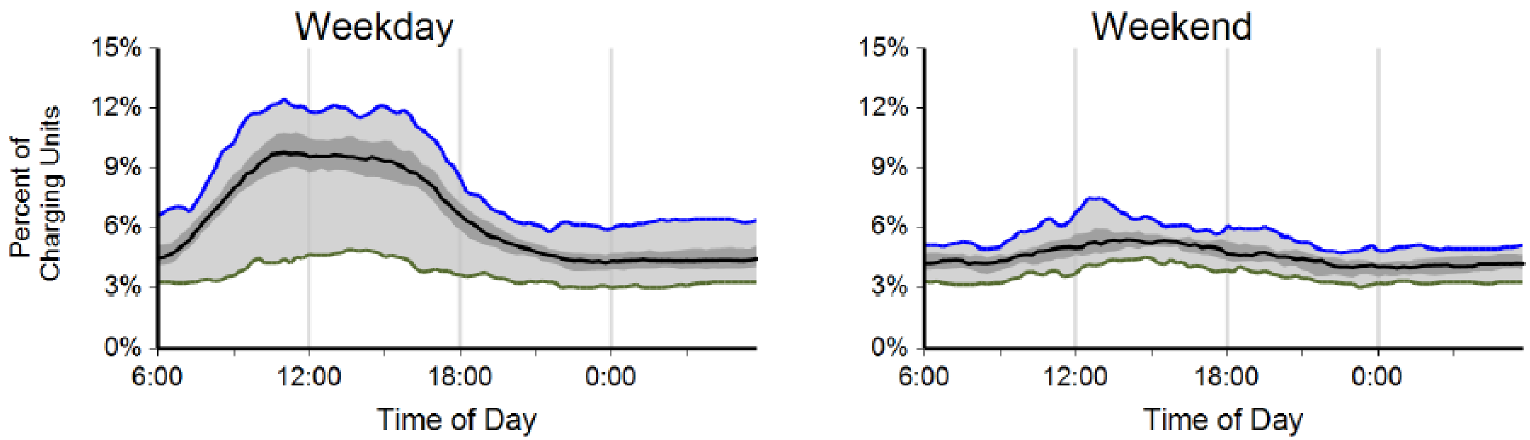




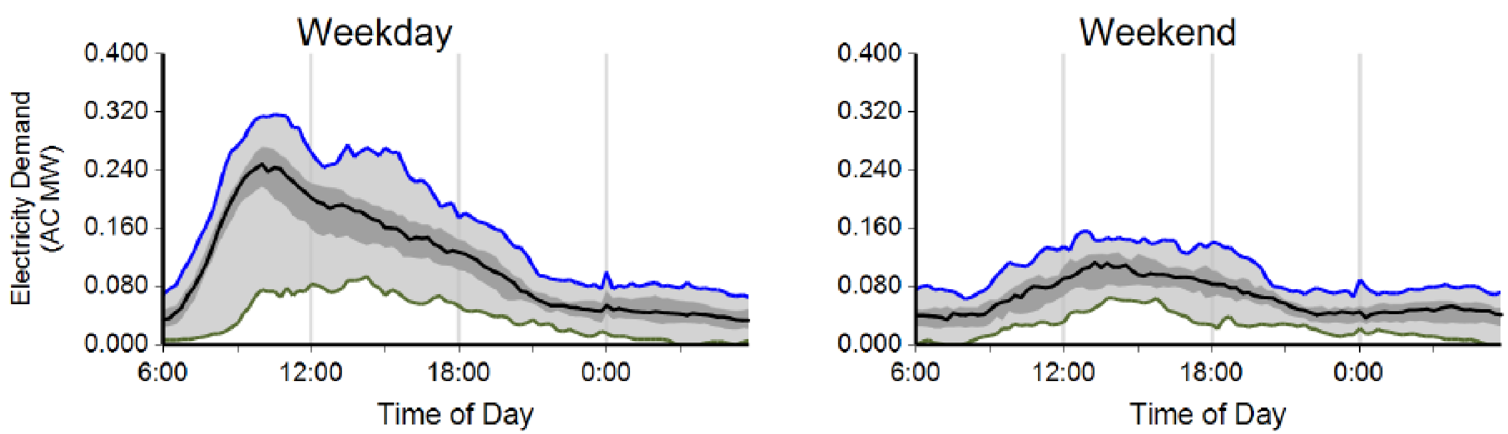
Lessons Learned: Commercial

Commercial: Availability / Demand

Range of % of EVSE with EV Connected vs. Time of Day



Range of Aggregate Electricity Demand vs. Time of Day



Lessons Learned: Commercial

- ADA significantly drives cost
  - Accessible charger
  - Van accessible parking
  - Accessible route to facility
  - Inconsistent application of ADA

Lessons Learned: Commercial

- Permit fees and delays are significant
  - Load studies
  - Zoning reviews

Region	Count of Permits	Average Permit Fee	Minimum Permit Fee	Maximum Permit Fee
Arizona	72	$228	$35	$542
Los Angeles	17	$195	$67	$650
San Diego	17	$361	$44	$821
Texas	47	$150	$37	$775
Tennessee	159	$71	$19	$216
Oregon	102	$112	$14	$291
Washington	33	$189	$57	$590

Lessons Learned: DC Fast Charge

DC FC Barriers

- Demand and energy costs are significant for some utilities
  - 25¢/kWh
  - $25/kW
- Some utilities offer commercial rates without demand charges
- Others incorporate a 20 kW to 50 kW demand threshold
- Nissan Leaf is demand charge free in a few service territories

No Demand Charges - Nissan Leaf	
CA	Pacific Gas & Electric
	City of Palo Alto
	Alameda Municipal Power
	Silicon Valley Power
AZ	Tucson Electric Power
OR	Eugene Water & Electric Board
	Lane Electric Co-op
TN	Middle Tennessee Electric
	Duck River Electric
	Harriman Utility Board
	Athens Utility Board
	Cookeville Electric Department
	Cleveland Utilities
	Nashville Electric Service
	EPB Chattanooga
	Lenoir City Utility Board
	Volunteer Electric Cooperative
	Murfreesboro Electric
	Sequachee Valley Electric Cooperative
	Knoxville Utility Board
	Maryville
	Fort Loudoun Electric
	Memphis Light Gas and Water Division

Demand Charges

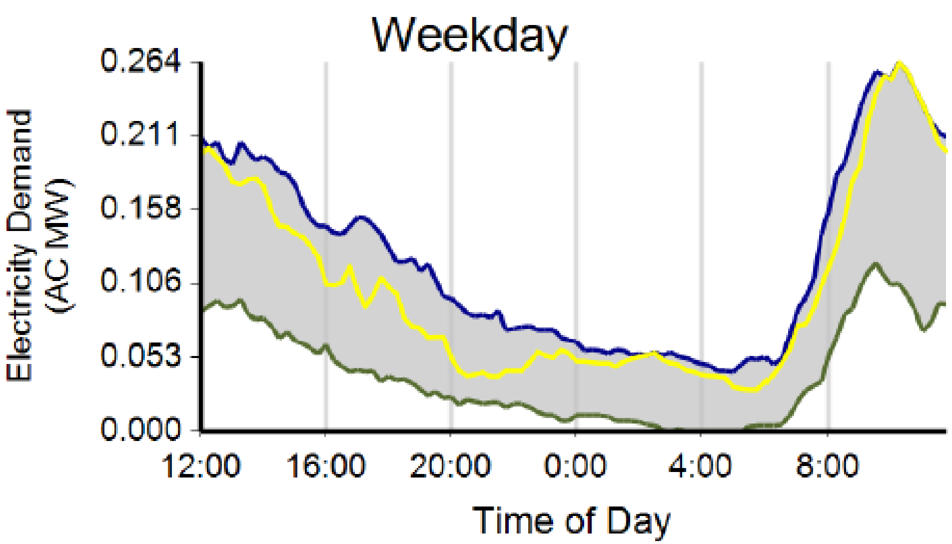
Recurring Nissan Leaf demand charges (60 kW) are significant in many utility service territories

Utility Demand Charges - Nissan Leaf		Cost/mo.
CA	Glendale Water and Power	$ 16.00
	Hercules Municipal Utility:	$ 377.00
	Los Angeles Department of Water and Power	$ 700.00
	Burbank Water and Power	$ 1,052.00
	San Diego Gas and Electric	$ 1,061.00
	Southern California Edison	$ 1,460.00
AZ	TRICO Electric Cooperative	$ 180.00
	The Salt River Project	$ 210.50
	Arizona Public Service	$ 483.75
OR	Pacificorp	$ 213.00
WA	Seattle City Light	$ 61.00

Mitigation Technologies

- Limit demand of DC FCs
  - 20 kW maximum charge rate
  - 5 kWh in any 15 minute period
  - Other output rates (25, 30 kW?)
  - Incorporate w/ facility energy management systems
    - Variable TOU restrictions by site
    - Utilize up to the peak capacity

Publically Available EVSE Demand



- Energy Storage assisted DC FC
  - Demand reduction
  - Grid ancillary services
  - Renewables absorption
- Revised Utility Tariffs
  - Demand responsive charging
  - Aggregated charger loads

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