U.S. Department of Energy's Vehicle Technologies Program

Update on US and Los Angeles EV and PHEV Demonstrations – China / US EV and Battery Technology Workshop @ UMass

Jim Francfort

UMass Campus Center
Boston, MA
August 23-24, 2012

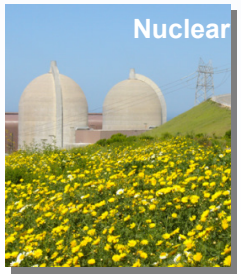
Idaho National Laboratory

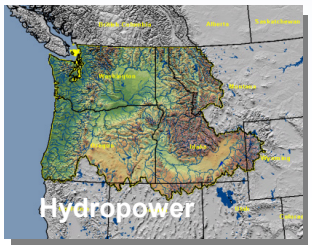
Outline

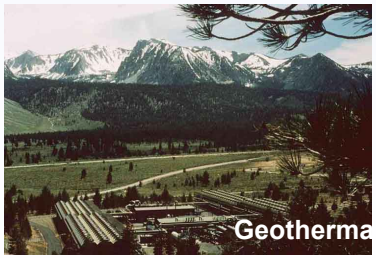
- Participants
- Goals
- Testing experience
- Data processes and data security
- EV Project (Majority of presentation)
  - Description and data parameters
  - Project status
  - Leaf, Volt, and EVSE benchmarking results
- Other electric drive vehicle research activities
- Summary
- Future work

Idaho National Laboratory (INL)

- Eastern Idaho based U.S. Department of Energy (DOE) Federal research laboratory
- 890 square mile site with 4,000 staff
- INL supports DOE's strategic goal
  - Increase U.S. energy security and reduce the nation's dependence on foreign oil
- Multi-program DOE laboratory
  - Nuclear Energy
  - Energy Critical Infrastructure Protection
  - Homeland Security and Cyber Security
  - Advanced Vehicles and Battery Development
  - Fossil, Biomass, Wind, Geothermal and Hydropower Energy







AVTA Participants

- INL manages the Advanced Vehicle Testing Activity's (AVTA) field testing of advanced technology light-duty vehicles for DOE's Vehicle Technologies Program
- ECOtality provides testing support via a competitively bid NETL (National Energy Testing Laboratory) contract
- Test partners include electric utilities, Federal, state and local government agencies, private companies, and individual vehicle owners
- AVTA benchmarking supports DOE's international petroleum reduction goals with
  - Canada
  - China
  - European Union

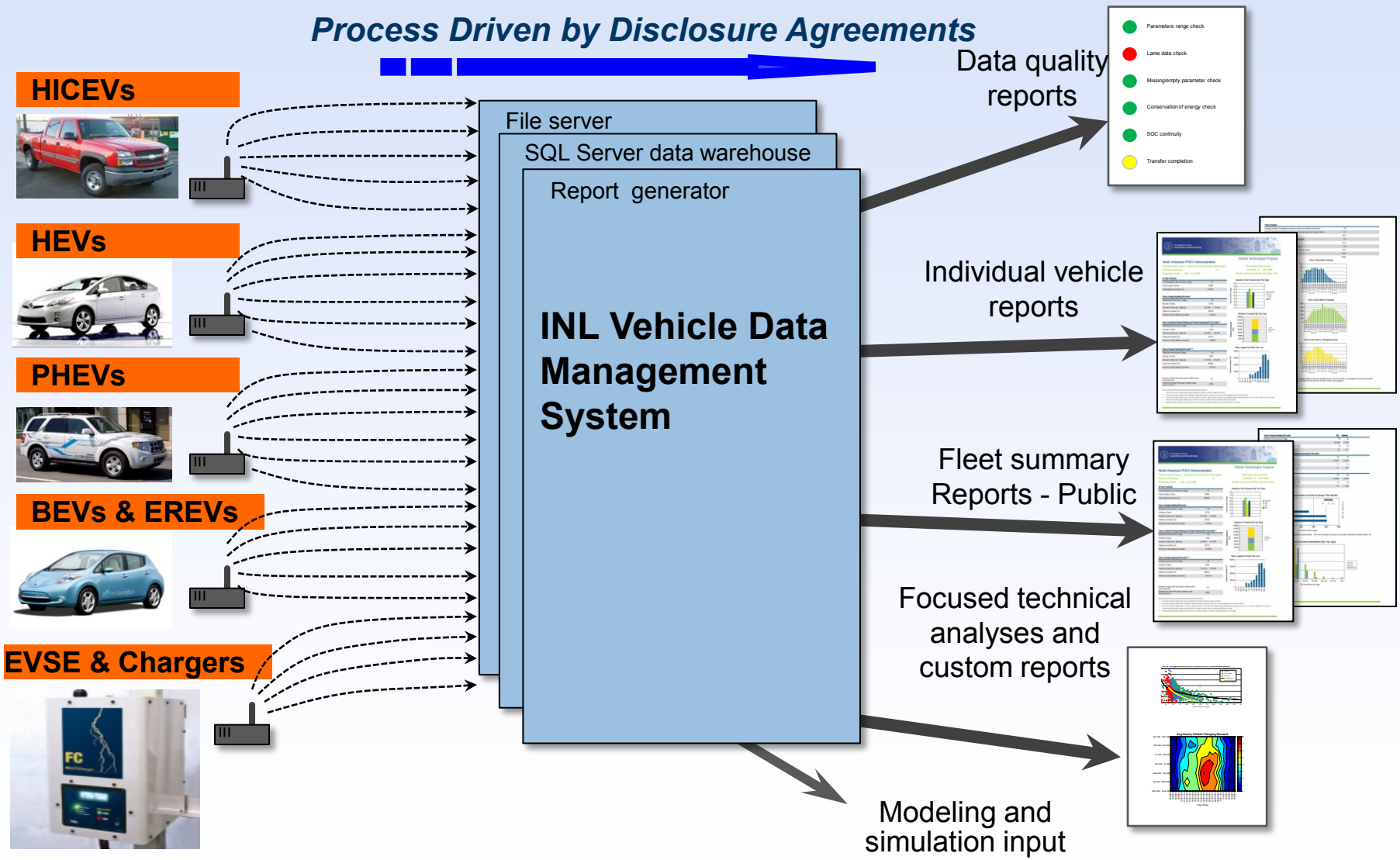
AVTA Goals

- **The AVTA goals**
  - **Petroleum reduction and energy security**
  - **Benchmark technologies that are developed via DOE research investments**
- **Confuse people with facts via structured benchmark testing**
- **Provide benchmark data to DOE, National Laboratories (ANL, NREL, ORNL, PNNL), Federal Agencies (DOD, DOI, DOT, EPA, USPS), technology modelers, R&D programs, vehicle manufacturers (via USCAR's VSATT, EESTT, GITT), and target and goal setters**
- **Assist fleet managers, via Clean Cities, FEMP and industry gatherings, in making informed vehicle and infrastructure deployment and operating decisions**

Vehicle / Infrastructure Testing Experience

- 54 million test miles accumulated on 9,000 electric drive vehicles representing 115 models
- EV Project: 5,500 Leafs, Volts and Smart EVs, 6,500 EVSE (electric vehicle supply equipment), 36 million test miles
  - EV Project LA: 488 Leafs and Volts, 528 EVSE, 2.9 million test miles
- PHEVs: 14 models, 430 PHEVs, 4 million test miles
- EREVs: 1 model, 150 EREVs, 900,000 test miles
- HEVs: 21 models, 52 HEVs, 6.2 million test miles
- Micro hybrid (stop/start) vehicles: 3 models, 7 MHVs, 509,000 test miles
- NEVs: 24 models, 372 NEVs, 200,000 test miles
- BEVs: 47 models, 2,000 BEVs, 5 million test miles
- UEVs: 3 models, 460 UEVs, 1 million test miles
- Other testing includes hydrogen ICE vehicle and infrastructure testing

INL Vehicle/EVSE Data Management Process

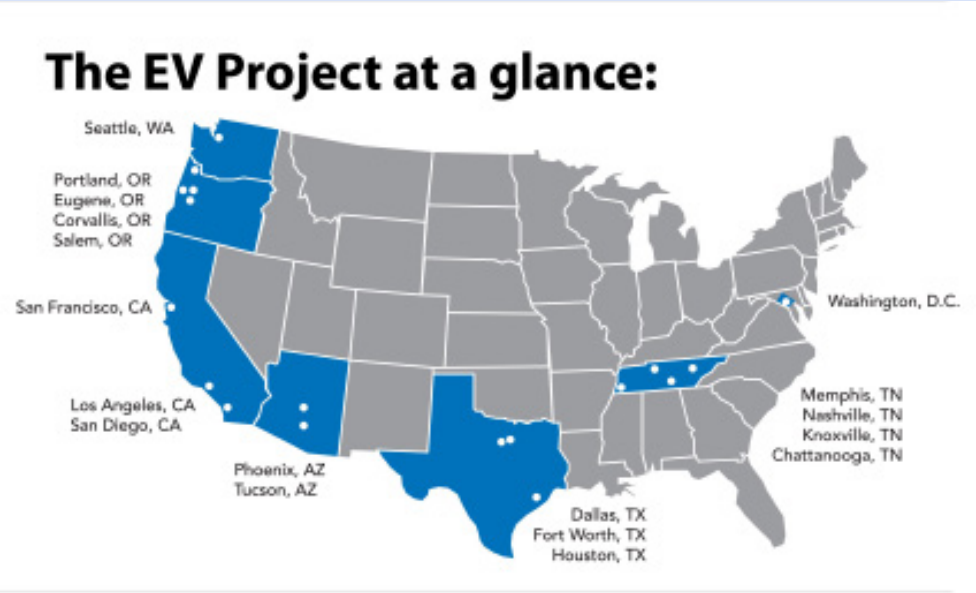


Data Collection, Security and Protection

- **The AVTA has used data loggers on vehicles and EVSE (electric vehicle supply equipment) since 1993 to benchmark vehicle and charging equipment profiles**

- **All vehicle, EVSE, and personal raw data is legally protected by NDAs (Non Disclosure Agreements) or CRADAs (Cooperative Research and Development Agreements)**
  - **Limitations on how proprietary and personally identifiable information can be stored and distributed**
  - **Raw data, in both electronic and printed formats, is not shared with DOE in order to avoid exposure to FOIA**
  - **Vehicle and EVSE data collection would not occur unless testing partners trust INL would strictly adhere to NDAs and CRADAs**
  - **Raw data cannot be legally distributed by INL**

EV Project Goal, Locations, Participants, and Reporting



- **Goal: Build and study mature charging infrastructures and take the lessons learned to support the future streamlined deployment of grid-connected electric drive vehicles**
- **ECOtality is the EV Project lead, with INL, Nissan and Onstar/GM as the prime partners, with more than 40 other partners such as electric utilities**
- **EV Project reporting requires INL to blend three distinct data streams from ECOtality, Nissan and Onstar/GM**
- **40 different EV Project reports are generated quarterly for the general public, DOE, ECOtality, project participants, industry, regulatory organizations, as well as per special requests**

EV Project – EVSE Data Parameters Collected per Charge Event

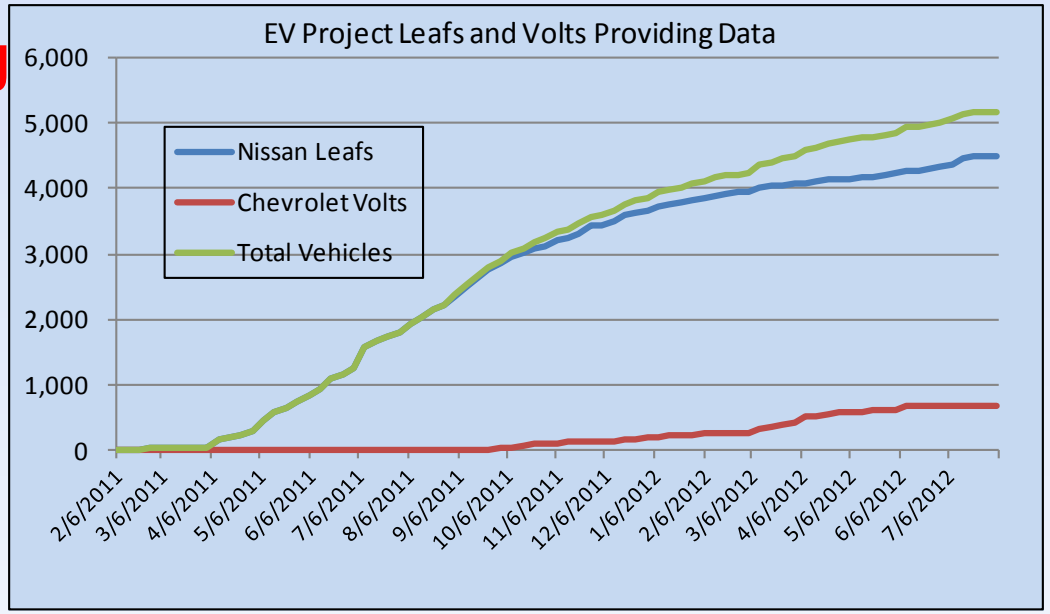
- Data from ECOtality's Blink EVSE network
- Connect and Disconnect Times
- Start and End Charge Times
- Maximum Instantaneous Peak Power
- Average Power
- Total energy (kWh) per charging event
- Rolling 15 Minute Average Peak Power
- Date/Time Stamp
- Unique ID for Charging Event
- Unique ID Identifying the EVSE
- And other non-dynamic EVSE information (GPS, ID, type, contact info, etc.)

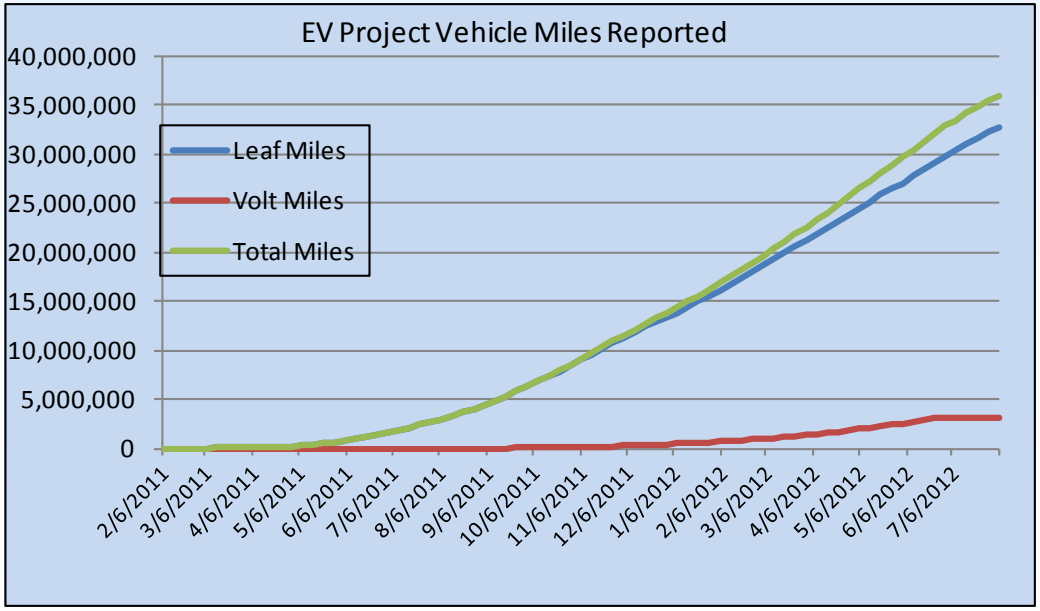
EV Project – Vehicle Data Parameters Collected per Start/Stop Event

- Data is received via telematics providers from Chevrolet Volts and Nissan Leafs
- Odometer
- Battery state of charge
- Date/Time Stamp
- Vehicle ID
- Event type (key on / key off)
- GPS (longitude and latitude)
- Recorded for each key-on and key-off event

EV Project – Vehicle Deployments / Miles

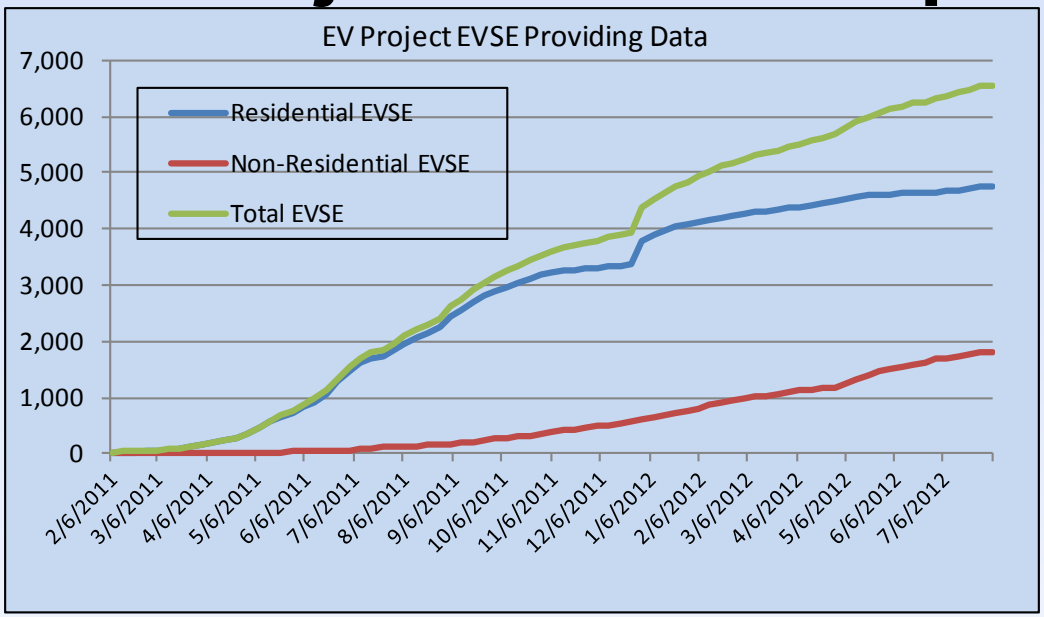
- **5,177 vehicles reporting data and growing**
- **4,500 Leafs (7/29) and 677 Volts (6/24) reporting data**
- **36 million total miles**
- **112,000 test miles per day**

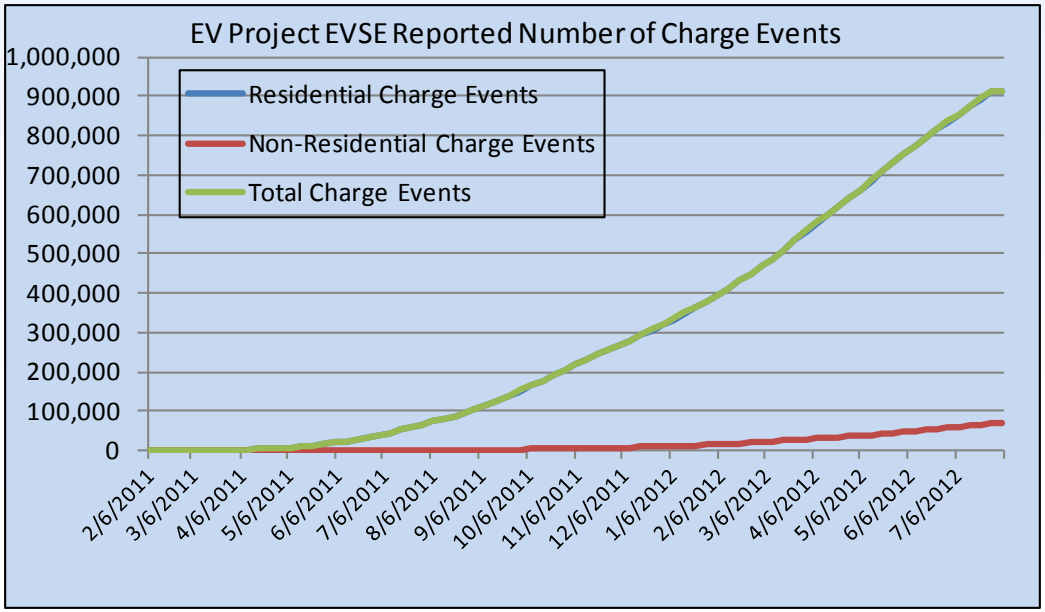




- **First data set just received for ~300 Daimler Smart EVs**

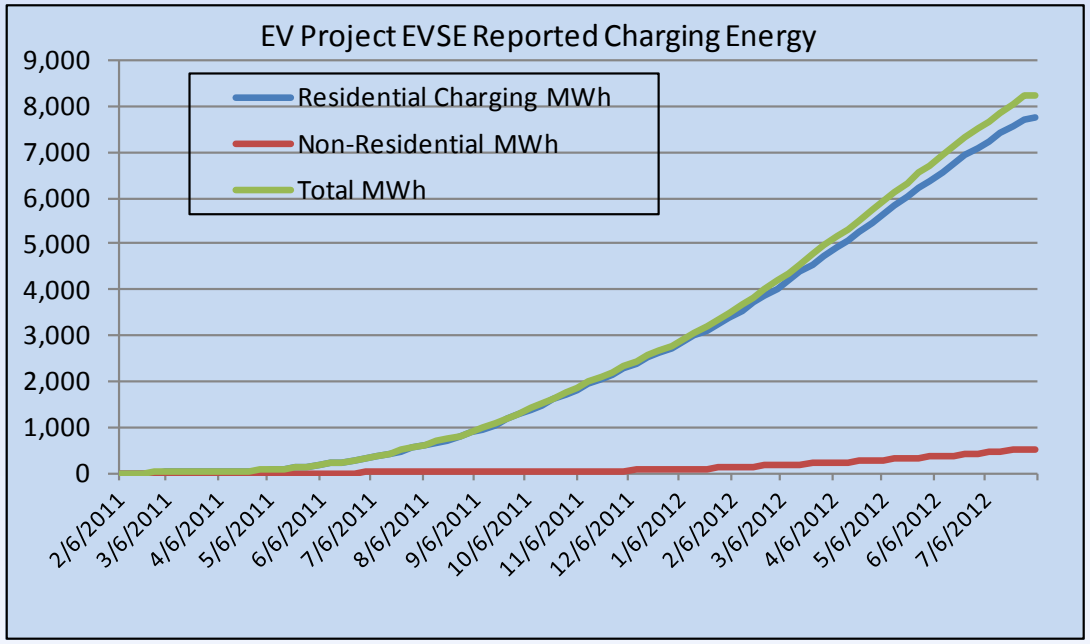
EV Project – EVSE Deployment and Use





- **As of 08/05/12, 6,535 total EVSE**
  - **4,736 Residential EVSE**
  - **1,799 non-Residential EVSE, includes DCFC**
- **914,000 charge events**
- **3,150 charge events per day**
- **Data is continuously back-filled**

EV Project – Total Charge Energy (MWh)

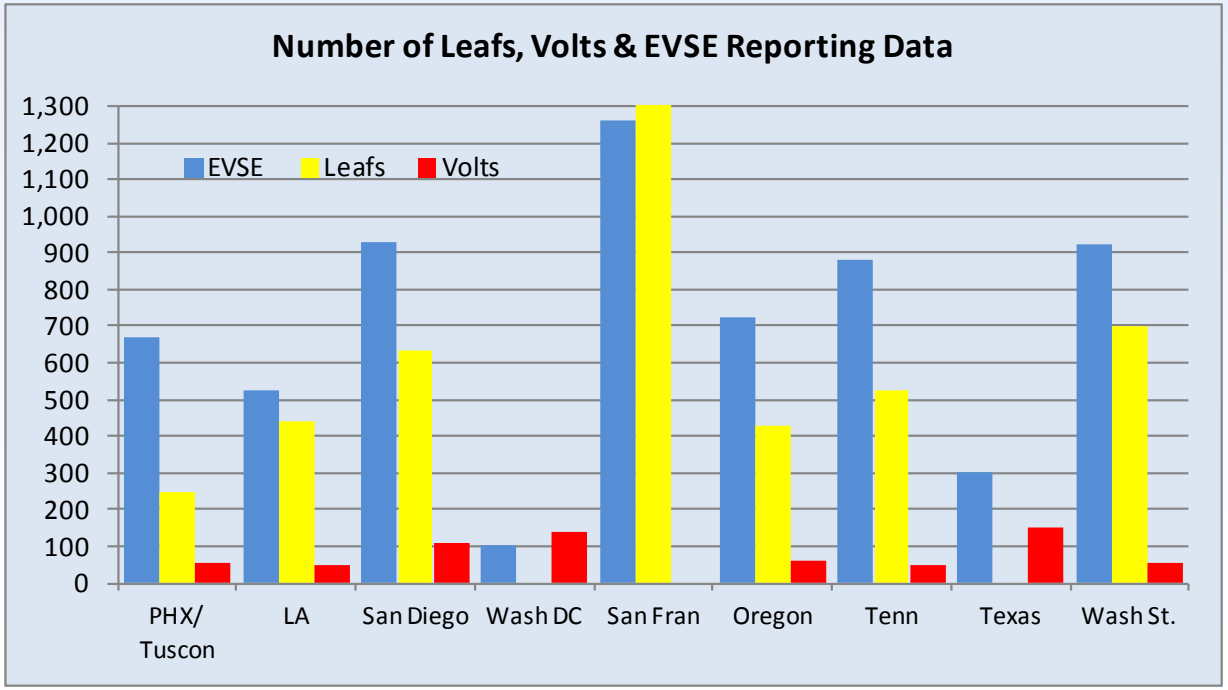


- **8,239 MWh total electricity charged**
  - **7,728 MWh residential**
  - **510 MWh non-residential**
- **29 MWh used for charging per day**

- **Vehicle efficiency cannot be accurately calculated using total vehicle miles and total energy**
  - **Non-EV Project vehicles sometimes charge at EV Project EVSE**
  - **EV Project vehicles may charge at 110V or other 240V non-EV Project EVSE**

EV Project – Overview Report 2nd Quarter

- **Vehicles and charging infrastructure deployed 2nd quarter 2012 and data received by INL**
- **Charging infrastructure**
  - **6,319 units installed**
  - **881,06 charging events**
  - **7,513 AC MWh**
- **Vehicles**
  - **4,322 Leafs**
  - **676 Volts**
  - **33 million miles**
- **Regional analyses are conducted and reported each quarter**
- **2nd quarter 2012: 94 pages and 53,000 data values calculated for 4 public reports**



EV Project – Leaf Usage Report

Leaf Usage – 2nd quarter 2012 Data

	National	L.A.
• Number of vehicles	2,911	274
• Number of Trips	788,000	66,581
• Distance (million miles)	5.7	0.48
• Average (Ave) trip distance	7.2 mi	7.1 mi
• Ave distance per day	30.6 mi	28.7 mi
• Ave number (#) trips between charging events	3.9	3.9
• Ave distance between charging events	28.1 mi	27.8 mi
• Ave # charging events per day	1.1	1.0

* Note that per day data is only for days a vehicle is driven

EV Project – Volt Usage Report

Volts Usage – 2nd quarter 2012 Data

	National
• Number of vehicles	408
• Number of Trips	148,000
• Distance (million miles)	1.2
• Average (Ave) trip distance	8.0 mi
• Ave distance per day	39.6 mi
• Ave number (#) trips between charge events	3.2
• Ave distance between charging events	26.0 mi
• Ave # charging events per day	1.5
• Overall mpg	155
• Overall AC Wh/mi	242

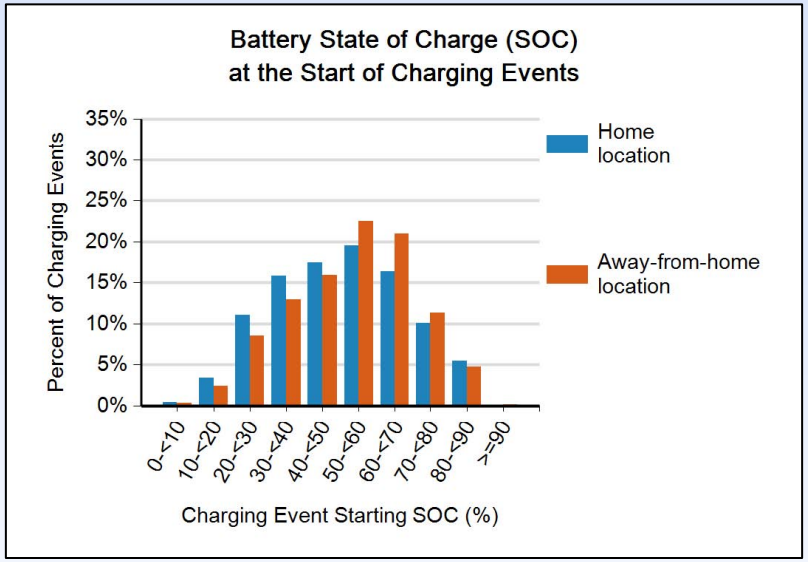
* There are insufficient numbers of matched EVSE and Volts to report L.A. data

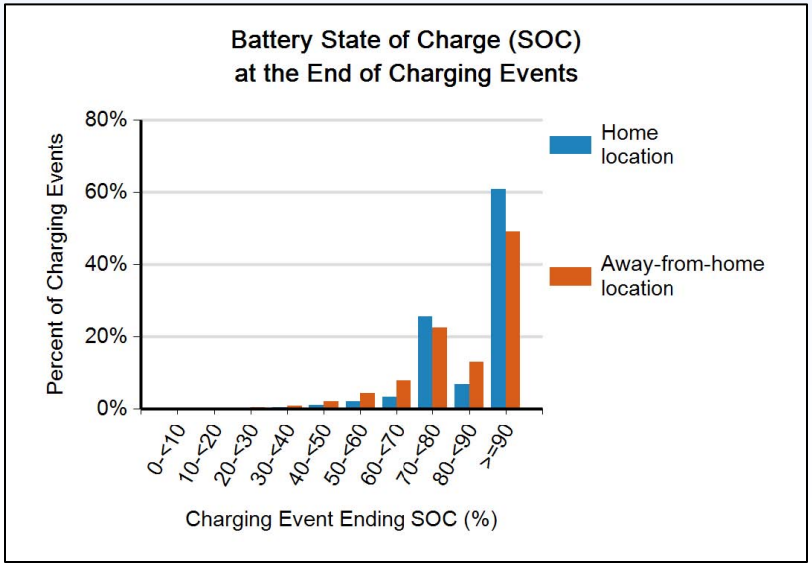
* Note that per day data is only for days a vehicle is driven

EV Project – Leaf Usage Report (2nd ¼ 2012)

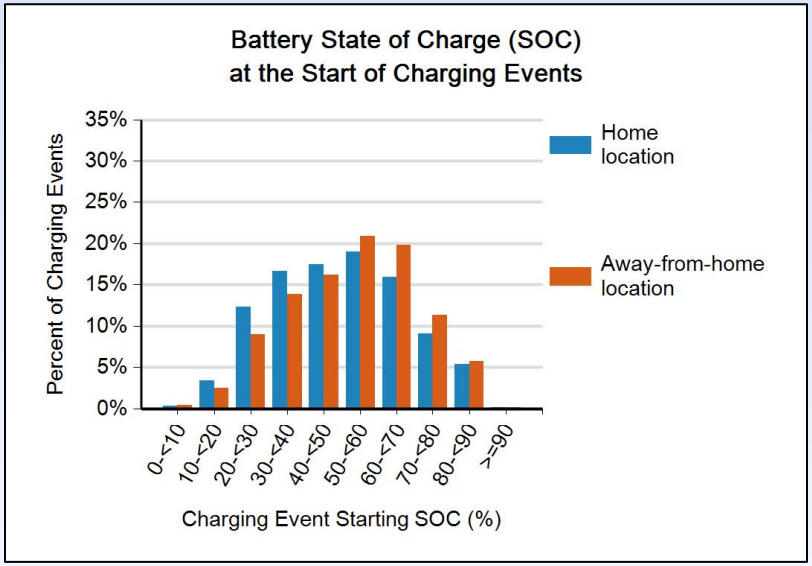
- **Leaf battery SOC before and after charge events by home and non-home locations**

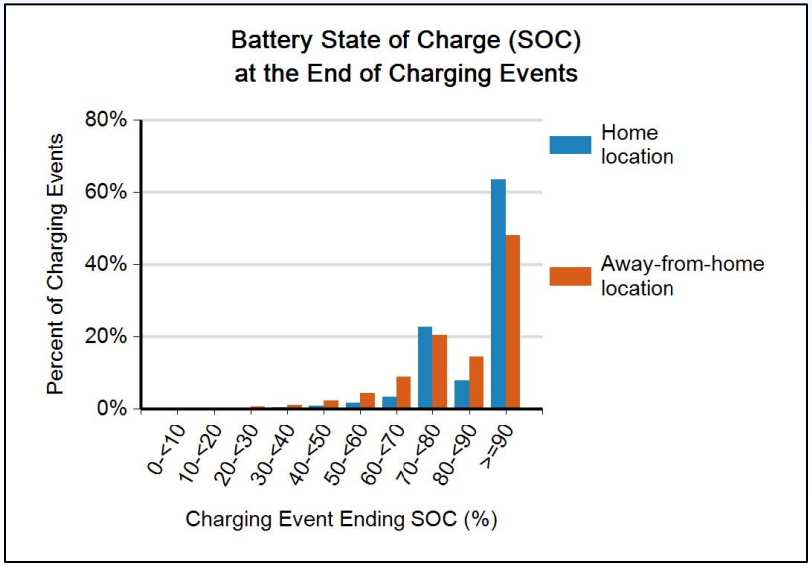
National Data





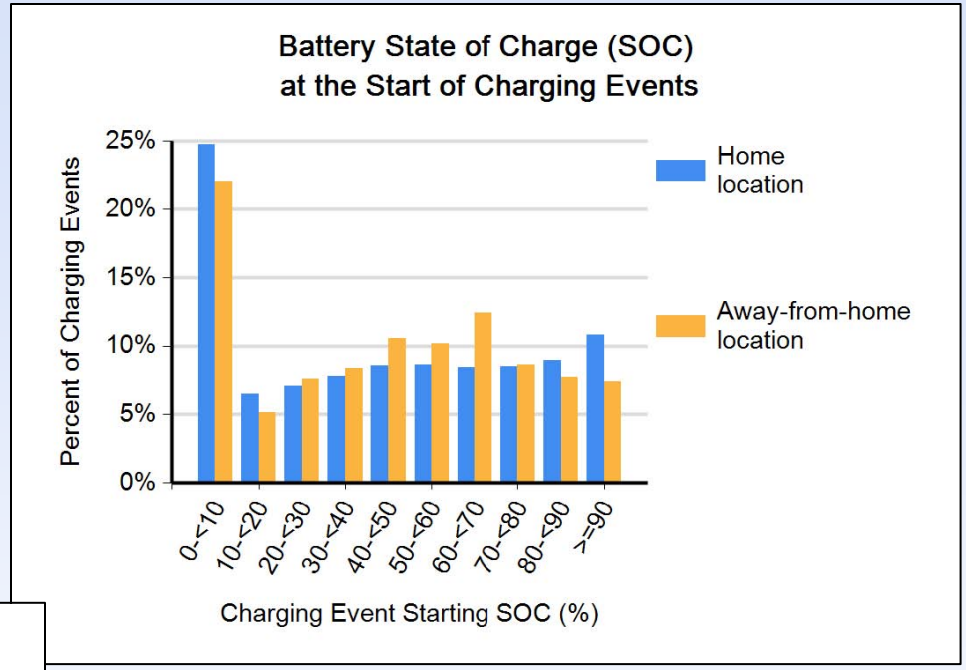
L.A. Data

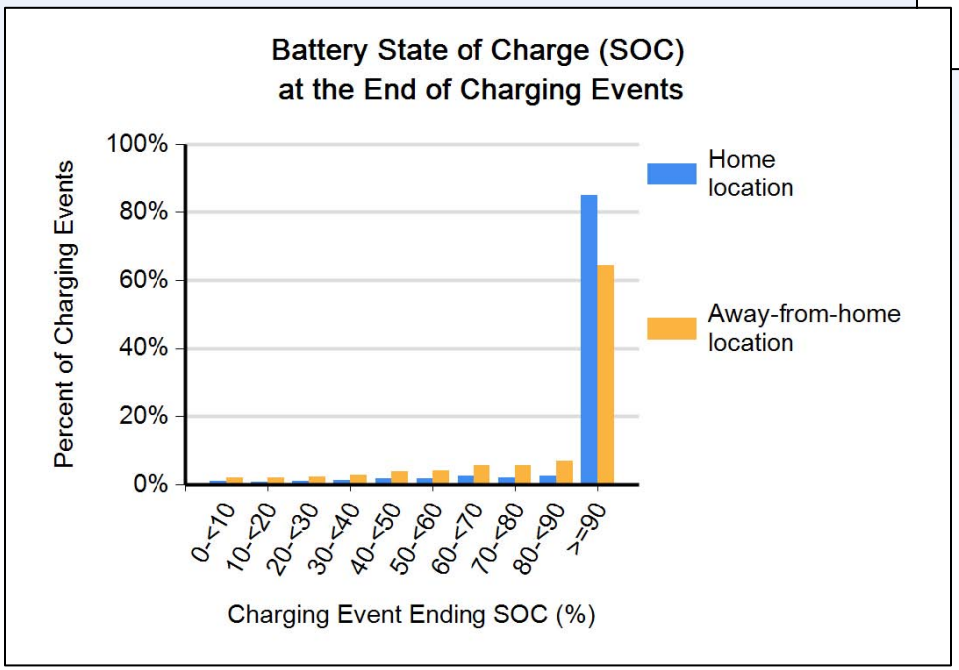




EV Project – Volt Usage Report (2nd ¼ 2012)

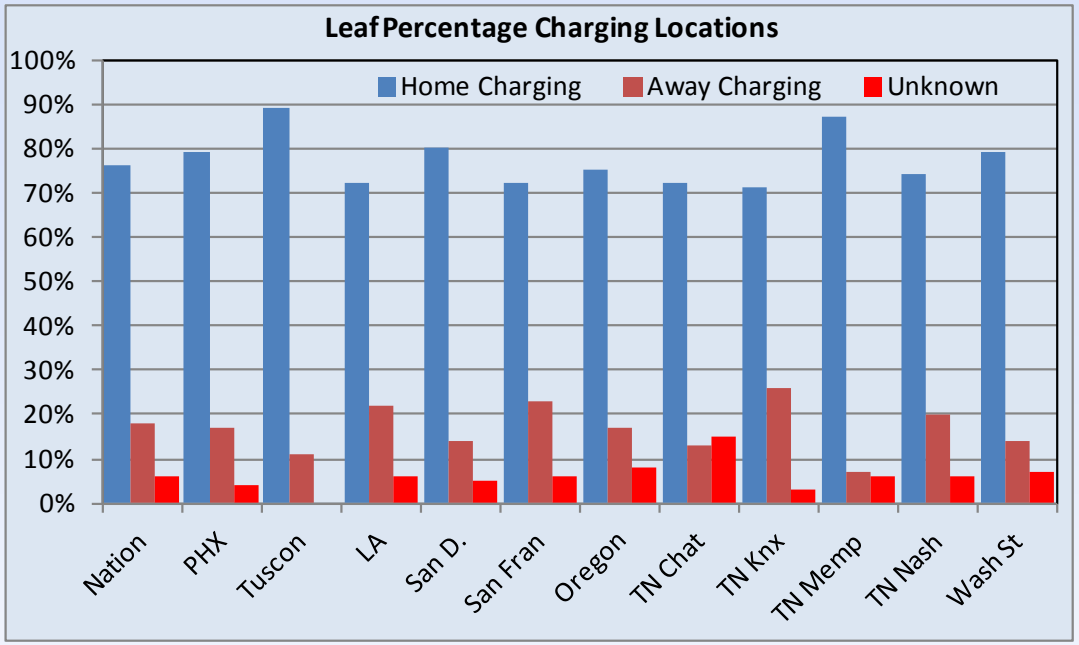
- **Volt battery SOC before and after charge events by home and non-home locations**



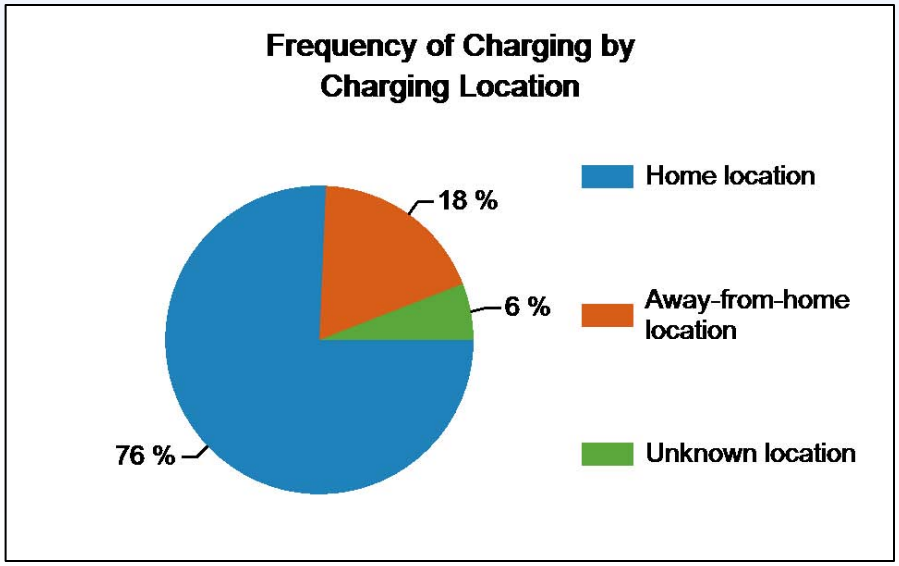


EV Project – Leaf Usage Report (2st ¼ 2012)

- Regional variations in charging behavior
- LA has lower percent of at home charging frequency and higher away from home charging frequency



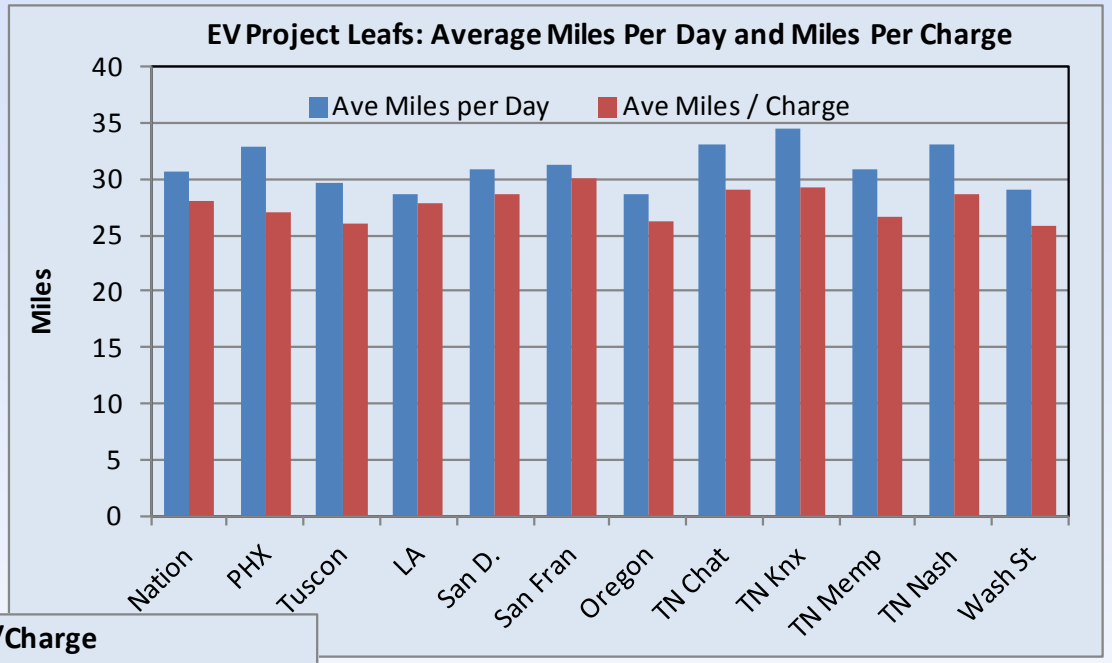
National Data

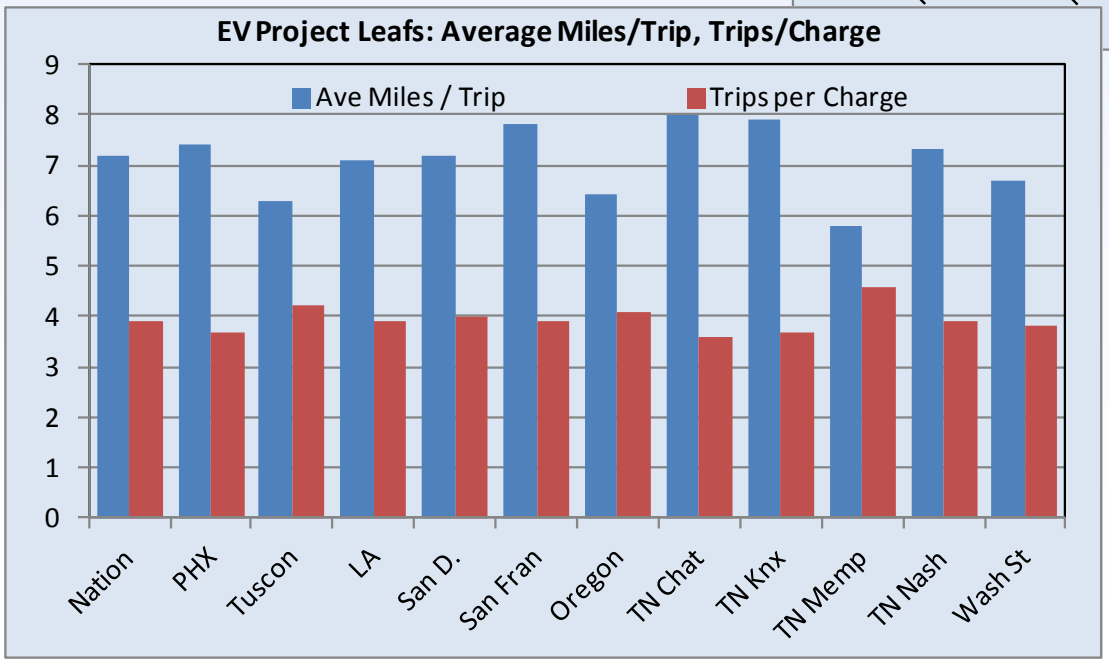


- Data is also available for Volts

EV Project – Leaf Usage Report (2nd ¼ 2012)

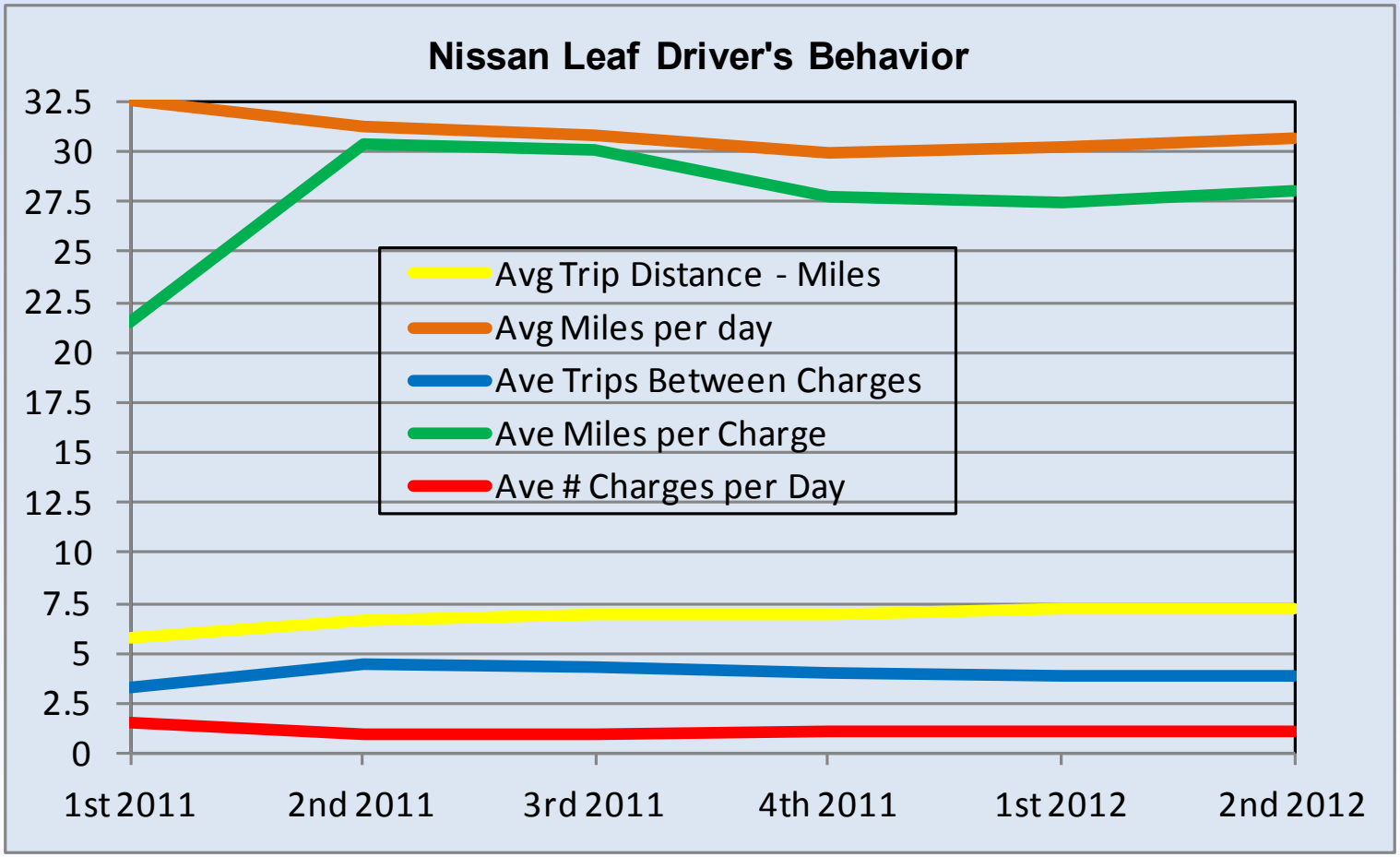
- Some regional variations in driving and charging profiles
- LA has low miles per day and per charge
- LA miles per trip and charge are average





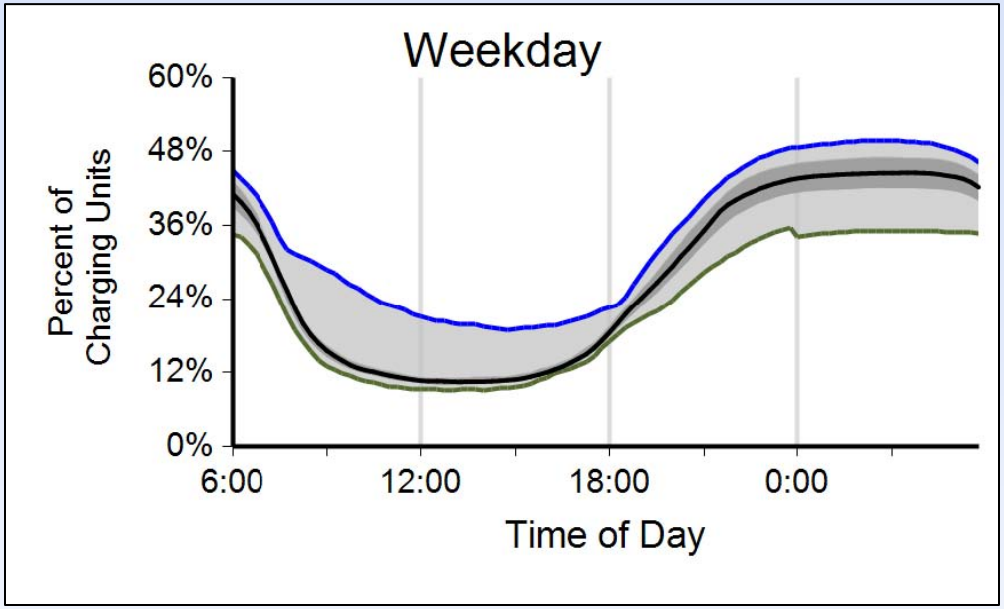
- Data is also available for Volts

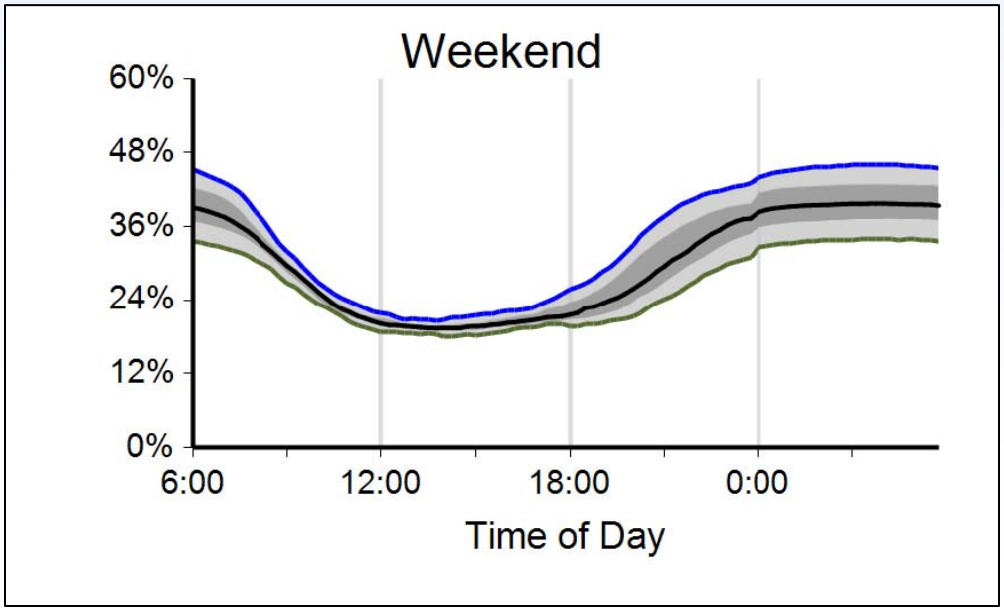
EV Project – Leaf Usage Report 5 Quarters



Number of Leafs reporting each quarter					
35	956	2,394	2645	2987	2911

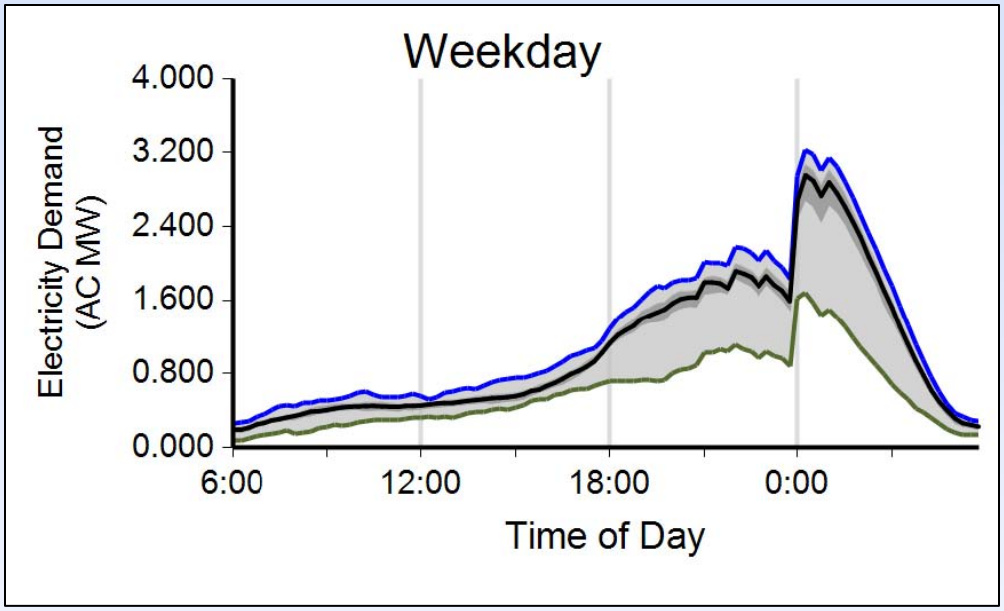
EV Project – EVSE Infra. Summary Report

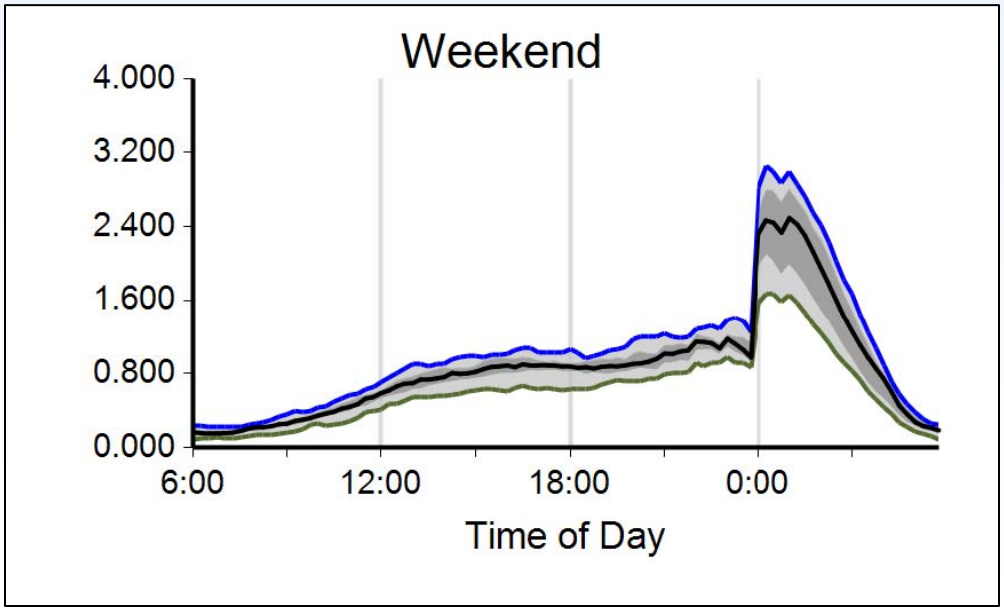




- Graphs document when EVSE have a vehicle connected during the 2nd quarter 2012
- National Data
- Range of Percent of Charging Units with a Vehicle Connected vs. Time of Day
- 4,821 total EVSE
- 3,338 residential and 1,483 publicly available Level 2 EVSE

EV Project – EVSE Infra. Summary Report



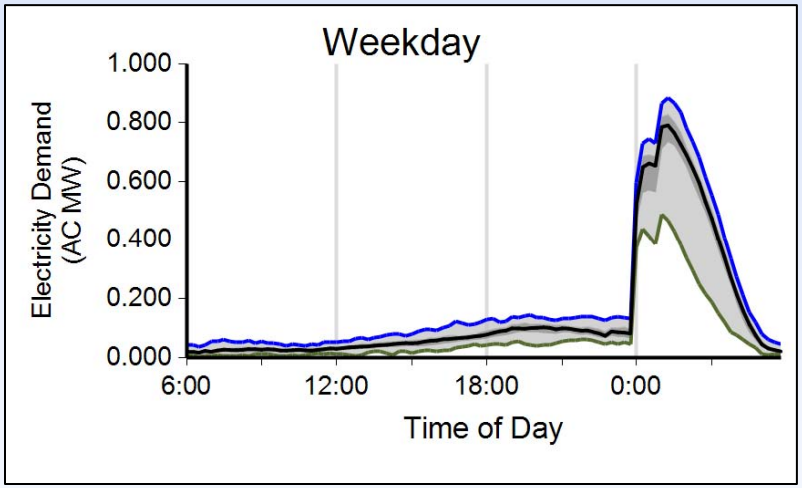


- Charging demand in AC MW during the 2nd quarter 2012
- National data, all EVSE
- Time of day kWh rates are influencing charging start times as measured by AC MW demand
- Range of Aggregate Electricity Demand vs. Time of Day (AC MW)
- 4,821 total EVSE
- 3,338 residential and 1,483 publicly available Level 2 EVSE

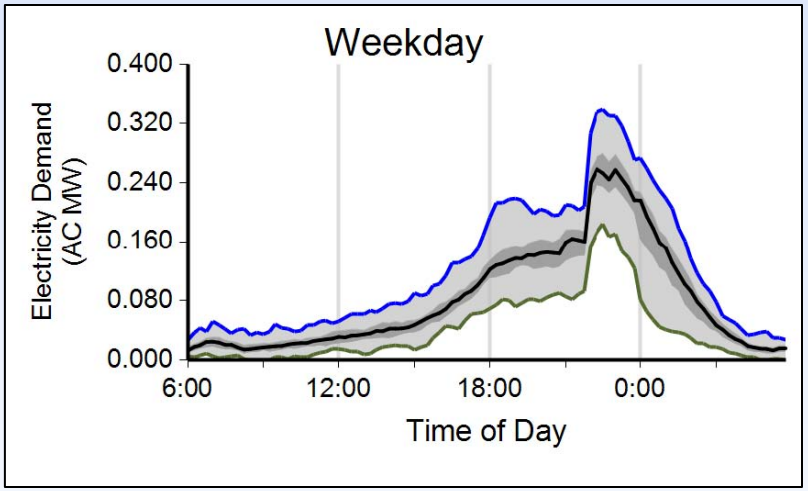
EV Project – EVSE Infra. Summary Report

- **Residential Level 2 Weekday EVSE 2nd Quarter 2012**
- **Time of day kWh rates clearly influence charge patterns**

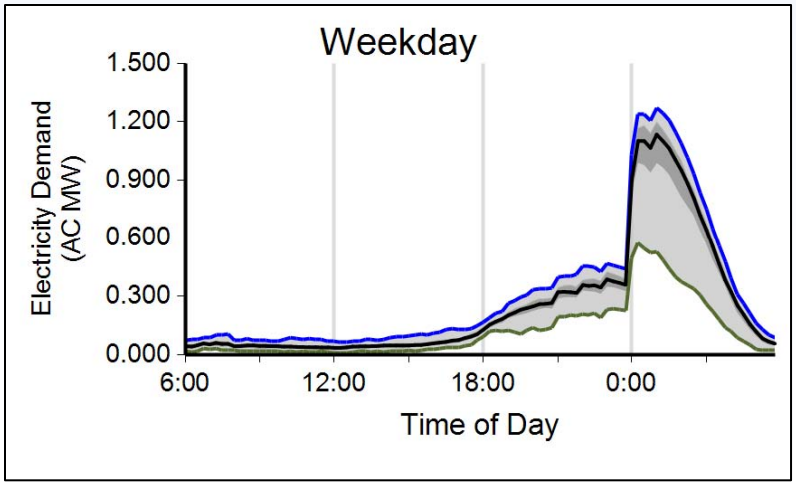
San Diego



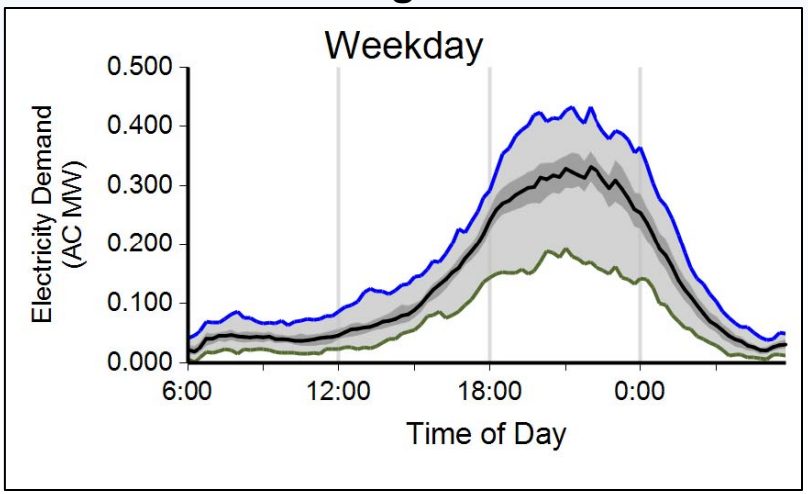
Oregon



San Francisco



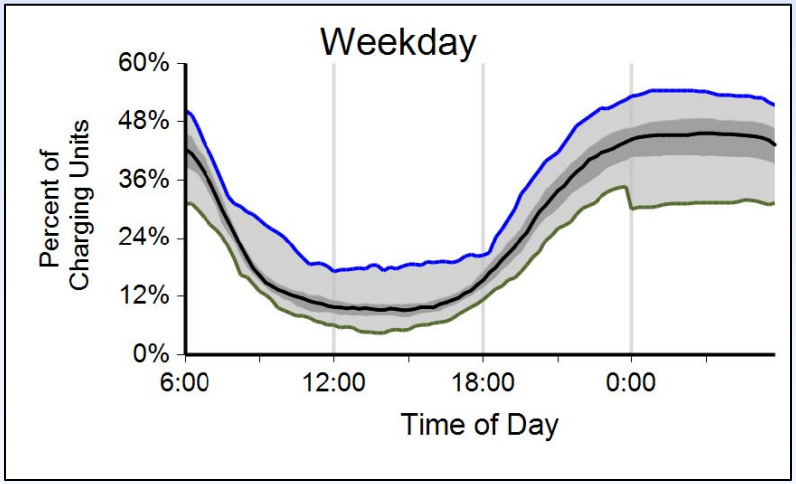
Washington State



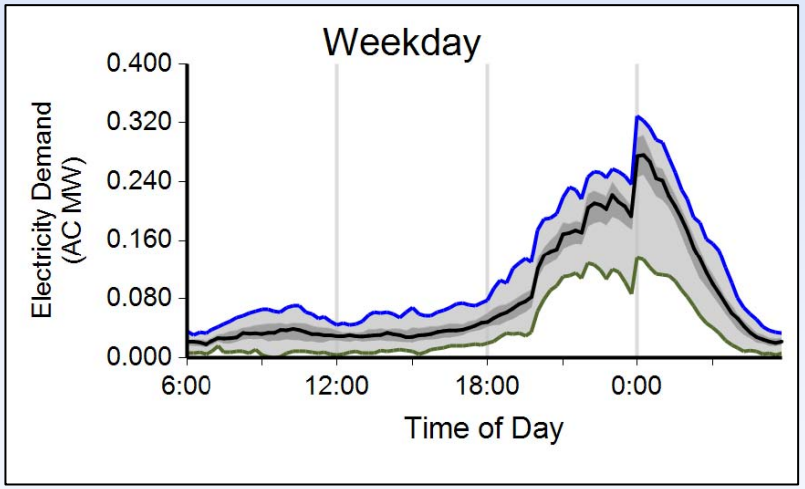
EV Project – EVSE Infra. Summary Report

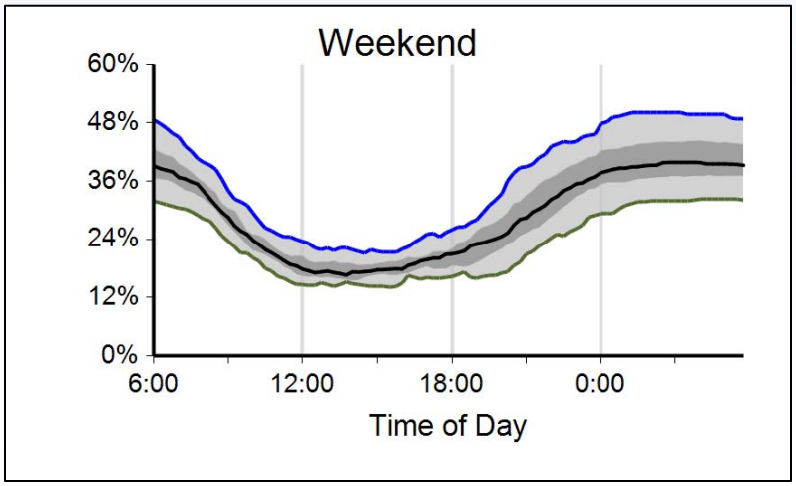
- **L.A. Residential and Non Residential Level 2 Weekday EVSE 2nd Quarter 2012**

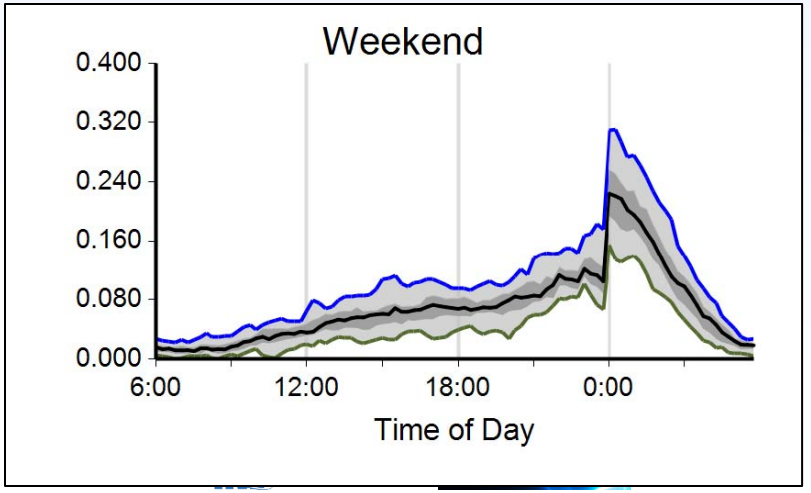
LA Vehicle Connected



LA Demand – AC MW







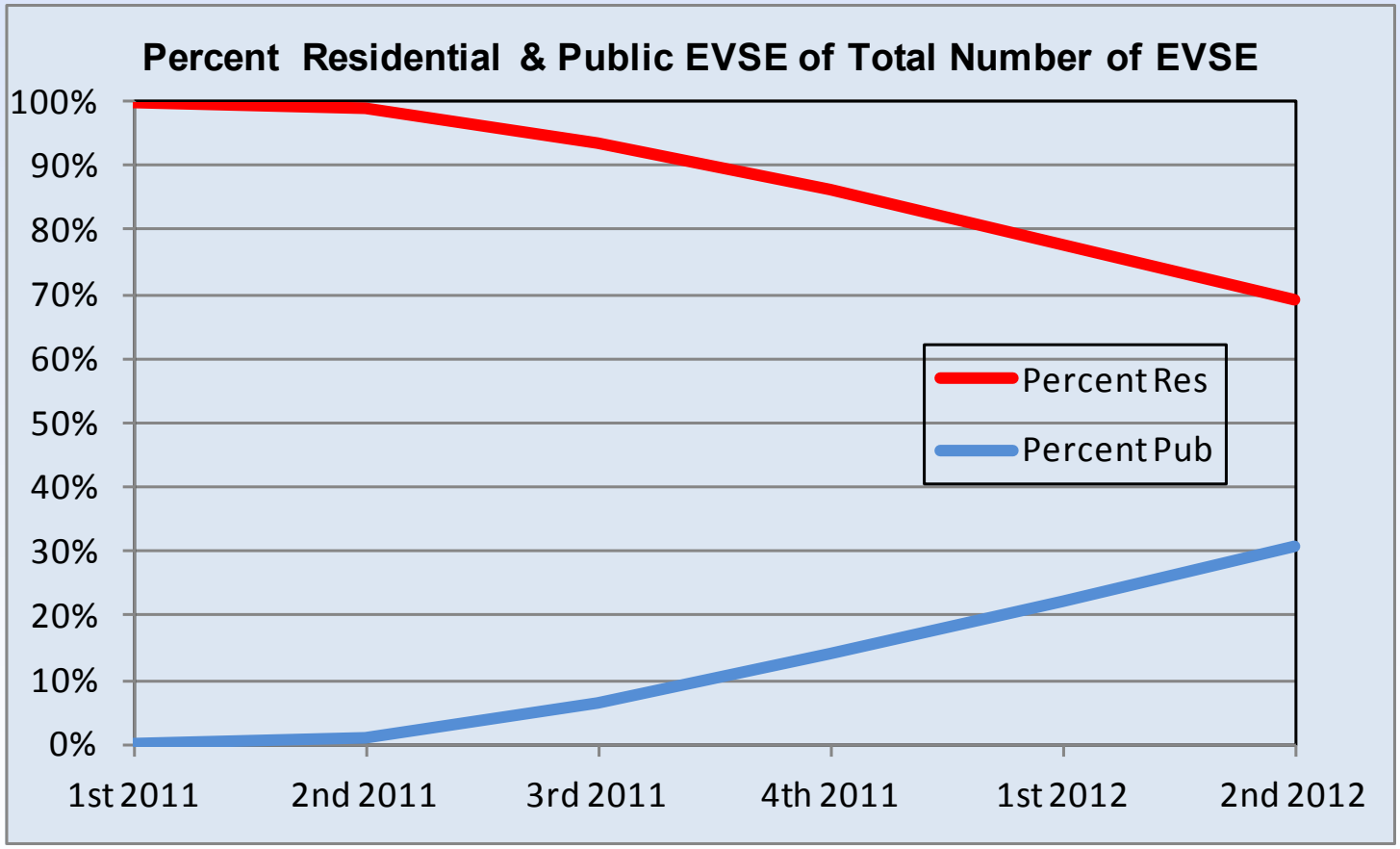
EV Project – EVSE Infra. Summary Report

2nd quarter 2012	National	L.A.
Ave hours V connected R2 WD	11.6	11.9 hours
Ave hours V connected R2 WE	11.6	11.5 hours
Ave hours V drawing power R2 WD	2.5	2.6 hours
Ave hours V drawing power R2 WE	2.1	2.3 hours
Ave AC kWh/charge event R2 WD	8.7	9.6 AC kWh
Ave AC kWh/charge event R2 WE	7.5	8.2 AC kWh
Ave hours V connected P2 WD	6.1	4.8 hours
Ave hours V connected P2 WE	4.1	3.8 hours
Ave hours V drawing power P2 WD	2.3	2.3 hours
Ave hours V drawing power P2 WE	2.2	1.6 hours
Ave AC kWh/charge event P2 WD	7.7	7.9 AC kWh
Ave AC kWh/charge event P2 WE	7.7	5.6 AC kWh

- R: residential, P: public, WD: weekday, WE: weekend, 2: Level 2 EVSE, and V: vehicle

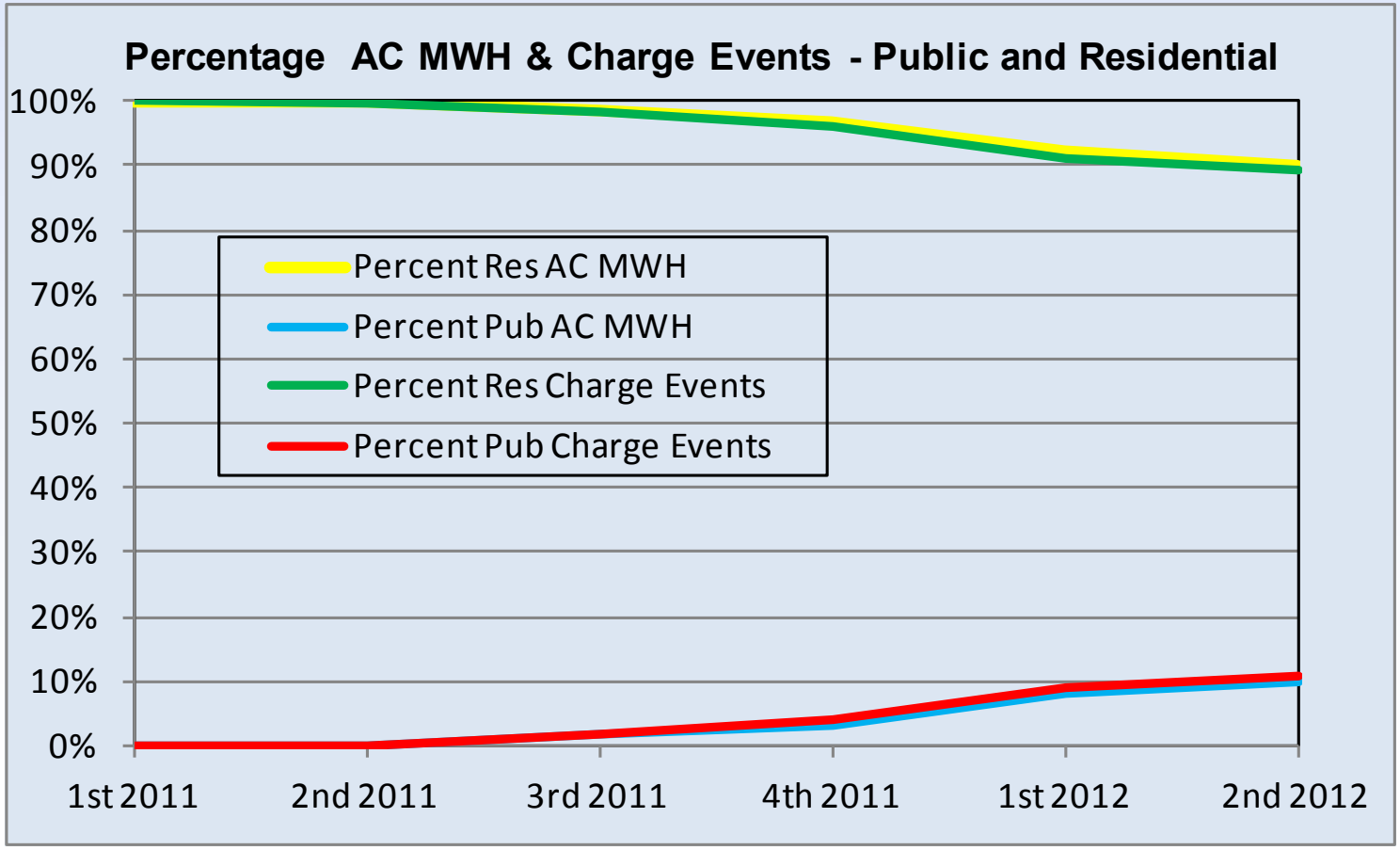
EV Project – EVSE Infra. Summary Report

- **Percent of public EVSE deployed is increasing, now representing 31% of all EVSE**



EV Project – EVSE Infra. Summary Report

- Percent charge events and AC MWH use by residential and public EVSE each reporting quarter
- Public EVSE use (red & blue lines) is increasing
- 10.8% charge events and 10.0% MWh 2nd quarter 2012



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy | VEHICLE TECHNOLOGIES PROGRAM

Chevrolet Volt Vehicle Demonstration

Fleet Summary Report

Reporting period: April 2012 through June 2012

Number of vehicles: 143

Number of vehicle days driven: 6,598

All operation

Overall gasoline fuel economy (mpg)	73.7
Overall AC electrical energy consumption (AC Wh/mi)	170
Average Trip Distance	12.6
Total distance traveled (mi)	370,987
Average Ambient Temperature (deg F)	71.0

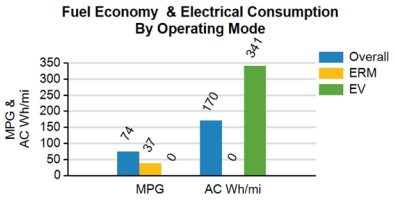
Electric Vehicle mode operation (EV)

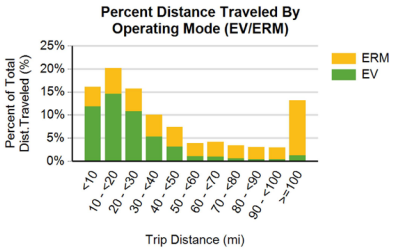
Gasoline fuel economy (mpg)	No Fuel Used
AC electrical energy consumption (AC Wh/mi)	341
Distance traveled (mi)	185,282
Percent of total distance traveled	49.9%
Average driving style efficiency (distance weighted)[1]	83%

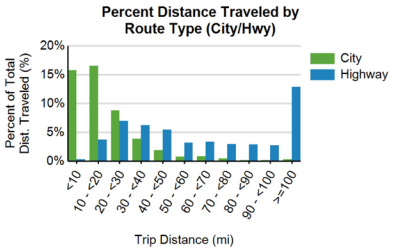
Extended Range mode operation (ERM)

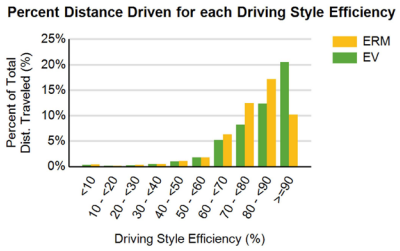
Gasoline fuel economy (mpg)	36.9
AC electrical energy consumption (AC Wh/mi)	No Elec. Used
Distance traveled (mi)	185,705
Percent of total distance traveled	50.1%
Average driving style efficiency (distance weighted)[1]	79%

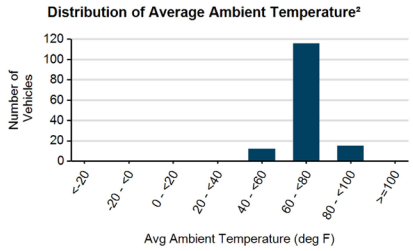
	City[3]	Highway[3]
Percent of miles in EV operation (%)	68.0%	32.4%
Percent Number of trips	85.4%	14.6%
Average trip distance (mi)	7.3	43.7
Average driving style efficiency (distance weighted)[1]	80%	82%











1 The energy efficiency over the drive cycle is based on driving style. Driving in a more efficient manner results in a higher percentage for driving style.

2 Plot shows average ambient temperature during all driving in the reporting period for each vehicle

3 City / Highway defined per SAE J2841

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Chevrolet Volt DOE ARRA Project

- Non-public fleet drivers operating 150 Volts
- May '11 to June '12
  - 1.2 million total miles
  - All trips, 70.0 mpg, 174 AC Wh/mi
  - EV mode, 352 AC Wh/mi. 49.5% miles
  - Extended range mode, 35.4 mpg
- April to June 2012
  - 371,000 miles
  - EV mode, 341 AC Wh/mi. 49.9% miles

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Chevrolet Volt DOE ARRA Project

- **Non-public fleet drivers**
- **150 Volts (May '11 – June '12)**
  - **Average charging events per month 17**
  - **Average # charging events per vehicle day 1.3**
  - **Average miles per charging event 43 miles**
  - **Average trips between charging events 3.4**
  - **Average time connected per event 3.2 hours**
  - **Average energy per charge event 7.2 AC kWh**
  - **Average charging energy per vehicle month 125 AC kWh**
  - **Average trip distance city driving 7.3 miles**
  - **Average trip distance highway driving 44.0 miles**
  - **Percent of miles in EREV (electric) mode 49.5%**

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Ford Escape Advanced Research Fleet

Number of vehicles: 21 | Date range of data received: 11/01/2009 to 06/30/2012

Reporting period: Nov 09 - June 12 | Number of vehicle days driven: 9,131

All Trips Combined

Overall gasoline fuel economy (mpg)	38
Overall AC electrical energy consumption (AC Wh/mi)[1]	100
Overall DC electrical energy consumption (DC Wh/mi)[2]	68
Total number of trips	44,178
Total distance traveled (mi)	528,632

Trips in Charge Depleting (CD) mode[3]

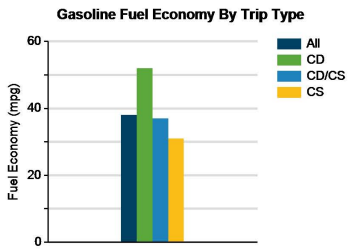
Gasoline fuel economy (mpg)	52
DC electrical energy consumption (DC Wh/mi)[4]	163
Number of trips	25,801
Percent of trips city | highway	83% | 17%
Distance traveled (mi)	151,628
Percent of total distance traveled	29%

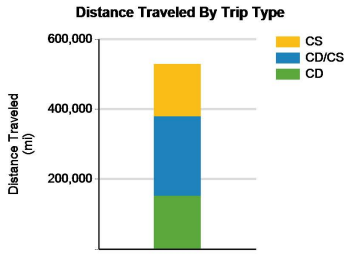
Trips in both Charge Depleting & Charge Sustaining (CD/CS) modes[5]

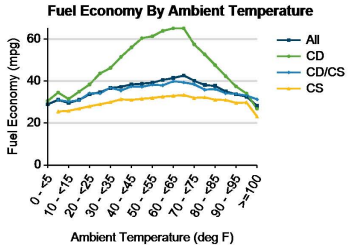
Gasoline fuel economy (mpg)	37
DC electrical energy consumption (DC Wh/mi)[6]	54
Number of trips	8,261
Percent of trips city | highway	38% | 62%
Distance traveled (mi)	227,283
Percent of total distance traveled	43%

Trips in Charge Sustaining (CS) mode[7]

Gasoline fuel economy (mpg)	31
Number of trips	10,106
Percent of trips city | highway	66% | 34%
Distance traveled (mi)	149,720
Percent of total distance traveled	28%







Notes: 1 - 7. Please see http://avt.inl.gov/pdf/phev/fordreportnotes.pdf for an explanation of all PHEV Fleet Testing Report notes.

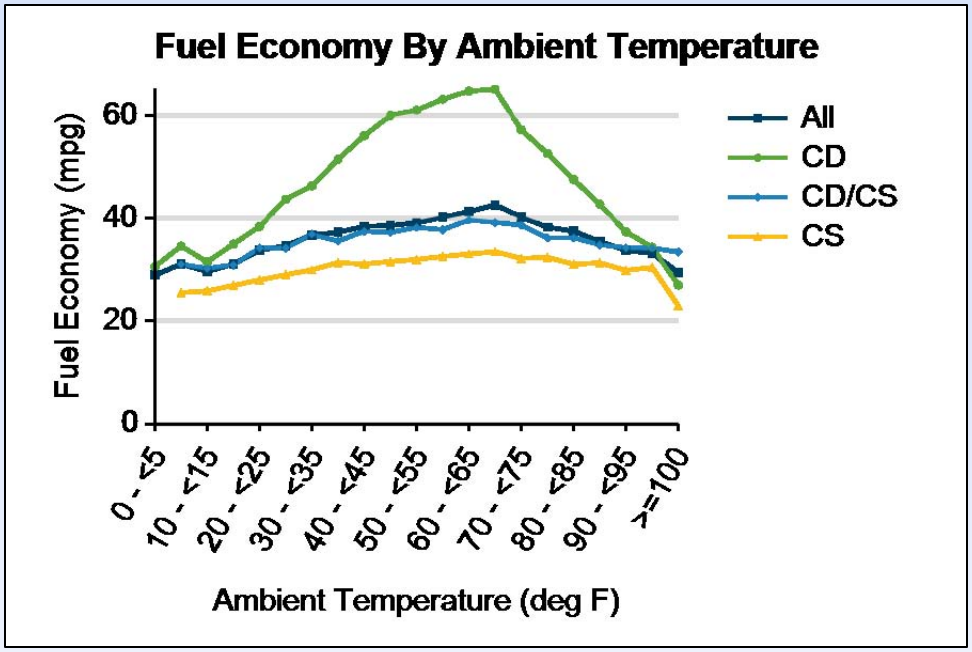
Since these vehicles are flex-fuel capable, some driving events are conducted with E-85, which may decrease fuel economy results

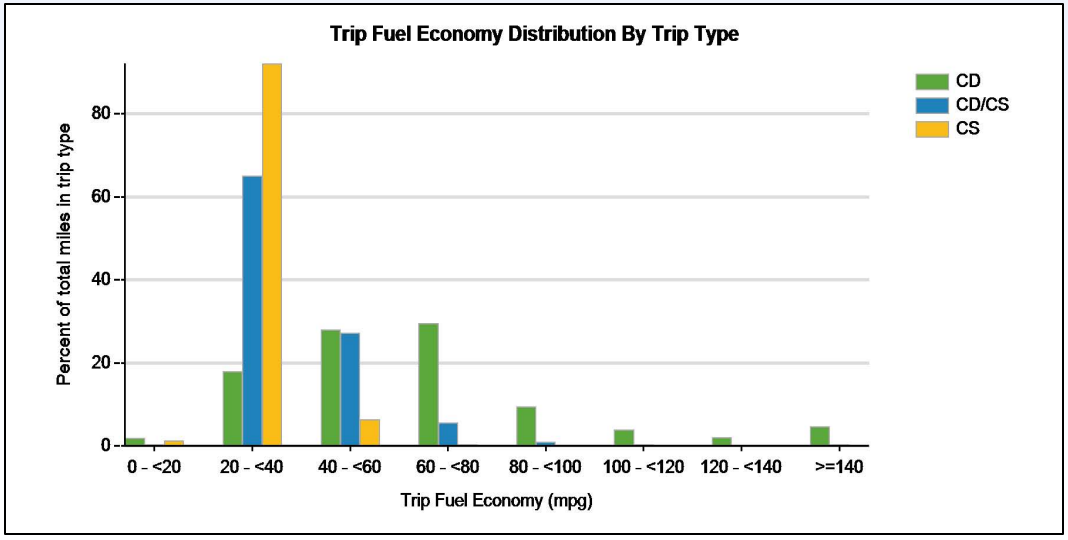
"The Ford Escape Advanced Research Fleet was designed as a demonstration of customer duty cycles related to plug-in electric vehicles. The vehicles used in this demonstration have not been optimized to provide the maximum potential fuel economy."

Ford Escape Adv. Research Vehicle

- 21 Ford Escape PHEVs
- Fleet drivers
- Nov 09 to July 12
- 529,000 test miles
- All trips, 38 mpg, 100 AC & 68 DC Wh/mi
- Charge Depleting (CD), 52 mpg & 163 DC Wh/mi. 29% of all miles
- Charge Sustaining (CS), 31 mpg. 28% of all miles
- Charging = 68% overall increase in mpg when comparing CD to CS trips

Ford Escape Adv. Research Vehicle





- Ambient temperature and increased engine off-times impact mpg
- Charging = 57% increase in city mpg and 78% increase in highway mpg (compare CD to CS)
- City - 36% CD and 23% CS miles engine off
- Highway - 11% CD and 4% CS miles engine off

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Chrysler RAM PHEV Fleet

Number of vehicles: 109
Reporting period: July 2011 to May 2012

All Fleets

Date range of data received: 7/1/2011 to 5/31/2012
Number of vehicle days driven: 14280

All Trips Combined

Overall gasoline fuel economy (mpg)	19
Overall AC electrical energy consumption (AC Wh/mi)[1]	100
Overall DC electrical energy consumption (DC Wh/mi)[2]	69
Overall DC electrical energy captured from regenerative braking (DC Wh/mi)	44
Total number of trips	88,891
Total distance traveled (mi)	815,236

Trips in Charge Depleting (CD) mode[3]

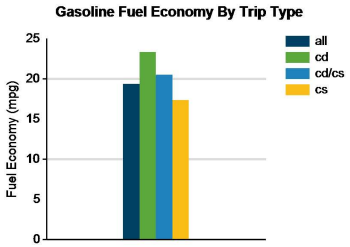
Gasoline fuel economy (mpg)		23
DC electrical energy consumption (DC Wh/mi)[4]		210
Number of trips		37,002
Percent of trips city | highway	94% |	6%
Distance traveled (mi)		205,637
Percent of total distance traveled		25%

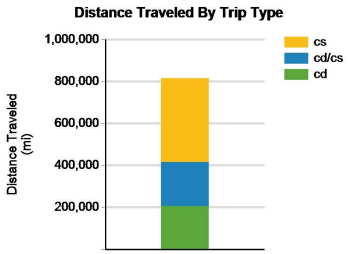
Trips in both Charge Depleting & Charge Sustaining (CD/CS) modes[5]

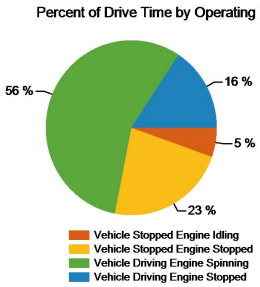
Gasoline fuel economy (mpg)		21
DC electrical energy consumption (DC Wh/mi)[6]		69
Number of trips		10,253
Percent of trips city | highway	74% |	26%
Distance traveled CD | CS (mi)	78,551 |	131,862
Percent of total distance traveled CD | CS	10% |	16%

Trips in Charge Sustaining (CS) mode[7]

Gasoline fuel economy (mpg)		17
Number of trips		41,636
Percent of trips city | highway	90% |	10%
Distance traveled (mi)		399,840
Percent of total distance traveled		49%







Notes: 1 - 9. Please see http://avt.inl.gov/pdf/phev/chryslerreportnotes.pdf for an explanation of all PHEV Fleet Testing Report notes. This document also includes all report changes to date.

The Chrysler RAM PHEV Fleet was designed as a demonstration program of customer duty cycles related to plug-in electric vehicles and may not necessarily demonstrate optimized fuel economy.

Vehicle fuel economy is based on customer usage and may not be representative of maximum potential fuel economy.

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Chrysler Ram PHEV Project

- 109 Ram PHEVs
- Fleet drivers
- July 2011 to May 2012
- 815,000 test miles
- All trips, 19 mpg, 100 AC & 69 DC Wh/mi. 44 DC Wh/mi captured by regenerative braking
- CD, 23 mpg & 210 DC Wh/mi
- CS, 17 mpg
- Charging = 35% overall increase in mpg when comparing CD to CS trips

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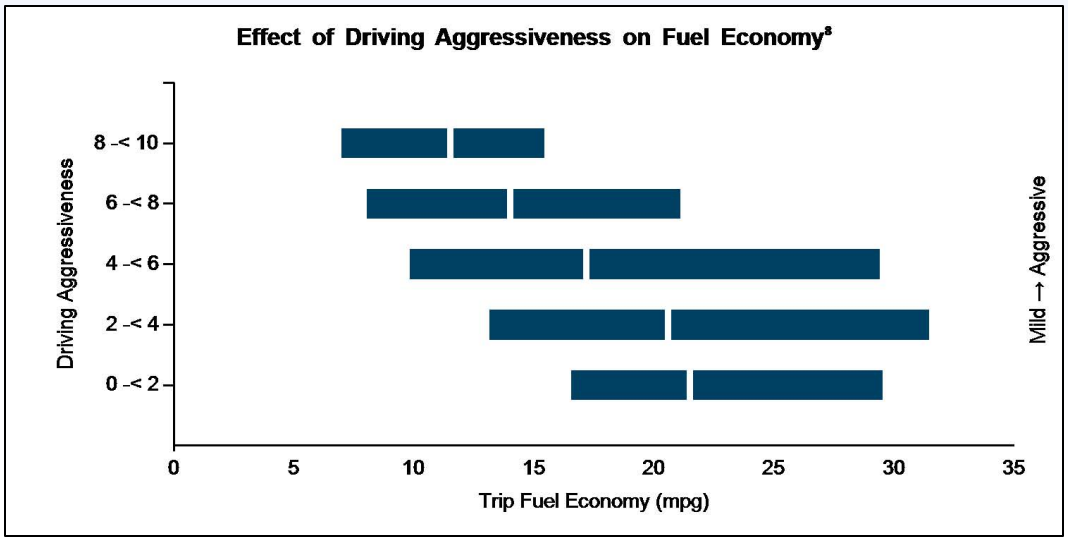
Chrysler Ram PHEV Pickups

- Rams in fleet applications
- Vehicle driving 16% time engine stopped
- Vehicle stopped 23% time engine stopped
- 64.1 miles per charge event
- 7.0 trips per charge event
- 0.89 charge events per vehicle day
- 2.4 average hours per charge event
- 6.4 AC kWh average energy / charge



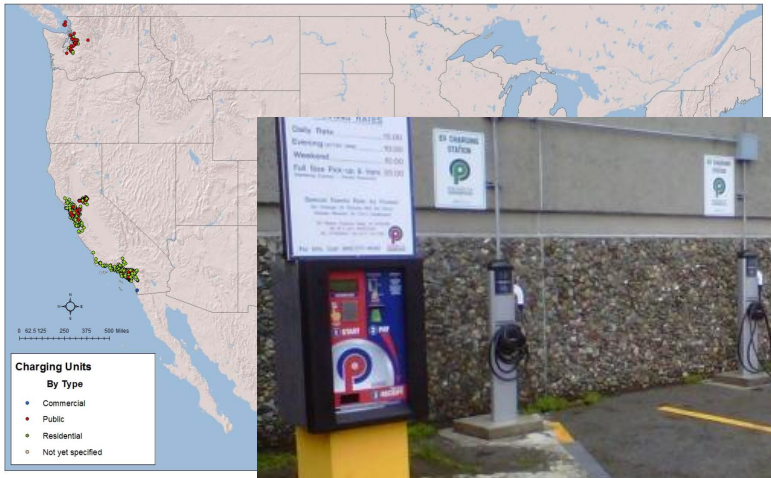
ChargePoint® America Vehicle Charging Infrastructure Summary Report

Project Status to Date through: March 2012

Charging Unit - By State	Residential	Private Commercial	Public	Not Specified	Charging Units Installed to Date[1]	Number of Charging Events Performed[2]	Electricity Consumed (AC MWh)
California	578	34	463	3	1,078	128,396	873.3
Connecticut	8	-	-	-	8	1,815	9.7
District of Columbia	-	13	16	-	29	503	3.9
Florida	24	10	204	2	240	3,195	18.1
Maryland	17	7	46	-	70	3,807	24.0
Massachusetts	13	7	64	-	84	1,501	11.5
Michigan	196	12	160	-	368	37,707	260.4
New Jersey	44	2	17	-	63	10,589	63.6
New York	20	88	85	-	193	11,530	91.8
Texas	39	9	182	-	230	11,729	75.3
Virginia	23	6	39	-	68	7,280	47.7
Washington	10	7	95	-	112	5,067	32.5
Total	972	195	1,371	5	2,543	223,119	1,511.8

ChargePoint America Charging Unit Distribution

Project to Date through March 2012



[1] Includes all charging units that were in use by the end of the repo

[2] A charging event is defined as the period when a vehicle is conn some power is transferred

ChargePoint Network

Idaho National

ChargePoint America ARRA Project

- Conducted by Coulomb
- Project to March 2012
- 2,543 EVSE installed and reporting data
- 972 Residential
- 195 Private/commercial
- 1,371 Public
- 5 unknown
- 223,000 charge events
- 1,500 AC MWh

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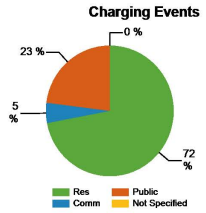
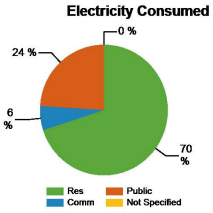
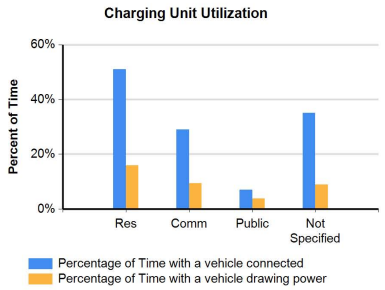
ChargePoint® America Vehicle Charging Infrastructure Summary Report

Report period: February through March 2012

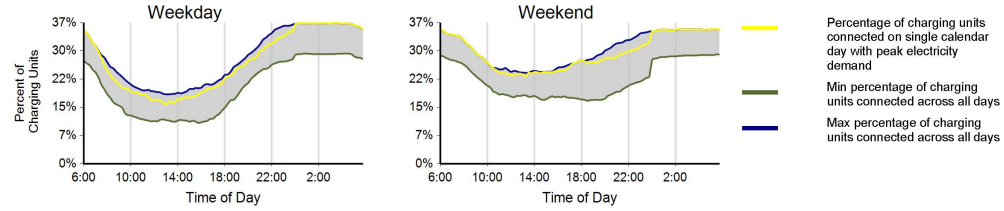
Charging Unit Usage - By Type	Residential	Private Commercial	Public	Not Specified	Total
Number of charging units[1]	913	124	981	5	2,023
Number of charging events[2]	48,370	3,075	15,198	162	66,805
Electricity consumed (AC MWh)	322.81	26.99	110.51	1.22	461.54
Percent of time with a vehicle connected	51%	29%	7%	35%	29%
Percent of time with a vehicle drawing power	16%	9%	4%	9%	10%



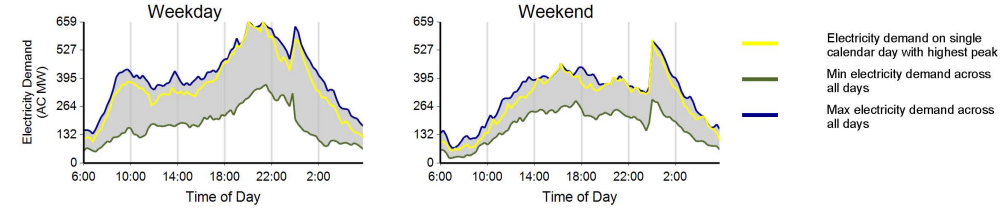




Charging Availability: Range of Percent of Charging Units with a Vehicle Connected versus Time of Day



Charging Demand: Range of Aggregate Electricity Demand versus Time of Day



[1] Includes all charging units that were in use during the reporting period and have reported data to the INL

[2] A charging event is defined as the period when a vehicle is connected to a charging unit, during which period power is transferred

ChargePoint Network | Idaho National Laboratory

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ChargePoint America ARRA Project

- Feb & March 2012 data
- 67,000 charge events
- Percent time vehicle connected
  - Residential 51%
  - Private/com 29%
  - Public 7%
- Percent time drawing power
  - Residential 16%
  - Private/com 9%
  - Public 4%
- EVSE data only

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Additional PEV and Infrastructure Testing

- Conducting testing of “dumb” and “smart” EVSE
- Initiated wireless charging test program
- Initiated field and lab DC Fast and Level 2 charging study of impacts on battery life in 6 vehicles
- Conducting first responders training program with the National Fire Prevention Association and NHTSA
- Battery mule test vehicle provides field testing of traction battery packs at any power and efficiency level
- 20 Quantum PHEV Escape conversions in benchmarking
- Additional EVSE providers are also providing charging data to INL

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EV Project Summary To Date

- EV Project vehicles connected much longer than needed to recharge - opportunities to shift charging times
- Significant residential Level 2 EV Project charging occurs off-peak with charge-starts occurring at the midnight starts of super off-peak TOU kWh rates
- Significant opportunities to fully understand how the public uses public versus non-public infrastructure
- Revenue models for public charging are currently being introduced – impacts?
- Only about 30% of EV Project data collected to date
- "Normal" research project process requires:
  - Design and execute the project, data collection completed, data analyzed, and finally, reports issued at completion of experiment
- INL/ECOtality needs to completely collect all data before definitively reporting seasonal trends and behaviors

Future EV Project Data Analysis Subjects

- Pricing elasticity – TOU rate influences?
- Regional and seasonal demographics and charging behaviors?
- Density of residential and non-residential EVSE as input to local micro distribution studies – transformer failures?
- Charge control preferences – vehicle, Blink and web based, and scheduled versus random?
- Rich public versus non-rich public EVSE charging behaviors?
- Level 2 EVSE versus DCFC behaviors?
- Travel corridor versus convenience charging at stores?
- Length of vehicle ownership and miles per day / week / charge?
- Non-residential subcategories (public and work parking)?
- Etc., etc., etc.?

Acknowledgement

This work is supported by the U.S. Department of Energy's EERE Vehicle Technologies Program

This presenter is very grateful for DOE's support and the contributions of all the testing partners

More Information

http://avt.inl.gov

This presentation will be posted in the publications section of the above website

INL/MIS-12-26977