Idaho National Laboratory

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

Clean Cities Webinar – The EV Project & Other Electric Drive Vehicle Testing Results to date (June 2012)

Jim Francfort – Idaho National Laboratory

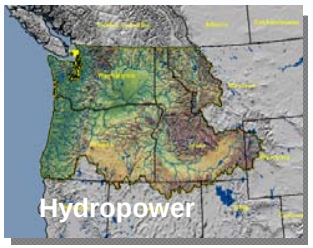
U.S. Department of Energy
Clean Cities Webinar
June 25, 2012

Outline

- Background, participants, testing experience
- Data processes and data security
- EV Project
  - Description and data parameters
  - Leaf, Volt, and EVSE benchmarking results (bulk of presentation)
- DOE ARRA Volt project benchmarking results
- DOE TADA Ford Escape Advanced Research Vehicle PHEV benchmarking results
- DOE ARRA Chrysler Ram PHEV benchmarking results
- Other research activities
- Summary

Idaho National Laboratory (INL)

- Eastern Idaho based U.S. Department of Energy (DOE) Federal laboratory
- 890 square mile site with 4,000 staff
- Support 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



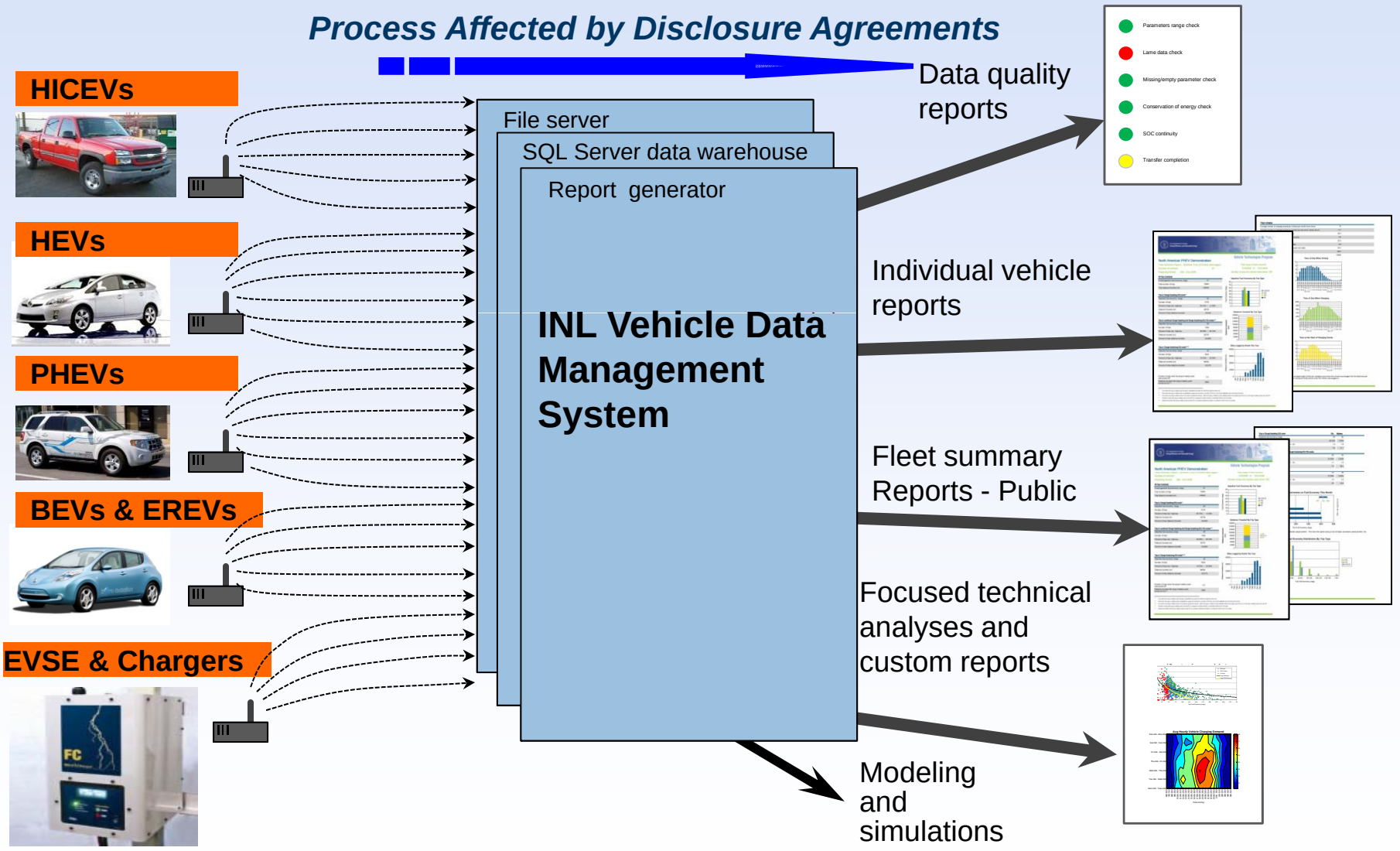
AVTA Participants and Goals

- INL manages the work performed in support of DOE's Advanced Vehicle Testing Activity (AVTA)
  - AVTA is part of DOE's Vehicle Technologies Program
  - ECOtality provides testing support via NETL
- ECOtality is the EV Project lead, with INL, Nissan and GM/OnStar as significant partners
- EV Project and AVTA test partners often include electric utilities, Federal, state and local government agencies, private companies, and individual vehicle owners
- The AVTA goal: Petroleum reduction and energy security
  - Confuse people with facts
  - Provide benchmark data to DOE, technology modelers, research and development programs, vehicle manufacturers (via VSATT), 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

- **45 million test miles accumulated on 8,000 electric drive vehicles representing 100+ models**
- **EV Project: 4,191 Leafs (5/27) and 428 Volts (4/1)**
  - **27.6 million test miles (5/27 and 4/1, 2012)**
- **PHEVs: 14 models, 430 PHEVs, 4 million test miles**
- **EREVs: 1 model, 150 EREVs, 878,000 test miles**
- **HEVs: 19 models, 50 HEVs, 6 million test miles**
- **Micro hybrid (stop/start) vehicles: 3 models, 7 MHVs, 300,000 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**
- **6,000+ EVSE with data loggers**

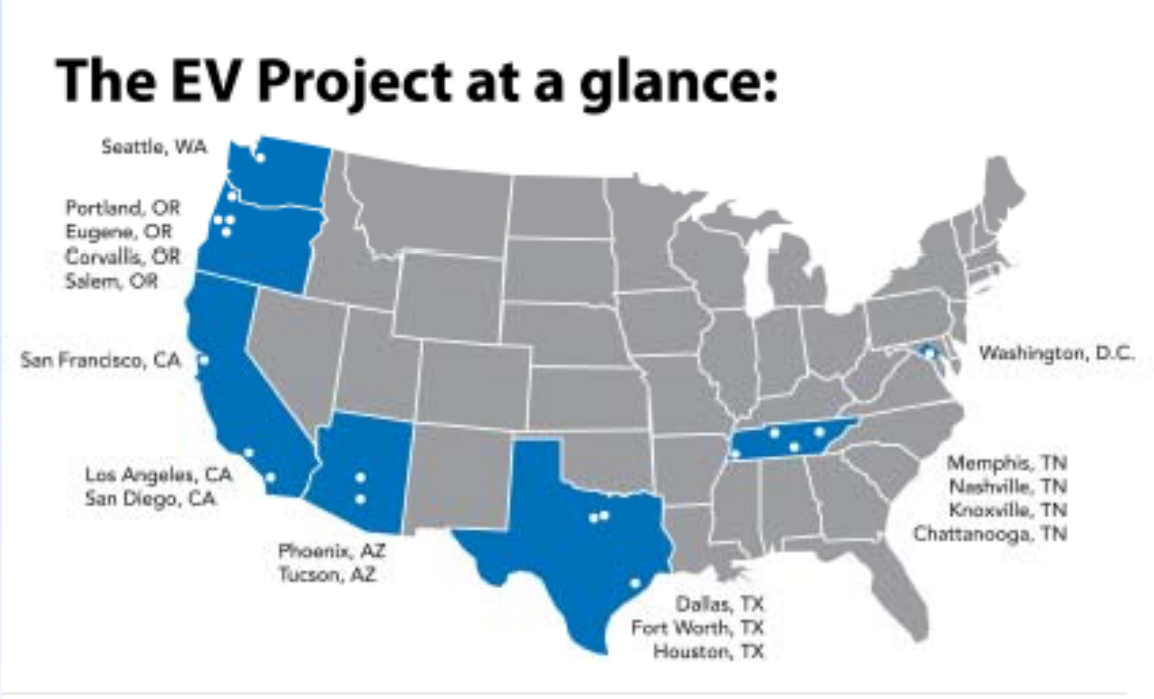
INL Vehicle/EVSE Data Management Process



Data Security, Protection and Use

- All vehicle, EVSE, and personal information raw data protected by NDAs (Non Disclosure Agreements)
  - Limitations on how proprietary data can be distributed, stored, and used
  - No raw data can or will be distributed by INL
  - 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 the above limitations are strictly adhered by INL
- The AVTA has used data loggers on vehicles and EVSE (electric vehicle supply equipment) since 1993 to benchmark vehicle and charging equipment profiles
- EV Project reporting requires INL to blend three distinct data streams based on GPS and time/date stamps, and provide independent reports to DOE, ECOtality, project participants, industry, and the general public

EV Project Locations



- **Largest vehicle & EVSE data collection activity in the world**
- **Purpose: Build and study mature charging infrastructures and take the lessons learned to support the future streamlined deployment of grid-connected electric drive vehicles**

EV Project – EVSE Data Parameters Collected per Charge Event

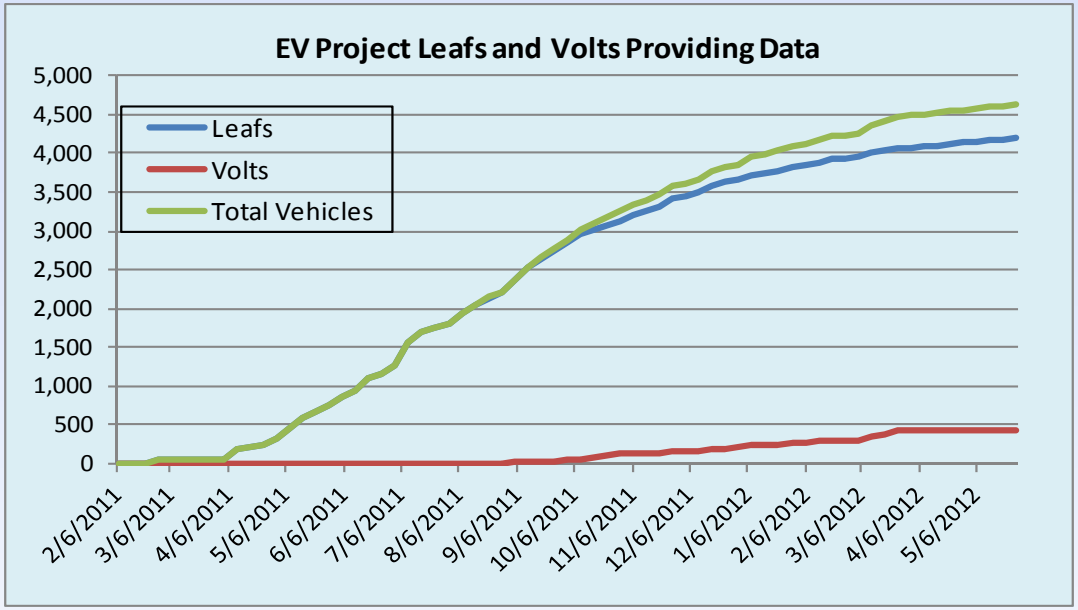
- Unique ID for Charging Event
- Unique ID Identifying the EVSE
- Date/Time Stamp
- Connect and Disconnect Times
- Start and End Charge Times
- Maximum Instantaneous Peak Power
- Average Power
- Total energy (kWh) per charging event
- Rolling 15 Minute Average Peak Power
- And other non-dynamic EVSE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

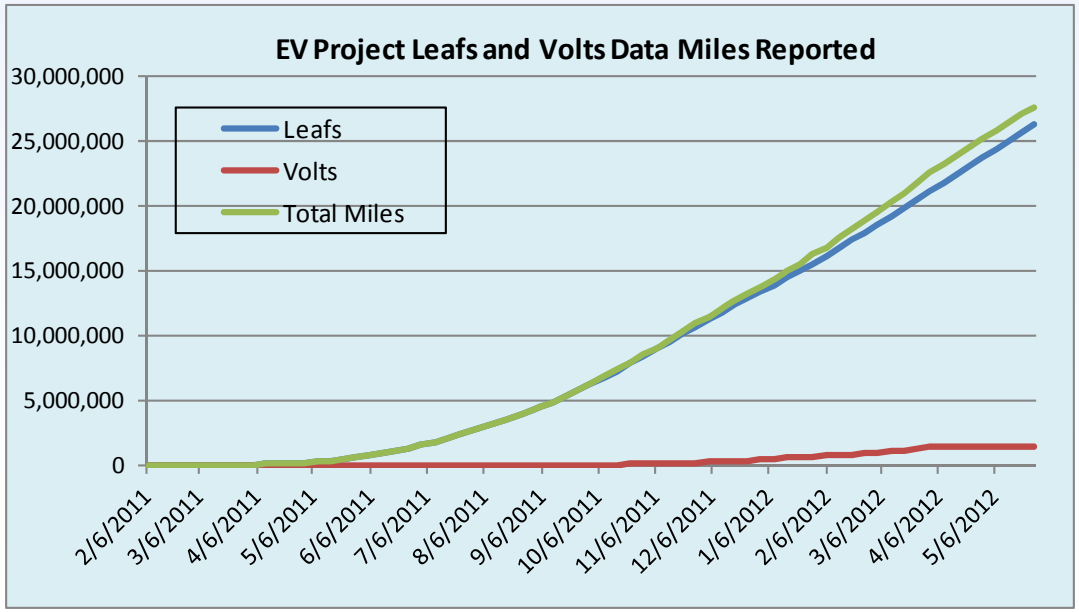
EV Project – Vehicle Data Parameters Collected per Start/Stop Event

- Vehicle ID
- Event type (key on / key off)
- Odometer
- Battery state of charge
- Date/Time Stamp
- GPS (longitude and latitude)
- Recorded for each key-on and key-off event

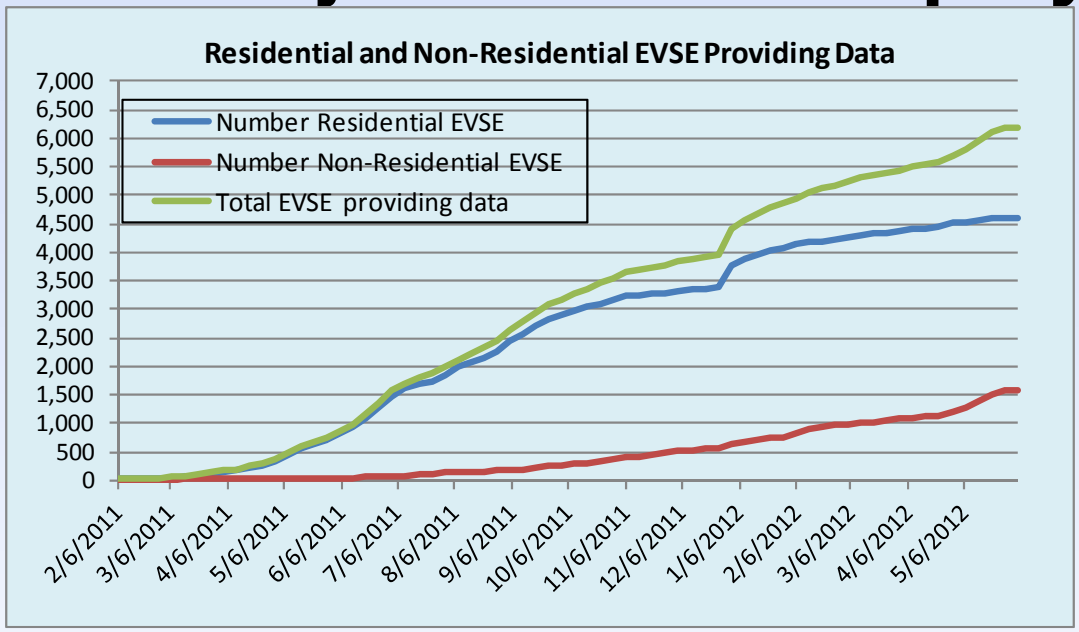
EV Project – Vehicle Deployments / Miles

- **4,191 Leafs (5/27) and 428 Volts (4/01) reporting data**
- **27.6 million total miles**
- **104,000 test miles and 3,516 charge events per day**

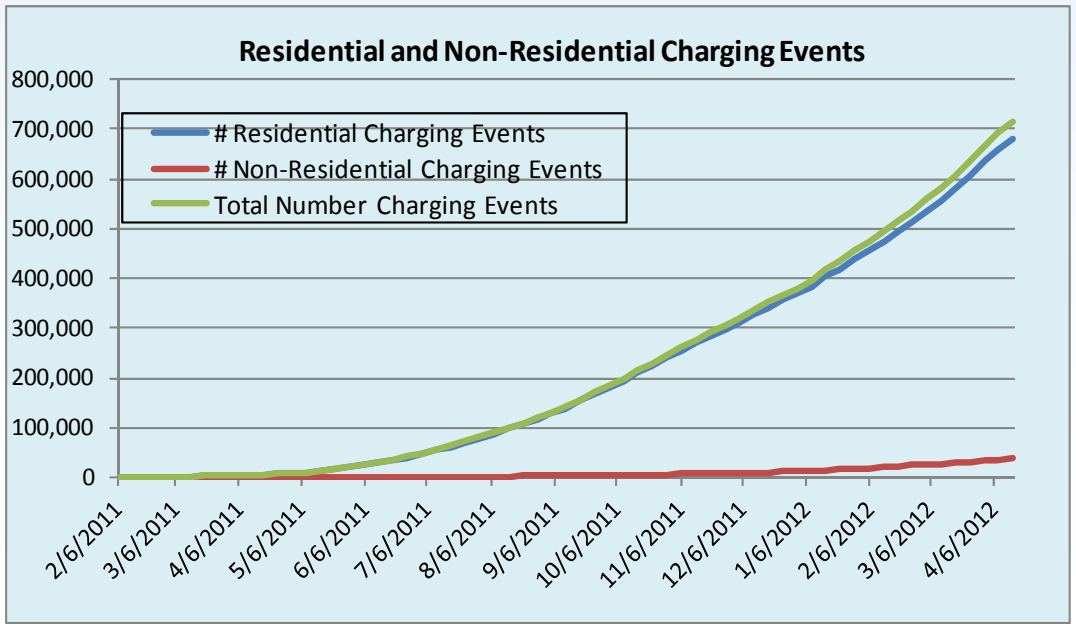




EV Project – EVSE Deployment and Use

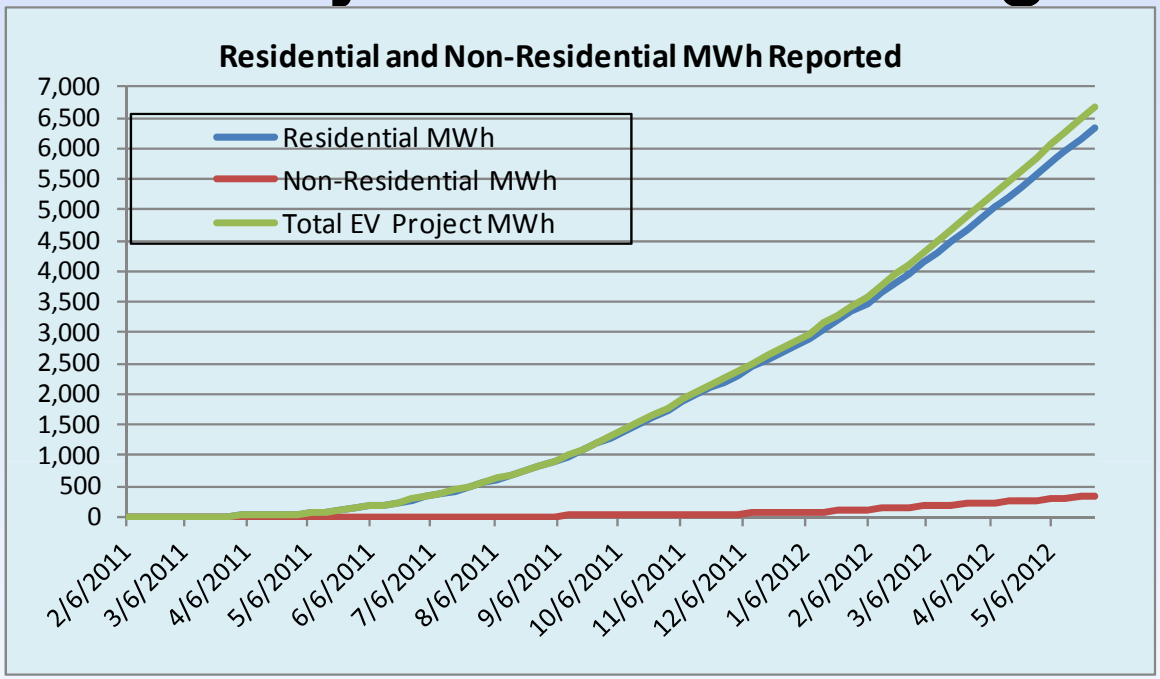


- 4,606 Res. EVSE
- 1,588 non-Res EVSE
- 6,194 total EVSE
- 864,000 charge events
- Non-Residential includes DCFC
- Above as of 6/03/12



- INL reports vehicle and EVSE data differently than ECOtality as INL is required to report processed data counts, not deployment counts

EV Project – Total Charge Energy (MWh)

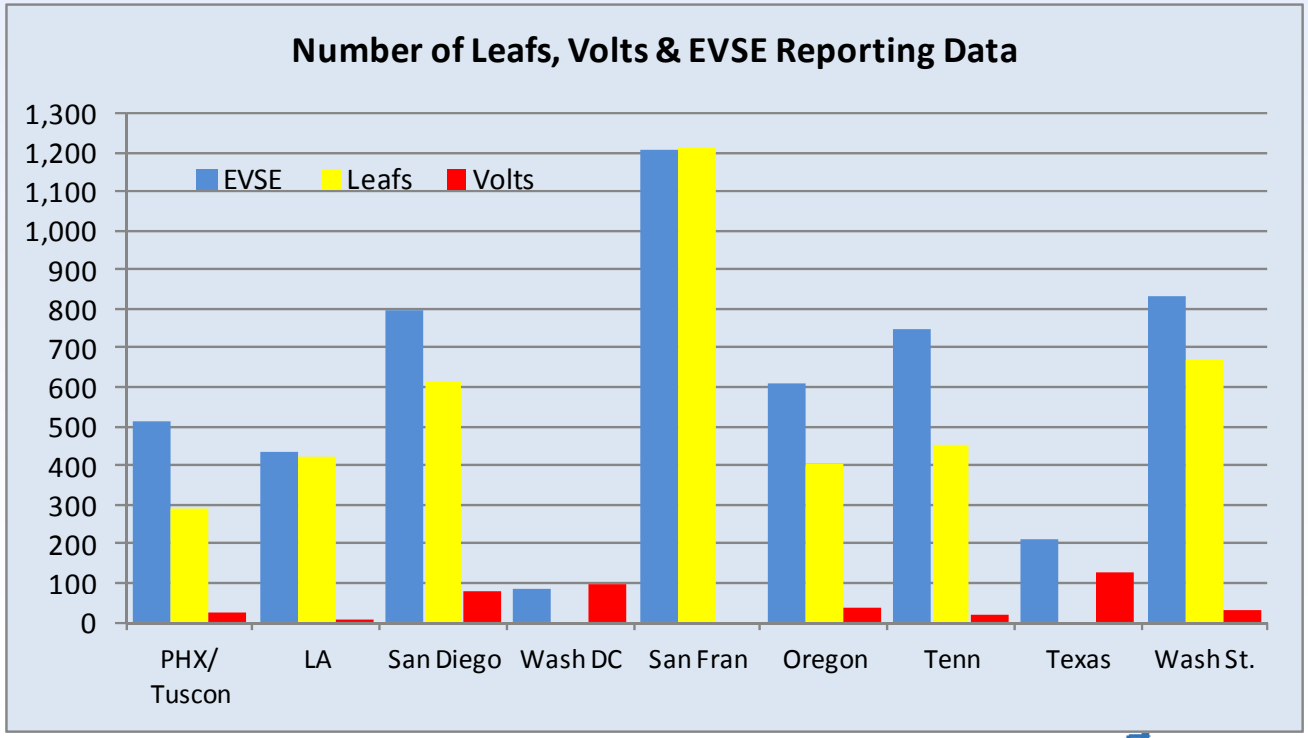


- **6,660 total MWh charged via EV Project EVSE and DCFC (4/29/12)**

- **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 1st Quarter

- **Vehicles and charging infrastructure deployed to date 1st quarter 2012 and data received by INL**
- **Charging infrastructure**
  - **5,432 units installed**
  - **665,968 charging events**
  - **5,069 AC MWh**
- **Vehicles**
  - **4,066 Leafs**
  - **427 Volts**
  - **22.6 million miles**



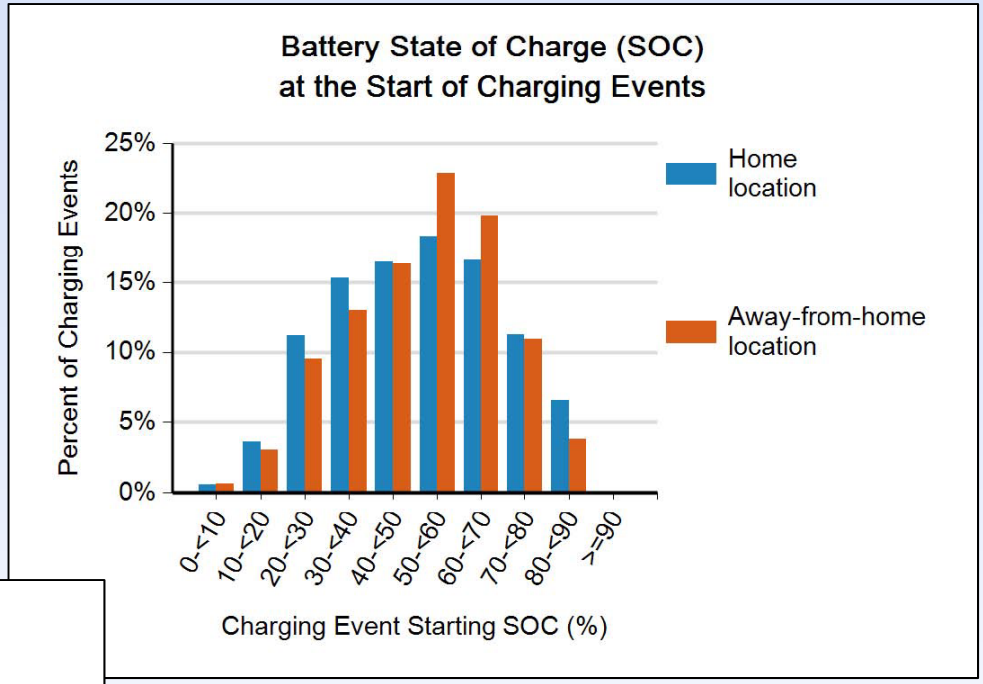
EV Project – Vehicle Usage Report

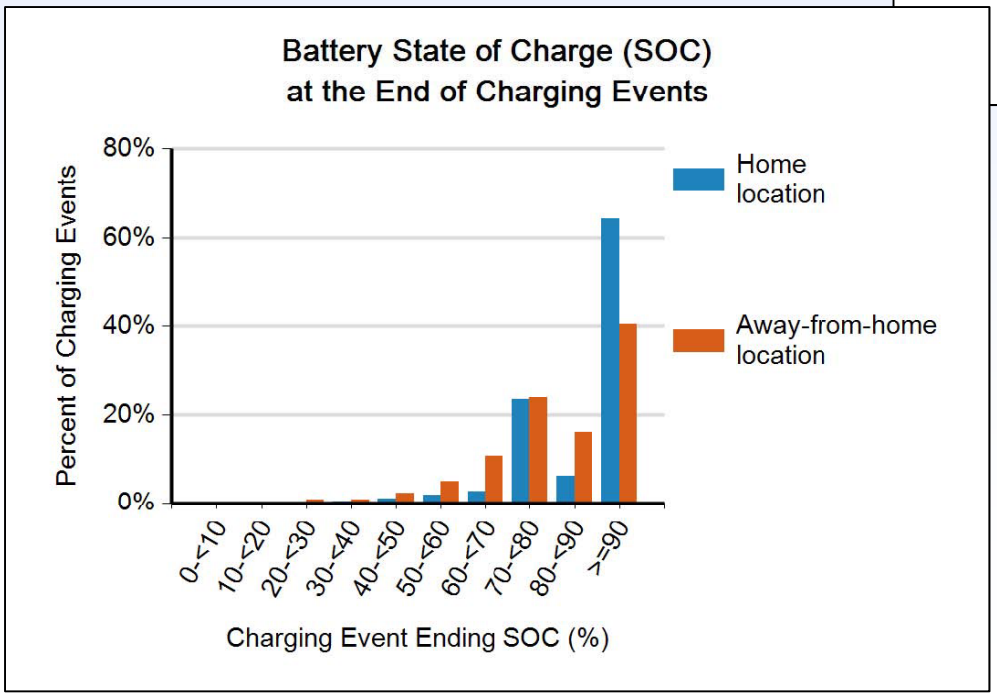
Vehicle Usage – 1st quarter 2012

	Leafs	Volts
• Number of vehicles	2,987	317
• Number of Trips	773,602	76,425
• Distance (thousands)	5,558 mi	610 mi
• Average (Ave) trip distance	7.2 mi	8.0 mi
• Ave distance per day	30.2 mi	36.4 mi
• Ave number (#) trips between charging events	3.8	3.0
• Ave distance between charging events	27.4 mi	24.1 mi
• Ave # charging events per day	1.1	1.5

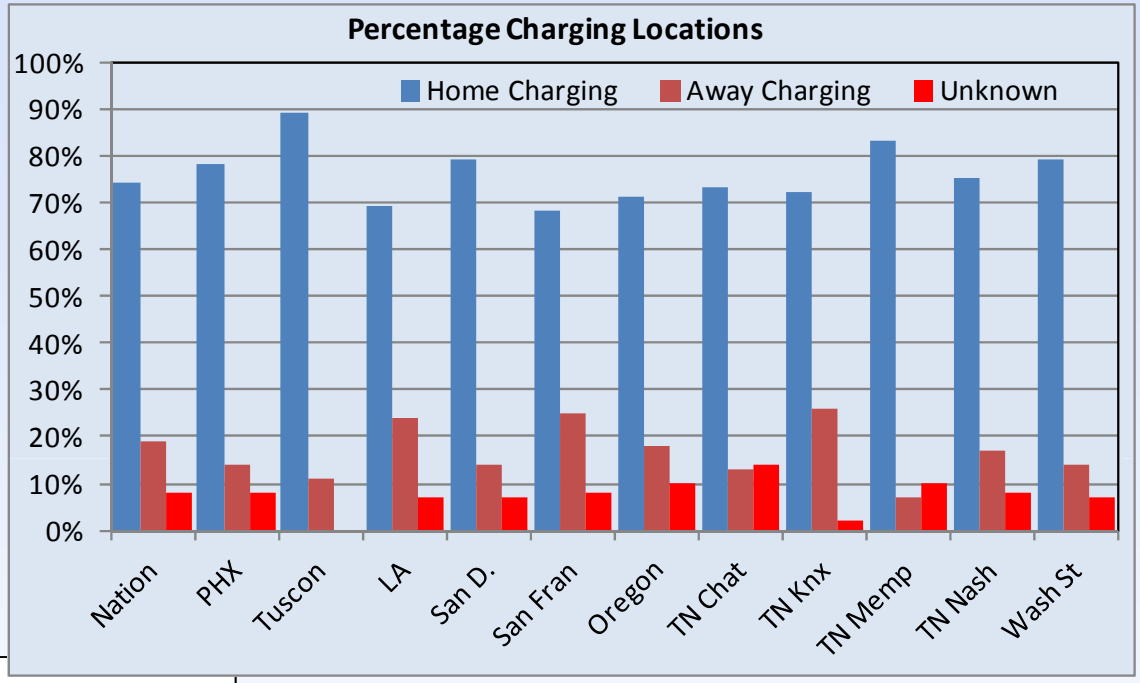
Note that per day data is only for days a vehicle is driven

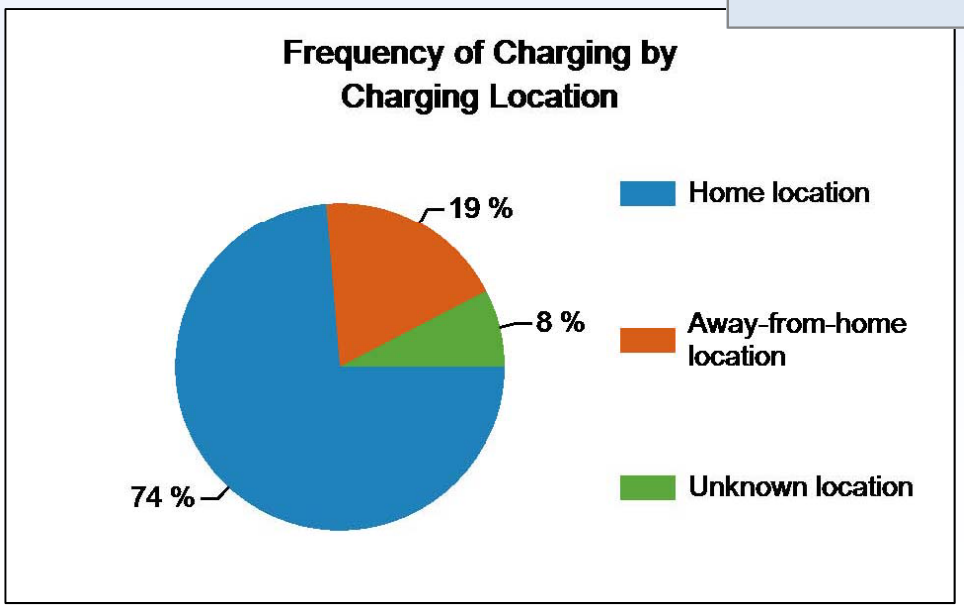
EV Project – Leaf Usage Report (1st ¼ 2012)



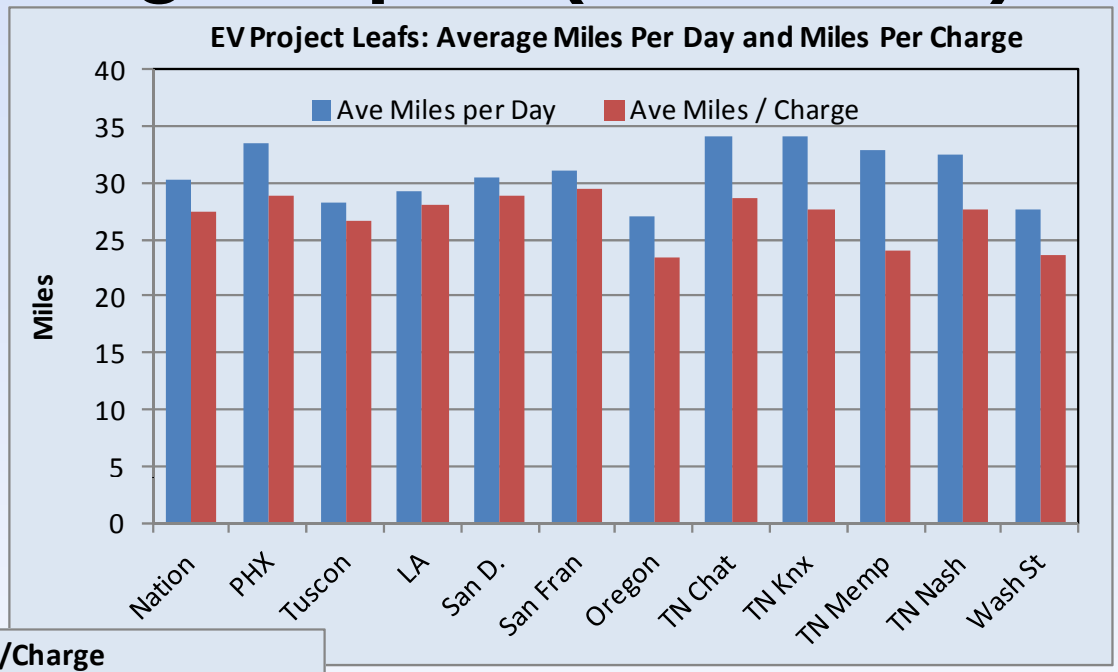


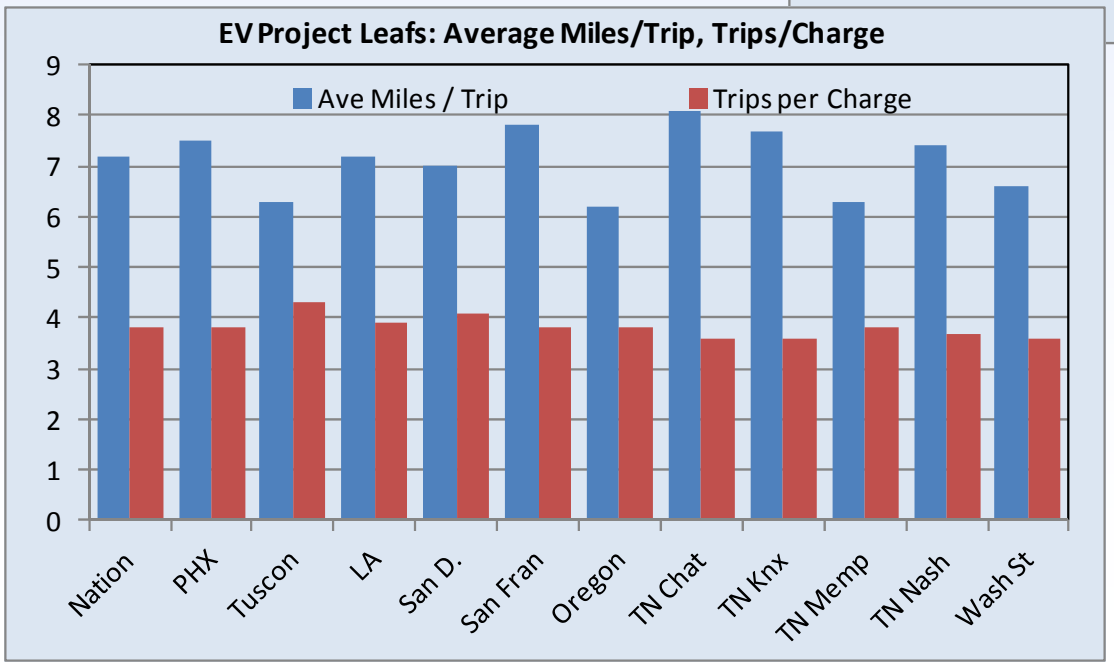
EV Project – Leaf Usage Report (1st ¼ 2012)



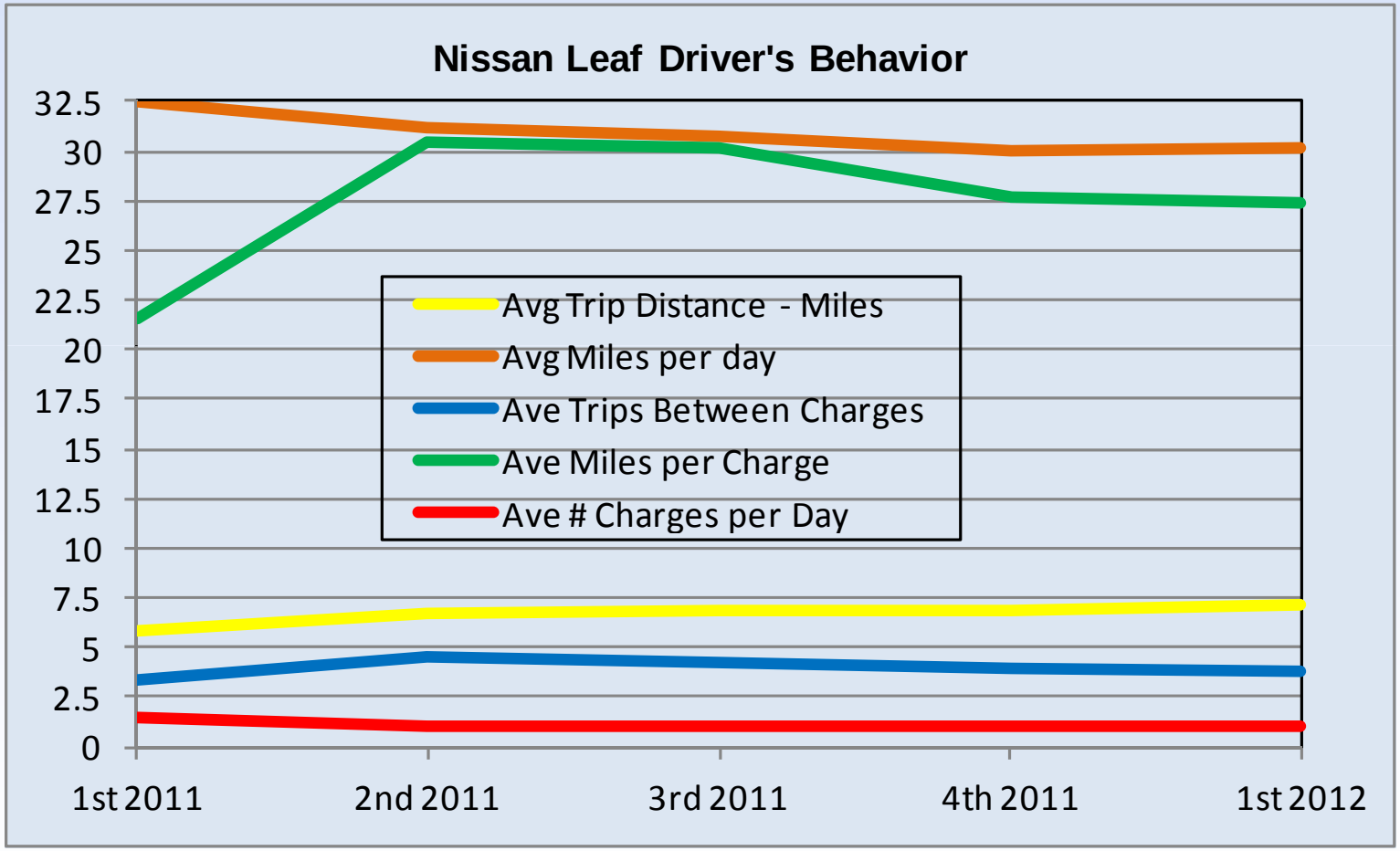


EV Project – Leaf Usage Report (1st ¼ 2012)

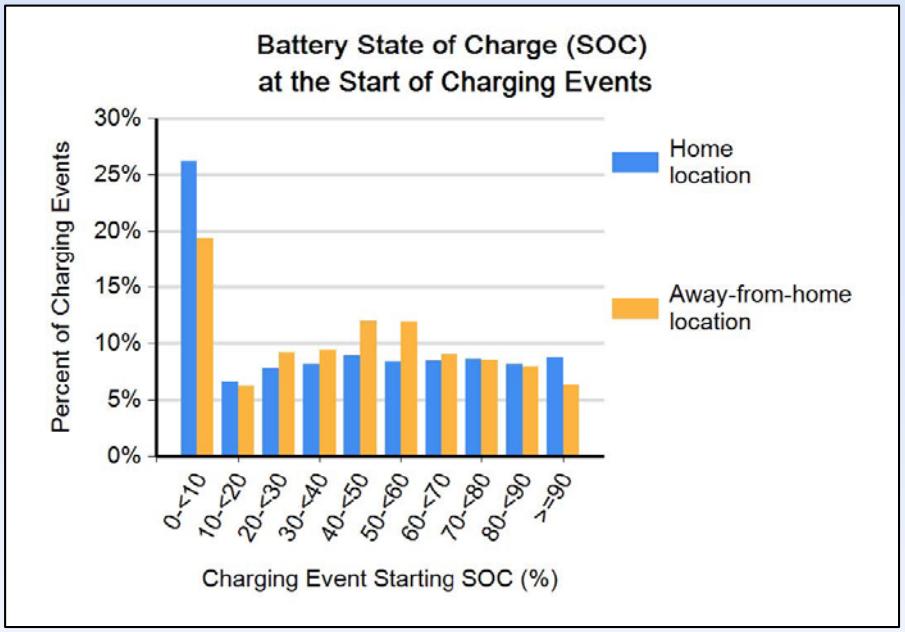


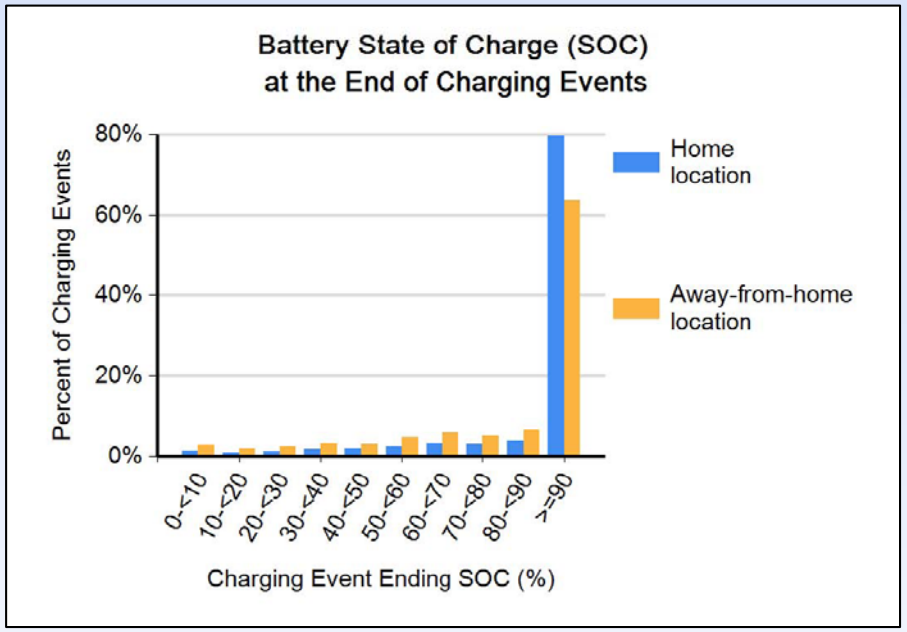


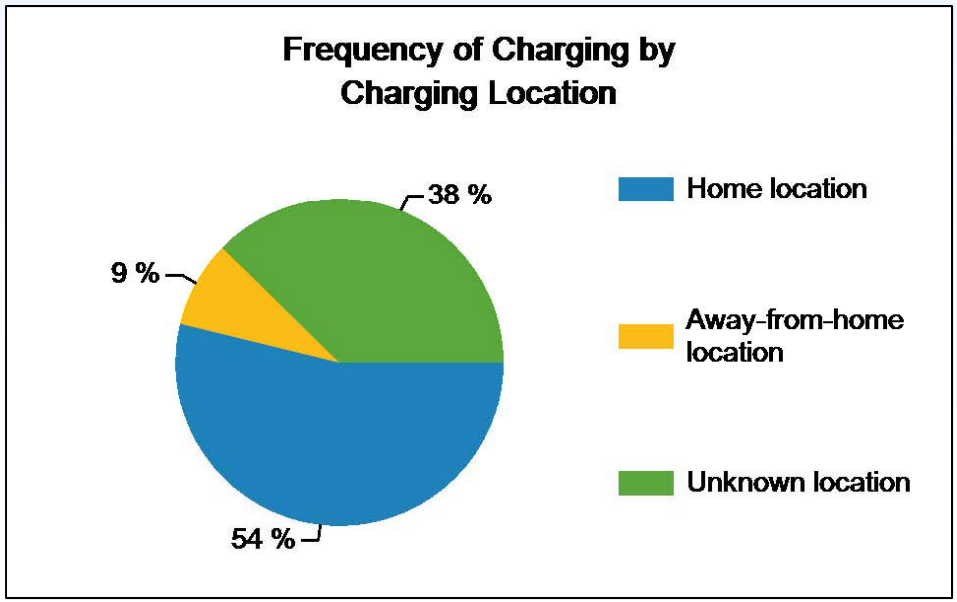
EV Project – Leaf Usage Report 5 Quarters



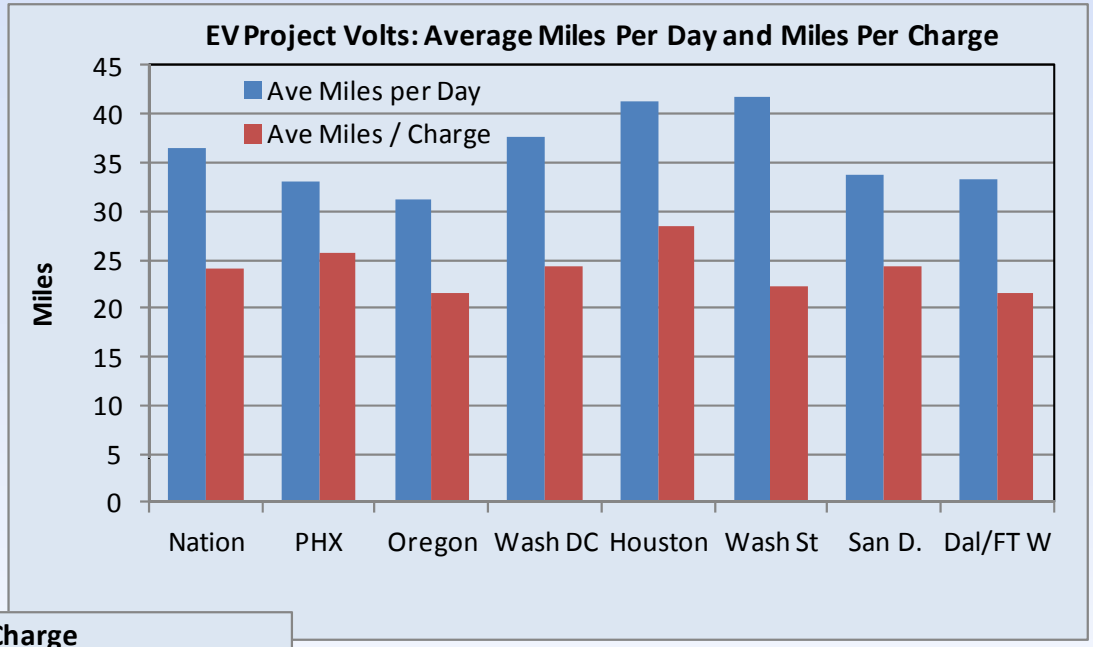
EV Project – Volt Usage Report (1st ¼ 2012)

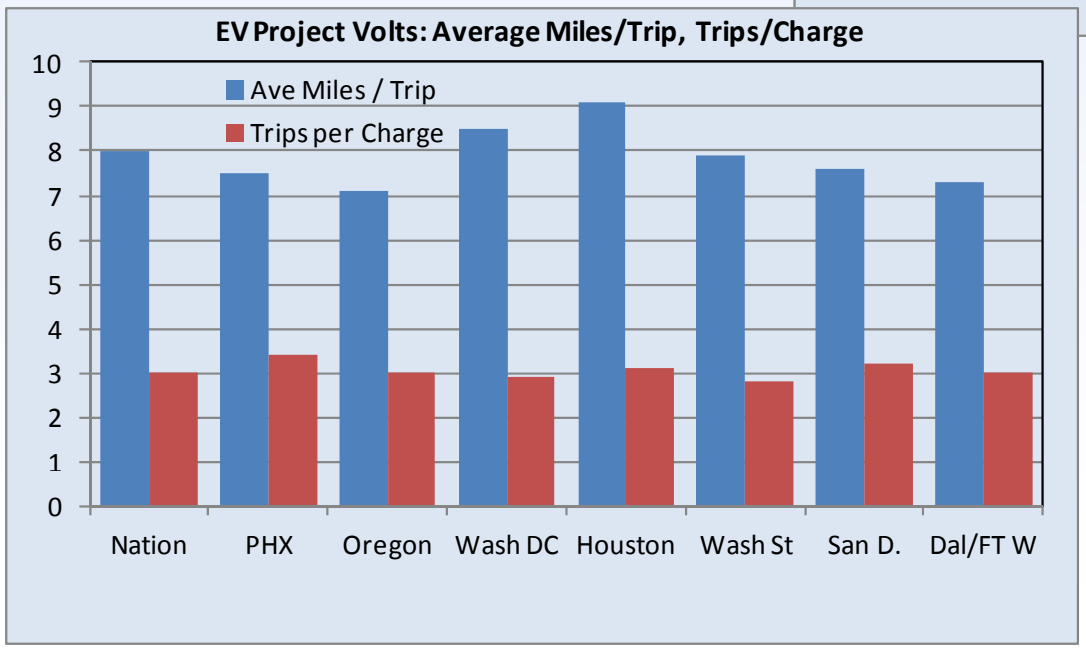




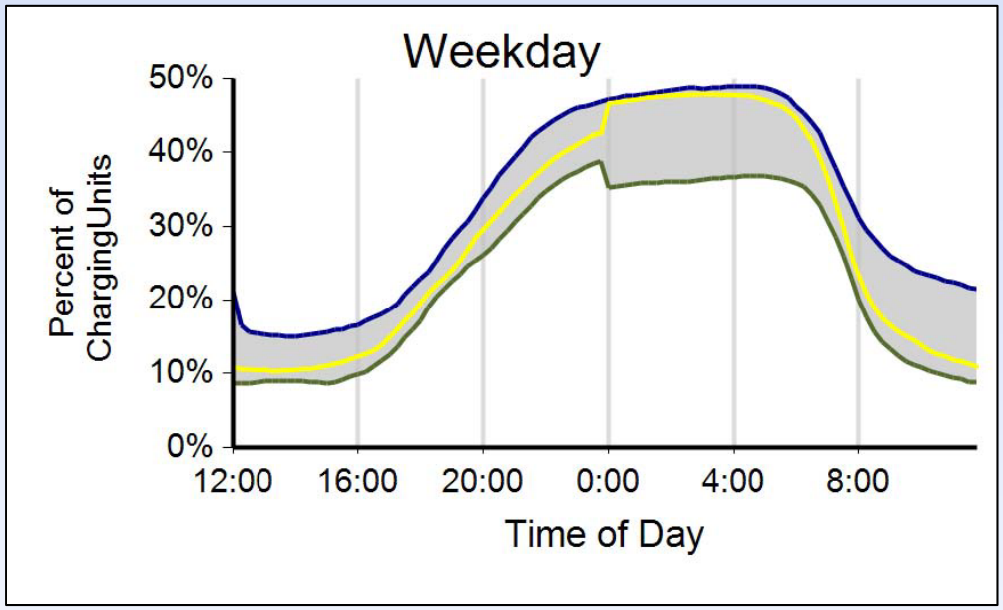


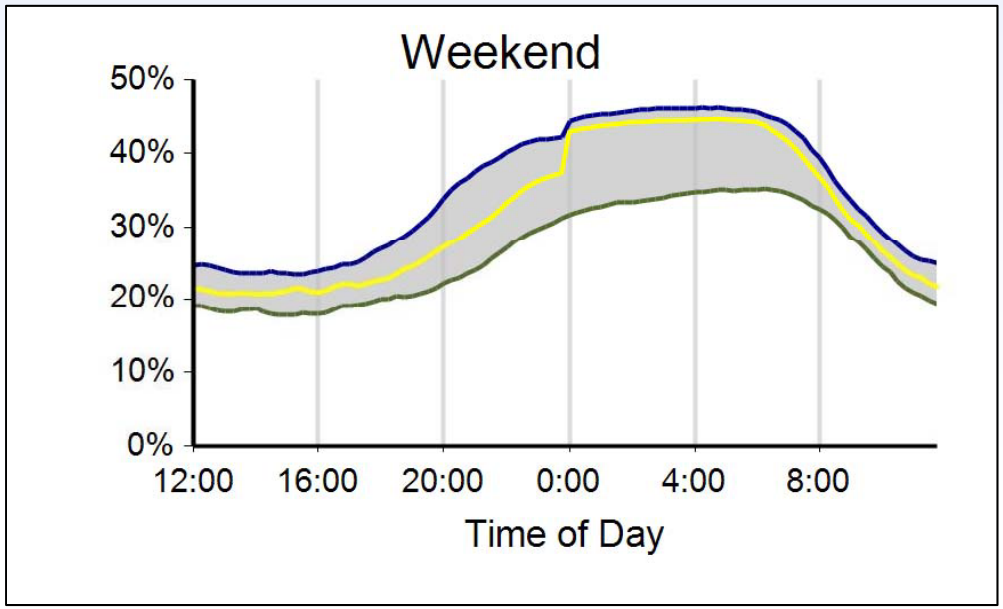
EV Project – Volt Usage Report (1st ¼ 2012)





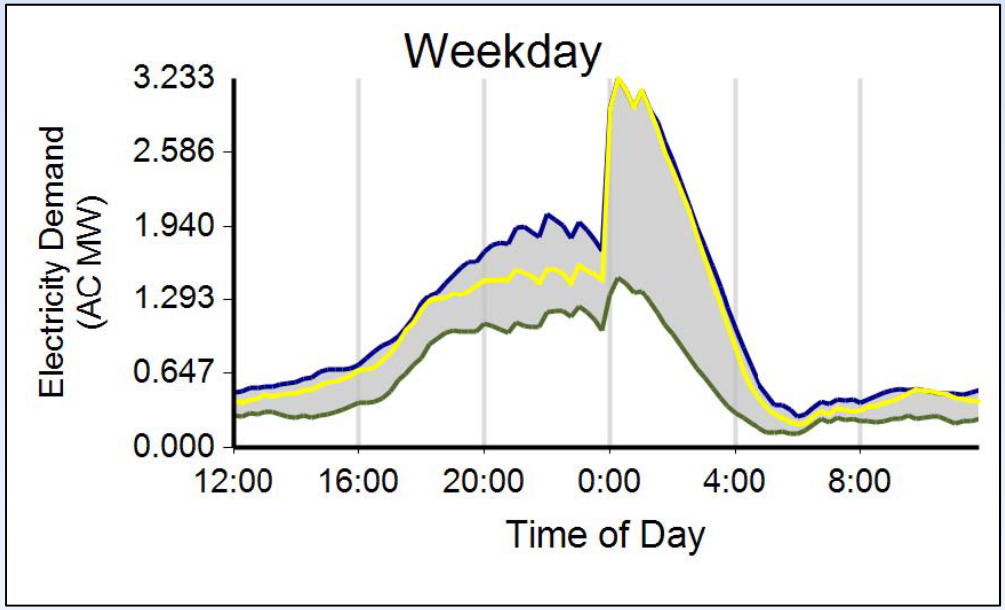
EV Project – EVSE Infra. Summary Report

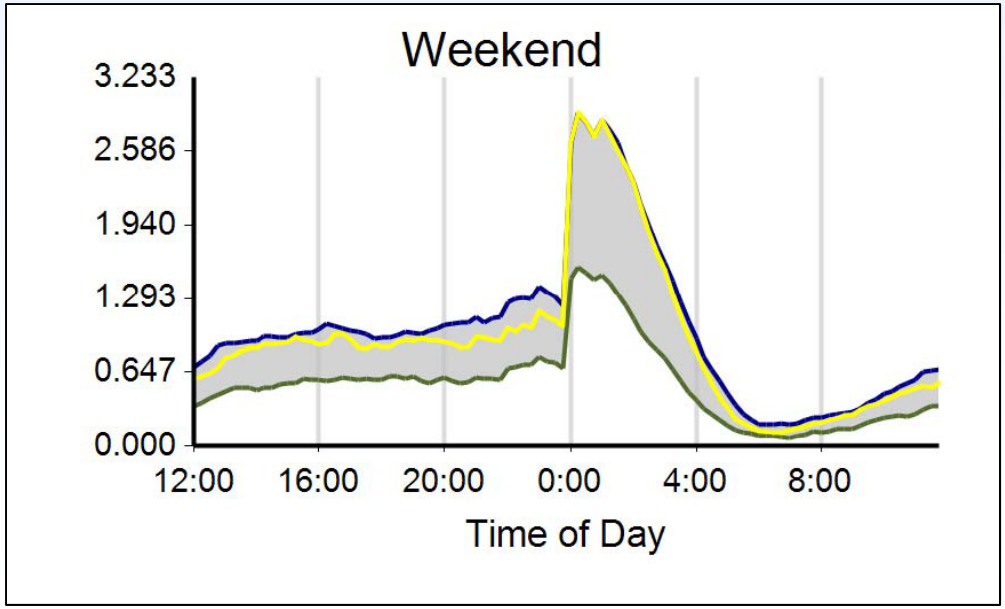




- **Charging Availability**
- **National Data**
- **Range of Percent of Charging Units with a Vehicle Connected vs. Time of Day**
- **1st quarter 2012**
- **3,324 residential and 955 publicly available Level 2 EVSE**
- **10 DC fast chargers**
- **51,476 values produced for this 1st quarter 2012 report**

EV Project – EVSE Infra. Summary Report



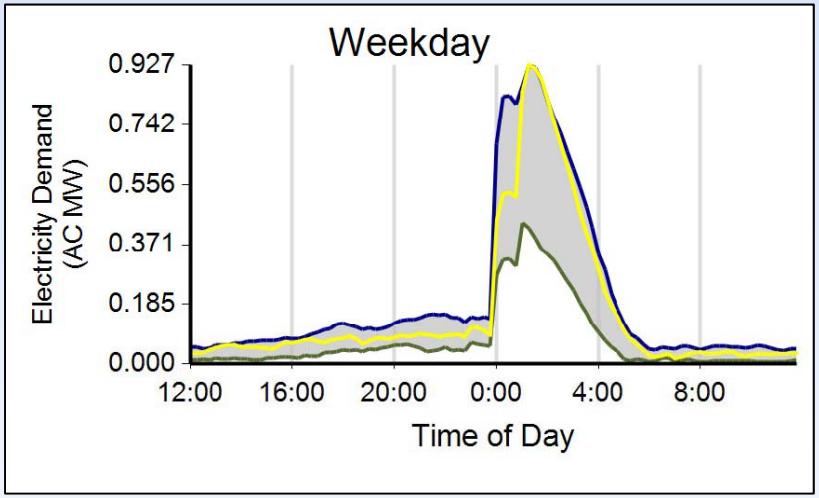


- **Charging Demand**
- **National Data**
- **Range of Aggregate Electricity Demand vs. Time of Day (AC MW)**
- **1st quarter 2012**
- **3,324 residential and 955 publicly available Level 2 EVSE**
- **10 DC fast chargers**

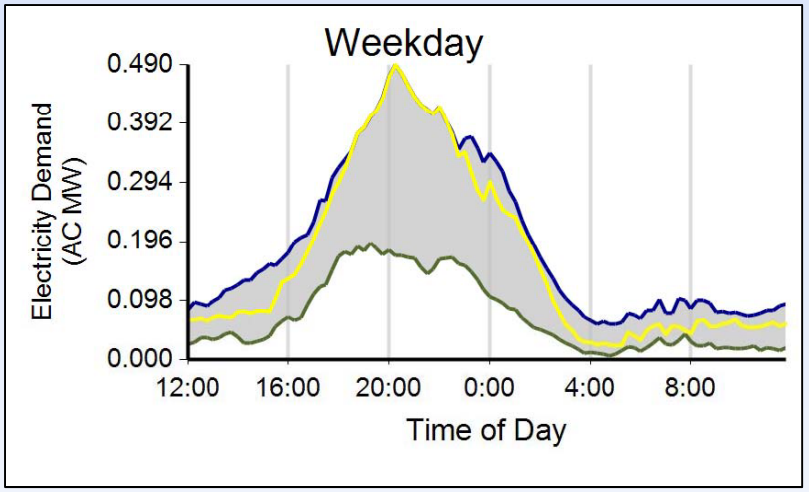
EV Project – EVSE Infra. Summary Report

- **Residential Level 2 Weekday EVSE 1st Quarter 2012**

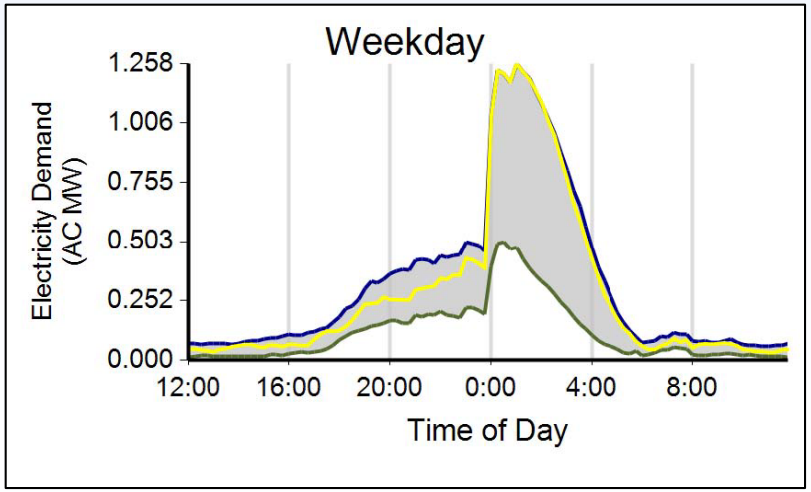
San Diego



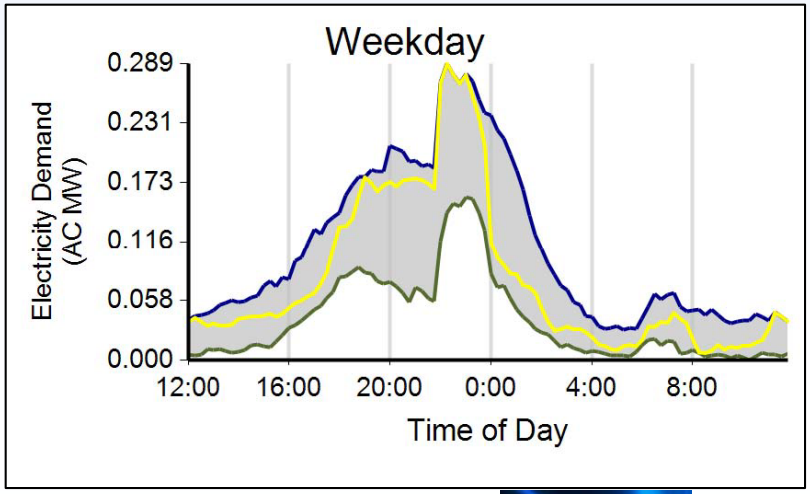
Washington State



San Francisco



Oregon



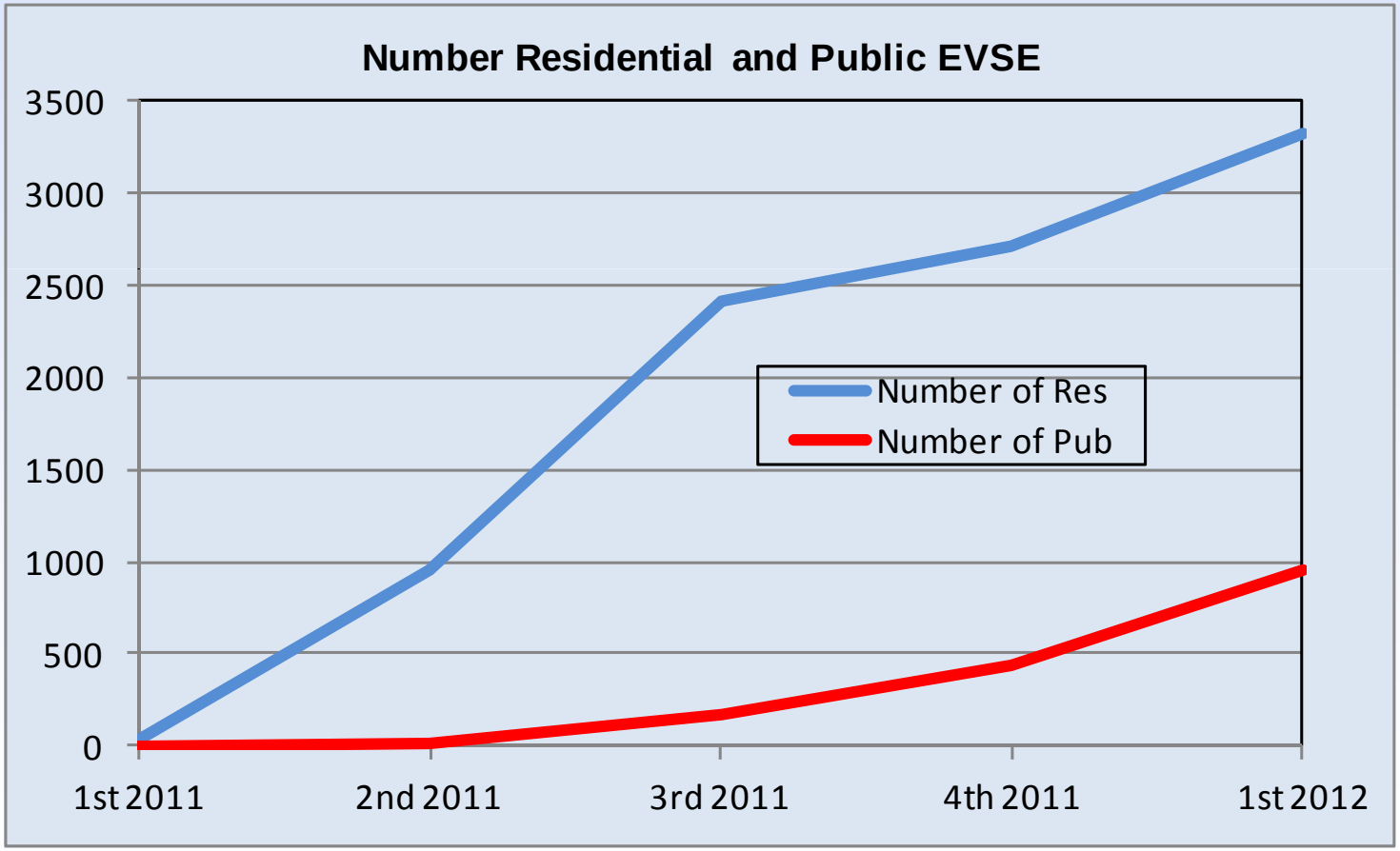
EV Project – EVSE Infra. Summary Report

- National Data – 1st quarter 2012
  - Ave time vehicle connected R2 WD 11.4 hours
  - Ave time vehicle connected R2 WE 11.8 hours
  - Ave time vehicle drawing power R2 WD 2.4 hours
  - Ave time vehicle drawing power R2 WE 2.0 hours
  - Ave energy per charge event R2 WD 8.7 AC kWh
  - Ave energy per charge event R2 WE 7.3 AC kWh
  - Ave time vehicle connected P2 WD 6.3 hours
  - Ave time vehicle connected P2 WE 4.1 hours
  - Ave time vehicle drawing power P2 WD 2.1 hours
  - Ave time vehicle drawing power P2 WE 1.9 hours
  - Ave energy per charge event P2 WD 7.3 AC kWh
  - Ave energy per charge event P2 WE 6.6 AC kWh

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

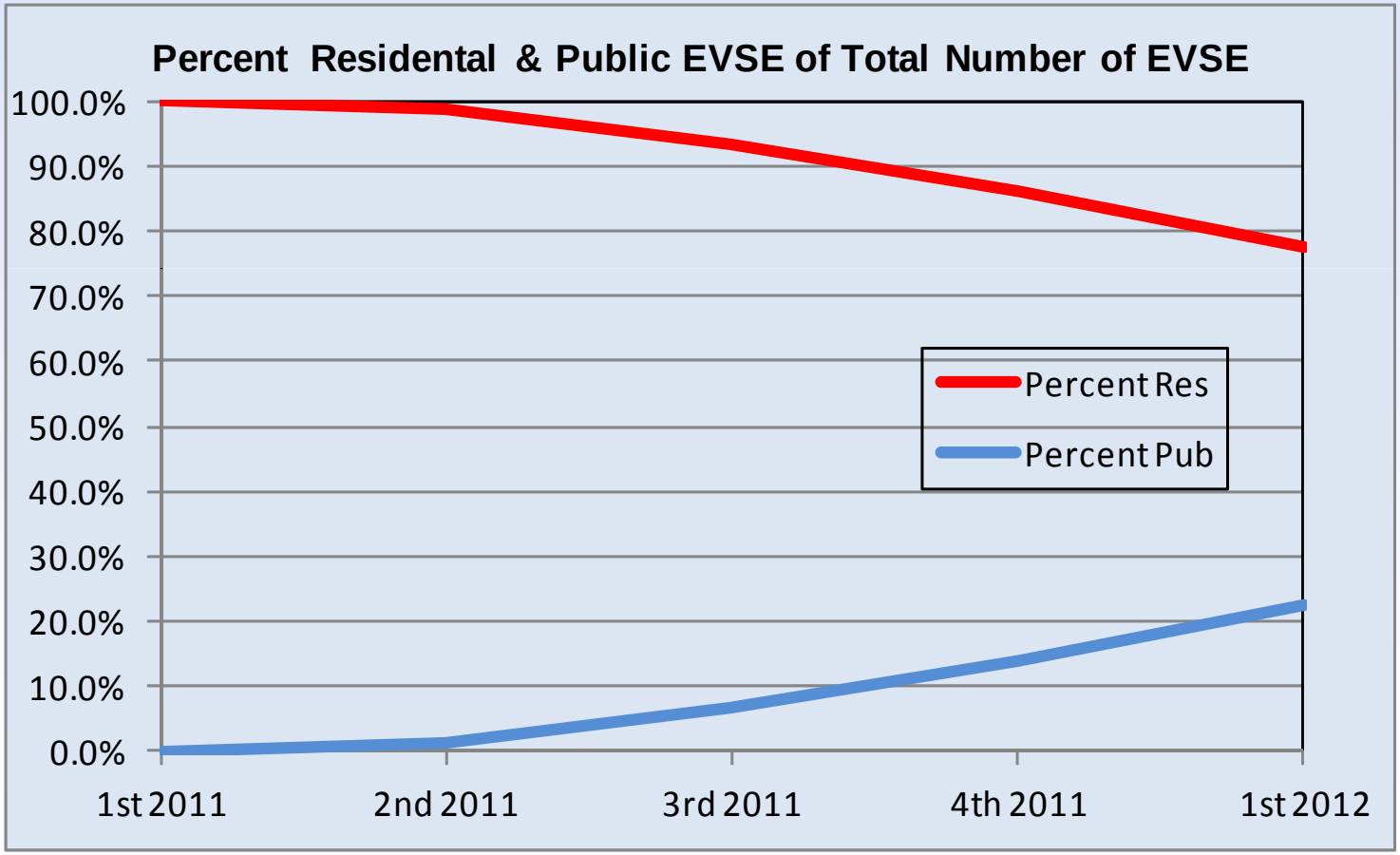
EV Project – EVSE Infra. Summary Report

- **Cumulative number of residential and public EVSE deployed by reporting quarter**



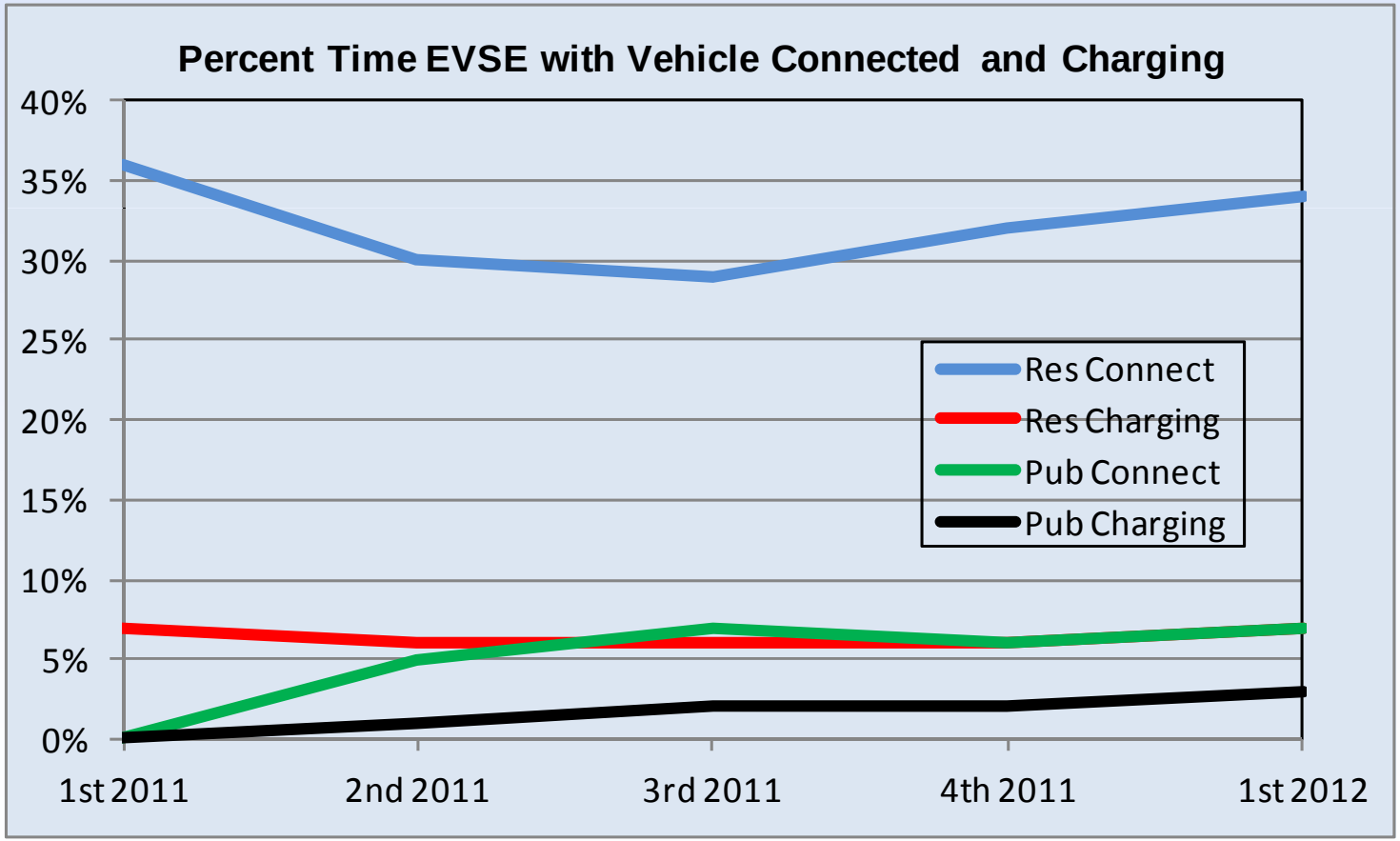
EV Project – EVSE Infra. Summary Report

- **Percentage of residential and public EVSE deployed by reporting quarter**



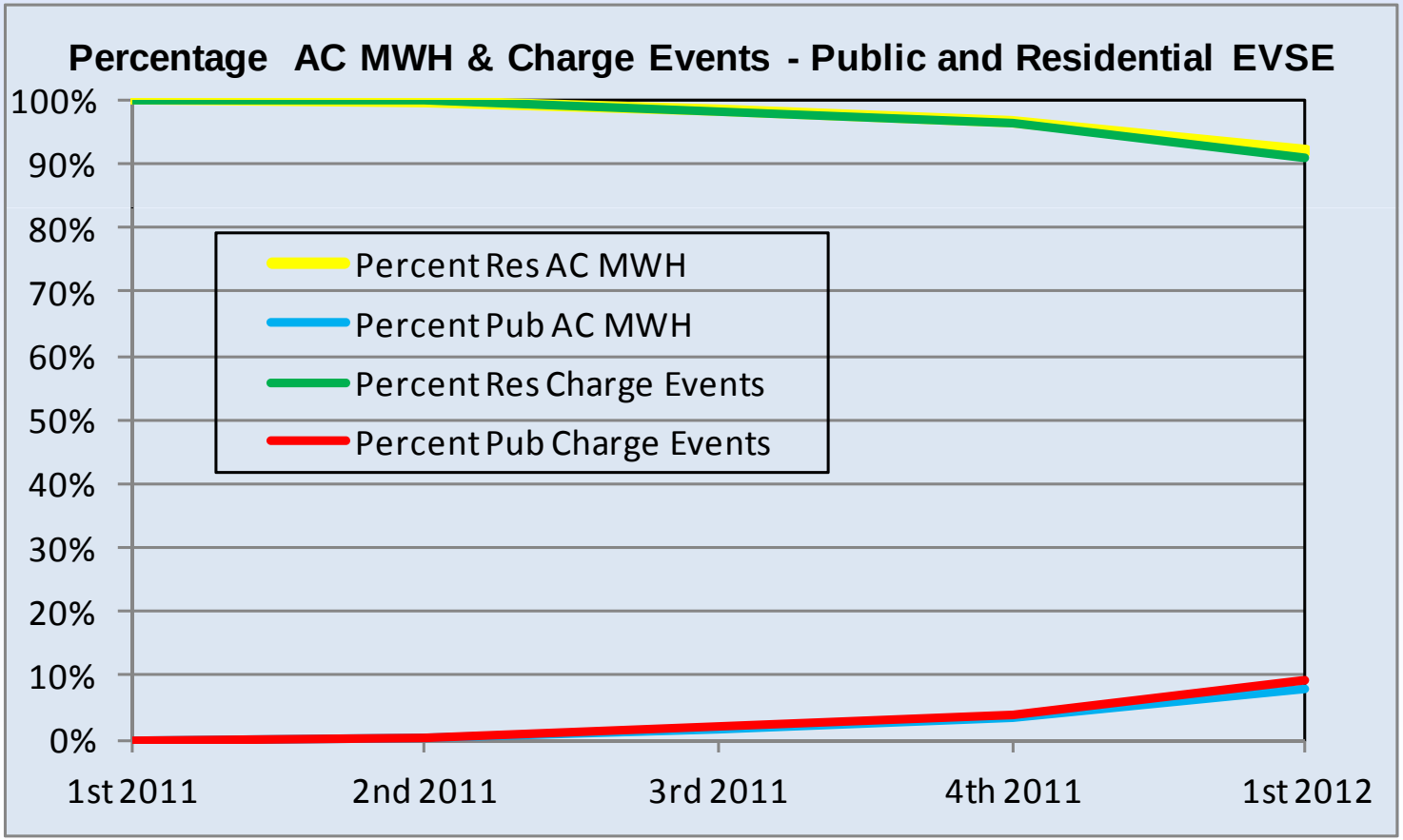
EV Project – EVSE Infra. Summary Report

- Percent time EVSE has a vehicle connected by quarter
- Percent time EVSE is charging a vehicle by quarter
- Data by residential (Res) and public (Pub) EVSE



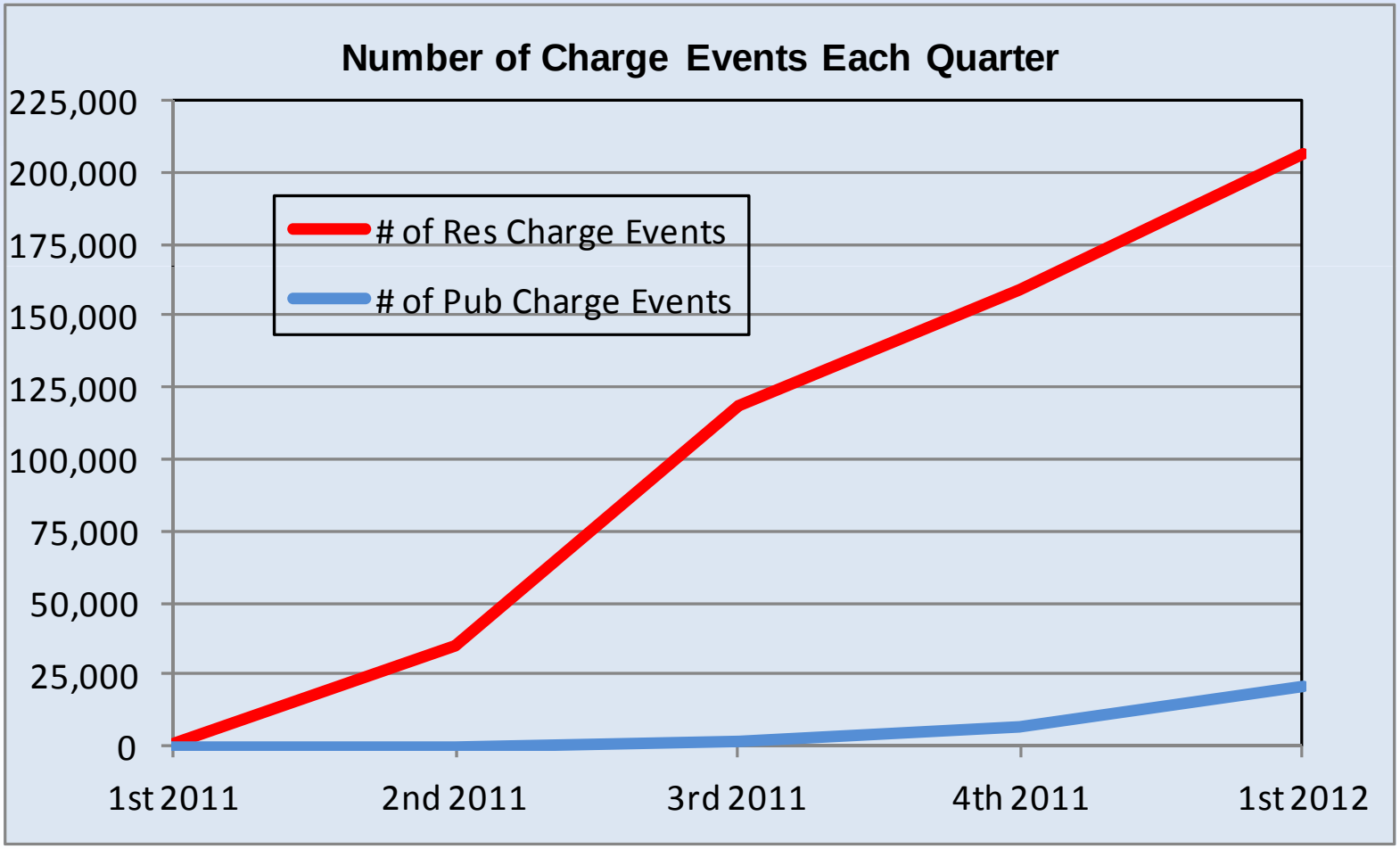
EV Project – EVSE Infra. Summary Report

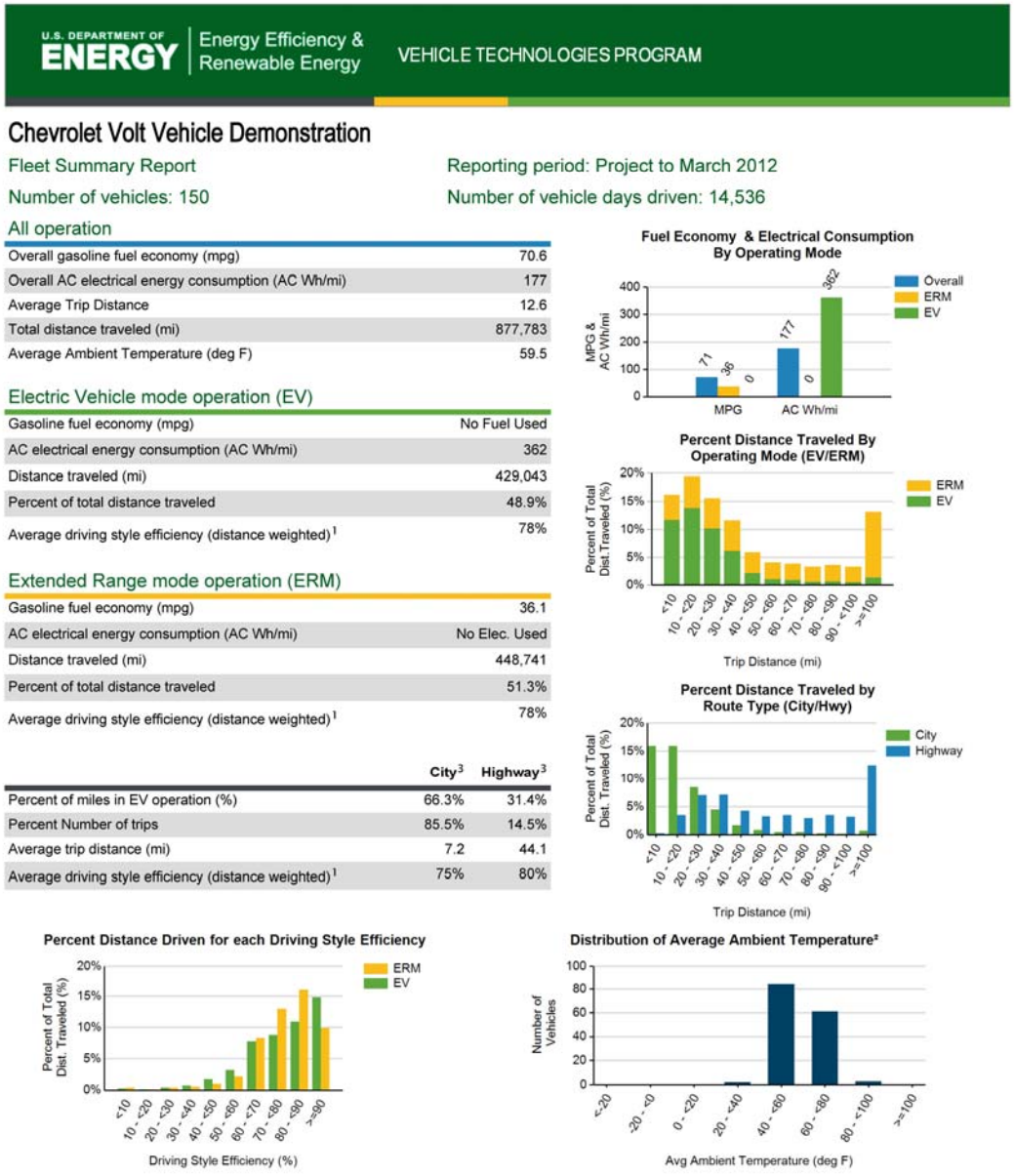
- **Percent AC MWH used by residential and public EVSE**
- **Percent charge events occurring by residential and public EVSE**



EV Project – EVSE Infra. Summary Report

- **Number of charging events each reporting quarter for residential and public EVSE. NOT cumulative data**





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Chevrolet Volt Vehicle Demonstration

Fleet Summary Report — Reporting period: Project to March 2012

Number of vehicles: 150 — Number of vehicle days driven: 14,536

All operation

Overall gasoline fuel economy (mpg)	70.6
Overall AC electrical energy consumption (AC Wh/mi)	177
Average Trip Distance	12.6
Total distance traveled (mi)	877,783
Average Ambient Temperature (deg F)	59.5

Electric Vehicle mode operation (EV)

Gasoline fuel economy (mpg)	No Fuel Used
AC electrical energy consumption (AC Wh/mi)	362
Distance traveled (mi)	429,043
Percent of total distance traveled	48.9%
Average driving style efficiency (distance weighted)[1]	78%

Extended Range mode operation (ERM)

Gasoline fuel economy (mpg)	36.1
AC electrical energy consumption (AC Wh/mi)	No Elec. Used
Distance traveled (mi)	448,741
Percent of total distance traveled	51.3%
Average driving style efficiency (distance weighted)[1]	78%

	City[3]	Highway[3]
Percent of miles in EV operation (%)	66.3%	31.4%
Percent Number of trips	85.5%	14.5%
Average trip distance (mi)	7.2	44.1
Average driving style efficiency (distance weighted)[1]	75%	80%

Fuel Economy & Electrical Consumption By Operating Mode

Percent Distance Traveled By Operating Mode (EV/ERM)

Percent Distance Traveled by Route Type (City/Hwy)

Percent Distance Driven for each Driving Style Efficiency

Distribution of Average Ambient Temperature[2]

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

INL Idaho National Laboratory | GM | OnStar

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Chevrolet Volt DOE ARRA Project

- **Non-public fleet drivers**
- **May '11 to March '12**
  - **878,000 total test miles, 150 Volts**
  - **All trips, 70.6 mpg, 177 AC Wh/mi**
  - **EV mode, 362 AC Wh/mi. 48.9% miles**
  - **Extended range mode, 36.1 mpg**
  - **Average 68.8 mpg**
- **Jan to March 2012**
  - **346,000 miles**
  - **EV mode, 384 AC Wh/mi. 46.8% miles**

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Chevrolet Volt DOE ARRA Project

- **Non-public fleet drivers**
- **150 Volts (May '11 – March '12)**
  - **Average charging events per month 16**
  - **Average # charging events per vehicle day 1.2**
  - **Average miles per charging event 42 miles**
  - **Average trips between charging events 3.4**
  - **Average time connected per event 3.3 hours**
  - **Average energy per charge event 7.2 AC kWh**
  - **Average charging energy per vehicle month 117 AC kWh**
  - **Average trip distance city driving 7.2 miles**
  - **Average trip distance highway driving 44.1 miles**
  - **Percent of miles in EREV (electric) mode 48.9%**

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Ford Escape Advanced Research Fleet

Number of vehicles: 21 | Date range of data received: 11/01/2009 to 04/30/2012

Reporting period: Nov 09 - Apr 12 | Number of vehicle days driven: 8,648

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	41,414
Total distance traveled (mi)	498,463

Trips in Charge Depleting (CD) mode[3]

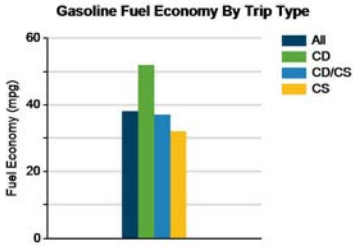
Gasoline fuel economy (mpg)	52
DC electrical energy consumption (DC Wh/mi)[4]	164
Number of trips	24,032
Percent of trips city | highway	83% | 17%
Distance traveled (mi)	140,530
Percent of total distance traveled	28%

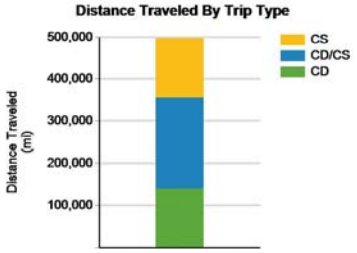
Trips in both Charge Depleting & Charge Sustaining (CD/CS) modes[5]

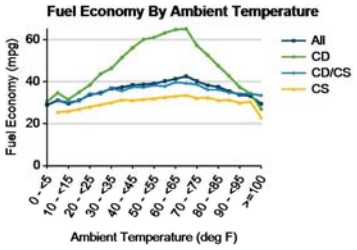
Gasoline fuel economy (mpg)	37
DC electrical energy consumption (DC Wh/mi)[6]	54
Number of trips	7,763
Percent of trips city | highway	38% | 62%
Distance traveled (mi)	214,676
Percent of total distance traveled	43%

Trips in Charge Sustaining (CS) mode[7]

Gasoline fuel economy (mpg)	32
Number of trips	9,610
Percent of trips city | highway	66% | 34%
Distance traveled (mi)	143,257
Percent of total distance traveled	29%







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."

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Ford Escape Adv. Research Vehicle

- 21 Ford Escape PHEVs
- Fleet drivers
- 498,000 test miles
- All trips, 38 mpg, 100 AC & 68 DC Wh/mi
- Charge Depleting (CD), 52 mpg & 164 DC Wh/mi. 28% of all miles
- Charge Sustaining (CS), 32 mpg. 29% of all miles
- Charging = 63% increase in overall mpg when comparing CD to CS trips

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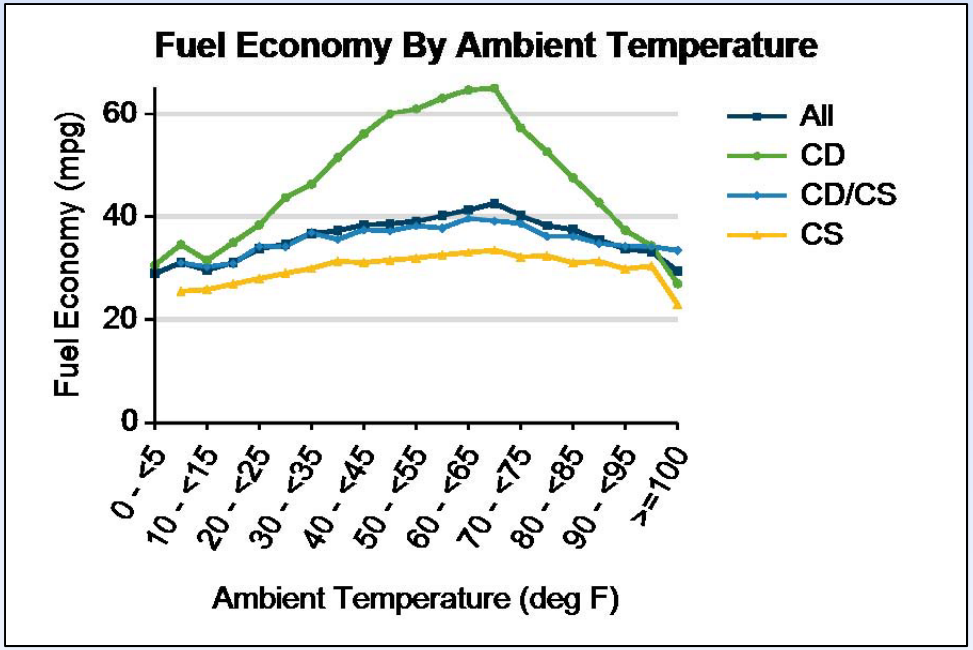

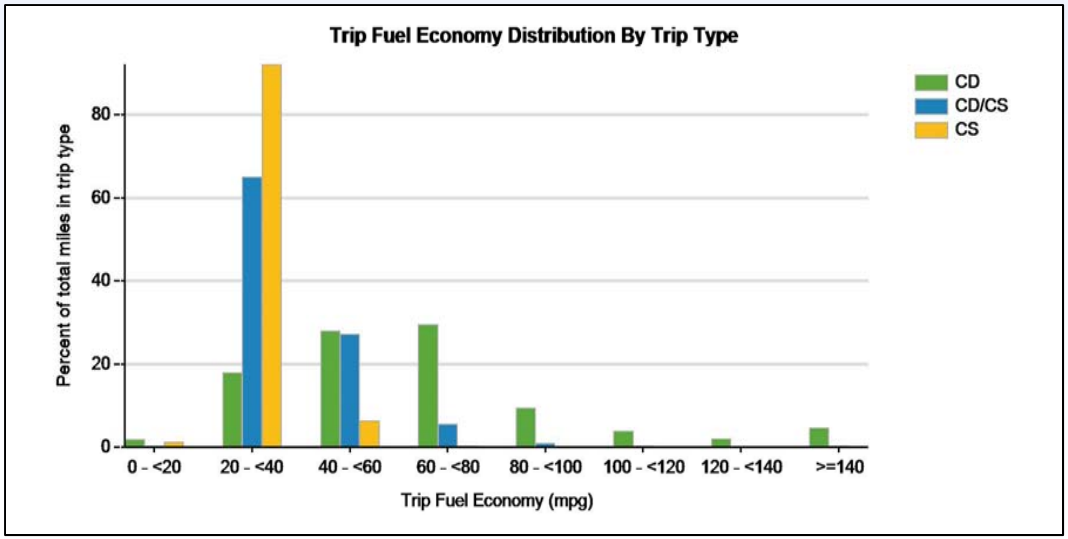

Ford Escape Adv. Research Vehicle

- CD city, 48 mpg, 162 DC Wh/mi
- CD highway, 58 mpg, 166 DC Wh/mi
- CS city, 30 mpg
- CS highway, 32 mpg
- Charging = 60% increase in city mpg and 82% increase in highway mpg (compare CD to CS)
- City - 36% CD and 23% CS miles engine off
- Highway - 12% CD and 4% CS miles engine off

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Chrysler RAM PHEV Fleet

Number of vehicles: 108
Reporting period: Jul 11 - Apr 12
Date range of data received: 7/1/2011 to 4/30/2012
Number of vehicle days driven: 12425

All Trips Combined

Overall gasoline fuel economy (mpg)	19
Overall AC electrical energy consumption (AC Wh/mi)[1]	101
Overall DC electrical energy consumption (DC Wh/mi)[2]	69
Overall DC electrical energy captured from regenerative braking (DC Wh/mi)	45
Total number of trips	77,676
Total distance traveled (mi)	693,160

Trips in Charge Depleting (CD) mode[3]

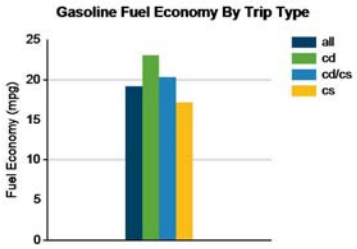
Gasoline fuel economy (mpg)			23
DC electrical energy consumption (DC Wh/mi)[4]			210
Number of trips			32,475
Percent of trips city | highway	94%	|	6%
Distance traveled (mi)			175,126
Percent of total distance traveled			25%

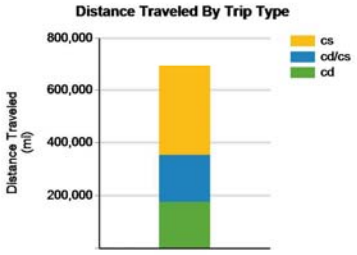
Trips in both Charge Depleting & Charge Sustaining (CD/CS) modes[5]

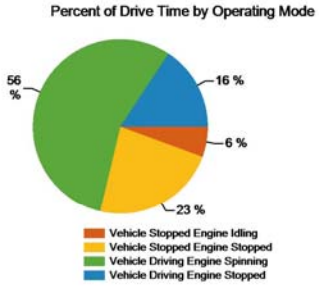
Gasoline fuel economy (mpg)			20
DC electrical energy consumption (DC Wh/mi)[6]			69
Number of trips			8,887
Percent of trips city | highway	75%	|	25%
Distance traveled CD | CS (mi)	65,619	|	111,533
Percent of total distance traveled CD | CS	9%	|	16%

Trips in Charge Sustaining (CS) mode[7]

Gasoline fuel economy (mpg)			17
Number of trips			36,314
Percent of trips city | highway	90%	|	10%
Distance traveled (mi)			341,354
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

- 108 Chrysler Ram PHEVs
- July 2011 to April 2012
- 693,000 test miles
- All trips, 19 mpg, 101 AC & 69 DC Wh/mi. 46 DC Wh/mi captured by regenerative braking
- CD, 23 mpg & 210 DC Wh/mi
- CS, 17 mpg
- Charging = 35% increase in overall mpg when comparing CD to CS trips

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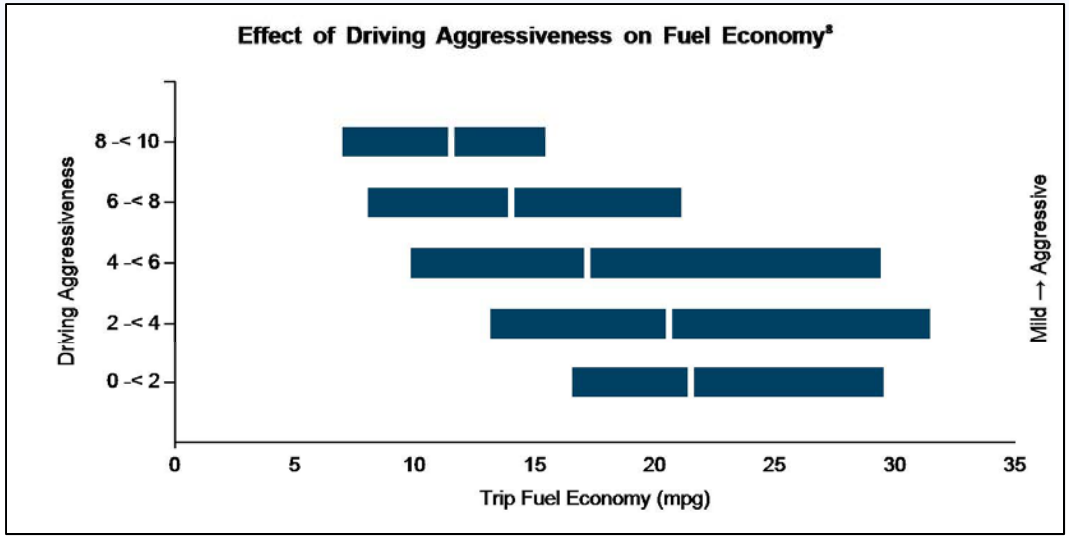
Chrysler Ram PHEV Pickups

- Rams in fleet applications
- 39% total time gas engine is stopped
  - Vehicle driving 16% time engine stopped
  - Vehicle stopped 23% time engine stopped
- 63.6 miles per charge event
- 7.1 trips per charge event
- 0.88 charge events per vehicle day
- 2.4 average hours per charge event
- 6.5 AC kWh average energy / charge



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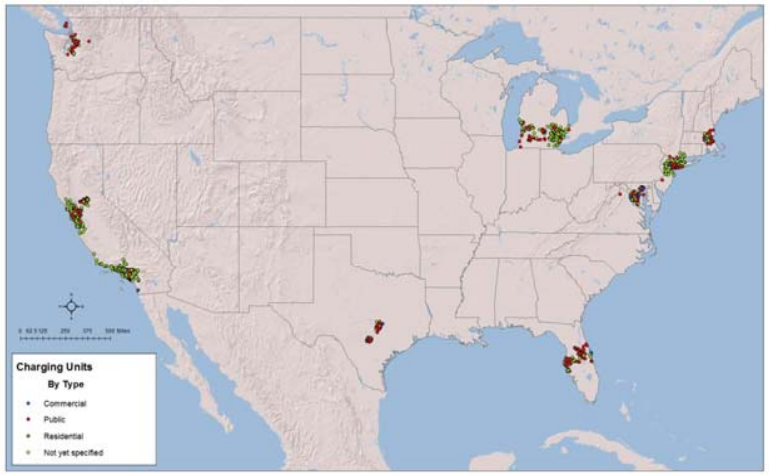
ChargePoint® America Vehicle Charging Infrastructure Summary Report

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 reporting period

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

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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
- 223,119 charge events
- 1.512 AC MWh

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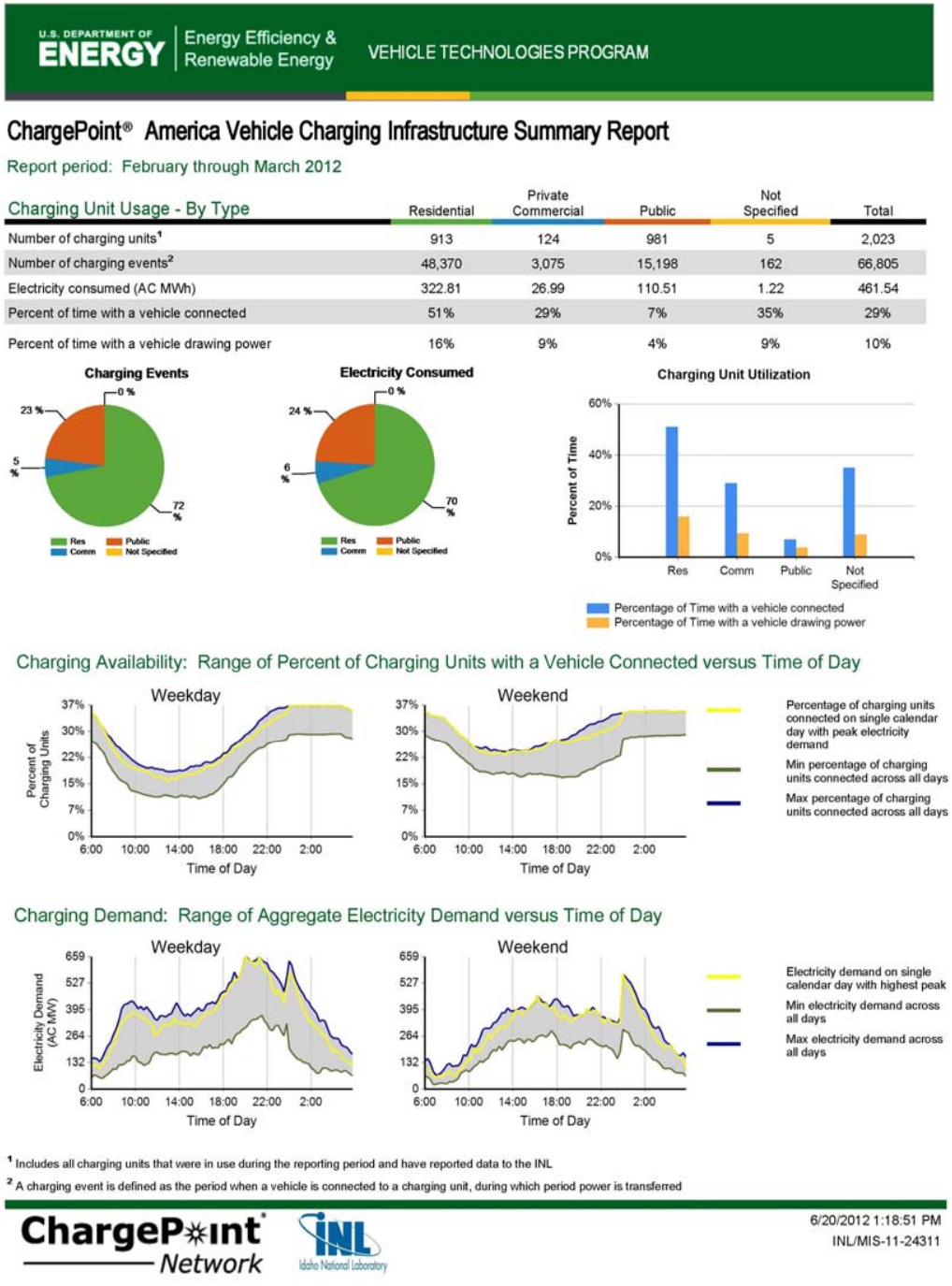

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ChargePoint® America Vehicle Charging Infrastructure Summary Report

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 | INL Idaho National Laboratory

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ChargePoint America ARRA Project

- Feb & March 2012 data
- 66,805 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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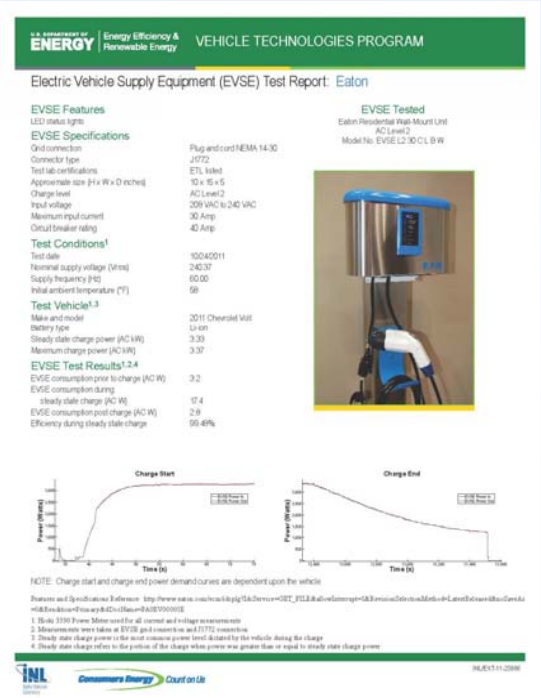
Other AVTA Projects for DOE

- **Fast charge study compares DC Fast vs Level 2 charging impacts on battery life in vehicles and laboratory tests**
- **Initiated first responders training program with the National Fire Presentation Association and NHTSA**
- **Seven conductive Level 2 EVSE recently benchmarked**
- **Battery mule “Leaf” testing of Enerdel lithium battery**
- **Supporting DOE FOA with a wireless charging test project**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Electric Vehicle Supply Equipment (EVSE) Test Report: Eaton

EVSE Features

EVSE Specifications

EVSE Tested

Test Conditions

Test Vehicle

EVSE Test Results

Charge Start

Charge End

NOTE: Charge start and charge end power demand curves are dependent upon the vehicle

More AVTA Projects for DOE

- Collecting 20 Lithium PHEV Escape conversions data
- DOD support, including JBLM and Andrews AFB
- Mass impacts on fuel efficiency of HEVs, ICEVs and BEVs
- Obtained 1 Ram PHEV for ORNL and ANL, and 1 for INL
- Tested 5 USPS electric LLV conversions
- Supporting Office of Electricity's Smart EVSE FOA with testing support

Summary – Based on 1st Quarter 2012 Data

- **EV Project benchmarking includes 104,000 vehicle miles and 3,516 charge events per day**
- **Leaf regional miles per day range from 27.6 in Washington State to 33.4 in Phoenix (1st 2012)**
- **Leaf regional miles per trip range from 6.2 in Oregon to 8.1 in Chattanooga (1st 2012)**
- **Leaf regional miles per charge range from 23.4 in Oregon to 29.5 in San Francisco**
- **Known Leaf regional at-home charging ranges from 68% in San Francisco to 89% in Tucson**
- **Volts @1.5 and Leafs @ 1.1, charges per day when driven**
- **Volts @36.4 and Leafs @30.2 miles driven per day**
- **Leafs @27.4 and Volts @24.1 miles driven / charge event**
- **Total of 52,768 values produced to populate the EV Project's four, 1st quarter 2012 reports**

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 kWh rates
- Significant opportunities to fully understand how the public uses public versus non-public infrastructure
- Leaf trip distances are increasing slightly but miles per day are slightly decreasing over five reporting quarters
- Only about 25% 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 distribution studies
- Charge control preferences - vehicle and Blink based, and scheduled versus random
- Rich public versus non-rich EVSE charging behaviors
- Level 2 EVSE versus DCFC behaviors
- Travel corridor versus convenience charging
- Non-residential subcategories (public and work parking)
- Etc., etc., etc.,

Acknowledgement

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More Information

http://avt.inl.gov

INL/MIS-12-26406