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

A Summary of Results Thus Far from The EV Project

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National Governor's Association State and Local Plug-in Electric Vehicle Workshop
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This presentation does not contain any proprietary or sensitive information

Idaho National Laboratory

Idaho National Laboratory

- INL is a U.S. Department of Energy (DOE) federal laboratory
- 890 square mile site with 4,000 staff
- Support DOE's strategic goal of reducing the nation's dependence on foreign oil
- Multiple RDD&D programs
  - Nuclear, renewable, and unconventional fossil energy
  - Advanced vehicles and batteries
  - Homeland security and cyber security

DOE's Advanced Vehicle Testing Activity (AVTA)

- INL manages light-duty vehicle and infrastructure testing for AVTA
  - AVTA is part of DOE's Vehicle Technologies Program
  - ECOtality provides testing support via NETL

- ECOtality leads The EV Project, with INL, Nissan and GM/OnStar as primary partners

- EV Project and AVTA test partners include electric utilities, federal, state and local government agencies, private companies, and individual vehicle owners

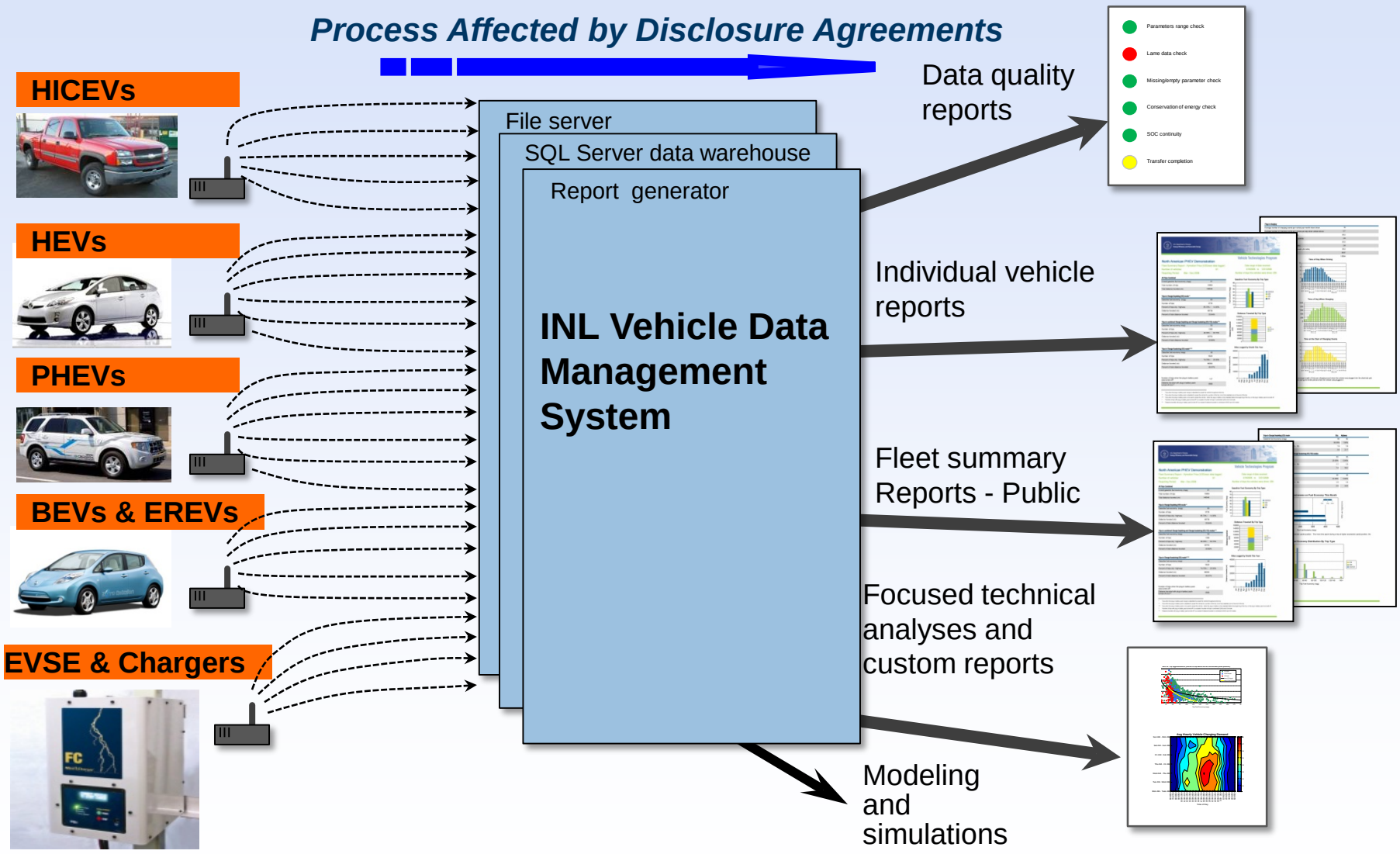
- AVTA goal: Petroleum reduction and energy security through unbiased benchmarking of vehicle technology

Vehicle / Infrastructure Testing Experience

INL/AVTA testing has accumulated 47 million miles on 8,000 electric drive vehicles representing 100+ models

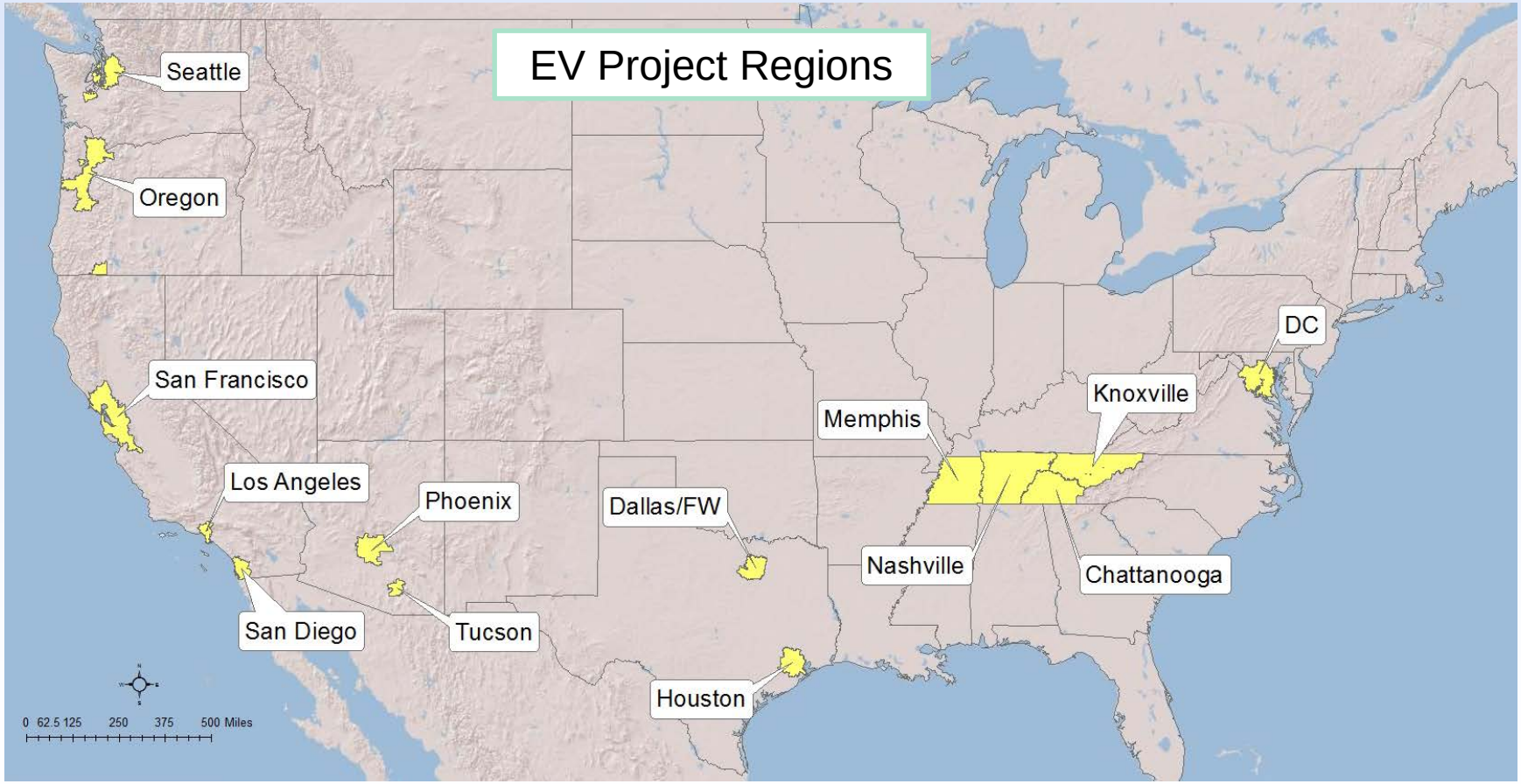
- EV Project: 4,278 Leafs, 428 Volts, 30.3 million test miles (as of 6/28/2012)
- PHEVs: 14 models, 430 PHEVs, 4 million test miles
- EREVs: 1 model, 150 EREVs, 878,000 test miles
- BEVs: 47 models, 2,000 BEVs, 5 million test miles
- HEVs: 19 models, 50 HEVs, 6 million test miles
- Micro hybrid (stop/start) vehicles: 3 models, 7 MHVs, 300,000 test miles
- NEVs: 24 models, 372 NEVs, 200,000 test miles
- UEVs: 3 models, 460 UEVs, 1 million test miles
- 6,000+ Electric Vehicle Supply Equipment (EVSE) charging units with data loggers

INL Vehicle/EVSE Data Management Process



The EV Project

Purpose: Build and study mature charging infrastructure and use lessons learned to streamline deployment of grid-connected electric drive vehicles



The EV Project

Data being collected from Nissan Leafs, Chevrolet Volts, and Blink AC level 2 and DC fast charge units

Chevrolet Volt

Blink AC level 2 wall-mount unit

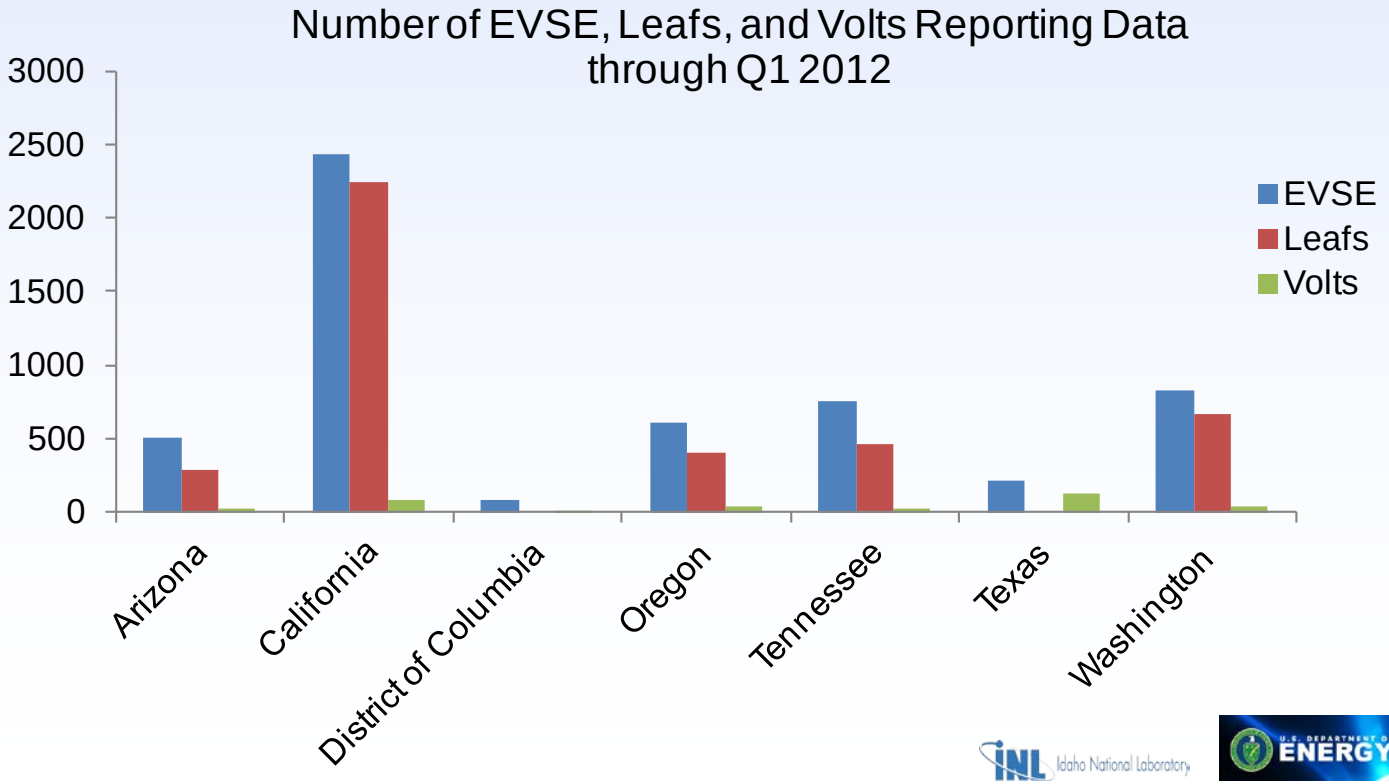
Blink DC fast charger

Nissan Leaf

EV Project Overview Report

Vehicles and charging units reporting data through Q1 2012

- Charging infrastructure
  - 5,432 units
  - 665,968 charging events
  - 5,069 AC MWh
- Vehicles
  - 4,066 Leafs
  - 427 Volts
  - 22.6 million miles

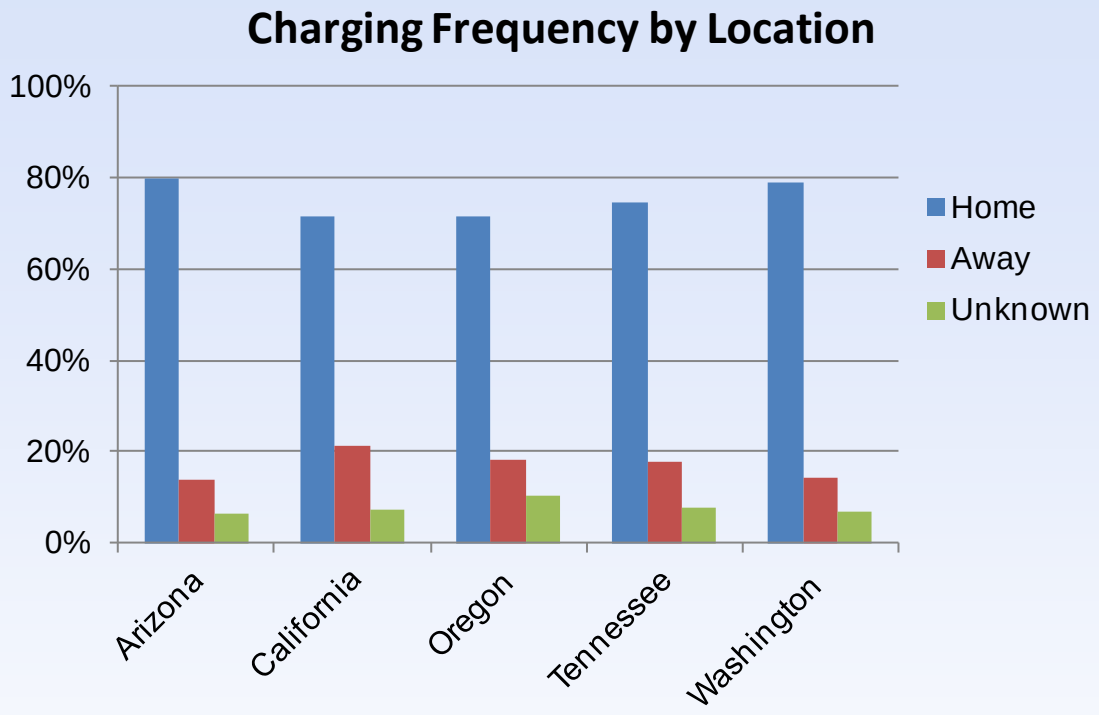


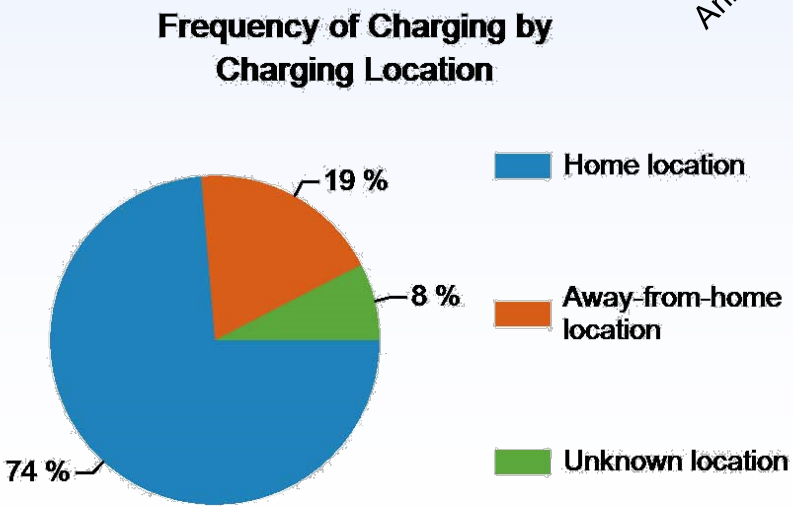
EV Project – Vehicle Usage Report (Q1 2012)

	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

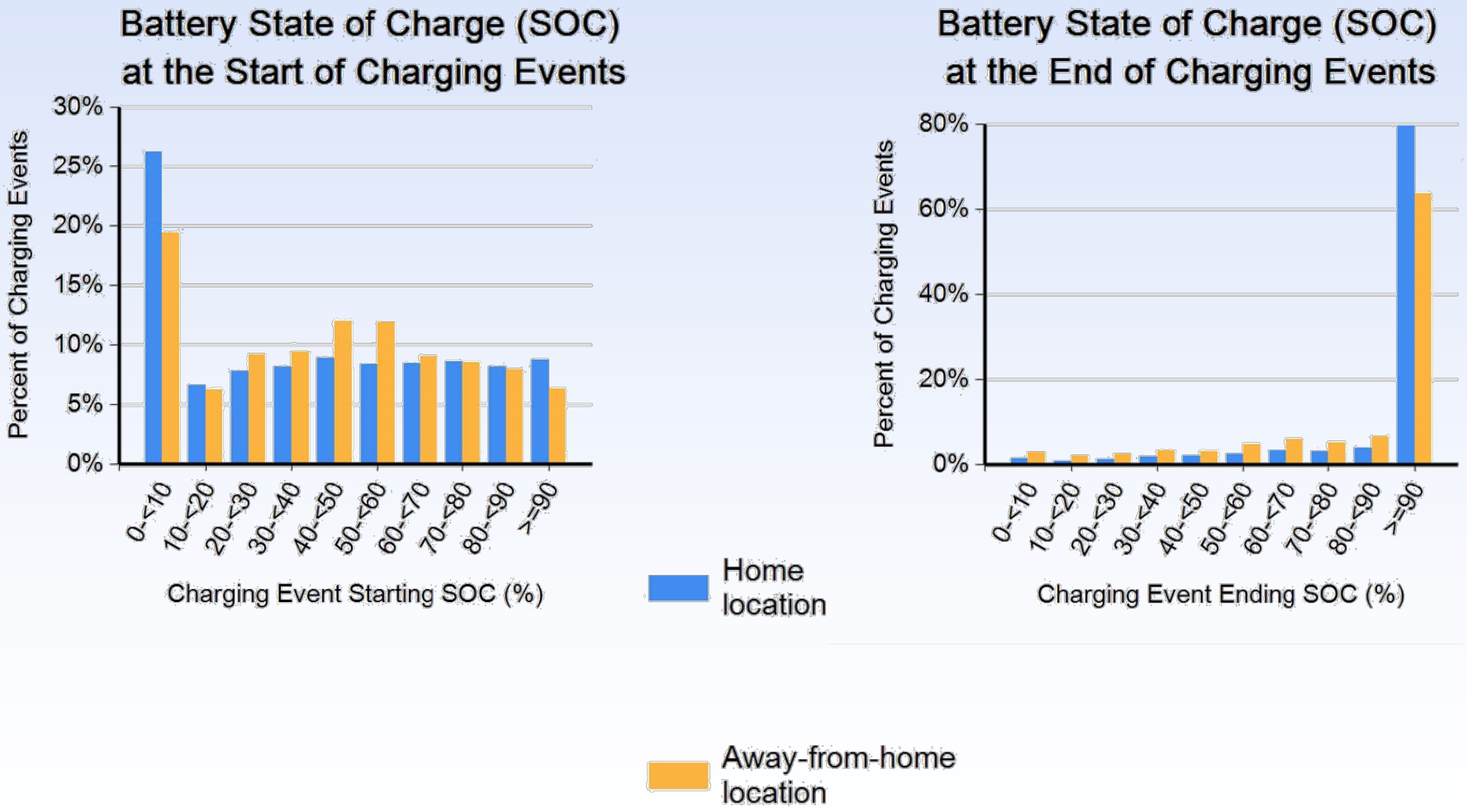
Note that per-day metrics consider only days a vehicle is driven

EV Project – Leaf Usage Report (Q1 2012)

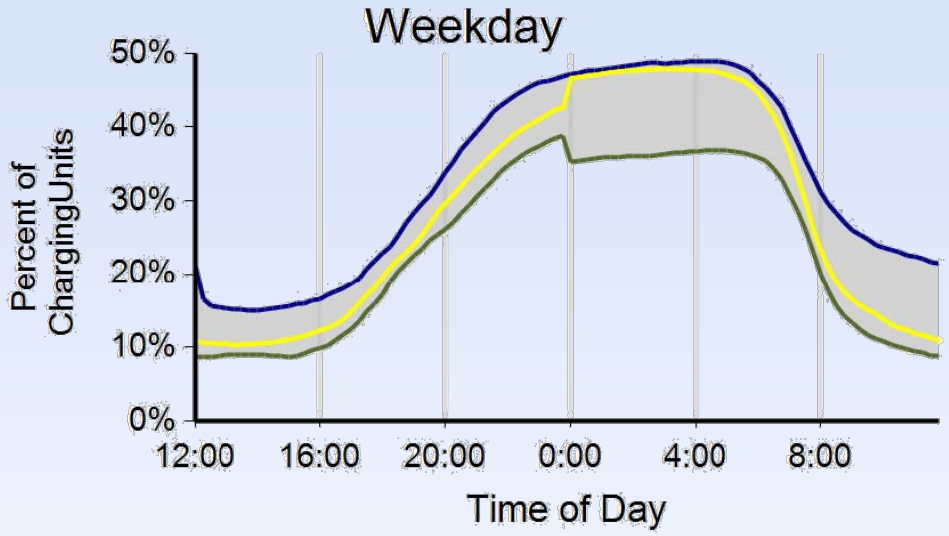


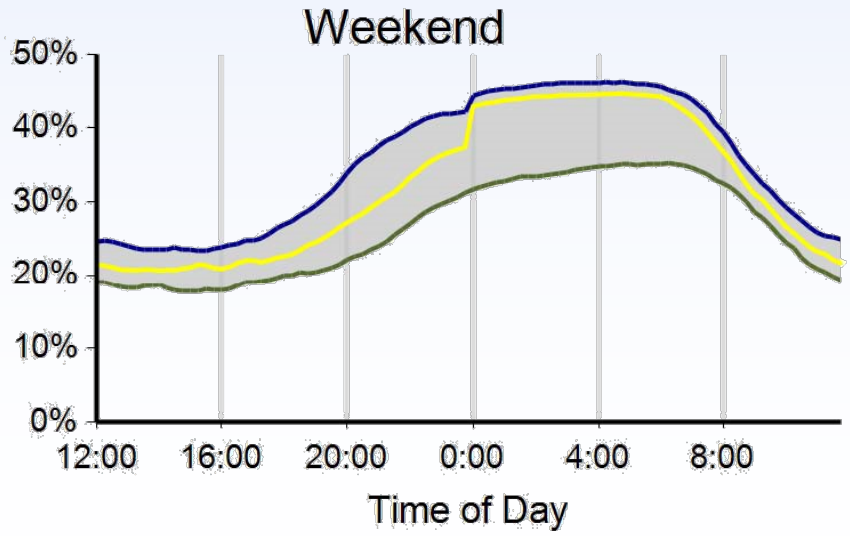


EV Project – Volt Usage Report (Q1 2012)



EV Project – EVSE Infra. Summary Report





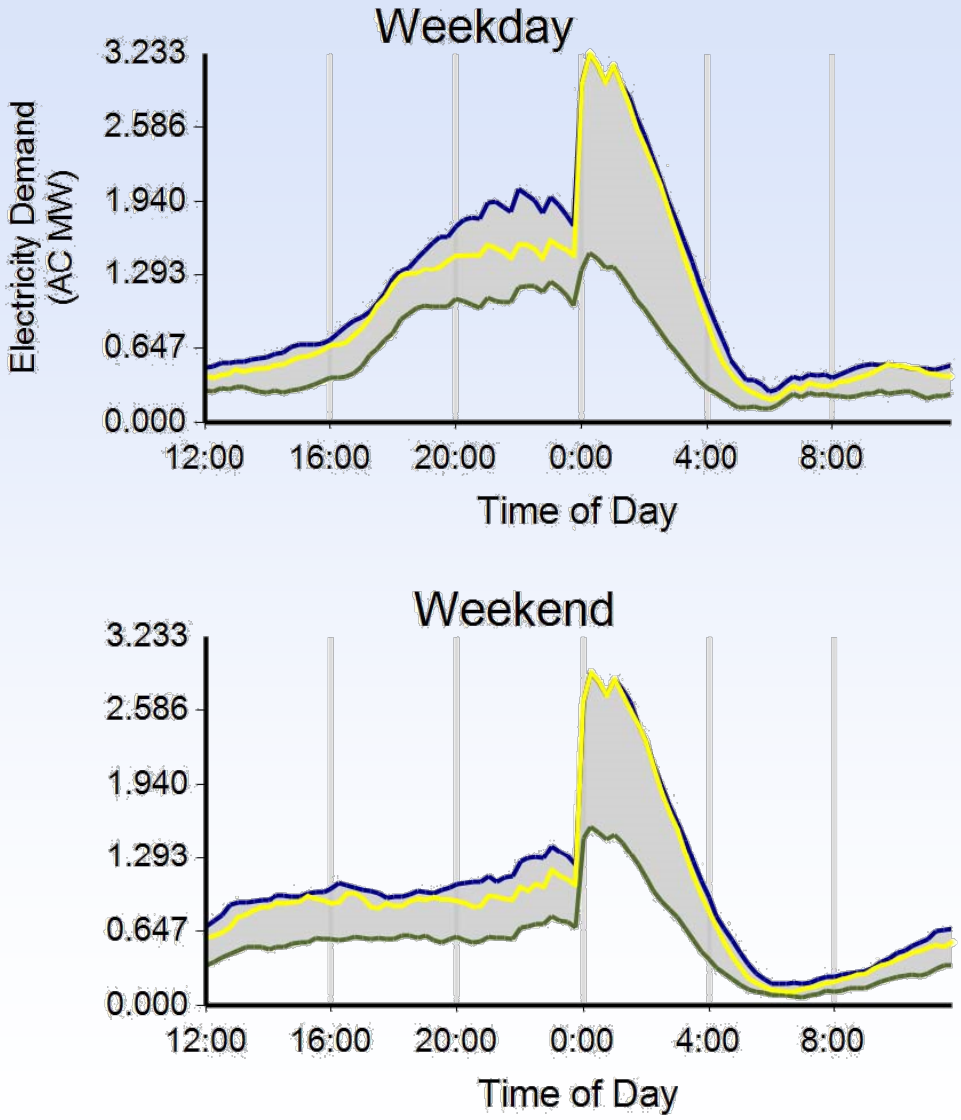
Charging Availability

- National Data
- Range of Percent of Charging Units with a Vehicle Connected vs. Time of Day

Q1 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)

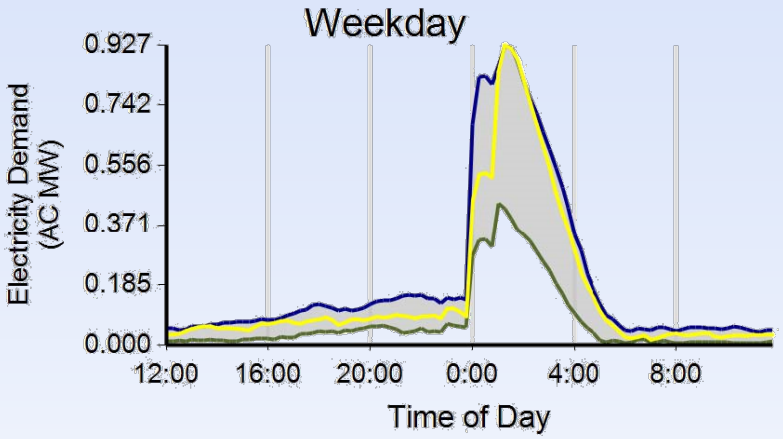
Q1 2012

- 3,324 residential and 955 publicly available Level 2 EVSE
- 10 DC fast chargers

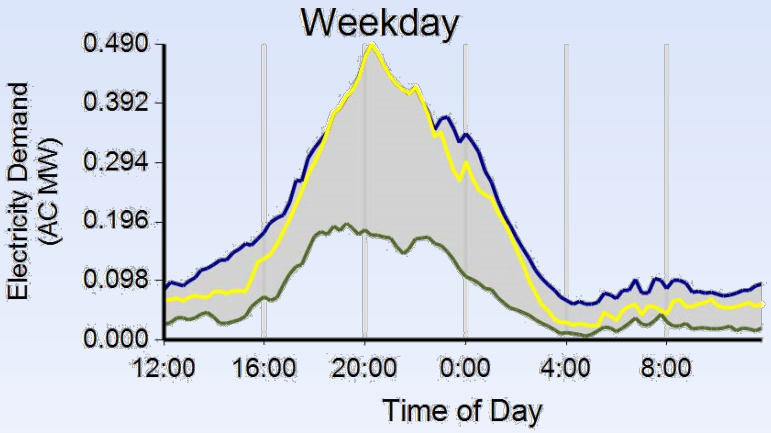
EV Project – EVSE Infra. Summary Report

Q1 2012 Charging Demand: Residential Level 2 EVSE

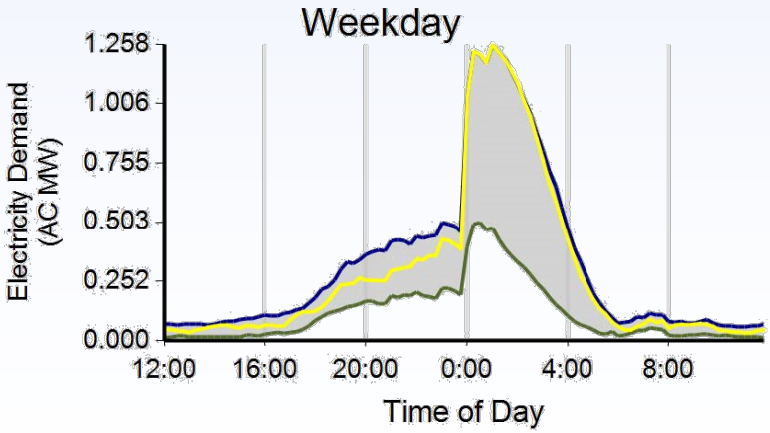
San Diego



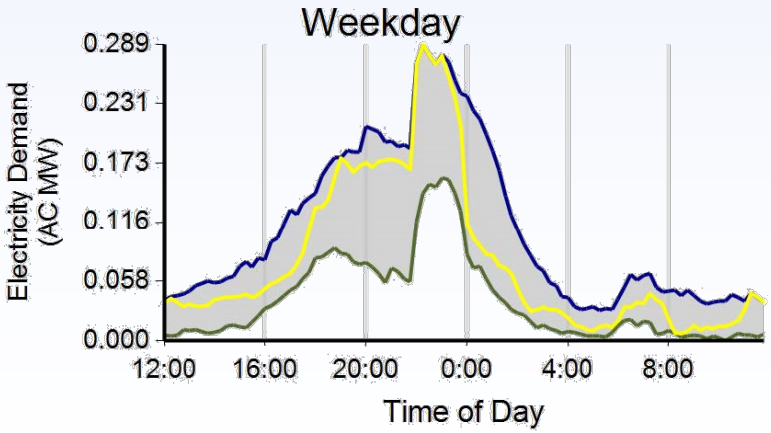
Washington State



San Francisco



Oregon



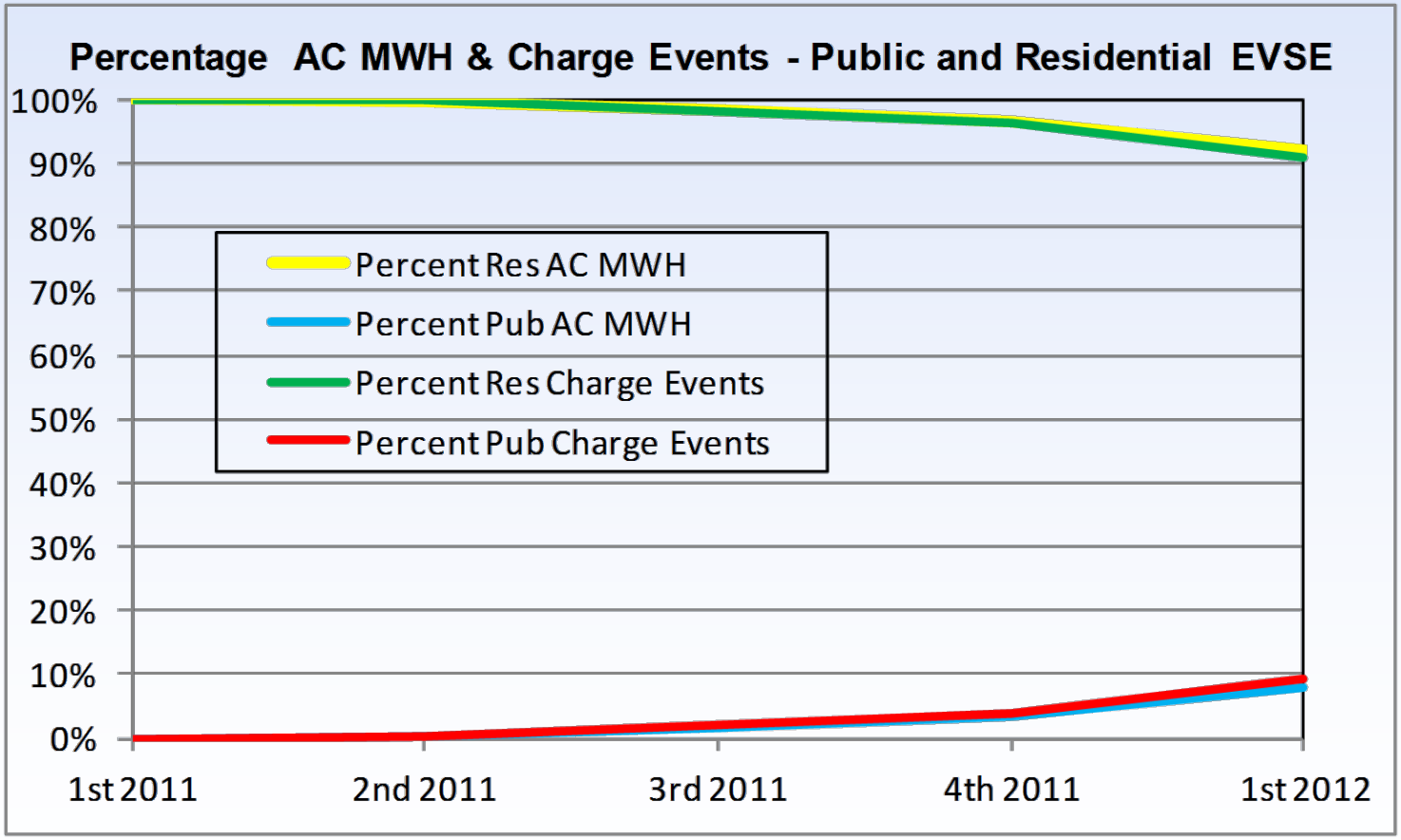
EV Project – EVSE Infra. Summary Report

- 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

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



Summary – Based on Q1 2012 Data

- Leaf regional miles per day range from 27.6 in Washington State to 33.4 in Phoenix
- Leaf regional miles per trip range from 6.2 in Oregon to 8.1 in Chattanooga
- Leaf regional miles per charge range from 23.4 in Oregon to 29.5 in San Francisco
- Known Leaf regional at-home charging frequency 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

EV Project Observations To Date

- EV Project vehicles connected much longer than needed to recharge - opportunities to shift charging times
- Significant residential Level 2 charging occurs off-peak. In areas with EV charging time-of-use electricity rates, start of charging coincides with start of off-peak period.
- Leaf owners drive farther between charging than Volt owners, but not much farther
- Significant opportunities to understand:
  - How vehicle owners use public versus private infrastructure
  - Regional and seasonal changes in behavior
  - Demand for Level 2 EVSE versus DC fast charging
  - Etc. etc.
- Only about 25% of EV Project data collected to date…

  …We've only just begun

Acknowledgement

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

More Information

http://avt.inl.gov

Additional vehicle and infrastructure demonstrations results available for Chevrolet Volt, Chrysler Ram PHEV, Ford Escape PHEV, Coulomb ChargePoint America, and more.

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