- This presentation was given for the Navigant Research Webinar on *Fast DC Charging for Electric Vehicles*

- http://www.navigantresearch.com/webinar/fast-dc-charging-for-electric-vehicles

- April 9, 2013

Lessons Learned on the EV Project and DC Fast Charging

Garrett Beauregard
Executive Vice President and General Manager, eTec Labs

April 9, 2013

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ECOtality Company Overview

Leading Hardware, Software and R&D for electric transportation

Diversified revenue base of 3 complementary business segments

Blink

- Residential, public & commercial EV charging solutions
- Contracted by U.S. Dept. of Energy for The EV Project (~$115M)
- Over 11,000 chargers installed as of April 2013

Minit-Charger

- Fast charging electric material handling and ground support equipment
- 5,600+ chargers deployed in warehouse and distribution centers
- Reduces fuel costs while enhancing productivity and safety

ETEC Labs

- 20+ years of consulting for Advanced Transportation Testing, Evaluation, Research & Analysis
- Awarded $26.4M by U.S. Dept. of Energy for advanced vehicle testing
- 86 million+ miles of testing on advanced vehicles & infrastructure

Blink EV Charge Stations

Membership Card

Level 2 Residential

Level 2 Commercial

DC Fast Charger

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The EV Project

The largest Department of Energy EV Infrastructure Program

PROJECT MANAGER: *ECOtality North America (eTec)*

PROJECT SCOPE: *Approx. 13,000 Charging Stations*
8,300 Nissan LEAFs, GM Volts, Smart ForTwo

TOTAL VALUE: ***$230 million project***

($115m grant from US DoE, $115m ECOtality/Partner match)

OBJECTIVES:

- *Plan, build and evaluate mature EV charge infrastructure*
- *Collect and analyze data on EV driving and charging*
- *Evaluate business models for public EVSE*
- *Generate lessons learned to guide policy makers, industry planners and investors*
- *Lay foundation for shift to EVs in broader market*

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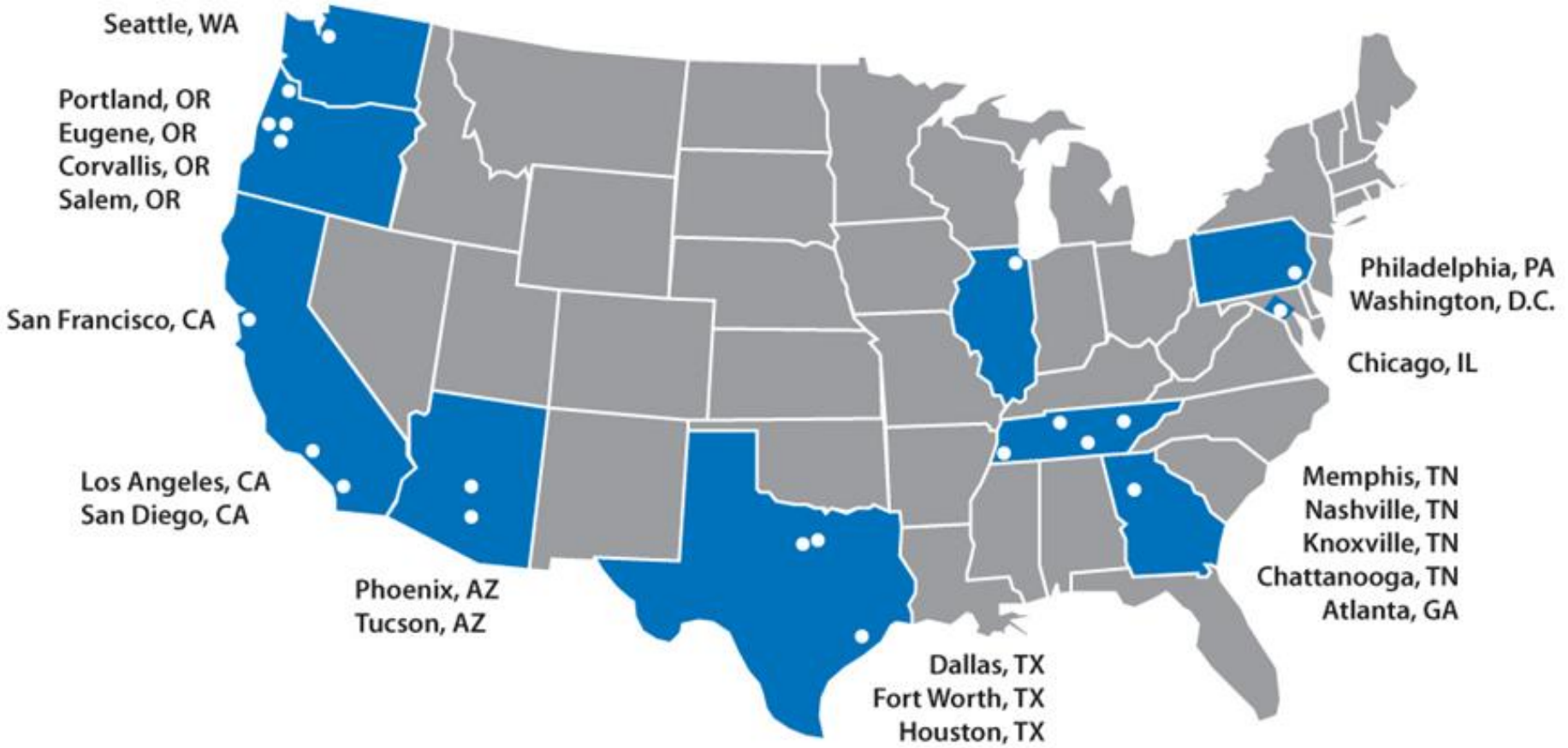
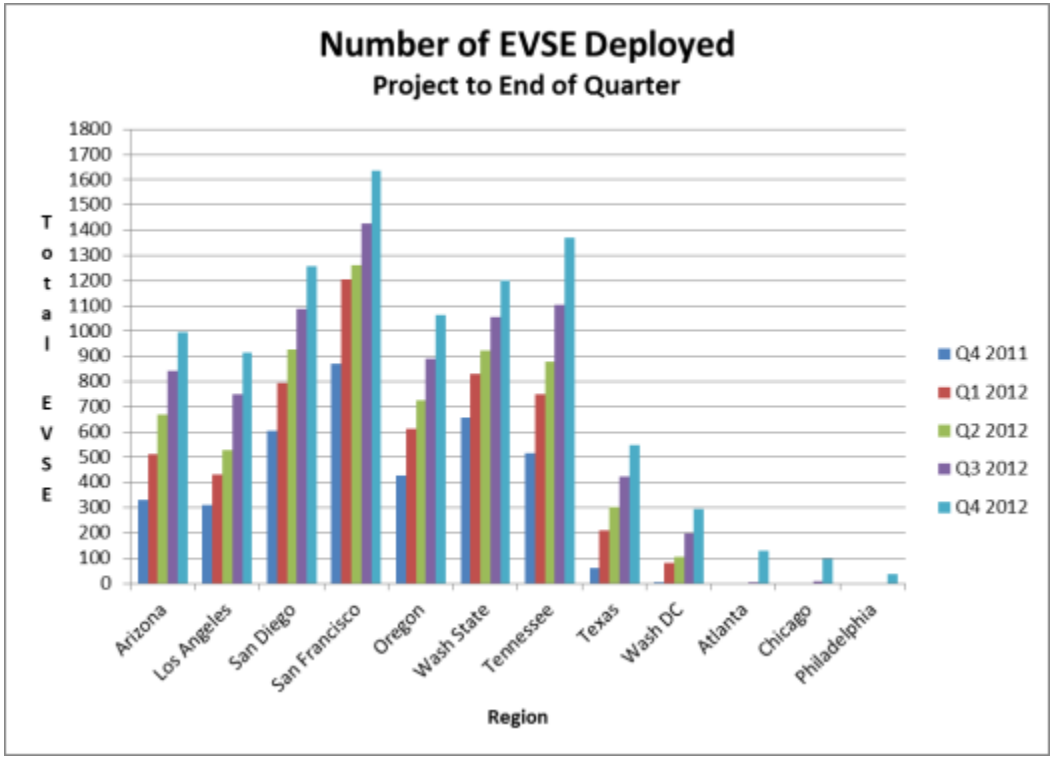


Quarterly Reports Lessons Learned

EV Project Quick Facts

- Over 78,000,000 miles recorded on EVP vehicles to date
- Approximately 2,500,000 gallons of gasoline saved
- 2.2 million residential charge events
- Over 19,600 MWh energy charged into Project vehicles
- 5,700 metric Tons CO_2 avoided



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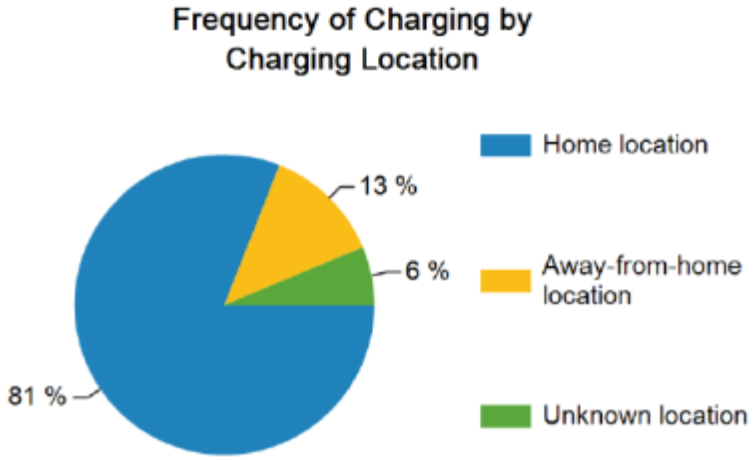
Quarterly Reports Lessons Learned

Chevrolet Volt

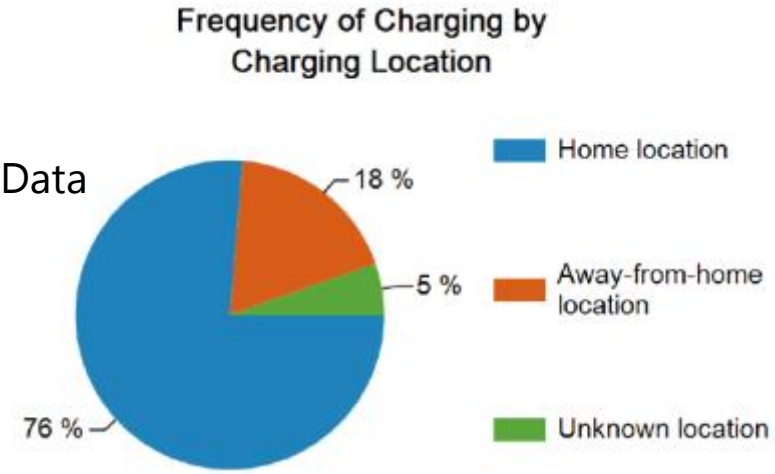
- Avg distance traveled per day (mi): 40.5
- Avg trip distance (mi): 8.1
- Avg # of trips between charging: 3.5
- Avg distance between charging (mi): 28.2
- Avg # of charging events/day: 1.4

Nissan Leaf

- Avg distance traveled per day (mi): 29.2
- Avg trip distance (mi): 6.9
- Avg # of trips between charging: 3.8
- Avg distance between charging (mi): 26.3
- Avg # of charging events/day: 1.1

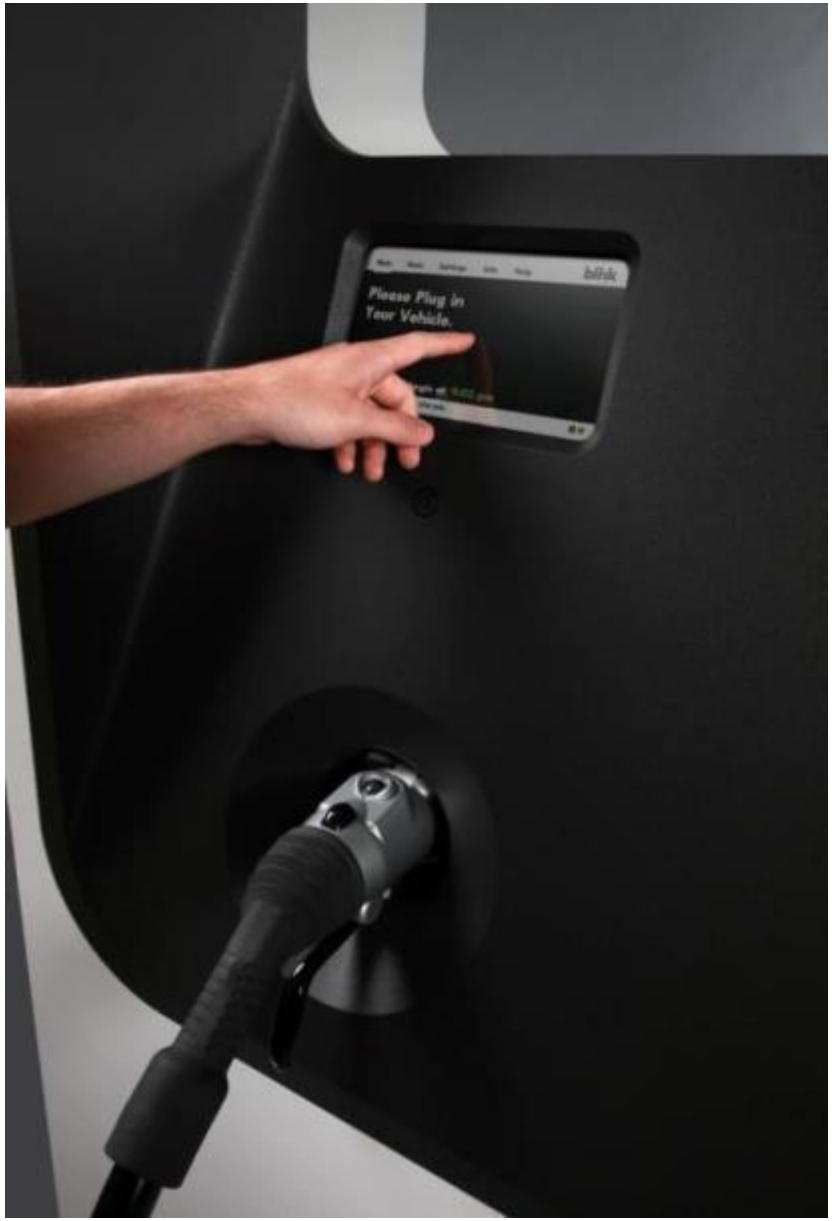


4th Quarter 2012 Data



blink

- 69 DC Fast Chargers installed
- Dual port dispenser design
- Real time communications
  - 3G or Ethernet
- Certified utility meter
- CHAdeMo Certified
- ADA compliant
- 42" Color Monitor (optional); specified advertising space



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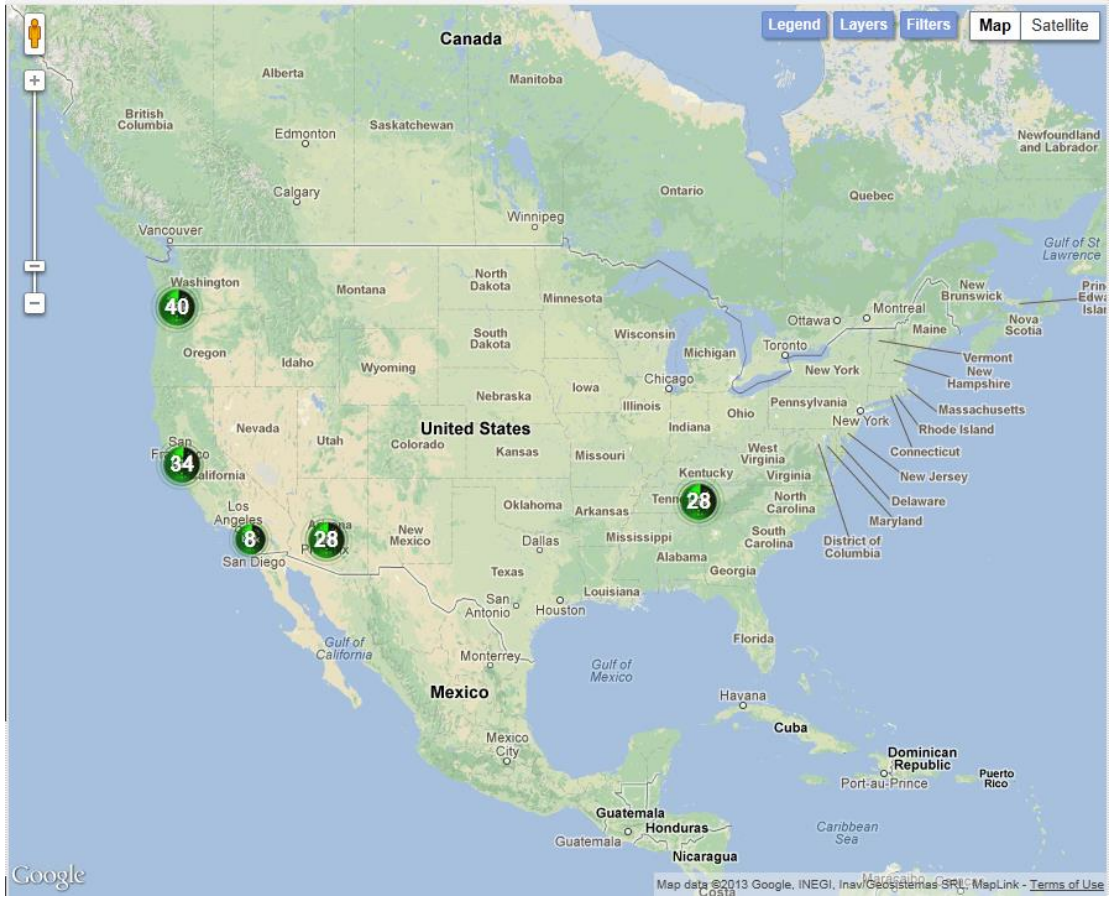
DC Fast Charge Locations

Region	State	DC FC Installed
Seattle	WA	5
Tacoma	WA	1
Portland	OR	11
Salem	OR	3
Santa Rosa	CA	4
North Bay Area	CA	2
Palo Alto	CA	5
East Bay Area	CA	3
San Jose	CA	3
Lost Angeles	CA	2
Santa Ysabel	CA	1
San Diego	CA	1
Phoenix	AZ	14
Nashville	TN	4
Chatanooga	TN	6
Knoxville	TN	4
	Total	**69**



See www.blinknetwork.com/blinkMap.html

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DC Fast Charge Facts

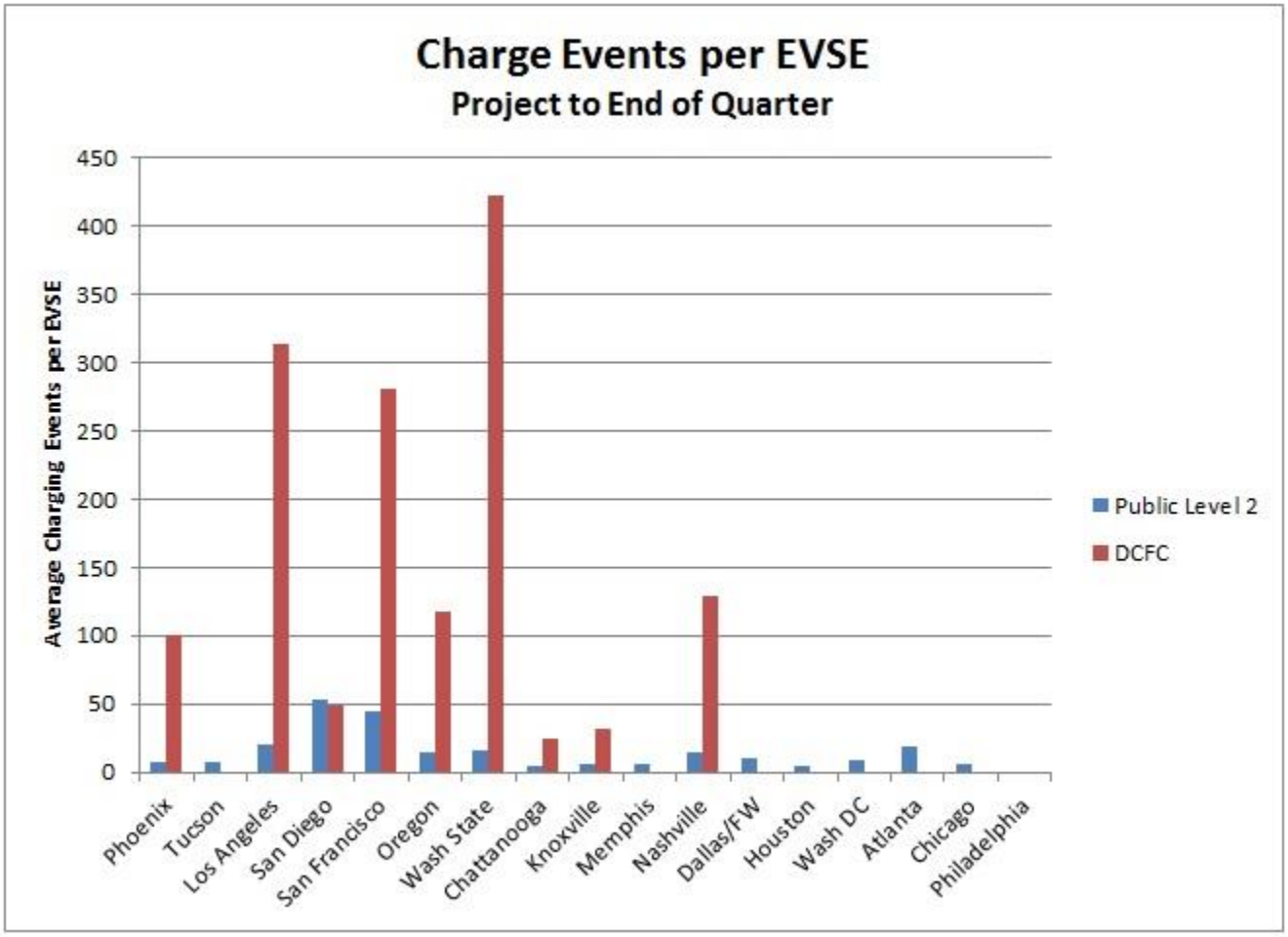
Greatest use of Fast Chargers as of the end of Q4 2012

- Seattle – 423 charge events per EVSE
- Los Angeles – 314
- San Francisco – 280

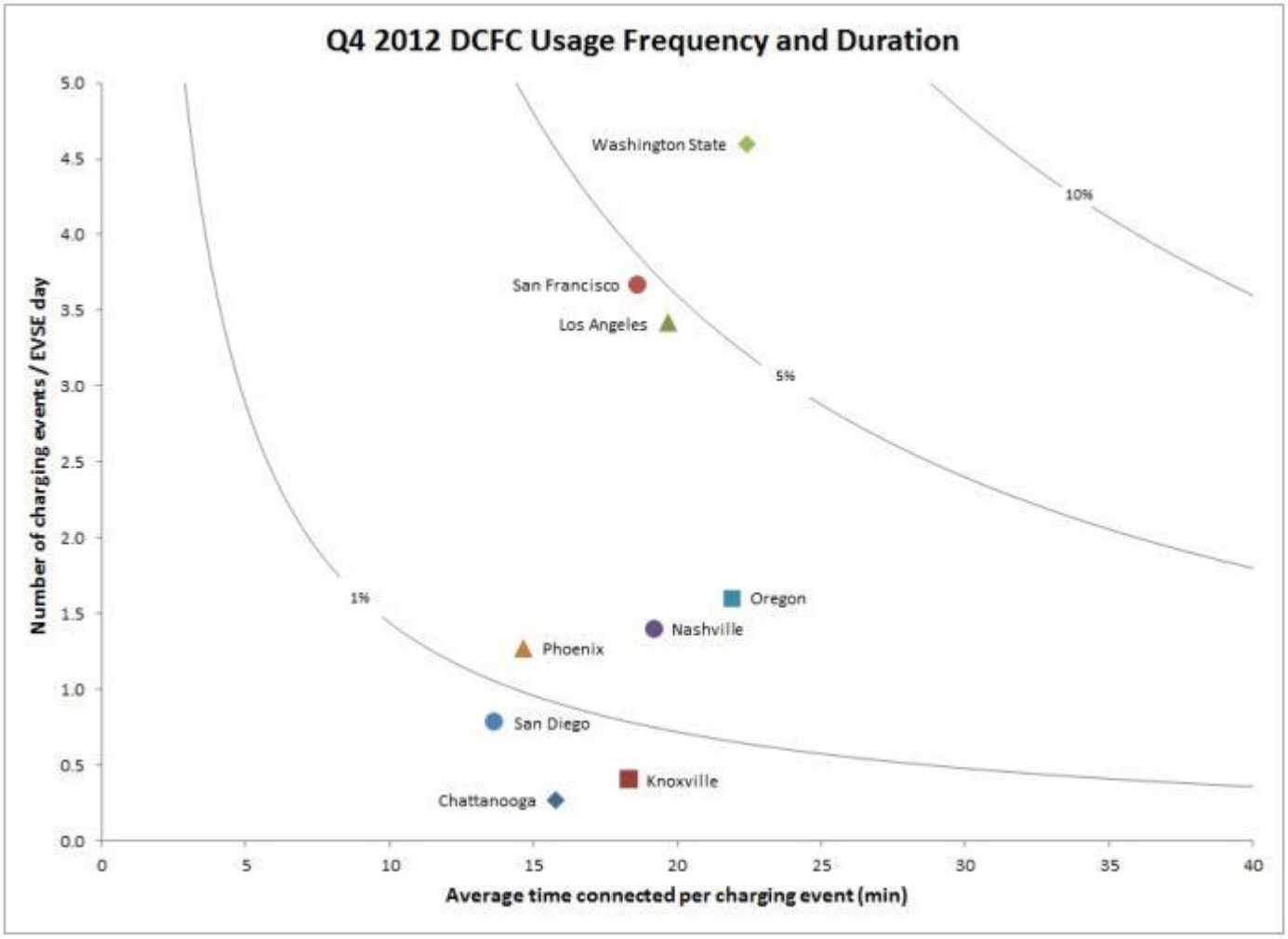
Highest Total AC Consumption for DC Fast Chargers

- San Francisco – 18.2 MWhr
- Oregon-13.4
- Seattle – 10.4

DC Fast Usage



DC Fast Usage



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DC Fast Charge Barriers

- **Demand and energy costs are significant for some utilities**
  - 25¢/kWh (cost of energy)
  - $25/kW (demand charges per kW)
- DC FC is demand charge free in a few service territories
- Many utility service territories have significant Demand charges

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

DC Fast Charge Barriers

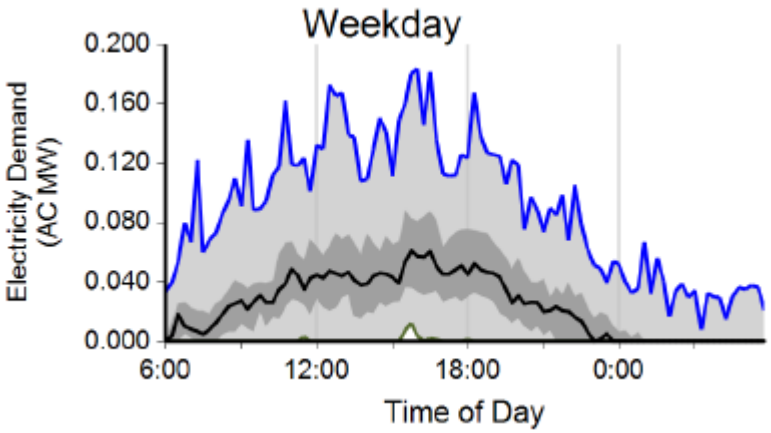
- Demand charges can have a drastic effect on per charge costs
- Example analysis using $12/kW demand charge

Scenario	Number of Vehicles Charged/ Month	Meter Charge	Demand Charge	Energy Charge	Monthly Total	Cost per Vehicle
1	0	$200	$0	$0	$200	N/A
2	1	$200	$600	$2.20	$802.20	$802.20
3	10	$200	$600	$22	$822	$82.20
4	100	$200	$600	$220	$1,020	$10.20
5	250	$200	$600	$550	$1,350	$5.40
6	500	$200	$600	$1,100	$1,900	$3.80

Mitigation Technologies

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

Publicly Available EVSE Demand



Mitigation Technologies

- **Energy Storage assisted DC FC**
  - Demand reduction
  - Grid ancillary services
  - Renewables absorption

- **Revised Utility Tariffs**
  - Demand responsive charging
  - Aggregated charger loads
  - Longer term--PUCs

North American Standardization

- DC Fast Charge standard confusion
  - Some Japanese OEMs have adopted the CHAdeMO standard
  - Other OEMs will adopt SAE COMBO standard
- VHS vs Beta, again
  - Will take 5-10 years to get to one common standard

Global Standardization Challenges

- Risk of stranding EV first adopters
- Lack of standard stalls deployment
- Expensive to convert & recertify DC Fast Charge equipment
- OEM & industry cooperation

Stay Tuned!

- Another year of collecting data
- More Leafs and Volts participating
- 17 more DC FC installed Q1 2013 toward 200 total
- More lessons to be learned
- Q1 2013 report released soon
- www.TheEVProject.com

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www.ECOtality.com www.blinknetwork.com

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