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Review of Integrated Resource Plans and Electric Vehicle Load Forecasting

NASEO Transportation Committee| July 25, 2013

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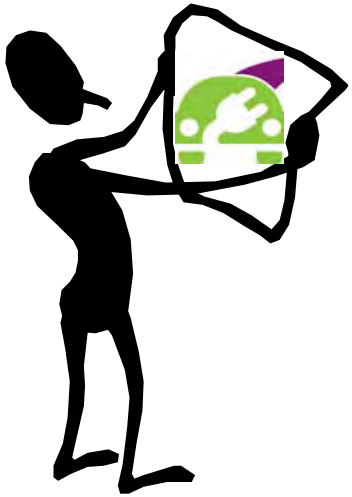
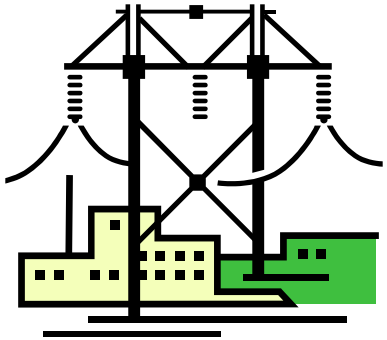
Goal

- Determine best practices and the state of inclusion of electric vehicles in utility planning and forecasting documents.





Why?

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- Grid implications are important planning consideration for entities responsible for maintaining resilient grid infrastructure and reliable electricity delivery.

- EVs present both a source of additional energy demand, and a possible grid resource with vehicle to grid interoperability.

- EVs have the potential to be either load filling (at night) or load building (during the day).

- Evidence suggests that the distribution of EVs in our communities will not be random but may occur in clusters.

- Increased demand, potential clustering of that demand, need for off-peak charging, and the potential for EVs to act as a grid resource, utilities should begin (or continue) to include these vehicles in their long-term planning.

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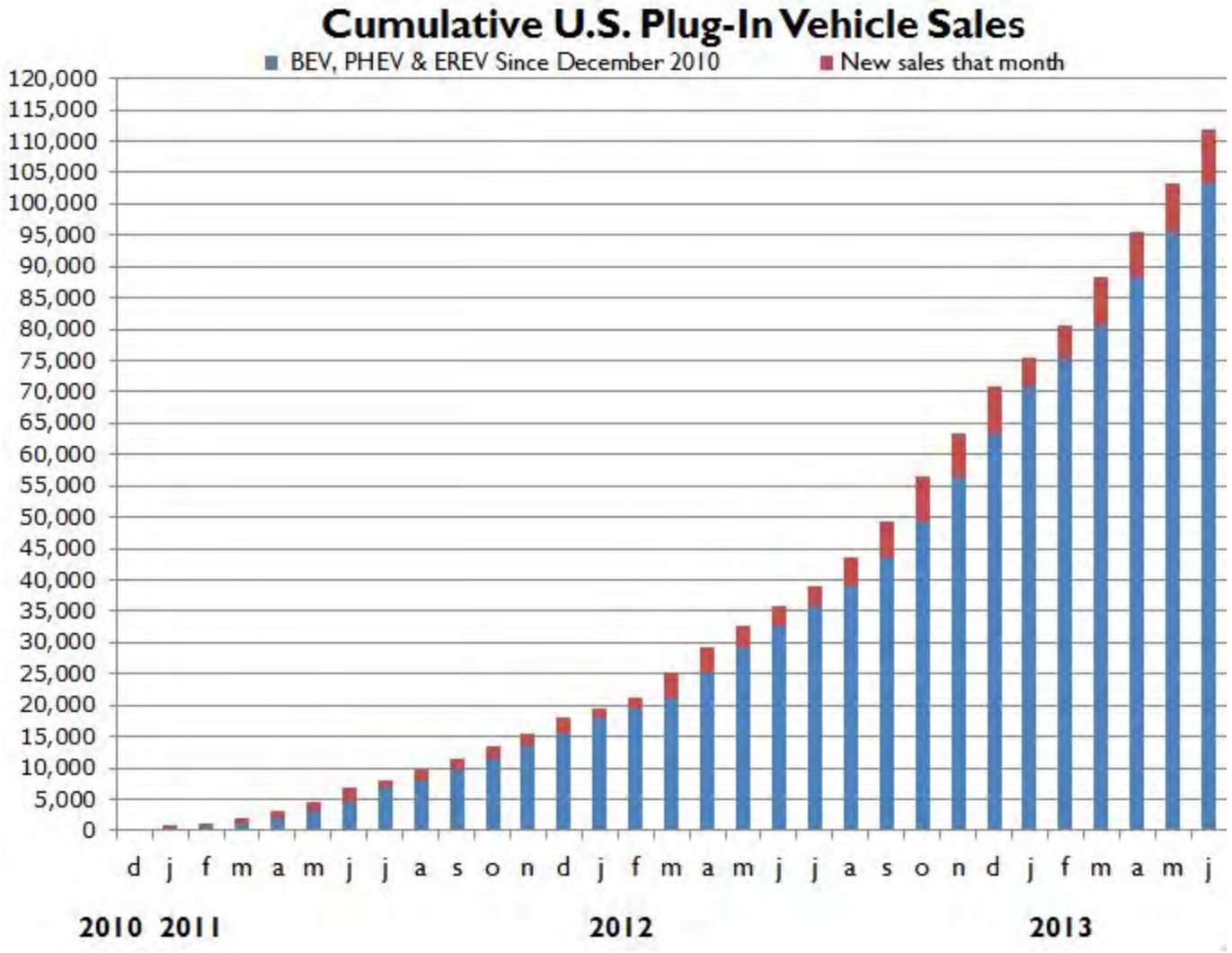

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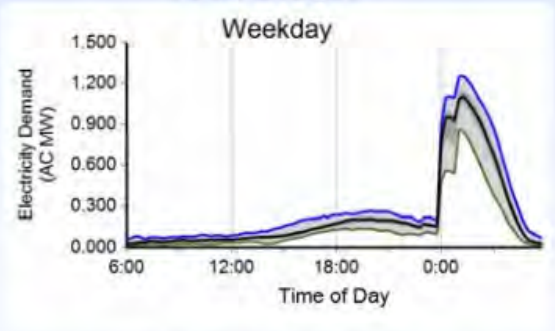
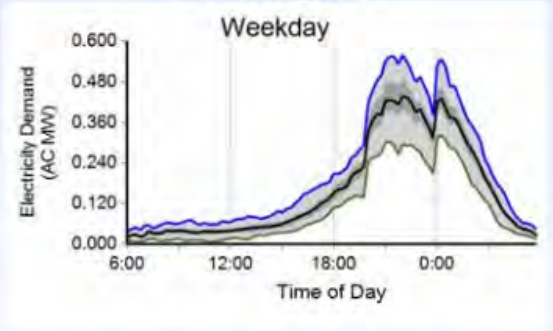
EV Project – EVSE Infra. Summary Report

- **Residential Level 2 Weekday EVSE 1st Quarter 2013**
- **TOU kWh rates in San Diego and San Francisco clearly impact when vehicle charging start times are set**

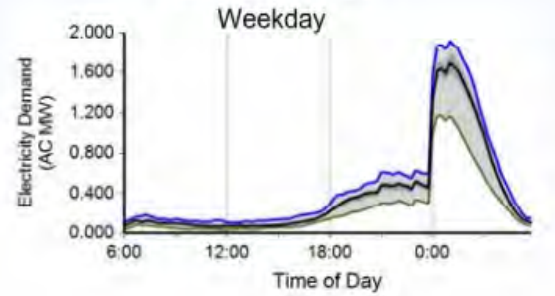
San Diego



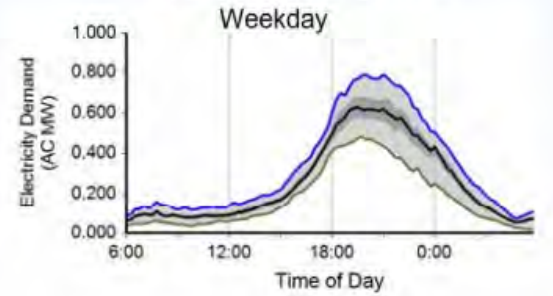
Los Angeles



San Francisco



Washington State



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Predicting Additional Load From EVs

- Requires integration and modeling of
  - travel behavior,
  - charging behavior, and
  - spatially explicit EV penetration scenarios, including effects on peak load and effects of TOU rates.

Evidence suggests that EV penetration may be clustered.

Where IRPs exist

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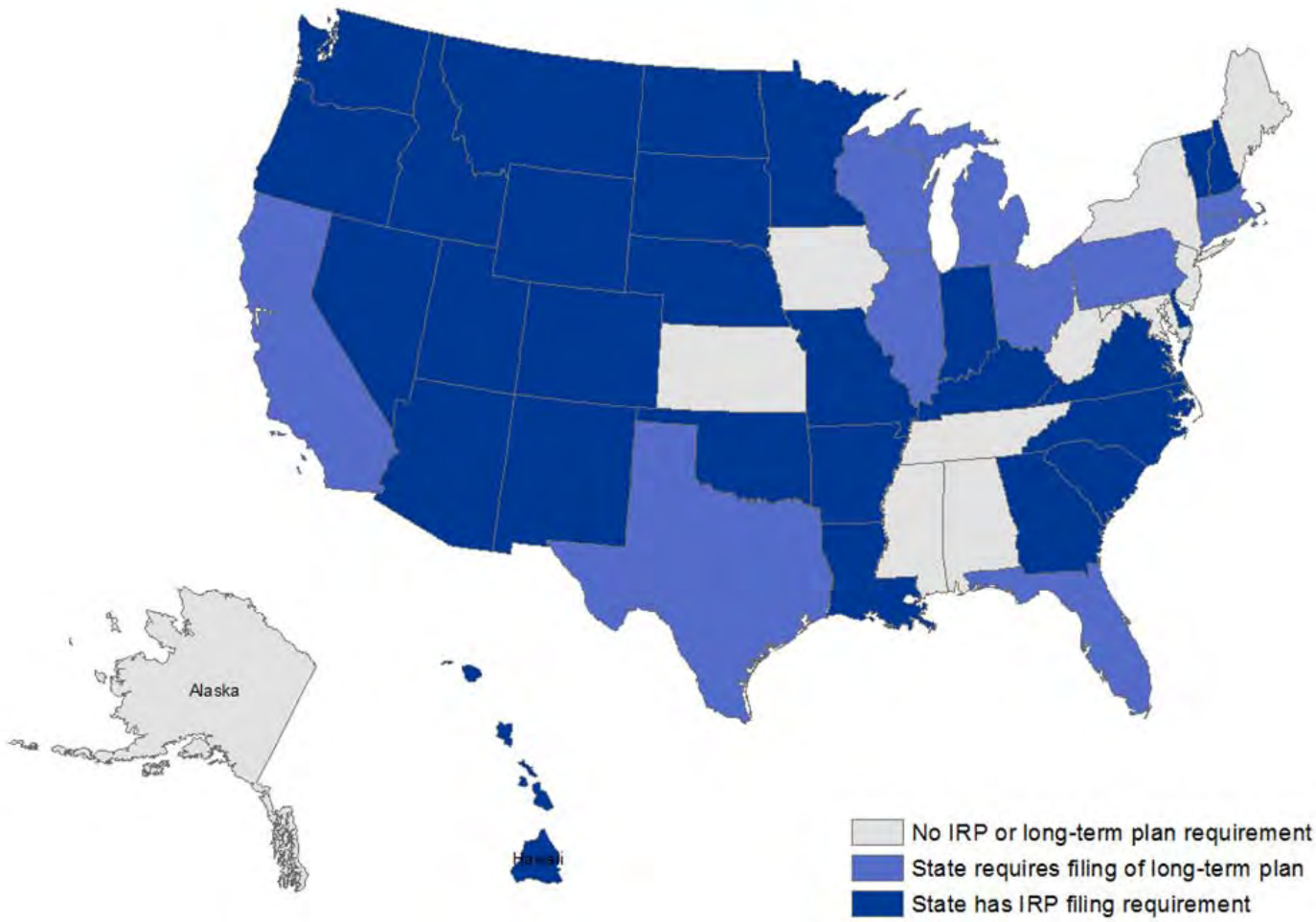

Plans Reviewed

- 31 utilities
  - Varied in size from less than 15,000 to greater than 5 million customers
  - Varied in type – investor owned, community owned, federally owned
- Focused on states expected to have higher than average EV penetration rates (CA, OR, VT)
- Plans that included some discussion of EVs

Utility Type	# IRPs reviewed	IRP includes EVs	IRP does not include EVs
Federally owned	1	1	0
Cooperative	3	0	3
Community owned	5	4	1
Investor owned	21	14	7

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Plans reviewed – cont.

- Majority of plans reviewed included EVs, either in the load forecast or in the plan text (19 of 31).

- While load growth from EVs acknowledged ,little modeling or analyses conducted to specifically incorporate EVs in forecast.

Table 2. Integrated Resource Plans Reviewed

Utility	Location	Utility Type	# Customers or Towns Served	IRP Year	Consideration of EVs included in IRP?[1]	Projected additional EV load
AEP-East	Indiana, Michigan, Kentucky, Ohio, Tennessee, Virginia, West Virginia	Investor owned	7.2 million	2010	No	-
Alaska Energy Authority-Southeast	Southeast Alaska	Community owned	30 communities	2011	Yes	-
Avista	Washington, Idaho, Montana	Investor owned	680,000	2011	Yes	<1% annual load growth
Black Hills Power	South Dakota, Wyoming, Montana	Investor owned	70,000	2011	Yes	-
Central Valley Electric Cooperative	Southeastern New Mexico	Cooperative	14,000	2013	No	-
Central Vermont Public Service Corporation (merged with Green Mountain Power in 2012)	Central Vermont	Investor owned	159,000	2011	Yes	-
Chelan Public Utility District	Chelan County, Washington	Community owned	47,000	2012	Yes	0.36-1.93 MW (< 1% total load)
Connecticut Light and Power	Connecticut	Investor owned	1.2 million	2010	Yes	3% total load in 2030
Consolidated Edison Company of New York	New York City, Westchester County	Investor owned		2013	Yes	-
Delmarva Power and Light Company	Delaware and Maryland	Community owned	300,000	2010	No	-
Dominion North Carolina Power and Dominion Virginia Power	North Carolina and Virginia	Investor owned	-	2012	Yes	806 GWh in 2027 (<1% total load)
Duke Energy	North and South Carolina, Florida, the Midwest	Investor owned	7.2 million	2011	Yes	-

Utility	Location	Utility Type	# Customers or Towns Served	IRP Year	Consideration of EVs included in IRP?[1]	Projected additional EV load
East Kentucky Power Cooperative, Inc.	Kentucky	Cooperative	520,000	2009	No	-
El Paso Electric Company	West Texas	Investor owned	380,000	2012	No	-
Entergy	Arkansas, Louisiana, Mississippi, Texas	Investor owned	2.8 million	2012	No	-
Green Mountain Power	Central and northwest Vermont	Investor owned	-	2012	Yes	65 GWh in 2030 (4% total load)
Hawaii Electric Company	Hawaii	Investor owned	1.4 million	2013	Yes	319 GWh in 2033 (4-5% of total load)
Indianapolis Light and Power	Indiana	Investor owned	470,000	2012	Yes	-
Minnesota Power	Central and northeastern Minnesota	Investor owned	144,000	2013	No	-
National Grid	New Hampshire, Massachusetts, New York	Investor owned	3.5 million	2010	No	-
New Hampshire Public Service	New Hampshire	Investor owned	500,000	2010	Yes	-
Northwest Power and Conservation Council	Oregon, Washington, Idaho, Montana	Planning organization	n/a	2010	Yes	100-550 MW in 2030 (<1 - 2% total load)
PacifiCorp	Utah, Colorado, Wyoming, Idaho, Oregon Washington, California	Investor owned	1.7 million	2011	No	-
Platte River Power Authority	Colorado	Community owned	4 municipalities	2012	No	-
PNM	New Mexico	Investor owned	500,000	2011	Yes	-
Portland General Electric	Northwestern Oregon	Investor owned	800,000	2009	Yes	5-50 MW in 2020 (< 1% total load)

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Utility	Location	Utility Type	# Customers or Towns Served	IRP Year	Consideration of EVs included in IRP?[1]	Projected additional EV load
San Diego Gas and Electric	San Diego, CA	Investor owned	1.4 million	2012	No	-
Seattle City Light	Seattle	Community owned	400,000	2012	Yes	36 MW (2.6% total load) in 2030
Tennessee Valley Authority	Tennessee, Virginia, Kentucky, North Carolina, Georgia, Mississippi, Alabama	U.S. government-owned corporation	9 million	2011	Yes	-
United Illuminating	Connecticut	Investor owned	325,000	2010	Yes	3% total load in 2030
Vermont Electric Coop	Northern Vermont	Cooperative	32,000	2012	No	-

IRP Inclusion of EVs in States with Highest 2015 Per Capita EV Projections

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State	Projected EVs per 10,000 people*	State requires IRP process?	IRPs that included EVs	IRPs that included EVs in load forecast	Total IRPs reviewed
California	30	No (Long Term Procurement Plan required)	0	0	2
Vermont	27	Yes	2	1 (Green Mountain Power)	3
Oregon	25	Yes	2	1 (Portland General Electric)**	3
Washington	25	Yes	4	3 (Avista, Chelan County PUD Seattle City Light,)	5
District of Columbia	24	No	0	0	0
New Hampshire	23	Yes	1	0	2
Connecticut	23	Yes	1	0	1
Massachusetts	22	No	0	0	1
Virginia	21	Yes	2	2 (Dominion and Duke)	2
Maryland	20	No	0	0	1

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IRP Inclusion of EVs and Utility Size

Utility Size (# customers)*	# IRPs that included EVs	# IRPs that did not include EVs
< 100,000	2	1
100,000 – 1 million	8	6
1 – 5 million	2	3
> 5 million	2	1

Recommendations for Future IRPs Incorporating EVs

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- Track EV and charging infrastructure deployment through coordination with local transportation partners (state Departments of Transportation, Clean Cities Coalitions)
- Develop projections of EV penetration rates, additional energy demand, and peak load effects in the utility service area
- Determine spatially explicit infrastructure needs that may result from EV use
- Consider how utility efficiency programs can reduce projected demand resulting from EV charging
- Consider EVs as a grid resource through vehicle-to-grid interoperability and the role of Smart Grid to optimize the resource potential

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Cross-Sector Challenges

- Planning for EVs is a new challenge for the electric sector
- Requires integration of travel behavior data, previously relegated to the transportation sector.
- Coordination with public agencies will facilitate optimal deployment of EVs,
- Ensuring that electric infrastructure is adequate to handle the additional load in the necessary locations and that charging infrastructure is located such that travel demand can be met using EVs.

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"The opportunity to electrify the transportation sector could be a new market segment for electric utilities. However, while this represents a load growth opportunity, **it will likely require significant planning and potentially even organizational changes to pursue**.

For instance, most utilities don't have people dedicated or experienced with studying the impact of electric vehicles on the distribution system. They also may not have people well versed in promoting electric vehicles and understanding the technology of the car, the new charging infrastructure, or the economics of it all."(pg. 16)

2012 strategic directions in the U.S. Electric Utility Industry

A Black & Veatch Report