

Compilation of Utility Commission Initiatives Related to Plug-in Electric Vehicles and Electric Vehicle Supply Equipment



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Acronyms and Initialisms

§	Section	EPRI	Electric Power Research Institute
A	Ampere(s)	EREV	Extended Range Electric Vehicle
AB	Assembly Bill	EV	Electric Vehicle
AC	Alternating Current	EVIC	Electric Vehicle Infrastructure Council
AFV	Alternative Fuel Vehicle	EVSE	Electric Vehicle Supply Equipment
AL	Alabama	GEV	Grid-Enabled Vehicle
AMI	Advanced Metering Infrastructure	GM	General Motors Company
APS	Arizona Public Service Company	HI	Hawaii
AZ	Arizona	HOV	High-Occupancy Vehicle
BEV	Battery Electric Vehicle	ICE	Internal Combustion Engine
BEVT	Business Electric Vehicle Time-of-Use Rate	IN	Indiana
BTA	Business Time Advantage	IOU	Investor-Owned Utility
CA	California	ISO	Independent System Operator
CAISO	California Independent System Operator	kW	Kilowatt(s)
CEC	California Energy Commission	kWh	Kilowatt Hour(s)
CO	Colorado	KY	Kentucky
CT	Connecticut	LADWP	Los Angeles Department of Water and Power
DC	Direct Current	LEV	Low-Emission Vehicle
DE	Delaware	LIPA	Long Island Power Authority
DMV	Department of Motor Vehicles	MI	Michigan
DOD	U.S. Department of Defense	MSRP	Manufacturer's Suggested Retail Price
EPA	U.S. Environmental Protection Agency	NARUC	National Association of Regulatory Utility Commissioners
EPAct	Energy Policy Act	NJ	New Jersey
EPIC	Electric Program Investment Charge	NNA	Nissan North America, Inc.

NV	Nevada	R	Residential
NYCRR	New York Codes, Rules and Regulations	REVI	Regional Electric Vehicle Initiative
NYISO	New York Independent System Operator	RS	Residential Service
NYSERDA	New York State Energy Research and Development Authority	RT	Real Time
		SCC	State Corporation Commission
		SCE	Southern California Edison
OEM	Original Equipment Manufacturer	SDG&E	San Diego Gas & Electric Company
OR	Oregon	TOU	Time of Use
ORS	Oregon Revised Statutes	TOU-D-T	Time of Use Domestic Tiered
PA	Pennsylvania	U.S.	United States
PEV	Plug-in Electric Vehicle	URC	Utility Regulatory Commission
PG&E	Pacific Gas and Electric Company	V	Volt(s)
PHEV	Plug-in Hybrid Electric Vehicle	V2G	Vehicle-to-Grid
PSC	Public Service Commission	ZEV	Zero-Emission Vehicle
PUC	Public Utilities Commission		

1. Executive Summary

Utilities commissions, utility regulatory commissions (URCs), public utilities commissions (PUCs), and public service commissions (PSCs), herein collectively referred to as “commissions,” throughout the United States are involved in several aspects of plug-in electric vehicle (PEV) deployment, most specifically with electric vehicle supply equipment (EVSE) installation and use. As the EVSE market matures, commissions and the utilities they regulate will need to design and adopt policies surrounding EVSE use, operation, and ownership. Some state commissions have been proactive in establishing policies and initiatives in support of this evolving technology. These include regulation modifications (e.g., permitting the sale of electricity from EVSE and demand response or vehicle-to-grid electricity management strategies), incentives (e.g., special PEV time-of-use [TOU] rates and rebate or grant programs), and utility directives (e.g., notification of EVSE installation, utility ownership of EVSE, PEV batteries for grid use, and outreach). These policies and initiatives are listed below in the suggested order of priority for being addressed.

Excluding EVSE service providers from being classified as regulated public utilities permits these operators to bill PEV users based on the electricity used rather than charging a flat hourly rate that might not properly reflect the value of service being provided. California and Oregon PUCs decided that EVSE service providers would not be included in the definition of a public utility based on their interpretations of state law at the time of that decision. Now several states—including California, Colorado, Florida, Maryland, and Virginia—have passed laws specifically excluding EVSE service providers from public utility regulations if the electricity is used exclusively as a transportation fuel. Similar distinctions have been made in the past for compressed natural gas. In New York State, the public service law definitions for a “gas corporation” include an exemption for when compressed natural gas is sold, distributed or furnished solely as a fuel for use in motor vehicles.

Special electricity rates for PEV charging use TOU rate schedules to incentivize PEV owners to charge during off-peak times. The amount of electricity required to charge a PEV, coupled with the ease of charging during off-peak hours, make PEV owners ideal candidates for TOU rates. Many utilities have established PEV-specific rate structures that offer significant energy cost reductions at “super off-peak” times. Some rates have a separate meter only for the EVSE, while others use a single meter for the entire house including the EVSE. Some utilities offer a fixed monthly charge for electricity drawn by the EVSE. Utilities can propose special PEV rates for commission approval to more effectively manage electricity use by PEVs. However, utilities in several states have not taken the initiative until the commission has directed them to do so. The “smart meter” is a key element that allows customers both to take maximum advantage of TOU rate schedules and to support utility roll-out of further advanced strategies that influence EV charging schedules.

Notification of EVSE installations helps utilities determine if the local distribution system is ready for the increased demand from additional localized PEV use. Currently, most processes for doing this are ad hoc and may need to evolve into formalized procedures as electrical charging impacts on the grid increase as a result of more widespread PEV use. California is currently

investigating how this might be accomplished, and Maryland has modified laws to permit the Motor Vehicle Administration (MVA) to disclose PEV registration information to utilities.

Utility ownership and operation of EVSE introduces a large player into the EVSE service provider business. This may help resolve some issues of grid reliability because the utility would know where the stations are being installed and could better serve markets that might not be as profitable for other EVSE service providers. However, utility ownership of EVSE may limit customer choices and perhaps even dampen the competition that may yield cost-reducing innovation in this evolving market. The California PUC does not permit utilities to own and operate EVSE, but the PUC of Oregon determined that electric utilities should not be excluded from providing EVSE services as long as the utilities carefully consider how to structure the ownership and operation. Oregon also stipulated that there must be a compelling case if utilities request rate recovery for EVSE investment.

Rebates or grants have been offered by some utilities to customers for EVSE, EVSE installation, or PEVs as the basis for a research program. Utilities may use these incentives to learn about the technology and understand how it will be used by their customers or merely to promote PEV and EVSE deployment. Most of the early programs were very limited in scope and restricted to a small funding limit. California has initiated the Electric Program Investment Charge (EPIC) for 2013–2020, a \$162.0 million-per-year program that funds electric public interest investments in applied research and development, technology demonstration and deployment, and market facilitation for clean energy technologies. Program coverage includes policy evaluation and infrastructure development sufficient to overcome any barriers to the widespread deployment and use of plug-in hybrid and electric vehicles.

Stakeholder involvement and outreach carried out by commissions and utilities address the impact PEVs could have on the grid and help define existing opportunities for mitigating issues and maintaining low electricity costs. Being involved in PEV initiatives is often the most effective way for commissions and utilities to encourage PEV adoption (a growing opportunity to increase customer services) and to guarantee that due consideration is given to both grid and business during policy and planning discussions.

Demand response and vehicle-to-grid (V2G) services could minimize the impact of PEV charging to the grid, enable PEVs to help balance electricity supply and demand, provide additional revenue to PEV owners, and allow the PEV battery to provide electricity during a power outage. While many states have net metering regulations, only Delaware has a statutory requirement for utilities to accommodate net metering from PEVs, so utilities in other states are not obligated to purchase electricity from PEV batteries. Further investigation into the true value of these services, along with appropriate guidelines and tariffs, can help ensure that demand response and V2G services are implemented safely and fairly compensate PEV owners.

Repurposing PEV batteries for grid use at the end of the batteries' useful PEV life can create a valuable asset for stationary energy storage. Research and demonstrations are under way to prove the viability and reliability of this secondary application. A standardized way of testing and determining remaining useful life would be very useful to the grid storage industry.

2. Introduction

The purpose of this white paper is to document and summarize current PEV- and EVSE-related initiatives from commissions around the United States. The following chapters expand on critical topics that will involve utilities and commissions in addressing potential barriers to PEV technology deployment.

Presented in the suggested order of priority, these topics are:

- EVSE Exclusion from Public Utility Regulations
- Special Electricity Rates for PEV Charging
- EVSE Installation Notification
- Utility Ownership of EVSE
- Rebates and/or Grants
- Outreach and Education
- Demand Response and Vehicle-to-Grid Services
- EV Batteries for Grid Use

Numerous precedents are listed in each section and the appendices to highlight relevant PEV and EVSE policies and initiatives implemented by proactive commissions and utilities. Key findings are summarized for each topic and revisited in the Conclusions section of this document.

At its 2012 annual meeting, the National Association of Regulatory Utility Commissioners (NARUC) board of directors adopted several resolutions on alternative fuel vehicle (AFV) development and deployment.¹ These included a number of topics addressed in this white paper (see highlights in the list below). The resolutions were approved by NARUC's various committees, its board of directors, and its membership and are now considered NARUC policy, providing guidance and positions for NARUC's advocacy before Congress, the White House, federal agencies, and the courts. They recognized that AFVs, which include PEVs, can enhance national energy security and reduce emissions, and that continued leadership by state and federal policy makers is needed to ensure the resolutions' goals are fulfilled in today's rapidly evolving AFV market. NARUC urges state and federal regulators to collaborate with other policy makers to remove barriers to AFV deployment and ensure consistent, fuel-neutral policies to help realize the full economic, environmental, and societal benefits of AFVs. The resolutions state that NARUC:

- Supports utility company programs and policies that allow for the AFV market's continued development, including addressing any potential upgrades to grid and pipeline infrastructure that may be needed to maintain the integrity of the utility system and design of **innovative rate programs or incentives** to maximize customer savings.
- Believes third-party providers of fueling and charging services that purchase power or fuel from a regulated public utility or other competitive energy supplier to provide to the public should **not be considered public utilities** and therefore not be regulated as such.

¹ NARUC, "Resolutions Approved by the Committee of the Whole 124th Annual Meeting," November 14, 2012, <http://naruc.org/Resolutions/Resolution%20on%20Expanding%20the%20Alternative%20Fuel%20Vehicle%20Market.pdf>.

- Encourages utility companies to collaborate with federal, state and local policy makers to address **potential consumer protection concerns, safety issues and reliability impacts** that could arise from fueling and charging services provided by third parties.
- Supports a competitive AFV marketplace in which utility companies, businesses, governments, and third-party service providers are able to participate in the **owning, leasing, operating, or maintenance** of charging or fueling equipment.
- Encourages utility companies to work with local governments, state agencies, automakers, and other stakeholders to secure timely **notification** of AFV purchases and proposed charging or fueling infrastructure installations to facilitate strategic system-wide planning and targeted customer outreach.
- Supports **customer education and outreach** on the benefits of AFVs, including their availability, environmental benefits, and cost effectiveness, and the proper installation and efficient use of charging or fueling infrastructure, as well as the availability of programs and tariffs that maximize savings from AFV use and protect the utility system's integrity.
- Encourages state legislatures and governors to consider consistent, fuel-neutral transportation funding solutions and policies that support the growth, adoption, and increased environmental performance of AFVs.

PEV and EVSE Basics

PEVs have a long history, yet for most of the narrative on the automobile, PEVs have only been mentioned as niche products or curiosities. Now several automakers have produced or are planning PEV models, and some, such as Nissan, are investing heavily in an automobile market with a significant PEV component.

Three categories of PEVs can utilize standard EVSE to recharge onboard batteries: (1) battery electric vehicles (BEVs) powered exclusively by electricity stored in batteries, (2) plug-in hybrid electric vehicles (PHEVs) that can be powered by either an electric motor or gasoline engine, and (3) extended range electric vehicles (EREVs) that are powered by an electric motor but can use grid electricity or an onboard gasoline generator to replenish the battery pack.

The market for PEVs is growing, with 7,632 sold nationwide in March 2013, up from 4,161 sold in March 2012. In 2012, 52,835 PEVs were sold in the United States, which is 11% of the combined sales for hybrid electric and PEVs, but still only 0.37% of all vehicle sales. From December 2010 to March 2013, a total of 88,328 PEVs have sold, including 54,803 PHEVs and EREVs and 33,525 BEVs.² These sales numbers show PHEVs and EREVs outselling BEVs, suggesting that consumers generally appreciate the safety net a gasoline engine provides against range anxiety.

Given the small number of PEV purchases so far, characterizing current and potential PEV owners is an important task for determining where to focus attention and investment. At the Plug-In 2012 Conference,³ PEV automakers grouped potential owners as follows:⁴

² Electric Drive Transportation Association, "Electric drive vehicle sales figures (U.S. Market) - PEV sales," accessed 19 April 2013, <http://electricdrive.org/index.php?ht=d/sp/i/20952/pid/20952>.

³ July 23–26, 2012, San Antonio, Texas.

- Previous PEV owners: These people were part of the PEV rollout attempt in the previous decade or are currently driving a vehicle conversion.
- Tech-savvy: These people want to have the latest, coolest, and most high-tech car in the neighborhood.
- Uber-greens: These people are eco-conscious and most aware of their carbon footprint. They particularly appreciate the environmental and local benefits that PEVs bring.
- Energy security hawks: These people consider reducing the nation's dependence on foreign oil to be of the utmost importance, as international oil imports support regimes whose interests are often not aligned with those of the United States.⁵

While it is important to highlight PEVs' advantages, including reduced fueling costs and potentially zero emissions, PEVs do face significant challenges. The U.S. Environmental Protection Agency (EPA) website, *fuelconomy.gov*, lists the following issues related to the battery, while reminding its audience that improvement is occurring on all of these fronts:

- Driving range: Most BEVs can go only about 60–100 miles before recharging, while gasoline vehicles can travel more than 300 miles before refueling.
- Recharge time: Fully recharging the battery pack can take 4–8 hours or more. Even a “quick charge” to 80% capacity can take 30 minutes.
- Battery cost: Battery packs are expensive and may also need to be replaced at a later date.
- Bulk and weight: Battery packs weigh several hundred pounds and take up considerable vehicle space, with some states removing that weight for classification.

All of these factors represent tradeoffs for PEV buyers to consider. PEV original equipment manufacturers (OEMs) have each taken different approaches to range, cost, and charging speed when designing their cars (see Table 0 and Table 2). While reduced refueling and maintenance expenses reduce long-term ownership costs, making them comparable to internal combustion engine (ICE) vehicle lifetime costs, purchase prices for PEVs are up to \$10,000 more than comparable ICE vehicles or even hybrid electric vehicles.⁶

PEV ownership is skewed toward metropolitan areas, with 89% of PEV owners living in city areas with populations of 50,000 or greater. The likely reason is that 81% of the U.S. population lives in metropolitan areas, and PEV operational characteristics match the needs of those residents. However, within these metropolitan areas, PEV ownership is concentrated in the less-dense suburban and exurban portions of cities.

EVSE locations are a critical piece of the PEV ecosystem and an important component in facilitating the expanded use of this technology. EVSE comes in various levels of charging, such as alternating current (AC) Level 1 (120 V AC, 12–16 A), AC Level 2 (240 V AC, up to 80 A), direct current (DC) Level 1 (200–500

⁴ John Volecker, “Electric Car Industry Sums Up Progress, Challenges At Plug-In 2012,” Green Car Reports, 27 July 2012, http://www.greencarreports.com/news/1078004_electric-car-industry-sums-up-progress-challenges-at-plug-in-2012.

⁵ A similar statement could be made regarding the lithium in lithium-ion batteries.

⁶ This is in addition to the costs of EVSE, which may be upward of \$1,000 for AC Level 1 and potentially involve hundreds or thousands of dollars in installation costs.

V DC, up to 80 A), and DC Level 2 (200–500 V DC, up to 200 A), as shown in Figure 1. The EVSE rating affects charging duration and electrical demand placed on the grid.

Table 0. Currently available PEV models⁷

Vehicle	Type	Battery Size	Electric Range	MSRP ⁸	Federal Tax Credit ⁹
Chevrolet Volt	EREV	16.5 kWh	38 miles	\$39,995	\$7,500
Coda Automotive CODA	BEV	31 kWh	88 miles	\$38,145	\$7,500
Fisker Karma	EREV	20 kWh	33 miles	\$102,000	\$7,500
Ford C-Max Energi	PHEV	8 kWh	21 miles	\$33,745	\$3,751
Ford Focus Electric	BEV	23 kWh	76 miles	\$39,995	\$7,500
Ford Fusion Energi	PHEV	8 kWh	21 miles	\$39,495	\$3,751
Honda Accord Plug-in	PHEV	7 kWh	13 miles	\$40,570	\$3,334
Mitsubishi i	BEV	16 kWh	62 miles	\$29,975	\$7,500
Nissan Leaf	BEV	24 kWh	73 miles	\$29,650	\$7,500
Tesla Model S¹⁰	BEV	40 kWh	160 miles	\$59,900	\$7,500
Toyota Prius Plug-in	PHEV	4.4 kWh	11 miles	\$32,795	\$2,500
Toyota RAV4 EV	BEV	42 kWh	103 miles	\$50,645	\$7,500

Table 2. Upcoming and limited availability PEV models⁷

Vehicle	Type	Battery Size	Electric Range	MSRP ⁸	Federal Tax Credit
Chevy Spark EV	BEV	20 kWh	87 miles	N/A	\$7,500
Fiat 500e	BEV	24 kWh	87 miles	N/A	\$7,500
Honda Fit EV	BEV	20 kWh	82 miles	\$36,625	\$7,500
Mitsubishi Outlander Plug-in	PHEV	12 kWh	34 miles	N/A	\$5,419
Scion iQ EV	BEV	12 kWh	38 miles	N/A	\$5,419
Smart Fortwo Electric	BEV	17.6 kWh	68 miles	\$25,000	\$7,500

⁷ Office of Energy Efficiency and Renewable Energy, Fueleconomy.gov home page, <http://www.fueleconomy.gov>, accessed 28 November 2012; and PEV manufacturer sites.

⁸ MSRPs are taken from manufacturers' websites for base model and include destination charges; MSRPs do not include the available \$2,500–\$7,500 federal tax credit.

⁹ Federal Tax Credits for Electric Vehicles. <http://www.fueleconomy.gov/feg/taxevb.shtml>, accessed 18 April 2013.

¹⁰ Tesla Model S base model with a 40 kWh battery. Optional 60 kWh battery model has a range of 208 miles (\$69,900), and 85 kWh battery model has a range of 265 miles (\$79,900).

	AC level 1 (SAE J1772™)		DC Level 1 (SAE J1772™)
	PEV includes on-board charger 120V, 1.4 kW @ 12 amp 120V, 1.9 kW @ 16 amp Est. charge time: PHEV: 7hrs (SOC* - 0% to full) BEV: 17hrs (SOC – 20% to full)		EVSE includes an off-board charger 200-500 V DC, up to 40 kW (80 A) Est. charge time (20 kW off-board charger): PHEV: 22 min. (SOC* - 0% to 80%) BEV: 1.2 hrs. (SOC – 20% to 100%)
	AC level 2 (SAE J1772™)		DC Level 2 (SAE J1772™)
	PEV includes on-board charger (see below for different types) 240 V, up to 19.2 kW (80 A) Est. charge time for 3.3 kW on-board charger PEV: 3 hrs (SOC* - 0% to full) BEV: 7 hrs (SOC – 20% to full) Est. charge time for 7 kW on-board charger PEV: 1.5 hrs (SOC* - 0% to full) BEV: 3.5 hrs (SOC – 20% to full) Est. charge time for 20 kW on-board charger PEV: 22 min. (SOC* - 0% to full) BEV: 1.2 hrs (SOC – 20% to full)		EVSE includes an off-board charger 200-500 V DC, up to 100 kW (200 A) Est. charge time (45 kW off-board charger): PHEV: 10 min. (SOC - 0% to 80%) BEV: 20 min. (SOC - 20% to 80%)
Voltages are nominal configuration voltages, not coupler ratings Rated Power is at nominal configuration operating voltage and coupler rated current Ideal charge times assume 90% efficient chargers, 150W to 12V loads and no balancing of Traction Battery Pack			
Notes: 1) BEV (25 kWh usable pack size) charging always starts at 20% SOC, faster than a 1C rate (total capacity charged in one hour) will also stop at 80% SOC instead of 100% 2) PHEV can start from 0% SOC since the hybrid mode is available.			

ver. 100312

ver. 100312

Figure 1. SAE Charging Configurations and Ratings Terminology¹¹

Siting EVSE effectively, so it is most useful for current and future PEV owners, requires prioritizing EVSE locations in certain contexts. Numerous studies have reached the following conclusions regarding the use of EVSE by future PEV owners:

- A single battery charge can easily accommodate typical automobile tours. This includes *all* of the trips made while away from home, such as commuting to work and running errands along the way.
- The majority of charging will occur at home; the second-highest percentage will occur at work.
- Public charging will largely involve “topping off” the battery.
- PEV owners will likely be more concerned about non-typical travel, giving importance to “safety-net” charging sites. The availability of a network of public charging stations tends to increase drivers’ willingness to use their PEV batteries more fully, but an increase in EVSE usage will not necessarily occur.

To fully benefit the PEV ecosystem, EVSE installations should be concentrated where current and projected PEV owners will be travelling. Public EVSE should also be located in high-visibility places, increasing usage by current PEV owners and persuading potential owners that there are sufficient public

¹¹ SAE International, SAE Charging Configurations and Ratings Terminology, 2012, www.sae.org/misc/pdfs/chargingtable10-3-2012.pdf.

opportunities, even if the owners may not use the EVSE in question. EVSE is being installed in public locations at a rapid rate; nearly all of these are AC Level 2 chargers. While great interest has been expressed in DC fast chargers, there is no publicly accessible fast charge EVSE in the Northeast. However, one public DC fast charging station is planned for the Flying J in Carney's Point (NJ). There are also four existing DC fast charging stations at privately accessible locations: two for Tesla owners, one in Milford (CT) and one in Newark (DE); and two at EVSE manufacturers, namely Eaton in Warrendale (PA) and Fuji Electric in Edison (NJ).

There are a number of installation contexts for EVSE, with the majority of deployments to date falling under the following categories:

PEV Dealerships and Service Stations, Nissan dealerships in particular, may have two EVSE installations: one public and one for the service station. For dealerships, publicly displaying EVSE is as much about introducing the public to PEVs as it is about gaining goodwill from existing PEV owners. These installations are generally not great public EVSE locations because they are unlikely to be located near other destinations that the PEV driver could walk to.

Downtown locations include both municipal and private lots. Municipal lots are government-sponsored, and EVSE installation therefore reflects policy. These lots are usually located at town centers and serve public facilities. Meanwhile, in private lots, EVSE acts as a service differentiator, drawing customers for extended periods of time.

Retail locations use EVSE as a marketing opportunity, drawing in potential customers and/or extending their stays because of charging requirements. These locations appear to be particularly appealing to PHEV or EREV owners, allowing them to top off their batteries and avoid using their gasoline engines. Some large companies, such as Walgreens or Price Chopper, have EVSE at multiple stores to support corporate initiatives that encourage this technology.

Commercial Offices install EVSE because of internal missions, employee demands, or developer marketing. Where paired with PEV-owning employees, these are prime secondary or even primary charging locations because of consistent patterns and long dwell time. National efforts are being made to lobby and educate employers about the benefits of integrating PEVs and workplace charging into their corporate strategies.¹² A new initiative by the U.S. Department of Energy, Workplace Charging Challenge, aims for a tenfold increase in the number of employers offering charging over the next five years.

Higher Education institutions, i.e., colleges and universities, are strategic EVSE locations given the strong connection between PEV ownership and educational attainment. Installations at these major employment centers can serve professors and employees, as well as distinguish a school's sustainability policies. Many of these stations are at public universities, in which case the installation may have been driven by government policies.

Leisure Destination locations include a range of destinations and activities, such as stadiums, performance venues, and public parks. Visitors are willing to travel a bit longer to reach such

¹² See www.evworkplace.org, a CALSTART partnership with Google.

places because they expect to relax and enjoy themselves once they arrive. While the seasonality of some sites might limit utilization, regular attendees fit the typical EV owner demographics, and these locations provide good exposure to the technology.

PEVs bring with them the classic “chicken and egg” argument over whether the cars or infrastructure is needed first to stimulate the other’s deployment. To address consumers’ worries about range anxiety and to promote the use of domestically produced electricity, the federal government, several states, and private investors are supporting the installation of public EVSE. These charging stations must also be maintained to provide charging services and payment management for PEV owners; this creates a business case for EVSE service providers.

Electric Power Research Institute (EPRI) studies indicate that most utilities are not likely to have any major grid reliability problems, even if PEVs make up a sizable portion of the vehicle fleet. Two big mitigating factors will be when and where customers recharge their PEVs. Some localized distribution upgrades may be needed in neighborhoods with high PEV adoption (“clustering”), where distribution transformers are already overloaded as a result of load growth or older distribution loading standards, or where assets have little marginal load capacity. A number of PEVs recharging at the same time may, in some cases, shorten transformer life because of their larger power draws.¹³ Understanding when and where PEVs are charged is critical to determining how PEVs will affect the distribution network.

¹³ EPRI, “Transportation Electrification: A Technology Overview,” 18 July 2011, http://my.epri.com/portal/server.pt?Abstract_id=000000000001021334.

3. EVSE Exclusion from Public Utility Regulations

Currently, most public EVSE owner–operators offer free charging, but that will likely change as use of public EVSE increases. AC Level 2 EVSE is capable of transferring up to 19.2 kW, although most current onboard chargers draw between 3.3 kW and 10 kW. While not widely deployed yet, DC “fast chargers” could draw up to 100 kW with charging times measured in minutes rather than hours. A number of EVSE owners have started charging for EVSE use by the hour. This can be problematic because different PEVs draw various rates of electricity, which is not reflected in a fixed hourly price. This can create a situation in which EVSE owners must choose between taking a big loss every time a Tesla plugs in (which can draw up to 10 kW) or charging far more per hour than a Chevrolet Volt or Nissan Leaf could use (these vehicles draw 3.3 kW or, in the case of the recently upgraded Leaf, a maximum of 6.6 kW). Pricing EVSE use based on the amount of electricity used and rate of demand would accurately reflect the cost of electricity drawn from the EVSE and allow appropriate pricing for different PEV models.¹⁴ In most states, utility regulations forbid entities other than public utilities from reselling electricity, making this preferred pricing strategy illegal. Therefore, if EVSE service providers want to charge based on electricity drawn by the PEV, they must be classified as public utilities.

EVSE service providers claim that it would be prohibitively expensive even to attempt to comply with the numerous and strict regulations covering public utilities. A broad array of entities may take on the role of charging service provider, including owners of standalone EVSE, residential and commercial landlords that provide charging as a service to tenants or tenants’ customers, and condo associations or employers offering charging as a service to residents or employees. Some utilities have argued that EVSE service providers should in fact be considered public utilities—distinguishing the EVSE service provider as a wholesaler of electricity rather than just a retail customer—but subject to flexible or light-handed regulations covering areas such as safety, interoperability, and reliability of equipment and services. These utilities believe that defining EVSE service providers as public utilities is necessary to ensure that vehicle charging occurs in a manner consistent with safety and grid reliability.¹⁵

Many states have already passed or proposed an exclusion from being classified as a gas corporation for entities that sell compressed natural gas solely for vehicular use. A similar provision for the sale of electricity for vehicular use could be modeled after this exclusion. In New York State, the Public Service Law, Article 2 “Definitions,” includes the following:

11. The term "gas corporation," when used in this chapter, includes every corporation, company, association, joint-stock association, partnership and person, their lessees, trustees or receivers appointed by any court whatsoever, owning, operating or managing any gas plant (a) except where gas is made or produced and distributed by the maker on or through private property solely

¹⁴ Pat Romano, “Proceed with Caution,” *charged*, August/September 2012.

¹⁵ Public Utilities Commission of the State of California, “Decision in Phase 1 on whether a corporation or person that sells electric vehicle charging services to the public is a public utility,” 29 July 2010, http://docs.cpuc.ca.gov/word_pdf/AGENDA_DECISION/121242.pdf.

for its own use or the use of its tenants and not for sale to others, (b) except where compressed natural gas is sold, distributed or furnished solely as a fuel for use in motor vehicles.¹⁶

The following definition found in the same New York State, the Public Service Law, Article 2, for an electric corporation does not include a similar exception for motor vehicles, but it does exclude situations where electricity is generated and distributed at the same site using co-generation, small hydro, or alternative energy production.

13. The term "electric corporation," when used in this chapter, includes every corporation, company, association, joint-stock association, partnership and person, their lessees, trustees or receivers appointed by any court whatsoever (other than a railroad or street railroad corporation generating electricity solely for railroad or street railroad purposes or for the use of its tenants and not for sale to others) owning, operating or managing any electric plant except where electricity is generated or distributed by the producer solely on or through private property for railroad or street railroad purposes or for its own use or the use of its tenants and not for sale to others; or except where electricity is generated by the producer solely from one or more co-generation, small hydro or alternate energy production facilities or distributed solely from one or more of such facilities to users located at or near a project site.¹⁶

Precedents/Examples

California

A decision by the California PUC in 2010 that was passed into law through AB 631 stipulates that an entity providing electricity as fuel for light-duty electric vehicles will not be regulated as a public utility. A precedent for both the PUC decision and the state bill exists in the alternative fuel arena, as the California PUC and state legislature followed a similar path with regard to compressed natural gas.¹⁷

Section 216 of the Public Utilities Code (i) The ownership, control, operation, or management of a facility that supplies electricity to the public only for use to charge light duty plug-in electric vehicles does not make the corporation or person a public utility within the meaning of this section solely because of that ownership, control, operation, or management. For purposes of this subdivision, "light duty plug-in electric vehicles" includes light duty battery electric and plug-in hybrid electric vehicles.¹⁸

The explanation of the California PUC's decision stated that many instances of PEV charging do not constitute "public dedication," and thus the charging provider would clearly not be an electrical corporation or public utility. Clearly, the homeowner's charging equipment is not dedicated to public use, and the homeowner would not be found to be a public utility. Other examples could include residential and commercial landlords that provide electric vehicle charging as a service on the premises to tenants, condominium associations that provide electric vehicle charging on the premises as a service

¹⁶ onecle, New York Public Service – Article 1 – § 2 Definitions, http://law.onecle.com/new-york/public-service/PBS02_2.html.

¹⁷ M. Madden, "California Legislature Fueling the Future of Electric Vehicles," *TriplePundit*, 13 June 2011, www.triplepundit.com/2011/06/california-legislature-fueling-future-electric-vehicles/.

¹⁸ State of California, Bill Number AB 631, 6 October 2011, http://leginfo.ca.gov/pub/11-12/bill/asm/ab_0601-0650/ab_631_bill_2011006_chaptered.html.

to condominium owners, and employers that provide access to recharging facilities as a service to their employees.¹⁹ However, even in the case of an EVSE that is entirely for public use, this definition excludes the owner or operator from being a regulated public utility.

Colorado

Colorado Revised Statutes Chapter 40, Article 1, Sections 101–104 (modified through Colorado House Bill 1258, 2012) states that a corporation or individual that resells alternative fuel (propane, liquefied natural gas, compressed natural gas, or electricity) supplied by a public utility for use in an alternative fuel vehicle is not subject to regulation as a public utility. Additionally, a corporation or individual that owns, controls, operates, or manages a facility that generates electricity from a renewable resource on the property where the charging or fueling facilities are located exclusively for use in alternative fuel vehicle charging or fueling facilities is not subject to regulation as a public utility.²⁰

Florida

Florida Statutes 366.94 states: “The provision of electric vehicle charging to the public by a nonutility is not the retail sale of electricity for the purposes of this chapter. The rates, terms, and conditions of electric vehicle charging services by a nonutility are not subject to regulation under this chapter. This section does not affect the ability of individuals, businesses, or governmental entities to acquire, install, or use an electric vehicle charger for their own vehicles.”²¹

Hawaii

Hawaii’s Revised Statutes Article 269-1 states that public utilities do not include “any person who owns, controls, operates, or manages plants or facilities primarily used to charge or discharge a vehicle battery that provides power for vehicle propulsion.”²²

Illinois

Illinois Public Act 097-1128, signed into law on August 8, 2012, amended the Public Utilities Act by inserting: “An entity that furnishes the service of charging electric vehicles does not and shall not be deemed to sell electricity and is not and shall not be deemed a public utility.... If, however, the entity is otherwise deemed a public utility under this Act, or is otherwise subject to regulation under this Act, then that entity is not exempt from and remains subject to the otherwise applicable provisions of this Act.” EVSE providers were also excluded from the definition of an “alternative retail electric supplier.” The Act also requires the Illinois Commerce Commission to establish certification requirements for

¹⁹ Public Utilities Commission of the State of California, “Decision in Phase 1 on whether a corporation or person that sells electric vehicle charging services to the public is a public utility,” July 29 2010, http://docs.cpuc.ca.gov/word_pdf/AGENDA_DECISION/121242.pdf.

²⁰ Colorado Revised Statutes 40-1-103.3, “Alternative fuel vehicles – definition,” 8 August 2012, LexisNexis, www.lexisnexis.com/hottopics/colorado/?app=00075&view=full&interface=1&docinfo=off&searchtype=get&search=C.R.S.+40-1-103.3.

²¹ The Florida Senate, Florida Statutes 366.94, “Electric vehicle charging stations,” s. 11, ch 1212-117, www.flsenate.gov/Laws/Statutes/2012/366.94.

²² Hawaii Revised Statutes, Part I, “Public Utilities, Generally, §269-1 Definitions,” 2012, www.capitol.hawaii.gov/hrscurrent/Vol05_Ch0261-0319/HRS0269/HRS_0269-0001.htm.

persons or entities that install, maintain, or repair electric vehicle charging stations as well as rules regulating the installation of charging stations.²³

Maryland

Through the Maryland Statutes, State Government Code 10-101(a), effective October 1, 2012, owners and operators of EVSE are not subject to state regulation as electricity suppliers or public service companies. For the purpose of this regulation, owners and operators of EVSE are considered retail electric customers.²⁴

Minnesota

In 2009, the Minnesota Statutes for Public Utilities - 216B.02, Definitions, was modified to state that a public utility does not include a retail seller of electricity used to recharge a battery that powers an electric vehicle. This follows the exclusion of a retail seller of compressed natural gas purchased from a public utility if the compressed natural gas is used as a vehicular fuel.²⁵

Oregon

The PUC of Oregon concluded that Oregon Revised Statutes (ORS) 757.005(1)(b)(G) expressly exempts a non-utility EVSE operator that provides charging services to PEVs from being defined as a public utility. Regardless of how charging services are defined, the PUC determined that when electricity is furnished as part of the charging services provided by an EVSE service provider and that electricity is used as motor fuel only, the exception to ORS 757.005 applies. ORS 757.005(1)(b)(O) exempts from that definition any entity providing electricity as motor fuel, provided the entity does not also furnish any utility service. The PUC of Oregon further concluded that an EVSE service provider exempted under ORS 757.005 is not subject to other regulatory requirements imposed on utilities in ORS Chapters 757 and 758, including the territorial allocation laws.²⁶

Virginia

In 2011, the Virginia General Assembly passed legislation that deems EVSE service providers not to be engaged in the resale of electricity, provided that 100% of the electricity used to provide EVSE services is purchased from the electric utility in the provider's service territory and that the electricity purchased is used solely for transportation. The law deems the provision of EVSE services to be a permitted utility activity, but it exempts EVSE service providers from being regulated as public utilities.²⁷

§ 56-1.2. Persons not designated as public utility, public service corporation, etc.

²³ Illinois General Assembly, Public Act 097-1128, 8 August 2012, www.ilga.gov/legislation/publicacts/fulltext.asp?Name=097-1128.

²⁴ U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Alternative Fuels Data Center, Electric Vehicle Supply Equipment (EVSE) Regulation Exemption, last updated 24 October 2012, www.afdc.energy.gov/laws/law/MD/10032.

²⁵ Minnesota Office of the Revisor of Statutes, 2012 Minnesota Statutes 216B.02 Definitions, www.revisor.leg.state.mn.us/statutes/?id=216B.02.

²⁶ Public Utility Commission of Oregon, UM 1461 Investigation of matters related to Electric Vehicle Charging, 19 January 2012, <http://apps.puc.state.or.us/orders/2012ords/12-013.pdf>.

²⁷ Metropolitan Washington Council of Governments, Overview of State Law/Regulation Related to EVSE, 17 January 2012, www.mwcog.org/uploads/committee-documents/IF1eXV9Z20120113144913.pdf.

2. Any person who is not a public service corporation and who provides electric vehicle charging service at retail. The ownership or operation of a facility at which electric vehicle charging service is sold, and the selling of electric vehicle charging service from that facility, does not render the person a public utility, public service corporation, or public service company solely because of that sale, ownership, or operation.²⁸

§ 56-232.2:1. Regulation of electric vehicle charging service.

The Commission shall not regulate or prescribe the rates, charges, and fees for the provision of retail electric vehicle charging service provided by persons other than public service corporations. Sales of electricity by public utilities to persons who (i) are not public service corporations and (ii) provide electric vehicle charging service shall continue to be regulated by the Commission to the same extent as are other services provided by public utilities. The Commission may adopt regulations implementing this section.²⁹

Washington

Washington Substitute House Bill 1571 added a new section to the Revised Code of Washington Chapter 80.28 that reads: “The commission shall not regulate the rates, services, facilities, and practices of an entity that offers battery charging facilities to the public for hire; if: (1) That entity is not otherwise subject to commission jurisdiction as an electrical company; or (2) that entity is otherwise subject to commission jurisdiction as an electrical company, but its battery charging facilities and services are not subsidized by any regulated service.”³⁰

Key Findings

In states where discussions have been held on the classification of EVSE owners and operators as public utilities, all seven listed examples concluded that an exemption should be adopted. Variations in the regulatory language include the following: restriction to light-duty vehicles (California), inclusion of on-site renewable energy generation to power the EVSE (Colorado), certification requirements for persons or entities that install, maintain, or repair electric vehicle charging stations (Illinois), and restriction to the use of electricity purchased from the incumbent electric utility in the given service territory (Virginia).

New York State PSC Case 11-M-0710 resulted in reviewing and amending the electric submetering regulations (Compilation of Codes, Rules and Regulations of the State of New York [NYCRR], Title 16, Public Service, Part 96). Consequently, a memorandum and resolution adopting residential electric submetering regulations was issued on December 18, 2012. This document included a request to make explicit in these definitions that electric vehicle charging stations are not “submeterers” and are exempted from commission or utility regulations and standards. At this time, the PSC did not establish a

²⁸ Code of Virginia, § 56-1.2, Persons not designated as public utility, public service corporation, etc., 2011, <http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+56-1.2>.

²⁹ Code of Virginia, § 56-232.2:1, Regulation of electric vehicle charging service, 2011, <http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+56-232.2C1>.

³⁰ State of Washington, Substitute House Bill 1571, 62nd Legislature, 2011 Regular Session, <http://apps.leg.wa.gov/documents/billdocs/2011-12/Pdf/Bills/Session%20Laws/House/1571-S.SL.pdf>.

position on the overall regulation of EVSE as a public utility. For purposes of this case, however, electric vehicle charging stations were not submeterers, are not subject to Part 96 and, therefore, are not included in the term “submeterer.” The official 16 NYCRR Part 96 was amended such that 96.2 (d) reads as follows:³¹

Electric service may be provided to the facility owner or operator of campgrounds, recreational trailer parks, marinas and parking facilities for redistribution to individual campsites, trailer, boat hookups, or plug-in electric vehicle charging stations with or without submetering. Master metering and submetering, at the facility owner’s or operator’s option, may be installed and used for billing without Commission approval and are not subject to submetering service conditions.

Ultimately, the definition of a utility and its exclusions should be set by a state law. Prior to the passing of such a law, the Commission’s interpretation of the current state laws may determine the definition (as was conducted in California and Oregon). As set by the California precedent, excluding EVSE service providers from being public utilities complements state directives to support the widespread deployment of EVSE.

³¹ State of New York Public Service Commission, Memorandum and Resolution Adopting Residential Electric Submetering Regulations, 18 December 2012, [www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/d4f1e6b0f51ac85785257687006f39cc/\\$FILE/11-M-0710%20Commission%20Memorandum%20and%20Resolution.pdf](http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/d4f1e6b0f51ac85785257687006f39cc/$FILE/11-M-0710%20Commission%20Memorandum%20and%20Resolution.pdf).

4. Special Electricity Rates for PEV Charging

This particular issue was covered in detail in the *Pace Environmental Law Review* on April 18, 2011, entitled “Electric Vehicles and Time-of-Use Rates: The Impending Role of the New York State Public Service Commission in Regulating Our Transportation Future.”³² The following excerpts from this paper provide an overview of the purpose and motivation for this strategy:

Along with the environmental benefits of market penetration comes the challenge of effectively managing grid enabled vehicle (GEV) electricity use to ensure that those environmental benefits are realized and that electricity price spikes are avoided. GEV owners will likely want to plug in as soon as they are near a suitable outlet in order to keep their cars charged for future use. For many GEV owners this will mean plugging in their cars when they return home from work. Unfortunately, this occurs during the evening peak in electricity demand, which usually falls between the hours of 4:00 P.M. and 7:00 P.M. By adding to the peak demand for electricity, GEVs would drive up the peak electricity price, ultimately leading to higher rates for customers.

In Time-of-Use (TOU) rate schedules, utility customers pay one of two [or more] electricity prices depending on the time of day. In most cases, the peak and off-peak prices differ widely (with peak prices being much higher than off-peak prices), heavily incentivizing the customer to shift use away from the peak hours and on to the off-peak times. Although all major utilities offer voluntary TOU rate schedules, the vast majority of residential customers do not opt in. Disregarding the lack of public awareness that TOU rates are even an option, this under-utilization makes intuitive sense because most residential customers require electricity at peak times and their demand is relatively inelastic.

There has rarely been a situation that so clearly calls for the adoption of TOU rates as the impending growth in GEV ownership. The amount of electricity required to charge a GEV, coupled with how easy it would be to charge one during off-peak hours, would make GEV owners ideal candidates for time-of-use rates. Incentivizing GEV charging away from the peak would not only alleviate some of the environmental problems associated with the dirtier generating units that are only economical during peak hours, but it would also increase demand for cheap generation that runs during off-peak hours. In New York, much of this cheap, off-peak generation comes from wind, a clean, renewable source of energy that produces most of its electricity during off-peak hours, as wind tends to blow more consistently at night.

By lowering costs for charging PEVs during off-peak times, new rate structures for PEV charging support consumer adoption of PEVs. TOU rates that effectively move PEV charging to off-peak hours smooth the load on the energy grid, allowing utilities to better utilize underused electrical distribution assets. Metering is central to such rate structures. Some utilities are considering advanced metering infrastructure (AMI) or smart meter technology as a tool for participating customers to determine the most cost-effective times for PEV charging in conjunction with the home’s other energy end-uses and

³² J. Seligman, “Electric Vehicles and Time-of-Use Rates: The Impending Role of the New York State Public Service Commission in Regulating Our Transportation Future,” *Pace Environmental Law Review* 28, issue 2, article 4, 18 April 2011, <http://digitalcommons.pace.edu/cgi/viewcontent.cgi?article=1671&context=peir>.

the overall demand being placed on the grid. While TOU rates can be carried out without AMI, smart meters can facilitate the introduction of more advanced strategies that ensure PEV charging does not have significant negative impact on the utility grid. In the future, it may be feasible to transmit a pure TOU price signal to further encourage charging at times of excess energy availability or enable more active control of these power draws. One issue utilities have found with PEV TOU rates is that PEVs can cause an additional demand spike on the grid at the start of the off-peak period if all the PEVs are programmed to start charging at the same time. AMI would provide the ability to stagger the starting charge time for vehicles based on their battery state of charge.

A residential single-meter PEV rate, while specifically designed for PEV charging, is applied to a residence's entire electricity usage. In some cases, an existing TOU rate structure for residential customers can incentivize a PEV owner to charge during off-peak hours, but it may not be advantageous if the customer has a high on-peak electricity use that cannot be moved to off-peak hours. However, because of the significant electricity draw from PEVs, the utility may want a special TOU rate structure for PEV owners that has an even greater price differential between on-peak and off-peak hours to more strongly encourage load shifting, modify the off-peak times in anticipation that a significant demand from PEVs will occur at the beginning of the off-peak period, or establish a super off-peak period to push the majority of PEV charging to the lowest point on the grid's demand profile. The challenge of single-meter PEV rate design is to structure a simpler, cost-based TOU rate that still incentivizes lower electricity use, such as tiered rates or efficiency rebates. Increasing the electricity load by charging a PEV will end up increasing the overall energy use of the household. However, a single-meter PEV rate may motivate a customer to better manage the peak impacts of the entire household's electricity usage, not just the energy used for PEV charging. It also does not require any additional meters, which can be expensive.

Separate metering or submetering for EVSE allows PEV owners to benefit from TOU rates even if they cannot shift the rest of their electricity use to off-peak hours. The rates can be structured to heavily incentivize charging during very low electricity demand periods. The disadvantage with a separate meter for EVSE only is the expense to install an additional meter and account.

Precedents/Examples

A few states and commissions have directed the establishment of TOU rate structures specifically for PEVs.

California

The California PUC initiated Rulemaking 09-08-009 on August 24, 2009, to consider alternative-fueled vehicle tariffs, infrastructure and policies to support California's greenhouse gas emissions reduction goals. The PUC sought to ensure that the charging of these vehicles would not adversely affect California's electric system in terms of safety and reliability. The "Phase 2 Decision Establishing Policies To Overcome Barriers To Electric Vehicle Deployment And Complying With Public Utilities Code Section 740.2," issued on July 14, 2011, stated that "with certain exceptions, the electric utilities' existing residential PEV rates are sufficient for early PEV market development, and, similarly, that existing commercial and industrial rates are sufficient in the early PEV market for non-residential customers."

However, it was also determined that the PUC should revisit the suitability of the utilities' PEV residential rate schedules in 2013–2014, as the commission will have a better understanding of customer charging behavior and more PEV load profile data to inform future rate design at that time.³³ One aspect that is likely to come up for discussion is how to properly structure demand charges for publicly accessible EVSE, particularly DC fast chargers.

Maryland

The Electric Vehicle Pilot Program requires the Public Service Commission to establish a pilot program for charging electric vehicles by June 30, 2013. This program allows utilities to participate and requires that they include incentives for residential, commercial, and government customers to recharge electric vehicles in ways that will accomplish specified goals, namely modifying behavior so that recharging occurs during off-peak hours. Incentives may include (1) time-of-day pricing of electricity, (2) credits on distribution charges, (3) rebates on the cost of charging systems, (4) demand response programs, or (5) other incentives approved by the commission.³⁴

Oregon

On January 19, 2012, the PUC of Oregon issued Order No. 12-013, which directed the utilities to provide all PEV customers, regardless of rate class, with the choice of a PEV TOU rate that mimics a utility's whole premise TOU rate (to the extent that a utility already offers this rate) but applies only to a PEV by submeter.³⁵

Virginia

The Virginia State Corporation Commission (SCC) directs public utilities to evaluate time-differentiated rates and other incentives to encourage off-peak all-electric (EV) and plug-in hybrid electric vehicle charging. The SCC may authorize public utilities to conduct pilot programs to determine the feasibility and implications of offering off-peak rates and other incentives. Pilot programs may include voluntary load control options, rate structures with financial incentives, rebates, or other incentives that offset the cost of purchasing or installing EVSE for users who elect off-peak rate structures. An electric utility that participates in an approved pilot program may be entitled to recover annually the costs of its participation in any pilot program conducted on or after January 1, 2011.³⁶

A number of utilities have proposed special rate structures for PEV owners that have been approved by commissions to encourage the use of EVSE during off-peak hours when it would have minimal affect on the grid. Select examples are listed here, with all remaining known PEV rates included in Appendices A and B.

³³ California Public Utility Commission, Rulemaking 09-08-009: Phase 2 Decision Establishing Policies To Overcome Barriers To Electric Vehicle Deployment And Complying With Public Utilities Code Section 740.2, 14 July 2011, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/139969.PDF.

³⁴ State of Maryland, Chapter 403 (Senate Bill 179) An Act concerning Electric Companies – Demand Response Pilot Program for Charging Electric Vehicles, 19 May, 2011, http://mlis.state.md.us/2011rs/chapters_noln/Ch_403_sb0179E.pdf.

³⁵ Public Utility Commission of Oregon, Guidelines Adopted; Utilities Ordered To Make Revised Tariff Filings, 19 January 2012, <http://apps.puc.state.or.us/orders/2012ords/12-013.pdf>.

³⁶ State of Virginia, Chapter 408, 23 March 2011, <http://leg1.state.va.us/cgi-bin/legp504.exe?111+ful+CHAP0408>.

Residential tariffs exclusively for EVSE charging through a separate meter or submeter

Consumers Energy Company (MI) Residential Plug-In Electric Vehicle-Only Rates³⁷

- Level 2 charging through a separate meter. Low-speed electric vehicles including golf carts are not eligible.
- Option 1: Time-of-Day Rate (REV-2)
 - o Off-peak charge (summer): 6.7¢ per kWh (vs. 11.3¢ for residential time-of-day rate)³⁸
 - o Mid-peak charge (summer): 14.4¢ per kWh (vs. 11.3¢ for residential time-of-day rate)
 - o On-peak charge (summer): 21.9¢ per kWh (vs. 14.3¢ for residential time-of-day rate)
- Option 2: Monthly Fee (REV-3)
 - o \$40.25 per month all-inclusive for the first 300 kWh
 - o Over 300 kWh (summer): 18.1¢ per kWh

Dominion Power (VA) Schedule EV – Residential EV Charging (Experimental)³⁹

- 750 participants who contract for service on or before December 1, 2013
- Basic customer charge: \$2.90 per billing month (vs. \$12.00 for standard residential TOU)⁴⁰
- Super off-peak energy charge: 4.2¢ per kWh (vs. 2.4¢ for standard residential TOU)
- Off-peak energy charge: 5.0¢ per kWh (vs. 2.4¢ for standard residential TOU)
- On-peak energy charge: 14.3¢ per kWh (vs. 15.0¢ for standard residential TOU)

Pacific Gas and Electric (CA) Electric Schedule E-9B⁴¹

- Meter charge rate: \$0.22 per day (vs. \$0.25 for residential TOU Schedule E-6)⁴²
- Off-peak charge (summer baseline): 4.5¢ per kWh (vs. 9.8¢ for residential TOU Schedule E-6)
- Part-peak charge (summer baseline): 9.4¢ per kWh (vs. 17.0¢ for residential TOU Schedule E-6)
- Peak charge (summer baseline): 29.7¢ per kWh (vs. 27.9¢ for residential TOU Schedule E-6)

Southern California Edison (CA) Domestic Time-Of-Use Electric Vehicle Charging (TOU-EV-1)⁴³

- This PEV charging schedule has a fixed distribution charge independent of total energy use, whereas the standard residential TOU domestic tiered (TOU-D-T) schedule⁴⁴ has a tiered rate structure that increases with higher total energy usage.
- Off-peak charge (summer): 12.6¢ per kWh (vs. 13.3¢ - 24.7¢ for residential TOU-D-T)
- On-peak charge (summer): 28.2¢ per kWh (vs. 26.8¢ - 60.1¢ for residential TOU-D-T)

³⁷ Consumers Energy Company, Experimental Residential Plug-In Electric Vehicle Charging Program, [www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/1E3229B7D4BA57E185257A28005E1141/\\$FILE/elerates.pdf?Open](http://www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/1E3229B7D4BA57E185257A28005E1141/$FILE/elerates.pdf?Open).

³⁸ Consumers Energy Company, Residential Service Time-Of-Day Secondary Rate RT, [www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/CB76B6714118911D85257A38004BE3B9/\\$FILE/elerates.pdf?Open](http://www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/CB76B6714118911D85257A38004BE3B9/$FILE/elerates.pdf?Open).

³⁹ Virginia Electric and Power Company, Schedule EV: Residential Electric Vehicle Charging (Experimental), www.dom.com/dominion-virginia-power/customer-service/rates-and-tariffs/pdf/vabev.pdf.

⁴⁰ Virginia Electric and Power Company, Schedule 1T: Residential Service, www.dom.com/dominion-virginia-power/customer-service/rates-and-tariffs/pdf/vab1t.pdf.

⁴¹ Pacific Gas and Electric Company, Electric Schedule E-9, www.pge.com/tariffs/tm2/pdf/ELEC_SCHS E-9.pdf.

⁴² Pacific Gas and Electric Company, Electric Schedule E-6, www.pge.com/notes/rates/tariffs/ResTOUCurrent.xls,

⁴³ Southern California Edison, Schedule TOU-EV-1 Domestic Time-Of-Use Electric Vehicle Charging, www.sce.com/NR/sc3/tm2/pdf/ce114-12.pdf.

⁴⁴ Southern California Edison, Schedule TOU-D-T Time-Of-Use Tiered Domestic, <http://asset.sce.com/Documents/Shared/CE220.pdf>.

Residential tariffs for entire households with EVSE (single-meter)

Consumers Energy Company (MI) Residential Plug-In Electric Vehicle-Only Rates⁴⁵

- Level 1 charging combined with household electric usage. Low-speed electric vehicles including golf carts are not eligible.
- Option 1: Residential Home and PEV Time-of-Day Rate (REV-1)
 - o Off-peak charge (summer): 3.0¢ per kWh (vs. 11.3¢ for residential time-of-day rate)⁴⁶
 - o Mid-peak charge (summer): 10.7¢ per kWh (vs. 11.3¢ for residential time-of-day rate)
 - o On-peak charge (summer): 18.2¢ per kWh (vs. 14.3¢ for residential time-of-day rate)

Dominion Power (VA) Residential Service with EV Charging (Experimental) Schedule 1EV⁴⁷

- 750 participants who contract for service on or before December 1, 2013
- Basic customer charge: \$7.00 per billing month (vs. \$12.00 for standard residential TOU)⁴⁸
- Super off-peak energy charge: 3.5¢ per kWh (vs. 2.4¢ for standard residential TOU)
- Off-peak energy charge: 4.7¢ per kWh (vs. 2.4¢ for standard residential TOU)
- Intermediate energy charge: 6.9¢ per kWh (vs. 15.0¢ for standard residential TOU)
- On-peak energy charge: 12.6¢ per kWh (vs. 15.0¢ for standard residential TOU)

Pacific Gas and Electric (CA) Electric Schedule E-9A⁴⁹

- Meter charge rate: \$0.22 per day (vs. \$0.25 for residential TOU Schedule E-6)⁵⁰
- Off-peak charge (summer baseline): 3.7¢ per kWh (vs. 9.8¢ for residential TOU Schedule E-6)
- Part-peak charge (summer baseline): 9.9¢ per kWh (vs. 17.0¢ for residential TOU Schedule E-6)
- Peak charge (summer baseline): 30.2¢ per kWh (vs. 27.9¢ for residential TOU Schedule E-6)

Southern California Edison TOU-D-TEV⁵¹

- Super-off-peak charge (summer Level 1&2): 11.2¢ & 17.7¢ per kWh (vs. 13.3¢ & 24.7¢ for residential TOU)⁵²
- Off-peak charge (summer Level 1&2): 13.6¢ & 27.5¢ per kWh (vs. 13.3¢ & 24.7¢ for residential TOU)
- On-peak charge (summer Level 1&2): 19.0¢ & 60.6¢ per kWh (vs. 26.8¢ & 60.1¢ for residential TOU)

⁴⁵ Consumers Energy Company, Experimental Residential Plug-In Electric Vehicle Charging Program, [www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/1E3229B7D4BA57E185257A28005E1141/\\$FILE/elerates.pdf?Open](http://www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/1E3229B7D4BA57E185257A28005E1141/$FILE/elerates.pdf?Open).

⁴⁶ Consumers Energy Company, Residential Service Time-Of-Day Secondary Rate RT, [www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/CB76B6714118911D85257A38004BE3B9/\\$FILE/elerates.pdf?Open](http://www.consumersenergy.com/tariffs.nsf/ELECTRIC_TARIFFS/CB76B6714118911D85257A38004BE3B9/$FILE/elerates.pdf?Open).

⁴⁷ Virginia Electric and Power Company, Schedule 1EV: Residential Service with Electric Vehicle Charging (Experimental), www.dom.com/dominion-virginia-power/customer-service/rates-and-tariffs/pdf/vab1ev.pdf.

⁴⁸ Virginia Electric and Power Company, Schedule 1T: Residential Service, www.dom.com/dominion-virginia-power/customer-service/rates-and-tariffs/pdf/vab1t.pdf.

⁴⁹ Pacific Gas and Electric Company, Electric Schedule E-9, www.pge.com/tariffs/tm2/pdf/ELEC_SCHS E-9.pdf.

⁵⁰ Pacific Gas and Electric Company, Electric Schedule E-6, www.pge.com/notes/rates/tariffs/ResTOUCurrent.xls.

⁵¹ Southern California Edison, Schedule TOU-D-TEV Time-Of-Use Domestic Tiered Electric Vehicle Charging, www.sce.com/NR/sc3/tm2/pdf/CE324.pdf.

⁵² Southern California Edison, Schedule TOU-D-T Time-Of-Use Tiered Domestic, <http://asset.sce.com/Documents/Shared/CE220.pdf>.

Commercial tariffs

Alabama Power (AL) Business Electric Vehicle TOU Rate (BEVT)⁵³

- Separately metered load used for the exclusive purpose of charging electric vehicle batteries
- Base charge: \$100 per month (vs. \$225 plus \$/kW demand for business time advantage [BTA] rate)⁵⁴
- Off-peak charge (year-round): 4.5¢ per kWh (vs. 4.0¢ plus \$5.7–\$7 per kW for BTA rate)
- Intermediate charge (year-round): 7.3¢ per kWh (vs. 4.0¢ plus \$5.7–\$7 per kW for BTA rate)
- On-peak charge (summer only): 17.8¢ per kWh (vs. 20.0¢ plus \$5.7–\$7 per kW for BTA rate)

Hawaiian Electrical Company (HI) Commercial EV Charging Service Pilot, Schedule EV-C⁵⁵

- Exclusive for PEV charging, \$5.00 monthly metering charge
- Non-demand service
 - Off-peak charge: 15.6¢ per kWh (vs. 18.3¢ for small commercial TOU service)⁵⁶
 - On-peak charge: 23.3¢ per kWh (vs. 26.3¢ or 23.3¢ for small commercial TOU service)
- Demand service
 - Off-peak energy charge: 15.6¢ per kWh (vs. 16.0¢ for commercial TOU service⁵⁷)
 - On-peak energy charge: 19.0¢ per kWh (vs. 19.0¢ or 22.0¢ for commercial TOU service)
 - On-peak demand charge: \$11.69 per kW (vs. \$11.69 or \$18.69 for commercial TOU service)

Key Findings

New rate structures for PEV recharging support consumer adoption of PEVs and provide price signals that incentivize recharging at optimal times for the electric utility system. PEV-specific rates typically differ from other existing residential TOU rates by including a “super off-peak” period in the middle of the night when overall electricity use significantly decreases. PEV TOU rates also typically have a greater price break between on-peak and off-peak electricity and remove tiered structures, if applicable, that would traditionally encourage lower overall energy use. San Diego Gas & Electric has been conducting a study with an experimental PEV schedule to better understand residential customer TOU charging preferences and to estimate the price elasticity of demand for PEV charging. Customers that are selected to participate will be randomly assigned to one of three experimental PEV rate schedules that have varying levels of discounts for super off-peak periods with inversely higher rates for on-peak periods. Another important consideration with higher PEV use would be a strategy to stagger the start time of PEV charging. This may be possible through multiple PEV rate schedules that stagger the starting time for super off-peak periods and offer higher price discounts for customers that select a later start time, reducing the amount of charging time available before the PEV must be used in the morning.

⁵³ Alabama Power, Rate BEVT: Business Electric Vehicle - Time-Of-Use, www.alabamapower.com/business/pricing-rates/pdf/BEVT.pdf.

⁵⁴ Alabama Power, Rate BTA: Business Time Advantage, www.alabamapower.com/business/pricing-rates/pdf/BTA.pdf.

⁵⁵ Hawaiian Electrical Company. Commercial EV Charging Service Pilot, Schedule EV-C, www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECOSchEV-CPilot04-13-2011.pdf.

⁵⁶ Hawaiian Electrical Company. Schedule TOU-G: Small Commercial Time-Of-Use Service, www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECORatesTOU-G.pdf.

⁵⁷ Hawaiian Electrical Company. Schedule TOU-J: Commercial Time-Of-Use Service, www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECORatesTOU-J.pdf.

Shifting electricity demand by incentivizing off-peak energy use through TOU rates has benefits for the utility, but because consumers are unfamiliar with this pricing strategy, many may be reluctant to switch. One option, utilized by NV Energy's Electric Vehicle Rate,⁵⁸ is to offer no-risk TOU rates: the customer signs up for the TOU rate, but at the end of the year, the utility compares the actual costs under flat rates and TOU rates, and the customer receives a rebate if he or she would have paid less under the default residential rate. All of these TOU rate strategies require a "smarter" meter than most locations currently have, and because of the impact that PEVs could have on the grid, deploying the most advanced smart meters to PEV charging locations would allow utilities to more easily roll out more advanced strategies when they are established or needed.

⁵⁸ NV Energy, Electric Vehicle Rate, www.nvenergy.com/home/saveenergy/electricVehicle.cfm#rate.

5. EVSE Installation Notification

Advance information of where a new PEV will be charging is very helpful for a utility that must determine whether the local distribution system is ready for the added demand. As PEV sales increase, electrical charging impacts on the grid will increase, as will the chance of localized disruptions due to PEV charging. Notification of EVSE installations is important to minimize potential issues, and ad hoc processes may not be sufficient. With timely notification to the utility that a PEV will be regularly charging in its service territory, the utility can address potential reliability problems, keep infrastructure costs down, and assist, as appropriate, with ensuring that PEV owners have positive experiences and maximize the benefits of these vehicles. If a utility can identify PEV owners, then the utility can target consumer education and outreach to appropriately advise the PEV owners of the benefits of TOU rates that reflect the cost of charging on-peak and on the economics of PEV ownership and operation. Early notification is also helpful for municipalities and installers for planning permitting, inspections, and installations. There are very few formalized procedures for PEV owners to notify their utilities, even though there are numerous occasions when these data are collected. This includes vehicle purchase from the automaker or dealer, vehicle registration with the state, EVSE sales from suppliers, and issuing of a permit for EVSE installation. General Motors Company (GM) has implemented a voluntary utility notification system using an opt-out-style questionnaire seeking permission to share address-level data with utilities.

Precedents/Examples

California

The concept of advance notification began in the California market on an ad hoc basis. The California PUC has directed utilities to conduct an assessment of early notification efforts (regarding customer PEV interest and EVSE installation) with a view to formalize the notification process and potentially expand it beyond the state. Specifically, the PUC directed Southern California Edison, Pacific Gas & Electric, and San Diego Gas & Electric to collaborate with stakeholders, perhaps relying on existing forums established by the California Plug-In Electric Vehicle Collaborative, to further develop such a system. The California PUC directed the utilities to prepare an assessment report that sets forth potential notification options, the merits and projected costs of these options, and implementation scenarios. The assessment report must also recommend a preferred option going forward and explain how other stakeholders, if any, will participate in the notification system. The options detailed in the report may require participation by the Department of Motor Vehicles (DMV) or other government agencies to identify and address any privacy concerns that may arise due to the sharing of relevant information.⁵⁹

California Senate Bill No. 859, which was approved by the governor and filed with the Secretary of State on September 26, 2011, amended Section 1808.23 of the Vehicle Code relating to vehicles.⁶⁰ The bill added an exception to the confidentiality of DMV records for an electrical corporation, as defined, or a

⁵⁹ California Public Utility Commission, Rulemaking 09-08-009: Phase 2 Decision Establishing Policies To Overcome Barriers To Electric Vehicle Deployment And Complying With Public Utilities Code Section 740.2, 14 July 2011, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/139969.PDF.

⁶⁰ The State of California, Senate Bill No. 859, Chapter 346: An act to amend Section 1808.23 of the Vehicle Code, relating to vehicles, 26 September 2011, www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_859_bill_20110926_chaptered.pdf.

local publicly owned electric utility, if the corporation or utility, or its agent, under penalty of perjury, requests and uses the information only for the purposes of identifying where an electric vehicle is registered with the following conditions:

- The department may disclose to the electrical corporation or local publicly owned utility only the type of vehicle and address of the electric vehicle owner. The department shall not disclose the name of the electric vehicle owner.
- Within 15 days of receiving residence address information from the department pursuant to this section, an electrical corporation or local publicly owned utility shall provide a clear, express disclosure to the electric vehicle owner that his or her residence address information is permitted by law to be shared with the corporation or utility. The disclosure shall not contain marketing information or a solicitation for the purchase of goods or services.
- Confidential home address and type of vehicle information of electric vehicle owners disclosed pursuant to this paragraph shall only be used for the purpose of identifying where an electric vehicle is registered and shall not be used or disclosed for any other purpose, including for purposes of identifying the individual or individuals residing at the address, or to any other person.
- The electrical corporation or local publicly owned utility and its agents shall not sell, share, or further disclose, including to any subsidiaries, the residence address or type of vehicle information of electric vehicle owners obtained pursuant to this paragraph, or name information determined by matching residence information against the corporation's or utility's customer records.
- Residential addresses released shall not be used for direct marketing or solicitation for the purchase of any consumer product or service.

A gas rebate incentive resulting from California's Low Carbon Fuel Standard Program has also been considered to provide notification of an electric vehicle purchase to utilities, but it has not been enacted to date.

Georgia

At the bottom of Atlanta's EVSE electrical permit form is a box that the submitter checks to allow the City to share his or her address with local utilities. The City encourages everyone installing EVSE to check the box because this information is important for utility planners who work to reinforce the electrical distribution system for neighborhoods that have large numbers of plug-in vehicle owners.⁶¹

Maryland

Via House Bill 1279 and Senate Bill 998,⁶² an Act concerning Motor Vehicle Administration – Plug-In Vehicles – Disclosure of Personal Information modified Maryland State Law so that the Motor Vehicle

⁶¹ City of Atlanta, Permitting Process for Electrical Vehicle Supply Equipment (EVSE) in a Single Family Residence Setting, <http://www.atlantaga.gov/modules/showdocument.aspx?documentid=538>,

⁶² The State of Maryland, Chapter 335 (House Bill 1279): Motor Vehicle Administration – Plug-In Vehicles – Disclosure of Personal Information, 2 May 2012, http://mlis.state.md.us/2012rs/chapters_noln/Ch_335_hb1279T.pdf.

Administration can disclose personal information for use by an electric company, with the following specifications:

- Information describing a plug-in vehicle and identifying the address of the registered owner of the plug-in vehicle
- For use in planning for the availability and reliability of the electric power supply
- If the information is not a) published or re-disclosed or b) used for marketing or solicitation purposes

Key Findings

Several of the current methods for notifying the utilities of PEV charging locations have significant limitations. Utility rates specifically for PEV charging can identify EVSE locations, but PEV owners may not sign up for special PEV rates if they are not aware that such rates exist or if the savings are not significant, among other reasons. There is another drawback to identifying through consumer PEV rate adoption: when a PEV household signs up for a PEV rate, the charging station would likely already be in place, and any grid disruption may have already occurred. The ability for DMVs to release information on electric vehicles, as is now permitted in California and Maryland, is useful; but it may not be effective at proactively identifying localized disruptions due to PEV charging. DMV registration occurs at the time of the purchase, and the request from utilities for that information may not happen prior to a charging event. California has found that an electric vehicle has typically been charging at home for six months before notification is obtained through this process.

Therefore, commissions should support and encourage efforts by auto dealers, EVSE service providers, DMVs, state energy offices, permitting authorities, or utilities that encourage consumers to notify utilities before purchasing PEVs or installing home EVSE. GM's voluntary utility notification system and the provision on Atlanta's electrical permit form attempt to provide this information to the utilities at a very early stage in the procurement of PEVs and EVSE.

6. Utility Ownership of EVSE

To help stimulate PEV sales, commissions in some states are allowing utilities to pilot charging station programs, including leasing programs for charging infrastructure, incentives for buying/installing charging stations or using utility-owned infrastructure. Utilities that can implement infrastructure programs face two challenges: 1) justifying and funding such programs and 2) installing sufficient public infrastructure prior to large-scale PEV adoption. Some utilities are using federal or state grant funding to establish pilot charging programs.

However, states may decide to prohibit investor-owned utilities (IOUs) from owning or operating charging stations, as is the case in California. Utility ownership of EVSE may limit customer choice and perhaps even dampen the competition that may yield cost-reducing innovation. To avert these outcomes, utilities would need to be prevented from advantageously pricing electricity for PEV charging at utility-owned stations over third-party EVSE service providers. Leveraging the utilities' entire rate base to supplement the cost of EVSE would also give them an unfair advantage. Utilities may also have an uncompetitive advantage over third-party EVSE service providers on bids, as utilities could install EVSE or supporting electrical work using resources paid for by the rate payers. In addition, utilities could have an upper hand attaining EVSE locations connected with municipal parking, given utilities' longstanding service relationships. Electricity providers could also leverage the ability to offset some of the costs for challenging installations, such as street parking, through other general grid upgrade work orders.

Permitting utilities to own and operate EVSE can have several advantages; however, several of these can be addressed through policy changes to support third-party providers' participation in the market. The following summarizes the relevant lines of reasoning:

- Utilities have the resources to ensure that the EVSE operates most efficiently on the grid, which in turn may result in more EVSE deployment and lower usage costs. However, policies could be implemented that would allow third-party-owned and -operated EVSE to take advantage of cost-reduction strategies currently available only to utilities.
- The potential for EVSE to disrupt the local utility grid would likely be reduced if the utility owned and operated EVSE because the utility would be familiar with the installation location and the local grid capability. However, this advantage would be moderated through the establishment of a notification process for EVSE installations, as previously discussed.
- As also discussed above, most states do not permit EVSE service providers to sell electricity; therefore, the providers typically charge hourly fees that might not accurately reflect the value of the electricity that was transferred. Since the utilities are regulated to sell electricity, they could establish price structures based on electricity use. However, if an exception is provided for EVSE service providers not to be regulated as a utility, then any station could charge based on electricity use.
- Utilities may also be able to establish a method for public EVSE use to be billed to an individual's utility bill, allowing consolidation of a PEV owner's bills for charging.
- Because private EVSE service providers will target profitable locations, utility ownership of EVSE may help address PEV charging in underserved markets. However, this has been partially

addressed to date by funding and incentives from the state or federal sources that have been used to support EVSE deployment in all markets.

- Because municipal governments already have permitting requirements that review EVSE installations for their safety merits, utility ownership of EVSE is not likely to have safety advantages over EVSE owned by customers or other entities. Additionally, national standards on EVSE couplers and other equipment features ensure manufacturers' adherence to safety standards.

Precedents/Examples

Arizona

In the matter of Arizona Public Service Company's (APS's) application for approval of a proposed electric vehicle readiness demonstration project, the Arizona Corporation Commission ruled that "Arizona Public Service Company shall work cooperatively with the federally-funded EV infrastructure contractors for the first year of the proposed Study" and not deploy utility-owned EVSE. "Should APS identify a specific gap in charging infrastructure deployment, or another deficiency in the federally-funded EV infrastructure efforts, APS may request approval of a public point-of-sale rate in APS' first annual report of Study findings to the Commission."⁶³

California

The California PUC reviewed and considered all of the previously stated arguments for and against utility ownership of EVSE. The PUC did not hear convincing evidence that utility ownership of EVSE will result in safety advantages over EVSE owned by customers or other entities. They also found speculative the assertion that utility ownership of EVSE will reduce customer costs. Ultimately, the California PUC did not find that the benefits of utility ownership of EVSE outweigh the potential for competitive limitations resulting from utility ownership and has thus restricted utilities from owning EVSE. However, utilities may continue to own EVSE used to charge their own electric vehicle fleets or provide workplace charging for utility employees. The one aspect that remained an uncertainty to the PUC was whether prohibiting utility ownership of EVSE at this early stage of market development could result in underserved markets or market failure. The PUC reserved the right to revisit this prohibition should utilities present evidence that this provision results in underserved markets or market failures in areas where non-utility entities fail to properly serve all markets.⁶⁴ To date, no utilities have presented evidence of market failures, but adequate time is needed to validate and prove market failure has occurred as a result of this policy.

Oregon

The PUC of Oregon deemed it paramount to allow all market players, including the electric utilities, the flexibility to respond to emerging market demands. The PUC did not find that allowing utilities to

⁶³ Arizona Corporation Commission, Docket No. E-01345A-10-0123 / Decision No. 72582, 15 September 2011, <http://images.edocket.azcc.gov/docketpdf/0000129728.pdf>.

⁶⁴ California Public Utility Commission, Rulemaking 09-08-009: Phase 2 Decision Establishing Policies To Overcome Barriers To Electric Vehicle Deployment And Complying With Public Utilities Code Section 740.2, 14 July 2011, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/139969.PDF.

potentially participate in the EVSE market will necessarily impede the vibrancy of the whole market. Electric utilities should be allowed to invest in EVSE and operate PEV charging stations as a non-regulated, non-rate-based venture. A utility may decide how to structure its ownership and operation of EVSE and charging stations, whether below the line as a non-regulated utility investment, or as a utility investment. The PUC advises a utility to thoroughly and carefully consider how to structure EVSE ownership and operation. A utility providing EVSE on a below-the-line basis would also need to be careful to avoid violation of territorial allocation laws.

The PUC of Oregon also concluded that utilities may legally recover EVSE installation and operation costs in rates. They expect a utility that requests rate recovery for EVSE investment to make a compelling case that the utility's ownership and operation of the EVSE is beneficial to ratepayers, not just the public generally. Utility EVSE investment may have net benefits to customers if 1) installing and operating charging infrastructure at a particular location would facilitate PEV adoption in the greater area and 2) a third-party EVSE service provider or utility affiliate would not provide the same services at the location or a nearby location.⁶⁵

Washington

Washington Substitute House Bill 1571 stated that “an electrical company may offer battery charging facilities as a regulated service, subject to commission approval.”⁶⁶

Key Findings

This topic is one area where different states have come to significantly different conclusions, and there is no consensus on the best approach. Therefore, rulemaking on this topic should receive extra deliberation. Under the current regulations for resale of electricity, the limited measures for addressing demand from EVSE, and the lack of an established centralized EVSE notification process, there are clear advantages for utility ownership of EVSE: payment based on electricity usage, ability to enact demand response programs with EVSE in the future, and minimized grid disruptions thanks to knowledge of local grid capabilities. It is unclear whether utility ownership of EVSE would reduce customer costs, but utilities will likely have a competitive advantage over third-party EVSE service providers, limiting customer choice and perhaps dampening the competition that may yield cost-reducing innovation. Currently, however, the business case for providing EVSE services has not fully developed, and utilities do not appear to be using their competitive advantage to monopolize the market. When this subject was formally addressed in California and Oregon, the commissions came to two different conclusions because the best course of action is not obvious. When discussing this topic, commissions can expect to have very strong arguments from both utilities and third-party EVSE service providers, and a decision will likely have strong opposition by one of these two groups. By default, utilities are not prohibited from owning and operating EVSE, and the approval process for utility initiatives through the commissions may be sufficient to ensure that utilities are not inappropriately leveraging their potential

⁶⁵ Public Utility Commission of Oregon, Guidelines Adopted; Utilities Ordered To Make Revised Tariff Filings, 19 January 2012, <http://apps.puc.state.or.us/orders/2012ords/12-013.pdf>.

⁶⁶ State of Washington, Substitute House Bill 1571. 62nd Legislature, 2011 Regular Session, 22 July 2011, <http://apps.leg.wa.gov/documents/billdocs/2011-12/Pdf/Bills/Session%20Laws/House/1571-S.SL.pdf>.

competitive advantage over other EVSE service providers. In cases where commissions are making the ruling, that ruling applies only to IOUs; municipal-owned utilities will be subject to political decisions at a local level.

7. Rebates and Grants

Most utilities do not have a full understanding of how PEV purchase and use, along with EVSE installation and use, will affect their operations and their customers' electricity usage. To learn about this technology, some utilities are establishing research and demonstration programs. Such efforts can also be used to convey best practices and lessons learned to their customers when promoting the effective use of EV technology. Justifying the full costs required to carry out an internal research project (i.e., purchasing EV and EVSE, simulating real-world driving patterns, and analyzing data) is a challenge and is not practical for utilities. Therefore, some utilities are offering credits or rebates to customers for charging stations, charging station installation, or PEVs in exchange for access to information on how the product is used; this feedback serves as the basis for a research program. To gain regulatory approval and establish budget ceilings, the programs often are limited in terms of customers (generally between 500 and 5,000 customers) and/or duration (often two to five years).⁶⁷ Such programs also help promote the deployment of PEVs and EVSE, which comprise an evolving market for utilities and represent an opportunity to highlight the environmental and economic benefits of electricity over conventional liquid petroleum fuels. In addition, PEVs also represent a potential revenue stream for utilities, so these incentives are supporting their self-interests.

Precedents/Examples

New York

Long Island Power Authority (LIPA) established a rebate program to award a one-time rebate check of \$500 to each LIPA customer who purchases and registers a new, qualified PEV. The rebate, available through the end of 2011, equated to the approximate electricity costs to charge the PEV for one year or the cost for purchasing a Level 1 residential charging station. The rebate program provided financial assistance to LIPA customers and allowed LIPA to monitor the purchase and location of the PEVs for better reliability of the utility system. Information regarding the vehicles' locations was seen as essential in planning for Long Island's energy future.⁶⁸

California

The California PUC ruled to waive the \$2,000 deductible on distribution upgrade costs that could be required for transformers serving households with an electric vehicle. The PUC decided that, while the electric vehicle may have been the final element to overload the transformer, other loads (including previously installed EVSE) from other households also contribute to the transformer's overload. Therefore it was determined that this cost should be covered by all rate payers and not the individual vehicle owner.

On May 24, 2012, the California PUC established the purposes and governance for the EPIC and funding collections for 2013–2020. The purpose of the funding is to provide public interest investments in applied research and development, technology demonstration and deployment, market support, and

⁶⁷ Edison Electric Institute. 2011. The Utility Guide to Plug-in Electric Vehicle Readiness. November. www.eei.org/ourissues/EnergyEfficiency/Documents/EVReadinessGuide_web_final.pdf.

⁶⁸ Long Island Power Authority. 2010. LIPA Becomes First Utility in the State to Announce New Plug-In Electric Hybrid Rebate Program. December 20. www.lipower.org/newscenter/pr/2010/122010-phev.html.

market facilitation of clean energy technologies and approaches for the benefit of electricity ratepayers of Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), and Southern California Edison (SCE), the three large IOUs. The decision authorizes continued funding collections at the level of \$162.0 million per year beginning January 1, 2013, and ending December 31, 2020. EPIC funds will be administered 80 percent by the California Energy Commission (CEC) and 20 percent by the three IOUs, with the IOU role limited to the area of technology demonstration and deployment. In regards to low-emission vehicles and the transportation sector, supported activities should evaluate policies and develop infrastructure sufficient to overcome any barriers to the widespread deployment and use of plug-in hybrid and electric vehicles.⁶⁹

PG&E has proposed to use EPIC funds for three projects. The first is directly related to EVs: Pilot Subtractive Billing with Submetering for EVs. The other two other projects might support further integration of electric vehicles onto the grid: 1) Energy Storage End Uses and 2) Improve Distribution System Safety & Reliability through New Data Analytics Techniques.⁷⁰

SDG&E has proposed to use EPIC funds for the following projects: Smart Grid Architecture Pilots, Distributed Control for Smart Grids, Non-Traditional Uses of Distributed Energy Resources, and Pilot for Visualization and Situational Awareness System (data processing). All of this research can support demand response and reverse energy transfer with electric vehicles.⁷¹

SCE has proposed to use EPIC funds on the following projects intended to support EVs: 1) Load Scanning to Identify Electric Vehicle Charging Locations and 2) Transformer Load Management Analysis – AMI Load Correlations, Electric Vehicles and Residential Energy Storage Unit Impacts.⁷²

Los Angeles Department of Water and Power (LADWP) initiated a pilot program in April 2011 that provided rebates of up to \$2,000 to the first 1,000 LADWP customers for home chargers and installation costs for their electric vehicles. The Board of Water and Power Commissioners approved the Electric Vehicle Home Charger Rebate Program—Charge Up LA—to ease the financial burden for any resident who wants to install a rapid (Level 2) charger at home for qualifying electric vehicles. The LADWP will track the PEV charging patterns to ascertain where to allocate resources for potential energy growth. By

⁶⁹ California Public Utility Commission, Rulemaking 11-10-003, 24 May 2012, http://docs.cpuc.ca.gov/WORD_PDF/AGENDA_DECISION/167158.pdf.

⁷⁰ Pacific Gas and Electric Company, Electric Program Investment Charge, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=4&ved=0CDsQFjAD&url=https%3A%2F%2Fwww.pge.com%2Fregulation%2FEPIC-InvestmentPlan2012-2014%2FOther-Docs%2FJoint-PSS%2F2012%2FEPIC-InvestmentPlan2012-2014_Other-Doc_Joint-PSS_20120928_250783.pptx&ei=V9x6UY2wl-LB4APu04HABw&usg=AFQjCNHgsONq3GP3EkOmOWaz0DSZvhm9RA&sig2=udOvnmKnWJb6CEnt-tqsaaw. Accessed 26 April 2013.

⁷¹ San Diego Gas & Electric Company, Proposed EPIC Programs, www.sdge.com/sites/default/files/regulatory/Final%20Proposed%20EPIC%20Programs.pdf.

⁷² Southern California Edison, Application of Southern California Edison Company for Approval of its Triennial Investment Plan for the Electric Program Investment Charge Program, [www3.sce.com/sscc/law/dis/dbattach4e.nsf/0/14462901E712A29A88257AAD007AE235/\\$FILE/A.12-11-004+EPIC+SCE+Application+for+Approval+of+Triennial+Investment+Plan.pdf](http://www3.sce.com/sscc/law/dis/dbattach4e.nsf/0/14462901E712A29A88257AAD007AE235/$FILE/A.12-11-004+EPIC+SCE+Application+for+Approval+of+Triennial+Investment+Plan.pdf).

monitoring charging patterns, the LADWP can guard against straining the grid. The rebate program is part of an overall strategy by the City to ensure that Los Angeles is EV-ready.⁷³

Anaheim Public Utilities is offering a PEV charger rebate to any customer who installs a Level 2 (240 V) charger. Through this program, Anaheim Public Utilities will reimburse customers for out-of-pocket expenses up to \$1,500 per charger. Eligible expenses include the charger purchase price, installation costs, and panel upgrades. In addition to the \$1,500 rebate, the program will waive the City's permit application fees related to the installation of the PEV charger.⁷⁴

Connecticut

In May 2011, Northeast Utilities launched a research project to determine the impact that PEVs would have on Connecticut's electric grid. About 20 towns and businesses served by Connecticut Light & Power, which is owned by Northeast Utilities, are expected to participate in the project. By gathering information from municipal and business customers, Connecticut Light & Power will gain tangible experience to help guide future decisions about infrastructure, policies, and ways to ultimately serve all customers as electric vehicles become more common.⁷⁵

Michigan

Consumers Energy is offering a limited incentive program for home charging stations to help customers make the transition to using PEVs. For the first 2,500 qualified customers who enroll in the program, Consumers Energy will reimburse up to \$2,500 spent on the purchase, installation, and required home wiring of a Level 2 charging station.⁷⁶

DTE Energy has a \$2,500 incentive for the first 2,500 customers who purchase a PEV and enroll in the rate program (D1.9 Electric Vehicle Rate). The offer covers the cost of a separately metered 240 V charging station. To qualify, a participant must have an active DTE Energy account, must be a homeowner or provide written approval from the property owner, must have a vehicle that is SAE J-1772 compliant, and must have a dedicated parking spot at the residence.⁷⁷

Indiana Michigan Power offers incentives to PEV owners in the utility's Michigan territory. The first 250 qualified PEV owners can receive \$2,500 to offset the cost of installing a home charging station. The home charging station must be installed by a licensed electrician and comply with National Electric Code specifications.⁷⁸

⁷³ Engadget, Los Angeles pilot program offers up to \$2,000 off PEV charging stations, 25 April 2011, www.engadget.com/2011/04/25/los-angeles-pilot-program-offers-up-to-2-000-off-ev-charging-st/.

⁷⁴ City of Anaheim, Plug-in Electric Vehicle Incentives, www.anaheim.net/article.asp?id=4946,

⁷⁵ J. Podsada, "Northeast Utilities Launches Electric Vehicle Charging Station Project." *The Hartford Courant*, 3 May 2011, http://articles.courant.com/2011-05-03/business/hc-electric-vehicle-charging-stations20110503_1_electric-grid-watson-collins-evs.

⁷⁶ Consumers Energy, Plug-in Electric Vehicle Incentive Program, www.consumersenergy.com/content.aspx?id=3368,

⁷⁷ DTE Energy, Get Plug-In Ready, www.dteenergy.com/residentialCustomers/productsPrograms/electricVehicles/getReady.html,

⁷⁸ Indiana Michigan Power, Electric Vehicle Savings Incentives, www.indianamichiganpower.com/save/ElectricVehicles/incentives.aspx.

Texas

Austin Energy offers residential customers and PEV owners a rebate covering 50 percent of the cost of a Level 2 charging station, including purchase and installation. The maximum rebate amount is \$1,500. Qualified applicants must be Austin Energy customers and use an approved contractor. To receive the rebate, PEV owners must agree to participate for three years in an Austin Energy pilot project and share information about electric vehicle charging habits so that Austin Energy can research and develop “smart charging” strategies to prepare the electric grid for the expected influx of electric vehicles. Austin Energy will study smart charging strategies, such as whether the air conditioner and home charging station can be synchronized so that when the air conditioner cycles off normally, the charging station starts charging the electric vehicle, thus decreasing the load on the transformer. Other options under study during the pilot period include the following: using electric vehicles to store electricity and feed it back into the home, charging with clean solar power, and charging at the workplace.⁷⁹

CPS Energy and the City of San Antonio offered a 50 percent rebate of the actual cost and installation of a Level 2 residential charging station, up to a maximum of \$1,000. PEV owners who want to install chargers at their homes needed to apply before the May 15, 2012, deadline. Funding of \$25,000 was allocated for this program.⁸⁰

Key Findings

EVSE incentives offered by utilities provide an opportunity to track the installations’ locations and gather usage data from the charging stations. While useful they provide some useful data, incentive programs have limited funding and may not be the most cost-effective research method. Early projects provided insights into how PEVs would be used. While various utilities have offered PEV or EVSE incentives, it was not clear whether these programs resulted in additional PEV purchases. However, these programs show utilities’ and states’ support of PEVs, which is a positive message from key partners in this transition into transportation electrification. Paying for incentives through utilities, rather than the state’s general fund, may make PEV incentives more politically appealing.

⁷⁹ Austin Energy, Austin Energy Issues First Rebate for Home Charging Station, 29 March 2011, www.austinenergy.com/about%20us/newsroom/Press%20Releases/Press%20Release%20Archive/2011/firstChargingStationRebate.html.

⁸⁰ U.S. Department of Energy Alternative Fuels Data Center. Electric Vehicle Supply Equipment (EVSE) Incentive - CPS Energy www.afdc.energy.gov/laws/index.php?p=law&state=TX&id=9297&print=y. Accessed 26 April 2013.

8. Stakeholder Involvement and Outreach

Utilities have not traditionally been involved in transportation sector initiatives for private vehicle owners. Often their own fleet is very active in pursuing alternative fuels, including both compressed natural gas and electricity (PEVs), but this is primarily driven by Energy Policy Act (EPAct) requirements through the State and Alternative Fuel Provider Fleet Program. PEVs are changing this perspective for the utilities because residential customers are now purchasing electricity for charging their PEVs at home. Selling more electricity may be beneficial to the utility if it does not adversely affect the grid demand profile and cause disruptions or require the development of additional distribution capacity. PEVs significantly change the assumed usage profile of a typical household. Rate structure modifications and other strategies, as previously mentioned, may be necessary to prevent cost increases to all customers. Electric vehicle working groups or committees often seek utilities' participation to have this valuable perspective on balancing PEVs' negative and positive impacts on the grid. Commissions can also initiate or lead discussions to help shape policy and public knowledge through working with a diverse group of stakeholders.

Precedents/Examples

Many utilities, either through internal investigations or associated with grant-funded EVSE deployment, have gathered data and gained knowledge on PEV use and charging. Many have also established web pages and brochures that provide basic information about PEVs to their customers. The following examples are state-wide efforts involving the commissions to formally evaluate how well all involved parties are addressing PEV adoption.

California

California Senate Bill 626 required California PUC, in consultation with the California Energy Commission, the state board, electrical corporations, and the motor vehicle industry, to evaluate policies to develop infrastructure sufficient to overcome any barriers to the widespread deployment and use of plug-in hybrid and electric vehicles.⁸¹

The California PUC has adopted the following principles and requirements to guide utility education and outreach:⁸²

- Each utility has an obligation to use funds to provide its customers with information regarding the choices available for metering arrangements, rates, demand response programs, EVSE, equipment installation, safety, reliability, and off-peak charging.
- Each utility has an obligation to use funds for targeted electric vehicle education and outreach to educate customers about the environmental and societal benefits of electric vehicles consistent with the state's policy goals related to the reduction of greenhouse gas emissions set

⁸¹ State of California, SB 626: An act to add Section 740.2 to the Public Utilities Code, relating to electrical infrastructure, 11 October 2009, www.leginfo.ca.gov/pub/09-10/bill/sen/sb_0601-0650/sb_626_bill_20091011_chaptered.html,

⁸² California Public Utility Commission, Rulemaking 09-08-009: Phase 2 Decision Establishing Policies To Overcome Barriers To Electric Vehicle Deployment And Complying With Public Utilities Code Section 740.2, 14 July 2011, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/139969.PDF.

forth in
AB 32.

- Due to the potential for conflicts of interest, this information must be communicated in a competitively neutral manner without value judgments or recommendations.
- Regarding safety, reliability, and off-peak charging, utilities may present information and make value judgments and recommendations. The neutral communication requirement does not apply because safety and reliability are primary utility responsibilities, and information on safety, reliability, and off-peak charging is unlikely to raise conflicts of interest or anti-competitive behavior.

The California PEV Collaborative,⁸³ a multi-stakeholder public–private partnership, is working to ensure a strong and enduring transition to a PEV market in California. The collaborative includes all key California PEV stakeholders, including elected and appointed officials, automakers, utilities, infrastructure providers, environmental organizations, research institutions, and others. The collaborative will facilitate PEV deployment in California to meet economic, energy, and environmental goals. The collaborative’s purpose is to identify the most important near-term actions that are best accomplished together and to provide the organization, resources, and sense of urgency to ensure these actions are accomplished in short order. Through a member-driven process, the collaborative created working groups to implement recommendations from the strategic plan:

- Workplace Charging Infrastructure (active from 2012–2013)
- Multi-Unit Dwelling Charging Infrastructure (2012–2013)
- Infrastructure Coordination (2011–2012)
- Messaging and Communication (2011–2012)
- Government Coordination and Incentives (2011–2012)
- Market Expansion (2011–2012)
- Research (2011–2012)

California has established the Governor’s Interagency Working Group on Zero-emission Vehicles in response to Governor Brown’s executive order, issued in March 2012, directing state government to help accelerate the market for zero-emission vehicles (ZEVs) in California. This interagency working group, led by the Governor’s Office, includes several state agencies and associated entities, building upon significant work already undertaken by these agencies.

- California Air Resources Board
- California Department of Food and Agriculture, including the Division of Measurement Standards
- California Department of Transportation
- California Energy Commission
- California Housing and Community Development Department
- California Independent System Operator
- California Labor and Workforce Development Agency, including the Employment Training Panel
- California Public Utilities Commission

⁸³ California Plug-in Electric Vehicle Collaborative website, Sacramento, CA, n.d., www.evcollaborative.org.

- Department of General Services, including the Division of the State Architect and Building
- Standards Commission
- Governor's Office of Business and Economic Development
- Governor's Office of Planning and Research

The Governor's Interagency Working Group on Zero-emission Vehicles releases ZEV Action Plans identifying specific strategies and actions that state agencies will take to meet milestones of the executive order. The "2013 ZEV Action Plan," a roadmap toward 1.5 million ZEVs on California roadways by 2025, benefits from extensive input from outside stakeholders, including the California Plug-in Electric Vehicle Collaborative and the California Fuel Cell Partnership.⁸⁴

Connecticut

In Connecticut, the governor established the Connecticut Electric Vehicle Infrastructure Council (EVIC) that includes Northeast Utilities and United Illuminating. EVIC recommended several state initiatives, some of which have already been implemented into law, such as a requirement that the state building code be updated to include PEVs and an exemption from the state sales tax for new PEV purchases.⁸⁵

Florida

Florida Statute 366.94 directed the PSC to conduct a study of potential effects of public charging stations and privately owned electric vehicle charging on both energy consumption and the electric grid in the state. The PSC was also instructed to investigate the feasibility of using off-grid solar photovoltaic power as a source of electricity for the electric vehicle charging stations.⁸⁶ In December 2012, the report's conclusions (summary excerpt below) were submitted to the President of the Senate, the Speaker of the House of Representatives, and the Executive Office of the Governor:

EV charging is expected to have a negligible effect on electricity consumption in Florida within the ten-year planning horizon. At the same time, EV owners should reduce the consumption of gasoline in Florida by more than two million gallons in 2012. EVs are also not currently expected to cause a significant increase in electric demand or contribute significantly to a need for new generation until well past 2021. Clusters of electric vehicles charging simultaneously on a single residential transformer could potentially require upgrades to that transformer, but individual vehicles are not expected to affect the distribution system. "Quick-charge" stations may pose potential challenges for the distribution system. The use of off-grid solar photovoltaics for EV charging is technically feasible, but it may only be practical in unique circumstances due to economic considerations.⁸⁷

⁸⁴ Governor's Interagency Working Group on Zero-emission Vehicles, "2013 ZEV Action Plan," February 2013, [http://opr.ca.gov/docs/Governor's Office ZEV Action Plan \(02-13\).pdf](http://opr.ca.gov/docs/Governor's%20Office%20ZEV%20Action%20Plan%20(02-13).pdf).

⁸⁵ State of Connecticut, Department of Energy & Environmental Protection, Governor Rell's Executive Order No. 34 Focus of EV Council, www.ct.gov/pura/cwp/view.asp?a=3856&q=452086,

⁸⁶ The Florida Senate, Florida Statutes 366.94 Electric vehicle charging stations, s. 11, ch. 2012-117, 2012, www.flsenate.gov/Laws/Statutes/2012/366.94,

⁸⁷ Florida Public Service Commission, "Report On Electric Vehicle Charging," December 2012, www.psc.state.fl.us/utilities/electricgas/electricvehicles/09_06_2012/Electric_Vehicle_Charging_Report.pdf.

Illinois

In Illinois, the governor signed into law the Illinois EV Advisory Council in July 2011. The council is made up of lawmakers, regulators, utilities, regional and national environmental organizations, automakers, and municipal leaders. The council is tasked with investigating and recommending strategies that the governor and the Illinois General Assembly may implement to promote the use of PEVs, including potential infrastructure improvements, state and local regulatory streamlining, and changes to electric utility rates and tariffs.⁸⁸

The Illinois Commerce Commission Initiative on Plug-In Electric Vehicles was formed in September 2010 to ensure that the commission is proactive in assessing the potential impacts of PEVs on the state's electric system and to help guide the commission in understanding and beginning to consider future regulatory issues necessary to accommodate this new mode of transportation. The initiative's report and recommendations, published in March 2012, largely reaffirmed that many existing policies in Illinois are well-suited for the introduction of PEVs, and that the regulatory issues that need to be addressed are either narrowly focused or longer-term in nature.⁸⁹

Maryland

The Maryland Electric Vehicle Infrastructure Council (EVIC) was created to develop, evaluate and recommend strategies to facilitate successful integration of electric vehicles and electric vehicle infrastructure into Maryland's existing transportation infrastructure.⁹⁰ The final report of the council's findings and recommendations was presented to the governor and General Assembly on December 1, 2012. The recommendations, summarized below, are intended to provide sufficient support to reach an ambitious goal of 60,000 PEVs, or 2.3% of the state's passenger vehicle fleet, on the road in Maryland by 2020:

- Continue the council with the objective of engaging more extensively with local counties and municipalities on education, outreach and planning initiatives. Also, create a task force under the council to study issues and opportunities for workplace and urban charging and continue the development of solutions and best practices.
- Establish goals for the state vehicle fleet purchases of zero-emission light-duty vehicles at 10 percent by 2020 and 25 percent by 2025.
- Explore the potential for the leasing of PEVs, bulk purchase agreements with local governments, and bulk purchase or lease agreements with the other Northeast Corridor states to reduce purchase costs.
- Extend current incentive programs including the excise tax credit through July 1, 2016, the electric vehicle charging station income tax credit through December 2016, and HOV lane use permits for PEVs through September 30, 2020.

⁸⁸ State of Illinois, HB2902, Electric Vehicle Act, 2011, www.ilga.gov/legislation/97/HB/PDF/09700HB2902lv.pdf.

⁸⁹ Illinois Commerce Commission, "Initiative on Plug-In Electric Vehicles: Report and Recommendations," Springfield, IL, 6 March 2012, www.icc.illinois.gov/electricity/pev.aspx.

⁹⁰ Maryland Department of Transportation, Maryland Electric Vehicle Infrastructure Council website, Hanover, MD, www.mdot.maryland.gov/Office%20of%20Planning%20and%20Capital%20Programming/Electric_Vehicle/Index.html.

- Establish a grant program for EVSE installation and the initial procurement of transaction management software for multi-unit dwellings including apartments, condominiums, and managed community parking.
- Implement an education and outreach plan that includes a website for Maryland-specific PEV information and resources; educational workshops and webinars for developers, property managers and homeowner associations about the benefits of providing charging for residents; and guidance documents for local governments.⁹¹

Michigan

The Michigan Plug-in Electric Vehicle Preparedness Taskforce was convened by Michigan PSC Chairman Orjiakor Isiogu to create a seamless customer experience and acceptance of PEVs in Michigan. The taskforce began meeting in February 2010 and has since expanded to include several subcommittees. The taskforce includes members of regulated and unregulated utilities, nonprofit organizations, government groups, electrical contractors and inspectors, automotive manufacturers, and local clean energy organizations. The taskforce addresses such issues as education and communication, incentives, rates, infrastructure, and building code changes to streamline the installation of charging equipment, among others. The taskforce, which now has a state-wide website titled Plug-In Michigan, has been instrumental in achieving changes in Michigan building codes and establishing statewide education and outreach programs.⁹²

Northeastern States

In 2009, a group of utility companies based in New England formed the Regional Electric Vehicle Initiative (REVI) to encourage collaboration among entities interested in advancing electric transportation. REVI's six founding members are: Northeast Utilities, National Grid, The United Illuminating Company, NSTAR, Connecticut Municipal Electric Energy Cooperative, and Massachusetts Municipal Wholesale Electric Company. In anticipation of PEVs coming to market, REVI was organized to exchange information and establish shared positions and priorities for a charging infrastructure utilizing the existing regional electric systems. REVI supports regional and state policy goals to reduce greenhouse gas emissions and develop alternative fuel resources. REVI's founding members agree that implementation of a PEV charging infrastructure is imminent, and that utilities should be prepared to play an appropriate role in support of that process. The group's focus is on understanding PEV market development and advancing the region's PEV planning process, policies, and dialogue with stakeholders. As the PEV market evolves, REVI utilities will work together for the benefit of customers and strive to achieve cost efficiencies, consistency of applicable standards, and economies of scale. With electric transportation undergoing rapid change and technology advances, REVI utilities are staying up to date and can be a reliable source of PEV information.⁹³

⁹¹ Maryland Electric Vehicle Infrastructure Council, "Final Report to the Governor and Maryland General Assembly by the Electric Vehicle Infrastructure Council," 1 December 2012, www.mdot.maryland.gov/Office_of_Planning_and_Capital_Programming/Electric_Vehicle/Documents/Final_Report_Full_Document.pdf.

⁹² Plug-in Michigan website, <http://pluginmichigan.org/about-us>,

⁹³ Regional Electric Vehicle Initiative website, www.revi.net,

Pennsylvania

In light of the many advantages in reducing the use of imported petroleum in the transportation sector, the PUC has begun a process to focus on AFVs, specifically those technologies which utilize natural gas and electricity. The commission is particularly interested in exploring how to foster policies and regulatory frameworks that support investments in natural gas and electric vehicles and their required infrastructure. The PUC is examining:

- The state of development and costs of various technologies
- Constraints in developing AFVs, both nationwide and in Pennsylvania
- Appropriate private sector, utility and commission roles in fostering the economic development and the expansion of the necessary infrastructure
- Hurdles related to specific transportation sector markets (private, commercial, mass transit, etc.)
- AFV development's impact on the operation and reliability of both the power grid and natural gas supply system
- Specific local, state, and federal regulatory needs required to support AFV growth

The Pennsylvania PUC held a forum on May 31, 2012, to seek information from interested parties on PUC jurisdictional issues related to AFVs, specifically natural gas and electric. The PUC envisioned this forum as the first step in an ongoing discussion of AFV issues under its jurisdiction, creating a foundation for possible future action by the commission. Presiding over the forum were the five PUC commissioners, Pennsylvania Department of Environmental Protection Secretary, and Pennsylvania Department of Transportation Secretary. The forum included presentations and panel discussions of natural gas and electric vehicle-related issues.⁹⁴

Key Findings

Commissions can direct utilities to educate early adopters on how to maximize savings on their energy bills, which will help protect grid reliability and minimize infrastructure upgrades. While many of the examples listed stemmed from legislative initiatives, Michigan's PSC took action without such a directive. Ensuring a positive customer and company experience with PEVs will require the involvement and support from a diverse group of public and private organizations as well. Commissions and utilities that are actively involved in PEV initiatives gain an understanding of the industry and recognize the numerous resources that could be leveraged for educating their customers. The forum held by the Pennsylvania PUC is a good example of how the PSC can gain knowledge on the developments of the PEV industry and recognize the upcoming filings and issues that may be brought before the commission. The California Governor's Interagency Working Group on Zero-emission Vehicles is an extensive effort to bring together several state agencies and associated entities, a promising means of addressing PEV issues that are crosscutting among different organizations.

Leading or participating in state, regional, or national PEV working groups is an effective way for commissions and utilities to provide input on behalf of the electrical providers during these policy and

⁹⁴ Pennsylvania Public Utility Commission, Alternative Fuel Vehicles, 2012, www.puc.state.pa.us/utility_industry/electricity/alternative_fuel_vehicles.aspx,

planning discussions, while also supporting PEV adoption. There are numerous national organizations that have been establishing these types of stakeholder collaborations for many years. Beyond bringing stakeholders to the same table, these groups bring together and focus years of experience and many resources towards a common goal, which in this case is PEV adoption. Several states, including Connecticut, Illinois, Maryland, and Michigan, have established special executive councils or committees specifically to recommend and implement policies to promote PEV adoption and to coordinate interagency strategies. Regional initiatives, such as REVI in New England that promote using the region's existing electric system to charge PEVs, support regional and state policy goals to reduce emissions and develop alternate fuels. Other PEV collaborations often include commissions, neighboring state and local government agencies, utilities, electrical contractors, and inspectors. One example is Project Get Ready, an initiative between cities and industry leaders to develop and disseminate best practices for PEV integration and adoption.⁹⁵ These groups are both critical to the seamless installation of PEV charging infrastructure and an overall positive customer experience. Sponsoring, funding, or guiding PEV research at the university level can also accelerate PEV developments while fostering good community relationships.

It is important that utilities engage in public education and outreach supporting PEV use. Customers are turning to the utilities for advice and recommendations on PEVs for personal use. PEV drivers also need to understand the impact that vehicle charging has on their utility bills. Many of the concepts already described in this paper, such as PEV-specific rate structures and EVSE notification procedures, will only be effective if they are widely used by the customers. This requires education and outreach, along with continual evaluation and modification of policies and strategies. Most utilities currently have PEV web pages to educate consumers on the basics of the technology and its use. These should continue to be enhanced and updated to reflect the most recent technology advancements, best practices, policies, and strategies available for current and potential PEV owners.

⁹⁵ Rocky Mountain Institute, Project Get Ready, Snowmass, Colorado, www.rmi.org/project_get_ready.

9. Demand Response and Vehicle-to-Grid Services

When PEVs are connected to the grid, the primary objective is to draw electricity to recharge the batteries. However, because of higher charging rates available with AC Level 2 EVSE, and possibly DC Level 1 or 2 in the future, a fully charged PEV may be connected to the grid after it has completed a charge and before the driver needs to use the vehicle. It is possible that EVSE could provide variable charging rates to level electric load throughout the day or use an intermittent energy supply (particularly from renewable energy sources) if charging is not highly time-sensitive for the PEV (i.e., the vehicle is a plug-in hybrid that has other propulsion options, or immediate continuous PEV charging at the station is not necessary for the PEV to complete its next trip). Similar demand response programs have been enacted for smart thermostats that can be raised a few degrees during peak electricity demand periods to lessen the load from the air conditioning system. Eventually, EVSE and PEVs might be capable of transferring electricity back to the grid from the vehicle batteries. V2G services could have benefits to the grid if enacted at a large scale, but they may affect the PEV's capability in the short term (less range for the next trip) and long term (more cycles on the batteries can affect the performance and reliability over its life). Therefore, it will be important to provide a financial benefit to the PEV owner for V2G electricity transfer.

Both demand response and V2G programs require AMI at the EVSE and enable direct control, which is more advanced than the smart charging discussed earlier that allowed the EVSE to respond to a TOU rate structure or pricing signals. For these strategies to be effective, there needs to be a sufficient aggregate of PEVs charging at the time when demand response or V2G services are needed, and those PEV owners must be willing to allow charging to stop or potentially feed electricity back into the grid. Workplace charging might be the most practical scenario since cars are usually charging at the workplace during on-peak times.

Demand response and V2G are both technically feasible, but the acceptance, value, and enactment of such services for the grid and PEV owner are not clear. As mentioned, there would need to be a significant amount of readily available energy storage in PEVs to provide enough demand for V2G to affect the grid's demand profile. Similarly, demand response strategies would be effective only if there were sufficient PEVs currently charging that could be temporarily halted. PEV owners want fair compensation for using their vehicles to provide these services; this compensation would cover any impact to the batteries and might help improve the return on investment for owning a PEV. To be successfully implemented, the communication of information is essential: PEV owners need to know when they are allowing these services and what impact their participation might have on expected charging events; and the New York Independent System Operator (NYISO) needs to know what energy storage capacity or displaceable load is available and how much can be used in a certain period while still providing the needed PEV charging. The utility may act as the enabler of this strategy by supporting the distribution of information and electricity throughout the system. Demand response and V2G will be very limited prior to widespread penetration of PEVs. Charging for public EVSE use is also needed so the PEV owner can benefit from a discount given for offering these grid services. However, these solutions may be desired in certain circumstances, such as for emergency back-up power at a residential home or a corporate fleet with many vehicles at one location. Further research into the true value of these

services, along with appropriate guidelines and tariffs, can help ensure that demand response and V2G are done safely and PEV owners are fairly compensated.

Precedents/Examples

California

PG&E has initiated a PEV pilot to evaluate specific requirements for PEVs and how their unique attributes can be incorporated both by the California Independent System Operator (CAISO) and in distribution-level operations and planning.⁹⁶ This 2012–2014 project will concentrate on:

- Determining the requirements needed for PG&E to incorporate demand response from PEVs into its operational and planning groups and the associated benefits that would accrue to demand response PEV providers.
- Evaluating the technical capability to provide timely two-way communications, such as price and direct load control messages, to the EVSE and PEVs over the AMI network and/or broadband network using national standards.
- Evaluating how quickly and in what manner EVSE and PEVs respond to signals to alter charging patterns based on PEV battery state of charge and user profiles, both on an individual basis and in aggregate.
- Evaluating customers' charging patterns, preferences, behavior, and reactions to utility interaction with PEV charging.

Delaware

Two recent efforts have prompted Delaware to address laws relating to V2G: Mid-Atlantic Grid Interactive Cars Consortium's V2G test at the University of Delaware and the subsequent commercial V2G pilot project that NRG Energy is currently conducting with the University of Delaware in partnership with PJM and EV Grid.⁹⁷ Delaware Code Title 26, Chapter 10, Section 1014 (g) is a provision to treat PEV V2G similarly to other situations of net metering and (h) outlines some additional provisions for tariffs related to PEV V2G.

(g) A retail electric customer having on its premises one or more grid-integrated electric vehicles shall be credited in kilowatt-hours (kWh) for energy discharged to the grid from the vehicle's battery at the same kWh rate that customer pays to charge the battery from the grid (equal to the sum of delivery service charges and supply service charges for residential customers and the sum of the volumetric energy [kWh] components of the delivery service charges and supply service charges for nonresidential customers). Excess kWh credits shall be credited to subsequent billing periods to offset a customer's consumption in those billing periods, unless a customer requests payment from the electric supplier for any excess kWh credits. To qualify under this subsection, the grid-integrated electric vehicle must meet certain requirements,

⁹⁶ Pacific Gas and Electric Company, Advice 4077-E-A. San Francisco, California, 21 December 2012, www.pge.com/nots/rates/tariffs/tm2/pdf/ELEC_4077-E-A.pdf.

⁹⁷ S. Fisher, "V2G Business Models," Plug-in Electric Vehicle Collaborative – V2G Workshop, 11 April 2012, www.pevcollaborative.org/sites/all/themes/pev/files/docs/Fisher_PEVC%20Collaborative%20V2G%20Panelv2_120411.pdf.

while the connection and metering of grid-integrated vehicles shall be subject to the specified rules and regulations.

(h) The Commission may adopt tariffs for regulated electric utilities that are not inconsistent with subsection (g) of this section. Such tariffs may include rate and credit structures that vary from those set forth in subsection (g) of this section, as long as alternative rate and credit structures are not inconsistent with the development of grid-integrated electric vehicles.⁹⁸

For the commercial V2G pilot project, the University of Delaware team has developed a system to collect payments for work (balancing supply and demand moment to moment) that is normally the domain of power plants. The 15 cars with bi-directional power flow capability respond to a signal from the regional grid operator which tells the batteries to charge, or to discharge, or to do neither. Alternatively, if the cars need charging, they can provide the same service by varying the amount of current they draw. For the grid, the effect is to add or subtract load in a coordinated way that aids stability. It was estimated that this frequency regulation service is worth about \$5 a day, or about \$1,800 a year.⁹⁹

Minnesota

Minnesota Statutes 325F.185 for electric vehicle infrastructure state that “any electric vehicle infrastructure installed in this state must without significant upgrading of the electric vehicle infrastructure: (3) be capable of providing bi-directional charging, once electrical utilities achieve a cost-effective capability to draw electricity from electric vehicles connected to the utility grid.”¹⁰⁰

U.S. Department of Defense

As part of their Plug-In Electric Vehicle Program, the U.S. Department of Defense (DOD) completed a thorough business case analysis for V2G and non-V2G fleet electrification efforts and launched a V2G Pilot Initiative. Through a case study with an electric vehicle sedan fleet in Southern California, the value of 15 kW in bi-directional capability for the frequency regulation market was found to be \$2,520 for the year or \$210/month. Approximately 73 percent of this frequency regulation value is retained even when the vehicles are used for transportation purposes during normal business hours (8:00 a.m. to 5:00 p.m., Monday through Friday). DOD has found that V2G is an essential element to satisfy the financial constraints of their fleet electrification efforts. The software system and fleet management tool successfully projects the charge state of battery upon vehicle return, produces a charging schedule for next use, bids into relevant energy/power markets, and dispatches the relevant signal from the utility/ISO/facility to charging stations. DOD found bureaucratic barriers to be more substantial than technical barriers to actualization of V2G services. DOD is committed to exploring avenues that will bring

⁹⁸ State of Delaware, Title 26: Public Utilities, Chapter 10, Electric Utility Restructuring, <http://delcode.delaware.gov/title26/c010/index.shtml>.

⁹⁹ Matthew Wald. In Two-Way Charging, Electric Cars Begin to Earn Money From the Grid. New York Times. 25 April 2013.
www.nytimes.com/2013/04/26/business/energy-environment/electric-vehicles-begin-to-earn-money-from-the-grid.html?pagewanted=1&r=2&hpw&

¹⁰⁰ Minnesota Office of the Revisor of Statutes, 2012 Minnesota Statutes 325F.185 Electric Vehicle Infrastructure, <https://www.revisor.leg.state.mn.us/statutes/?id=325F.185>.

V2G technologies to bear and is initiating a large-scale testing and evaluation program for PEVs on six sites in four regions with V2G capability; the purpose is to demonstrate the financial and operational benefits of a V2G fleet.¹⁰¹

Key Findings

Many early V2G demonstrations have proven the concept's feasibility: AC Propulsion's V2G Demonstration Project, Mid-Atlantic Grid Interactive Cars Consortium's V2G test at the University of Delaware, Austin Energy's V2G Pilot Study with a V2Green connectivity module, Xcel Energy's SmarGridCity Project in Boulder (CO), and ECotality North America's Bi-Directional Charging Project with Idaho National Laboratory.¹⁰² As mentioned, NRG Energy is currently conducting a commercial V2G pilot project with the University of Delaware and in partnership with PJM and EV Grid. PJM recently lowered its requirement for the frequency regulation market from one megawatt down to 100 kilowatts, which is a wholesale market rule change that lowers the barriers to entry for V2G.¹⁰³ In addition, the California PUC and NRG Energy have entered into an agreement in which NRG will build a comprehensive PEV charging network in California, which will include smart grid and grid storage services that enable PEV drivers to support electrical grid reliability with needed energy services through V2G.¹⁰⁴ CAISO has recently engaged in discussions regarding vehicle integration into the energy market. One of the discussion topics is utility's role for this service, as the largest benefit would likely come from the utilities' having active control of this energy node. CAISO found that the existing demand management techniques are not applicable to vehicles.

Widespread use of PEVs for demand response or V2G programs will likely not occur in the near future, but V2G may be used for emergency back-up power at a residential home during natural disasters. Net metering rules pave the way for V2G, but statutory revisions or commission rule making may need to specifically address energy supplied by PEVs to a building on the grid. In anticipation that demand response or V2G services may be rolled out in the future, AMI can be installed at EVSE locations.

¹⁰¹ Camron Gorguinpour, DOD, Office of the Assistant Secretary of the Air Force, "Plug-In Electric Vehicle Program: The DOD V2G Pilot Project Overview," 2013, <http://electricvehicle.ieee.org/files/2013/03/DoD-Plug-In-Electric-Vehicle-Program.pdf>.

¹⁰² A. Briones, J. Francfort, P. Heitmann, M. Schey, S. Schey, and J. Smart, Idaho National Laboratory, "Vehicle-to-Grid (V2G) Power Flow Regulations and Building Codes Review by the AVTA," September 2012, <http://avt.inel.gov/pdf/evse/V2GPowerFlowRpt.pdf>.

¹⁰³ P. Carson, "The business of V2G," *Intelligent Utility Magazine*, September/October 2012, www.intelligentutility.com/magazine/article/284831/business-v2g.

¹⁰⁴ J. Addison, "California Gains 10,000 EV Charge Points in NRG Agreement," *CleantechBlog*, 26 March 2012, www.cleantechblog.com/2012/03/california-gains-10000-ev-charge-points-in-nrg-agreement.html.

10. PEV Batteries for Grid Use

Utilities have a stake in the aftermarket for electric vehicle batteries. At the end of a battery's life in a vehicle, it still has around 80 percent of its initial capacity—a significant amount—available for use. If utilities were to use this remaining capacity for grid storage, excess wind and solar energy that is generated could be stored for later use. Since most wind energy is generated at night when demand and prices are at their lowest, this energy could be stored for discharge later in the day when demand and prices are higher. This can potentially increase the percentage of renewable energy utilized on the electric grid. Lithium-ion batteries are not suited for all time ranges of power storage and discharge that are necessary for proper grid support. They are part of a larger storage solution that consists of systems ranging from super capacitors to pumped hydroelectric storage. Lithium ion falls into the fast response category of storage systems, expected to discharge for between one and four hours.¹⁰⁵

There are several demonstration projects across the country using lithium-ion batteries for grid storage. In addition, NREL has a testing facility that uses aged PEV batteries for storage on a microgrid. The facility utilizes used batteries with varying chemistries and health. This type of research will be necessary to prove the validity of battery second use viability and reliability. Batteries being repurposed for second life in grid storage are going to be returned with very different states of health. A standardized way of testing and determining remaining useful life would be very useful to the grid storage industry.¹⁰⁵

ABB, the leading power and automation technology group, 4R Energy, Nissan North America, Inc. (NNA), and Sumitomo Corporation of America have formed a partnership to evaluate the reuse of lithium-ion battery packs that power the Nissan LEAF. The purpose is to evaluate and test the residential and commercial applications of energy storage systems or back-up power sources using lithium-ion battery packs reclaimed from electric vehicles after use.¹⁰⁶

General Motors, also working with ABB, is investigating applications for the 16 kilowatt-hour lithium-ion battery pack used in the Chevrolet Volt. The ABB and GM team is building a prototype energy storage system for 25 kW/50 kWh applications, about the same power consumption as five U.S. homes or small retail and industrial facilities. ABB has determined its existing power quality filter inverter can be used to charge and discharge the Volt battery pack to take full advantage of the system and enable utilities to reduce the cost of peak load conditions.¹⁰⁷

Duke Energy and Tokyo-based ITOCHU Corp. are collaborating on advanced energy technologies, starting with the evaluation and testing of second-life applications for electric vehicle batteries. The companies will assess how PEV batteries perform in their “second lives,” including stationary applications in homes, neighborhoods, and commercial buildings. This pilot project will help Duke Energy and ITOCHU validate potential business models for future commercialization. In addition, the

¹⁰⁵ B. Gilchrist, Oregon State University, “Advanced EV Battery Technology: Incentives for Applications Beyond Their Useful Life in Vehicles and End-of-Life Disposal to Ensure Materials Security,” prepared for ASME and the WISE Program, 2012, <http://files.asme.org/asmeorg/NewsPublicPolicy/GovRelations/Programs/33318.pdf>.

¹⁰⁶ “ABB and partners to evaluate the reuse of the Nissan LEAF battery for commercial purposes,” ABB press release, 18 January 2012, on the ABB website, www.abb.com/cawp/seitp202/a2b2d2aff96520bec1257989004e62ae.aspx,

¹⁰⁷ J. Cobb, “GM/ABB Group partnership developing uses for post-consumer Volt batteries,” 22 July 2011, on the GM-Volt website, <http://gm-volt.com/2011/07/22/gm-partnership-looks-for-uses-for-post-consumer-volt-batteries/>.

companies believe increasing the total lifetime value of batteries through second-life applications could help reduce initial battery cost.¹⁰⁸

PG&E's PEV Pilot¹⁰⁹ will study and assess cases of providing demand response from electric vehicle batteries outside of the vehicle (secondary use of electric vehicle batteries). Second-life battery studies align with the governor's "2013 ZEV Action Plan" and will help PG&E understand the life cycle of the technology and the relationship to customer acceptance. Specifically, the pilot will evaluate and engage various automaker OEM and electric vehicle vendor channels to explore what the best mechanism is to encourage demand response adoption by electric vehicle customers. The pilot will also evaluate the costs and benefits of utilizing second-life electric vehicle batteries to provide various grid services. The California PUC specifically requested that PG&E include this topic in the PEV pilot because of the potential for second-life EV battery usage to present an alternative business model for financing electric vehicles.

One challenge is that since the latest PEVs just entered the marketplace, their used batteries will not be available in large numbers for eight to ten years. If the cost of new batteries decreases significantly over that time, as expected, it will be harder for used batteries to compete. Although there will be no costs associated with the (paid-for) used batteries, per se, there are other costs involved: the batteries will have to be removed from the cars and repackaged for grid use, and automakers may also need to pay the car owners for the batteries.¹¹⁰ Another challenge is that utilities, which are expected to be the primary future customers, are usually conservative and do not like taking risks with used equipment that has not proven its value. There are likely regulatory or other hurdles as well that would need to be overcome to create a viable business model to use PEV batteries for grid storage. PEV manufacturers will look to work with utilities and regulatory agencies to consider some of these challenges and determine likely future scenarios.

¹⁰⁸ Duke Energy, "Duke Energy and ITOCHU to Develop Strategies for Reusing Electric Vehicle Batteries," 23 November 2010, on the Duke Energy website, www.duke-energy.com/news/releases/2010112301.asp.

¹⁰⁹ Pacific Gas and Electric Company, Advice 4077-E-A.

¹¹⁰ K. Bullis, "Automakers Hope to Make Money on Used EV Batteries," *MIT Technology Review*, 22 July 2011, www.technologyreview.com/news/424772/automakers-hope-to-make-money-on-used-ev-batteries/.

11. Conclusions

Commissions and utilities play a vital role in supporting the expanded use of PEVs and ensuring that PEV charging is performed in a way that benefits the PEV owner, electrical grid system, and all rate payers. This white paper has presented various commission initiatives related to PEVs and EVSE. These are critical PEV topics that will require involvement from utilities and commissions to address current barriers for deployment of this technology and other actions to promote the use of electricity for transportation. As mentioned herein, a number of commissions have been proactive in establishing policies and initiatives in support of PEV and EVSE deployment. The key findings of this white paper are summarized below:

- Appropriate pricing of EVSE use based on electricity drawn cannot be offered by third-party EVSE service providers until these entities are excluded from the definition of an “electric corporation”; a similar precedent is the exclusion for entities that dispense condensed natural gas for vehicular use from the definition of a “gas corporation.” In states that have not clarified this issue, the ambiguity may be suppressing investments in public EVSE.
- As PEV use increases, PEV charging will have an impact on the electrical grid, and strategies will be needed to manage this additional load. Deploying advanced smart meters to PEV charging locations would allow utilities to more easily roll out these strategies when they are established or needed.
- PEV charging during off-peak periods is feasible for the majority of PEV charging needs and is beneficial to the utilities. Establishing PEV TOU rates can influence this behavior by financially incentivizing PEV owners to charge during off-peak and super off-peak periods; however, consideration should be taken to structure these so a demand spike is not created at the beginning of a super off-peak period when all PEV chargers could be programmed to start.
- Localized disruptions due to PEV charging can likely be prevented by enacting a formal process that notifies utilities of EVSE installations and triggers an examination of the current load on the impacted transformers to determine whether an upgrade is needed.
- There are many perceived pros and cons associated with utility ownership of EVSE. Two state commissions, California and Oregon, arrived at different conclusions when addressing this topic. If commissions are able to use existing processes to prevent utilities from inappropriately leveraging their positions to gain a competitive advantage over other EVSE service providers, action to prohibit utilities from owning and operating EVSE may not be necessary.
- While it is unclear whether utility rebates or grants are influential in expanding PEV and EVSE adoption, these incentives can be used by utilities to show their support for this technology or as opportunities to collect information on PEV and EVSE deployment and use.
- Utilities are a logical choice as entities to provide educational information on PEVs and EVSE. Utilities play key roles in powering this technology, and such activities can also be used to promote utility initiatives to minimize the impact of PEV charging on the grid.

- Leading or participating in state, regional, or national PEV working groups is an effective way for commissions and utilities to provide input on behalf of the electrical providers during policy and planning discussions, while also gaining valuable knowledge on the emerging technology and market associated with electrifying the transportation industry.
- Utilization of used PEV batteries on the grid for electrical storage, demand response, and V2G services are topics that will not likely affect utilities for some time, but these are important subjects to understand. The latest developments should be followed, as these technologies could significantly change how PEVs interact with or influence the electrical grid.

12. Appendix

Appendix A: Additional listing of residential tariffs exclusively for EVSE charging through a separate meter or submeter

Alaska Electric Light and Power Company Experimental Residential Off-Peak Electric Vehicle Charging¹¹¹

- Electric vehicle must be licensed to operate on the public road system and must be rated to have a driving range of at least 40 miles on one charge, available to ten (10) eligible residential customers.
- Company shall reimburse customer for up to \$1,000 of the actual installed cost of the customer-owned EVSE following compliance with rate requirements for one year.
- Off-peak charge (10 p.m.–7 a.m.): 5.8¢ per kWh (equal to peak season energy charge for demand metered residential customers without additional demand charges)
- On-peak charge (7 a.m.–10 p.m. peak season): 11.9¢ per kWh (equal to the energy charge for non-demand metered residential customers)
- On-peak charge (7 a.m.–10 p.m. off-peak season): 9.8¢ per kWh (equal to the energy charge for non-demand metered residential customers)

Detroit Edison (MI) Experimental Electric Vehicle Rate D1.9¹¹²

- Level 2 EVSE, low-speed electric vehicles including golf carts are not eligible, limited to 2,500 customers
- Option 1: Time-of-Day Pricing
 - o Service charge: \$1.95 per month (vs. \$19.00 for residential time-of-day rate)
 - o Off-peak: 7.7¢ per kWh (vs. 10.4¢ for summer residential time-of-day rate)
 - o On-peak: 18.2¢ per kWh (vs. 18.6¢ for summer residential time-of-day rate)
- Option 2: Monthly Flat Rate (limited to 250 customers)
 - o \$40.00 monthly flat rate

Hawaiian Electrical Company (HI) Residential EV Charging Service Pilot EV-R¹¹³

- Open to 1,000 customers for charging highway-capable electric vehicles with a battery capacity of 4kWh or more. The pilot will be in effect until 2013.
- Service charge: \$1.50 per month (vs. \$10.50 for single-phase service on residential TOU-R rate)¹¹⁴
- Off-peak charge (year-round): 11.1¢ per kWh (vs. 19.4¢ for residential TOU-R rate)
- On-peak charge (year-round): 19.8¢ per kWh (vs. 27.9¢ for residential TOU-R rate)

¹¹¹ Alaska Electric Light and Power Company, Experimental Residential Off-Peak Electric Vehicle Charging, Sheet 138-139, www.aelp.com/tariff/Schedule%20of%20Fees%20and%20Charges.pdf,

¹¹² The Detroit Edison Company, Electric Rate Book, www.dteenergy.com/pdfs/detroitEdisonTariff.pdf.

¹¹³ Hawaiian Electric Company, Schedule EV-R. www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECORatesEV-RPilot04-13-2011.pdf.

¹¹⁴ Hawaiian Electric Company, Schedule TOU-R. www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECORatesTOU-R.pdf.

Indiana Michigan Power (MI) Home Charging Station Incentive¹¹⁵

- The first 250 qualified plug-in electric vehicle owners in Michigan service area can receive \$2,500 to offset the cost of installing a home charging station.
- TOU rate¹¹⁶ can be applied to a separate meter for the EVSE while keeping the rest of the home on the standard electricity rate.
- On-peak charge: 22.6¢ per kWh (vs. 15.9¢ for residential RS rate)¹¹⁶
- Off-peak charge (9 p.m.–7 a.m.): 12.1¢ per kWh (vs. 15.9¢ for residential RS rate)

Indianapolis Power and Light Company (IN) Experimental Time-of-Use Service For EV Charging, Rate EVX¹¹⁷

- First 150 eligible customers receive utility-owned and -operated Level 2 EVSE
- Customer charge: \$0.00 per month (vs. \$6.70 for residential RTX TOU rate)¹¹⁸
- Off-peak charge (winter): 2.8¢ per kWh (vs. 2.9¢ for residential RTX TOU rate)
- Off-peak charge (summer): 2.3¢ per kWh (vs. 2.9¢ for residential RTX TOU rate)
- Mid-peak charge (summer): 5.5¢ per kWh (vs. 6.1¢ for residential RTX TOU rate)
- Peak charge (summer): 12.2¢ per kWh (vs. 8.8¢ for residential RTX TOU rate)

Los Angeles Department of Water & Power (CA) EV Time-of-Use Rate¹¹⁹

- 2.5¢ per kWh discount on the first 500 off-peak kWh per month (2.2¢ per kWh instead of 4.7¢ in the high season and 2.5¢ per kWh instead of 5.0¢ in the low season)

Northern Indiana Public Service Company (IN) IN-Charge Electric Vehicle Program¹²⁰

- Supplemental Environmental Project under the NIPSCO New Source Review NOV settlement. Three-year pilot program through January 31, 2015. Limited to the first 250 customers (free overnight charging will be offered after the full amount of financial incentives are gone, but limited to a \$250,000 cap on the total amount of fuel cost associated with free EV charging).
- \$1,650 per residential customer toward the purchase and installation of a Level 2 (240 V) electric charging station, including any required electric upgrades within a customer's home.
- Free charging during the night-time hours of 10 p.m. through 6 a.m. (charging outside of these hours will be billed at normal residential rates).

¹¹⁵ Indiana Michigan Power, Electric Vehicle Rates, Programs, and Incentives, www.indianamichiganpower.com/save/ElectricVehicles/incentives.aspx.

¹¹⁶ Indiana Michigan Power, Schedule of Tariffs, www.indianamichiganpower.com/global/utilities/lib/docs/ratesandtariffs/Michigan/IM_MI-TB-4-1-2013.pdf.

¹¹⁷ Indianapolis Power & Light Company, Rate EVX, www.iplpower.com/uploadedFiles/iplpowercom/Business/Programs_and_Services/Rate%20EVX%20effective%2001.19.11.pdf.

¹¹⁸ Indianapolis Power & Light Company, Rate RTX, www.iplpower.com/Our_Company/Rates/Residential_Rates/Residential_Rates/.

¹¹⁹ Los Angeles Department of Water & Power, EV Time-Of-Use Rate, www.ladwp.com/ladwp/faces/ladwp/residential/r-gogreen/r-gg-driveelectric/r-gg-de-evncentives?_adf.ctrl-state=1bnnfdyy9x_17&_afLoop=460487721737000.

¹²⁰ Northern Indiana Public Service Company, IN-Charge Electric Vehicle Program, www.nipsco.com/en/our-services/in-charge-ev/in-charge-at-home.aspx.

Pacific Power (OR) Separately Metered EV rate¹²¹

- Single-family residential consumers with electric vehicle charging installations where such service is supplied at a point of delivery separately metered from other residential service.
- Basic charge: \$9.00 per month
- Demand charge: \$2.20 per kW (same as residential service)
- Energy charge: 4.2¢ per kWh (same as residential service)

San Diego Gas and Electric (CA) EV Time-of-Use rate (EV-TOU)¹²²

- This PEV charging schedule has a fixed distribution charge independent of total energy use, whereas the standard residential DR-TOU schedule¹²³ has a tiered rate structure that increases with higher total energy usage.
- Super off-peak distribution charge (summer): 9.5¢ per kWh (vs. 7.9¢ - 20.7¢ for DR-TOU)
- Off-peak distribution charge (summer): 9.6¢ per kWh (vs. 7.9¢ - 20.7¢ for DR-TOU)
- On-peak distribution charge (summer): 9.8¢ per kWh (vs. 0 – 21.0¢ for DR-TOU)

Sacramento Municipal Utility District (CA) Residential Time-of-Use Electric Vehicle (RTEV) rate¹²⁴

- The system infrastructure fixed charge (\$10.00) is waived.
- This option requires installation of a time-of-use meter (a submeter to the premise's main meter), and a credit on the off-peak electricity usage charges will be provided as follows:
 - o 2.43¢ per kWh winter off-peak energy credit ¢/kWh
 - o 2.71¢ per kWh summer off-peak energy credit

¹²¹ Pacific Power, Separately Metered Electric Vehicle Service For Residential Consumers Delivery Service, www.pacificpower.net/content/dam/pacific_power/doc/About_Us/Rates_Regulation/Oregon/Approved_Tariffs/Rate_Schedules/Separately_Metered_Electric_Vehicle_Service_for_Residential_Consumers_Delivery_Service.pdf.

¹²² San Diego Gas & Electric Company, Schedule EV-TOU, http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_EV-TOU.pdf.

¹²³ San Diego Gas & Electric Company, Schedule DR-TOU, http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_DR-TOU.pdf.

¹²⁴ Sacramento Municipal Utility District. Residential Service Rate Schedule R. <http://www.smud.org/en/business/customer-service/rates-requirements-interconnection/documents/1-R.pdf>.

Appendix B: Additional listing of residential tariffs for entire households with EVSE (single meter)

Arizona Public Service Company (AZ) Experimental Rate Schedule ET-EV¹²⁵

- Experimental rate available until December 31, 2014. Neighborhood electric vehicles do not qualify.
- Super off-peak charge (summer): 4.2¢ per kWh (vs. 6.1¢ for residential Time Advantage)¹²⁶
- Off-peak charge (summer): 6.5¢ per kWh (vs. 6.1¢ for residential Time Advantage)
- On-peak charge (summer): 24.8¢ per kWh (vs. 24.5¢ for residential Time Advantage)

Georgia Power (GA) Plug-in Electric Vehicle Rate¹²⁷

- Super off-peak charge (year-round): 1.3¢ per kWh (vs. 4.6¢ for standard residential TOU)¹²⁸
- Off-peak charge (year-round): 6.1¢ per kWh (vs. 4.6¢ for standard residential TOU)
- On-peak charge (year-round): 20.3¢ per kWh (vs. 20.3¢ for standard residential TOU)

Hawaiian Electrical Company (HI) Residential EV Charging Service Pilot TOU EV¹²⁹

- Open to 1,000 customers for charging highway-capable electric vehicles with a battery capacity of 4 kWh or more. The pilot will be in effect until 2013.
- Service charge: \$9.50 per month (vs. \$10.50 for single-phase service on Residential TOU-R Rate)¹³⁰
- Off-peak charge (year-round): 11.9¢ per kWh (vs. 19.4¢ for residential TOU-R rate)
- Mid-peak charge (year-round): 19.9¢ per kWh (vs. 24.9¢ for residential TOU-R rate)
- Priority-peak charge (year-round): 22.9¢ per kWh (vs. 27.9¢ for residential TOU-R rate)

Kentucky Utilities Company (KY) Low-Emission Vehicle Service (LEV)¹³¹

- Three-year pilot program, restricted to 100 customers.
- Off-peak charge (year-round): 4.6¢ per kWh (vs. 7.0¢ for standard residential RS rate)¹³²
- Intermediate charge (year-round): 6.7¢ per kWh (vs. 7.0¢ for standard residential RS rate)
- Peak charge (year-round): 13.0¢ per kWh (vs. 7.0¢ for standard residential RS rate)

Los Angeles Department of Water & Power (CA) Residential Time-of-Use Rate with EV Discount¹³³

¹²⁵ Arizona Public Service Company, Experimental Rate Schedule ET-EV, www.aps.com/library/rates/ET-EV.pdf.

¹²⁶ Arizona Public Service Company. Residential Pricing Chart. www.aps.com/library/rates/ET-2.pdf.

¹²⁷ Georgia Power, Time Of Use – Plug-In Electric Vehicle Schedule: “TOU-PEV-3,” http://www.georgiapower.com/pricing/files/rates-and-schedules/2.30_tou-pev-3.pdf.

¹²⁸ Georgia Power, Time Of Use – Residential Energy Only Schedule: “TOU-REO-7,” http://www.georgiapower.com/pricing/files/rates-and-schedules/2.20_tou-reo-7.pdf.

¹²⁹ Hawaiian Electric Company, Schedule TOU EV, www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECORatesResidentialTOUEVPilot04-13-2011.pdf.

¹³⁰ Hawaiian Electric Company, Schedule TOU-R, www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tariffs/HECO/HECORatesTOU-R.pdf.

¹³¹ Kentucky Utilities Company, Standard Rate LEV – Low Emission Vehicle Service, www.lge-ku.com/ev/ku_lev_tariff.pdf.

¹³² Kentucky Utilities Company, Standard Rate RS – Residential Service, www.lge-ku.com/rsc/ku/kuelecrates.pdf.

- 2.5¢ per kWh discount on the first 500 off-peak kWh per month (2.2¢ per kWh instead of 4.7¢ in the high season and 2.5¢ per kWh instead of 5.0¢ in the low season)

Louisville Gas and Electric Company (KY) Low-Emission Vehicle Service (LEV)¹³⁴

- Three-year pilot program, restricted to 100 customers.
- Off-peak charge (year-round): 5.0¢ per kWh (vs. 7.2¢ for standard residential RS rate)¹³⁵
- Intermediate charge (year-round): 7.1¢ per kWh (vs. 7.2¢ for standard residential RS rate)
- Peak charge (year-round): 13.4¢ per kWh (vs. 7.2¢ for standard residential RS rate)

NV Energy (NV) Electric Vehicle Rate¹³⁶

- EV TOU rates apply to the entire house. If after the first 12-month period, a customer has spent more on the TOU rate than he or she would have spent on the standard rate, NV Energy will refund the difference and restore the customer to the standard rate (if he or she chooses).
- Northern Nevada EV Rate (July–September weekdays): \$9.83 basic service charge (per meter)
 - o EV rate (10 p.m.–6 a.m.): 5.6¢ per kWh (vs. 6.4¢ per kWh
 - o Off-peak (9 p.m.–10 p.m., 6 a.m.–10 a.m.): 6.4¢ per kWh
 - o Mid-peak (10 a.m.–1 p.m., 6 p.m.–9 p.m.): 20.7¢ per kWh
 - o On-peak (1 p.m.–6 p.m.): 39.1¢ per kWh
- Southern Nevada EV Rate A (June–September): \$11.30 basic service charge (per meter)
 - o EV rate (10 p.m.–6 a.m.): 6.4¢ per kWh
 - o Off-peak (7 p.m.–10 p.m., 6 a.m.–1 p.m.): 7.1¢ per kWh
 - o On-peak (1 p.m.–6 p.m.): 32.9¢ per kWh
- Southern Nevada EV Rate B (July–August): \$33.60 basic service charge (per meter)
 - o EV rate (10 p.m.–6 a.m.): 5.3¢ per kWh
 - o Off-peak (7 p.m.–10 p.m., 6 a.m.–2 p.m.): 5.9¢ per kWh
 - o On-peak (2 p.m.–6 p.m.): 50.1¢ per kWh

San Diego Gas and Electric (CA) EV Time-of-Use rate (EV-TOU-2)¹³⁷

- This PEV charging schedule has a fixed distribution charge independent of total energy use, whereas the standard residential DR-TOU schedule¹³⁸ has a tiered rate structure that increases with higher total energy usage.
- Super off-peak distribution charge (summer): 9.5¢ per kWh (vs. 7.9¢ - 20.7¢ for DR-TOU)
- Off-peak distribution charge (summer): 9.6¢ per kWh (vs. 7.9¢ - 20.7¢ for DR-TOU)
- On-peak distribution charge (summer): 9.8¢ per kWh (vs. 0 – 21.0¢ for DR-TOU)

¹³³ Los Angeles Department of Water & Power, EV Time-Of-Use Rate, www.ladwp.com/ladwp/faces/ladwp/residential/r-gogreen/r-gg-driveelectric/r-gg-de-evncentives?_afrctrl-state=1bnnfdyy9x_17&_afrcLoop=460487721737000,

¹³⁴ Louisville Gas and Electric Company, Standard Rate LEV - Low Emission Vehicle Service, www.lge-ku.com/ev/lge_lev_tariff.pdf,

¹³⁵ Louisville Gas and Electric Company, Standard Rate RS – Residential Service, www.lge-ku.com/rsc/lge/lgereselectric.pdf,

¹³⁶ NV Energy, Electric Vehicle Rate, www.nvenergy.com/home/saveenergy/electricVehicle.cfm#rate,

¹³⁷ San Diego Gas & Electric Company, Schedule EV-TOU, http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_EV-TOU.pdf,

¹³⁸ San Diego Gas & Electric Company, Schedule DR-TOU, http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_DR-TOU.pdf,