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Exhibit Number	:	
Commissioner	:	Carla J. Peterman
Admin. Law Judge	:	Irene Moosen
ORA Project Mgr.	:	Rajan Mutialu
ORA Witnesses		Anand Durvasula Jose Aliaga-Caro Rajan Mutialu Dan Willis

OFFICE OF RATEPAYER ADVOCATES
California Public Utilities Commission

PREPARED TESTIMONY ON THE APPLICATION OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902-E) FOR AUTHORITY TO IMPLEMENT A PILOT PROGRAM FOR ELECTRIC VEHICLE-GRID INTEGRATION

San Francisco, California
March 16, 2015

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California Center for Sustainable Energy (CCSE)

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Plug-In Electric Vehicle (PEV)

San Diego Gas and Electric and Company (SDG&E)

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Vehicle to Grid Integration (VGI)

Zero-Emission Miles (ZEM)

Zero-Emission Vehicles (ZEV)

EXECUTIVE SUMMARY

This testimony was prepared to examine San Diego Gas & Electric Company's (SDG&E) Vehicle Grid Integration (VGI) Pilot Program. SDG&E plans to install and own 5,500 Plug-In Vehicle charging stations at 550 sites, at a cost of $103 million, in Multi-unit Dwellings (MuDs) and workplaces in its service territory with the assumption that an increase in electric vehicle supply equipment (EVSE) will increase plug-in electric vehicle (PEV) adoption. The Office of Ratepayer Advocates (ORA) recommends that the Commission deny SDG&E's application and adopt ORA's Pilot Plan Framework outlined in Chapter 6. Furthermore, ORA recommends that the Commission require SDG&E to implement a pilot program consisting of 500 charging stations open to third party ownership.

Any EVSE infrastructure pilot approved by the Commission should be designed to test the assumption that an increase in EVSE infrastructure will result in an increase in PEV adoption. A lack of EVSE infrastructure may not be the only barrier to PEV adoption. A well-designed pilot should provide an insight into the extent that increased deployment of EVSE infrastructure results in increased PEV adoption, or if other barriers, such as PEV price or choice in PEV models, play a significant role. In order to achieve California's goal of getting 1.5 million PEVs on the roads by 2025, full-scale EVSE programs should incorporate lessons learned from pilot results. SDG&E's VGI Pilot Program is not designed to achieve this objective.

Based on ORA's assessment of SDG&E's application and ORA's testimony, ORA recommends that the Commission deny the application. Instead, the Commission should adopt ORA's proposed Pilot Plan Framework that will maximize information gathering and minimize ratepayer risk of stranded cost. If the Commission does not deny SDG&E's VGI Pilot Program application, then ORA recommends the Commission direct SDG&E to do the following:

- Allow SDG&E to only deploy the number of charging stations slated for the first year of the VGI Pilot Program—500 charging stations. This will provide the relevant data to enable the Commission to determine the appropriate level of EVSE infrastructure needed to bring 1.5 million PEVs to California by 2025.
- Restrict SDG&E's ownership of charging stations to 20% of the market —250 charging stations—leaving the remainder open to third-party participation.
- Adopt ORA's Pilot Plan Framework to aid in the development of future EVSE programs.

ORA's testimony is comprised of the following chapters:

Chapter Number	Description	Witness
1	Introduction—provides a brief synopsis of ORA's policy recommendations.	Rajan Mutialu
2	Determination of Size—discusses SDG&E's failure to provide a method for determining the size of its VGI Pilot Program.	Jose Aliaga-Caro
3	Anti-competitive Aspects of SDG&E's VGI Pilot Program—addresses how the design and structure of SDG&E's VGI Pilot Program grants it an unfair advantage in the EVSE market.	Anand Durvasula
4	Pilot Design and Implementation—discusses the need for SDG&E's VGI Pilot Plan to consider methods to examine how EVSE cost and access barriers may impact PEV adoption and EVSE utilization.	Rajan Mutialu
5	VGI Rate Design Issues	Dan Willis
6	ORA Pilot Plan Framework—details ORA's Pilot Plan Framework which describes the process for developing EVSE pilots in order to inform full scale, well planned programs.	Rajan Mutialu

CHAPTER 1. INTRODUCTION

Sponsored by Rajan Mutialu

On April 11, 2014 SDG&E filed an "Application for Authority to Implement a Pilot Program for Electric Vehicle-Grid Integration" (VGI Pilot Program) with supporting testimony. The ORA recommends the Commission deny SDG&E's application and adopt ORA's recommendation for the development of utility PEV pilot plans discussed in Chapter 6.

SDG&E plans to install and own 5,500 Plug-In Vehicle charging stations at 550 sites at MuDs and workplaces[1] in its service territory. The estimated cost is $103 million: $59 million in capital costs and $44 million in operations and maintenance (O&M). The entire program will be ratepayer funded. SDG&E plans to implement the program over 10 years and collect the costs in rates until 2037—12 years after the program ends. The Commission should deny SDG&E's application because the VGI Pilot Program's scope, cost and duration more closely resembles a fully developed utility program than an experimental pilot. In addition, SDG&E's application fails to detail a plan to measure the pilot's effect on EVSE[2]-related market barriers to PEV adoption and use at MuD and workplace locations. Approval of SDG&E's application would burden ratepayers with the costs of a large scale PEV infrastructure deployment without first making an effort to establish a framework to measure its success or failure is unreasonable.

[1] "The term "workplace" is made up of several private location types, such as fleet, large commercial, municipalities, small business; any private location where EVs will be parked for several hours during the day and stay plugged-in for EV charging." Prepared Direct Testimony of Randy Schimka, Chapter 2, A. 14-04-014, p. 4.

[2] The term "EVSE" refers to any off-board equipment used to supply energy to charge the vehicle. The complexity of different EVSE technologies varies widely, as does the price. EVSE can be as simple as an outlet, but may also include a cord and station mounted to a pole, wall, or pedestal. They may serve one or several vehicles at a given time.

ORA recommends that the Commission deny this application and instead adopt ORA's proposed Pilot Plan Framework. ORA's proposal outlines a viable alternative to SDG&E's VGI Pilot Program because it:

- Create a working group that will establish the parameters of an PEV pilot that can be leveraged to implement an effective full-scale PEV program;
- Is based on data from prior PEV pilot studies;
- Works with PEV charging station hosts to reduce barriers;
- Includes a least-cost engineering study;
- Systematically selects sites to promote PEV adoption; and,
- Bases full-scale PEV infrastructure deployment on data gathered from the pilot.

CHAPTER 2. DETERMINATION OF SIZE

Sponsored by Jose Aliaga-Caro

I. INTRODUCTION

The electric vehicle market is still in its nascent stages of development. No single business model has yet been adopted for deployment of PEV charging infrastructure.[3] Nationally, electric industry regulators and utilities are in the process of developing policies and practices to adapt to the developing electric vehicle and the charging infrastructure markets.[4] Therefore, before approving of SDG&E's proposed large-scale program, the Commission should carefully examine the potential that SDG&E's VGI Pilot Program may create stranded assets should PEV technology develop to the point where a large scale charging infrastructure is not required. ORA recommends that the Commission reject SDG&E's VGI Pilot Program as proposed, adopt ORA's proposed Pilot Framework as discussed in Chapter 6 to design a new pilot program, and require SDG&E to implement a pilot program consisting of 500 charging stations open to third party ownership.

II. THE SIZE OF SDG&E's PILOT PROGRAM SHOULD BE REDUCED

SDG&E's VGI Pilot Program proposes to build 5,500 charging stations in MuDs and workplaces. Additionally, SDG&E proposes that ratepayers fund the entire VGI Pilot Program. ORA recommends that SDG&E's VGI Pilot Program be rejected because there is no significant evidence that increasing the number of charging stations at workplace and MuD locations will increase PEV adoption. An effective pilot program should inform the Commission about the effect of

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[3] Jones, Kevin, and Zoppo David. *A Smarter, Greener Grid.* Santa Barbara: Praeger, 2014. Print. (110).

[4] Id.

EVSE deployment in MuD and workplace host locations has on PEV ownership and EVSE utilization. SDG&E's pilot fails to test SDG&E's assertion that increasing the number of charging stations in workplace locations and MuDs will increase PEV adoption. The size of the pilot should be evaluated based on both the current and future need for charging stations, considering advances in technology and other factors—besides increasing the number of charging stations—that may affect PEV ownership. SDG&E's VGI Pilot Program size should also be consistent with prior Commission approved pilots and not entail a full-scale roll out of IOU-owned EVSE before providing evidence that an increase in PEV charging stations will indeed increase PEV adoption. This would ensure the effective expenditure of ratepayer funds.

A. SDG&E's VGI Pilot Program does not Consider Other Factors That may Affect the Size of PEV Charging Infrastructure

SDG&E's claim that "MuD and workplace siting has great potential to increase EV ownership"[5] is unsubstantiated. SDG&E has not provided significant evidence that an increase in PEV infrastructure size, specifically at workplaces, will encourage PEV adoption. SDG&E relies on *one* survey[6] consisting of *only* 34 respondents, all of whom are SDG&E employees. This limited survey of one workplace location, one type of business, and similar participants cannot be generalized into the broader public scope.

Increasing the number of workplace and MuD charging stations may not necessarily result in greater PEV sales. Although the concept that an increase in charging stations has increased PEV adoption is supported by findings from limited PEV charging infrastructure projects at locations such as at Google[7] and

[5] A.14-04-014, p. 2.

[6] Prepared Direct Testimony of Randy Schimka, Chapter 2, A. 14-04-014, p. B3.

[7] SCE states "This mentality has proven itself for businesses like Google, which has expanded

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some hotels,[8] other factors may play a role in increasing PEV adoption. A study[9] on the socio-economic factors on PEV adoption analyzed PEV adoption in various countries and found that charging infrastructure was correlated to PEV adoption levels but cautioned that there is no guarantee that the relationship would hold for all countries. In fact, in some countries there was a weak correlation between charging infrastructure and PEV market share. For example, the study showed that Austria, Sweden and the United States had comparable PEV market shares (percent of annual car sales) but the charging infrastructure (per 100,000 residents) in Austria was six times as much as that of the United States, and in Sweden it was twice as much. The study also showed that other countries, such as Ireland and Denmark, with six times as many charging infrastructure (per 100,000 residents) as the United States, had PEV market shares smaller than the United States.

In the study referenced above, Sierzchula et al. mentions factors other than charging infrastructure that may affect PEV ownership.[10] The high purchase price of a PEV, the limited battery capacity and the long charging period[11,12] are factors that have been identified as discouraging PEV adoption. The cost of purchasing a PEV is considered to be the greatest barrier. A survey showed that for 46.3% of

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from an initially oversized installation of 100 charging ports for workplace charging needs in 2011 to over 880 charging ports today because of a surge in ownership." *Southern California Edison Company's Comments on Assigned Commissioner's Scoping Memo and Ruling,* filed on August 29, 2014 under *the Order Instituting Rulemaking to consider Alternative-Fueled Vehicle Programs, Tariffs, and Policies* (R.13-11-0078). p. 12.

[8] A September 2014 news article states that some consumers are choosing their hotels based on if the hotel offers an EV charger (http://www.greenlodgingnews.com/electric-vehicle-charging--if-you-build-it-they-will).

[9] Sierzchula, W., Bakker, S., Maat, K., and van Wee, B. "The influence of financial incentives and other social-economic factors on electric vehicle adoption." *Energy Policy* 68 (3014) 183-194.

[10] Id.

[11] Id.

[12] Availability of charging stations has also been identified as a factor.

survey respondents, PEV cost was the main barrier.[13] The price of a PEV can range from $26,000 for a Chevrolet Volt to $105,000 for a Tesla Model S,[14] putting a PEV beyond the reach of many persons living in California where the per capita income is $29, 527.[15] Of the remaining survey respondents 27.5% expressed range anxiety as a primary barrier, for 21.3% it was concern about access to charging infrastructure, and for 5% it was charging time.

Increasing the availability of workplace charging may not be the most effective way to increase PEV adoption because drivers may prefer to charge their vehicles at home. For example, a report by the EV Project states that 87% of charging events initiated by Chevrolet Volt drivers were at home while 13% occurred away from home during the course of a 15 month study.[16] Another report by the EV Project that included participants with access to both work and home charging found only "14% of vehicles needed workplace charging to complete their daily commutes most of the time, 43% of vehicles needed it some of the time."[17] This finding implies that away-from-home (including workplace) charging may not be required and supports smaller pilot projects at workplaces.

A smaller workplace and MuD pilot project is capable of providing the necessary statistical data to support the hypothesis that workplace and MuD siting of charging stations will increase PEV ownership. A smaller pilot could also be

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[13] Slavin, M.I. "Drivers and Barriers to Electric Vehicle Adoption." *EV World.* http://evworld.com/article.cfm?storyid=2076&first=3078&end=3077.

[14] Tesla Model S Buyer's Guide. Car and Driver Car Reviews. http://www.caranddriver.com/tesla/model-s

[15] United States Census Bureau (http://quickfacts.census.gov/qfd/states/06000.html)

[16] "What Kind of Charging Infrastructure Do Chevrolet Volt Drivers in the EV Project Use and When Do They Use It?" October 2014. Idaho National Laboratory. EV project. http://avt.inl.gov/pdf/EVProj/VoltHomeAwayL1L2DayNightCharging.pdf

[17] "Charging and Driving Behavior of Nissan Leaf Drivers in the EV Project with Access to Workplace Charging" (November 2014) http://avt.inl.gov/pdf/EVProj/WorkplaceChargingandDriving-Leaf.pdf

used to investigate other factors that affect PEV adoption as "there is little research that uses empirical data to analyze factors affecting PEV adoption rates."[18] A smaller pilot would also give the Commission a means to evaluate and identify the appropriate ratepayer funded mechanism to site EVSEs and thereby minimize the risk of low EVSE utilization and associated stranded assets that are ratepayer funded.[19]

B. Other Technological Advances may Reduce the Need for Large Scale Workplace Infrastructure

SDG&E asserts that its proposed large number of PEV charging stations is intended to relieve PEV drivers' range anxiety,[20] increase PEV adoption and increase Zero-Emission Miles (ZEM) driven.[21]

Although range anxiety could be a barrier to PEV adoption[22] researchers are working on a number of new technologies that will increase battery capacity and extend PEVs driving range. Increased battery capacity would decrease range anxiety and may reduce the need for a large scale workplace charging infrastructure. SDG&E's VGI Pilot Program does not consider how these

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[18] Sierzchula, W., Bakker, S., Maat, K., and van Wee, B. "The influence of financial incentives and other social-economic factors on electric vehicle adoption." *Energy Policy* 68 (3014) 183-194.

[19] For example, as of January 4, 2015, it already has been reported that there are unused charging stations due to improper siting in Springfield, Oregon. (http://registerguard.com/rg/news/local/32533942-75/story.csp).

[20] "Range anxiety" is defined as a PEV driver's worry about having insufficient driving range in their electric vehicle to reach their destination and become stranded without access to charging stations. See Neubauer, J., E. Wood. (2014). "The Impact of Range Anxiety and Home, Workplace, and Public Charging Infrastructure on Simulated Battery Electric Vehicle Lifetime Utility." *Journal of Power Sources* 257(0): 12-20.

[21] A.14-04-014, p. 2.

[22] A study by the EV Project concluded that "workplace charging is valuable as a range extender for drivers who live far from work, as well as drivers who sometimes need additional driving range beyond their typical commute." "Charging and Driving Behavior of Nissan Leaf Drivers in the EV Project with Access to Workplace Charging" (November 2014) http://avt.inl.gov/pdf/EVProj/WorkplaceChargingandDriving-Leaf.pdf.

advances in technology could change the PEV charging market, charging station deployment, or the size of infrastructure needed to meet the Governor's goal of 1.5 million PEVs on California's roads by 2025. If SDG&E is allowed to deploy 5,500 charging stations in the proposed 5-year timeframe, then some of the charging stations may end up underutilized if range extender technologies mature in the near future, which would result in stranded costs. Any infrastructure deployment at workplaces should be evaluated on a small scale to adapt to evolving technology and avoid stranded assets.

The main limitation to a PEV's driving range is battery technology. Lithium-ion (Li-ion) batteries are the most common battery technology used in PEVs[23] today. Li-ion batteries currently hold more than twice as much energy by weight compared to those in 1991.[24] These batteries provide PEVs with a driving range of up to 100 miles[25, 26] per charge (with the exception of Tesla's Model S vehicle, which has a range of 300 miles per charge but comes at a hefty price to the consumer). Although the energy density[27] of Li-ion batteries has increased almost linearly since their inception in the early 1990s, these batteries are nearing their capacity limit. Figure 2-1 shows the Li-ion energy density growth throughout the years and the future forecast. The Li-ion battery energy density has increased from around 100 Watt-hour per kilogram (W-h/kg) in 1991 and is expected to reach its limit of around 325 W-h/kg by 2018.

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[23] Texas River Cities Plug-In Electric Vehicle Initiative Regional Plan and Final Report. Texas River Cities Plug-In Electric Vehicle Initiative. https://www1.eere.energy.gov/cleancities/pdfs/texas_river_cities_readiness_plan.pdf

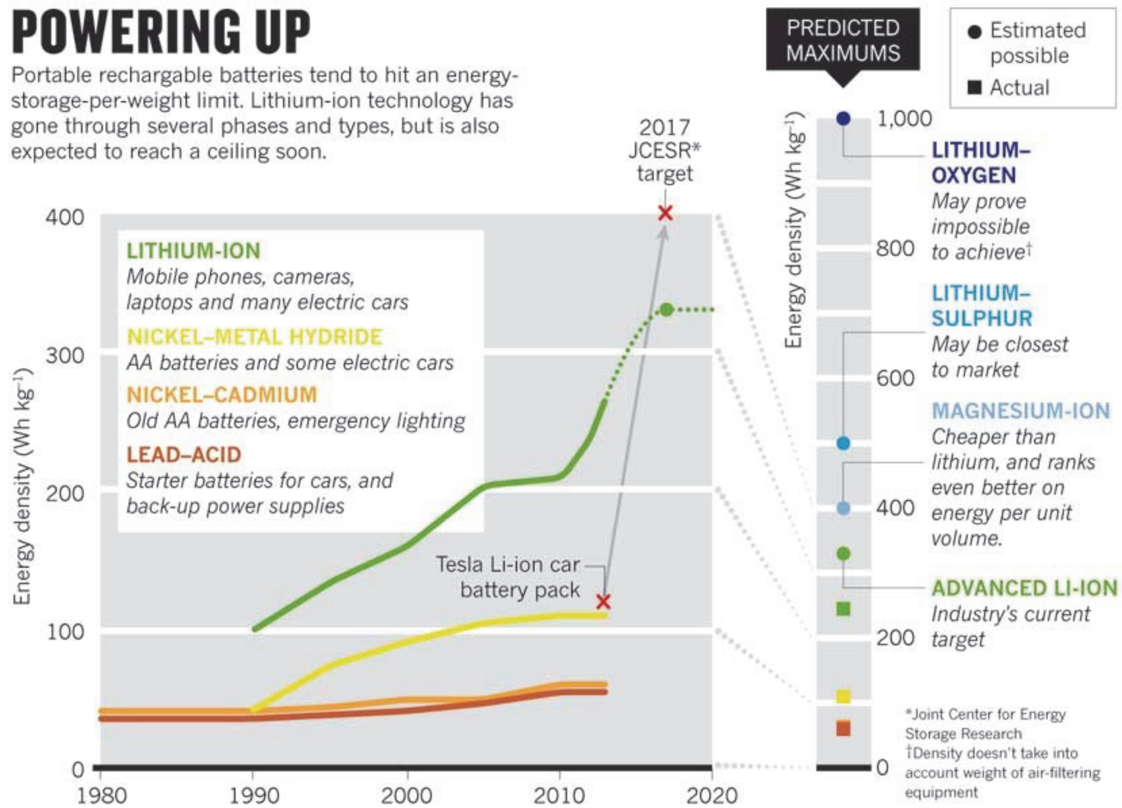
[24] Van Noorden, R. "The Rechargeable Revolution: A Better Battery." Nature, International Weekly Journal of Science. March 05, 2014. http://www.nature.com/news/the-rechargeable-revolution-a-better-battery-1.14815.

[25] http://www.solarjourneyusa.com/EVdistanceAnalysis4.php.

[26] Low or high temperatures will affect battery performance and driving range.

[27] Energy density is an indicator of an EV's driving range and is expressed in watt-hours per kilogram (W-h/kg).

Figure 2-1:[28] The energy density is increasing for Li-ion batteries but it has a limit of approximately 325 W-h/kg.



A number of new technologies that may increase driving range have been reported in the news, such as Aluminum-Air (Al-O) batteries.[29] In March 2013, it was reported that an Al-O battery could allow a vehicle to travel 1,000 miles.[30] In June 2014, an electric car featuring this battery system made its track debut at

[28] Source: C.-X. Zu & H. Li *Energy Environ. Sci.* 4, 2614–2624 (2011)/Avicenne. Obtained from http://www.nature.com/news/the-rechargeable-revolution-a-better-battery-1.14815.
[29] Hruska, J. "New Aluminum Air Battery Could Blow Past Lithium-Ion, Runs on Water." *Extreme Tech*. January 28, 2015. http://www.extremetech.com/extreme/198462-new-aluminum-air-battery-could-blow-past-lithium-ion-be-refilled-with-water.
[30] Brown, N. "Aluminum-Air Battery Can Power EVs for 1000 Miles." Clean Technica. March 26, 2013. http://cleantechnica.com/2013/03/26/aluminum-air-battery-can-power-evs-for-1000-miles/.

Montreal's Circuit Gilles-Villeneuve.[31,32] The battery is promoted as a "supporting technology," that is, a back-up battery. The battery cannot be recharged and would only be used in the event the main battery ran out of charge. The battery is replaceable and depending on driver use, it may only need to be replaced once a year. Spent batteries could be replaced during "quick operations" at local service stations. The companies developing this battery, Phinergy and Alcoa, are discussing a demonstration project involving a small fleet of vehicles using this technology in Quebec, Canada.[33] If this technology is proven reliable, it could alter the PEV market and serve to alleviate "range anxiety" and the need for a large PEV workplace charging infrastructure.

Lithium-Sulfur (Li-S) batteries have also been in the news. Li-S batteries can theoretically store five times more energy than the Li-ion battery and at a lower cost but researchers suspect it will only store twice as much energy in real-life applications—a researcher predicts that a commercial-sized cell could achieve an energy density of around 500 W-h/kg.[34] But the life cycle of Li-S batteries is short and therefore presents a barrier toward its commercialization.[35] As of 2012,

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[31] MacKenzie, A. "Electric Test Car with Aluminum-Air Battery Takes to the Track." Gizmag.com, June 29, 2014. http://www.gizmag.com/aluminium-air-battery-could-extend-ev-range-by-1000-km/32454/.

[32] The Circuit Gilles Villeneuve is a motor racing circuit in Montreal, Quebec, Canada.

[33] "Electric Car with Massive Range in Demo by Phinergy, Alcoa: Aluminum-Air Battery Uses Air and Water to Release Stored Electricity." *CBC News*. June 04, 2014. http://www.cbc.ca/news/technology/electric-car-with-massive-range-in-demo-by-phinergy-alcoa-1.2664653.

[34] Van Noorden, R. "The Rechargeable Revolution: A Better Battery." *Nature, International Weekly Journal of Science*. March 05, 2014. http://www.nature.com/news/the-rechargeable-revolution-a-better-battery-1.14815.

[35] Yang, Y. Yu, Guihua, Cha, J.J., Wu, H., Vosgueritchian, M., Yao, Y., Bao, Z., and Cui, Y. "Improving the Performance of Lithium-Sulfur Batteries by Conductive Polymer Coating," *ACS Nano*, 5(11), 9187-9193.

research showed that the previous determination that the life cycle of Li-S batteries was poor may have been flawed due to experimental methods.[36]

Two companies, Oxis Energy in Abingdon, UK, partnering with Lotus Engineering in Ann Arbor, Michigan, are working on a project to develop a PEV Li-S battery with an energy density of 400 W-h/kg by 2016.[37,38,39] This is a much higher energy density than what is currently offered by Li-ion batteries. If Li-S batteries, with energy densities of around 400 W-h/kg, can be developed by 2016 and be on the market shortly thereafter, then the driving range of PEVs could nearly double. In this scenario, the need for a large-sized PEV workplace infrastructure may not be required.

Research on Lithium-Air (Li-O) batteries could potentially increase PEVs driving range. As of 2011, Li-O batteries were still in the development stage[40] but the Li-O battery is attractive because it can, "in theory, store energy as densely as a petrol engine – more than ten times better than today's car battery packs."[41] For example, theoretically, a 200 kilogram Li-O battery pack could enable a car to have a driving range of close to 400 miles, whereas a Li-ion battery pack of the

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[36] Shwartz, M. "Scientists Observe Lithium-Sulfur Batteries in Action." *Stanford, Precourt Institute for Energy*. July 18, 2012. https://energy.stanford.edu/news/scientists-observe-lithium-sulfur-batteries-action.

[37] "Li-S Battery Company OXIS Energy receives 2014 European Frost & Sullivan Award for Technology Innovation." *GreenCarCongress.com*. December 08, 2014. http://www.greencarcongress.com/2014/12/20141208-oxis.html.

[38] "OXIS Energy Teams Up with Industry Leaders to Attract Technology Strategy Board Funding." September 04, 2013. Press Release. http://www.oxisenergy.com/blog/oxis-energy-teams-up-with-industry-leaders-to-attract-technology-strategy.

[39] Sigler, D. "400 Watt-Hours per Kilogram by 2014." November 11, 2014. *blog.cafefoundation.org*. http://blog.cafefoundation.org/400-watt-hours-per-kilogram-2014/.

[40] Kraytsberg, A. and Ein-Eli, Y., "Review of Li-air batteries—Opportunities, limitations and perspective." *Journal of Power Sources* 196 (2011) 886-893.

[41] Van Noorden, R. "The Rechargeable Revolution: A Better Battery." Nature, International Weekly Journal of Science. March 05, 2014. http://www.nature.com/news/the-rechargeable-revolution-a-better-battery-1.14815.

same weight could enable a car to have only a driving range of about 80 miles.[42] Li-O batteries today do have shortcomings—battery capacity is lost after each cycle of recharge, decreasing the battery's lifetime.[43],[44] Scientists anticipate that this type of battery will be studied for a few more years until this problem can be eliminated. Although this technology is not feasible at the moment, one must consider its implications for improving a PEV's driving range and decreasing the need for large PEV charging infrastructure should it prove feasible in the future.

Battery capacity and technology continue to improve. As SDG&E commented "both the PEV and PEV fueling services markets are in their early stages of development."[45] In such a young market, it would be premature to build a large scale workplace infrastructure based only on today's information and technology, especially before fully evaluating the need for it. With increased battery capacity in the future, PEV drivers may ultimately be able to obtain their necessary PEV charge at home and not require workplace charging. If PEV drivers are able to obtain their necessary PEV charge at home due to the rapid change in technology and new innovations, large-scale PEV workplace charging infrastructure is at risk of being underutilized. If the EVSE assets have been rate-based the ratepayers will continue to pay for them even if they are underutilized and/or obsolete or stranded. The Commission should be mindful of the dynamic nature of PEV-related research and adopt a smaller pilot before authorizing ratepayer funds for large-scale PEV workplace charging infrastructure.

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[42] Christensen, J., Albertus, P., Sanchez-Carrera, R.S., Lohmann, T., Kozinsky, B., Liedtke, R., Ahmed, J., and Kojic, A. "A Critical Review of Li/Air Batteries." *Journal of the Electrochemical Society*, 159 (2) R1-R30 (2012).

[43] Id.

[44] Kraytsberg, A., Ein-Eli, Y., "Review on Li-air batteries—Opportunities, limitations and perspective." *Journal of Power Sources* 196 (2011) 886-893.

[45] Prepared Supplemental Testimony of San Diego Gas & Electric Company, A. 14-04-014, p. ST-19.

C. The Size of SDG&E's Pilot is far Larger Than the Size of Other PEV Charging Infrastructure Pilots in the United States

SDG&E's VGI Pilot Program objective, to "test how EV charging customers can be encouraged (through pricing) to charge at a grid-friendly time of the day, while accommodating EV charging customers' needs,"[46] may be met by implementing smaller scale pilots. Under the U.S. Department of Energy's (DOE) Smart Grid Investment Grant program, six utilities in the United States evaluated operations and customer charging behavior for in-home and public electric vehicle charging stations.[47] The results gave the utilities insight into the demand growth and peak-period charging habits that can be anticipated once PEV adoption increases. These pilots were much smaller than SDG&E's proposed VGI Pilot Program. For example, Duke Energy's (North Carolina) pilot consisted of 282 charging stations. The charging station evaluation objectives included analyzing load profile data to determine grid impacts and achieve a better understanding of future infrastructure needs as PEV adoption grows. Similarly, Indianapolis Power and Light Company's pilot consisted of 170 charging stations. That pilot's objectives were to gain insights into the potential impacts on the distribution system, testing new equipment, customer response to time-based rates, determining customer acceptance of electric vehicles and alleviation of "range anxiety" when depending on public charging.

Other pilots designed to increase PEV adoption are also significantly smaller than SDG&E's proposed pilot. For example: (1) SCE's Charge Ready and Market Education Program pilot intends to deploy 1,500 charging stations,[48] and

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[46] Prepared Direct Testimony of Randy Schimka of SDG&E A. 14-04-014, Chapter 2, p. RS-4.

[47] "Evaluating Electric Vehicle Charging Impacts and Customer Charging Behaviors – Experience from Six Smart Grid Investment Grant Projects" Smart Grid Investment Grant Program, December 2014. U.S. Department of Energy.

[48] A.14-10-014.

(2) Kansas City Power and Light Co. (KCPLC)[49] plans to build three to five charging stations at 225 locations.[50] At most, this would amount to 1,125 charging stations. KCPLC is looking to sell more kilowatt-hours and to maximize the use of the existing grid.

One of the major lessons learned from the DOE program was to "(i)nitially install a small number of chargers as demonstrations, and evaluate their use to justify larger deployments."[51] The program's report also recommended "conduct(ing) smaller, in-house process and field tests prior to full field implementation, perhaps using employees." SDG&E has conducted a smaller in-house process at its own facilities which showed positive results. SDG&E states that about 67% of SDG&E employees who own or lease a PEV said the presence of workplace charging influenced their buying or leasing of a PEV. Of those, 41% (14 respondents) said Workplace Charging influenced their PEV purchase decision significantly and 32% said Workplace Charging had some influence.[52] But this was a limited pilot at one business site. SDG&E should conduct small-scale pilots at workplaces (other than SDG&E's) and MuDs to determine if increased charging stations will increase PEV adoption. The findings obtained from these efforts will then lay the foundation for larger projects (if warranted) and help ensure that ratepayer dollars are spent prudently and effectively.

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[49] KCPLC is a unit of Great Plains Energy Inc. with more than 800,000 customers in western Missouri and eastern Kansas.

[50] "In Kansas City, utility bets big on EV charging network." *Energy Wire*. January 29, 2015. http://www.midwestenergynews.com/2015/01/29/in-kansas-city-utility-bets-big-on-ev-charging-network/

[51] "Evaluating Electric Vehicle Charging Impacts and Customer Charging Behaviors – Experience from Six Smart Grid Investment Grant Projects" Smart Grid Investment Grant Program, December 2014. U.S. Department of Energy. p. 17

[52] Prepared Direct Testimony of Randy Schimka, Chapter 2, A. 14-04-014, p. B3.

D. The Size and Cost of SDG&E's Pilot is far Larger Than the Size and Cost of Past Commission-Approved Pilots

SDG&E's proposed pilot is larger than other pilots the Commission has approved. In the past, the Commission has approved small-scale pilots in order to test assumptions and the efficacy of certain technologies before approving of full-scale programs. This principle should be applied in this case as well. The Commission should not allow a pilot costing $103 million to be implemented before testing the hypothesis that workplace and MuD siting of charging stations will increase PEV adoption. This hypothesis could be tested with a smaller pilot.

For example, the Submetering Pilot Program adopted in D.13-11-002 consists of only 500 participants for each of the Investor Owned Utility (IOU) (SCE, SDG&E and PG&E) pilots.[53] SCE's 2012-2014 workplace pilot program only included 233 charging stations.[54] The cost of SDG&E's proposed VGI Pilot Program, $103 million, is also much greater than the cost of other pilot programs that the Commission has previously approved. For example, 1) the Submetering Pilot Program cost between $3 million to $4.7 million;[55] 2) PG&E's Demand Response (DR) Pilot Plan, which proposed to use PEVs as DR resources, cost approximately $2.5 million over the course of three years (2013 to 2015);[56] and 3) SCE's workplace PEV pilot program had an estimated cost of $1.2 million for the years (2012 to 2014).[57] The costs associated with SDG&E's proposed VGI Pilot

[53] Alternative Fuels Vehicles Proceeding (R.09-08-009)

[54] SCE AL 2746-E, filed January 2013.

[55] D.13-11-002 requires the utilities to recover the majority of costs of the submetering pilot program through the Electric Program Investment Charge (EPIC) program. It also authorized the utilities to establish memorandum accounts to track the costs related to the submetering pilots. EPIC funding for the submetering pilots will be subtracted from these memorandum accounts. If the EPIC budgets are not sufficient to provide recovery of pilot related costs, the utilities may seek to recover the memorandum account costs up to $2 million per utility in excess of EPIC funding.

[56] PG&E AL 4077-E, filed June 2012.

[57] SCE AL 2746-E, filed January 2013.

Program are on par with a full scale program. Ratepayers should not be asked to bear the costs of a full scale program without first testing via much smaller pilots the hypothesis that an increase in workplace and MuD charging stations will accelerate PEV ownership.

E. The Costs Associated With SDG&E's VGI Pilot Program far Exceed the Costs Associated With Other PEV Pilot ProgramsP

To further accelerate the adoption of EVs, the California Energy Commission (CEC) has provided $40 million in its Alternative and Renewable Fuel and Vehicle Technology (ARFVT) Program funding for electric vehicle charging stations.[58] A majority of charging stations funded by previous awards constitute residential charging infrastructure.[59] In November 2014, the CEC released a new solicitation for charging infrastructure that includes up to $6 million in funding available from FY 2012-2013, plus an opportunity for additional funds.[60] This funding solicitation had such a strong interest that the funding was increased to more than $13 million.[61] SDG&E's pilot cost of $103 million is more than twice as much as the total $40 million CEC has spent. Without data showing that an increase in PEV charging stations will increase PEV adoption, this level of ratepayer funding should not be permitted.

The costs of the other PEV pilot programs discussed in Section C of this Chapter are significantly less than the cost of SDG&E's VGI Pilot Program. The Phase 1 Pilot for SCE's proposed Charge Ready and Market Education Programs

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[58] 2014-2015 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program. California Energy Commission. January 2015.

[59] Id.

[60] Id.

[61] Id.

has an estimated cost of $22 million. The Kansas City Power and Light Company project has an estimated cost of $20 million.[62]

F. The Size of SDG&E's Pilot is Inconsistent With the Purpose of a Pilot

By definition, a pilot study is a "small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict an appropriate sample size to improve upon the study design prior to performance of a full-scale research project."[63] Pilots are carried out before large-scale equipment or service program implementations to avoid unnecessary costs and delays of an inadequately designed project. The pilot study can give advance warning of weaknesses in a proposed study, inform feasibility, and identify modifications needed in the design of the larger study.[64,65] A pilot is a "version of the main study that is run in miniature to test whether the components of the main study can all work together."[66] Thus, SDG&E's proposed pilot for 5,500 stations does not fit the definition of a pilot. It more clearly resembles a full scale business model which is inappropriate when risking ratepayer money. The size of SDG&E's VGI Pilot Program can be greatly reduced while testing whether an increase in charging stations will increase PEV adoption rates.

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[62] "In Kansas City, utility bets big on EV charging network." *Energy Wire*. January 29, 2015. http://www.midwestenergynews.com/2015/01/29/in-kansas-city-utility-bets-big-on-ev-charging-network/

[63] Hulley, Stephen B. *Designing Clinical Research*. Lippincott Williams & Wilkins, 2007, p.168-169.

[64] Conducting Pilot Studies. Excerpts adapted from: Simon, M.K. (2011). Dissertation and scholarly research: Recipes for success (2011 ed.) Seattle, WA: Dissertation Success, LLC.

[65] Leon, A.C., Davis, L.L., and Kraemer, H.C. "The Role and Interpretation of Pilot Studies in Clinical Research." *Journal of Psychiatry Res*. 2011 May; 45(5): 626-629.

[66] Arain, M., Campbell, M.J., Cooper, C.L. and Lancaster, G.A "What is a pilot or feasibility study? A review of current practice and editorial policy." *BMC Medical Research Methodology* 2010, 10:67 Downloaded from: http://www.biomedcentral.com/content/pdf/1471-2288-10-67.pdf

III. ORA's RECOMMENDATIONS ON PILOT SIZE FOR SDG&E's VGI PILOT PROGRAM

If the Commission decides to approve SDG&E's VGI Pilot Program, ORA recommends that the size of the program should be significantly reduced. The goals of SDG&E's VGI Pilot Program are to:

- Examine and measure VGI benefits;[67]
- Promote PEV driver "range confidence;"
- Increase demand for PEV charging stations;
- Increase zero emission miles driven per PEV; and
- Increase PEV cost savings with a time-variant rate for the purchase of electricity;

A reduced pilot size can adequately measure how siting of charging stations at MuDs and workplaces will meet these goals without undue risk to ratepayers of stranded costs. The development of a variety of study questions can elucidate how these individual goals have been met in a given program. As noted in Section C above, many smaller pilots have been used to effectively achieve the intended program objectives.

Further, SDG&E claims "the (VGI) Pilot Program should serve to accelerate PEV adoption rates, particularly among segments of the community that do not have access to single family residential charging."[68] The VGI Pilot Program should determine if expanded installation of workplace or MuD charging stations will indeed increase PEV adoption rates. A reduced pilot size will also meet this goal. A reduced VGI Pilot Program size will also expedite the collection and analysis of data to inform a smarter, educated roll out of PEV infrastructure. It will also justify spending ratepayer money on larger programs by providing a

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[67] Application of SDG&E for Authority to Implement a Pilot Program for Electric Vehicle-Grid Integration, A. 14-04-014, p. 1.

[68] Prepared Supplemental Testimony of San Diego Gas & Electric Company, A. 14-04-014, p. ST-12.

quantitative basis for this effort. Without proven results or any evidence that this investment in charging stations will incent purchase of PEVs, ratepayers should not subsidize the "pilot" as proposed by SDG&E at this time which costs $103 million.

Therefore, should the Commission decide to move forward with SDG&E's application, ORA recommends that SDG&E be authorized by the Commission to only implement Year One of its VGI Pilot Program of 500 charging stations at a cost of $7.7 million. This will allow SDG&E the opportunity to collect, analyze, and report data related to PEV adoption which can then be used to design a larger roll out for Commission approval. ORA's Pilot Design Framework from Chapter 6 should also be adopted to create a process to re-design SDG&E's Year One implementation.

SDG&E's VGI Pilot Program, which proposes the deployment of 5,500 charging stations, is on par with a full-scale business model.[69] Generally, 10% of the number of items to be deployed in a full-scale program is the recommended size for a pilot.[70] With this guidance, the appropriate VGI Pilot Program size should represent approximately 10% of 5,500 chargers which amounts to 550 charging stations. This estimate is almost equivalent to SDG&E's proposed first year VGI Pilot Program roll-out of 500 charging stations. This number of charging stations is also within the same order of magnitude as other PEV pilot studies conducted. The first year deployment costs in SDG&E's VGI Pilot Plan application is $7.7 million. Additionally, to prevent the development of an anti-competitive[71] market (owning 500 charging stations would give SDG&E a 41%[72]

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[69] *Joint Assigned Commissioner and Administrative Law Judge's Scoping Memo and Consolidating Ruling*. A.14-04-014 and R. 13-11-007 Consolidated. p. 3-4.

[70] Conducting Pilot Studies. Excerpts adapted from: Simon, M.K. (2011). Dissertation and scholarly research: Recipes for success (2011 ed.) Seattle, WA: Dissertation Success, LLC.

[71] The anti-competiveness aspect of SDG&E's VGI Pilot Program is discussed in Chapter 3

market share), SDG&E's ownership of charging stations should be restricted to 20% of the market share—250[73] charging stations—leaving the remainder open to third-party participation. Installation of charging stations should not be biased towards SDG&E-owned charging stations as this will give SDG&E an unfair advantage in the EVSE market. ORA recommends that the SDG&E-owned charging stations (kiosks, pedestals, chargers and charging equipment) be shareholder funded to prevent anti-competitive impacts on the EVSE market as discussed in Chapter 3.

Alternatively, if the Commission wants to only adopt an SDG&E-owned pilot model, ORA recommends SDG&E should be authorized to install and own only 200 charging stations. If SDG&E intends to own a PEV charging station market share of 20%[74] by 2025, and will not to compete with third party businesses, SDG&E should be required to only deploy enough charging stations to give it 20% of today's market;[75] this number is roughly 183[76] charging stations or 200 charging stations rounded up. This number is also comparable to what has been done in past Commission approved pilots. As mentioned above, ORA

(continued from previous page)

[72] This number is calculated by dividing 500 charging stations by the total number of charging stations after pilot implementation. There are currently around 730 non-single family charging stations currently in place in SDG&E's service territory. (Supplemental Testimony, ST-26). Therefore, after installation, there would be 500 plus 730 charging stations, or 1230 charging stations.

Therefore: 500 / (730 + 500) = 0.407

[73] Actual number has been rounded up. 20% of the market share would actually be 246 charging stations.

[74] Prepared Supplemental Testimony of San Diego Gas & Electric Company, A. 14-04-014, p. ST-31.

[75] In this context, the market includes the number of charging stations after SDG&E Pilot deployment.

[76] This number is calculated by: Let X equal the number of SDG&E-owned charging stations, then X divided by the total number of charging stations in SDG&E's territory (after SDG&E deployment) equals the percent market share. There are currently around 730 non-single family charging stations currently in place in SDG&E's service territory. (Supplemental Testimony, ST-26).

Therefore: X / (730 + X) = 0.20

Solving for X results in X = 182.5 or 183 charging stations.

recommends that the SDG&E-owned charging stations (kiosks, pedestals, chargers and charging equipment) be shareholder funded.

ORA proposes that the Commission and stakeholders evaluate how lessons learned from SDG&E's Year 1 VGI Pilot Program will inform the design and implementation of a full-scale rollout of EVSEs. This will be further discussed in Chapter 6.

CHAPTER 3. ANTI-COMPETITIVE ASPECTS OF SDG&E'S VGI PILOT PROGRAM

Sponsored by Anand Durvasula

I. INTRODUCTION

Decision (D.) 14-12-079 states that the Commission will examine the potential competitive impacts of any proposed utility program as part of a balancing test intended to weigh the benefits of utility ownership of PEV fueling infrastructure against the potential competitive limitation associated with that ownership.[77] ORA recommends that the Commission reject the ownership structure proposed in SDG&E's VGI Pilot Program because, taken together, the ownership structure proposed by SDG&E, the size of the pilot program and the inherent utility advantages that SDG&E possess are likely to have a significant anti-competitive impact on the nascent EVSE market.

II. The SIZE OF SDG&E's VGI PILOT PROGRAM GRANTS SDG&E AN UNFAIR ADVANTAGE IN THE EVSP MARKET THAT MAY LEADTO AN ANTI-COMPETITIVE MATKET

The size of the VGI Pilot Program may give SDG&E an unfair advantage in the EVSP market, rendering the market anti-competitive. If the Commission approves SDG&E's proposal to own 5,500 charging stations, then SDG&E may become the dominant EVSP in its entire service territory in what is still a nascent PEV charging station market. Three facets of the proposed VGI Pilot Program — size, funding source, and ownership and rates—will give SDG&E an unfair market advantage over third-party EVSPs. These VGI Pilot Program features may allow SDG&E to overwhelm the market with SDG&E's own charging stations.

[77] D. 14-12-079, pp 5-8.

SDG&E proposes to install and own 5,500 charging stations located at 550 sites. The number of sites is nearly equal to twice the current number of non-single family residential installations in the SDG&E territory—charging stations have been installed at 239 sites in the SDG&E territory as of September 2014.[78] The 5,500 charging stations is also more than seven times the number of non-single family charging stations currently in service in the SDG&E territory—there are 701 non-single family charging stations in the SDG&E territory as of September 2014.

SDG&E claims that 5,500 charging stations "would be approximately 20% of the market in 2025"[79] and thus the VGI Pilot Program will not have a detrimental impact on competition in the future EVSE market as the remaining 80 percent of charging stations would be third party-owned. However, owning 5,500 charging stations would give SDG&E 88 percent of today's market. SDG&E's assertion is based on a projection that 28,000 charging stations will be needed in its service territory to meet the Governor's 1.5 million zero-emission vehicles goal. However, SDG&E cannot accurately project what number of charging stations will comprise 20% of the 2025 market. Thus, this argument that SDG&E's VGI Pilot Program would not constitute an unfair advantage in the EVSE market has no merit.

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[78] Data downloaded from U.S. DOE AFDC Data download tools retrieved on September 20, 2014 from http://www.afdc.energy.gov/data_download. Utility territories were determined using the geographic coordinates in the U.S. DOE dataset and the CEC utility territory shape profile provided on request. AFDC dataset is biased toward commercial or other large scale EVSE deployment and does not represent access to charging at residence that did not require a major infrastructure upgrade or commercial EVSE deployment.

[79] Prepared Supplemental Testimony of San Diego Gas & Electric Company, A. 14-04-014, p. ST-31

III. RATEPAYER FINANCING OF VGI PILOT PROGRAM GRANTS SDG&E AN UNFAIR ADVANTAGE IN THE EVSP MARKET THAT MAY LEAD TO AN ANTI-COMPETITIVE MARKET

The Commission recognized that SDG&E's Application is "on par with a full program business model, rather than an initial, research-oriented test project."[80] The cost of the charging station (kiosks, pedestals, chargers and charging equipment replacement) amounts to $66.6 million over the life of the program. This is 64.8% of the total cost ($103 million) of SDG&E's pilot. Essentially, SDG&E is asking ratepayers to fund an independent business owned by SDG&E that will compete with EVSPs that own charging stations.

Ratepayer financing of its charging stations gives SDG&E an unfair advantage in the EVSP business market because other privately owned businesses do not have ratepayer funding to start a large scale EVSP business and to compete with SDG&E's proposed 5,500 charging stations. SDG&E's proposed pilot has already halted at least one company's business in the SDG&E service territory. PowerTree Services, a company that owns and operates a multi-unit dwelling-based PEV charging network, has a financing commitment to build almost $300 million worth of PEV infrastructure in the state of California.[81] PowerTree's financial investors advised it to cease deployment in the SDG&E service territory until a decision is made in the VGI Pilot Program application--"in no uncertain terms…we [PowerTree] cannot go into the San Diego or even do premarket development in San Diego until this issue is resolved…because we will wind up going into a market monopoly provider that we have to buy from with a severe disadvantage and rate uncertainty on the part of our financers."[82]

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[80] *Joint Assigned Commissioner and Administrative Law Judge's Scoping Memo and Consolidating Ruling*. A.14-04-014 and R. 13-11-007 Consolidated. p. 3, 4.

[81] *Application of San Diego Gas & Electric Company (U902E) for Approval of its Electric Vehicle-Grid Integration Pilot Program Prehearing Conference Transcript*. A.14-04-014. August 13, 2014. p. 61.

[82] Id. at 61-62.

In M. Lee (Radio Paging Co.), the Commission stated "(t)here can be no doubt that competition is a relevant factor in weighing the public interest."[83] Thus the Commission must consider the anti-competitive aspects of SDG&E's application. SDG&E acknowledged that although Pub. Util. Code Section 240.3 requires the Commission to "'ensure that the utilities do not unfairly compete with nonutility enterprises,' it does not prevent the utilities from competing at all."[84] Fair competition in this case could be achieved by SDG&E investing shareholder dollars into the VGI Pilot Program to recover charging station costs (i.e. kiosk, pedestal and charger). SDG&E notes that "PEV fueling services in California have benefited from federal and/or state assistance that subsidizes the cost of PEV fueling infrastructure in the market…SDG&E's proposal to spread VGI Pilot Program costs over all ratepayers is functionally similar to using the kinds of grants or other forms of subsidies that have benefited PEV fueling infrastructure to date in the market.[and that] SDG&E's plan would allow it to operate in a similar manner as other providers that have benefited" from such subsidies.[85] This analogy is not correct because the subsidies have not funded any one business, allowing it to own 20% of the market by 2025, or based on current deployment, roughly 88% of the market today.

Additionally, SDG&E proposes to own the distribution infrastructure and charging station and offer its customers a unique time-variant rate. The VGI day-ahead rate is only available to SDG&E customers—individuals that are not SDG&E electric customers will be unable to use the charging stations. This amounts to a vertically integrated structure. ORA proposes, in Chapter 5, that the VGI Pilot Program should be redesigned to allow the VGI rates to be passed onto the third-party owners and ultimately to PEV owners. An article on EVSP

[83] M. Lee (Radio Paging Co.) (1966) 65 Cal. P.U.C. 635, 640 and fn.1.

[84] Prepared Supplemental Testimony of San Diego Gas & Electric Company, A. 14-04-014, p. ST-8

[85] Id. at ST-36.

markets distortions states that "in pursuit of market dominance, EVSP networks have created subscriber services and have vertically integrated and branded charging stations with network services."[86] According to this description, SDG&E is placing itself in a position of market dominance as it plans to own all PEV infrastructure and charging stations deployed in the VGI Pilot Program and offer its VGI rate only to its electric customers.

IV. SDG&E's Inherent Advantages as an Incumbent Utility Could Stifle the Development of the EVSE Market

Given their historic role in producing and distributing electricity, utilities possess a number of inherent advantages over third-party companies in providing PEV charging infrastructure. SDG&E controls the location, operation and maintenance of the infrastructure that comprises the distribution system in its service territory and therefore will likely have access to information on prime charging locations. This existing knowledge of distribution capacity and the impact that incremental loads will have on local and system load conditions gives SDG&E an advantage in expediting site assessment over nonutility enterprises, which in turn manifests itself as a competitive advantage with regards to interconnection costs and time.

SDG&E possesses another inherent utility advantage: its pre-existing relationship with millions of captive customers, which endows SDG&E with superior name and brand recognition that can be leveraged to advertise new services through website and bill insert capabilities, the cost of which would be covered by ratepayers. Furthermore, SDG&E's role in interconnecting PEV charging stations to the distribution system, coupled with access to customers' billing infrastructure, ensures that SDG&E would be the first point of contact for all customers interested in PEV services. Beyond being the first point of contact

[86] Matute, J. and Peterson, D. "Electric Vehicle Service Provider Networks and Market Distortions." EVS26 International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium. Los Angeles, California, May 6—9, 2012.

for interested PEV customers, SDG&E's role in interconnecting PEV charging stations to the distribution system would also provide SDG&E with greater access to confidential customer information that could be useful in proposing EVSE installation to current and potential PEV customers.

Finally, and perhaps most important among the inherent advantages SDG&E possesses as an incumbent utility, is the ability to attain cost recovery from ratepayers for investments in EVSE infrastructure, thereby eliminating risk. This ability, coupled with guaranteed revenues from other electricity sales and costs recovery from general rate cases, could be leveraged to provide a competitive advantage, as SDG&E could rely on resources currently funded in rates such as customer outreach, contract development, cost estimation, engineering, procurement and construction oversight, and operations and maintenance.

D. 14-12-079 states that "[i]f the potential for the utility to unfairly compete is identified, the commission will determine if rules, conditions or regulatory protections are needed to effectively mitigate the anti-competitive impacts."[87] SDG&E's use of ratepayer dollars to recover costs of investments in the EVSE market constitutes a competitive advantage that cannot be effectively mitigated by a combination of rules, conditions or regulatory protections because third-party EVSE firms would have difficulty competing with a publicly subsidized entity.[88] Many third-party providers believe they could provide cheaper and more efficient EVSE service. These firms stress that a competitive marketplace will foster innovation and high-quality service.[89] For these reasons, the ownership model that SDG&E presents in its VGI Pilot Program is anti-competitive and may ultimately

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[87] D. 14-12-079, p. 9.

[88] Jones, Kevin, and Zoppo David. *A Smarter, Greener Grid*. Santa Barbara: Praeger, 2014. Print. (115).

[89] http://www.fhwa.dot.gov/environment/climate_change/mitigation/publications_and_tools/pev_action_plan/page03.cfm#ednref30

frustrate the innovation that private, independent third-party EVSE firms could bring to the nascent EVSE marketplace.

V. SDG&E'S OWNERSHIP OF EVSE INFRASTRUCTURE COULD RESULT IN LIMITS ON CUSTOMER CHOICE OF EVSE PRODUCTS AND SERVICES

The ownership structure in SDG&E's VGI Pilot Program has the potential to crowd out third-party EVSE firms resulting in limits on customer choice on EVSE products and services. Under SDG&E's pilot model, SDG&E's PEV charging stations will be completely financed by ratepayers. Third party EVSE firms, on the other hand, must raise funds to compete. If, as in PowerTree's case discussed above, these funds are not available, third-party EVSE firms may not be able to compete in locations in SDG&E's service territory where they may have previously contemplated operating. In such locations, SDG&E could conceivably become the sole EVSE provider, which could potentially limit consumer choice and reduce the likelihood that new business models and innovations -- that could ultimately lower the total cost of PEV ownership and hasten adoption -- would be introduced.[90] SDG&E's ownership of 5,500 charging stations in the San Diego area would create a formidable barrier to third parties who wish to enter the EVSE business and could create an anti-competitive market. Not only does SDG&E's VGI Pilot Program create a major disincentive for third parties to provide EVSE charging stations infrastructure in the San Diego area, it could discourage prospective customers from purchasing PEVs by eliminating more competitive supply of EVSEs to the market. The Commission has stated "there can be no doubt that competition is a relevant factor in weighing the public interest,"[91] and customer choice is an essential component of competition.[92]

[90] Jones, Kevin, and Zoppo David. *A Smarter, Greener Grid*. Santa Barbara: Praeger, 2014. Print. (115).

[91] M. Lee (Radio Paging Co.) (1966) 65 Cal. P.U.C. 635, 640 and fn.1.

[92] Giulietti, Monica, Catherine Waddams Price, and Michael Waterson. "Consumer Choice and Competition Policy: A Study of UK Energy Markets." *The Economic Journal* 115.506 (2005): 949-968.

The Commission should reject SDG&E's VGI Pilot Program because the size of the program, coupled with ratepayer financing of the program, create unfair advantages, beyond the inherent advantages that SDG&E possesses as an incumbent utility, that are likely to lead to an anti-competitive PEV market.

CHAPTER 4. PILOT DESIGN AND IMPLEMENTATION

Sponsored by Rajan Mutialu

I. INTRODUCTION

ORA recommends that all IOUs that wish to deploy Commission-approved EVSE pilots develop an EVSE Pilot Plan Study. Although SDG&E has proposed to utilize site selection criteria[93] to screen potential MuD and workplace host locations and implement a Research Plan that measures the cost-effectiveness of the VGI Pilot Program.[94] ORA recommends the development of an EVSE Pilot Plan Study to examine the ability of different EVSE ownership models to address EVSE cost and access barriers.[95] This assessment would entail the use of performance metrics (e.g., PEV charging sessions/day, kilowatt-hour (kWh)/charger or station, kilowatt (kW)/time of day (on-peak, off-peak, shoulder periods)) to identify relative effectiveness of various ownership models to alleviate these barriers and efficiently incent PEV adoption and EVSE utilization.

II. BACKGROUND

In D. 11-07-029 issued on July 14, 2011, the Commission stated that it would revisit its prohibition on utility ownership of electric vehicle service equipment (EVSE) if the utility presented evidence of underserved[96] markets or market failures[97]

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[93] Prepared Direct Testimony of Randy Schimka, Chapter 2, p.6

[94] Revised Prepared Testimony of J.C. Martin , Chapter 6, p.35

[95] A recent study suggests that firms wishing to deploy charging stations face a "steep learning curve". However, EVSPs "possess specific knowledge regarding (charging station installation) and have lower learning costs for installations. (from "Electric Vehicle Service Provider Networks and Market Distortions", submitted at EVS26 International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium pg. 3) http://innovation.luskin.ucla.edu/sites/default/files/Final%20Networks%20Paper_Matute_Peterson.pdf

[96] "Underserved markets" are generally defined as markets in which the demand for products or services has outpaced the provision of those goods and services.

[97] A "market failure" is a scenario in which supply and demand of goods or services is not optimal or efficient.

that non-utility entities could not resolve.[98] Thus, SDG&E's VGI Pilot Program targets electric vehicle charging infrastructure (EVSE) installation at multi-unit dwellings (MuDs) and workplace[99] host facilities, or markets deemed to be underserved. SDG&E's strategy was centered on three observations. First, SDG&E claimed that potential PEV customers could benefit from MuD PEV charging stations since approximately 50 percent of residential housing units in greater San Diego are MuDs.[100] Second, SDG&E pointed to results from the February 2014 California Center for Sustainable Energy (CCSE) Plug-In Electric Vehicle (PEV) Driver Survey that, of responding drivers, 88 percent of PEV drivers live in single-family detached homes and 93 percent own their own homes.[101] Third, SDG&E states that 46 percent of CCSE PEV Driver Survey respondents indicated they had access to workplace charging. Based upon these observations, SDG&E concluded that prospective PEV customers who could benefit from MuD and workplace PEV charging sites might be currently underserved.

In D.14-12-079 issued on December 18, 2014, the Commission decided that the impact of IOU EVSE ownership on PEV market competition should be evaluated on a case-by-case basis.[102] The Commission also clarified that "given the early stage of current PEV market development it may well be premature to reasonably assess "market failures" or whether "underserved markets" exist when the electric vehicle market is relatively new."

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[98] D. 11-07-029 p. 50.

[99] The term "workplace", as defined by SDG&E, is composed of several private location types, such as fleet, large commercial, municipalities, small business; any private location where EVs will be parked for several hours during the day and stay plugged-in for EV charging. SDG&E VGI Pilot Plan Application, Chapter 2 at RS-4.

[100] Application of SDG&E for Authority to Implement a Pilot Program for Electric Vehicle-Grid Integration, A. 14-04-014, p. 2.

[101] Id.

[102] D-14-12-079 Ordering Paragraph 2, p.12.

SDG&E's VGI Pilot Program was filed on April 11, 2014 – after D. 11-07-029 was adopted and before D. 14-12-079 was adopted – and targets "underserved markets." It is also the first application subject to a case-by-case utility ownership test.[103]

Based on its direction in D. 14-12-079, the Commission will not evaluate SDG&E's VGI Pilot Program based on market failures or underserved markets.[104] But SDG&E attributes additional benefits to MuD and workplace EVSEs. According to SDG&E, MuD and workplace charging sites offer around-the-clock opportunities for grid-integrated charging, due to long parking durations at these sites.[105] To better understand workplace PEV charging behavior, SDG&E studied fleet/employee utilization of alternating current (AC) Level 1 and 2 units and direct current (DC) Fast Charging Station.[106] SDG&E found that roughly 67% of SDG&E employees who own or lease a PEV indicate that access to workplace charging influenced PEV purchase or leasing decisions.[107] In addition, 79% of this cohort stated that the presence of workplace charging would increase weekly PEV mileage.[108] According to SDG&E, these findings lend support to its decision to target MuD and workplace EVSEs in the VGI Pilot Program.

SDG&E also asserted that its VGI Pilot Program had great potential to expand PEV ownership and zero emission miles driven per PEV and created an avenue to study the nexus between grid-integrated charging benefits and MuD and workplace siting. In addition, SDG&E claimed the VGI Pilot Program would spur increased

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[103] D.14-12-079, p. 5.

[104] D. 14-12-079 p.6.

[105] Prepared Direct Testimony of Randy Schimka, Chapter 2, p.6.

[106] Based on Society of Automotive Engineers (SAE) terminology, 240 volt AC charging is known as Level 2 charging, and 500 volt DC high-current charging is known as DC Fast Charge. Level 1 charging takes approximately 12+ hours to charge a PEV and Level 2 charging takes 4-8 hours to charge a PEV.

[107] Prepared Direct Testimony of Randy Schimka, Chapter 2, p.6.

[108] Id.

opportunity and business growth for companies that provide support services to PEV customers.[109]

III. SDG&E SHOULD CONSIDER ADDITIONAL METHODS TO OBTAIN DATA FOR ITS VGI PILOT PROGRAM RESEARCH PLAN

In revised testimony filed on January 14, 2015, SDG&E states that IOU ownership of PEV charging infrastructure should increase the market demand for fueling services and create additional opportunities for other service providers.[110] However, SDG&E later claims that the VGI Pilot Program does not propose to examine other "commercial factors that would be associated with a larger scale program launch."[111] SDG&E's testimony observes several barriers to EVSE investment in MuDs including landlord/tenant ownership issues, access to dedicated parking, difficulty of installation, and prioritization of other facility investment needs."[112] Then, SDG&E states that it will rely upon existing customer relations channels with agencies, local government parties (LGPs), trade associations and planning councils to engage potential VGI Pilot Program customers.[113] When these customer participants are identified, SDG&E intends to evaluate a number of EVSE related barriers including PEV demand, EVSE site conditions, and land ownership, and other issues prior to selecting EVSE host locations.[114] Finally, SDG&E outlines a Research Plan that entails collection and analysis of data over a 10 year period in the following performance metric categories:

- VGI installation and operating costs;

[109] SDG&E VGI Application Testimony at p. 2.

[110] SDG&E Supplemental Testimony, p. ST-12.

[111] SDG&E Supplemental Testimony, p. ST-46.

[112] SDG&E Supplemental Testimony, p. ST-48.

[113] SDG&E Chapter 2, p. RS-7.

[114] Prepared Direct Testimony of Randy Schimka, Chapter 2, p.7

- Charging load profiles (metered data for MuD and workplace locations, in aggregate and by circuit);
- Estimated percent of PEV purchases related to the VGI Pilot Program (gathered through surveys of PEV customers using the VGI facilities);
- Estimated VGI Pilot Program-related increases in ZEV miles traveled (gathered through surveys of PEV customers using the VGI facilities);
- PEV customer input on the VGI mobile and web applications, the VGI rate and overall convenience and ease of use of the VGI facility (gathered through surveys of PEV customers using the VGI facilities);
- PEV charging at home compared to PEV charging at work (gathered through SDG&E VGI billing data); and
- EV-TOU (time of use) or EV-TOU2 adoption increases attributed to the VGI Pilot.[115]

SDG&E's proposed metrics should be used to assess the cost-effectiveness of the VGI Pilot Program. However, alternative methods to obtain data for cost-effectiveness-related analyses must be considered. For example, the percentage of PEV purchases related to the VGI Pilot Program could also be obtained from MuD property owners. Low Carbon Fuel Standard (LCFS) PEV rebate credits that are issued to new PEV owners may be used to track PEV customers that reside or work at VGI Pilot Program host locations. In addition, VGI metered data might be used to identify if new PEV customers have initiated charging sessions. ORA also recommends that the VGI Pilot Program measure PEV customer utilization of VGI mobile and web applications to initiate and curtail PEV charging sessions. Aside from

[115] Revised Prepared Direct Testimony of J.C. Martin on Behalf of San Diego Gas & Electric Company Chapter 6, JCM-36.

obtaining PEV customer feedback through surveys, the Commission should consider measuring the effectiveness of VGI mobile and web applications via VGI software metrics. For example, the respective frequencies of PEV customer visits to VGI mobile and web applications and PEV customer use of VGI rates per MuD or workplace host location and in aggregate can be used to track customer engagement in the VGI Pilot Program. These strategies will provide the most robust and accurate data to develop effective EVSE pilots.

IV. SDG&E SHOULD ASSESS BARRIERS TOMuD AND WORKPLACE CUSTOMER INTEREST IN AND ELIGIBILITY FOR THE VGI PILOT PROGRAM

Based upon findings from the San Diego PEV Readiness Plan, EVSE installation in MuDs can pose a number of challenges.[116] For example, EVSE installation costs can vary based upon their distance from an electrical panel. In addition, variation in parking space availability and assignment can also present difficulties for where and how EVSEs should be installed. If PEV drivers live in homeowner's associations (HOA), the HOA board must approve the EVSE installation. The San Diego PEV Readiness Plan, which was developed by the San Diego Regional Electric Vehicle Infrastructure Working Group[117] and included SDG&E as a participant, provides options for alleviating these barriers.[118] In addition, SDG&E has also provided direction to employers and property owners regarding how to tackle EVSE barriers in MuD and workplace host locations.[119]

Despite its familiarity with mitigating EVSE barriers in MuD and workplace host locations, SDG&E has not detailed how it will measure or report the VGI Pilot

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[116] San Diego Regional Plug-In Electric Vehicle Readiness Plan p. 27. http://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-diego/Appendix_9.23.13%20RPCv2.pdf

[117] Id.

[118] San Diego Regional Plug-In Electric Vehicle Readiness Plan, Appendix B, pg. 8.

[119] http://www.sdge.com/clean-energy/business/employers-and-property-owners

Program's success or failure in alleviating these barriers. If the VGI Pilot Program does not result in a sufficient number of EVSE installations or significant use of EVSE at MuDs and workplaces, then SDG&E should examine the factors leading to this result. For example, if the Commission decides to test different ownership models (i.e. EVSE ownership by SDG&E, EVSPs, or non-single family home owner or property managers) within the VGI Pilot Program, either some or all of the EVSE barriers that SDG&E identified could prevent EVSE utilization. For example, EVSEs may not be deployed at potential host locations due to MuD or workplace owner concerns that they will become stranded assets. Some issues, related to MuD or workplace PEV owner access to EVSE infrastructure, are not related to EVSE ownership but could impact EVSE utilization and should also be examined. For example, electric vehicle supply and demand variables (e.g, PEV price and rebates) may also impact PEV adoption and subsequently EVSE utilization.[120]

Even though obtaining information regarding EVSE-related marketing barriers is critical, SDG&E's testimony does not indicate that data regarding their potential impact on EVSE deployment and use will be collected and analyzed. Lessons learned from this assessment will be critical for informing a future full-scale rollout of PEVs in SDG&E's service territory.

Thus, ORA recommends that the Commission direct the utilities to participate in a coalition in which PEV market stakeholders (i.e. relevant government agencies (CPUC, CEC, CARB), electric vehicle service providers (EVSPs), the CAISO, commercial property management associations and automobile manufacturers) are invited to develop a process to measure how EVSE-related market barriers affected customer interest in SDG&E's VGI Pilot Program and their ensuing charging behavior (EVSE Pilot Plan Study). The EVSE Pilot Plan Study should identify:

- PEV market demand;

[120] "How California Can Get Electric Vehicle Adoption Back on Track" Greentech Media January 21, 2015 http://www.greentechmedia.com/articles/read/how-california-can-get-electric-vehicle-adoption-back-on-track

- Prime locations for EVSE deployment (e.g., overlay PEV market demand and MuD and workplace housing stock maps to identify where EVSE deployment would not occur but for the VGI Pilot Program;
- Property owner EVSE barriers and solutions to alleviate these barriers;
- Least cost estimates for EVSE installation based upon a customer's PEV charging needs and desire to obtain benefits from future participation in the CAISO markets;
- Performance metrics to identify the link between EVSE deployment and PEV adoption and EVSE utilization; and
- Lessons learned that can be used for future EVSE deployment

Prior EVSE studies, as referenced in Chapter 2, should be consulted to inform how these EVSE Pilot Plan Study questions should be answered. Findings from the EVSE Pilot Plan Study should be vetted by the Commission prior to approval of future EVSE pilots. In addition, this EVSE Pilot Plan Study should apply to subsequent IOU pilot plans filed with the Commission to maintain consistency across IOU service territories. The following section provides a brief description of EVSE-related market barrier categories that should be considered in this assessment.

A. Excessive PEV Charger and Charger Infrastructure Costs

PEV charger and charger-infrastructure costs may be a barrier to PEV adoption and could explain the lower PEV adoption rate among MuD residents. Costs range from as low as $30 for a single Level 1 outlet[121] to $80,000 for a 20kW fast charger.[122] While either end of this range is extreme, most studies cite price ranges from several

[121] For example, see the Leviton Guide Light GFCI Receptacle – a photo-sensor controlled wall outlet. http://www.pluginamerica.org/accessories/leviton-guide-light-gfci-receptacle

[122] The Kanematsu Ultra Fast charger is equipped with battery storage, which provides 160kW "burst charging" while limiting input charging to 20kW. http://www.pluginamerica.org/accessories/kanematsu-ultra-fast

hundred to several thousand dollars.[123] If SDG&E's proposed VGI Pilot Program is approved, then ratepayers will pay for PEV charger costs. However, if the Commission allows ownership of PEV chargers by EVSPs within the scope of the VGI Pilot Program, the extent to which direct or indirect (i.e. costs that are passed through to VGI Pilot Program customers through EVSP service agreements) PEV charger costs may impact EVSE utilization should be examined.

ORA recommends that an EVSE Pilot Plan Study evaluate the impact that charger costs may have on MuD property owner or employer interest in the VGI Pilot Program. Customer survey data obtained from prior pilot studies should inform how EVSE cost and access barriers can be eliminated. If this data is not readily available or applicable, customer surveys should be developed and distributed during SDG&E or EVSP Marketing, Education, and Outreach (ME&O) activities. This process could shed light on how EVSE cost barriers may or may not have been alleviated.

Another important piece of information that should be obtained from surveys is the customer's (e.g., MuD or workplace property owners or managers) ability to fund varying levels of customer-side EVSE infrastructure, including the charging kiosk. For example, SDG&E proposes that at least 10 charging stations must be installed at each MuD or workplace host location. If prospective customers do not wish to enroll in the VGI Pilot Program, information must be obtained regarding their level of interest (e.g., Are customer-participants comfortable with 8 instead of 10 PEV charging stations?). Obtaining customer survey data on this metric will inform future full-scale rollout of EVSE infrastructure at MuDs and workplaces.

[123] Plug-in Recharge: Residential Level 2 Roundup: http://www.pluginrecharge.com/2011/08/residential-evse-roundup.html

B. EXCESSIVE MAKE-READY INFRASTRUCURE COSTS

PEV charging at MuD or workplace host locations requires make-ready infrastructure.[124] Make-ready project costs include subsurface remediation, if required, as well as labor, equipment (i.e. line extensions from the meter through conduit to the PEV charging kiosk, electrical panel upgrades, etc.), or other work required to finish the installation. Labor and construction related to the installation of PEV charging infrastructure can drive up costs significantly. Some studies show that labor required to install the electrical wiring to the EVSE can cost as much as the actual EVSE itself.[125] In its VGI Pilot Program cost estimates, SDG&E includes, with each new electric service, a pad mounted meter pedestal and breaker panel with a new meter, all the necessary trenching, conduit, wire, and connectors from the transformer to the new meter pedestal, and a refill/repair of the trench. This work will be the responsibility of SDG&E.[126]

ORA recommends that the EVSE Pilot Plan Study examine the impact of make-ready costs on customer enrollment in the VGI Pilot Program. In addition, ORA proposes that SDG&E or a third-party conduct an engineering study to develop a least-cost estimate in order to provide a benchmark cost for required make-ready infrastructure. MuD or workplace host location owners or property managers that wish to participate in the VGI Pilot Program can use this least-cost estimate to determine if EVSE ownership or leasing is feasible. If high costs for make ready infrastructure prevent MuD owners or workplace site hosts from participating in the VGI Pilot Plan, ORA recommends that the EVSE Working Group suggest measures to

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[124] Make-ready infrastructure includes one or more service drops, panels and junction boxes, as well as electrical conduit, transformers, metering and electrical wiring which can support at least one VGI-integrated EVSE. Cost components could include adequate building wiring electrical capacity upgrades, distance between the electrical service access point and the desired charging site and other construction requirements, and transformer and/or service capacity serving the community.

[125] SF Bay Area Air Quality Management District (BAQMD) (2013). *SF BAAQMD EV Readiness Plan*.

[126] Prepared Direct Testimony of Randy Schimka, Chapter 2, p.11.

reduce or minimize this cost barrier (e.g., an MuD owner or property manager could enter into a lease agreement with an EVSP that owns the EVSEs and assumes all upfront make ready costs with the exception of TSM costs.[127]) ORA further recommends that the EVSE Pilot Plan Study measure the impact that make-ready costs, adjusted for any Commission-approved ratepayer subsidies, have on customer (i.e. MuD or workplace property owners or managers) enrollment in the VGI Pilot Program.

C. VEHICLE TO GRID (V1G)[128] RELATED EVSE INFRASTRUCTURE COSTS

SDG&E states that VGI Pilot Program customers will "utilize a separate metered service, and not a facility connected load to a commercial customers service panel."[129] According to SDG&E's proposal, V1G PEV charging requires additional IT hardware and software and phone and web applications.[130]

If access to, and use of SDG&E mobile and web VGI applications is not efficient or effective, SDG&E ratepayers may incur incremental costs for IT hardware and software that may be underutilized.[131] For example, PEV owners who park their vehicles at workplace host sites may have difficulty utilizing VGI web-applications to respond to day-ahead time variant rates. If VGI enabled EVSEs are located at long-dwell parking locations where customer participants charge their vehicles only during

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[127] TSM costs refers to those costs for transformers, service drops, and meters.

[128] VIG is unidirectional power flow from the grid to the vehicle that can be managed or adjusted as needed. PEV charging during off-peak hours could potentially support grid reliability. Given that some vehicles spend the vast majority of the time parked (e.g., EVs that are utilized for commuting and parked at workplace locations), this scenario can provide a significant amount of potential grid-connected capacity that could be leveraged to provide grid services.

[129] SDG&E Response to UCAN Data Request DR-1 Q.16

[130] Prepared Direct Testimony of Randy Schimka, Chapter 2, A.14-04-014, p.14

[131] Id. SDG&E estimates that the VGI Billing System Integration will cost $1,385,900 for contract labor for software development and hardware costs. VGI Phone and Web Applications are estimated to cost $178,200

off-peak hours, the VGI hardware and software may not be fully used. In both of these scenarios, the V1G EVSEs may be underutilized.

ORA recommends that the VGI Pilot Program site selection criteria include a provision that VGI enabled EVSEs should be deployed at locations where current and future PEV owners would likely express an interest in utilizing a CAISO day-ahead time variant rate as proposed by SDG&E. In addition, the EVSP Pilot Plan Study should examine the effectiveness of marketing, education, and outreach programs to direct VGI Pilot Plan customers to mobile and web applications and enable PEV charging in response to CAISO day-ahead hourly rates.

D. PARKING SPACE ACCESS

Allocation of parking spaces at workplaces and MuDs may not be conducive to EVSE installation. In some circumstances, employees or MuD residents may not have access to a designated parking space. As a result, they may not have property rights or authority to invest in the additional infrastructure, even if they are willing and can afford to do so. Even if individual parking spaces are designated, the EVSE may not be optimally located. The following issues may exist at MuD or workplace as host locations for EVSE installations:

- Parking spaces may not be individually designated. In this case, all parking spaces would be shared and at least one of them would need to be designated as an EVSE installation site. This could impact parking space access for non-PEV owners. If MuD owners wish to install EVSEs in a shared parking space they may need to provide an incentive to non-PEV owners whose access to parking will be limited. This may not be feasible to implement.
- A designated parking space may not be optimally located for EVSE equipment and result in increased construction costs. The planned location for the EVSE equipment may be far from the perimeter of the building or in another suboptimal location,

increasing the length of the line extension required for interconnection. If the least-cost option for installing EVSEs requires reallocation of parking spaces for non-PEV owners, landlords, homeowners associations, or employers may not consent if the cost of providing PEV charging access exceeds expected gains.

The Commission should require the EVSE Pilot Plan Study to include surveys (developed by the EVSE Working Group) that pose questions to MuD owners, property managers, and tenants, and PEV buyers at the point-of-sale regarding PEV parking space access issues. These surveys could be administered by SDG&E, EVSPs or potentially by MuD property owners or managers. In addition, ORA recommends that if the survey results indicate that current or potential PEV ownership would be impacted by EVSE access, then the EVSE Working Group should provide potential solutions or alternatives. These solutions could include identifying the location of current public domain EVSEs in proximity to a current or prospective PEV owner's residence. If survey data obtained from PEV dealers in SDG&E's service territory reveals that there is a cluster of unmet demand for EVSEs, as indicated by prospective PEV buyers, then additional EVSEs could be installed at VGI Pilot Program host locations.

E. SPLIT INCENTIVE BETWEEN LANDLORD, HOMEOWNERS ASSOCIATION, OR EMPLOYER AND POTENTIAL PEV DRIVER

Another barrier to charging infrastructure deployment is the split incentive[132] between the property owner, homeowners association, or employer and the PEV owner.[133] At MuDs and workplaces, residents or employees considering the purchase of a PEV

[132] Chargepoint, Inc. Phase 1 Comments on Proposed Guiding Principles and Current Program Issues August 29, 2014 R.13-11-007 p. 10.

[133] The term 'split-incentive' in this context refers to MuD or workplace property owners or managers subsidizing the cost for installing EV charging infrastructure, while only EV owners may receive a benefit if EVSEs installation is not tied to increasing property value, rent, or the vacancy rate in MuDs or to increased workplace.

would benefit from EVSE infrastructure, but do not necessarily have access or authority to upgrade the property.

Recent California legislation has attempted to rectify the inability of MuD residents to install EVSEs. Enacted in 2012, Senate Bill (SB) 880 states that any condition which "prohibit(s) or unreasonably restricts" EVSE equipment installation in a resident's designated parking space is illegal.[134] Assembly Bill (AB) 2565 prohibits property owners from "unreasonably restricting" a leased tenant from installing a PEV charging station.[135] The tenant must have an allocated parking space and pay for all costs associated with the hardware, installation, property modification, liability coverage insurance, operation, and maintenance. However, residential buildings with fewer than five parking spaces are exempt from AB 2565.[136]

While these bills are significant and crucial steps towards making installation of EVSEs at MuDs easier, challenges still remain. For example, the benefit of EVSE equipment ownership after the employee or tenant leaves is unclear. While the make-ready portion of the infrastructure is tied to the property and construction costs are sunk, it is unclear what the EVSE asset value is to a MuD or workplace property owner. If tenants or employees choose to live or work at properties where EVSEs are installed, the property owner potentially benefits from the additional infrastructure assets or from increased revenue from tenants. However, unused EVSEs at MuD and workplace host locations can become stranded assets.

Opportunities exist to surmount EVSE cost; fee, access and split-ownership barriers, but they require increased collaboration and commitment from multiple stakeholders. For MuD residents in particular, PEV purchases are not just a reflection of consumer interest, but also include site-related uncertainties, costs, and negotiations. For PEV owners that require workplace PEV charging, access to PEV charging stations

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[134] http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_880_bill_20120229_chaptered.html

[135] http://www.leginfo.ca.gov/pub/13-14/bill/asm/ab_2551-2600/ab_2565_bill_20140921_chaptered.html

[136] Id.

is replete with similar challenges, but is not as likely to impact PEV purchasing decisions as MuD charging, since workplaces are expected to have more capacity to host a higher number of PEV charging spaces.[137]

SDG&E's VGI Pilot Program will account only for EVSE-related barriers during site selection.[138] From a more expansive perspective, ORA recommends that the Commission require that an EVSE Pilot Plan Study include a method to measure and report how EVSE-related barriers either were or were not alleviated and their impact on VGI Pilot Plan customer enrollment and EVSE utilization. This information could be obtained from customer surveys and the extraction of anonymized customer data generated from billing and managed charging software.

F. NON-EVSE RELATED MARKET BARRIERS TO PEV ADOPTION

Aside from EVSE-related market barriers, additional PEV supply and demand variables can also impact PEV purchasing decisions and subsequently use of EVSEs deployed in the VGI Pilot Program. The following is a suggested, preliminary list of PEV supply and demand variables:

<u>PEV supply variables</u>

(a) Availability and price of PEV models;

(b) Auto manufacturer or dealer enthusiasm (i.e. PEV sales can require additional training and knowledge of sales staff, selling an PEV might require more time than selling a conventional car[139]);

(c) Existing regulatory environments (e.g., ability of auto manufacturers to leverage manufacturing tax incentives to reduce PEV production costs); and

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[137] "Southern California Plug-In Electric Vehicle Readiness Plan" Pg. 50 UCLA Luskin Center http://www.scag.ca.gov/Documents/SCAG_PEV_Plan-Buildings_and_Retail_Owners.pdf

[138] Prepared Direct Testimony of Randy Schimka, Chapter 2, A. 14-04-014, p. RS-7

[139] "Many Car Dealers Don't Want to Sell Electric Vehicles" Green Car Reports Feb 14, 2014 http://www.greencarreports.com/news/1090281_many-car-dealers-dont-want-to-sell-electric-cars-heres-why

(d) Degree of involvement of local and state governments, and local utilities to incent PEV adoption.[140]

PEV demand variables:

(a) Consumer views of vehicle aesthetics and driving performance;

(b) Travel patterns in relationship to PEV range and other factors;

(c) Price and availability of residential, workplace, or public domain charging equipment;

(d) Vehicle price;

(e) Vehicle lease options; and

(f) Electricity rates relative to gasoline prices.

ORA recommends that the EVSE Pilot Plan Study examine the impact that PEV supply and demand factors have on PEV adoption and EVSE utilization. This could be accomplished by administering customer surveys to prospective PEV buyers at the point-of-sale. Currently, SDG&E VGI Pilot Program testimony does not address PEV supply and demand-related factors that could contribute to low PEV adoption rates, such as a high upfront cost of vehicles[141] or overall purchasing rates of vehicles amongst MuD owners relative to overall population. Also, several methods exist for identifying prime MuD or workplace host locations where EVSEs should be installed. One method to accomplish this would be to survey potential PEV customers at the point-of-sale to identify if PEV purchasing decisions are contingent upon EVSE availability in specific MuD or workplace host locations. This customer EVSE demand data could then be plotted onto a map with geographic information system

[140] "An Action Plan to Integrate Plug-in Electric Vehicles with the U.S. Electrical Grid." Center for Climate and Energy Solutions (C2ES) (2012).

[141] The high upfront cost of vehicles is a frequently cited barrier to electric vehicle adoption. However, the cost of these vehicles has dropped dramatically as they achieve larger scales of production. Currently, leases for vehicles such as the Nissan Leaf or the Chevy Volt provide low-cost financing competitive with conventional internal combustion engine vehicles. It is unclear how larger markets will respond to a leasing model rather than owning the vehicle asset outright.

(GIS) technologies to identify where MuD sites are located.[142] An example of harnessing GIS to identify EVSE deployment locations is the Nashville Electric Service's use of ArcGIS to identify areas of PEV adoption linked with housing tract and demographic data.[143] Other methods for identifying where EVSEs should be deployed in the VGI Pilot Plan including ranking the largest MuDs that are located in areas with high and medium PEV density.[144]

The distinction between non-EVSE and EVSE market barriers is an important one to make, as an inherent impetus for SDG&E's VGI Pilot Plan is to facilitate widespread deployment of PEVs to reach California's climate goal. Deployment of EVSE equipment only provides a benefit to the degree that the equipment results in more consumers choosing to purchase a PEV over a conventional vehicle that would not have done so otherwise. Therefore, ORA recommends that SDG&E's VGI Pilot Program be deployed only where there is evidence of current unmet or future PEV demand, as demonstrated by a thorough analysis of data obtained from surveys and other tools.

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[142] Since SDG&E has already determined that there are "approximately 15,500 MuD properties in San Diego, comprised of 2,200 small MuDs, 2,600 medium to large MuDs greater than 25 units, and 10,700 rentals", the process for determining where EVSEs should be sited has already been initiated from SDG&E Response to UCAN SDG&E DR-01 Q.22

[143] ESRI News for Electric Gas and Utilities Fall 2012 Newsletter https://www.esri.com/~/media/Files/Pdfs/library/newsletters/energycurrents/electric-gas-fall-2012.pdf

[144] "South Bay Cities Plug-In Electric Vehicle Deployment Plan" published by the UCLA Luskin Center for Innovation June 2013 http://innovation.luskin.ucla.edu/sites/default/files/South%20Bay%20Plan.pdf

CHAPTER 5. VGI RATE DESIGN ISSUES

Sponsored by Dan Willis

I. INTRODUCTION AND ORA RECOMMENDATIONS

SDG&E's proposed VGI rate design presents an opportunity to provide affordable day-time charging of PEVs, which can attract customers to the nascent EV market while potentially providing some relief to grid operations. In this chapter, ORA makes several recommendations to fine-tune the VGI rate design which attempt to more accurately balance the need for cost-based rates with the State's goals of encouraging PEV adoption. ORA also attempts to limit the burden that non-participating ratepayers must bear in order for the pilot to succeed.

ORA's position, described in the proceeding chapters, is to limit the size and possible anticompetitive nature of SDG&E's proposed pilot. ORA recommends that, if possible, third-party ownership of charging stations still would allow the VGI rates to be passed onto the third-party owners and ultimately to PEV owners, depending on the preferences of the third-party owners.

In summary, ORA recommends the following:

- Adjusting the base rate downwards so that revenues collected through CAISO day-ahead adders do not exceed the costs removed from the commodity base rate;
- Increasing the base rate slightly to account for providing customers with surplus energy credits on days where day-of prices fall below day-ahead prices;
- Offering a second option for a more cost-based commodity critical peak pricing (CPP) surcharge along with its proposed "CPP-Lite" design;

- Monitoring by SDG&E of whether using the top 150 system hours for the VGI commodity surcharge and the top 200 circuit hours for the VGI delivery surcharge accurately balance revenues collected with deferred demand costs;
- Collecting the costs of the pilot through distribution rates but using a total revenue allocator to reflect the broad benefits that the program is meant to provide; and
- Determining the details of a less-complicated rate design in another phase or as part of a working group in the event that third-party ownership of charging stations precludes exposing customers to a VGI-type rate.

ORA's recommendations result in the following changes to SDG&E's VGI rate:

Table 1: SDG&E and ORA VGI Rate Proposals

VGI Rate cents/kWh	SDG&E	ORA "Cost-based"	ORA "CPP Light"
Base Rate	13.22	8.33	9.59
C-CPP Surcharge	46.73	90.66	46.73
D-CPP Surcharge	39.02	39.02	39.02

In addition, ORA notes that its recommendations in this chapter assume ratepayer funding of the VGI pilot. Thus the infrastructure and program implementation costs are not included in ORA's rate design. However, this should not be taken as an explicit endorsement of the concept for a program larger than the pilot recommended by ORA. This issue should be revisited if SDG&E's VGI program were to move past the pilot stage or approach the size proposed by SDG&E.

II. SDG&E PROPOSALS

Chapter 3 of SDG&E's testimony presents the details of its proposed VGI rate design. As explained, this rate is meant to support several State policy goals as well as the rate design objectives outlined in the Residential Rates OIR.[145]

SDG&E's proposed VGI rate is composed of the following:

- A flat VGI base rate of 13.22 cents per kWh, which includes a base commodity rate, base distribution rate, as well as charges associated with transmission, public purpose programs (PPP), nuclear decommissioning (ND), the competition transition charge (CTC), reliability services (RS), and the Department of Water Resources bond charge (DWR-BC). These charges are based on the Medium and Large Commercial and Industrial (M/L C&I) class average rate for these components.[146]
- The hourly variable California Independent System Operator (CAISO) day-ahead market commodity price;
- A Commodity Critical Peak Pricing (C-CCP) surcharge applied to the top 150 system hours determined on a day-ahead basis, which collects 50% of commodity capacity costs; and
- Surplus energy credits applied on a day-of basis in the event that CAISO day-of prices are lower than day-ahead prices by one cent or greater;[147] and

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[145] SDG&E Opening Testimony, page CF-3 ll. 11-19.

[146] According to SDG&E, "the VGI Pilot Program would establish multi-vehicle charging facilities at workplace and multi-unit dwelling (MuD) facilities, where demand for these charging facilities is expected to exceed 20 kW. This is consistent with SDG&E's rates for M/L C&I customers (demand greater than 20 kW), which thus forms the VGI Pilot Rate's base component (Page CF-4 ll. 17-21)."

[147] SDG&E Opening Testimony, page CF-7 ll. 16-17.

- A Distribution Critical Peak Pricing (D-CPP) surcharge applied to the top 200 circuit hours collecting 50% of distribution capacity costs.

III. DISCUSSION

In this section, ORA discusses its recommendations for improving SDG&E's VGI rate design.

A. Remove CAISO Day-Ahead Price From Commodity Rate

SDG&E explains,

> With the inclusion of the CAISO hourly day-ahead price, the VGI base commodity rate will be reduced to reflect the removal of comparable variable costs embedded in current rates [which include] net CAISO market purchases and fuel and variable operations and maintenance (O&M) costs for both utility owned generators and tolling agreements.[148]

ORA agrees in principle with SDG&E's intention to remove variable costs from its base rate to allow for including the day-ahead market prices as part of the VGI rate without double-counting variable costs. In response to an ORA data request, SDG&E stated that it believes the costs it removed from the base rate revenue "represent the equivalent commodity cost as would be represented by the CAISO hourly day-ahead price as presented in the CAISO Day-Ahead Market."[149] This revenue reduction leads to a base rate reduction of about 1.4 cents. ORA recommends using the actual historical data from the CAISO Day-Ahead Market, and finds that the average 2014 day-ahead price in San Diego was approximately 4.9 cents per kWh. Thus, ORA reduces SDG&E's base commodity rate by about an additional 3.5 cents relative to SDG&E's proposal.

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[148] SDG&E Opening Testimony, page CF-8 ll. 8-9.

[149] SDG&E response to ORA data request #2, question 1.A., 5/27/14

B. Adjust Base Rate to Account for Surplus Energy Credits

SDG&E justifies its proposal to provide "surplus energy credits" as follows:

> Unexpected events, such as high wind on a sunny spring day, can result in unanticipated negative commodity prices on the day energy is delivered. These surplus energy events would not be captured in CAISO's hourly day-ahead price. To integrate surplus energy events into the VGI Pilot Rate, SDG&E will include day-of credits where the CAISO day-of price falls below CAISO's day-ahead price, in excess of a threshold of one cent for any given hour.[150]

SDG&E's proposal to provide surplus energy credits results in customers paying the day-of price when it falls more than one cent below the day-ahead price, while those customers do not pay day-of prices when they are higher than day ahead prices. ORA agrees that day-of prices can deviate from day-ahead prices, and that EV customers should be encouraged to charge their vehicles during times of very low or negative day-of energy prices. But in order to prevent VGI customers from underpaying, ORA recommends that the base commodity rate account for the revenues credited to customers.[151]

It is not yet clear how customers will manage their charging behavior using the mobile and web applications that SDG&E intends to provide. Customers might end up making decisions about whether or not they plan to charge their vehicles based on day-ahead prices. If so, it would be reasonable to provide customers some price certainty by not charging them more if the day-of price turns out to be higher than the day-ahead price but giving them the benefit of a credit if the opposite occurs.

[150] SDG&E Opening Testimony, page CF-8 ll. 11-15.

[151] Due to difficulty in accessing data from the CAISO website on Hour-Ahead (day-of) prices and time constraints, ORA's rates presented in Table 1 above do not reflect an adjustment to the base rate to account for SDG&E's proposed surplus energy credits. However, this issue and others could be addressed as part of the working group proposed by ORA in Chapter 1.

Alternatively, customers might not pay attention to the day-of prices but rather use the mobile and web applications to set predetermined price thresholds. If so, ORA sees no reason to protect customers from day-of prices whether they are higher or lower than the day-ahead prices. As SDG&E explains, the mobile and web applications will result in customers only paying the rates that are below their chosen threshold because they will not charge their EVs when the rates are higher.

C. Allocation of Commodity Capacity Costs

SDG&E proposes to collect 50% of the revenues associated with commodity capacity costs through the VGI C-CPP Hourly Adder and the remainder through the base commodity rate. This is consistent with SDG&E's current CPP-D[152] rate structure. SDG&E's testimony further notes, "The VGI Pilot Program presents a challenge on how to translate demand charge price signals in a commercial EV charging facility context, where multiple users contribute to the facility's peak load, in line with how capacity costs occur."[153]

There are several options for dealing with the issue of allocating the generation capacity costs. One is to time-differentiate the commodity base rate itself, as is done in a traditional time of use (TOU) rate. In an ORA data request, ORA asked SDG&E to design a rate that recovers 50% of the capacity cost through the C-CPP rate and to recover the remaining 50% by time-differentiating the commodity base rate. SDG&E's response indicates that doing so would increase summer on-peak base rates by about eight cents and reduce winter base rates by about 1.3 cents.[154] This rate has the advantage of providing lower rates during most off-peak times, benefiting those who charge at night in multi-family

[152] This is SDG&E's existing CPP default rate that is based on generation capacity costs. The "D" in "CPP-D" stands for "default," not for "distribution."

[153] SDG&E Opening Testimony, page CF-4 ll. 15-17.

[154] SDG&E response to ORA data request 4, scenario 3(a)

dwellings. But it also increases the rate during afternoons when EV charging might occur at workplaces, depending on system conditions.

Alternatively, an option for the VGI rate could be offered that collects almost all of the commodity capacity costs within the C-CPP adder. Using production-cost modeling software data from SDG&E's Rate Design Window proceeding (A.14-01-027), ORA estimates the cumulative percentage of Loss of Load Expectation (LOLE) falling within the top 150 system hours to be as high as 97%.[155] This shows that the relative LOLE outside of these hours is so small that a base rate based on marginal costs would not include more than 3% of commodity capacity costs.

It is difficult to balance the goal of providing a cost-based rate with that of providing a rate that will be attractive and understandable to customers. ORA agrees with SDG&E regarding the need to test customer response to the rate design.[156] In order to do so more effectively, ORA recommends that VGI customers be given two options for the C-CPP surcharge. One option should be SDG&E's proposal, which would collect half of capacity costs in the surcharge and the other half in the base rate that is not time-differentiated. The second option would recover 97% of capacity costs in the CPP surcharge. The remaining 3% would be collected through the base rate. The resulting CPP surcharge for the second option increases from 47 to 91 cents per kWh, while the commodity base rate decreases by 1.3 cents. Including ORA's adjustment to the base rate discussed in Section A above, the customer could opt for a total base rate as low as 8.33 cents/kWh.

ORA's second option provides an accurate and attractive VGI rate allowing affordable charging both in workplaces in the daytime (as long as CPP event hours are avoided) and multi-unit dwellings at night. In regard to the latter, ORA has

[155] Work papers supporting Chapter 3 (Barker) of SDG&E's 2015 RDW application.

[156] SDG&E Opening Testimony, page CF-7 ll. 5-8.

calculated that the average CAISO day-ahead price in 2014 from midnight to 6 am was 3.8 cents. Given that there would be no CPP surcharges at night, the total rate including the base rate would average 12.1 cents/kWh. This is comparable to the most attractive off-peak EV rates currently offered by SCE and PG&E, which are 10 and 11.5 cents/kWh respectively.[157] However, ORA also recommends the first option for customers who think they might need to charge during CPP event hours.

The lowest off-peak rate in SDG&E's currently-offered residential EV rates, Schedules EV TOU and EV TOU 2, is 16 cents/kWh, and that rate only covers midnight until 5am. ORA recommends that, in the next GRC, SDG&E examine alternative methods of allocating the capacity costs in its existing residential EV schedules to provide the option for lower off-peak charging costs more comparable to the rates of PG&E and SCE.

D. Allocation of Distribution Capacity Costs

As with its C-CPP adder, SDG&E proposes to collect 50% of its distribution capacity costs in the Distribution CPP adder, and the remainder as part of the distribution base rate. In a data request response, SDG&E explained that the adder is intended "encourage behavior that could potentially defer future investments in distribution infrastructure driven by use during peak circuit hours."[158] SDG&E argues,

> The VGI customer also has a cost responsibility for their use of existing distribution infrastructure. Absent further study on where the appropriate allocation is between pricing to encourage the deferral of future investment and recovery of customer utilization, SDG&E proposes to set the initial allocation to the D-CPP adder at 50% of distribution demand revenues.[159]

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[157] PG&E Schedule EV (off-peak rates 11pm-7am), and SCE Schedule TOU-D (off-peak rates 10pm-8am).

[158] SDG&E response to ORA data request 2, question 2, 5/27/14.

[159] Id.

ORA does not agree with SDG&E's articulated desire to recover the "cost responsibility for … use of existing distribution infrastructure." The existing infrastructure is a sunk embedded cost, and the Commission's policy is to base rates on marginal costs. Ideally, one would want to time-differentiate the distribution capacity costs for individual circuits in a manner conceptually similar to how generation capacity costs are time-differentiated. However, such information does not exist at this time. Thus, ORA does not oppose SDG&E's proposal because the D-CPP adder is equivalent to time-differentiating the distribution rate by allocating 50% of the costs outside the top 200 hours. It does nevertheless agree with SDG&E that more research is required to refine this parameter.

E. Choice of 150 Hours for C-CPP Adder and 200 Hours for D-CPP

SDG&E proposes to charge the C-CPP adder over 150 hours that are determined on a day-ahead basis, as opposed to using fewer hours falling within pre-defined periods, as in its current CPP-D rate. SDG&E argues, "To ensure that the VGI Pilot Rate sufficiently encourages reduction in system peak demand for EV charging, SDG&E proposes to apply the C-CPP Hourly Adder to the top 150 system hours."[160] SDG&E provides no additional justification as to why 150 hours is the best choice for employing its C-CPP adder.

For its Distribution CPP adder, SDG&E proposes to use the top 200 hours for each of its distribution circuits, also forecasted on a day-ahead basis, "when the forecasted load exceeds a threshold level established based on historic load."[161] SDG&E explains that its intention to do so is based on the load duration curve for a typical distribution circuit being flatter than that of the system.[162] Without

[160] SDG&E Opening Testimony, page CF-10 ll. 15-16.

[161] SDG&E Opening Testimony, page CF-18 ll. 5-6.

[162] SDG&E Opening Testimony, page CF-16 ll. 5-8.

further justification, 200 hours is especially arbitrary; and SDG&E recognizes this point, stating, "SDG&E will monitor the occurrence of the circuit peak hours and may revisit the appropriate number of circuit peak hours."[163]

Being an experimental pilot rate design, ORA is not opposed to using SDG&E's choices of 150 and 200 hours for its CPP adders. However, ORA agrees with SG&E in its intention to monitor the occurrence of circuit peak hours.[164] Should this program expand beyond the pilot stage, it will be critical to refine choices.

F. Pilot Program Cost Allocation

In its testimony, SDG&E states that it "proposes to recover the costs of implementing the VGI Pilot Program, which consists of costs for such things as charger equipment, transformers, services and meters … through distribution rates, consistent with the recovery of similar costs."[165] ORA expects that SDG&E intends to use a distribution marginal costs allocator to assign these costs between customer classes as part of its GRC Phase II revenue allocation process.

As stated above, ORA does not necessarily support broad ratepayer funding of a large VGI program. Distribution upgrades that may be required as a result of VGI charging installation would ideally be the responsibility of program participants. But, given the uncertainty in participation levels, it would be very difficult at this stage to determine each customer's cost responsibility. It also is uncertain to what extent this making participants pay for these cost would discourage PEV charging.

If ORA's recommendations in the proceeding chapters of this testimony are adopted, the amount of ratepayer funding for SDG&E's VGI pilot infrastructure would greatly decline relative to SDG&E's proposal, making the socialization of

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[163] SDG&E Opening Testimony, page CF-16 ll. 11-12.

[164] SDG&E Opening Testimony, page CF-16 ll. 11-12.

[165] SDG&E Opening Testimony, page CF-20 ll. 3-5.

these costs less of an issue. If these costs are socialized, ORA recommends that the program revenue requirement be collected through distribution rates, but using a total revenues allocator. While most of the costs associated with infrastructure build out will be on the distribution system, the VGI pilot rate design also is meant to benefit the generation system by avoiding peak usage through CPP surcharges and by absorbing surplus generation during times of very low or negative CAISO prices. The program could make the utilization of the generating system more efficient if it flattens load profiles or increases sales without requiring significant capacity upgrades.

In addition, SDG&E intends to leverage GHG revenues to pay for part of its pilot in recognition of its goals to reduce emissions. The costs of programs with explicit environmental benefits often are assigned to classes using an equal cents allocator,[166] as is done for the Self-Generation Incentives Program (SGIP) and the California Solar Initiative (CSI). To reflect that this proposal also impacts the distribution system, ORA recommends that a total revenues allocator be used. This would reflect a compromise between distribution system cost responsibility and the generation and environmental benefits that the program likely will provide.

G. Alternatives in Absence of VGI Rate Design

ORA recommends, regardless of the conclusions in this proceeding on charging station ownership, that end-users, or at least third-party EVSPs, will be offered a VGI rate similar to the one proposed herein. However, if the Commission determines that the rate is too complicated for SDG&E to administer under an alternative ownership model, ORA recommends that a subsequent phase of this proceeding be opened to create an alternative that would provide some of the benefits of a near real-time rate for PEV customers. ORA's proposed working

[166] An equal cents per kWh allocator is closer to a generation cost allocator than to a distribution cost allocator.

group would also be an appropriate forum to develop an alternative rate design. Several aspects of the innovative VGI rate, such as incorporating the CAISO day-ahead market prices, would not require SDG&E's participation.

IV. CONCLUSION

SDG&E's VGI rate proposal is an intriguing opportunity to provide customers with price signals that encourage PEV charging during optimal time periods. ORA has provided several adjustments to make the rate more accurate in its reflection of system costs and more attractive to PEV customers. Together with its recommendations in the proceeding chapters, ORA's intent isthat these rate design changes will reasonably balance the goals of promoting the nascent PEV market with that of protecting non-participants from unnecessary cost-shifting.

CHAPTER 6. ORA PILOT PLAN FRAMEWORK

Sponsored by Rajan Mutialu

I. PILOT PLAN GUIDING PRINCIPLES

The State of California has ambitious goals for greening its transportation sector. Executive Order B-16-2012 states that by the year 2020 California's ZEV infrastructure should support up to one million ZEVs and have at least 1.5 million ZEVs on California roads by 2025. This order also states that ZEV infrastructure or EVSE should be easily accessible. In the 2013 ZEV Action Plan, the California Air Resources Board (CARB), California Energy Commission (CEC), the California Public Utilities (CPUC) and others outlined the steps to expand the ZEV market, including:

- Completing needed infrastructure and planning;
- Expanding consumer awareness and demand;
- Transforming fleets; and
- Growing jobs and investment in the private sector.

ZEV Pilots should aim to achieve the broad goals laid out in the 2013 ZEV Action Plan. Therefore, ORA recommends these Guiding Principles for investor owned utility (IOU) ZEV related pilots:

1) The primary role of a pilot is to inform, through data gathering and analyses, the size and location of ZEV infrastructure needed to meet the Governor's goal for placing at least 1.5 million ZEVs on California's road by 2025.
2) ZEV pilots should identify how to expand customer awareness of, and demand for ZEVs through education, marketing and outreach (EM&O). EM&O should focus on California's general population and not focus only on prospective ZEV pilot participants.

3) Pilots should be designed with specific parameters, including size and duration, to protect ratepayer interests and avoid stranded costs. Evolution of PEV-related technologies, such as enhanced battery capacity, will increase driving range and may result in stranded assets. Therefore, rolling out small PEV pilots instead of full-scale PEV infrastructure may permit PEV charging deployment to adapt to changes in the market; and
4) Participation and investments into the PEV charging market by third parties should be encouraged and may lift some of the burden on ratepayers and the State.

The Commission has spent considerable time and resources to encourage an effective electric vehicle charging market. The IOUs' PEV pilot programs should be designed to achieve this goal. Because the PEV market is still in its nascent stages of development, there are many unknown factors and unanswered questions that will affect pilot programs. Some of these questions include:

- What PEV infrastructure is needed to support California's goals and in what market segments? What is the size of the PEV charging market in each IOU's service territory where EVSE deployment is being considered?
- What PEV infrastructure would not be deployed if not for IOU ownership of PEV charging infrastructure or ratepayer funding of EVSEs?
- What metrics will be used to measure the effectiveness of the variety of EVSE ownership models? (e.g., charging sessions/station or charger, increased ZEV miles traveled per PEV charging station deployed, PEV adoption per PEV charging station deployed, aggregate and EVSE host location

load impacts, relationship between rate and bill impacts and EVSE utilization, EVSE costs per unit of EVSE utilization, etc.)

- How will performance for key metrics (i.e. EVSE utilization, PEV adoption, and ZEV miles traveled) be impacted by partial or complete funding of EVSEs by IOUs' shareholders and recovered in ratebase? How will performance for key metrics (i.e. EVSE utilization, PEV adoption, and ZEV miles traveled) be impacted if IOUs' EVSE costs are funded entirely by ratepayers? How will battery technology evolve in the coming years and how will it shape the PEV market?
- How will the effectiveness of technology solutions to promote managed charging be measured?
- How have the IOU and EVSP ownership models addressed EVSE cost and access barriers (i.e. lack of parking zones for PEVs, unwillingness to engage in processes required to deploy EVSEs (i.e. construction, permitting, interconnection agreements), incremental cost burdens that exist despite ratepayer funding of EVSEs or EVSE-related infrastructure requirements, etc.) in MuD or workplace host locations?
- How can anonymized EVSE utilization data collected from PEV pilots be used while not revealing elements of IOU or third party business models (e.g, marketing, education and outreach efforts)?

PEV pilots that are based on ORA's Guiding Principles should answer the questions listed above, identify EVSE deployment challenges, and recommend solutions to accelerate the deployment of ZEVs.

II. DESIGN PRINCIPLES FOR RATEPAYER FUNDED PILOTS

In addition to its Guiding Principles, ORA also proposes that PEV-related pilot programs:

1) Base future P EV charging deployment on findings from prior pilot studies;
2) Analyze PEV charging-related grid and ratepayer impacts; and
3) Promote the adoption of PEVs.

To ensure prudent investment of ratepayer dollars while effectively yielding ratepayer benefits, PEV pilots must be designed and evaluated with attention to the following:

<u>Size</u>

PEV pilots must be reasonable in size to contain costs and permit data to be gathered and analyzed to inform full implementation. Pilots must also be sized depending on pilot objectives.

<u>Lessons Learned</u>

As stated in the Alternative Fuel Vehicle (AFV) Order Instituting Rulemaking (OIR), Rulemaking (R.) 13-11-007, PEV pilots need to incorporate lessons learned from other pilots.[167]

<u>Adaptable to Technology</u>

Deployment of EV charging infrastructure in PEV pilots should respond to emerging PEV-related technology. For example, improved battery capacity may reduce range anxiety and subsequently, reduce the need for workplace PEV charging. If the demand for wireless or Level-3 (L3) (DC fast charging) chargers

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[167] R.13-11-007 Assigned Commissioner's Scoping Ruling, July 16, 2014 pg. 7.

increases, then the need for Level-2 (L2) chargers may decrease and result in stranded PEV charging assets.

Incremental Deployment

PEV pilots should be deployed in stages to incorporate lessons learned from previous pilots. This will also ensure that ratepayer funded pilots can be curtailed once the PEV market is self-sustaining or if the pilot is unsuccessful. Rolling out PEV pilots instead of full-scale PEV charging infrastructure would permit future pilots to adapt to changes in the market.

Ensure Access to Charging

PEV pilots should be designed to maximum PEV charger usage. PEV chargers should serve as many PEV drivers as possible in one day. This can be accomplished through managed charging plans or rate incentives.

Accounts for Variation in Geography and Demographics

Deployment of PEV infrastructure must adapt to demographics and geography. One model does not fit all. For example, in San Francisco, a majority of residents live in MuDs that may or may not have parking spaces.[168] Additionally, urban workplaces, such as those in San Francisco's Financial District, may not have dedicated parking spaces. Employees may either take public transit or park in public garages. PEV pilot plans must include information from current PEV demand and property surveys to identify prime locations for siting PEV chargers.

In addition to demographics, PEV pilots must address PEV charging needs based upon geography. PEV battery capacity will

[168] Baker, David. R., "EV Charging Comes to S.F. Apartment Buildings." *San Francisco Chronicle* 20 October 2014.

deplete at a faster rate on San Francisco's hills than on the flatlands. Therefore, the distribution of PEV charging infrastructure in San Francisco should be different than that in a city such as Davis where MuDs are more likely to have parking lots and the landscape is flat. In suburban areas served by public transit such as the Bay Area Rapid Transit (BART), a significant number of commuters drive to a BART station, park, and take a BART train to work. PEV charging infrastructure may be needed at BART station parking lots.

Enable Participation in Grid Management Program

The Commission is tasked with developing "(p)ilot infrastructure systems that avoid or minimize demand impacts on the grid from PEV charging through energy storage, demand response, distributed generation or other mechanisms."[169] Customer participation in V1G (one-way energy flow from the grid to charge electric vehicles) or V2G (bidirectional energy flow between the grid and the vehicle) programs may yield grid benefits (i.e. avoided distribution infrastructure costs) and customer benefits (i.e. customer participation in CAISO markets).

Incorporate Renewable Energy and Energy Storage EV Charging

The 2013 ZEV action plan charges the Commission with the duty to "(e)xplor[ing] the possibility of pairing incentives that encourage distributed renewable energy generation with incentives to encourage ZEV usage."[170] To achieve this goal, PEV pilots should incorporate solar photovoltaics and energy storage to show how PEV

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[169] Office of Governor Edmund G. Brown, 2013 ZEV Action Plan: A Roadmap toward 1.5 Million Zero-emission Vehicles on California Roadways by 2025, p. 13.

[170] Id.

charging, paired with these resources, can provide benefits to both MuD and workplace site owners and the grid.

III. PEV PILOT DESIGN AND IMPLEMENTATION FRAMEWORK

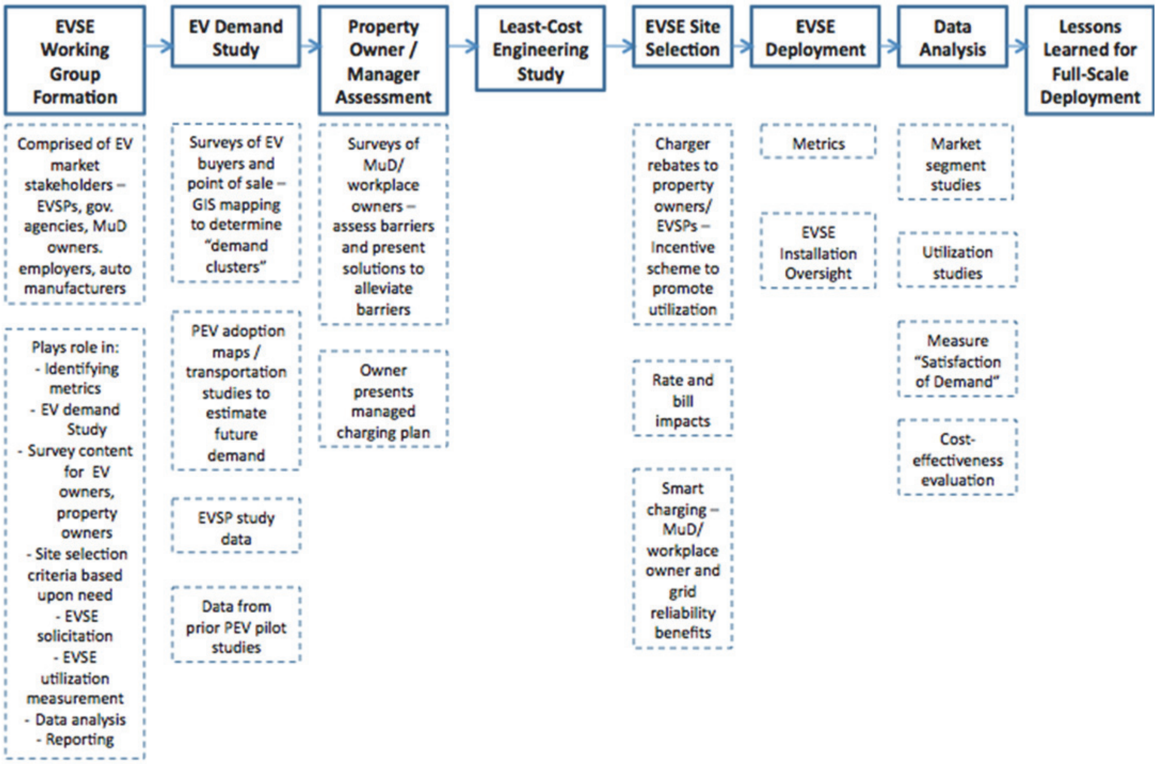
Based upon the tenets of the 2013 ZEV Action Plan mirrored in ORA's Guiding Principles and the Design Principles for Ratepayer Funded Pilots, ORA proposes a framework to design and implement PEV pilots.

Figure 6-1 lists elements of ORA's proposed Pilot Plan Framework that include, but are not limited to:

- PEV Demand Study;
- Property Owner/Manager Assessment;
- Least Cost Engineering Study;
- EVSE Site Selection;
- EVSE Deployment; and
- Data Analysis.

This tentative framework is a useful start to answer questions that have or have not been introduced by the IOUs in their applications but are not fully resolved including enabling California to reach its goal of 1.5 million PEVs on the road by 2025 In essence, utilizing this framework will avoid stranded costs and contribute to the sustainable deployment of PEVs. Therefore, this framework will expedite the process of deploying EVSE infrastructure by leveraging the knowledge and expertise of the parties and PEV market stakeholders to answer these foreseen and unforeseen implementation hurdles. Some of the components of this framework can occur concurrently thereby avoiding unnecessary delays.

Figure 6-1. ORA EVSE Pilot Plan Framework



A. Formation of an EVSE Pilot Working Group

ORA recommends the Commission to engage PEV market stakeholders and to form an EVSE Pilot Working Group (Working Group) whose objective is to develop an EVSE Pilot Plan that can be deployed in each IOU service territory. The Working Group should be composed of PEV market stakeholders, including PEV auto manufacturers, PEV dealers, EVSPs, relevant California agencies such as the California Energy Commission (CEC), California Air Resources Board (CARB), CPUC, regional air quality management districts (e.g., Southern California Air Quality Management District (SCAQMD)), research institutes (e.g., UCLA Luskin Center) and property management associations. This holistic approach will help ensure that EVSE Pilot Plans abide by the 2013 ZEV Pilot Plan Guiding Principles and are consistent in design and implementation strategy. Based on the Commission's experience with the electric vehicle submeter protocol,[171] \EVSE Pilot Working Group would be an effective forum to develop an EVSE Pilot Plan.

The San Diego Regional Plug-In Electric Vehicle Infrastructure Working Group (REVI) could be a model for the EVSE Pilot Working Group. In January 2014, REVI released the San Diego Regional PEV Readiness Plan (Readiness Plan), a document that assesses EVSE deployment at MuD, commercial, and workplace charging stations. In addition, the Readiness Plan provides recommendations for alleviating barriers to EVSE deployment in these market segments. These measures were developed by REVI voting and advisory members including public agencies, property owners, charging station manufacturers, local government parties (LGPs), EVSPs, and SDG&E. A similarly formed Working Group could add value to the development of an EVSE Pilot Plan.

ORA recommends that the Working Group identify:

- Data sources, tools (e.g., surveys), methodologies for evaluating macro-level PEV demand (e.g., demand for PEVs based upon census tract or zip code);
- The effectiveness of EVSE site selection;
- The effectiveness of EVSE utilization at MuD and workplace host locations;
- EVSE cost-effectiveness; and
- Evaluation, monitoring and verification (EM&V) methodologies for collecting and analyzing survey data related to include, but not limited to:
  - EVSE site selection;

[171] D.11-07-029 at pg. 44.

- EVSE utilization at MuD and workplace host locations; and
- EVSE cost effectiveness.

Finally, the Working Group should develop a preliminary SDG&E PEV Pilot Plan to be vetted by the Commission that includes a consensus-based framework to evaluate EVSE site selection, EVSE utilization, and EVSE cost-effectiveness that will inform full-scale rollout of EVSEs.

B. PEV Demand Study

ORA recommends that the Working Group identify data sources and develop tools and methodologies to target EVSE deployment where current PEV demand exists and where future PEV demand is expected. Obtaining this information will identify the latent PEV market in each IOU service territory. One intention is to identify low PEV adoption neighborhoods that would not have been served but for IOU involvement or any ratepayer subsidy to EVSPs. This strategy will maximize the effectiveness of IOU or EVSP ME&O efforts to recruit potential EVSE Pilot Plan customer participants and ultimately streamline and expedite EVSE deployment.

One method to ascertain PEV demand within an IOU service territory (i.e. census tract, zip code, or other geographic unit) is to analyze PEV customer driving behavior to identify PEV demand clusters specifically within MuD and workplace sites. According to the California PEV Collaborative, significant amounts of PEV customer behavior data are stored by companies providing mapping and navigation products that could provide a solid, empirical and statistical basis upon which to plan the optimal deployment of future charging infrastructure.[172] Although this data might primarily be used to identify locations

[172] "Maps and Apps: Today's Mapping and Location-Based Services for Plug-In Electric Vehicle Charging Infrastructure" California Plug-In Electric Vehicle Collaborative. pg. 13.

for public EVSE installation, it could also be linked to MuD and workplace sites where EVSEs are needed.

As the California PEV Collaborative notes, the challenge will be to determine if PEV stakeholders holding this data would be willing to share it for EVSE planning; in this instance, to develop a model EVSE Pilot Plan. Obtaining and using PEV customer behavior data can help maximize effective MuD and workplace EVSE siting. Therefore, ORA recommends that the Commission consider directing PEV stakeholders to release any relevant PEV customer data that could inform PEV demand and subsequently the development of EVSE Pilot Plans. ORA further recommends that the Commission review data access methods proposed by the EVSE Working Group to ensure compliance with its customer data privacy requirements.[173]

Another strategy to identify PEV demand clusters would be to create partnerships between EVSPs, IOUs, and PEV auto dealers to administer surveys to PEV buyers at the point of sale. Data from these surveys could inform the EVSE Pilot Plan Working Group that, if not for the availability of EVSEs in MuD or workplace host locations, a PEV would not be purchased.

ORA also recommends that customer data on self-reported residential location (e.g., zip codes) and type of residential housing (e.g., single-family home versus multi-unit dwelling) could be imported into GIS software to generate EVSE demand maps. The PEV Pilot Working Group could also rely on data that reveals the location of PEV drivers that have received a LCFS rebate.

C. Property Manager/Owner Assessment

After the Working Group identifies the macro-level demand for EVSEs at targeted MuD or workplace host locations, the next step is to assess EVSE and

[173] D.11-07-056 Decision Adopting Rules to Protect the Privacy and Security of the Electricity Usage Data of the Customers of PG&E, SCE, SDG&E, and SoCal Gas.

non-EVSE related barriers[174] at specific MuD or workplace EVSE host locations. ORA has provided a non-exhaustive list of EVSE barriers that the EVSE Pilot Working Group should consider:

IV EVSE COST, PEV RATE, PEV CHARGING ACCESS BARRIERS

a. Employer, MuD or workplace property owner/manager, fleet, public domain EVSE-related barriers

- High EVSE installation and O&M costs;
- Excessive EVSE stranded costs (in the event that PEV demand is reduced);
- Uncertain return on EVSE investment (in the event the EVSEs are owned by employers and commercial property owners or managers);
- Complex PEV rates and excessive PEV bill issues including demand charges, customer response to rate structures (i.e. time-of-use (TOU) or time-variant rates); and
- Inability to control EVSE access.

b. Employee or MuD resident EVSE-related barriers

- Inability to access EVSEs;
- High PEV charging overage penalties (to encourage PEV owners to depart charging station locations and permit other EV owners to charge their vehicles);
- Ineffective IT messaging that signals PEV owners to move vehicles into or out of PEV

[174] Non-EVSE related barriers may include aesthetic considerations or other non-cost or non-access related barriers.

charging station locations (i.e. e-mail or text alerts to notify PEV owners to access or depart PEV charging locations);

- Ineffective non-IT messaging to enter or depart from PEV charging stations (i.e. signs, messages, etc.); and
- Complex PEV rates and excessive PEV bills including demand charges, customer response to rate structures (i.e. time-of-use (TOU) or time-variant rates).

V. OPTIONS TO REDUCEOR ELIMINATE PEV CHARGING BARRIERS

The EVSE Pilot Working Group should identify measures that can reduce and or eliminate barriers to enrollment in EVSE pilots including ensuring that:

- Third party EVSE companies that own PEV chargers offer a lease agreement to employers, MuD or workplace property owners/managers, fleet managers, parking structure owners (site owners could reduce EVSE cost and O&M burdens); and
- Site hosts are offered a managed charging plan by EVSPs or the IOUs.

ORA recommends that the Working Group design this assessment to obtain hile minimizing the revelation of EVSP marketing strategies or trade secrets. In addition, understanding and resolving host level barriers is critical for facilitating current and future EVSE deployment.

D. EVSE Construction/Engineering Studies

The Working Group should coordinate a least-cost engineering study to be undertaken by the utility. The least-cost engineering study will provide a potential EVSE pilot plan customer with a benchmark for required EVSE-related infrastructure costs and will entail the following steps:

- In order to determine the optimal location where a charging station should be installed, the utility will coordinate a least cost engineering study. The Working Group will develop a methodology for conducting a least-cost study.
- If a participant decides to place a charging station in a different area due to aesthetics, any incremental cost would be borne by the site host or owner.

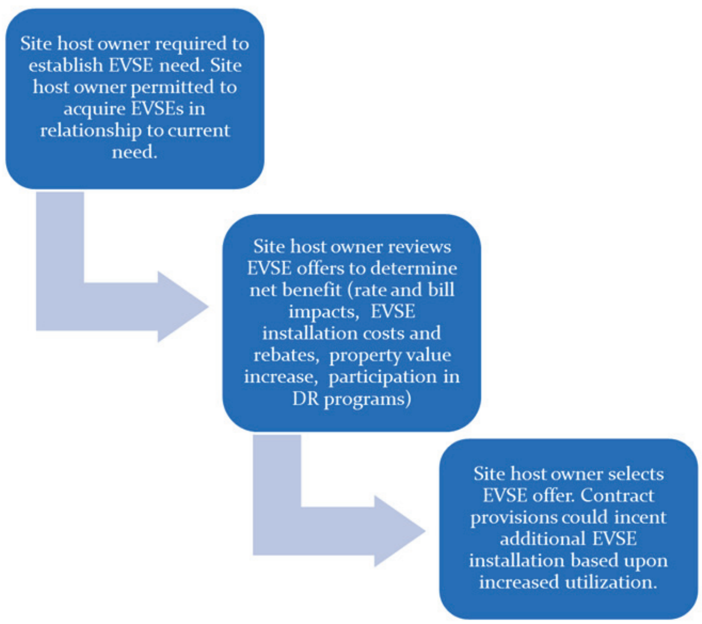
The least-cost engineering option should be dependent upon the customer's intent to obtain future benefits from participation in CAISO markets (e.g., ancillary services markets) and/or the arrival of new vehicle and charging infrastructure technologies. In these instances, customers may be willing to pay a premium to obtain these benefits. It is incumbent upon EVSPs to provide customers with the pros and cons of each proposed engineering option so that customers are able to make an informed decision.

E. EVSP Selection

ORA recommends that venues (e.g., IOU and EVSP forums or workshops) recommended by the Working Group may provide a method for prospective EVSE Pilot Plan site hosts to evaluate offers from EVSPs including utilities. The following diagram (Figure 6-2) illustrates an example of how this process would unfold. For interested parties that attend IOU and EVSP forums or workshops (e.g., EVSE site hosts or PEV drivers that live or work at potential host locations) EVSPs or IOUs should present rate and bill impacts associated with PEV and non-PEV (e.g., gasoline fueled vehicles) ownership.

ORA further recommends that the Working Group should determine alternatives strategies that could help site-hosts with EVSP selection. One method would be to suggest that property owners that manage several MuD sites could aggregate purchasing decisions to streamline the contracting process. Regardless of the strategy that has been proposed by an IOU or an EVSP, the Working Group's intent is not to reveal elements of a particular EVSPs business model or to stall the EVSE deployment process.

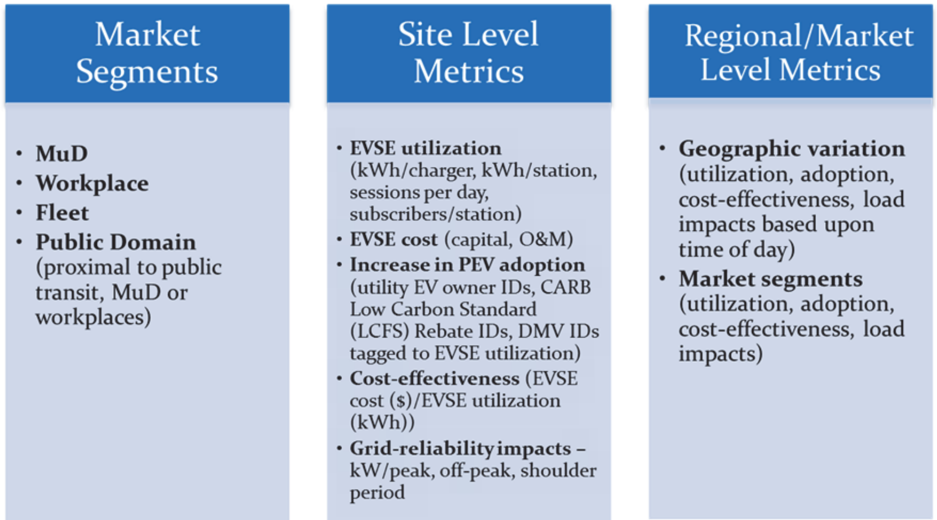
Figure 6-2. EVSE Contracting Process



F. Identification of relevant metrics

ORA recommends that the Working Group develop site and regional market-level metrics to measure the effectiveness of the pilot programs. These metrics are listed in Figure 6-3.

Figure 6-3. EVSE Pilot Plan Metrics



G. Post Implementation Data Analysis

The Working Group should determine if well-targeted EVSE installations satisfy criteria identified in the PEV demand study:

- Utilization can be used as a proxy for PEV adoption – determine EVSE utilization temporal trends;
- Market Segmentation – how did utilization rates change across market segments?; and
- Assess cost-effectiveness of EVSE utilization.

H. Lessons Learned

The findings from pilot plans should inform the design of future pilot plans or full scale EVSE deployment. These findings would include, but not be limited to:

- PEV Demand Study – what are the optimal locations for chargers based on current and future PEV purchasing?
- Site host Owner/Manager Assessment – what strategies lead to greater 'buy-in' from the property owners?

- Data Analysis – what common profiles did the best utilized charging stations share? What light did market segmentations analysis shed on utilization?

APPENDIX A

QUALIFICATIONS OF WITNESSESS

QUALIFICATIONS AND PREPARED TESTIMONY
OF
ANAND DURVASULA

Q.1. Please state your name and business address.

A.1. My name is Anand Durvasula. My business address is 505 Van Ness Avenue, San Francisco, CA 94102.

Q.2. By whom are you employed and in what capacity?

A.2. I am employed by the California Public Utilities Commission (CPUC) as a Public Utilities Regulatory Analyst in the Electricity Policy and Planning Branch of the Office of Ratepayer Advocates (ORA).

Q.3. Please describe your educational background and professional experience.

A.3. I hold a Bachelor of Science degree in Economics from the Carnegie Mellon University. I hold a Juris Doctorate degree from Santa Clara University. I have been employed with the California Public Utilities Commission, Office of Ratepayer Advocates since September 2014 and have worked on energy policy related to electric vehicles, energy markets, transmission and distribution planning.

Q.4. What is your area of responsibility in this proceeding?

A.4. I am sponsoring the following sections of ORA's Testimony: Chapter 3: Anti-competitive Aspects of SDG&E's VGI Pilot Program.

Q.5 Does this complete your testimony at this time?

A.5 Yes.

QUALIFICATIONS AND PREPARED TESTIMONY
OF
JOSE F. ALIAGA-CARO

Q.1 Please state your name and business address.

A.1 My name is Jose Aliaga-Caro. My business address is 505 Van Ness Avenue, San Francisco, CA 94102.

Q.2 By whom are you employed and in what capacity?

A.2 I am employed by the California Public Utilities Commission (CPUC) as a Utilities Engineer in the Office of Ratepayer Advocates' (ORA) Electricity Planning and Policy Branch (EPP).

Q.3 Please describe your education and professional experience.

A.3 I received a Bachelor of Arts degree in Film Studies from the University of California at Berkeley in 1996. I received a Bachelor of Science degree in Engineering Physics from the University of California at Berkeley in 2007. I received a Master of Science in Mechanical Engineering from the University of California at Davis in 2009. I worked as an engineer for the National Aeronautics and Space Administration (NASA) Ames Research Center, in Mountain View, CA, from August 2010 to December 2013. I became employed with the California Public Utilities Commission, Office of Ratepayer Advocates, in December 2013.

Q.4. What is your area of responsibility in this proceeding?

A.4 I am sponsoring the following sections of ORA's Testimony: Chapter 2: Determination of Size.

Q.5 Does this complete your testimony at this time?

A.5 Yes.

QUALIFICATIONS AND PREPARED TEDTIMONY
OF
RAJAN MUTIALU

Q.1 Please state your name and business address.

A.1 My name is Rajan Mutialu. My business address is 505 Van Ness Avenue, San Francisco, CA 94102.

Q.2 By whom are you employed and in what capacity?

A.2 I am employed by the California Public Utilities Commission (CPUC) as a Public Utility Regulatory Analyst (PURA) in the Office of Ratepayer Advocates' (ORA) Electricity Planning and Policy Branch (EPP).

Q.3 Please describe your education and professional experience.

A.3 I received a Bachelor of Science degree in Biology from the University of California at Los Angeles. I received a Master of Public Health degree in Environmental Health from the University of California at Berkeley. I worked as a PURA in Energy Division at the CPUC in the Retail Rate Design Section from 2012-14. I have been employed with the California Public Utilities Commission, Office of Ratepayer Advocates since September 2014 and have worked on energy policy related issues in the following programs: Renewables Portfolio Standard, Energy Storage, Electric Vehicles, and Distributed Resources Planning.

Q.4. What is your area of responsibility in this proceeding?

A.4 I am sponsoring the following sections of ORA's Testimony: Chapter 1: Introduction, Chapter 4: Pilot Design and Implementation, and Chapter 6: ORA Pilot Plan Framework.

Q.5 Does this complete your testimony at this time?

A.5 Yes.

QUALIFICATIONS AND PREPARED TESTIMONY
OF
DAN WILLIS

Q.1 Please state your name and business address.

A.1 My name is Dan Willis. My business address is 505 Van Ness Avenue, San Francisco, CA 94102.

Q.2 By whom are you employed and in what capacity?

A.2 I am employed by the California Public Utilities Commission (CPUC) as a Public Utilities Regulatory Analyst in the Electricity Pricing and Customer Programs Branch of the Office of Ratepayer Advocates (ORA).

Q.3 Please describe your educational background and professional experience.

A.3 I hold a Bachelor of Science degree in Environmental Economics and Policy from the University of California Berkeley. Since joining ORA in July of 2012, I have testified before the Commission in the Smart Meter Opt-Out Proceeding, A.11-03-014, and in Phase I of the Residential Rates Order Instituting Rulemaking (RROIR). I have also sponsored testimony in Phase II of PG&E's 2014 GRC, Phase II of SCE's 2015 GRC, and in Phase II of the RROIR. In addition, I have conducted detailed analysis on several other Commission proceedings on rate design, including the quasi-legislative portion of the RROIR and in PG&E's Application for an Economic Development Rate.

Q.4 What is your area of responsibility in this proceeding?

A.4 I am sponsoring Chapter 5 of ORA's prepared testimony, VGI Rate Design Issues.

Q.5 Does this complete your testimony at this time?

A.5 Yes.