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Admin. Law Judge	:	Karin Hieta
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Office of Ratepayer Advocates
California Public Utilities Commission

PREPARED TESTIMONY
ON THE APPLICATION
OF SOUTHERN CALIFORNIA EDISON COMPANY (U 338-E)
FOR APPROVAL OF ITS
CHARGE READY AND MARKET EDUCATION PROGRAM
(PHASE 1)

San Francisco, California
May 15, 2015

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EXECUTIVE SUMMARY

The Office of Ratepayer Advocates (ORA) prepared this testimony to examine the Phase 1 Pilot of Southern California Edison Company's (SCE) Charge Ready and Market Education Programs (Charge Ready Program).[1] In the Phase 1 Pilot, SCE plans to:

- install and own the infrastructure to support 1,500 Plug-In Vehicle charging stations at multi-unit dwellings (MuDs), workplaces, fleets, and destination centers throughout its service territory, and
- increase overall customer awareness of electric vehicles (EVs) through a Market Education campaign and Transportation Electrification (TE) Advisory Services.

SCE's proposal would cost ratepayers $22 million. ORA recommends the Commission expedite approval of SCE's Phase 1 Pilot with the modifications recommended in this testimony. ORA's recommendations are consistent with its *Motion to Consolidate Proceedings and Implement its Alternative Proposal for Deployment of Investor Owned Utility Electric Vehicle Infrastructure Pilots* (Cal EVIP), filed on April 13, 2015. These recommendations include:

- Limiting Electric Vehicle Charger Rebates;
- Expanding the role of SCE's proposed Advisory Board;
- Adopting metrics to gather necessary data from the pilot; and,
- Conducting workshops to determine;
  - The utilities' role in Marketing, Education and Outreach (ME&O); and
  - Siting of Electric Vehicle Supply Equipment (EVSE) in disadvantage communities.

[1] SCE has requested the Commission consider Phase 1 at this time and Phase 2 upon issuance of a decision on Phase 1. See *Application of SCE for Approval of its Charge Ready and Market Education Programs*, p. 8.

List of ORA Witnesses and Sponsored Chapters

Chapter	Section	Description	Witness
1	-	Introduction	Rajan Mutialu
2	I	Size and Duration	Rajan Mutialu
2	II	Competition	Anand Durvasula
2	III	Quarterly Reports	Rajan Mutialu
2	IV	Advisory Board	Anand Durvasula
2	V	Deployment in Disadvantaged Communities	Jose Aliaga-Caro
3	I	Adopt Proposed Changes	Rajan Mutialu
3	II	Limited Rebates	Rajan Mutialu
3	III	Siting at MuDs Should be Prioritized	Jose Aliaga-Caro
3	IV	Pilot Metrics	Rajan Mutialu
3	V	ME&O Efforts	Rajan Mutialu
3	VI	Siting at Disadvantaged Communities	Jose Aliaga-Caro

CHAPTER 1. INTRODUCTION

(Witness Rajan Mutialu)

As part of its proposal to provide "make-ready" infrastructure to support charging stations, SCE states that "utilities can and should play a similar but temporary 'early market catalyst' role to help facilitate the acceleration of electrification of transportation."[2] ORA agrees. SCE proposes a two phase program and this testimony focuses on the Phase 1 Pilot. The Phase 1 Pilot of SCE's Charge Ready Program will "allow SCE to validate its cost estimates and program incentives, identify and address field deployment issues, and refine its market education strategies, including for disadvantage communities"[3] by deploying infrastructure to support up to 1,500 charging stations in SCE's service territory. SCE's Charge Ready program will address potential anti-competitive effects in the electric vehicle service provider (EVSP) market by only installing electric vehicle infrastructure up to the "make-ready" stub at ratepayer cost. In addition, the deployment of 1,500 charging stations during Phase 1 will permit the Commission to obtain important near-term information that will inform electric vehicle charging station deployment for a larger program (Phase 2 of SCE's Charge Ready Program). SCE also proposes to offer Charge Ready customers a rebate for qualified EV charging stations in an amount that reflects their base cost up to $3,900.

To minimize ratepayer risks while enhancing its effectiveness, ORA recommends that the Commission adopt the following modifications to SCE's Charge Ready Phase 1 Pilot Program:

- Limit the EV charger rebate to 25% of the total EV charger cost that will include a 10% rebate that is tied to demonstrable EV charger utilization;

[2] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 01 – Policy, p. 1.

[3] *Application of SCE for Approval of its Charge Ready and Market Education Programs,* p. 6.

- Develop metrics that can better inform the Commission of the pilot's performance; and
- Develop guidance on the role of the utility in marketing, education and outreach efforts.

These recommendations are consistent with ORA's Cal EVIP proposal[4] which advances near-term, appropriately scaled deployment of IOUs' EV infrastructure on a statewide basis.

[4] *The Office of Ratepayer Advocates' Motion to Consolidate Proceedings and Implement its Alternative Proposal for Deployment of Investor owned Utility Electric Vehicle Infrastructure Pilots*, April 13, 2015.

CHAPTER 2. PROGRAM MERITS

(Witness Rajan Mutialu)

I. THE SIZE AND DURATION OF SCE'S PHASE 1 CHARGE READY PROGRAM MINIMIZES RATEPAYER RISK AND PERMITS THE COMMISSION TO OBTAIN FINDINGS THAT WILL INFORM PHASE 2 EV CHARGER DEPLOYMENT

ORA generally supports the design and phased implementation of SCE's Charge Ready proposal. The Phase 1 Pilot will focus on installation of the infrastructure up to and including the "make ready" stub[5] to support 1,500 EV charging stations. Phase 1 aims to (1) inform and refine design and cost estimates and (2) develop success measures for Phase 2 of the Charge Ready program.[6] In Phase 2, SCE will install infrastructure to support up to 30,000 charging stations[7] over a 4-year period. This two phase plan is prudent and should provide the Commission with a near-term strategy, including cost information, which can be used to evaluate full-scale EV charging station deployment.

If the quarterly status reports and the pilot status report SCE files with the Commission nine months into the Phase 1 Pilot do not yield adequate results to inform Phase 2,[8] then ORA recommends that Phase 1 should be extended for six months to gather more data on siting methodologies and EV adoption barriers. If needed, extending SCE's Phase 1 Pilot would ensure that sufficient information is obtained from the pilot to help implement a successful full-scale program (SCE's Phase 2) and minimize stranded costs to ratepayers.

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[5] The stub is the point of connection between the infrastructure (conduits and wires) and the charging stations.

[6] Id., at p. 2.

[7] Id.

[8] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 02 – Phase 1 Charge Ready and Market Education Program, pp. 19-20.

II. INVESTOR OWNED UTILITIES (IOU) OWNERSHIP OF ELECTRIC VEHICLE INFRASTRUCTURE UP TO THE "MAKE-READY" STUB ALLOWS EVSPS TO DIRECTLY PROVIDE CUSTOMERS WITH EV CHARGING STATION OPTIONS

In Decision (D.)14-12-079, the Commission determined it is important to 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.[9] SCE proposes to focus its efforts on providing supporting infrastructure necessary to deploy EVSE.[10] SCE states that it will provide the trenching, electrical upgrades, and other installation work necessary to create a safe, cost-effective interconnection between EVSE and the distribution grid.[11] ORA supports SCE's plan to fund electric EVSE up to the "make-ready" stub during the Phase 1 Pilot of the Charge Ready program because this approach will likely promote robust competition in the EVSP market. By participating in the program, third parties can create and provide EV charging station equipment and services, communications technology and networks, and additional vehicle-grid integration technologies.[12] SCE's proposed approach may serve to accelerate EVSE infrastructure deployment by allowing customers to choose, own, and operate and maintain charging stations.[13]

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

[10] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 01 – Policy, p. 29.

[11] Id.

[12] Id., at p. 4.

[13] Id.

III. QUARTERLY REPORTS WILL PROVIDE THE COMMISSION WITH PERIODIC FEEDBACK ON THE STATUS OF THE CHARGE READY PROGRAM

ORA agrees with SCE's commitment to provide quarterly status reports to the Commission's Energy Division and stakeholders of its Phase 1 Pilot Program regarding:

- Customer interest and satisfaction;
- Processes such as qualifying charging stations, procuring deployment services, and time and costs of the make ready equipment and of the EVSE;
- Post deployment impacts; and
- Market strategy.[14]

As SCE states, these reports will provide updates regarding the "progress, achievements, and lessons learned executing the Pilot." ORA concurs and views the analysis of data and generation of findings from the Phase 1 Pilot as a necessary and instrumental step to inform deployment of EV infrastructure to a full-scale program.

IV. SCE'S COLLABORATION WITH GOVERNMENTAL AGENCIES AND AN ADVISORY BOARD WILL ENHANCE THE EFFECTIVENESS OF EV CHARGER DEPLOYMENT

SCE proposes to form an Advisory Board with customers, industry stakeholders, and representatives from disadvantaged communities to review and provide input, guidance, and suggestions on the execution and improvement of the Charge Ready program.[15] The Advisory Board will aid SCE in engaging in a holistic approach to ensure that (1) EV infrastructure is efficiently targeted to demand; (2) timelines for installation, inspection and equipment installations are feasible; and (3) requirements specific to customer locations are well understood.

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[14] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 02 – Phase 1 Charge Ready and Market Education Pilot, p. 19.

[15] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 02 – Phase 1 Charge Ready and Market Education Pilot, pp. 3, 7.

SCE also proposes to collaborate with the California Energy Commission (CEC), the California Air Resources Board (CARB), the South Coast Air Quality Management District (SCAQMD), the Southern California Association of Governments (SCAG), and other regional agencies and beneficiaries of vehicle incentive programs in order to encourage more vehicle incentives and related state investments in disadvantaged communities.[16] ORA supports SCE's decision to engage with various governmental agencies and stakeholders to enhance the effectiveness of EV charger deployment in disadvantaged communities.

To ensure that the Advisory Board's function is integral to the process of developing the Charge Ready Program from beginning to end, ORA recommends that SCE's proposed Advisory Board be expanded, so that stakeholders have an opportunity to provide guidance and expertise regarding Charge Ready program elements including estimating EV demand, selecting EVSE sites, and developing performance metrics. The Advisory Board should be expanded to include PEV market stakeholders, including the PEV Collaborative, PEV auto manufacturers, PEV dealers, EVSPs, relevant California agencies including environmental groups and consumer advocates, in addition to those SCE already lists[17] which are local government parties (LGPs), research institutes and property management associations. Leveraging the collective knowledge and experience of the stakeholders in the Advisory Board to address foreseen and unforeseen implementation hurdles, will allow SCE to implement its Charge Ready Program effectively and efficiently.

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[16] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 03 – Phase 2 Charge Ready Program Design, Implementation Plan and Costs, p. 9.

[17] Id.

ORA recommends the Advisory Board provide SCE with input on:

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

There are also many unknown factors and unanswered questions that will play a role in the success of SCE's Charge Ready Program. Some of these questions include:

- What metrics will SCE use to measure the effectiveness of EVSE deployment models? (e.g., charging time per station or charger; number of ZEV miles traveled per PEV charging station deployed; rate of PEV adoption per PEV charging station deployed; aggregate and EVSE host location load impacts; relationship between rate and bill impacts; EVSE utilization and, EVSE costs per unit of EVSE utilization, etc.)
- How will SCE measure the effectiveness of technology solutions and scheduling practices to ensure access to charging?
- What practices, policies and procedures can best address EVSE cost and access barriers (i.e. lack of parking zones for PEVs; unwillingness of site hosts 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 SCE use anonymized EVSE utilization data collected from the Phase 1 pilot while not revealing elements of IOU or third party business models (e.g., marketing, education and outreach efforts)?

In addition to providing SCE with input, guidance, and suggestions on the development of metrics and methodologies prior to the development of Phase 1, ORA recommends that the Advisory Board also provide SCE with input on:

1. Evaluating Lessons Learned

   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.[18]

2. Adapting to Technology

   Deployment of EV charging infrastructure in SCE's Phase 1 Pilot 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 increases, then the need for Level-2 (L2) chargers may decrease and result in stranded PEV charging assets.

3. Ensuring Access to Charging

   SCE's Phase 1 Pilot 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.

4. Accounting for Variation in Geography and Demographics

   Deployment of PEV infrastructure must adapt to demographics and geography. For example, in a metropolitan area, like San Francisco, a majority of

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

residents live in MuDs that may or may not have parking spaces.[19] 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. SCE's Phase 1 Pilot should include information from current PEV demand and property surveys to identify prime locations for siting PEV charging stations.

In addition to demographics, a successful pilot must address PEV charging needs based upon geography. For example, PEV battery capacity will deplete at a faster rate in a geographic region with hills than on the flatlands. Therefore, the distribution of PEV charging infrastructure in such a location should be different than that in a city where the landscape is flat. In suburban areas served by public transit, a significant number of commuters drive to public transit stations, park, and take the train to work. PEV charging infrastructure may be needed at those public transit station parking lots.

5. Developing Strategies for Property Manager/Owner Assessment

The next step would be to assess EVSE and non-EVSE related barriers[20] at specific MuD or workplace EVSE host locations while protecting the trade practices of third party EVSPs. ORA provides a non-exhaustive list of EVSE barriers that the Advisory Board should consider:

I. 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 operation and maintenance (O&M) costs;

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

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

- Excessive EVSE stranded costs (if PEV demand does not meet projections);
- Uncertain return on EVSE investment (if employers and commercial property owners or managers own the EVSEs);
- 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;
- PEV charging overage penalties (to encourage PEV owners to vacate certain charging station locations and permit other EV owners to charge their vehicles);
- Ineffective Information Technology (IT) messaging that signals PEV owners to move vehicles into or out of PEV charging station locations (i.e. e-mail or text alerts to notify PEV owners to access or vacate certain PEV charging locations);
- Ineffective non-IT messaging to enter or depart from PEV charging stations (i.e. signs, messages, etc.).

6. <u>Identification of Relevant Metrics</u>

ORA recommends the Advisory Board provide SCE with input on developing site and regional market-level metrics to measure the effectiveness of the pilot programs. Chapter 3, Section IV of this testimony provides an in depth discussion of ORA's recommendations regarding potential metrics.

7. <u>Post-Implementation Data Analysis</u>

The Advisory Board should provide SCE with input regarding post-implementation data analysis:

- 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.

V. SCE'S PLAN TO DEPLOY EV INFRASTRUCTURE IN DISADVANTAGED COMMUNITIES MAY ENABLE EV ADOPTION IN THESE COMMUNITIES

SCE states that it "will target up to 10 percent of the Pilot's charging infrastructure deployment to take place in disadvantage communities."[21] This constitutes 150 charging stations, 10 percent of the 1,500 proposed in the Phase 1 Pilot. SCE will also reduce the minimum requirement from 10 charging stations to five charging stations per participating Site in appropriate circumstances."[22]

ORA agrees that disadvantaged communities[23, 24] should benefit from any ratepayer funded pilot program in order to encourage EV adoption. ORA acknowledges that due to significant barriers to EV adoption—the relatively high price of EVs in relationship to income level in these communities — EV adoption may be slow. The potentially slow rate of EV adoption in disadvantaged communities may initially create underutilized assets. However, deploying charging stations in this sector deserves special consideration because the stations, coupled with robust ME&O, may encourage individuals in these communities to purchase EVs.

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[21] Prepared Testimony In Support of Southern California Edison Company's Charge Ready Application, Volume 02 — Phase 1 Charge Ready and Market Education Pilot, p.7.

[22] Id.

[23] According to CAL. PRC. CODE § 75005: California Code - Section 75005, "Disadvantaged community" means a community with a median household income less than 80% of the statewide average. http://codes.lp.findlaw.com/cacode/PRC/1/d43/1/s75005

[24] Disadvantaged communities can also be defined using the California Environmental Protection Agency's (CalEPA's) California Communities Environmental Health Screening Tool. "SB 535 directs CalEPA to identify disadvantaged communities for purposes of the Cap-and-Trade funding program based on geographic, socioeconomic, public health, and environmental hazard criteria. (Health and Safety Code section 37911)"
See http://www.calepa.ca.gov/EnvJustice/GHGInvest/Documents/SB535DesCom.pdf

Additionally, because of disadvantaged communities' potentially low EV adoption rate, and third party EVSPs' potential reluctance to conduct business in what now may be a low-profit area, ratepayer-funded EVSE infrastructure may especially help to jump start the EV market. SCE's Phase 1 Pilot to install EV infrastructure may identify siting methodologies to encourage EV adoption in future deployment. A ratepayer funded deployment of EV charging infrastructure would also add EV charging infrastructure in areas that may not otherwise be served by third party EVSPs. Therefore, ORA supports SCE's Phase 1 Pilot proposal for disadvantaged communities.

CHAPTER 3. ORA RECOMMENDATIONS

(Witness Rajan Mutialu)

I. THE COMMISSION SHOULD ADOPT THE PROPOSED CHANGES TO ACCELERATE EV INFRASTRUCTURE DEPLOYMENT

ORA's recommendations in this testimony are based on its April 13, 2015 motion outlining Cal EVIP.[25] Cal EVIP was designed to start deployment of EV infrastructure on a state-wide basis while considering policy issues in a separate parallel track in the Alternative Fueled Vehicle OIR (R.13-11-007). Cal EVIP supports the installation of 1500 charging stations in SCE's service territory and ratepayer funding of EV charging infrastructure up to the "make-ready" stub, while providing a minimal rebate for EV charging stations. Given that several elements of SCE's Charge Ready program are mirrored in the Cal EVIP proposal, ORA recommends the Commission approve SEC's Phase 1 Pilot with ORA's recommended modifications.

II. EV CHARGER REBATES SHOULD BE LIMITED AND LINKED TO DEMONSTRATED EVSE UTILIZATION

SCE proposes to offer Charge Ready customers a rebate for qualified EV charging stations in an amount that reflects their base cost relative to the following three functionality profiles:[26]

1. Level 1 charging station, without network capability;
2. Level 2 charging station, with network capability integrated into the charging station; and

[25] *The Office of Ratepayer Advocates' Motion to Consolidate Proceedings and Implement its Alternative Proposal for Deployment of Investor owned Utility Electric Vehicle Infrastructure Pilots,* April 13, 2015.

[26] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 01 – Policy, p. 4.

3. Level 2 charging station, with network capability provided by external devices (such as a kiosk or gateway) shared among multiple stations.

While the cost of EV charging stations may be a barrier to customers' interest in the Charge Ready program, ORA does not support a rebate scheme that offsets the entire cost of EV charging stations. ORA recommends Charge Ready program customers should have some "skin in the game," and recommends that 25% of an EV charging station cost, according to an EV charging station's functionality, should be the maximum amount offered for a rebate. ORA further recommends that SCE offer Charge Ready program customers 15 % rebate of the EV charging station cost up front. SCE should offer the balance of the rebate -- 10% -- at the end of the pilot if program customers demonstrate EV charging station use.

SCE estimates a rebate of $3,900 per charging station.[27, 28] Twenty-five percent of the EV charger base cost cap is 0.25 x $3,900 or $975. This approximate rebate amount of $1000 on the EV charger base cost cap is similar in scale to EV charger rebates offered by the City of Anaheim for Level 2 chargers.[29]

An EV charger rebate of 25% also mirrors the relative cost of an EV and its associated vehicle credit. For example, the highest listed manufacturer's suggested retail price (MSRP) price of a 2015 model Nissan Leaf is $35,120.[30] This automobile is eligible for a federal Qualified Plug-In Electric Drive Motor Vehicle Credit of $7,500.[31] The Qualified Plug-In Electric Drive Motor Vehicle Credit represents approximately 21% of the Nissan Leaf's total cost (i.e.

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[27] Prepared Testimony In Support of Southern California Edison Company's Charge Ready Application, Volume 02 — Phase 1 Charge Ready and Market Education Pilot, p. 31.

[28] Final rebate will depend on results of a RFI process.

[29] Anaheim Public Utilities, Plug-In Electric Vehicle Charger Rebate Program, Plug-In Electric Vehicle Incentives http://www.anaheim.net/article.asp?id=4946

[30] http://usnews.rankingsandreviews.com/cars-trucks/Nissan_Leaf/

[31] http://www.efile.com/tax-credit/hybrid-car-tax-credit/

($7,500/$35,120)*100%). As such, a rebate of 25% of the total cost of EV charging stations is reasonable.

III. RATEPAYER FUNDING OF INFRASTRUCTURE FOR EVSE IN MuDs SHOULD BE PRIORITIZED

While ORA acknowledges the potential benefits of workplace EVSE siting,[32] such as extending zero-emission miles driven and relieving range-anxiety, ORA recommends the majority of *ratepayer funded* infrastructure to support EVSEs should be primarily at MuDs. The need for at-home-charging along with impending improvements in EV battery capacity that may extend driving range and reduce range anxiety may reduce the need for workplace charging stations.

Away-from-home charging may not be the correct application for ratepayer funding of EV infrastructure. An EPRI study[33] analyzed transportation data and concluded that "home charging will likely be the primary charging location for most vehicles" while "workplace charging will likely be an important secondary charging location." 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.[34] 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."[35] Pilot results should evaluate the impact siting of charging stations at MuDs has on EV

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[32] *Prepared Testimony in Support of Southern California Edison Company's Charge Ready Application;* Volume 01 – Policy, p. 20-22.

[33] Transportation Statistics Analysis for Electric Transportation, EPRI, December 2011.

[34] "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

[35] "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

adoption. It should also evaluate the quantity of workplace charging stations needed to promote more EV adoption.

Research into improving EV battery capacity is not stagnant — "private sector research and development indicates that the electric battery market holds a promising future."[36] The main limitation to a PEV's driving range is battery capacity. The most common battery technology used today is Lithium-ion (Li-ion); the battery capacity of Li-ion batteries is expected to reach a limit of around 325 W-h/kg[37] by 2018.[38] Assuming a 200 kg battery pack, this would provide a driving range of about 150 miles.[39] New technologies that may increase driving range have been reported in the news, such as Aluminum-Air (Al-O) batteries[40] and Lithium-Sulfur (Li-S) batteries.

In March 2013, it was reported that an Al-O battery could allow a vehicle to travel 1,000 miles.[41] This battery is promoted as a "supporting technology," that is, a back-up battery. It cannot be recharged and would only be used in the event the main battery ran out of charge. The battery is replaceable and may only need to be replaced once a year depending on usage. More recently, in January 2015, a representative of the battery developer stated that automakers in

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[36] Jones, K. and Zoppo, D. *A Smarter, Greener Grid*. Santa Barbara: Praeger, 2014. Print (89)

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

[38] C.-X. Zu & H. Li *Energy Environ. Sci.* 4, 2614-2624 (2011). Obtained from http://nature.com/news/the-rechargeable-revolution-a-batter-battery-1.14815

[39] 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).

[40] 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.

[41] 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/

Europe are building vehicles using the Al-O battery for testing.[42] Another article stated that "Renault-Nissan announced a possible partnership between the company and Phinergy to create an electric car by 2017 that will use the Al-O battery."[43, 44]

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.[45] The life cycle of Li-S batteries is short and that may hinder its commercialization.[46] But a 2015 article expresses that "recent academic studies have reported [increased life cycles of Li-S batteries] and commercialization should soon be realized."[47]

The Commission should consider the dynamic nature of PEV-related research. 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, then workplace charging infrastructure may be underutilized. If the EVSE assets have been rate-based, then the ratepayers will continue to pay for underutilized assets.

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[42] Oravecz, J. *Alcoa, Israeli company collaborate on aluminum-air battery*. January 10, 2015. http://triblive.com/business/headlines/7431480-74/battery-aluminum-alcoa#axzz3ZTvNwVxg

[43] Maverick, T. *"Breathing" Battery Extends EV Range*. January 16, 2015. http://www.wallstreetdaily.com/2015/01/16/aluminum-air-battery-phinergy/

[44] Phinergy is the Israeli company developing the Al-air battery.

[45] 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

[46] 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.

[47] Cuisinier, M., Hart, C., Balasubramanian, M., Garsuch, A., and Nazar, L. *Radical or Not Radical: Revisiting Lithium-Sulfur Electrochemistry in Nonaqueous Electrolytes*. Advanced Energy Materials, 2015, 1401807.

Whether the Commission approves workplace charging or not, ORA recommends, as stated in its Cal EVIP proposal, that the EVSPs and IOUs target EVSE deployment strategically in areas that will explicitly measure the increase of EV adoption. This could be achieved by classifying geographic areas into three general categories: 1) EVSE developed (areas where there is a high penetration of EVSEs), 2) EVSE semi-developed (areas that deemed to have a moderate level of EVSE penetration), and 3) EVSE minimally-developed (areas that have a sparse level of EVSE penetration). After "EVSE semi-developed" or "EVSE minimally developed" areas have been identified, EVSPs and IOUs could partner to determine if there is interest in EVSEs and if residents would invest in EVs if EV charging stations were available to them. If there is customer interest, and EV charging stations are deployed in these areas, this methodology may result in quantifiable data for the Commission and the parties to determine if increasing EV infrastructure promoted the purchase of electric vehicles.

Additionally, ORA recommends identifying where ratepayer funding of EV infrastructure at certain locations, which would otherwise not be installed, significantly helps promote EV adoption. That is, there should be a methodology developed to make sure that ratepayer funding does not support charging station installations that would be installed regardless if ratepayer funding was present or not.

IV. THE COMMISSION SHOULD REQUIRE DETAILED METRICS TO EVALUATE THE PHASE 1 PILOT

SCE lists a number of pilot-related attributes to be evaluated in the Phase 1 Pilot including:

- Market Education Strategies, including the channels selected, website, and collateral;
- Customer interest in and satisfaction with the Charge Ready program, including Disadvantaged Communities;
- Processes including (1) qualifying charging stations

(e.g., availability of Level 2 charging stations with load management and demand response capabilities), (2) procuring deployment-related services (e.g., sourcing of qualified electrical contractors), and (3) assumptions about time and costs to deploy EV charging infrastructure at participating customer sites; and

- Post-deployment impacts, including assumptions about load expected from installed charging stations.

One major issue that should be included in this list is an examination of customer interest in the Phase 1 Pilot relative to the existence and potential alleviation of EVSE cost and access barriers. In addition, ORA recommends SCE capture this information for specific EV market segments including multi-unit dwellings, workplaces, fleets, and other public locations.

ORA suggests the following additional list of metrics to measure the performance of the Phase 1 Pilot:

- Current and incremental EV demand per host site[48] (e.g., number of registered EV drivers (current EV demand), Low Carbon Fuel Standard Vehicle Rebate (incremental EV demand)
- Kilowatt-hour (kWh)/charging station, site (EV charger utilization)
- kWh/site as correlated with Customer Participant policies regarding access and use of charging stations[49]
- kW/site (load impact)
- Prospective Customer Participant willingness to:
    1. Sign easements.
    2. Fund EV charging station O&M costs for a 10-year period.
    3. Participate in demand response programs.
    4. Designate parking spaces for EV chargers.

[48] SCE Charge Ready Prepared Testimony Vol. 2, p. 6.

[49] SCE Charge Ready Prepared Testimony Vol. 2, p. 15.

5. Manage EV driver access to EV chargers.
6. Pay for additional "make-ready" costs beyond the least cost estimate.
7. Pay for additional EV charging stations costs beyond the Base Cost estimate.
8. Accept the number of EV charging stations proposed by SCE.[50]
9. Accept the location and configuration of EV charging stations.[51]

- ME&O metrics including the number of:
  1. Visits to the Charge Ready program website,
  2. Customer Participants that contacted TE Advisory services.
  3. Customer Participants that enrolled in the Charge Ready program due to information obtained from websites, radio spots, public events, etc.

V. THE IOU ROLE IN ME&O EFFORTS SHOULD BE ADDRESSED IN A SEPARATE TRACK OF THE ALTERNATIVE FUEL VEHICLE (AFV) ORDER INSTITUTING RULEMAKING (R.13-11-007)

SCE proposes increasing potential car buyers' awareness of the benefits of EV ownership including increased utilization of utility assets, reduced GHG emissions, and lower rates for off-peak charging.[52] In addition, SCE intends to expand its current advisory services for business customers to offer education and customer support in reference to electrifying fleets, EV charging, reducing GHG footprints and other transportation electrification areas for business customers.[53]

[50] SCE Charge Ready Prepared Testimony Vol. 2, p. 10.

[51] Id., at p. 12.

[52] Id., at p. 15.

[53] Id.

Given that Customer Participants will purchase EV charging stations from EVSPs,[54] it is likely that ME&O will also be offered by these private sector companies. ORA recommends the role of the IOUs in ME&O efforts be determined in a separate track in the AFV OIR in order to avoid duplicative efforts between the IOUs and EVSPs and to promote synergy. This proposal was also supported by SCE in its *Response to the Joint Party Motion to Consolidate Proceedings* and ORA's *Motion to Consolidate Proceedings and Implement its Alternative Proposal for Deployment of Investor Owned Utility Electric Vehicle Infrastructure Pilots (California Electric Vehicle Infrastructure Pilot (Cal EVIP))*.[55]

VI. THE COMMISSION SHOULD HOLD A WORKSHOP ON EV CHARGING STATION SITING IN DISADVANTAGED COMMUNITIES

A workshop to develop multiple siting methodologies in disadvantaged communities should be conducted before pilot deployment of EV infrastructure to help disadvantaged communities benefit from the Phase 1 Pilot EV infrastructure deployment.

In this market sector, ORA recommends siting of EV charging stations in MuDs should take precedence for the reasons stated in Chapter 3, Section III of this testimony. ORA also recommends the deployment of shared charging station among many MuDs. For example, EV charging stations may be located in one MuD's parking lot, but may be accessible, through service arrangements, by residents from other MuDs. Deployment conducted in this manner may mitigate the potential for

[54] SCE Charge Ready Prepared Testimony Vol. 2, p. 13.

[55] Southern California Edison's Response to the Joint Party Motion to Consolidate Proceedings and ORA's Motion to Consolidate Proceedings and Implement its Alternative Proposal for Deployment of Investor Owned Utility Electric Vehicle Infrastructure Pilots, p. 3.

stranded or under-utilized assets paid for by ratepayers while increasing exposure to EVs in disadvantaged communities. It may also lead to a greater geographical diversity of EV charging station deployment that may ultimately encourage more EV adoption.

Once EV demand and the need for charging stations are established, SCE or the EVSP must determine how to weigh the cost to install EV charging infrastructure against possible EV adoption. A Rocky Mountain Institute study[56] indicated that the cost to install one single charging station in a parking garage was up to $6000, and up to $9000 for curbside installation.[57] The cost decreased to $4000 to install five charging stations in parking garages, and to $6000 for dual stations for curbside installation. Whereas five charging stations at a cost of $4000 may seem a better expenditure of funds than dual stations at a cost for $6000, the siting methodology should determine which installation has the greater capacity to increase EV adoption. For example, the five stations may be situated in a parking structure that has limited access and low visibility, thus it may not incent individuals to adopt EVs, whereas the curb side installations may be more accessible and visible and may incent individuals to adopt EVs. Therefore, different siting methodologies of EV infrastructure deployment could be tested.

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[56] Agenbroad, J. and Holland, B. *Pulling Back the Veil on EV Charging Station Costs*, April 29, 2014. http://blog.rmi.org/blog_2014_04_29_pulling_back_the_veil_on_ev_charging_station_costs

[57] In the study the base charge station hardware cost was $2000. The remainder of the cost comprised of permitting, mobilization, electrician and other labor, and electrician and other materials.

APPENDIX A

QUALIFICATIONS OF WITNESSES

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 1, Section 2 (Competition) and Section 4 (Advisory Board).

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, Section 5 (Deployment in Disadvantaged Communities), and Chapter 3, Section 3 (Siting at MuDs Should be Prioritized) and Section 6 (Siting at Disadvantage Communities).

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

A.5. Yes.

QUALIFICATIONS AND PREPARED TESTIMONY

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 2, Section 1 (Size and Duration) and Section 3 (Quarterly Reports), and Chapter 3, Section 1 (Adopt Proposed Changes), Section 2 (Limited Rebates), Section 4 (Pilot Metrics), and Section 5 (Marketing, Education and Outreach Efforts).

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

A.5. Yes.