SCE - Open Vehicle Grid Integration Platform (OVGIP)

Residential Demand Response (DR) Project Summary Report

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Technical Update, December 2018

Project Manager: S. Chhaya

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ABSTRACT

This report provides a summary of the Southern California Edison (SCE) Open Vehicle Grid Integration Platform (OVGIP) Residential Demand Response (DR) Project, its findings and conclusions. The participants in the project are American Honda Motor Co Inc., Sumitomo Electric Innovation (SEI), EPRI, and SCE. SCE initiated this project through EPRI under the EPRI OVGIP Phase 2 Program supplemental agreement for implementing and demonstrating demand side management (DSM) of PEV charging use cases using the OVIGP as the central server providing the communications pathway between the utility and the PEVs. The functional premise is the OVGIP establishes a common utility interface utilizing utility industry communications standards and provides interoperability with automotive original equipment manufacturers (OEM) vehicle telematics application programming interfaces (API). The OVGIP is to provide a single utility interface to the multitude of automotive OEMs' electric vehicles.

This project was designed to provide aggregated demand response management of customer's PEV charging load in the residential environment. SCE used the OpenADR 2.0b protocol to communicate DR Event signals/requests to stop PEV charging via the OVGIP (aggregator). The 10/10 baseline methodology was instituted, based on SCE's customer's associated Green Button whole house meter data, for measurement and verification of PEV customers participation in the DR Events.

The purpose of the project was to assess how the OVGIP can best determine, report and facilitate OEM(s) to provide grid services through demand side management and to evaluate the DR measurement data results (10/10 baseline method) collected through the OVGIP to determine the use of OEM measurement capabilities for future programs (non-billing purposes).

The report also includes findings, conclusions, and recommendations from the evaluations of the customer enrollment process, customer survey, customer participation factors, comparative data results between the 10/10 baseline and OEM reported PEV load reduction, and impact assessment from the forecasted SCE PEV load demand through Year 2030.

Keywords

OVGIP, PEV, Telematics, Green Button, Demand Response, DR, Measurement and Verification (M&V), Electric Vehicles, Smart Charging, Managed Charging, VGI

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PROJECT OVERVIEW

Background

Plug-in Electric Vehicles (PEVs) are a rapidly growing class of smart, connected load with a nationwide installed base over 1,000,000 as of October 2018[1]. Utilities have an opportunity to manage the charging of PEVs in a manner consistent with demand response (DR) and demand-side management (DSM) objectives. However, the PEV infrastructure and load management landscape is fragmented with PEV and charging network providers positioning themselves as aggregators seeking to leverage their proprietary charging networks and interfaces. This complexity has been stifling the integration of PEVs into DR and DSM delivery channels, and thereby preventing potential benefits from accruing to utilities, PEV customers, and public-at-large.

EPRI's Electric Transportation Program is in collaboration with six leading global PEV manufacturers and multiple utilities to develop a utility-friendly, open standard platform to streamline the management of PEV charging. This platform, the Open Vehicle Grid Integration Platform (OVGIP), is to enable utility access to data from the EVs including vehicle energy use, charging profiles, and consumer response to various signals or inducements to affect charging behavior. The OVGIP is intended to enable utilities to integrate all PEVs within their service territories into DR and DSM programs.

The objective of the Phase 2 OVGIP Program is to advance the central OEM/Utility interface concept and assess the effectiveness of the platform to integrate PEV charging with grid objectives through DR and DSM mechanisms. The program consists of the following activities:

- Creating requirements and use cases for a unified grid services platform that is secure, low-cost, and extensible;
- Develop an architecture and functional representation of the platform to enable PEV integration into DR and DSM use cases;
- Assess the performance of the platform against utility requirements through field pilots at utility host sites.

Project Introduction

In support of these objectives, Southern California Edison engaged with EPRI in the Phase 2 Open Vehicle Grid Integration Program (OVGIP) to conduct an Electric Vehicle Residential Demand Response Project. The OVGIP project identifies a specific set of use cases[2] intending to be developed and demonstrated. SCE determined, after initial vetting of the use cases, that

[1] Electric Drive Transportation Association (EDTA) Electric Drive Sales Dashboard https://electricdrive.org/index.php?ht=d/sp/i/20952/pid/20952

[2] Open Vehicle-Grid Integration Platform – Unified Approach to Grid / Vehicle Integration - *Definition of Use Case Requirements - EPRI Report No. 3002005994*, Technical Update, December 2015

they are primarily interested in demonstrating Use Case 2: Aggregated EV Demand Response (DR).

Project Overview

The project entailed the development and demonstration of the OVGIP to provide the communications interface between Southern California Edison and Honda FIT EV customers to respond to day ahead DR signals. The communications architecture consisted of SCE generated OpenADR signals for EV load curtailment to the OVGIP to the Honda vehicle telematics system. The measurement and verification process was predicated on an applied 10/10 baseline (average of previous 10-day specific watt hour meter data) methodology utilizing EV customer's whole house meter data extrapolated from the SCE Green Button system.

The OVGIP was responsible to access the customer's residential meter data from the SCE Green Button system through the Third Party Connection access, calculate the 10/10 baseline for the DR event and provide the correlated customer charging data reported to the OVGIP from the OEM to verify customer participation in the DR Event. This was a five-month (May through October 2018) test and demonstration pilot to assess the functionality and effectiveness of the OVGIP central server interface between the utility and the PEV, the EV customer level of participation and performance, and an analysis of the resulting data to formulate an estimate of the larger scale impact from using EVs as a DR resource.

Project Objectives

This project objectives are to evaluate the following:

- How the OVGIP can best determine, report and facilitate OEM(s) to provide grid services through demand side management
- The methods by which SCE utilize the OVGIP to determine performance during DR events
    - SCE would like to evaluate the DR measurement data results (10/10 baseline method) collected from the OVGIP to determine the use of OEM measurement capabilities for future programs (non-billing purposes)
- The methods by which OEMs engage customers when DR events are scheduled
- The accuracy of existing methods for associating EV location to an enrolled premise account (e.g. GPS) and whether any other methods can or should be determined
- The methods by which IOUs can utilize OVGIP/OEMs to target specific locations (e.g. zip codes, sub-stations, line segments, etc.)
- The benefits to the transmission or distribution grid

The prime objective and benefit to the project is the validation of the direct communications accessibility through the OVGIP to the EVs from the utility for monitoring and managing EV charging as a Demand Response (DR) resource.

2
PROJECT ASSESSEMENT

Enrollment Process

The customer recruitment and enrollment process was the responsibility of the OEM (Honda) acting as a sub aggregator to the OVGIP providing the primary aggregator services and interface to SCE. The recruitment effort focused on Honda employees for the SCE project. Enrollment process was accommodated through the "Honda SmartCharge™" customer website providing instructions and links for downloading the HondaLink® EV App to authorize and activate the vehicle module interface to the Honda vehicle telematics server and enrolling in the SmartCharge Beta Programs. The Honda SmartCharge Beta Programs includes enrollment and customer administration for two Honda telematics based DR programs including the SCE OVGIP Residential DR Project and a California ISO Demand Response Auction Mechanism (DRAM) program with eMotorWerks. The primary vehicle being utilized for these programs is the Honda FIT BEV with estimated 186 mile all electric range, 20kWH Lithium Ion battery pack, and 1.3kW level 1/6.7 kW level 2 charging capability. The customer incentive for enrollment in the SCE project was a $50 upfront payment paid by Honda.

The enrollment process entailed 4 primary actions by the customer for the SCE project:

1. Download and activation of the HondaLink™ EV App
2. Agreement to Honda terms and conditions for authorizing the monitoring, recording, and reporting of their charging data (location, date, start/end times, kWH energy usage, etc.)
3. Linking to customer utility account information
4. Customer authorization for third party (OVGIP) access to their Green Button household metering data.

Challenge was that even with the intended automated enrollment process, it still required direct follow up with customers on certain aspects for reasoning and clarification about the vehicle and utility information being accessed and shared. This process revealed that if more than two follow ups are required there is a high risk (50% probability) of losing the potential enrollee. Additional issue is the need for personal customer follow-up elongates the enrollment process and requires more personnel resources be assigned to encourage and guide customers through the process.

The target for the project was to enroll between 25 and 35 Fit EV customers to achieve a potential DR capacity from 75kW to 100kW. The resulting recruitment achieved the enrollment of 5 employees. A barrier to recruitment is that many of the customers are participating in the California ISO DRAM Honda SmartCharge program, and some in other EV TOU programs and residential A/C programs. According to the California ISO rules customers could not participate in more than one program at the same time, so were not allowed to simultaneously enroll in the SCE OVGIP Residential DR Project. A waiver for customers to be able to enroll in this short term project was granted by the SCE Program Manager. However, this issue created some disinterest on the part of the customer to additionally enroll in the SCE OVGIP project.

Restricting customers to only participate in one program presents a challenge to the automakers and aggregators. It mitigates the business case and value potential for providing EV DR capacity resources. An example is Honda wanted to participate in the PG&E Excess Supply Pilot but could not because of the restrictions for participating in the California ISO program. There needs to be a policy change to enable customers to participate in multiple programs especially between the California ISO and the utilities.

There are several learnings relative to recruitment and enrollment of the customer. Outreach and communications process needs to be improved, potentially initiated at the dealership when customers are purchasing a PEV and improve the ease of on-line registration such as streamlining or consolidating the customer permission requirements between the utility and the OEM. The key learning is the ability to adequately communicate up front to the customer the benefits and incentives for participating in the DR programs to encourage their participation. An assumption is that with the accelerated growth of the EV market, more effective ongoing customer outreach and education, and appropriate incentives there will be a progressive increase in familiarity for vehicle grid integration programs which will enable a higher rate for enrollment.

DR Events and Customer Participation

The scheduling of the DR events was set to be consistently every Tuesday and Friday evenings during the field demonstration period throughout the month of September between the hours of 10 pm and 11 pm and first part of October 2018 between the hours of 2 am and 3 am. The premise of the determination for the late evening hours was to ensure, based on the small quantity of enrollees, the vehicles would be most available for participating in the DR events.

Events were initiated by an SCE dispatched OpenADR 2.0b SIMPLE signal (start time, duration, percent curtailment, etc.) to the OVGIP on a day ahead basis. The OVGIP receives and acknowledges receipt of the DR Event signal and transmits the DR Event signal to the OEM (Honda) servers via a generic or proprietary API. The OEM authenticates the customer enrollment in the DR Program and determines available EV capacity based on quantity vehicles plugged in at their residential location at the specified time. The OVGIP objective is to collect aggregated charge behavior data from the OEM to facilitate the capability to calculate projected EV DR capacity availability at minimum on a day-ahead basis but more optimally on a near real time hour ahead basis.

OEM server queries each plugged in vehicle to determine the customer's preset charging preferences (i.e. time charge is needed), and vehicle charge status/requirement (i.e. SOC, power required, and time required to charge), then makes determination for EV to Opt In/Out of event. Customer has option to manually opt-out at any time.

The overall customer participation rate was 77% (Opt In rate factor) based on number of vehicles plugged in during the period of the DR events. There were a total of nine DR events executed equating to 45 total customer participation opportunities (9 events X 5 customers). The actual number of customer participations (vehicles plugged in during the events or Opt In) was 35 of the total 45 opportunities, effectively a 23% Opt Out rate factor. Further qualification is that 7 of the 35 participating or plugged in vehicles had connectivity issues and were unable to record their session data. This adjusts the effective participation rate to 62% (28 completed connections/45).

Qualification criteria for utility acceptance of EV customer's participation in a DR Event is a secondary issue. The original criteria was if the customer is plugged in at the start of the DR event and did not charge during the event it qualified as a reduction in load for the event. However, it was later determined that the more appropriate qualification is the vehicle must be plugged in and charging prior to the DR event period and stopped charging during the event. Based on the latter criterion the customer EV qualification rate dropped from 80% to 20% of the 28 completed vehicle connections. This issue is somewhat ambiguous because the charging load consumption data prior to the event is not part of the DR Event baseline calculation. This is addressed further in the Measurement and Verification discussion.

Customer Survey

A customer survey has been prepared and submitted to the SCE OVGIP Residential DR Project which is provided in Appendix B - OVGIP Experimental Survey Summary. Results of the survey will be formalized and provided to SCE upon completion by the customers. Preliminary feedback on some of the questions from the customers are:

- Commuting distance from home to work is between 3 miles and 35 miles
- All drivers use the EV as their primary source of transportation
- All drivers drive alone, do not provide any car pooling
- One driver of the 5 charges at home with Level 1 charging, all others have Level 2 charging at home
- All have access to workplace charging – level 2
- 4 of the 5 drivers charge every day – other charges 3 times a week
- 2 drivers intentionally opted out of the DR event on two or three occasions
- All are participating for the monetary compensation
- All drivers own their residence – 1 is part of a multi dwelling complex – others are single family homes
- 4 drivers are on tiered rate and 1 driver is on TOU rate
- Drivers leave for work between 6 am and 9 am and leave work between 4 pm and 9 pm.

Measurement and Verification:

There are two sources of data collected and recorded for measurement and verification (M&V) of the customer performance and compliance to the DR events. The primary data source for M&V is the customer household meter data accessed through the SCE Green Button system. This data is the basis for quantifying the load (watt hour) increase/decrease between the average of the prior 10 days and the actual day of the event

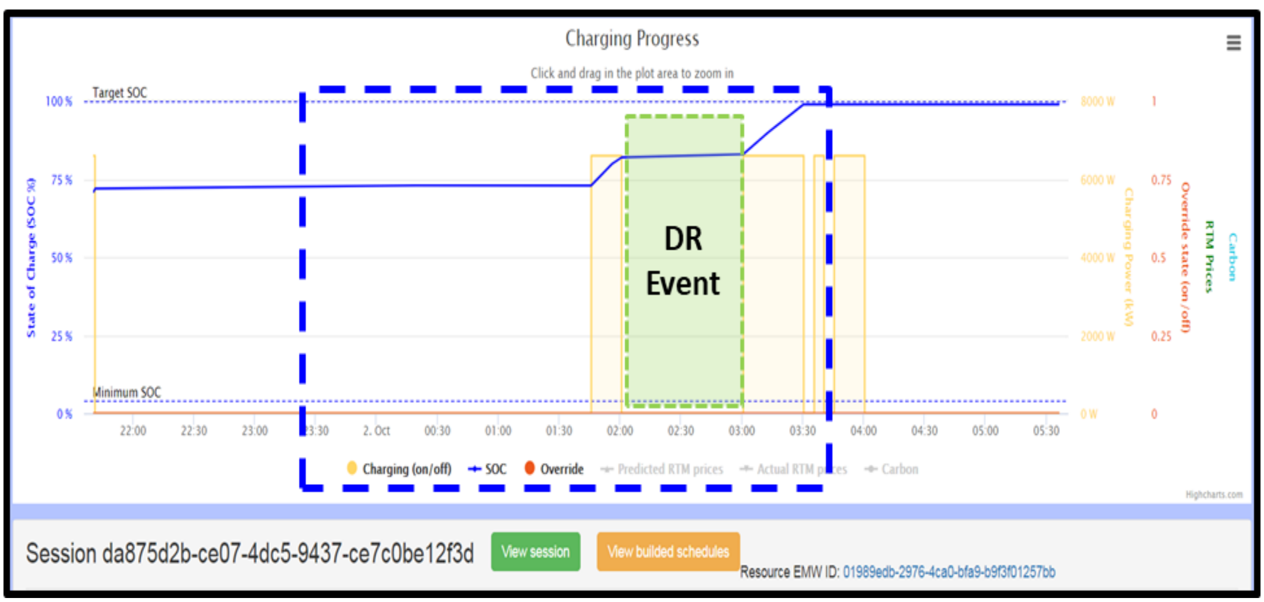

Figure 2-1
Vehicle Charging Profile Relative to October 2, 2018 DR Event – Extracted from presentation titled "SCE OVGIP Pilot – Honda Report"

The other data source is the OEM (Honda) recorded customer charging session profile data associated to the DR event. Summary of the baseline data

average watt hour consumption and DR Event watt hour consumption for each of the customers for each of the events is provided in Appendix A, which includes the OEM reported vehicle load reduction (kW) for each vehicle participating in the event.

Review and analysis of the data revealed issues with the efficacy of applying the 10/10 baseline as the methodology using the whole house meter data and the relevancy for determining or identifying the level of EV charging load reduction during the DR Event. Figure 1 represents the OEM reported charging session profile for a customer vehicle participating in the October 2, 2018 DR Event for the one hour period between 2 am and 3 am. It reflects the vehicle was plugged in and charging prior to the start of the event; that it correctly stopped charging during the period of the DR Event; and resumed charging after the end of the event. This is an ideal charging management profile verifying the vehicle's responsiveness to the DR Event signal.

The issue of the effectiveness of the 10/10 baseline methodology is related to the verification of the actual load reduction attributable to the curtailment of EV charging. Table 1 provides the summary of the 10/10 baseline data and the Honda reported vehicle load reduction for the profiled event depicted in Figure 2-1.

Table 2-1 Reported 10/10 Baseline Data for October 2, 2018 DR Event, Extracted from Appendix A data attributable to Figure 2-1

#Event Date	CSRId	Begin Hour(PDT)	End Hour(PDT)	Average watt hour for Prior 10 days	Event day (watt hour)	Delta (increase / decrease) watt hour	Honda Recorded Vehicle Load Reduction (kW)
10/2/2018	EF9PIOTJU	10/2/2018 2:00	10/2/2018 3:00	1166.18	1182	16	7.17

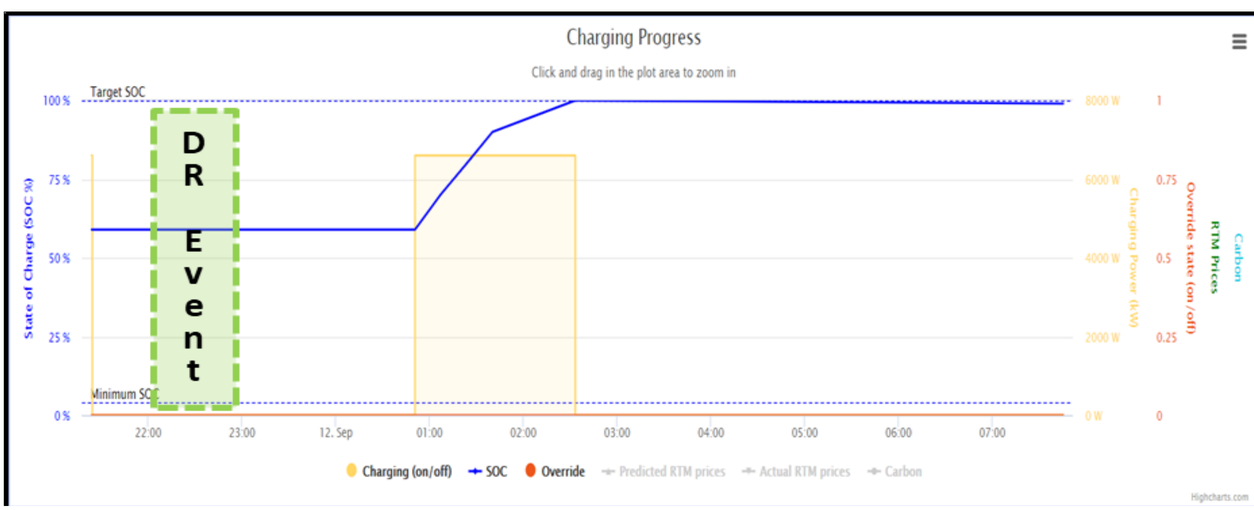

Figure 2-2
Vehicle Charging Profile Relative to October 2, 2018 DR Event – Extracted from presentation titled "SCE OVGIP Pilot – Honda Report

Per the whole house meter data extracted from the SCE Green Button system, summarized in Table 1, the prior 10 day average consumption during the 2 am to 3 am period is 1,166.18 watt hours versus 1,182 watt hours during the actual event. The baseline calculation reflects an

increase of 16 watt hours in load consumption during the event. Conversely, the Honda recorded vehicle data reports a load reduction of 7.17 kW which can be translated to a 7,170 watt hour reduction which is not accounted for in the baseline data.

Table 2-3:
Reported 10/10 Vaseline Data for September 11, 2018 DREvent - Extracted from Appendix A data attributable to Figure 2-2

#Event Date	CSRId	Begin Hour(PDT)	End Hour(PDT)	Average watt hour for Prior 10 days	Event day (watt hour)	Delta (increase / decrease) watt hour	Honda Recorded Vehicle Load Reduction (kW)
9/11/2018	EF9PIOTJU	9/11/2018 22:00	9/11/2018 22:30	906.00	1002	96	6.29

Figure 2 provides another representation of the OEM reported charging profile for the same customer on September 11, 2018 for the half hour period between 10 pm and 10:30 pm. This profile reflects the customer EV is plugged in prior to the event and did not charge either prior or during the event: and later started charging to meet the customer required time charge is needed preference. Again, per the whole house meter data extracted from the SCE Green Button system, summarized in Table 2, the 10/10 baseline calculation reflects an increase in load consumption of 96 watt hour during the event. Note that in Table 2 the Honda recorded vehicle load reduction is 6.29 kW or 3.14kWh for the half hour event duration.

The reason for the discontinuity between the reported meter baseline load consumption data and the reported vehicle charging profile data is the absence of EV charging load data in the 10/10 baseline. If the EV customer does not usually charge during the specified event hours within the prior 10 days, there is no offsetting increase in the baseline to account for any EV charging load reduction the day of the event. It is effectively a net zero situation. This issue can be potentially attributed to the selection of the time periods for the DR Event. In this case, the hours from 10pm to 11pm and 2 am to 3 am, are not typical charging hours for the average EV customers. More appropriate hours would be between 5 pm to 9 pm (evening peak hours) when customers arrive home from work and usually plug in to charge.

There is also the issue previously mentioned for qualification of an EV customer's participation in a DR Event whether the criteria should be the customer must be plugged in and charging prior to the DR Event, or just plugged in prior to the DR Event[3]. If the EV customer does plug in and charges prior to the start of the DR Event, the associated EV load data is not included in the baseline. It has no quantifiable effect for determining the EV charging load reduction during the DR Event. The alternative qualification criteria wherein the vehicle must only be plugged in prior to the DR Event also does not affect the baseline calculation. Technically, based on the OEM reported EV charging load reduction both charging session profiles presented in Figures 1 and 2

[3] Note: EV was disqualified if plugged in at the start of the event and charged during the DR Event.

reflect the customer's EV did respond to the DR Event signal. However, the 10/10 baseline calculations in both scenarios indicates an increase in watt hour consumption during the DR Event.

Evaluation and Assessment

The essence of the SCE OVGIP Residential DR Project was the ability to verify the capability of the Open Vehicle Grid Integration Platform (OVGIP) to provide a viable interface and communications connection between the utility and the customer PEVs for managing EV charging loads. It validated the viability for DR aggregation of PEV charging load utilizing the OEM telematics vehicle connection and the ability to collect and report individual customer charging profile data for purposes of verification. Premise need for direct PEV communications connectivity is accessibility for identification and utilization of PEVs to provide both excess supply side (add charging load) and supply side (reduce charging load) capacity that is responsive to signals in day ahead and near real time scenarios - the ability to exercise PEVs as a controllable dispatchable load for utilization as a load modifier resource.

Statistically, the enrollment population (5 Customers) for this project is small, but a key result is the OEM (Honda) recorded data reports the aggregated load reduction capacity of the 5 PEVs participating during a DR Event is 26.48 kW[4] effectively equating to a reduction or avoided load increase of 26.48 kWh over a one hour event duration. This is statistically significant when applied to a PEV cluster at a neighborhood transformer level. This information can be applied to estimate the potential PEV capacity available for load modification and aggregation within the SCE region through the 2030 timeframe.

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[4] Reference Appendix A - Summary of Customer 10/10 Baseline Data – DR Event 9/21/2018

3

FORECASTED PEV DEMAND

Forecasted SCE Region PEV Capacity

The PEV installed base in California is fast-approaching 500,000 vehicles. By the end of October 2018, the nationwide installed base of EVs reached 1,000,000 in the US. The State of California accounts for approximately 50% of the total vehicle sales nation-wide and is on pace to accelerate even further. PEV sales growth forecasts vary by region, and an EPRI analysis[5] indicates that there is a strong possibility for EVs to achieve, in an optimistic scenario, 40% market share of US wide new vehicle sales in 2030. This meshes with the State of California Governor's mandate of 5 million EVs by 2030.

Given the necessity of generating PEV projections to estimate the potential impact of PEVs on utilities, EPRI created a simplified methodology providing three scenarios to estimate the market adoption of PEVs. The Low and High trajectories are intended to be used as plausible bounding scenarios. The Medium scenario may be considered a middle-ground estimate, but it is not intended to be used as a sales prediction.

The three proxy scenarios were developed as follows:

- The Reference case from the Annual Energy Outlook 2015 (AEO 2015) was selected as the fundamental component of the Low scenario.[6] This version of AEO uses a vehicle choice model and assumptions that are generally unfavorable toward PEVs. In fact, the actual PEV market shares in 2015 and 2016 were about 50% higher than forecasted by the AEO 2015 Reference case. In light of this, the proxy Low scenario was set as the AEO 2015 Reference case multiplied by 1.5 (50% higher). The low proxy represents how PEV sales may grow if battery costs remain high, regulations that drive PEV sales are canceled, and incentives are reduced.

- Two external scenarios provide a moderate long-term outlook for PEV adoption. These are the "Midrange PEV" scenario from National Research Council's Transitions to Alternative Vehicles and Fuels report and the "Portfolio" scenario from the Infrastructure Expansion report published by NREL. [7, 8] The Medium scenario long-term proxy was determined as a simple year-by-year numerical average of the NREL and NRC estimates.

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[5] Plug-in Electric Vehicle Market Projections: Scenarios and Impacts, EPRI, Palo Alto, CA:2017, 3002011613

[6] *Annual Energy Outlook 2015*. U.S. Energy Information Administration, Washington, DC:2015. DOE/EIA-0383(2015).

[7] *Transitions to Alternative Vehicles and Fuels*. National Research Council, Washington, DC:2013.

[8] *Alternative Fuel Infrastructure Expansion: Costs, Resources, Production Capacity and Retail Availability for Low-Carbon Scenarios*. Prepared for the U.S. Department of Energy by National Renewable Energy Laboratory, Golden, CO: 2013. DOE/GO-102013-3710.

- The High scenario proxy is an average of two scenarios that employ assumptions that are highly favorable toward PEV adoption: the "Optimistic PEV" case in Appendix H of the NRC report and the "Electrification" case of the NREL report.

These proxy scenarios were then modified to account for regional differences, especially to account for the effects of the California Zero Emissions Vehicle (ZEV) mandate and sales-to-date in each region.

The California ZEV program uses a credit system and does not require the sale of a specific number of advanced vehicles. The credit structure is defined such that vehicles that provide greater zero-emissions capability earn more ZEV credits per vehicle, and the program includes several flexibilities that offer vehicle manufacturers options to comply with the program in diverse ways. In December 2011, CARB staff released a report that defined a proposed revision of the ZEV and tailpipe emissions regulations called the Advanced Clean Cars program. These modifications were approved by the Board in January 2012.[9] The staff report provided an expected trajectory of annual sales of different advanced vehicle types that would be required for manufacturers to comply with the regulation. These estimates assumed a significant number of fuel-cell electric vehicles (FCEVs) would be sold in California: less than 0.2% of new sales through 2017 but ramping up to 2.5% of sales by 2025. Assuming that these FCEV sales occur, the required PEV sales were less than 2.1% through 2017 and then ramping to 12.9% of new sales in 2025. In 2012, EPRI requested that CARB provide another scenario that assumed greater numbers of PHEVs with either 10 miles or 40 miles of all-electric range. This scenario increased the PEV estimate to 15.4% of sales by 2025.

After modification to account for the ZEV mandate, the projections are also modified to account for the trajectory of the actual local PEV sales using historical county-level sales data for 2010 through 2016. Beyond 2016, the regional projection (or national projection for the High case) is shifted up or down depending on the level of the local historical PEV sales relative to the average sales in the larger region. Specifically, the local sales bias is based on the local PEV market share 2013 through 2016. As the projection advances farther into the future, the local effects diminish somewhat and the projections trend toward the projection for the larger region. This homogenization effect assumes that PEV technology becomes increasingly mainstream and that the geographic distribution of PEVs becomes relatively uniform. The resulting cumulative PEV sales projections for the state of California are represented in Figure 3.

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[9] *Staff Report: Initial Statement of Reasons, Advanced Clean Cars, 2012 Proposed Amendments to the California Zero Emission Vehicle Program Regulations*. California Air Resources Board, Sacramento, CA: 2011.

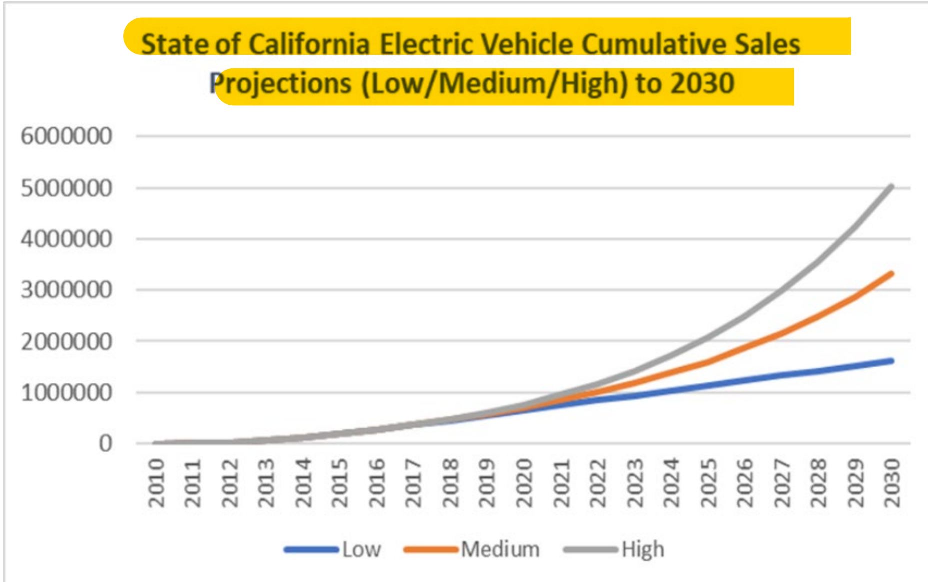

Figure 3-1*:*
Projected Electric Vehicle Cumulative Sales for the State of California (Source EPRI Research)

At the end of 2017, the relative share of PEV installed base in California among the IOUs was 41% PG&E, 33% SCE and 8% SDG&E. If we maintain this ratio to be constant (remaining 18% dispersed across the rest of the state), we can derive IOU-specific PEV capacity availability numbers. Figure 4 provides the cumulative PEV sales projection for the SCE territory based on the applied 33% of California's market share.

The cumulative 2030 sales projection for SCE indicate a total PEV load capacity between 3.8GW (524,910 PEVs X 7.2kW) at the low end and 11.5GW (1,590,527 PEVs X 7.2kW) at the high end projection. Both these projections present potentially significant load management implications versus a peak demand for SCE of 23.5 GW as of end 2017.

Managing PEVs as a Load Modifier or DR capacity resource could provide a huge beneficial impact on the grid. There is a need to create incentive mechanisms that are sustainable through business case-derived benefits to the grid. The primary benefits for utilization of PEV integrated grid services is to improve asset utilization, defer distribution upgrades, and increase utilization of renewables.

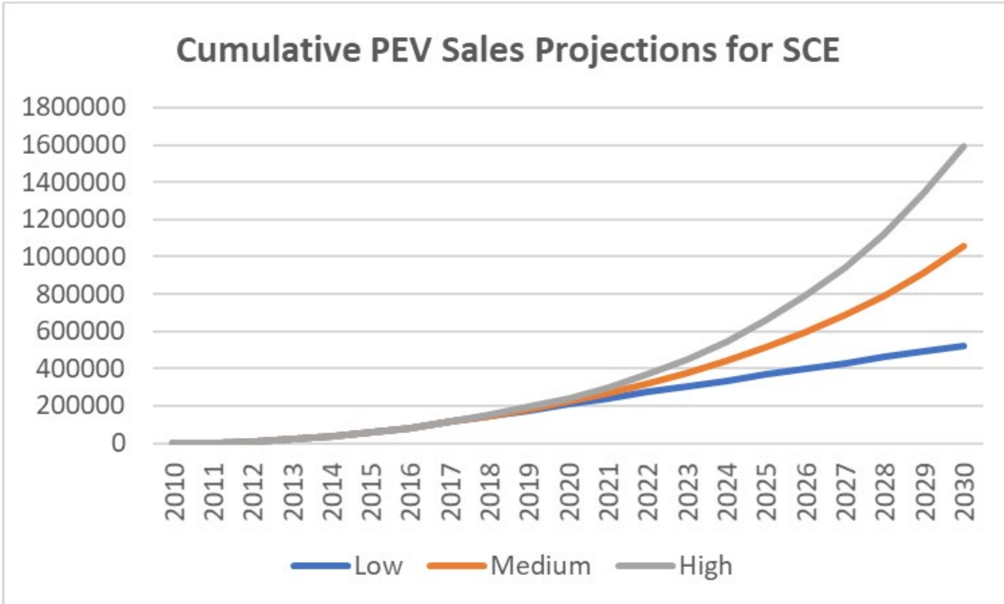

Figure 3-2*:*
Cumulative PEV Sales Projections for SCE Service Territory (Source EPRI Research)

The ability to access, monitor and manage these levels of PEV capacity will enable it to be included as a resource for participation in energy market programs such as DRAM[10] (Demand Response Auction Mechanism) in CAISO and through a Distributed Energy Resource Provider (DERP) mechanism[11] requiring a minimum 500kW threshold to bid into wholesale markets. Ability to manage even 20% to 50% of these capacity levels make if very appropriate for inclusion as a resource for Integrated Resource Planning (IRP) and Long Term Procurement Planning (LTPP). EVs are procured primarily for mobility purposes by PEV owners, and utilities are not required to pay for their acquisition costs. This makes them an attractive resource or load modifier entity to be studied carefully for IRP, LTPP, and DERP integration.

For PEVs to be included in the LTPP and IRP process, a reliable forecast of its market adoption is critical. This is the foundation upon which all the procurement plans are built. Any scenario assessment is subject to input uncertainties and modeling imprecision. What is certain is the state of California 2030 target for PEVs to reach 5 Million. EPRI looked at the PEV growth projections from a variety of factors, including benchmarking against publicly available data which are driven by automotive manufacturer product plans, manufacturing and supply chain investments to ensure the projections are triangulated and show potential. The major impacts regulations and incentives have on PEV sales in the near-term were accounted for as well.

EPRI[12] bound the forecast through three scenarios – minimum, medium and high numbers. Minimum growth numbers are based on 'Business as Usual' PEV adoption from customers,

[10] California's DRAM Tops 200 MW as utilities pick winners for distributed energy, GreenTechMedia, 7/26/2017, https://www.greentechmedia.com/articles/read/californias-dram-tops-200mw-as-utilities-pick-winners-for-distributed-energ#gs.T63Ix24

[11] Distributed Energy Resource Provider Participation Guide with Checklist, CAISO, v1.0, 8/26/2016, https://www.caiso.com/Documents/DistributedEnergyResourceProviderParticipationGuideandChecklist.pdf

[12] Plug-in Electric Vehicle Market Projections: Scenarios and Impacts, EPRI, Palo Alto, CA:2017, 3002011613

Maximum growth projections are based on growth rates significantly accelerating especially due to per-kWh battery cost reductions (cost reductions at an annualized rate of 14% per year over the last 10 years and projected to reduce further within the next 5 years). This is allowing Automotive OEMs more freedom to make this technology available across multiple classes of vehicles (crossovers, SUVs, vans, etc.) while also providing ever-increasing driving range. Relentless focus on infrastructure (including fast charging) from public agencies, especially in the state of CA and elsewhere will increase the appeal of PEVs. Coupled with petroleum prices hovering around $70/bbl[13] with an OPEC target between $80 and $100/bbl[14], EVs will continue to make more economic sense, especially if coupled with a variety of ownership models. However, achieving 5M vehicles installed base in CA by 2030 remains a challenging goal, so created a mid-range forecast (which is simply arithmetic average of the minimum and maximum forecasts) to provide a realistic feel for the volume in 2030. In 2011, a Presidential[15] goal of 1M vehicles US-wide by 2015 seemed out of reach at the time, yet end of October 2018, the US PEV market exceeded the 1M threshold. Over 50% of these vehicles are in California. Forcing policy and technology can make an impact on nudging the industry in a certain direction, and in case of EVs, the economics and exogenous factors (i.e. VW diesel emissions tampering) have given the right impetus for industry to voluntarily and seriously look at developing PEVs as an alternative energy management resource.

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[13] Per Platts, August 2018 Futures for Brent Crude were being priced at $74.74/bbl on 06/20/2018

[14] OPEC's new price hawk Saudi Arabia seeks oil price as high as $100 – sources, REUTERS, 4/18/2018, https://www.reuters.com/article/us-opec-oil-exclusive/exclusive-opecs-new-price-hawk-saudi-arabia-seeks-oil-as-high-as-100-sources-idUSKBN1HP1LB

[15] https://www.cheatsheet.com/automobiles/will-obama-executive-action-build-momentum-for-electric-cars.html/?a=viewall

4

SUMMARY

Conclusions:

The 10/10 baseline based on the residential whole house meter data is not an effective measurement and verification methodology for quantifying PEV DR kWH reduction.

- The time of day of the event in relation to when customers usually charge is an issue. If the customer does not usually charge during the event time duration (in the case of this project between the hours of 10pm and 11pm) in the previous 10 days, then there is no baseline to measure the EV charging reduction against.
- More appropriate time of day for a residential EV DR event might be during the evening peak hours from 5pm to 9pm when customers arrive home and tend to charge.
- Other household loads may offset the reduction in EV Charging during an event such as air conditioning during hot summer evenings.
- No measurable basis to determine actual EV charge reduction except when you compare the vehicle telemetry data.
- Established that the customer must be plugged in and charging prior to an event to qualify. Still does not resolve the ineffectiveness of using the 10/10 baseline methodology because the charging load just prior to the event is not included nor quantified in the baseline data.
- Without a method to directly and separately quantify the EV load increase or decrease it potentially mitigates the compensation value for the EV customer and the EV aggregator.

An observation, regarding the 10/10 baseline methodology based on the whole house meter data, is that PEV charging is being treated as a household load, which as described is not effective for identifying and quantifying any actual reduction in EV charging load, especially when limited to a specific time period of the day that is not relevant to the customer's normal charging time pattern. This creates the question as to whether it is more appropriate to treat PEV charging as a separate load that is monitored and managed accordingly versus including it as part of the whole house load, as just another appliance. It follows with the understanding the PEV is an intermittent load because it is not stationary to the home, or any location for that matter. Further rationale is that for the SCE service territory the projected total load capacity from PEV charging in the 2030 timeframe is 3.8GW (524,910 PEVs X 7.2kW) at the low end and 11.5GW (1,590,527 PEVs X 7.2kW) at the high end. As a percentage of SCE's total peak demand (23.5GW as reported for the end of 2017[16]) the projected PEV total load capacity is 16% and 49% respectively. This significantly potential impact on the SCE distribution system directly indicates the need to treat PEVs as a separate type of load and to develop PEV managed charging specific strategies and policies. The forward looking challenge is the implementation and integration of vehicle to grid (V2G) technology with bidirectional power flow which will present dynamically different management requirements from V1G. This is not addressed as part of this report.

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[16] Edison International and Southern California Edison 2017 Annual Report http://www.annualreports.com/HostedData/AnnualReports/PDF/NYSE_EIX_2017.pdf

A significant outcome is the project successfully verified the capability of the Open Vehicle Grid Integration Platform (OVGIP) to provide a viable interface and communications connection between the utility and the customer PEVs for managing charging loads. It validated the viability for DR aggregation of PEV charging load utilizing the OEM telematics vehicle connection and the ability to collect and report individual customer charging profile data for purposes of verification.

The achieved scale for customer enrollment in this project may not statically represent realistic participation or Opt In characteristics or rate factors. It constituted 5 Honda employees who are vested in PEV technology and infrastructure development and can be considered a pseudo controlled group.

Access and utilization of Green Button data presented some challenges. There is no visibility or reporting on user enrollment status available. Required to wait to receive first Green Button RCUST file to verify completion of customer enrollment and permission for 3rd party access. Could not reacquire Green Button data as a 3rd party – the SCE server only will POST the data to a 3rd party. There were anomalies in the data that require investigation. There are intermittent intervals, as well as whole days, in the data with no recorded consumption values.

Enrollment Learnings:

Requires personnel resources to manage customers through the enrollment process. Enrollment process was effectively automated through the Honda SmartCharge website, but customers still needed follow up and encouragement to complete the on-line enrollment process. A statistical finding is if more than two follow ups are required then there is a 50% probability of losing the customer. Honda indicated the potential need to address education about customer smart charge programs and the enrollment process at point of sale at the dealerships.

Requires improved up front outreach and communications on the benefits and incentives for participating in the programs and need to provide customer services for tracking and encouraging customers to complete the enrollment process. An assumption is this will become less an issue in the future as the market for PEVs grows and familiarity of PEV DR and other energy management programs become more common place.

Recommendations:

- Evaluate viability of utilizing the on-vehicle telemetry for measuring kWH consumption to measure and quantify DR event compliance/performance, especially for aggregation programs.
- Determine changes in California ISO and utility policies to enable EV customers to participate in multiple PEV load management programs. Is necessary to enhance the business case and the value proposition for the PEV customer, the aggregators, and the OEMs to engage and support the utilization of PEVs as a viable DR resource. The need is to qualify the capability of EV customers to participate in multiple EV load management programs based on prioritization of programs to avoid double counting.
- Enhance the Green Button Share My Data process for 3rd Parties. Include API for access to enrolled user list and ability to acquire Green Button data by specifying the user ID and time period.
- Most importantly is the recommendation to conduct expanded scale PEV managed charging projects. Achieving the ability to analyze the effectiveness and value of VGI programs will require a larger statistical sampling of the customer base (1000 to 2000 customers). Also, will provide more realistic assessment of customer requirements for incentives to engage in

PEV demand side load management behavior programs, determination of the personal transportation needs affecting customer Opt In/Out factors, and PEV customer demographic analyses. One aspect of the project would be the ability of the aggregator (OVGIP/OEMs) to project available customer DR capacity and ability to meet requested thresholds within prescribed locational designations such as sub lap regions. The objective in regard to a scaled up OVGIP DR demonstration project would be to engage a minimum of 3 OEMs, each with up to 400 to 600 customers. The scope should be enhanced to provide load modification functions for increasing and decreasing PEV charging loads according to actual projected grid conditions, energy market pricing, TOU and PEV rate tariffs, dynamic pricing, and renewables generation.

- A proposed VGI or V1G load management business use case or model can be to focus on when customers should charge. The measurement and verification methodology will be determined based on actual customer charge times and electricity consumption during the prescribed time periods of day that are least impactful to the distribution system and/or at the least cost to the customer based on TOU rates or dynamic pricing notifications. A number of utilities are considering PEV load management programs that prescribe charging only during the lowest demand periods (off peak) with the compensation based on verification of customer compliance on a month to month basis. In one case the utility is offering a kWh price discount to the TOU rate for consistently charging only during the prescribed off peak periods[17]. The verification methodology is intending to be based on the vehicle reported charging session and electricity consumption data.
- EPRI is developing a PEV load data modeling and analysis program to be offered to utilities to provide comprehensive information on the density and locational impact of PEV loads across the utility region. Additionally, the OEMs within the confines of the OVGIP are developing a data dashboard module to provide topographical mapping data of the their collective PEV population and the recorded charging load effects on the distribution system. EPRI will be instituting modeling and analysis of PEV load distribution impact on the utility grid circuits to identify PEV clusters and potential hot spots across the distribution system. The information can be valuable to the utility by providing baseline analysis data for determining and assessing types of PEV behind the meter load management use cases and programs to be implemented and demonstrated. A reasonable expectation from the data will be the ability to establish quantifiable metrics for evaluating the results of the PEV demand side management use cases and programs.

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[17] Con Edison is presently having a Smart Charge New York Program that rewards customers up to $500 per year to consistently charge during the specified off peak periods. Several automakers are working with Con Edison on utilizing the Open Vehicle Grid Platform (OVGIP) to provide the customer charging session and electricity consumption verification data.

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A

SUMMARY OF CUSTOMER 10/10 BASELINE DATA[18]

#Event Date	CSRId	Begin Hour(PDT)	End Hour(PDT)	Average watt hour for Prior 10 days	Event day (watt hour)	Delta (increase / decrease) watt hour	Honda Recorded Vehicle Load Reduction (kW)
9/4/2018	7MOFMDIJV	9/4/2018 22:00	9/4/2018 22:30	722.73	1230	507	
9/4/2018	2UGCNWSBS	9/4/2018 22:00	9/4/2018 22:30	298.18	320	22	1.32
9/4/2018	VLSMLBGK7	9/4/2018 22:00	9/4/2018 22:30	270.00	880	610	
9/4/2018	EF9PIOTJU	9/4/2018 22:00	9/4/2018 22:30	1180.36	480	-700	
9/4/2018	2XB4THJCG	9/4/2018 22:00	9/4/2018 22:30	594.55	330	-265	1.32
9/7/2018	7MOFMDIJV	9/7/2018 22:00	9/7/2018 23:00	1573.64	970	-604	1.44
9/7/2018	2UGCNWSBS	9/7/2018 22:00	9/7/2018 23:00	513.64	380	-134	1.33
9/7/2018	VLSMLBGK7	9/7/2018 22:00	9/7/2018 23:00	80.91	0	-81	
9/7/2018	EF9PIOTJU	9/7/2018 22:00	9/7/2018 23:00	1832.73	780	-1053	
9/7/2018	2XB4THJCG	9/7/2018 22:00	9/7/2018 23:00	922.73	510	-413	5.87
9/11/2018	7MOFMDIJV	9/11/2018 22:00	9/11/2018 22:30	621.82	440	-182	
9/11/2018	2UGCNWSBS	9/11/2018 22:00	9/11/2018 22:30	230.91	210	-21	6.13
9/11/2018	VLSMLBGK7	9/11/2018 22:00	9/11/2018 22:30	80.00	0	-80	6.37
9/11/2018	EF9PIOTJU	9/11/2018 22:00	9/11/2018 22:30	906.00	1002	96	6.29
9/11/2018	2XB4THJCG	9/11/2018 22:00	9/11/2018 22:30	387.27	490	103	5.94
9/14/2018	7MOFMDIJV	9/14/2018 22:00	9/14/2018 23:00	1149.09	1370	221	
9/14/2018	2UGCNWSBS	9/14/2018 22:00	9/14/2018 23:00	588.18	460	-128	
9/14/2018	VLSMLBGK7	9/14/2018 22:00	9/14/2018 23:00	80.91	0	-81	6.37
9/14/2018	EF9PIOTJU	9/14/2018 22:00	9/14/2018 23:00	1843.09	1998	155	6.29
9/14/2018	2XB4THJCG	9/14/2018 22:00	9/14/2018 23:00	995.45	920	-75	
9/18/2018	7MOFMDIJV	9/18/2018 22:00	9/18/2018 22:30	493.64	1050	556	
9/18/2018	2UGCNWSBS	9/18/2018 22:00	9/18/2018 22:30	210.91	320	109	6.19
9/18/2018	VLSMLBGK7	9/18/2018 22:00	9/18/2018 22:30	0.00	0	0	6.38
9/18/2018	EF9PIOTJU	9/18/2018 22:00	9/18/2018 22:30	984.00	540	-444	6.33
9/18/2018	2XB4THJCG	9/18/2018 22:00	9/18/2018 22:30	389.09	370	-19	6.06
9/21/2018	7MOFMDIJV	9/21/2018 22:00	9/21/2018 22:30	514.55	390	-125	1.44
9/21/2018	2UGCNWSBS	9/21/2018 22:00	9/21/2018 22:30	190.00	70	-120	6.21
9/21/2018	VLSMLBGK7	9/21/2018 22:00	9/21/2018 22:30	0.00	0	0	6.39
9/21/2018	EF9PIOTJU	9/21/2018 22:00	9/21/2018 22:30	819.27	354	-465	6.34
9/21/2018	2XB4THJCG	9/21/2018 22:00	9/21/2018 22:30	450.00	620	170	6.11
9/25/2018	7MOFMDIJV	9/25/2018 22:00	9/25/2018 22:30	474.55	310	-165	1.44
9/25/2018	2UGCNWSBS	9/25/2018 22:00	9/25/2018 22:30	184.55	330	145	6.23
9/25/2018	VLSMLBGK7	9/25/2018 22:00	9/25/2018 22:30	0.00	0	0	0.00
9/25/2018	EF9PIOTJU	9/25/2018 22:00	9/25/2018 22:30	689.45	402	-287	6.35
9/25/2018	2XB4THJCG	9/25/2018 22:00	9/25/2018 22:30	713.64	3430	2716	
9/28/2018	7MOFMDIJV	9/28/2018 22:00	9/28/2018 23:00	1022.73	880	-143	1.44
9/28/2018	2UGCNWSBS	9/28/2018 22:00	9/28/2018 23:00	720.91	4100	3379	
9/28/2018	VLSMLBGK7	9/28/2018 22:00	9/28/2018 23:00	92.73	0	-93	6.39
9/28/2018	EF9PIOTJU	9/28/2018 22:00	9/28/2018 23:00	1141.64	1074	-68	
9/28/2018	2XB4THJCG	9/28/2018 22:00	9/28/2018 23:00	1401.82	750	-652	1.35
10/2/2018	7MOFMDIJV	10/2/2018 2:00	10/2/2018 3:00	344.55	450	105	
10/2/2018	2UGCNWSBS	10/2/2018 2:00	10/2/2018 3:00	1744.00	510	-1234	
10/2/2018	VLSMLBGK7	10/2/2018 2:00	10/2/2018 3:00	265.45	50	-215	6.39
10/2/2018	EF9PIOTJU	10/2/2018 2:00	10/2/2018 3:00	1166.18	1182	16	7.17
10/2/2018	2XB4THJCG	10/2/2018 2:00	10/2/2018 3:00	486.36	270	-216	

[18] Table reflects the 5 enrolled vehicles and the date/time of each DR event. All highlighted Service ID represents customers/vehicles plugged in during the listed DR event. Red highlighted Service ID represents vehicle with connectivity issue during event.

B
OVGIP EXPERIMENTAL SURVEY SUMMARY

Q1 What is your primary type of transportation used for work/school travel?

◯ Drive alone (1)

◯ Carpool/vanpool (2)

◯ Rail (e.g., light/heavy, subway/metro, trolley) (7)

◯ Bus (8)

Q2
Approximately how many miles is your commute to your work or school (one-way, please round to the nearest 0.1 mile)?

Q3
On an average day, approximately how many minutes is your commute to your work or school? (one-way)

Q 4 Throughout a typical week, how often do you complete multiple tasks/purposes within a single trip (i.e., picking up children, going to the grocery store, etc.)?

◯ Never (1)

◯ Sometimes (2)

◯ About half the time (3)

◯ Most of the time (4)

◯ Always (5)

◯ I do not know (6)

Q5 At approximately what time do you leave for work?
▼ 12:00 AM (Midnight) (1) ... 11:30 PM (48)

Q6 At approximately what time do you leave work?

▼ 12:00 AM (Midnight) (1) ... 11:30 PM (48)

Q7 How many vehicles does your household currently own/lease?

◯ 0 (1)

◯ 1 (2)

◯ 2 (3)

◯ 3 (4)

◯ 4 (5)

◯ 5 or more (6)

Q8 Please list the year, make, and model of the vehicle(s) that your household **currently** owns/leases as well as your best estimate of the miles driven on each during the last 12 months (e.g., 2008 Honda Civic, 2000 miles per year).

Make sure to report all miles driven on the vehicle by anyone in your household. Please list the vehicle you drive most first.

*

Q8 When did you become a Honda Fit EV owner? (MM/DD/YYYY)

____

*

Q9 Approximately how many times **per month** do you experience anxiety about trying to make a trip based on insufficient battery range?

____

Q10 How often do you use the Honda Fit EV to do the following activities?

	Very Frequently (1)	Frequently (2)	Occasionally (3)	Rarely (4)	Never (5)
Commute to/from work (1)	◯	◯	◯	◯	◯
Shopping/Errands (2)	◯	◯	◯	◯	◯
School/Daycare/Religious activity (3)	◯	◯	◯	◯	◯

Medical/Dental services (6)	○	○	○	○	○
Social/Recreational (7)	○	○	○	○	○
Transport someone (8)	○	○	○	○	○
Meals (9)	○	○	○	○	○
Extended trips (10)	○	○	○	○	○
Other (4)	○	○	○	○	○

Charging Questions

Q11 What level of charging do you use at home?

○ Level 1 (120V) (1)

○ Level 2 (240V) (2)

○ Level 3 DC Fast Charger (4)

○ Level 4 Supercharger (5)

○ Other (6) ____

○ I don't know (7)

Q12 What level of charging do you **typically** use when you are NOT at home?

○ Level 1 (120V) (1)

○ Level 2 (240V) (2)

○ Level 3 DC Fast Charger (5)

○ Level 4 Supercharger (6)

○ Other (4) ____

○ I don't know (7)

Q13 Do you have access to a charger at work?

- Yes (1)
- No (2)

Q14 How regularly do you charge your vehicle at work?

- Always (1)
- Most of the time (2)
- About half the time (3)
- Sometimes (4)
- Never (5)

Q15 How regularly do you charge your vehicle at public charging stations while shopping/eating/running errands?

- Always (1)
- Most of the time (2)
- About half the time (3)
- Sometimes (4)
- Never (5)

Q16 How regularly do you charge your vehicle at home?

- Always (1)
- Most of the time (2)
- About half the time (3)
- Sometimes (4)

◯ Never (5)

Q17 with what frequency do you plug in your vehicle as soon as you return home? The vehicle may or not be charging at this time.

◯ Always (1)

◯ Most of the time (2)

◯ About half the time (3)

◯ Sometimes (4)

◯ Never (5)

Q18 With what frequency do you plug in your vehicle as soon as you reach work? The vehicle may or not be charging at this time.

◯ Always (1)

◯ Most of the time (2)

◯ About half the time (3)

◯ Sometimes (4)

◯ Never (5)

Q19 How often do you charge the battery for the Honda Fit EV?

◯ Everyday (1)

◯ 2 to 3 times per week (4)

◯ Once a week (5)

◯ Every 2 weeks (6)

◯ Once a month (7)

○ Once every 2-3 months (8)

○ Less than 3 months (11)

Q20
For your primary charge location, you were asked to create a charge schedule. Your EV will charge at the most efficient times during the window you set until your ideal charge level is reached. **Please enter your typical charge schedule for your primary location**. If you do not set a minimum or maximum SOC, please enter "NA" in those boxes.

	Start (HH:MM)	AM or PM?	End (HH:MM)	AM or PM?	Target SOC (%)	Minimum SOC (%) (7)
Weekday						

Q21 Do you set charging preferences for other times of the day for the weekday? If so, please describe.

____

____

____

____

____

Q22 Do you set charging preferences based on the time of the year (i.e., summer, winter)? If so, please describe.

____

____

____

Q23 How often do you change your timing preferences for charging?

○ Very Frequently (1)

○ Frequently (2)

○ Occasionally (3)

○ Rarely (4)

○ Never (5)

○ Do not set preferences (6)

Q24 In the last month, how many times did you override your preset timing preferences for charging?

____

Q25 When you have decided to override your preset timing preferences for charging, what reasons and how often do these reasons impact this decision?

	Very Frequently (1)	Frequently (2)	Occasionally (4)	Rarely (5)	Never (6)
Needed charge immediately for a trip (1)	○	○	○	○	○
Needed a full battery for the morning (2)	○	○	○	○	○
Electricity rates were cheaper at an earlier time (3)	○	○	○	○	○
Electricity rates were cheaper at later time (5)	○	○	○	○	○
Other (please specify) (6)	○	○	○	○	○

SmartCharge Registration Question

We will now ask you several questions related to your experience registering for the Honda SmartCharge Program.

Prior to your registration in the Honda SmartCharge Program, you were sent the following email to introduce the goals of the SmartCharge program:

Q26 Please select the statements that best reflect the goals of the SmartCharge program. You may choose more than one.

▢ Reduce electricity demand on the grid during peak hours (1)

▢ Reduce the utility's operating costs (5)

▢ Reduce reliance on electricity from fossil fuel plants (3)

▢ Use electricity when renewable energy production is high (2)

▢ Mitigate environmental impact of EV owners (6)

▢ Other, please specify: (7) ____

Q27 Please select the main reason you joined the SmartCharge program.

○ Monetary incentives (1)

○ Concern for the environment (2)

◯ Wanted to minimize electricity use during peak hours (3)

◯ Curiosity (4)

◯ Other, please specify: (5) ____

The registration steps for the SmartCharge program are lengthy, and Honda would like to improve the process for future participants.

Below are the steps for registration.
Q 28 Please rate the level of ease or difficulty you experienced at each step.

	Very easy (1)	Easy (2)	Neither easy or difficult (3)	Difficult (4)	Very difficult (5)	I don't remember (6)	I did not complete this step (7)
Download the HondaLink EV App (1)	◯	◯	◯	◯	◯	◯	◯
Accept the terms and conditions (2)	◯	◯	◯	◯	◯	◯	◯
Create charge location profile (set primary location and target SOC) (3)	◯	◯	◯	◯	◯	◯	◯
Receive the CISR form (4)	◯	◯	◯	◯	◯	◯	◯
Upload utility bill (for verification and to find if conflicts exist with existing incentive-based programs) (5)	◯	◯	◯	◯	◯	◯	◯
Green Button authorization (allows 3rd party access to view	◯	◯	◯	◯	◯	◯	◯

home meter data) (6)

Q29 Are you **comfortable** allowing a server to control the charging of your vehicle?

◯ Yes (1)

◯ No (2)

◯ Maybe (4)

Q30
Please describe why you feel uncomfortable allowing a server to control the charging of your vehicle.

____
____
____
____

Q31 Select the option that best describes your cell phone:

◯ Do not own a cell phone (1)

◯ Only call and text capabilities (2)

◯ Call, text, and internet access but does not have a data plan (3)

◯ Call, text, and internet access and has a data plan (*

◯ +4)

Start of Block: Vehicle and OEM Questions

V1G technology refers to the ability of grid operators to send signals to a vehicle about the current demand on the grid. Demand response programs refer to mechanisms that encourage users to lower electricity usage at times of peak demand.

In this scenario, you own a battery electric vehicle (BEV).

You have the opportunity to participate in a demand response program. In this program, you will use an app on your smartphone to set a charging schedule (i.e., when the car must be ready for use) as well as the desired state of charge (i.e., 90% charged). Using this information, a third party will choose when your vehicle charges to match when electricity demand is low and the availability of renewable energy is high. At any point in time, you can override the charging decisions made by the V1G program.

If an error occurs during charging and you do not have sufficient charge at your scheduled departure time, you will be reimbursed for a ride through a ride sourcing company (Uber/Lyft) or a taxi. For your participation in the program, you will receive a yearly incentive.

Q 32 Please select how likely you would be to participate in the demand response program for each of the following incentive levels. The incentive amount shown is how much <u>you will be paid</u> per year to participate in the V1G program.

	Definitely (1)	Probably (2)	Maybe (3)	Probably Not (4)	Definitely Not (5)
$0/year (1)	○	○	○	○	○
$50/year (2)	○	○	○	○	○
$100/year (3)	○	○	○	○	○
$150/year (4)	○	○	○	○	○
$200/year (5)	○	○	○	○	○
$250/year (6)	○	○	○	○	○
$300/year (7)	○	○	○	○	○
$400/year (8)	○	○	○	○	○
$500/year (9)	○	○	○	○	○
$750/year (10)	○	○	○	○	○
$1000/year (11)	○	○	○	○	○

Q33 What is your age?

- ○ Under 18 (1)
- ○ 18 - 24 (2)
- ○ 25 - 34 (3)
- ○ 35 - 44 (4)
- ○ 45 - 54 (5)
- ○ 55 - 64 (6)

- 65 - 74 (7)
- 75 - 84 (8)
- 85 or older (9)
- Prefer not to answer (10)

Q34 What gender do you identify with?

- Male (1)
- Female (2)
- Other (3) ____
- Prefer not to answer (4)

Q35 Do you own your residence?

- Yes (1)
- No (2)
- Prefer not to answer (3)

Q36 What type of home/dwelling do you live in?

- Detached single-family home (1)
- Building with more than 100 units (10)
- Building with between 10 and 100 units (11)
- Building/house with fewer than 10 units (12)
- Mobile home/RV/Trailer (13)
- Other (please specify) (8) ____
- Prefer not to answer (9)

Q37 What type of electricity program/plan do you follow?

- Fixed-rate (1)
- Variable-rate (7)
- Tiered-rate (2)
- Time-of-use (TOU) (3)
- Demand response (4)
- EV-specific plan (5)
- Other (please specify) (6) ____
- I don't know (8)

Q38 Please indicate which of the following activities you currently do at home. Select all that apply.

- Have solar panels installed at your home to provide electricity (1)
- Take advantage of peak and off peak electricity rates for your home (4)
- Purchase energy efficient appliances (5)
- Construct and maintain a compost bin, of participate in local compost collection (6)
- Purchase energy efficient light bulbs (7)
- Recycle waste (8)
- Purchase more locally grown products (9)
- Buy recycled products (10)
- Active in at least one environmental organization (11)
- ⊗None of these (12)

Start of Block: Incentive

OVGIP questions:
SCE OVGIP DR events were Tue 10-10:30 PM and Fri 10-11 PM.

Q41 Any overall comments/suggestions for improvement to SCE Utility re their pilot program?____

____

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