SCE DRET Findings
December 2018

DR16.02: Open Vehicle Grid Integration Platform (OVGIP)

Residential Demand Response (DR) Project Summary Report

The Plug-in Electric Vehicle (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. The Electric Power Research Institute (EPRI) PEV sales growth forecast 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.

Southern California Edison (SCE) launched an Open Vehicle Grid Integration Platform (OVGIP) Residential Demand Response (DR) Project to provide aggregated demand response management of customer's PEV charging load in a residential environment. The participants in the project are American Honda Motor Co Inc. (Honda), 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 premise is the OVGIP establishes a common utility interface using industry communications standards and provides connection 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. The purpose of the project was to evaluate how the OVGIP can best determine, report and facilitate OEMs 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.

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, Honda, reported PEV load reduction, and impact assessment from the forecasted SCE PEV load demand through Year 2030.

LIST OF ACRONYMS:

API	Application Programming Interfaces
DR	Demand Response
DSM	Demand Side Management
EPRI	Electric Power Research Institute
OEM	Original Equipment Manufacturers
OVGIP	Open Vehicle Grid Integration Platform
PEV	Plug-in Electric Vehicle
SCE	Southern California Edison
TOU	Time of Use

INTRODUCTION

What Is This Technology?

Open Vehicle Grid Integration Platform (OVGIP)

The OVGIP enables 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 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.

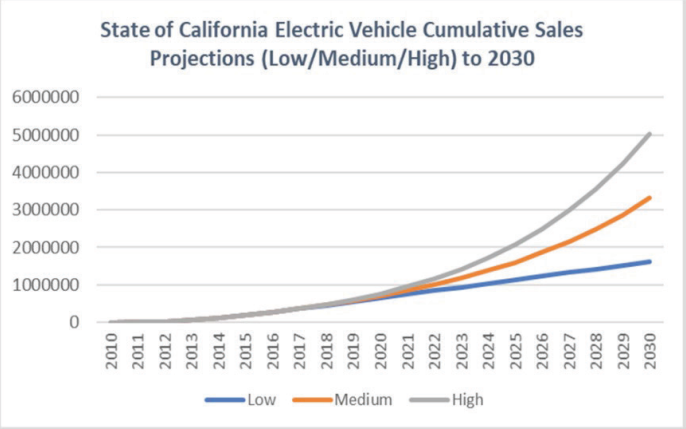
The objective of the Phase 2 OVGIP Program is to advance the central OEM/Utility interface concept and assess the effectiveness of the platform to integrate PEV charging with grid objectives through DR and DSM mechanisms. The program consists of the following activities:

- 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 a utility host site.

FIGURE 1. A DIAGRAM SHOWING THE ROLE OF DR IN PEAK LOAD REDUCTION



What We Did?

Residential Demand Response

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. Southern California Edison engaged with EPRI in the Phase 2 OVGIP to conduct an Electric Vehicle Residential Demand Response Project.

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 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 DR resource.

The OVGIP was responsible for accessing the customer's residential meter data from the SCE Green Button system through the Third Party Connection access, calculating the 10/10 baseline for the DR event, and providing 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.

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 or decrease between the average of the prior 10 days and the actual day of the event. The other data source is the OEM, Honda, recorded customer charging session profile data associated to the DR event.

FINDINGS

VERIFY THE CAPABILITY OF OVGIP to provide a viable interface and communications connection between the utility and the customer PEVs for managing EV charging loads. The research 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. A significant outcome is the project successfully verified the capability of the OVGIP to provide a viable interface and communications connection between the utility and the customer PEVs for managing charging loads.

KWH LOAD REDUCTION - The OEM, Honda, recorded data reports that the aggregated load reduction capacity of the 5 PEVs participating during a DR event was 26.48 kWh 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.

BASELINE MEASUREMENT AND VERIFICATION METHODOLOGY - 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. 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 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.

IMPROVED ENROLLMENT – The enrollment process was effectively automated through the Honda SmartCharge website, but customers still needed follow up and encouragement to complete the online enrollment process. Honda indicated the potential need to address education about customer smart charge programs and the enrollment process at point of sale at the dealerships. The improvements in DR capabilities at these two facilities were due to energy management activities, and there are still obstacles to achieving their full DR potential.

CONCLUSIONS

What We Concluded?

A proposed load management business use case or model can be to focus on when customers should charge. The M&V 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 time of use (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, i.e. off peak, with the compensation based on verification of customer compliance on a month to month basis. 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.

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. This can 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.

• 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). It will also 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.

These findings are based on the report “Open Vehicle Grid Integration Platform (OVGIP): Residential Demand Response (DR) Project Summary Report,” which is available on www.dret-ca.com.