

OPRA Project: Distributed Storage and EV Charging

I. Introduction

The Optimized Pricing and Resource Allocation (“OPRA”) project consists of EV charging load aggregated across three separate customer sites, as well as two stand-alone advanced energy storage (“AES”) systems connected to the SDG&E distribution grid (see attached diagram). OPRA’s top-line objective is to understand challenges associated with integrating aggregated modulated EV charging load and stationary storage assets into both the CAISO’s energy markets, and the full suite of Ancillary Service (A/S) markets. The project successfully supplied day ahead and real-time energy, and participated in the CAISO’s spinning and non-spinning reserve markets, becoming the first behind the meter resource aggregation to be certified to provide spinning reserves in California. The project’s final goal was to demonstrate that behind the meter resources can provide frequency regulation. This goal was achieved through simulation.

In addition to SDG&E, the OPRA project includes two partners: Shell International (“Shell”), and Olivine. Shell is currently piloting similar EV aggregation and optimization projects in Europe, and is lent significant IT and project management resources to the OPRA project throughout its duration. Olivine provided both market expertise and operational services, including real-time telemetry solutions for the project’s resources. The project was in operation from September 2014 and concluded in 2015. During the course of the project, Shell has operational control of all project assets, and will make all bidding decisions for project assets. Asset control is managed through an optimization and control engine (dubbed the “OCE”) that evaluates information about state of charge of the storage systems and vehicles, future charging needs, grid conditions and market prices, and make decisions about bidding next day based on those inputs. These decisions will be communicated to SDG&E, who serves as the scheduling coordinator and the demand response provider for the project’s assets. In terms of budget and costs, Shell is assuming a lion’s share of the project’s total costs. SDG&E’s limited cost obligations are funded through our RD&D budget.

II. Concept and Phases

Conceptually, OPRA is broken into three separate phases, two that fit squarely within existing rules and protocols for Proxy Demand Resource (PDR), and a third phase that looks to potentially expand PDR beyond its current design on a limited, proof of concept basis. Phase 1, successfully completed in Q1-Q3 2014, targeted the EV load/existing AES system participating in the CAISO’s Day-Ahead energy market via the CAISO’s PDR resource type. Phase 1 also had a heavy focus on installing, interconnecting and certifying the incremental stationary storage assets. Phase 2 combined both asset types (i.e., incremental stationary storage and modulated EV charging) into a single resource ID and provide Non-Spinning Reserves, Spinning Reserves and real-time energy. This Phase was complete by spring 2015, and the resource was certified to provide and is actively bidding into the CAISO’s energy, non-spin and spinning reserve markets.

Ultimately, this second planned phase is intended to be a precursor to a final, third phase: a proof of concept of frequency regulation delivered from behind-the-meter EV and storage assets utilized for both retail bill management and part-time wholesale market benefit. This would differ significantly from similar EV projects (e.g., the LA Air Force Base) where wholesale market participation is provided 24 x 7

through NGR – a model that may not prove entirely practical for the majority of customer-sited EV charging and storage. This phase was achieved through simulation, but not active market participation.

III. Roles/Responsibilities

Shell Responsibilities

- Optimize project assets and create hourly market transaction schedule
- Control and dispatch project assets in accordance with CAISO dispatch schedule
- Provide overall project management services
- Purchase two (2) 200 kW/400 kWh storage systems for use during the project.

SDG&E Responsibilities

- Register aggregated resource into the CAISO Demand Response System
- Install two (2) 200 kW/400 kWh storage systems in time to meet project objectives
- Facilitate market participation of project assets by scheduling and settling market transactions on Shell's behalf.
- Develop and implement automated, standardized interface for 3rd party aggregators to access the CAISO market.

IV. Purpose and potential benefits

SDG&E considers this a proof of concept project designed to gain insight into how aggregated resources access and reliably participate in the CAISO's markets. In short, the overarching goal is to understand barriers to entry, and to use that knowledge to identify business cases and best practices for future, large scale integration and interaction of dispatchable distributed energy resources with wholesale markets. Key learnings and potential benefits are thought to include:

- Understanding the CAISO processes, timelines and requirements for integrating distributed, customer side resources into the market.
- Understanding the challenges, costs and potential benefits of direct market participation
- Assessing the complexity and potential benefits -- from a market perspective -- of resource diversity and aggregation
- Developing and implementing standardized interface specifications for 3rd party aggregators to access the CAISO market.
- Improving our understanding of operational issues related to integration of DER into the utility system
- Testing and evaluating system integration solutions for applying new equipment types in the utility system
- Testing and evaluating interoperability solutions for utility and customer systems integration

V. Map of Sites

