



U.S. Department of Defense

Los Angeles Air Force Base



Vehicle-to-Grid Pilot Overview

May 3, 2016

**CPUC / CAISO Joint Workshop
on MULTI-USE APPLICATIONS**



DoD V2G Pilot Objectives & Plans

Demonstrate that battery storage of Plug-in Electric Vehicle (PEV) fleets can provide energy and ancillary services to the CAISO markets to generate additional revenues, thus reducing the cost difference between PEVs and conventional internal combustion engine (ICE) vehicles.



LA Air Force Base

Go live: December 24, 2015

34 V2G PEVs, 11 other PEVs

655 kW instantaneous demand or capacity

SCE Pilot Objectives

Enable direct market participation by a behind-the-meter (BTM) vehicle-to-grid (V2G) resource

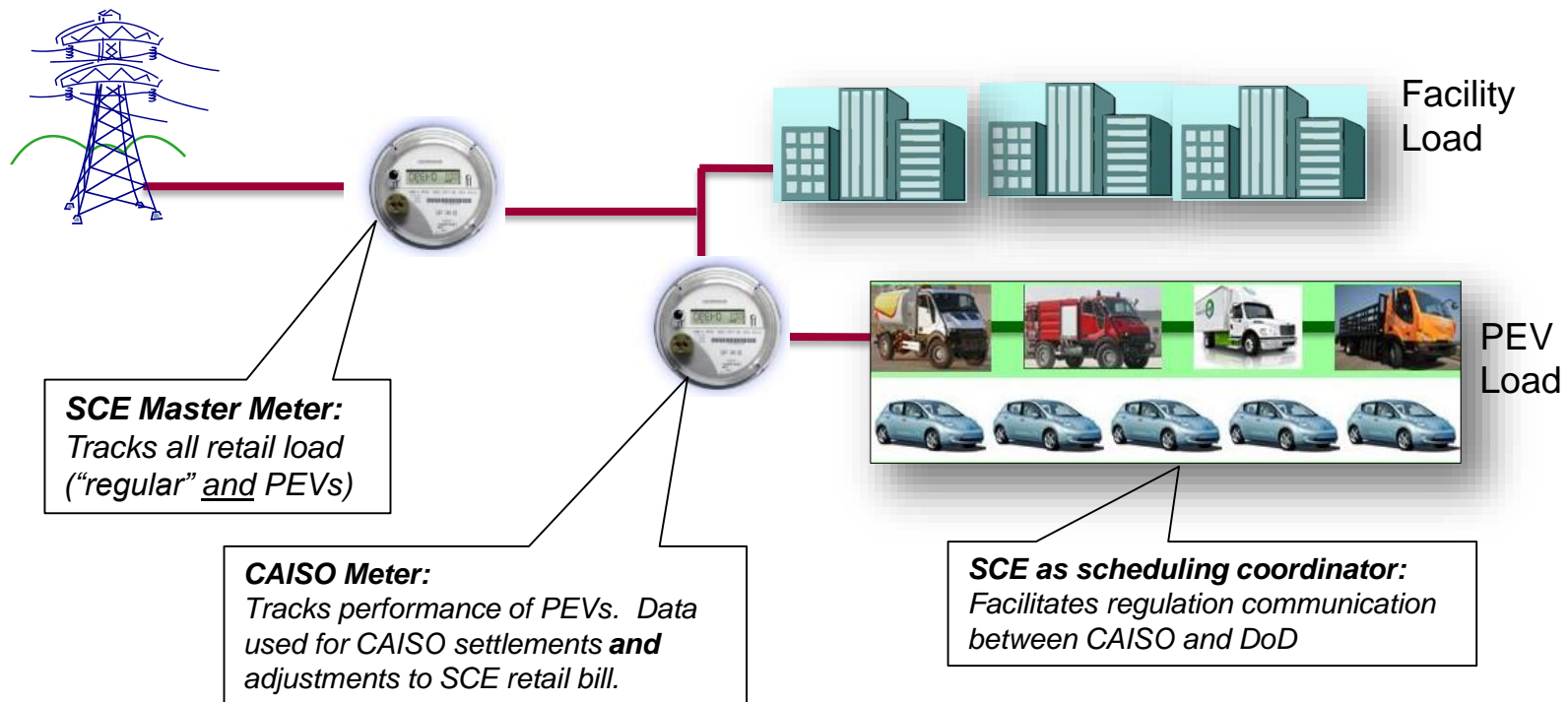
- **Study the role of the utility** in enabling BTM direct market participation
- **Determine the utility costs** in facilitating direct participation
- **Support a pioneering customer** in direct participation, including various technical and metering advances
- **Develop a potentially scalable solution** for BTM market participation by distributed energy resources (DERs)
- **Complete V2G “proof of concept” test**, demonstrating technical viability
- **Understand the settlement process** for BTM wholesale market participation

The Pilot is a complex example of Use Case 3

- The V2G resource provides customer (retail) benefits as well as wholesale benefits
 - **Retail services:** the Pilot resource intends to demonstrate retail peak shaving for the Air Force Base
 - **Wholesale service:** the Pilot will demonstrate participating in the wholesale market as a Non Generating Resource (NGR) providing ancillary services
- Enabling BTM participation as an NGR resource is significantly more complex than participation as a Proxy Demand Response (PDR) resource

Pilot Mechanics Overview – Basic Structure

- All load – both “regular load” and PEV load – receives electricity behind one point of interconnection to SCE’s distribution system. Retail load is billed at a single master meter.
- PEVs have a Wholesale Distribution Access Tariff (WDAT) interconnection behind a CAISO revenue-grade meter to distinguish PEV demand and energy from the remainder of the Air Force Base, which remains on an otherwise applicable tariff.
- CAISO reg up/reg down instructions are facilitated by SCE as Scheduling Coordinator.



Pilot Mechanics Overview – Billing and Settlements

- CAISO-directed energy discharges are “backed out” of the retail bill through a manual process.
- During these periods, the PEV discharges are treated as if the device were an “in front of the meter” (IFOM) device.
- Process details:
 - Identify hours where resource received CAISO award (“CAISO award hours”).
 - For all CAISO award hours, check if CAISO meter shows energy generation. If so, this energy quantity will be added back to retail bill for that interval.
 - Energy charging during CAISO award hours is *not* backed out of the retail bill.
- Retail Peak shaving is not possible during CAISO Award Hours, as all energy generation is added back to retail bill (During these hours, this device is similar to an IFOM device).

Key Challenges and Open Questions

Payment Issues

- **Challenge**

- Double payment concern: Resource should not receive CAISO energy payment when the PEVs are serving load and not exporting to the grid. Similarly, Resource should not get credit for retail peak shaving when earning CAISO revenues.
- Wholesale/Retail issue: Resource should not be allowed to charge at wholesale and discharge at retail.

- **Solution**

- During CAISO award hours, all PEV generation is “added back” as load to the retail bill, which should avoid double payments. Additionally, all charging is billed at retail.

- **Open questions**

- Can/should *charging* activity dispatched by CAISO also be “backed out” of retail bill?
- Would it be possible to “pre-charge” the battery at wholesale rates? If so, how would you ensure that this energy is not later used for retail load?
- How do we ensure that CAISO only issues settlements during “CAISO award hours” and does not issue Energy Imbalance settlement in other hours?
- In the current set up, all charging goes to the retail bill, thus this resource is “charging at retail and discharging wholesale.” And if charging occurs via CAISO dispatch, there will be double billing (both wholesale AND Retail). Will the Regulation award payment be sufficient to mitigate losses on energy transactions from CAISO dispatches?

Key Challenges and Open Questions

Administrative and Technical Complexity

- **Challenges**
 - Need to isolate wholesale activity from retail activity
 - Need to reconcile retail bill to wholesale activity and modify retail load to “back out” wholesale activity
 - Need to ensure wholesale settlements only reflect wholesale activity (no settlements during hours that are not CAISO award hours)
- **Solution**
 - Implementing costly, manual, back office procedures
 - Significant manual work to identify wholesale hours and activities, determine energy to be added back to retail bill, and manually adjust retail bill.
- **Open questions**
 - How can this process be scalable?
 - How can this process be automated?
 - How can this process be workable when the Load Serving Entity is not also the Scheduling Coordinator?
 - Is additional communication / reconciliation with CAISO necessary to ensure all settlements occur properly?