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<td><strong>Docket Number:</strong> 18-MISC-04</td>
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<td><strong>Project Title:</strong> Vehicle Grid Integration Roadmap Update</td>
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<td><strong>Document Title:</strong> Presentation - Smart Charging of Plug-in Vehicles and Driver Engagement for Demand Management</td>
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<td><strong>Description:</strong> Presentation by Doug Black - Smart Charging of Plug-in Vehicles and Driver Engagement for Demand Management and Participation in Electricity Markets Agreement #EPC-14-057</td>
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Smart Charging of Plug-in Vehicles and Driver Engagement for Demand Management

Additional submitted attachment is included below.
Smart Charging of Plug-in Vehicles and Driver Engagement for Demand Management and Participation in Electricity Markets Agreement #EPC-14-057

Vehicle-Grid-Integration Roadmap Discussion Panel 4: Customer Experience

October 30, 2018
Alameda County—PEVs and PHEVs at AlCoPark Garage

12 Nissan LEAF
24 kWh battery

2 Chevy Bolt
60 kWh battery

17 Ford Focus Electric
23 kWh battery

2 Toyota RAV4 EV
41.8 kWh battery

2 Toyota Prius Plug-in
4.4 kWh battery

2 Chevrolet Volt
16.5 kWh battery

3 Ford C-Max Energi
7.6 kWh battery
AlCoPark Garage—Primary public and fleet charging location

- Total Ports: 14 Level 1 and 36 Level 2

5 CT2100 each with a L1 and L2 port
5 CT2100 each with a L1 and L2 port
3 CT4020 each with two L2 ports

1 CPE200 DCFC with 1 SAE Combo and 1 CHAdeMO

4 CT2100 each with a L1 and L2 port
8 CT4020 each with two L2 ports

Floor 8
Public Access
7a-7p
Fleet Charging
7p-7a

Floor 2
Public Access
7a-7p
Fleet Charging
7p-7a

Street Level
24-h Access

Basement
Fleet Operations; No public access
Impact of EV Charging on Electric Demand at AlCo Park Garage

Before EV charging

With EV charging
Connected and active charging times vary

\[ l_{flex} = \frac{d_{session} - d_{charge}}{d_{session}} \]
Approach for Public EV Smart Charging

- Flexibility to shift charging is constrained to operating hours 7 AM to 7 PM
  - Peak period is 12p-6p so shifting out of peak is limited
- Optimization algorithm “smoothed” peak period charging demand
- Minimized risk to public charging station users by delivering charge energy equal to that of unmanaged charging
Smart Control of Public Charging Stations

- Smart Charging participant starts a session at an AlCoPark charging station and receives a text with a link to web-site that requests estimated departure time and charge needed.
- Charging optimization code uses the user provided information along with current demand of all other AlCoPark charging sessions, and forecast of non-charging demand to create charging plans for all Smart Charging participants.
Public Station Smart Charging Performance

(a) Participants’ Charging Power
- Controlled EVs
- Uncontrolled EVs

(b) Public Stations’ Charging Power
- Controlled Public Charging
- Uncontrolled Public Charging

Power, [kW]

Time of Day

Public Charging Control on 2017-10-12
Summary of Public Smart Charging

- Pilot demonstrated that communicating with customers can be done with fairly simple and inexpensive text messaging.
- Also demonstrated feasibility of remote optimization and control of public charging sessions; No stranded drivers!
- Providing incentives for large-scale participation needs further study.
- Cost savings were relatively modest here due to public charging station configuration at ALCoPark Garage; level 2 stations limited to level 1 rate.
- Total cost of public charging is reduced by 2% (Sep) to 16% (Nov) if only public smart charging sessions are considered.

![Graphs showing cost savings](image)
Charging Energy Increased Faster than Total Electricity Costs Thanks to Smart Charging!

![Graph showing normalized facility electric costs and normalized EV charging energy over time. The orange line represents normalized EV charging energy, which increases faster than the blue line for normalized facility electric costs.](image-url)
Proposed TOU Peak and Mid-Peak Periods

- Peak period will change from 12p-6p to either 5p-10p (PG&E) or 4p-9p (SCE and SDG&E)
- Partial peak period will change to 3p-5p and 10p-12a for PG&E
- The new peak periods will require more sophisticated smart charging controls for vehicles parked overnight
  - Especially for EVSE constrained fleets and MUDs
Questions...

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