Southern California Edison

THE CLEAN POWER AND ELECTRIFICATION PATHWAY
Realizing California’s Environmental Goals
November 2017

Million Metric Tons of CO2

1990  2017  2020  2030  2050

40% BELOW 1990

80% BELOW 1990
SCE Charge Ready

- $22 million pilot project that seeks to accelerate the installation of Electric Vehicle (EV) charging stations for non-residential customers
- Install up to 1,500 EV Level 1 or 2 charge ports (EVSEs) in four different long dwell segments: Workplaces, Destination Centers, Fleets, Multi-Unit Dwellings
- SCE will install and maintain the supporting electrical infrastructure at no cost to participants
- Program participants, or site hosts, will receive rebates to purchase chargers and will own operate and maintain them
Charge Ready Infrastructure

*Service drop, meter, panel, and circuit dedicated to EV charging

Infrastructure deployed by SCE (all costs covered by the Program)

Owned and operated by participating customers (rebate against hardware and installation costs)
OpenADR in Charge Ready

- OpenADR 2.0 required for participation in Charge Ready
- Event parameters scheduled day ahead
- Five EVSE Communication Vendors currently participating in pilot
- Load Control signals call for 50% reduction
Charge Ready DR Pilot Design

Load Shift and Reduction Timeline

Load Shift Control
6-11AM
Reduce Load Below
Historical Baseline
- and -

Load Shift Incentive
11AM-3PM
Get Incentives for Each
kWh Used

Load Reduction Control
and Incentive
4-9PM
Get Incentives for Each
kWh Saved Below
Historical Baseline

Load Shift and Reduction Details

<table>
<thead>
<tr>
<th></th>
<th>Load Reduction</th>
<th>Load Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentive Period</td>
<td>4 PM to 9 PM M-F, except holidays</td>
<td>11 AM to 3 PM M-F, except holidays</td>
</tr>
<tr>
<td>Control and Baseline Period</td>
<td>4 PM to 9 PM</td>
<td>6 AM to 11 AM</td>
</tr>
<tr>
<td>Months</td>
<td>June through September</td>
<td>March through May and October through December</td>
</tr>
<tr>
<td>Number of events per day</td>
<td>Single one-to-five hour control event</td>
<td>Single one-to-five hour control event</td>
</tr>
<tr>
<td>Number of events</td>
<td>Up to 10 each year</td>
<td>Up to 10 each year</td>
</tr>
<tr>
<td>Shift or Reduction</td>
<td>Up to 50%</td>
<td>Up to 50%</td>
</tr>
<tr>
<td>Credits</td>
<td>$0.10 per kWh reduced during Control/Incentive Periods</td>
<td>$0.05 per kWh used during the Incentive Period</td>
</tr>
<tr>
<td>Notification</td>
<td>Day ahead</td>
<td>Day ahead</td>
</tr>
</tbody>
</table>

These parameters could change at any time during the pilot - for the latest information please see the Charge Ready DR Pilot tariff at: [https://www.sce.com/NR/sc3/tm2/pdf/ce397.pdf](https://www.sce.com/NR/sc3/tm2/pdf/ce397.pdf)
Charge Ready DR – Load Shifting

- The average weekday load shape for sites participating in Charge Ready peaks at 9am.
- During a load shift event the goal is to move or shift that usage to later in the day when more renewable generation is available.
- In addition to offering incentives for increasing load between 11am and 3pm, control signals are sent to charging stations to reduce their charging capacity during morning hours in an attempt to shift that charging into the 11am to 3pm load shift event window.

Load Profile Data: [https://www.nrdc.org/experts/sierra-martinez/new-end-improved-electric-grid-california](https://www.nrdc.org/experts/sierra-martinez/new-end-improved-electric-grid-california)
Data Analysis: Workplace (38 Sites/705 Ports)

Usage peaks at 9am then drops off dramatically by 3pm and continues to taper off. Negligible weekend use.

Could be leveraged to shift morning load to times of high renewable generation.
Data Analysis: Destination Center (22 Sites/234 Ports)

Usage peaks at 9am on weekdays, but shows consistent use into the evening on weekdays and weekends.

Could be leveraged for both shifting morning load and reducting evening peaks.

Destination Center - kW by Hour - Apr 2019

- kW - Weekday
- kW - Weekend
Usage peaks at 5pm on weekdays, significant load available in afternoon and evening hours

Could be leveraged for evening ramp down on weekdays
Data Analysis: Multi-Unit Dwelling (3 Sites/35 Ports)

Usage peaks at 12am on weekends. Highest weekday usage between 7pm and 1am

Evening load available to reduce weekday evening ramp
2018 Load Shift Events

- Control Period from 6am – 11am
- AM load reduced by approximately 17% to 24%
- No load shift to increase load from 11am – 3pm
- Load decreased from 11am – 3pm
- Control Period may have been too long, allowing vehicles to fully charge even with a 50% reduction in charging capacity

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Sites</th>
<th>Ports</th>
<th>Control Period 6am-11am Baseline</th>
<th>Event</th>
<th>Reduction</th>
<th>Incentive Period 11am-3pm Baseline</th>
<th>Event</th>
<th>Shift</th>
<th>Compared to Baseline % Reduction</th>
<th>Event Day % Shift</th>
<th>% Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/16/2019</td>
<td>68</td>
<td>1020</td>
<td>4023</td>
<td>3357</td>
<td>666</td>
<td>2919</td>
<td>2626</td>
<td>-293</td>
<td>16.55%</td>
<td>-10.04%</td>
<td>-43.99%</td>
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<tr>
<td>10/30/2018</td>
<td>68</td>
<td>1020</td>
<td>4107</td>
<td>3250</td>
<td>857</td>
<td>2959</td>
<td>2706</td>
<td>-253</td>
<td>20.87%</td>
<td>-8.55%</td>
<td>-29.52%</td>
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<tr>
<td>11/14/2018</td>
<td>68</td>
<td>1020</td>
<td>4090</td>
<td>3124</td>
<td>966</td>
<td>2639</td>
<td>2603</td>
<td>-36</td>
<td>23.62%</td>
<td>-1.36%</td>
<td>-3.73%</td>
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<tr>
<td>11/28/2018</td>
<td>68</td>
<td>1020</td>
<td>4104</td>
<td>3417</td>
<td>687</td>
<td>2839</td>
<td>2699</td>
<td>-140</td>
<td>16.74%</td>
<td>-4.93%</td>
<td>-20.38%</td>
</tr>
</tbody>
</table>
## 2019 Load Shift Events

- **Control Period from 9am – 11am**
- **AM load reduced by approximately 19% to 35%**
- **Load shift of approximately 1% to 8%**
- **Approximately 5% to 36% of load reduced during the event control period shifted to the event incentive period**
- **Shorter control periods contributed to load shifting**

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Sites</th>
<th>Ports</th>
<th>Control Period 9am-11am</th>
<th>Incentive Period 11am-3pm</th>
<th>Compared to Baseline</th>
<th>Event Day</th>
</tr>
</thead>
</table>
Impact of 2019 Load Shift Events

Charge Ready DR Event: 03/28/19

No. SAs: 69; No. Ports: 1038

Hourly Usage (kW)

0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Hour

DR Event

Baseline Avg (kW) Event Sum (kW)

Charge Ready DR Event: 04/11/19

No. SAs: 70; No. Ports: 1057

Hourly Usage (kW)

0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Hour

DR Event

Baseline Avg (kW) Event Sum (kW)
Impact of 2019 Load Shift Events (continued)

Charge Ready DR Event: 04/18/19

No. SAs: 70; No. Ports: 1057

Baseline Avg (kW)  Event Sum (kW)

Charge Ready DR Event: 04/25/19

No. SAs: 70; No. Ports: 1057

Baseline Avg (kW)  Event Sum (kW)