SMUD DER Flexibility

Denver Hinds
Grid Evolution R&D
3/24/2021
SMUD’s Flexible pathway to zero carbon by 2030

1. **Proven clean tech**
   - 90% reduction of greenhouse gas emissions
     - >3,000 MW of new renewable energy & storage—equivalent to energy needs of more than 800,000 homes.
     - Growing rooftop solar and batteries.

2. **New tech & business models**
   - Pilot & scale new projects & programs
     - Research game changing technologies and alternative fuels.

3. **Natural gas gen repurposing**
   - Goal to retire 2 power plants and re-tool fleet
     - to drastically reduce operations and emissions.

4. **Financial impact & options**
   - Rate impacts limited to rate of inflation
     - Expand partnerships and grants to offset costs & generate operational efficiencies.

**Work with all our communities to reduce greenhouse gas emissions together.**
Partner and collaborate with community organizations, attract business, innovation and jobs to Sacramento.

Alignment with SMUD’s Sustainable Communities Initiative.

March 9, 2021
Board Strategic Development Committee and Special SMUD Board of Directors Meeting
Education & demand flexibility to:
Help our region and customers partner with SMUD to reduce greenhouse gas emissions.

**Plan**
- Pilot Flex Alert programs to offset capacity needs without technology requirements.
- Pursue education and behavior-based opportunities.

**Research**
- Customer & market research to develop solutions.

- **Educate customers and community organizations** on how they can play a role toward zero carbon.
- **Pilot behavioral-based demand response and flexibility** such as “Flex-Alert” to help reduce customer bills and system peak demand **without requiring investment in technology**.
- **Assess pilots and programs** to ensure alignment with zero carbon goals.
Virtual Power Plants (VPPs) & Vehicle-to-Grid (V2G) Support the elimination of fossil fuels in SMUD’s electricity supply.

**Plan**
Partner directly with customers or third-party providers to pilot and then scale up solutions where customer-owned devices help manage the grid.

**Research**
Identify VPP partners to develop & test customer offerings.
Assess VPPs relative to alternatives to determine operational scale.

- **Assess ability of** customer-installed devices** such as thermostats, pool pumps, water heaters to be aggregated into VPPs.**

- **Pilot Bring Your Own Device (BYOD)** using multi-DER approach that aggregate a variety of customer-owned devices including thermostats, EV Charging to manage load.

- **Pilot Solar & Storage VPP** to test ability to deliver grid-type scale and services such as capacity and short-term energy.

- **Pilot and scale Vehicle-to-Grid (V2G).**

- **Develop scaling models and prioritize.**
SMUD DERMS Architecture

OSI Integra DERMS

- Forecasted Load & Generation
- Network State (SCADA & Powerflow)
- Schedule Creation
- DER Network Model
- Network & Economic Optimization
- DER Business Rules Data

DERMS Operator

Situational Awareness

Utility Controlled Assets

- Metered
- Un-metered

- Dispatchable Generators
- Energy Storage
- DR and Smart Appliances
- Microgrids

Aggregator Assets

- Aggregation Node A
- Aggregation Node N

Network & Economic Optimization

GIS Network Model

Weather Service API

SCADA, DMS, OMS
DER Flexibility Pathways

- TOU $
- Wholesale $
- (Off) Peak $
- Fixed Grid $

DERMS
Local DER Visibility and Optimization

IEEE 2030.5
OpenADR

Simple Scheduler
Price Schedule Engine and DB

Simple API

Automation Programs
- thermostat
- Heat Pump H₂O Heater
- Commercial TES
- Residential Storage
- Local Energy Market
- Managed EV Charging
- Multi-DER BYOD
- Virtual Power Plant
- Vehicle to Grid

SMUD
1. Design Guide Summary
This is intended to guide the implementation of OpenADR VTN and VEN services to deliver upon the use case needs of SMUD’s DER programs. The information in this document is intended to be shared openly with potential technology vendors. No confidential information is included.

1.1. Use Case Summary

<table>
<thead>
<tr>
<th>Category</th>
<th>Use Case</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Load Control</td>
<td>Event based load control using consumption/generation setpoint</td>
</tr>
<tr>
<td></td>
<td>Load Optimization</td>
<td>Event based signal where interval data maps resources to specific other use case event signals.</td>
</tr>
<tr>
<td>Pricing</td>
<td>Time of Use Pricing</td>
<td>Event based TOU pricing signal</td>
</tr>
<tr>
<td></td>
<td>Day Ahead Hourly Pricing</td>
<td>Event based day ahead pricing signal</td>
</tr>
<tr>
<td></td>
<td>Peak Price Events</td>
<td>Event based peak price signaling</td>
</tr>
<tr>
<td>Reporting</td>
<td>Energy Metering</td>
<td>Telemetry reporting of current consumption/generation</td>
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<tr>
<td></td>
<td>State of Charge</td>
<td>Telemetry reporting of current charge state</td>
</tr>
<tr>
<td></td>
<td>Capability Forecast</td>
<td>Reporting of potential generation and load shed capacity</td>
</tr>
<tr>
<td>Other</td>
<td>Group Assignment</td>
<td>Mapping of DER resources to grouping constructs. Out of scope for this mapping effort as may be handled at the DERMS rather than OpenADR level.</td>
</tr>
</tbody>
</table>
# Design Guide: Sample Use Case Characteristics

## Day Ahead Hourly Pricing

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case Objective</strong></td>
<td>Notification of day ahead hourly pricing</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Provide event notification of next day’s pricing on a day ahead hourly basis. Price changes are a function of wholesale market pricing or the situational use of short-term price differentials to influence customer load use behavior</td>
</tr>
<tr>
<td><strong>Signaling end point</strong></td>
<td>Facilitator/aggregator, who will in turn distribute pricing to SMUD customer resources</td>
</tr>
<tr>
<td><strong>Benefit</strong></td>
<td>Utility: Shape load via price, optimizing generation costs, defer T&amp;D upgrades Customer: Manage costs through pricing awareness?</td>
</tr>
<tr>
<td><strong>Target Load</strong></td>
<td>Any – Best effort program</td>
</tr>
</tbody>
</table>
| **Event Signals** | Signal Name: ELECTRICITY_PRICE  
Signal Type: price  
Units: currencyPerKWh  
ItemDescription: currencyPerKWh  
ItemUnits: USD  
ScaleCode: none |
| **Event Time Frames** | - Typically, events may be called 1 times per day  
- Events start at midnight and end at midnight.  
- 23hr and 25hr event on Daylight Savings Transition Days.  
- Notification between 1 day and 1 hour before start of new day  
- 24 hours of pricing values per event. one hour or multi-hour intervals of pricing values in the signal. In later phases, individual interval length could be arbitrary. |
| **Event Randomization** | None |
| **Event Ramp Up** | None |
| **Event Baselines** | None |
| **Event Opt Responses** | VEN to provide a mandatory optin as a confirmation signal that they received the event. |
| **Event Targeting** | GroupID – VTN will create abstract groups by location or other constructs and send those to the VEN out of band. |
| **Event Signal Targeting** | None |
| **Polling** | 1 minute polling? |
| **Sequence Diagram** | Default Event Sequence |
| **Other** | MarketContext: http://www.smud.org/day_ahead_hourly/01  
Priority set to zero  
Current Value – Omit from payload |
Questions