SMUD DER Flexibility

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Grid Evolution R&D
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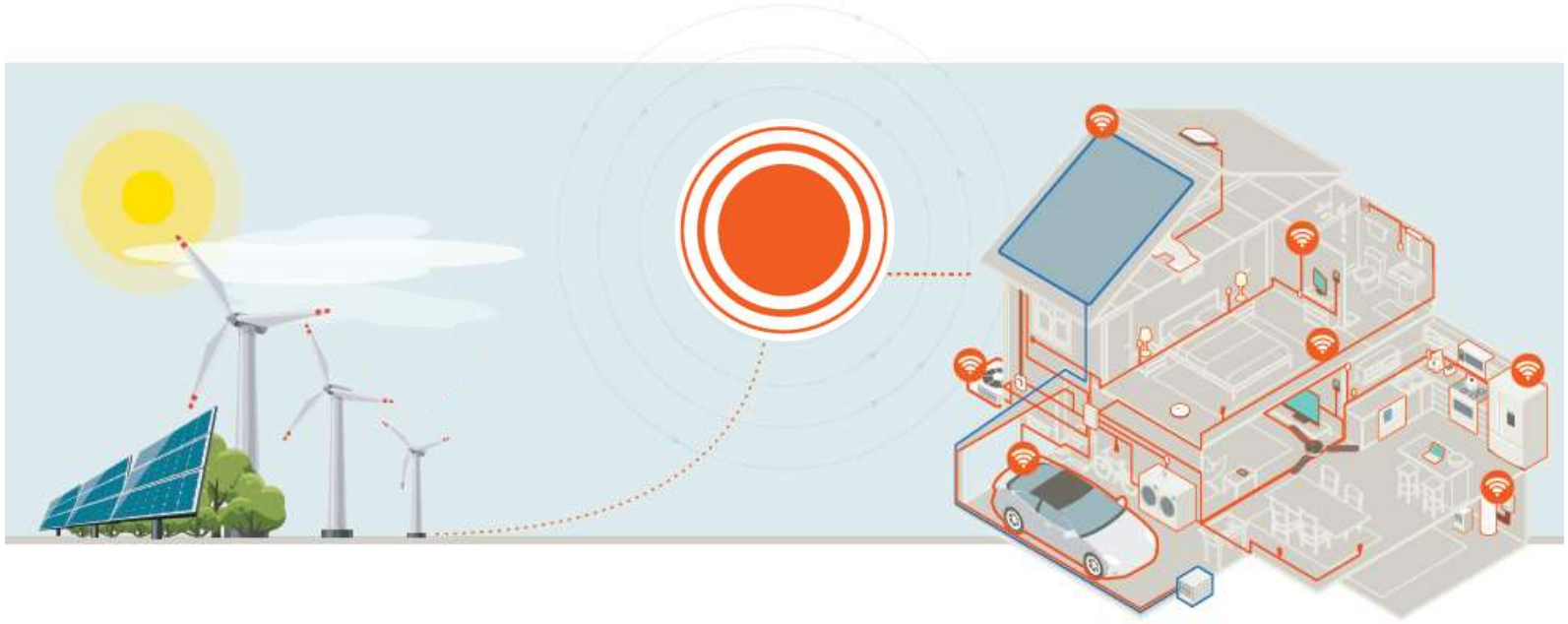

SMUD's Flexible pathway to zero carbon by 2030

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.

100% Zero carbon by 2030

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2 New tech & business models

Education & demand flexibility to:

Help our region and customers partner with SMUD to reduce greenhouse gas emissions.

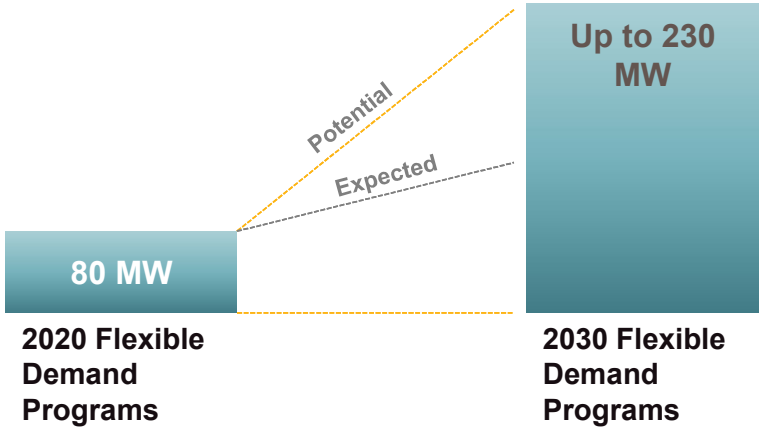
Plan

- 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.



2 New tech & business models

Virtual Power Plants (VPPs) & Vehicle-to-Grid (V2G)

Support the elimination of fossil fuels in SMUD's electricity supply.

Plan

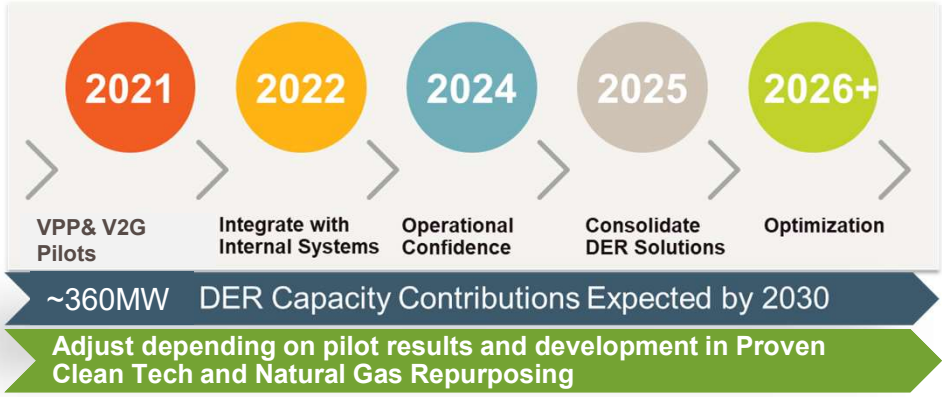
Partner directly with customers or third-party providers to pilot and then scale up solutions where customer-owned devices help manage the grid.

Research

Identify VPP partners to develop & test customer offerings.

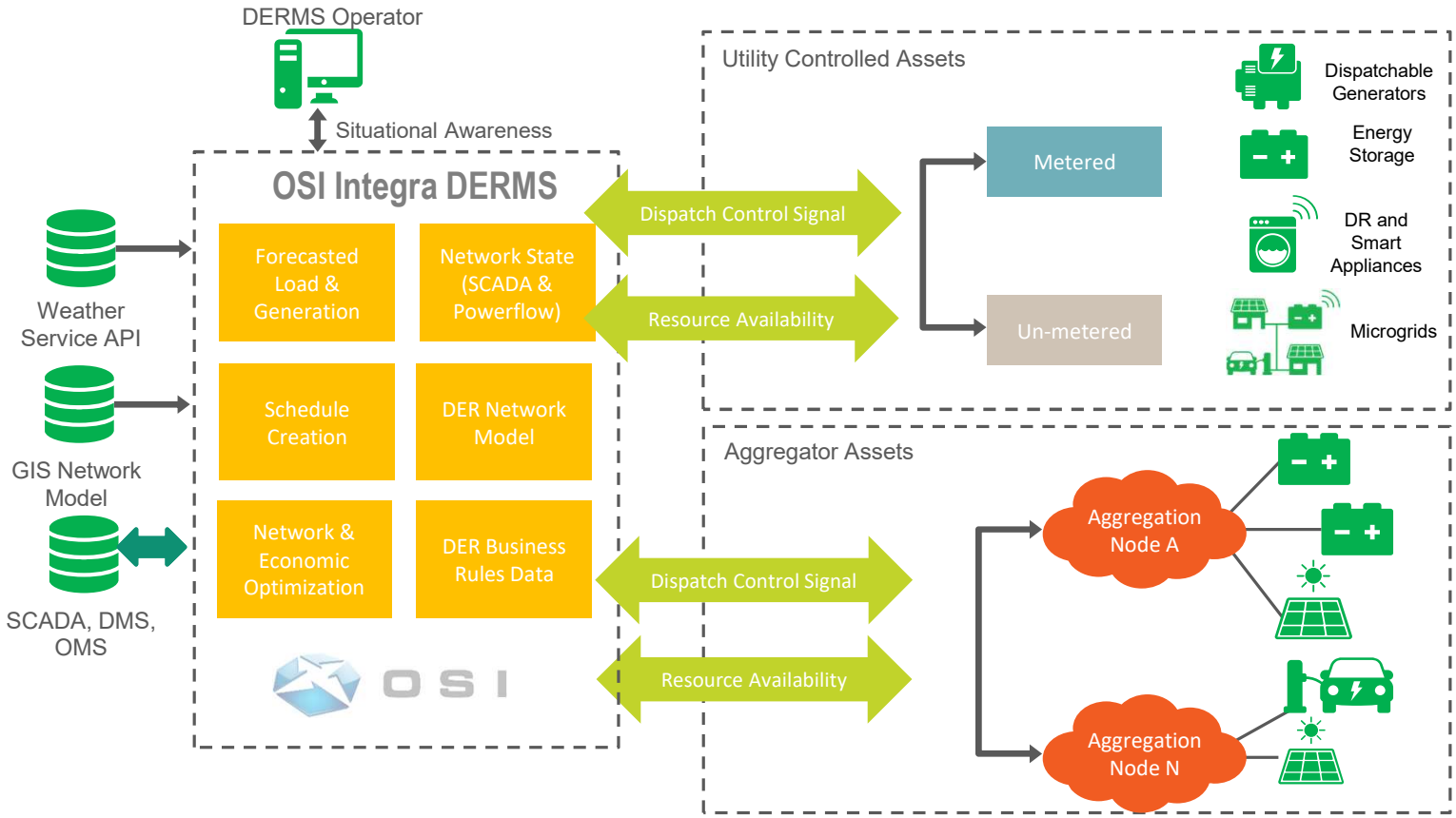
Assess VPPs relative to alternatives to determine operational scale.

- 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



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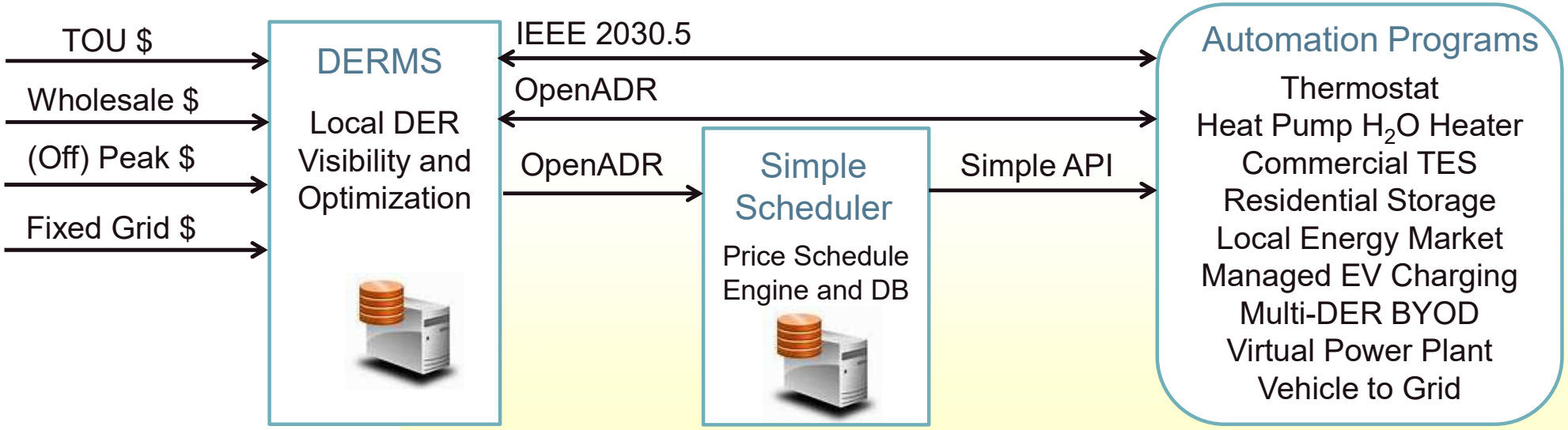
DER Flexibility Pathways



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SMUD OpenADR Design Implementation Guide

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 in intended to be shared openly with potential technology vendors. No confidential information is included

1.1. Use Case Summary

Category	Use Case	Brief Description
Control	Load Control	Event based load control using consumption/generation setpoint
	Load Optimization	Event based signal where interval data maps resources to specific other use case event signals.
Pricing	Time of Use Pricing	Event based TOU pricing signal
	Day Ahead Hourly Pricing	Event based day ahead pricing signal
	Peak Price Events	Event based peak price signaling
Reporting	Energy Metering	Telemetry reporting of current consumption/generation
	State of Charge	Telemetry reporting of current charge state
	Capability Forecast	Reporting of potential generation and load shed capacity
Other	Group Assignment	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.

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Design Guide: Sample Use Case Characteristics

Day Ahead Hourly Pricing	
Characteristic	Description
Use Case Objective	Notification of day ahead hourly pricing
Description	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
Signaling end point	Facilitator/aggregator, who will in turn distribute pricing to SMUD customer resources
Benefit	Utility: Shape load via price, optimizing generation costs, defer T&D upgrades Customer: Manage costs through pricing awareness?
Target Load	Any – Best effort program
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

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Questions