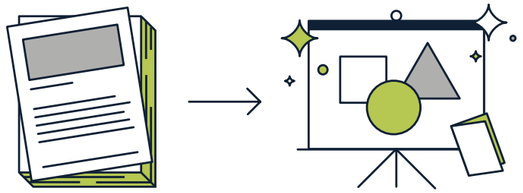
What is TA&D?

TA&D is a process developed by Electric Power Research Institute (EPRI) for sharing the story of the California Energy Commission's (CEC) Electric Program Investment Charge (EPIC) projects funded by Southern California Edison (SCE) rate payers.

TA&D presents learnings and opportunities from each project, distilled into engaging presentations and materials that provide real-time updates on the latest advancements from EPIC integrated demand side management (IDSM) and distributed energy resource (DER) technologies.



Southern California Edison

Emerging Markets & Technologies Group
1515 Walnut Grove Avenue
Rosemead, CA 91770
www.sce.com

Electric Power Research Institute

Power Delivery and Utilization
3420 Hillview Avenue
Palo Alto, CA 94304
www.epri.com

For more information, contact Mark S. Martinez

Senior Program Manager,
Emerging Markets and Technologies
Customer Programs and Services
Southern California Edison

mark.s.martinez@sce.com

Technology Assessment & Delivery

Demand Side Resource Integration Platform (DSRIP)

Customer-centric Demand Management using Load Aggregation and Data Analytics.

CEC EPC Project 15-075

June 2019

Suggested Next Steps for DSRIP

- **Explore and test control strategies** to mitigate water heater needle peaks and unexpected heat-ups. Communicate with Curb to expand battery's status to both "Consumption" and "Production", i.e., apply +/- to indicate whether it is charging or discharging.
- **Develop low-priced event signals** and the test the system with full price signals; ie: establish the Time-of-Use rate signal and test the full response of the system to real price signals.
- **Deploy and test in the field** new technologies and home energy management systems and add the behavior factor.

Key Findings

Successes

- Development of DER-vendor agnostic data models supports data aggregation and control.
- Lab setup demonstrated an orchestrated response (water heater, battery, smart thermostat) to respond to a single load shed signal.

Challenges

- Control strategies for water heaters that successfully mitigate needle peaks and unexpected heat-ups.
- A layered control strategy that maintains customer's comfort/energy goals and overall grid benefits.
- An understanding of customer's tolerance for automated controls on customer-sited end-devices.

Opportunities for Collaboration

While the overall DSRIP platform architecture demonstrates orchestration, control and feedback, the next piece is gaining a better understanding of how customers will respond to this control and related pricing structures. Fortunately, additional EPIC projects lead by EPRI provide leverage points that have the potential to support full-scale integration with EV/PV aggregation platforms and final data analytics related to customer behavior.

Leverage Points

- The overall DSRIP platform architecture
- Transactive Incentive Signals (TIME) project
- Open Vehicle to Grid Integration Platform (OVGIP)
- Manufacturing partners, e.g. ecobee, Rheem, SolarEdge, GE, Curb, Sonnen
- Partner IOUs, SCE, SDG&E, PG&E
- Possible Partners SMUD, LADWP

Demand Side Resource Integration Platform (DSRIP) Project 15-075

Supporting California's Clean Energy Goals

Increasing customer demand for alternative energy is compelling utilities to explore how distributed energy resources (DERs), aggregation platforms, and transformative energy technologies are changing the traditional utility business model. The shift toward a higher-rate of customer-managed DERs – against the backdrop of an evolving transmission market and low participation in customer load control strategies – has identified the need for a single control point for demand response (DR) programs that simultaneously;

1. leverages data analytics insights that measure and verify the impacts of various rate structures on customer behavior and;
2. offers end-users value-added feedback and insights, such as dashboards, to help visualize personal usage and as a result, deepen customer engagement.

The integration of different types of customer-managed resources (e.g., solar photovoltaics, storage, thermostats, EV) will be essential for load management planning on the electric grid of the future. The core technology proposed to solve this issue is a demand side resources platform (DSRIP) software, designed to aggregate DERs and data from smart devices across residential, small/medium commercial, and electric vehicle end-users that would benefit ratepayers, gird operators, and utilities.

The Electric Power Research Institute (EPRI) is leading the development and implementation of an innovative, proof-of-concept software platform to serve as a single point of aggregation across a wide variety of load types and products. In partnership with Lawrence Berkeley National Laboratory, the California Independent System Operator (ISO) and electric utilities, leading manufacturers, and other energy service providers and consultants, this software will leverage connected technologies and data feedback mechanisms to help utilities measure the impacts of various rate structures on customer energy use, advance load management planning and improve the overall customer experience.

Project Goals

The overarching goal of this project is to evaluate the potential of an innovative software platform that could serve as a single point of aggregation for a wide variety of load types, providing a better customer experience while helping utilities measure the impacts of various rate structures on customer behaviors. This software would provide integrated control of residential demand side resources and as a result, influence consumer energy use to provide greater grid stability, relatability, and lower greenhouse gas emissions.

A successfully designed DSRIP will achieve the following objectives:

Data aggregation between connected devices and DERs onto a central repository.

Rate understanding from utility participants is integrated to enable appropriate analysis.

Analyze/visualize data to address customer comfort, usage, and aggregate grid performance.

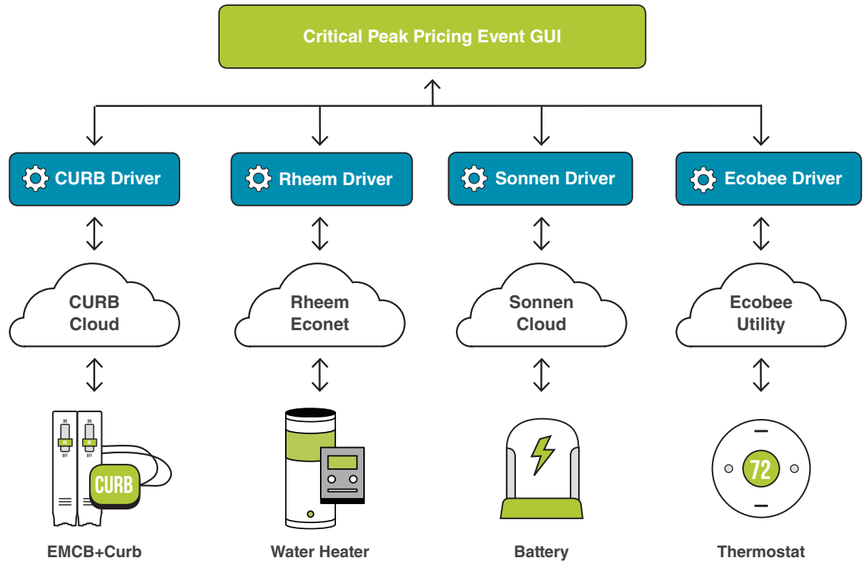
Support a tiered/modular control methodology to enable a study of active controls on overall energy utilization.

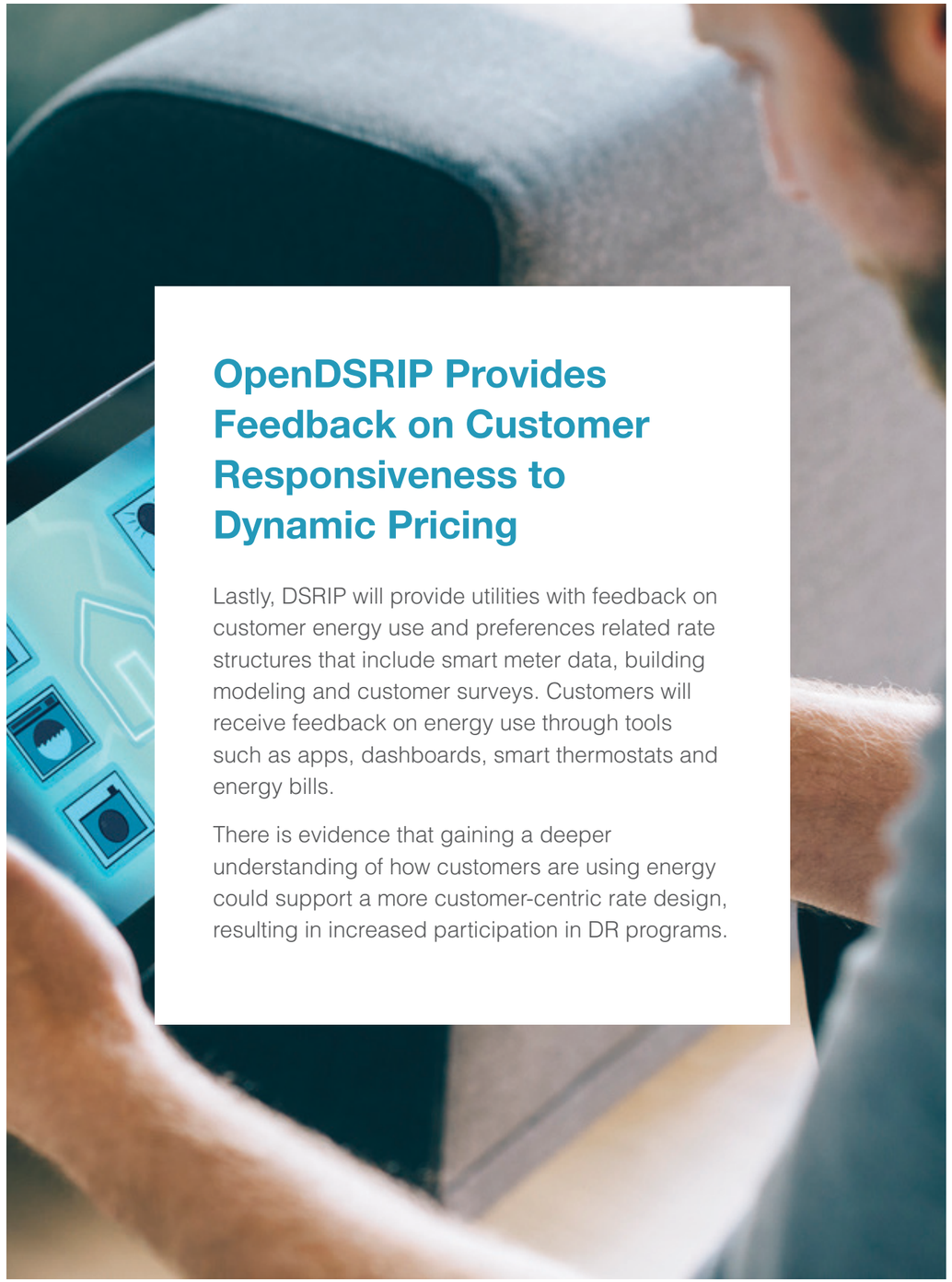
Lab Testing

EPRI tested the concept of orchestration in a laboratory setting between a Sonnen battery, a Rheem water heater and an Ecobee thermostat to respond to a TOU event. The controlled setting also facilitated the capture of individual and aggregated responses.

Communications and Controls Architecture

- Graphic user interface (GUI) triggers a single, high-priced event and visualizes the data.
- GUIs connect to individual device drivers that expose a standard set of API methods – data is transferred and controls are set.
- Drivers connect to the cloud data backhaul and cloud API control endpoints and are responsible for translating standard API methods.
- Cloud APIs connect to the physical devices to effect controls and gather more data.





OpenDSRIP Provides Feedback on Customer Responsiveness to Dynamic Pricing

Lastly, DSRIP will provide utilities with feedback on customer energy use and preferences related rate structures that include smart meter data, building modeling and customer surveys. Customers will receive feedback on energy use through tools such as apps, dashboards, smart thermostats and energy bills.

There is evidence that gaining a deeper understanding of how customers are using energy could support a more customer-centric rate design, resulting in increased participation in DR programs.

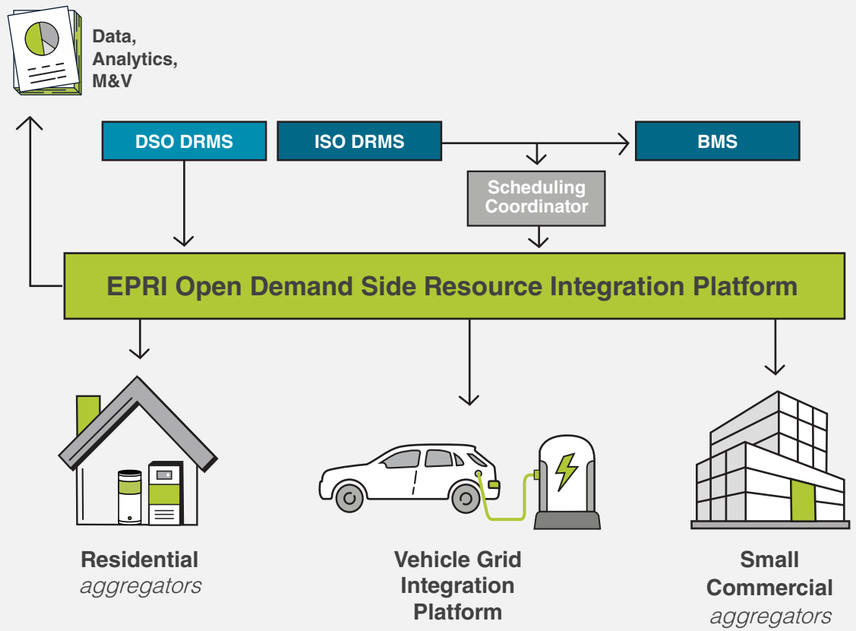
Developing an OpenDSRIP

Developing an open and enabled platform that is agnostic to the method of end use connectivity requires completion of the following key technology tasks:

- A rates translation engine to translate utility and ISO rates
- A Residential Orchestration Module (ROM) that connects and coordinates end-use devices
- A data aggregation layer for M&V
- A customer App with custom messaging and preference settings

The Vision

Enabling least cost flexibility of energy end uses while providing complete customer choice on their appliances to insure a shared, integrated grid.



Key Elements and Features of DSRIP

Utility Layer

Connects to the grid using utility/ISO acceptable protocols and messaging (e.g., OpenADR, IEEE 2030.5)

Data Module

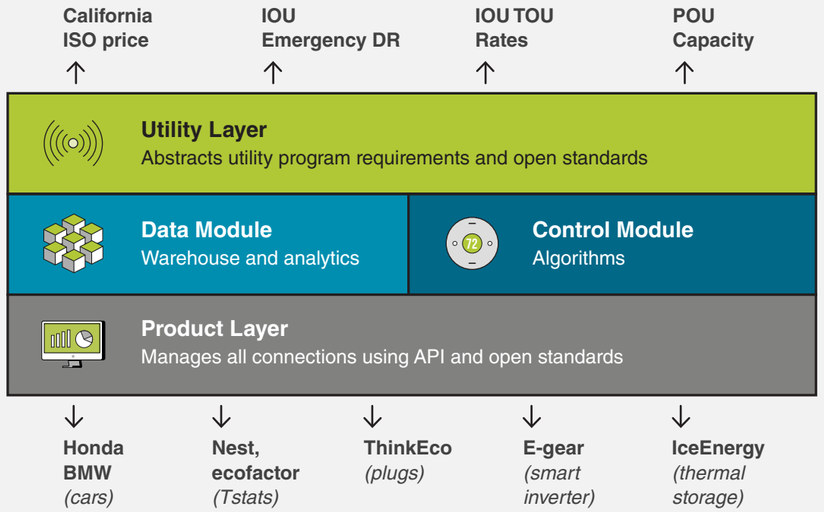
Aggregated database that collects, cleans, and analyzes data from all connected products while maintaining a registry of customers and their devices.

Controls Module

Manages aggregation and orchestration of grid and price signals, uses learned customer preferences and optimizes device settings.

Product Layer

Connects to an application programming interface (API) from connected devices/ third parties to provide consumers with a full choice of devices.



OpenDSRIP Provides Orchestration and Personalization

Segment level, smart device end-use data, typically lives in silos across multiple vendor applications, available via separate, secured, cloud APIs. These vendors (heating/ cooling, water heating and lighting) provide utilities with APIs that allow for a variety of control actions but again, they are device/vendor specific and do not talk to each other.

An OpenDSRIP facilitates the orchestration required to horizontally stitch data and control across these vendor applications to provide a single coherent application. This will allow automated control of end-user devices in response to a single peak pricing event.

Orchestration also facilitates personalization through various levels using customer tools (apps, alerts, etc.), allowing end users to opt-in/opt-out of participation, set priorities, select how devices are controlled and benefit from optimized energy use due to this personalization.

Message

Behavioral orchestration – providing customers tools (apps, alerts, etc.).

Opt-in/Opt out

Customers opt-in/opt out of participation based on fixed set of controls by end-use.

Control: Level 1

Customer sets priority by end use.

Personalize

Provide varying levels of orchestration. Leads to personalization.

Optimize

Use gained knowledge of user preference and building characteristics to optimize energy use.

Control: Level 2

“Rules-based” where customer selects how devices are controlled when certain signals (DR, rate changes, etc.) are provided.