TAD Project Update Content Development Template

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EXECUTIVE SUMMARY
Name of the Project Customer-centric Demand Management using Load Aggregation and Data Analytics [EPC-15-075]
Issue driving the need for the Project Increasing customer demand for alternative energy are compelling utilities to explore how distributed energy resources (DERs), aggregation platforms, and transformative energy technologies are transforming the traditional utility business model. The business shift toward a higher-rate of customer-managed DERs – against the backdrop of an evolving transmission market and lack of customer acceptance of load control – has surfaced the need for a single control point for demand response (DR) programs that simultaneously; a. leverages data analytics insights that measure and verify the impacts of various rate structures on customer behavior and; b. offers end-users value-added feedback and insights, such as dashboards, to deepen customer engagement.
Description of the technology(s) and the potential it holds for solving the issue 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 software platform for aggregating distributed energy resources (DERs) and data from smart devices across residential, small/medium commercial, and electric vehicle end-users that would benefit ratepayers, gird operators, and utilities.
Timeline for the Project 5/18/2016 to 12/31/2019
PROJECT DETAILS
Overview of the Project – what is it and who is leading it? In partnership with Lawrence Berkeley National Laboratory, the California Independent System Operator and electric utilities, leading manufacturers, and other energy service providers and consultants, the Electric Power Research Institute (EPRI) is leading the development and implementation of an innovative and proof-of-concept software platform to serve as a single point of aggregation of a wide variety of load types and products leveraging connected technologies and data feedback mechanisms that provide a better customer experience and help utilities in measuring the impacts of various rate structures on customer behaviors.

Goals for the project – what do we hope to learn/develop/solve?

The overarching goal of this project is to influence aggregated demand side resources and consumer behavior to provide grid stability, relatability, and greenhouse gas emissions. To achieve this goal, EPRI and project partners are developing DSRIP to achieve the following objectives:

- Design, develop, test, and validate operational strategies for load management using behind-the-meter resources
- Enable integration of residential and small commercial customers through DSRIP and leverage data analytics to understand individual preferences for end users to enhance the customer experience
- Evaluate the effectiveness of different tariff structures through development and testing of baseline estimation, telemetry, and measurement and verification strategies and employ active control approaches as an incentive to reduce or shift end-user demand use behaviors
- Accelerate commercialization of open source technologies that support DSRIP implementation
- Demonstrate aggregation and load control capabilities with minimal restrictions or disruptions on end-user devices
- Enable scalability of data analytics

Approach – what methodology is being used?

The overarching approach to this project is to develop the DSRIP to integrate, aggregate, and manage customer loads testing various rate structures and attending customer engagement enablers.

EPRI and project partners outlined seven key sequentially-dependent task areas to compete the project:

1 – General Project Tasks
2 – Develop Project Requirements
3 – Design, Build, and Test Open Demand Side Resource Integration Platform
4 – Deploy, Ingrate and Operate the Platform for Data Collection
5 – Analyze Data and Develop Insights into Operational Strategies and Consumer Behavior
6 – Evaluation of Project Benefits
7 – Technology/Knowledge Transfer Activities

Project Participants – who is involved in the development and testing of this solution?

EPRI is the project lead, overseeing all aspects of project design, development, and implementation.
The Technical Advisory Committee is comprised of representatives from CAISO and the following investor-owned utilities: **Southern California Edison Co., Pacific Gas & Electric Co., and San Diego Gas & Electric Co.**

Participating manufacturers include **Honda Motor Americas, BMW North America, ecobee, Nest Labs, Eguana, and Meritage Homes.**

Energy service providers and consultants include **Lawrence Berkley National Laboratory InTech Energy, Sumitomo Electric, Olivine, Inc. Clean Fuel connection, Inc., and Chai Energy.**

Phases of the Project

The project is broken down into three Pillars: (1) Zero Net Energy (ZNE) / Residential Pilot, (2) Open Vehicle-Grid Integration Platform, and (3) Small Commercial Energy Management Platform.

Pillar 1 entailed a pilot program, in partnership with SCE and the California Public Utilities Commission, to study 20 zero net energy homes in the City of Fontana, California as residential aggregators. Pillar 1 focused on solar PV, battery storage, and smart connected devices technologies in single-family, owner-occupied ZNE homes.

Pillar 2 involves a proof-of-concept vehicle grid integration (VGI) platform to develop a unified interface to enable a single method of communication between all plug-in electric vehicles (PEVs) and utilities. A collaboration between EPRI, automobile manufactures, and several investor-owned utilities (IOUs) over the past three years, VGI is a single open-source platform enabling interactive communications and data gathering through PEV telematics. The platform will enable automated communications between the PEV and its driver while providing utilities with situational awareness insights to accurately project PEV load conditions and locational supply capacity restraints.

With Pillar 3, EPRI and project partners are aiming to achieve secure, end-to-end connectivity through development of a Small Commercial Energy Management Platform, called Energy 360, in connection with InTech Energy, Inc. The platform serves as a communications hub to optimize building energy storage, solar PV, pumps and motors, lighting, HVAC, plug loads, demand management and device-level monitoring systems, and EV chargers. Energy 360 communicates with the DSRIP core's aggregation and orchestration module.

EPRI and project partners outlined seven key tasks to compete the project:

Task 1 – General Project Tasks (complete)
Task 2 – Develop Project Requirements (in progress)
Task 3 – Design, Build, and Test Open Demand Side Resource Integration Platform (in progress)
Task 4 – Deploy, Ingrate and Operate the Platform for Data Collection (planned)
Task 5 – Analyze Data and Develop Insights into Operational Strategies and Consumer Behavior (planned)
Task 6 – Evaluation of Project Benefits (planned)
Task 7 – Technology/Knowledge Transfer Activities (planned)

Current Phase
EPRI and project partners are currently working on Task 3 for Pillars 2 and 3.

MARKET POTENIAL

Target Audience – who is this solution being developed for?

The target audiences for this solution are residential, small business, and electric vehicle end users.

Potential Benefits – if the technology is adopted by the target market, what is the perceived long-term benefit?

The long-term benefits to participating end users include, but are not limited to: lower electricity costs, increased awareness of electricity usage, and lower greenhouse gas emissions.

The long-term benefits to grid operators include but are not limited to: increased grid efficiency and improved reliability.

The benefits to utilities include but is not limited to: increased customer engagement in load management / demand response programs and a better understanding of the effectiveness of various rate structures on consumer behavior, and lower greenhouse gas emissions.

Potential Market Challenges – what market actors or factors currently exist that may affect adoption?

Adoption of integrated load management has faced the headwinds of poor consumer awareness or acceptance of demand response programs in addition to a scarcity of readily-available technologies that can reliably provide needed reductions.

Delivery Channel – which key delivery channels have been engaged to date?
What opportunities or challenges currently exist?

To date, EPRI and project partners are testing a customer user interface and in-app messaging to transfer data analytics and insights to future customers.

CURRENT PROJECT PROGRESS

What has been accomplished?

EPRI and project partners have developed a comprehensive DSRIP architecture, use-cases, functional and interface requirements, and design specifications; created a core framework for the DSRIP core[1]; enrolled small/medium businesses and recruited and participating residential communities and EV manufacturers; and conducted early-stage prototyping of the Residential Orchestration Module (ROM).[2]

What key learnings have been identified to date?

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

What roadblocks or factors have occurred to delay or divert progress?

- Customer behavior
- Integration with EV/PV aggregation platforms
- Full-scale integration
- Final data analytics

What potential opportunities or challenges do you see at this stage?

Leverage Points

- 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

Challenges

- Control strategies for water heaters
- A layered control strategy that maintains customer's comfort/energy goals and overall grid benefits.
- Understanding customer's tolerance for automated controls of customer-sited end-devices.

[1] Developed with Microsoft Azure Data Lake®, the DSRIP core include an administrator user interface, an analytics and reporting module, a control module, a utility abstraction module, and an aggregation and orchestration module.
[2] The Residential Orchestration Module includes the end-user visualization and interface with in-home smart technologies such as ecobee, GA, Curb, LG/Eguana, and Rheem as part of Pillar 1.

NEXT STEPS FOR THE PROJECT

When will the current stage be completed? What activities remain?

1. Test control strategies for water heaters
2. Develop customer behavior influence through messaging
3. Develop low priced event signals
4. Test full price signals
5. Deploy and test in the field

What activities are involved in the next stage?

The following activities are planned for Q4 2018:

- Expand zero net energy pilot to multi-dwelling units
- Integrate Scheduling Coordinator API for scheduled rate-change events

The following activities are planned for Q1 2019:

- EV: Complete full-scale integration with OVGIP platform
- ROM: Capture customer preferences in ROM via Chai Mobile App, create enhanced customer message via Chai Mobile App, and integrate EV at-home/outside (preference-based) control actions
- Residential Devices: Integrate battery/storage and AMI data via utitliy API

The following activities are planned for Q2 2019:

- DR/ToU/rate-change schema: Full Open ADR2.0B compliance

Any additional comments: