TAD Project Update Content Development
DR Control Strategies

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EXECUTIVE SUMMARY
Name of the Project CEC EPC-16-026 – Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants
Issue driving the need for the Project Despite the large opportunity for demand response (DR) in industrial processes – especially in areas like as water pumping and frozen food processing and storage – much of the technology and automation has yet to be developed and tested.
Description of the technology(s) and the potential it holds for solving the issue The proposed Flexible Energy Management System (FEMS) for water pumping integrates sub-metered pump electricity information with process controls information (e.g., water pressure and storage levels) accessible through the Supervisory Control and Data Acquisition (SCADA) system, to enable the pumping system control for fast and flexible DR. The system is able to leverage actual and historical data trends to inform DR availability and capabilities. For refrigeration, electricity usage and control schemes will be integrated into the existing supervisory energy management and control system, called BMCS. The system will use data inputs to inform fast and flexible control and synchronization of compressors, condensers, and evaporator fans. Additionally, overall plant operational constraints will be factored into control strategies.
Timeline for the Project 6/15/2017 to 12/30/2020
Project details
Overview of the Project – what is it and who is leading it? The project will develop and pilot test integrated control strategies for fast and flexible DR for two of the most important end-use sectors: water delivery and refrigerated food distribution. Testing will take place at two demonstration sites in California: 1) a water pumping station in Montebello and 2) an industrial refrigerated warehouse facility at the Port of Long Beach. The project is funded by the California Energy Commission in partnership with EPRI and leading regional IOUs and technology providers.

Goals for the project – what do we hope to learn/develop/solve?
The primary objective is to achieve 20% demand reduction or adjustment in the water delivery and refrigerated food distribution sectors in support of California's goals for DR, energy efficiency, renewables integration, and greenhouse gas emissions reductions. Project goals are to:

- identify control strategies appropriate for fast and flexible demand response,
- advance industry understanding on best practices for employing load control
- develop a market-signaling interface using open Automated Demand Response 2.0
- pilot test developed strategies in a water pumping station and an industrial refrigeration plan
- design and implement FEMS to integrally manage multiple loads while responding operational and system constraints.

Approach – what methodology is being used?
The methodology centers around three key tasks: 1) develop a technical framework for flexible demand response using FEMS, 2) develop a fast and flexible control strategy and pilot testing for water delivery*, and 3) develop a fast and flexible control strategy and pilot testing in an industrial refrigeration plant.**

*Control strategies will include sub-metering for baseline data collection, control panel upgrades, operator interviews on operational constraints and systems integration alternatives, and SCADA software interfacing.

**Control strategies will include SCADA upgrades, monitoring and data collection, and analytics on proposed DR strategies to assess long-term impacts on equipment.

Project Participants – who is involved in the development and testing of this solution?
The project's utility participants include EPRI, SCE, SDGE. Technology providers and subcontractor are CPower, Cypress Ltd, NXTCOLD and Aqua Sierra Controls, Inc. The demonstration site partners are CA Water Service and Lineage Logistics.

Phases of the Project
The project is broken down into the following tasks:
Task 1 – General Project Tasks
Task 2- Technical Framework for Flexible Demand Response
Task 3 – Fast and Flexible Control Strategy Development and Pilot Testing in Water Pumping Station
Task 4 – Fast and Flexible Control Strategy Development and Pilot Testing in Industrial Refrigeration Plant
Task 5- Evaluation of Project Benefits
Task 6 – Technology / Knowledge Transfer Activities

Current Phase
The project is currently undertaking critical project review for Tasks 2-4.

MARKET POTENIAL

Target Audience – who is this solution being developed for?
The project targets two key industrial sectors in California: water delivery and food service refrigeration.

Potential Benefits – if the technology is adopted by the target market, what is the perceived long-term benefit?
If successfully adopted, the technology solution will enable faster and more flexible demand response, resulting in optimized on-site operations and energy bill savings. The solution integrates controls, building energy costs, historical load data, and rate tariff information to facilitate optimized demand response utilization.

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

Current issue:

- Difficult to get data from both participants – causing delays in schedule – could pose future issues if protocol for data capture is not redefined to alleviate privacy concerns.
- Project is not far enough along to determine market challenges at this point

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

Two key participants are facilitating the design and testing of a Technical Framework for Flexible DR

Water Pumping Station Pilot Site

The California Water Service, East LA Station in Montebello, CA is on task to test three key technologies:

- Variable Speed Pump
- Pump/Controls
- Pump Storage Tank

Industrial Refrigeration Plant Pilot Site

Lineage Logistics is the 2nd largest industrial refrigeration chain and the Long Beach, CA plant consists of:

- 215,000 sq. ft. of refrigerated space
- 36 Refrigeration Units
- 175 analog input/output points
- 130 digital input/output points

CURRENT PROJECT PROGRESS

What has been accomplished?

Water Delivery

- Issued pre-authorization to CPower to commence billable work on the project
- Conducted multiple pre-site visit meetings with SCE, CAISO, and CPower and identified key questions for site visits
- Held site visit with CalWater on April 13, reviewed key components of existing water system, and discussed meter data collection options to inform a workable system architecture
- Identified additional EPRI resources needed to support system archtecture
- Discussed target with wastewater site for case study development
- Conducted meeting with SMUD on April 26, observed by CEC and technical advisory committee, providing a briefing on project, marketing opportunities, and requirements for participation.

Refrigeration

- Operational data points have been obtained for the packaged refrigeration units
- SCE approved the account to access utility interval meter data from June 2017 – April 2018. Data review and analysis is in progress
- Identified need to understand full potential for demand response and barriers for automated DR in large refrigerated warehouses
- Developed a draft architecture for communication, retrieval, and storage for data
- Reviewed vision for refrigerated warehouse DR optimization with customer's senior technical team
- Continued to work with the controls vendor and the system integrator to identify full range of controls strategies

- Discussed feasibility to optimize three of the site rooftop units to increase potential kW demand offset with customer's senior technical team

What key learnings have been identified to date?
Project still in start-up – data collection is the challenge to date

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

Water Delivery
The project team has faced delays in implementation of delivery schedule due to a limited pre-authorization to CPower to conduct a site visits of the Montebello Station. The pre-authorization needs to be expanded in the event contracting cannot be completed in time to avoid delays in the contracting process. Additionally, due to the departure of key data collection personnel at Montebello, which may impact when the case study can be developed. This is not a critical path item that will impact overall project progress.

Refrigeration
Data indicate compressors in the packaged refrigeration units are essentially operating at a single fixed speed. Compressor speed variation is a key strategy in the project plan for testing fast and flexible DR. Limited field data sow compressor power demand by the controller for the VFD compressor is not being recorded and power data reading by the refrigeration units is missing. Lastly, it is taking much longer than anticipated to obtain metered data from the side amid concerns of privacy.

What potential opportunities or challenges do you see at this stage?
Still too early in the project.

NEXT STEPS FOR THE PROJECT

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

What activities are involved in the next stage?

Water Delivery
Next steps at the demonstration sites are to:

- install sub metering equipment
- investigate operational constraints
- identify security policies
- create systems integration alternatives.

Refrigeration
Next steps at the demonstration site are to:

- monitor, collect, and analyze operational data,
- assess current control schemes,
- conceptualize and analyze proposed schemes
- test and evaluate

Any additional comments:

This project is of great interest to the EMT group at SCE. It provides a starting place for realizing the potential for deep DR with water pumping and industrial refrigeration is high. Would be ideal to hold a conduct a follow up TA&D assessment once the project has progressed more.