Flexible Demand Response Collaborative (Flex DR – Phase 2)



- Advance operational flexibility of large pump systems and other large loads such as electric buses and data centers
- Support power system reliability and efficiency
- Identify potential electric service cost savings
- Employ Flexible demand response to support renewable integration and reduce emissions

Background, Objectives, and New Learnings

Environmental policies and technology advancements have driven the electric power industry towards a more sustainable and diverse power system, with higher penetrations of variable renewable generation. Flexible Demand Response (Flex DR) refers to end-use customer capability to adjust power consumption based on power system operational needs. Flex DR is an emerging source of flexibility that can be employed as a balancing resource to support integration of wind, solar, and other variable supply.

This proposed project structures a collaborative effort to demonstrate effective and sustainable demand flexibility from large pumps and other loads. A core focus is on water or wastewater (e.g., well extraction, booster, influent/effluent, and filtration pumps). Such loads can range from 100 kW to 1 MW+ per pump, and can thus connect into distribution or transmission systems without aggregation. In collaboration with electric utilities and water processing customers, programmatic and technical challenges are addressed to engage large pumping loads as flexibility resources and to advance affordability of electric service for customers.

Although the importance of flexible resources is well recognized, enabling demand flexibility and demonstrating value is an industry challenge. This project seeks to identify viable load shift strategies for different types of large loads, considering uncertainty about DR availability and response characteristics. Results are to inform DR models usable in operations and planning tools. In regions with significant penetration of renewable energy sources, and opportunities to absorb excess renewable resource output during times of overgeneration, the ability of Flexible DR to also respond by increasing load needs to be modeled and demonstrated.

The objectives of the project are to: 1) demonstrate the capability and value of large pumping loads to flex usage; 2) characterize and model the capability and availability of large pumps and other loads for better integration in power system operations; and 3) foster industry collaboration to explore program alternatives and share best practices in sustainably engaging Flex DR to support system flexibility needs.

Benefits

Employing Flex DR to balance variable generation supports system resource adequacy and can lead to reduced renewable curtailment during times of overgeneration, enhanced ability to balance supply and demand during periods of ramping in variable resource output, lowered environmental impact including carbon reduction, and more affordable electric service.

Through collaborative demonstration, the project is designed to advance Flex DR as a flexibility resource for utilities and system operators, by clarifying opportunities and best practices for deriving value from DR, while maintaining or improving system reliability. Funders can enhance understanding of the capabilities and limitations of Flex DR and effective methods for modeling and engaging its contribution. Anticipated outcomes include improved operational efficiency, cost savings for customers, support for renewable integration and carbon emission reduction.

Project Approach and Summary

The collaborative effort leverages simulation and modeling conducted under Phase 1 of EPRI's Flex DR Collaborative. The effort also leverages experience gained from field assessment and case studies on Flexible Water Pumping completed under a government grant to EPRI.

The proposed three-year project collaboration includes analytical development, case studies, and hosted demos designed to pave the way for future Flex DR programs:

Collaboration for Model Development and Tech Transfer

- Develop Flex DR models and apply in simulation
- Share lessons learned on how to advance Flex DR programs to include Power Up
- Clarify opportunities to support renewable integration and reduce emissions with Flex DR

Site-Specific Case Study

- Analyze potential benefits of Flex DR strategies
- Design process operator's decision support tool for engaging pump load at a field site in Flex DR events

Hosted Demonstration

- Clarify host objectives and regional requirements for Flex DR integration
- Develop test plan and site implementation plan
- Report on demonstration outcomes and assessed value

Leveraging initial year developments, the field demos will illustrate the technical capability targeted by the collaborative for demonstrating Flex DR value. Technology transfer through meetings and project reports will summarize analytic and case study findings, as well as lessons learned from field assessments (e.g., well extraction, filtration, and other pumps) to provide flexibility for system operations.

Deliverables

- Flex DR model and simulation results illustrating cases (e.g., when Power Up can be used); modeling capability and availability of Flex DR (e.g., response time, duration, predictability in short-term, persistence in long-term) for application in bulk system operations and planning; and considering both the characteristics and operational limitations of Flex DR as a resource.
- Case studies on Power Up/Down potential and value. The case studies include illustrative design of decision support tools for engaging pump loads in Flex DR events.
- Field demonstrations of Flex DR against flexibility requirements informed by system operators. Technical update summarizing field results and benefits for each hosted demonstration.
- Final Report summarizing findings from field demos analytic tasks, and collaborative insights on advancing Flex DR programs.

Price of Project

Base participation in the project includes model development and application results, as well as summary results from site-specific case studies and hosted demonstrations. Pricing is tiered based on annual distribution:

- Less than 60,000 GWh: $35k per year for three years
- 60,000 GWh or greater: $50k per year for three years
- ISOs/RTOs: $35k per year for three years
- No distribution metric: $50k per year for three years

A minimum of five base participants is required. With additional participants, it may be possible to prioritize other types of large loads for analyses (e.g., load shifting at bus stations, and load migration with data centers).

For those participants also choosing to sponsor a case study, the price is an additional $75k per site. For sponsors wishing to advance completed case studies to field demonstration, the estimated cost is an additional $50k/year for three years (which covers DR triggering, instrumentation, and data processing using existing interfaces). Any host equipment or software upgrades necessary would be the responsibility of the site or host.

This project qualifies for tailored collaboration (TC) or self-directed funding (SDF).

Project Status and Schedule

The project is to launch by end of 2022 and is anticipated to be completed within three years, from modeling and analytic tasks to conclusion of field demonstrations illustrating valuable applications of large pumping loads to provide demand flexibility.

Who Should Join

Electric service providers like distribution utilities and load-serving entities seeking to increase demand flexibility. Grid operators, planners, independent system operators, and regional transmission organizations that recognize the importance of developing new sources of flexibility and want to integrate Flex DR to reliably provide such services.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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