DEMAND RESPONSE PARTNERSHIP PROGRAM

Research Brief and Preliminary Findings

Overview

Demand response (DR), utilized as a resource in the electric system, delivers various reliability, economic, and societal benefits. Demand response resources may deliver bill savings to customers, reduce the magnitude of reserve requirements for traditional generation resources, enable low-cost integration of large amounts of non-dispatchable and intermittent renewable generation resources, and improve air quality. This project is based on the hypothesis that all buildings can effectively adopt low-power modes and that doing so is cost-effective for building occupants, ratepayers, and broader society.

The Demand Response Partnership Program (DRPP) connects utilities, service providers, and customers to continue the transformative journey of automated demand response (ADR) at the company, state and national levels. Our combination of outreach and research presents unique opportunities to share and test ideas, measure responses, and explore new ways to approach common problems. Findings from the DRPP research process will be utilized to modify components of the outreach and customer participation efforts.

Research Goals

- Determine strategies to overcome challenges and barriers to engaging new ADR participants
- Provide DR performance assessment and estimation for commercial buildings, including baselines and peak load benchmarks
- Provide evidence for the financial benefits and cost-effectiveness of ADR in commercial buildings
- Estimate system-wide environmental and grid impacts of ADR

Research Methodology

The research, led by Lawrence Berkeley National Lab, is based on building load, weather, cost, generation resource mix, and emissions data as well as customer surveys. The research agenda broadly falls into four categories: market adoption, environmental impact, grid reliability, and program results. The following reports and analyses are planned:

1. Market Adoption
   - Optimal DR program structures to maximize participation and participant perception
   - Barriers analysis and best practices documentation

2. Environmental Impact
   - Environmental Benefits Assessment, including impact on generation stack, unit dispatch avoidance, and potential for fossil fuel reduction
   - Generation emissions reduction and building greenhouse gas footprint reduction

3. Grid Reliability
   - Suitability for DR as a balancing mechanism for renewable generation
   - Transmission and distribution congestion impacts
   - Potential to reduce spinning reserve requirements in presence of robust DR programs

4. Program Results
   - Quantification of load changes at the individual building level
   - Demand response estimation methods, including establishing building load baselines
   - Peak load and DR benchmarks for comparison against other buildings and past performance
   - Persistence of program benefits beyond the DR event as well as significant "rebound" effects
   - Cost and benefits of DR programs using traditional cost tests and customer economics

Preliminary Findings

The key metrics describing the success of demand response enablement are:

- Response time
- Reliability of load reductions
- Reduction of load while maintaining comfort

These key metrics are influenced by characteristics of buildings that determine their ability to participate in DR:

- Building size, type, systems
- Occupancy
- Load characterization, including peak load time and magnitude
- Load variability
- Weather sensitivity

Preliminary analysis of buildings enrolled in the DRPP research track suggests the following findings:

- Effective DR strategies can lead to load sheds from 5% to 18%
- Large load size does not necessarily make a stronger case for high DR effectiveness
- Outside air temperature can be a good predictor of load shapes and potential load sheds in buildings
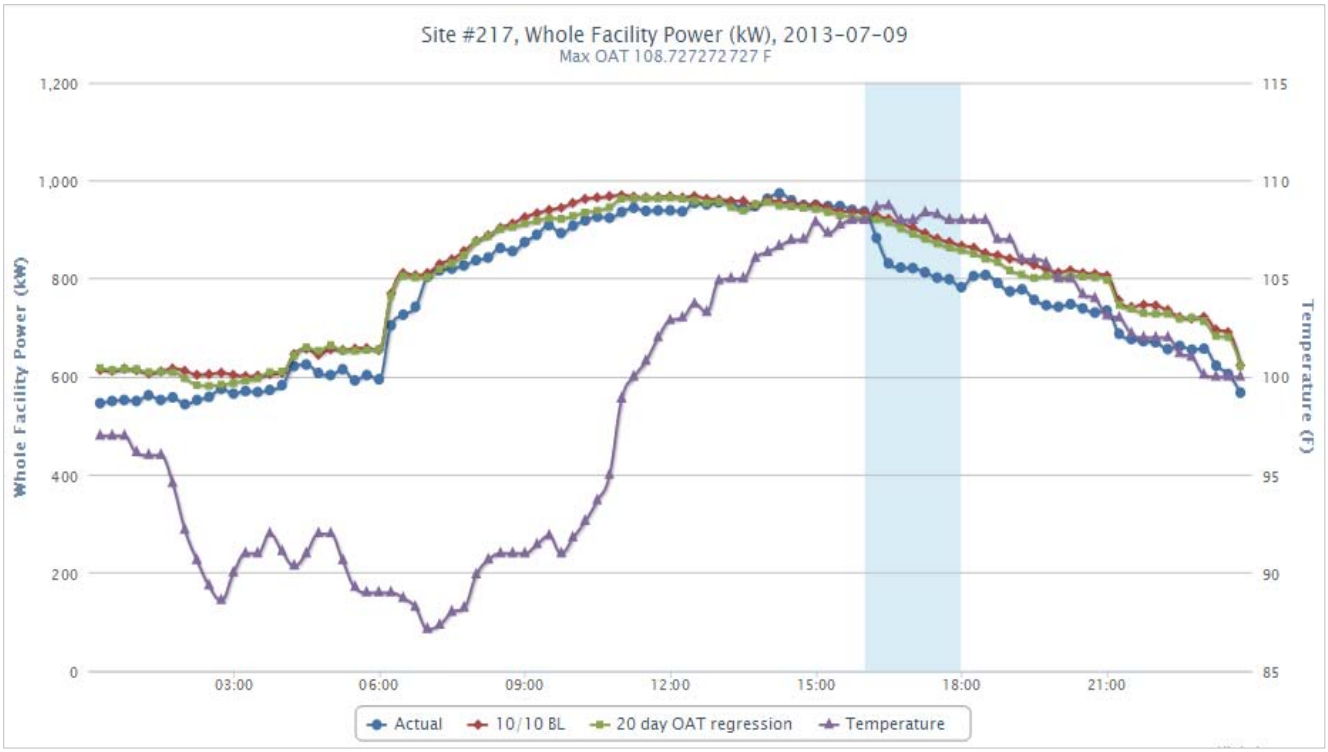
Figure 1. Example of load shed analysis, including two baselines based on the 10 similar-day average load and 20-day outdoor air temperature.