



Fact Sheet

November 2015

Demand response offers benefits to utilities and consumers

The relationship between energy consumers and suppliers is more interactive than ever, and it's producing real benefits on both sides of the power meter.

Periods of peak electrical demand can strain the power grid, making it more difficult or expensive to deliver the amount of power required. For example, operating hydropower dams for fish passage can limit the amount of power available to meet high demand. Transmission grid congestion or a lack of generating capacity, coupled with the need to stand ready with capacity in reserve in case of system contingencies, also contribute to the challenge and cost of meeting peak energy demands. Energy use experts estimate that 60 percent of peak energy use is consumed by homes¹, and 14 percent of peak energy demand could be reduced with demand response².

BPA believes demand response can benefit the region by helping level out the spikes of energy consumption during peak periods (such as weekday mornings and evenings), increase reliability and reduce stress on the power system. To prove these benefits, BPA is analyzing new technologies through pilot programs and demonstrations. If those measures are reliable and cost-effective, BPA may deploy them in day-to-day operations or recommend them as solutions to other utilities.

¹ U.S. Energy Information Administration

² Federal Energy Regulatory Commission, *A National Assessment of Demand Response Potential*

What is demand response?

Demand response enables industrial and residential consumers to play a significant role in the operation of the electric grid by reducing their energy use during times of peak demand in response to time-based rates or other forms of financial incentives. Electric system planners and operators are using demand response programs as resource options for balancing supply and demand.



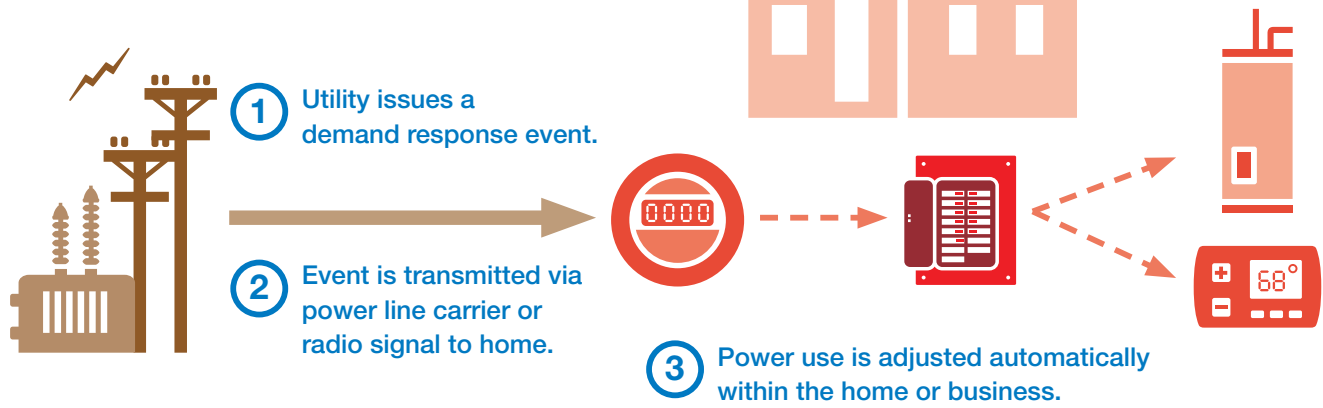
Demand response controllers on residential equipment such as water heaters can help grid managers keep the power system in balance.

How does it work?

Demand response works by using notification or direct control devices to shut off, shift the use of or change the energy consumption of appliances and other equipment when needed. For example, utilities have recruited end users who allow the utility to reduce the energy consumption of certain appliances, such as



How Demand Response Works



water heaters or air conditioners, when the demand for electricity is high, or to turn the appliances on when power generation outpaces demand. A large-scale commercial version of this type of load control, which calls on industrial facilities to power up or down, could provide substantial grid flexibility.

Benefits

Demand response can be a money saver for utilities and their consumers because it reduces the amount of energy used during peak times and the cost of standing ready with power reserves that may or may not be called on to balance supply and demand. Flattening out electricity use during peak hours can help keep rates lower, typically by reducing the need for utilities to purchase energy from more expensive sources to meet spikes in demand. Demand response projects can also reduce the likelihood of potential service disruptions by keeping overall energy demand within the limits of the power system's production capacity.

Drivers for demand response research

BPA's demand response work is driven by several developments in the utility industry and in the Northwest. They include:

- A proliferation of variable energy resources, such as wind and solar, that are taxing the Federal Columbia River Power System's capacity to balance unexpected fluctuations in generation.
- Generation capacity constraints.
- The high cost of stand-ready generation capacity to meet spikes in energy use.
- Congestion of the existing high-voltage transmission system.
- Aging lower-voltage distribution systems.

BPA research

BPA seeds the demand-side management technologies of the future by seeking new groundbreaking approaches in the field through its Technology Innovation office. In 2014, BPA convened a large group of industry experts to develop a road map for demand response. This body of work identified several capability gaps which drive BPA's current research effort.

BPA's primary focus in the near term will be exploring the ways that demand response tools can aid in areas critical to its business, such as:

- Additional nonfederal peaking capacity.
- Within-hour balancing reserves.
- Contingency planning for proposed transmission line builds.

BPA's demand response research has three goals to prove commercial viability. It must be reliable, cost effective and easy to deploy. Proof of concept research and development projects are a part of BPA's Technology Innovation program and are identified as pilots. Efforts to prove availability, reliability, cost effectiveness and ease of use are more advanced and larger scale — these efforts are referred to as demonstration projects.

Experience

In 2009 BPA began four years of research studies in partnership with over 20 regional utilities and groups to conduct demand response field tests, pilots modeling and analysis. The projects tested:

- Commercial and public building load control.
- Energy storage using residential and commercial space heating.
- Water heater energy storage and load control.
- Industrial process load control and energy storage.
- Large farm water-management system load control and storage.
- Small-scale battery energy storage.
- Load shifting using aquifer recharge opportunities.

Through these pilots, BPA learned that demand response is diverse, available in predictable and reliable quantities and time periods, available from many end uses and variable in cost.

More recently, BPA has worked with customer utilities, regional groups and demand response aggregators to identify and implement advanced demonstration projects that assess the ability of demand response to address multiple needs in the region. Over time, these demonstration projects will likely total 60 to 100 megawatts to test the appropriate mechanisms to contract for demand response services and prove the availability and reliability of demand response to help address

regional requirements, including utility peaks and distribution system constraints, wholesale system peaks, within-hour balancing, over-generation and non-wires transmission and distribution reinforcement or investment deferral opportunities. While these demonstrations will simulate actual system conditions as closely as possible, BPA will not rely on their responses to help meet day-to-day operational needs.

Below is more information on two larger-scale advanced commercial “aggregator” demonstrations that would tie a number of end loads together to provide a single demand response product as needed. These demonstrations will simulate actual system conditions and commercial contracts.

Balancing demonstration with Energy Northwest

BPA began this project in 2013 with Energy Northwest, which is serving as an aggregator for public power loads. Through this demonstration project, up to 35 megawatts of reliable demand response capacity can be fully deployed in just 10 minutes, with the objective of testing an additional tool to support the federal hydro system's energy balancing needs.

Energy Northwest has developed the Demand Response Aggregation Control System, a comprehensive data-gathering, monitoring, control and communications infrastructure system for the project. Communication devices are installed by each participating resource to report to and receive direction from the system via secure cloud-based data paths. The system is hosted within the Pacific Northwest National Laboratory's Electricity Infrastructure Operations Center, a U.S. Department of Energy-funded incubator facility built and operated for such activities.

Capacity and transmission demonstration with EnerNOC

In July 2014, BPA selected EnerNOC, a leading national demand response aggregator, for a two year demonstration of up to 25 megawatts. The aggregator is working closely with public power utilities to recruit and enable facilities in their territories to participate.

In this demonstration, BPA is testing two products: a summer capacity product to help mitigate transmission



Large industrial facilities may have flexibility in their power use — they are good candidates for utility-scale demand response aggregator projects.

congestion along the Interstate 5 corridor, and a winter capacity product to shave peak energy use.

For the summer product EnerNOC is working with utilities in specific locations where a demand response load reduction helps mitigate transmission congestion on the Oregon and Clark County, Wash. portion of the Interstate 5 corridor. EnerNOC is working to recruit between 5 to 25 megawatts of demand response load reduction by summer of 2016.

For the winter product EnerNOC is completing the final steps to begin service in winter of 2015. EnerNOC is seeking up to 13 megawatts of demand response load reduction in the winter of 2015–2016 and up to 25 megawatts in winter of 2016–2017.

For more information about BPA's demand response research efforts, visit www.bpa.gov/goto/DemandResponse.