

Technology Innovation Project



Project Brief

TIP 331: Using Distribution-Level Energy Assets to Help Optimize Regional Transmission Systems

Context

Rapid, concentrated expansion of wind generation has sometimes caused significant operational challenges in the BPA network, parts of which now operate at transmission capacity during a substantial portion of the year. This congestion forces sub-optimal operation of generating resources and may at times require spilling water over dams or curtailing wind power.

Simultaneously, demand response (DR) and energy storage (ES) are proliferating in utility distribution systems, driven by incentives, such as the Washington Clean Energy Fund, and mandates, such as the California PUC directive requiring state utilities to buy 1.3 GW of energy storage resources by 2020. Such distributed resources can potentially benefit BPA operations, but only when their operation is coordinated with the needs of the transmission system.

Description

This project builds upon current research to improve transmission network operation via advanced computational techniques aimed at optimizing the use of both ES & DR resources owned by distribution utilities on BPA's network. Snohomish PUD purchases more power from BPA than any other utility, thus the use of its distribution assets represents an ideal proving ground for new technology that spans the transmission and distribution grids.

The Energy Positioning research being conducted by the University of Washington ARPA-E project will model how ES and DR assets may be used to move energy to other locations on the transmission network in anticipation of high load or excess generation events in order to mitigate both technical and economic costs of congestion.

The project extends these efforts and combines them to allow BPA to create, test and document a system for accessing distribution network storage and demand response resources within its system to improve the reliability and operating costs of its transmission grid.

Why It Matters

ES and DR hold the promise of introducing additional reliability to the transmission network by storing and using energy during times of high generation and low demand, and releasing or reducing use of energy during times of high load. Proper use of these assets can reduce overloading of the network during times of high load, allowing more reliable operation. The ability to more effectively make use of excess generation during times of load imbalance will reduce the need

to resort to negative power pricing and wind curtailment, leading to more economical operation.

Intelligent use of ES and DR assets sited closer to loads (in particular on distribution networks) represents an effective means to deal with increased distributed generation during times of high baseline generation.

Goals and Objectives

The objective of this project is to demonstrate a system that (i) creates new value streams for distribution utilities, thereby making energy storage more cost effective for them; and (ii) can align BPA and distribution-level grid operators like the PUD, creating better incentives for an actively managed system, while respecting local decision making and control. Key elements to this objective include:

- Specify a signal protocol to serve as a regional model for requesting distribution-level ES and DR to support BPA's regional transmission operations.
- Simulate meaningful amounts of distribution-level ES and DR assets, managed and optimized via advanced control systems, to support BPA's transmission operations.
- For accepted transactions, establish a means to verify ES/DR performance to signal request.
- Apply new ARPA-E research to determine the economic value of applying DR and ES assets to support transmission operations.

Deliverables

Major deliverables from the project will include:

- 1) development of a protocol for requesting use of distribution-level ES and DR resources to support BPA's transmission operations;
- 2) development of software to enable communications between transmission operators and the distribution utilities they serve;
- 3) simulate the effects of deployment of transmission level "energy positioning" algorithms to most effectively use ES and DR resources;
- 4) simulated real-world testing and refinement of the system using SnoPUD's deployed assets; and
- 5) analysis and recommendations on how BPA can extend benefits of the system to the rest of its network.

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Project Start Date: October 1, 2014

Project End Date: September 30, 2016

Reports & References

Links

Funding

Total Project Cost: \$2,513,000

BPA Share: \$1,000,000

BPA FY2016 Budget: \$ 500,000

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