Technology Innovation Project

Project Brief

TIP 241: Evaluation of Power Flow Controls, Load Control and Energy Storage Opportunities to Resolve Transmission Constraints in the Pacific Northwest

Context

Electric power consumption increases continuously. Transmission system expansion does as well – but much more slowly. Thus, nonwire alternatives to line building are avidly sought, generally in the form of power flow controls that provide the opportunity to push power from heavily loaded lines to less-loaded lines and therefore allow better usage of the existing transmission system; load-control methods that seek to control demand; and energy storage technologies that allow power usage to be opportunely delayed. Another classification of solutions considers preventative actions like power flow control for high probability events and postevent efforts such as RAS generation dropping schemes for lower probability situations.

Description

The BPA transmission system has major congestion points in the Portland Metro, Seattle/ Northern Intertie, and mid-Columbia areas. These are acute system stress points where a methodology for evaluating and ultimately selecting the most effective nonwire alternatives must pass muster to earn acceptability. There is also great interest in increasing export capabilities, particularly under high-water high-wind conditions. Conventional solutions, such as building new lines, are usually priced in the hundreds of millions of dollars, incur staggeringly long times for permitting and face huge public opposition. There is a need to look at the alternative solutions to new lines mentioned above. But tools and methodologies to explore those alternatives are as yet underdeveloped and require urgent attention. This project concentrates on the Northwest's major urban congestion points – as well as premier testing grounds for wet, windy weather -- to explore ideas for the most effective nonwire alternative planning.

Why It Matters

As BPA continues to study nonwire solutions for projects over 5 million dollars, a report on the feasibility, benefits, adopting accepted practices relative to the reliability standards of different applications will provide value to the starting point of new evaluations. The development of in-house knowledge on nonwire solutions will improve BPA's planning capabilities and allow for more efficient evaluation of all types of improvements available to maximize Federal Columbia River Power System (FCRPS) transmission facilities. With respect to the increasingly dynamic behavior of power generation and grid transfer due to integration of variable resources such as wind power, the results of this project will have near-term benefits if power flow applications are identified for managing dynamic constraints (bottlenecks or changing reactive demand) on the grid.

Goals and Objectives

1. Develop the framework and methodology for evaluating power flow control and load-control options in the transmission planning process – i.e., expanding the toolbox of the transmission planners to include applicable nonwire solutions.
2. Test the methodology to size up power flow control and load-control options for the following locations and/or conditions: Portland metro area; Seattle/Northern Intertie; Export capability out of Pacific Northwest.
3. Study feasibility of various power flow control and load-control options.
4. Evaluate control strategies.

Deliverables

1: Methodology Draft, Regulatory Framework Assessment (7/1/2012)
1A. Draft the methodology for evaluating and studying the potential of power flow control, load control and energy storage solutions for congestion management.
1B. Gap analysis for study tools and system models to study the non-wire solutions.

2A: System impact studies for power flow controls (4/1/2013)
Report on viability of power flow controls for resolving congestion in Portland Metro and Seattle areas. Report on viability of power flow controls for increasing export capacity during high-wind conditions. System impact studies on power flow controls focused on congestion management, power system stability and dynamic performance with variables including voltage stability, angular stability, oscillation damping and frequency response.

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2B: System impact studies for demand-side solutions (10/1/20)

Reports on viability of demand-side solutions for resolving congestion in Portland and Seattle Metro areas and demand-side solutions for increasing export capacity during high-wind conditions, using the same conditions and variables as above.

3: Feasibility assessment (4/1/2014)

Feasibility report and cost analysis of using (a) power flow control devices and (b) demand-side solutions, such as direct load control and energy storage for the Portland and Seattle Metro areas and the Northern Intertie, and export capabilities during high-wind conditions. This is a key decision point for the project.

4: Control Simulations (10/1/2015)

Report on control strategies for powerflow controls, direct load controls, and energy storage options for congestion management and stability improvement. Developing models and simulation coding for studying and simulating controls. Project success is dependent on control strategies that will manage the portfolio of the nonwire alternatives. Control objectives will be developed, along with design, analysis and simulations of various control strategies.

5: Final Methodology, Study and Business Case Guidelines (10/1/2016)

Methodology for studying power flow controls, direct load controls, and energy storage options for congestion management and stability improvement.

1. Power system models and tools required to conduct such studies.
2. Guidelines for transmission planners on studying and developing a business case for power flow controls, direct load controls, and energy storage options.

Project Start Date: Oct 1, 2011

Project End Date: Sept 30, 2016

Funding

Total Project Cost:	$1,236,000
BPA Share:	$1,236,000
External Share:	None
BPA FY2012 Budget:	$186,000

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