TIP 409: Coordinated Voltage Controls to Increase Dynamic Transfer Capability (DTC)

Context

Several states in the Western Interconnection have very aggressive renewable portfolio standards. High level of renewable generation integration requires expanding balancing footprint beyond a single Balancing Authority.

Dynamic transfers are seen as a key enabler of expanding the balancing footprint. California-Oregon Intertie (COI) Dynamic Transfer Capability (DTC) is of particular interest to link renewable resources and balancing resources of the California Independent System Operator (ISO) and those of the Pacific Northwest.

Pacificorp joined California ISO Energy Imbalance Market (EIM) in 2014. Puget Sound Energy, Portland General Electric and Idaho Power have also joined California ISO EIM or announced their intention to do so. The EIM resources are on the opposite sides of California-Oregon Intertie, and require dynamic transfers on the intertie.

Several BPA technology innovation projects laid the foundation for DTC methodology and analysis. BPA conducted studies in 2014 to determine the existing DTC capabilities. TIP 355 performed studies to evaluate technical approaches to increase DTC. TIP 370 began the development, simulation and validation of a coordinated voltage control scheme for increasing DTC. This project completes the work of TIP 370.

Description

Coordinated voltage controls have shown the potential to increase DTC on the COI and Pacific Direct Current Intertie (PDCI).

BPA planning and operations developed a roadmap on technical approaches to increase the Dynamic Transfer Capability (DTC) on COI and PDCI. This project advances one of the approaches identified in the roadmap.

Under TIP 370 we contracted with Power World to implement Remedial Action Schemes (RAS) models for dynamic simulations and Synchrophasor RAS studies to mitigate voltage stability impact.

This project allows BPA to implement Synchrophasor RAS for dynamic simulations, and sets the stage for development of state awareness tools for planning and operations staff to monitor the impact of dynamic transfers on voltages and system performance.

Work completed for TIP 370 included:

- DTC study set-up developed
- DTC ramp analysis tools developed, including data extracts and basic analytics DTC studies performed for Montana – NW, BC – US paths, BPA network, California – Oregon Intertie and Pacific HVDC Intertie
- Synchrophasor RAS studies to mitigate voltage stability impact
- Contract with Power World to implement RAS models for dynamic simulations (A)

Work completed for TIP 409 includes:

- Contract with Power World implemented for Synchrophasor RAS for dynamic simulations (deliverable A)
- Additional Synchrophasor RAS studies and completed and approved (supports deliverable B)
- Coordinated voltage controller completed (deliverable B)
- Expert panel of the top industry experts in the area of voltage controls convened
- Voltage control simulations completed using time sequence simulations
- Developed state awareness tools for planning and operations staff to monitor the impact of dynamic transfers on voltages and system performance (deliverable C).

Benefits

There is more demand for DTC than what is currently available with today's system. The demand for DTC is expected to grow even further as the footprint of EIM increases. This project addresses voltage stability and voltage fluctuation limitations associated with dynamic transfers.

The tools and products created in this project will, if fully implementation, greatly increase the dynamic transfer limits on California – Oregon Intertie and Pacific HVDC Intertie.

Accomplishments

The project met its objective to research and develop voltage controls to increase dynamic transfer capabilities on the California – Oregon Intertie and Pacific HVDC Intertie.

Deliverables

BPA planning and operations developed a roadmap on technical approaches to increase the Dynamic Transfer Capability (DTC) on COI and PDCI. This project advances one of the approaches identified in the roadmap. The project's deliverables include:

A. Development and implementation of models for DTC studies
B. Development of control algorithms for coordinated voltage controls,
C. Development of situational awareness tools to monitor the system impact on power system performance.

TIP 409: Coordinated Voltage Controls to Increase Dynamic Transfer Capability (DTC)

Project Start Date: September, 2018

Project End Date: September, 2019

Related Projects

TIP 051-Voltage Stability Controls

TIP 281-Impacts Due to Dynamic Transfer

TIP 355-Evaluation of Technical Approaches to Grow Dynamic Transfers

TIP 370- Coordinated Voltage Control to Increase Dynamic Transfers

For More Information Contact:

Technology Innovation Program Manager
Cindy Polsky
chpolsky@bpa.gov

BPA Technical Contacts:
Steve Yang, Electrical Engineer
hyang@bpa.gov

Dmitry Kosterev, Electrical Engineer
dmkosterev@bpa.gov

Participating Organizations

PowerWorld Corporation
US Army Corps of Engineers (USACE)

Conclusions:

The project concluded successfully with all deliverables completed. The PowerWorld RAS and Contingency Modeling for steady state-based contingency actions now includes features for transient stability simulation. Full and complete public documentation of features implemented in this project have been provided in this project. All documentation are available for free to customers and non-customers alike on the PowerWorld website. Additionally, the following has also been completed:

- Expert Panel class completed in July for operation and planning engineers. Highly successful!
- Industry outreach workshop at Pacific Corp completed in July 2019.
- PowerWorld contract work completed as planned
- Power Plant System Monitor (PPSM) at Quenett Creek substation
- USACE meeting with Undrill completed in July 2019