WESTERN INTERCONNECTION SYNCHROPHASOR PROGRAM Project Update

Synchrophasor Data used to Calibrate and Validate Columbia Generating Station (CGS) Model

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The Western Interconnection Synchrophasor Program (WISP) uses synchrophasor data to improve and verify the accuracy of generator models. Model validation improves power system reliability by verifying the simulation tools used to monitor and study the behavior of the power grid.

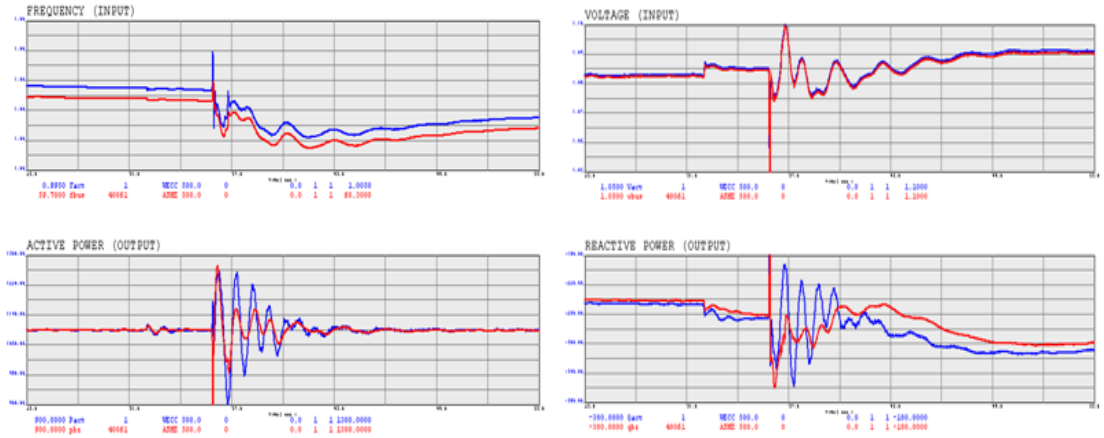
Bonneville Power Administration (BPA) recently completed the calibration and validation of a model, which predicts the dynamic behavior of the 1100 MW Columbia Generating Station (CGS) nuclear generator in Hanford, Washington. Models are used to simulate the behavior of power system components under both normal and abnormal conditions in order to set safe operating limits and to comply with North American Electric Reliability Corporation (NERC) reliability standards.

NERC standards require that generator models be validated every five years. Until recently, models were verified by taking the generator off-line and performing manual tests. Phasor Measurement Unit (PMU) data now can be used for this purpose without taking the generator off-line. Disturbances that occur on the Interconnection – both small and large – are recorded by PMUs to measure the generators' responses to these events. PMU's can assist in improving the generator model if needed, and verify that the model used in simulation closely tracks how the generator actually behaves.

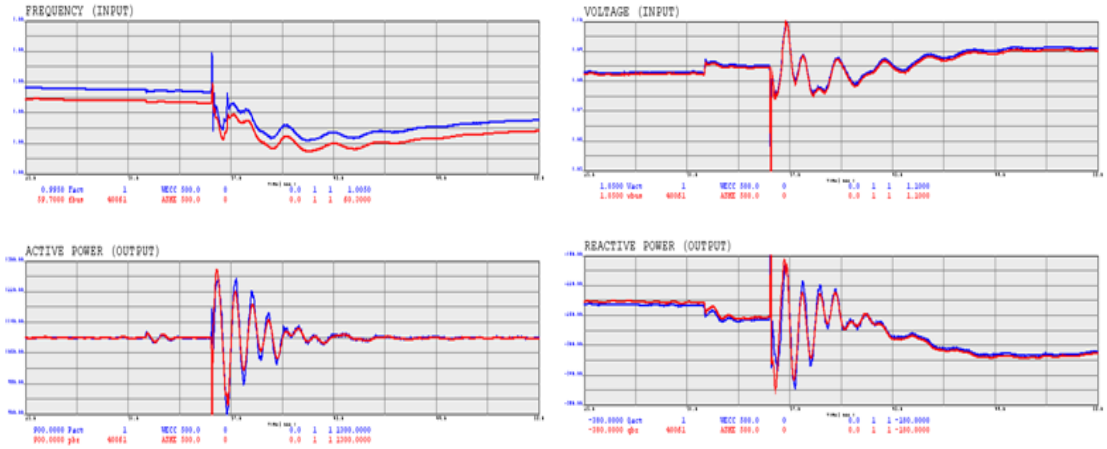
BPA captured and recorded the PMU data measuring the CGS generator's actual response during four disturbance events to improve or calibrate the CGS model. Ten subsequent disturbances were run to verify or validate the new model with excellent results. The generator was on-line for the entire procedure, resulting in a savings of between $100K and $700K, depending on the timing of the avoided outage. The reliability benefits of the more-accurate model have not been quantified, but are additive.

To illustrate this improved accuracy, graphical depictions of the model before and after calibration for two events are shown below. In each case, the red traces reflect the simulated responses of the model and the blue traces reflect actual responses of the generator to the frequency and voltage inputs. Notice how closely the traces match after calibration:

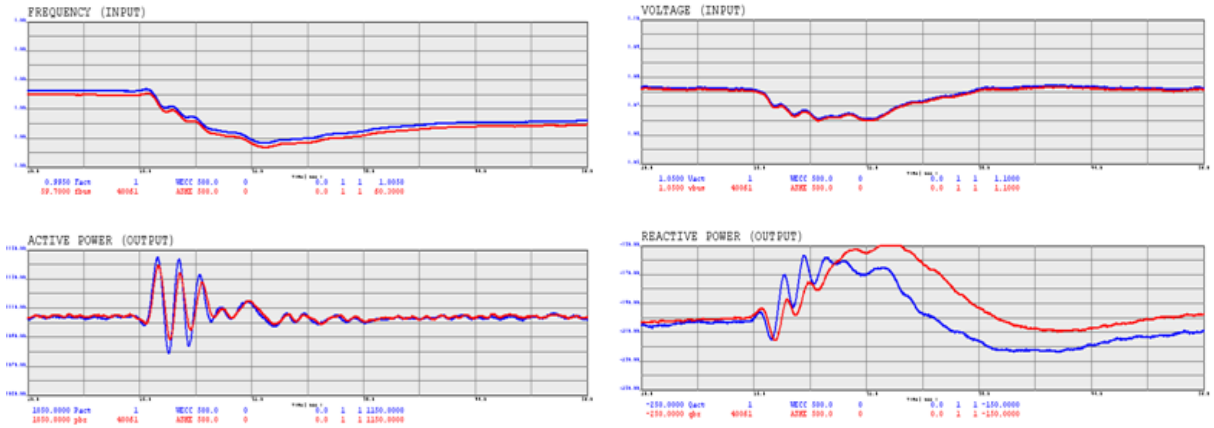
Model Before Calibration: Event A



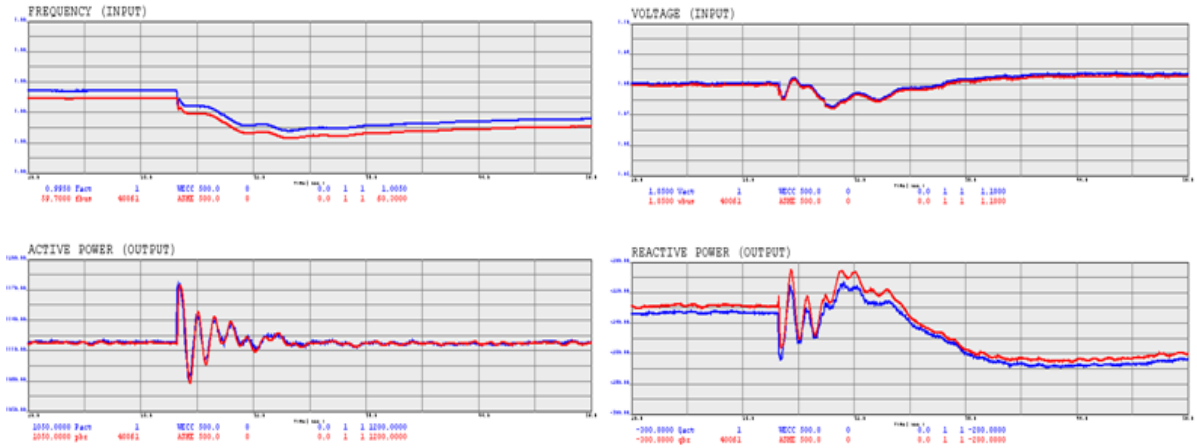
Model After Calibration: Event A



Model Before Calibration: Event B



Model After Calibration: Event B



About SGIG

The U.S. Department of Energy awarded over $328 million to support the installation of 1,400 PMUs across the United States under the American Recovery and Reinvestment Act's Smart Grid Investment Grant initiative. SGIG funds were awarded to accelerate the modernization of the nation's electric transmission and distribution systems and promote investments in smart grid technologies, tools, and techniques that increase flexibility, functionality, interoperability, cybersecurity, situational awareness, and operational efficiency.

About WISP

WECC received $53.9 million in funding from U.S. Department of Energy's Assistance Agreement DE-OE0000364. The funding, awarded under the American Recovery and Reinvestment Act's Smart Grid Investment Grant initiative, matches dollars committed by nine WISP Cost Share Participants to extend and deploy synchrophasor technologies within their western electrical systems. The total funding for WISP is $107.8 million.

About BPA

BPA, part of the U.S. Department of Energy, is a federal, nonprofit, and self-funded agency based in the Pacific Northwest. BPA markets wholesale electric power from 31 federal hydro projects in the Columbia River Basin, one nonfederal nuclear plant, and several other small nonfederal power plants. About one third of the power used in the Northwest comes from BPA. BPA also owns, operates, and maintains about three-fourths of the high-voltage transmission in its service territory which includes Idaho, Oregon, Washington, western Montana and small parts of eastern Montana, California, Nevada, Utah and Wyoming. As part of its responsibilities, BPA promotes energy efficiency, renewable resources and new technologies. The agency also funds regional efforts to protect and rebuild fish and wildlife populations affected by hydropower development in the Columbia River Basin.

About WECC

WECC is geographically the largest and most diverse of the eight Regional Entities that have Delegation Agreements with the North American Electric Reliability Corporation (NERC). WECC's service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia, the northern portion of Baja California, Mexico, and all or parts of the 14 Western states between. Due to the vastness and diverse characteristics of the region, WECC and its members face unique challenges in coordinating the day-to-day interconnected system operation and the long-range planning needed to provide reliable electric service across nearly 1.8 million square miles.