Fact Sheet

August 2016

BPA leads the nation with its use of synchrophasor technology

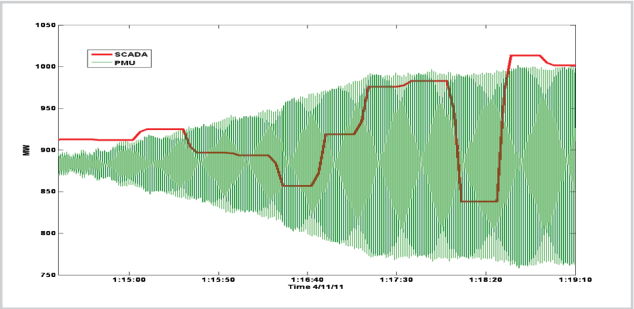
What are synchrophasors and why does BPA use them?

The Bonneville Power Administration's synchrophasor system is the most advanced in the electric utility industry. Phasor measurement units, the source of synchrophasor measurements, are installed in substations across BPA's transmission grid, which accounts for 75 percent of the high-voltage transmission in the Northwest. The shoe-box sized devices send precise, GPS time-stamped readings of electrical voltage, current and frequency to a control center 60 times per second. Thanks to the synchrophasor program, BPA's operators now have a more dynamic view of the region's power system, and engineering staff can analyze problems with finely detailed data after the fact. Synchrophasor data also lets power system operators spot — and either resolve or reduce — potential problems before they become serious.

The BPA synchrophasor program began in the early 1990s and then grew exponentially after the 1996 West Coast blackout, when high temperatures and a high demand for electricity combined with a major transmission line failure, knocking out power to 4 million people in eight Western states. Power system operators knew synchrophasor data could have helped them see the growing system instability that led to the blackout, and they wanted access to better predictive and analytic data — so the synchrophasor program took off. BPA built a synchrophasor network to stream data in real time to its laboratory, where BPA was working on developing engineering and control room applications.

BPA has installed more than 100 phasor measurement units. These shoe-box sized devices transmit a feed of precise power system data that provides operators a higher-resolution view of the grid.

A little over ten years later, federal funding boosted synchrophasor program development across North America. That advancement serendipitously coincided with fiber optic communications investments BPA was making on its system. As it turns out, the increased bandwidth of BPA's fiber network was instrumental in moving the tremendous volume of data generated by synchrophasors. Synchrophasor units take synchronized measurements many times each second, compared to previous measurement systems that provided snapshots of system conditions every two seconds. BPA's control centers now receive over 250,000 power system measurements per second from across the grid. Several of the synchrophasor application displays are now available on the BPA control center video display wall and operating procedures are in place for dispatchers to mitigate power oscillations when detected by the synchrophasor applications.



PHASOR MEASUREMENT UNITS	CONVENTIONAL SCADA
High time resolution; 30 to 120 samples per second	Scanned every 2 to 4 seconds
Data is time synchronized at the source	Time stamped in the control center

Synchrophasor data is far more refined than conventional SCADA data.

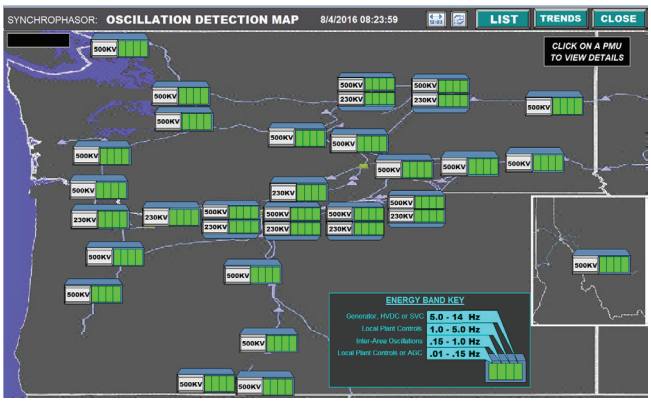
All of that data adds up quickly. System operators and planners are challenged with how to store, manage and analyze such a tremendous volume of information. But the challenge is worth the reward, because synchrophasor measurements provide several important benefits to BPA and its customers.

Visibility, reliability and savings

Synchrophasor data benefits power system operations in a numbers of complementary ways. Some power system protection equipment is programmed to operate instantly based solely on synchrophasor-sourced information — reacting to potential problems before they become a reality. Advancements in the control center technologies also enabled BPA to develop and deploy applications that perform data analytics in real time to identify system reliability threats. In the near real-time environment, operators observe developing trends and act on abnormal measurements from synchrophasor data as situations evolve — again reducing or eliminating problems before they become severe. Finally, the terabytes of information from synchrophasors are archived and used later in power system modeling applications and for post-disturbance analysis, providing enhanced visibility into the workings of the power system. And when engineers do need to look back at a problem, the synchronized measurements from across the grid are available almost instantly, instead of requiring days to gather and process information from across the region.

Recent BPA R&D projects have demonstrated that synchrophasors can enable the testing of generator units more quickly, without taking the generator out of service, at greatly reduced expense. These tests are an operating requirement, so anything that makes these important equipment checks quicker and reduces disruption is a significant benefit.

Finally, because the BPA power system is a part of the entire Western Interconnection, an increase in BPA system reliability improves the reliability of the entire interconnection. BPA is a part of the Western Interconnection Synchrophasor Program, which offers an unprecedented level of synchrophasor data exchange among operating entities in the Western U.S.



Synchrophasor data is displayed for system operators in BPA's control room.

What's next?

BPA has already won several awards and received national attention for its synchrophasor program, but there are still many opportunities to fully realize the benefits that synchrophasors can provide. Ten years ago, Vickie VanZandt, then BPA's vice president of Transmission Services, set the direction to advance BPA's synchrophasor program from wide-area monitoring to wide-area controls. BPA is also expanding the system through additional synchrophasor installations, building a framework for deploying power system management tools as they are developed, and testing new synchrophasor advancements — all while remaining open to using these tools in new ways not yet considered.

One thing is certain: The BPA synchrophasor program investment will continue to pay dividends for the Northwest's transmission system for years to come.