

CASE STUDY

POWERGRID Corporation—India

Using Wide-Area Synchrophasor Measurements to Improve System Reliability

Meeting the ever-increasing needs of electric power while improving system uptime is a challenge for any utility. POWERGRID Corporation is using a newly installed synchrophasor system to improve system operation and reliability.

India has experienced strong economic growth over the past 20 years and is forecasting continued growth for the future. Energy, particularly electricity, is essential to sustaining this growth. POWERGRID Corporation is one of the largest transmission utilities in the world, and its transmission network handles approximately 45 percent of the total power generation in India. One of the key challenges for POWERGRID in managing the bulk transfer of electric power is that demand in the northern and western regions exceeds generation. Imported power travels over long-distance transmission lines and, depending on conditions, can lead to large-scale system outages. POWERGRID needed additional insight into the network operating conditions to improve situational awareness and understanding of system operating points.

Wide-Area Measurement System

POWERGRID teamed with Schweitzer Engineering Laboratories, Inc. (SEL) to design, install, and commission a wide-area measurement system. The system included installing phasor measurement units (PMUs) at four key substations across a large geographic area (northern grid of India). This system included the following equipment:

- Four SEL-451 Protection, Automation, and Control Systems with PMU capability

- Four SEL-2404 Satellite-Synchronized Clocks
- SEL-3378 Synchrophasor Vector Processor (SVP)
- SEL-5078 SYNCHROWAVE® Console Software
- Dell® server (for data storage) and PC (for human-machine interface [HMI])
- Garrettcom® router
- D-link 16-port switch
- Proficy Historian and Real-Time Information Portal SCADA software
- OPC and ODBC connectivity
- Custom software developed for POWERGRID
- Installation, testing, and commissioning services

The system architecture includes PMUs located at the Dadri, Kanipur, Moga, and Vindhychal 400 kV substations, the SVP, and Dell computing hardware running the software in the Northern Regional Load Dispatch Center (NRLDC).



Figure 1—SEL-3378 Synchrophasor Vector Processor

With this system in place, operators have the ability to view the following in real-time: real and reactive power, voltage and current angles and magnitudes, frequency, change of frequency, slip, and acceleration of the system at these four critical substations.

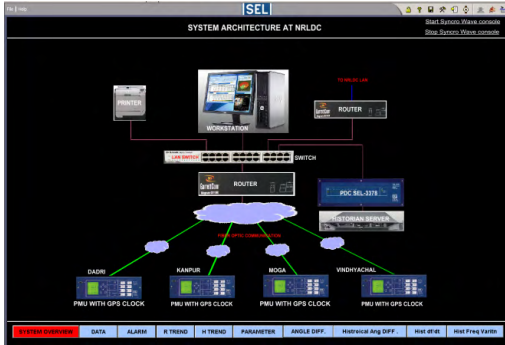


Figure 2—Wide-Area Measurement System Architecture

Additionally, POWERGRID has been able to further characterize the system conditions at various operating points, allowing them to set alarms and know the limits of system operation. With this information, engineers and operators at POWERGRID are able to analyze and diagnose system-wide disturbances and develop contingency plans for various scenarios. These contingency plans will help them mitigate both the number of outages and the number of customers impacted by outages.

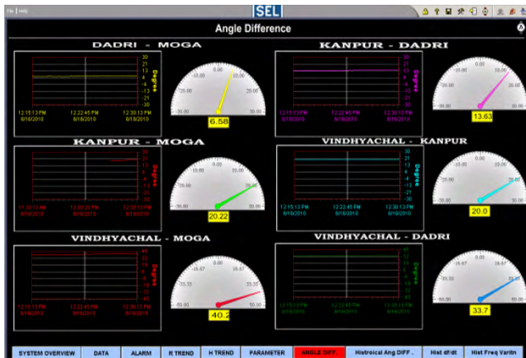


Figure 3—Voltage Angle Measurements Between Substations

Summary

While this system installation is a pilot system for POWERGRID, the immediate benefits of the ability to see wide-area, real-time system operation and the development of improved system models have been significant. POWERGRID is looking for other ways to use their new synchrophasor measurements to further improve system operation and reliability.

About POWERGRID

POWERGRID, a Navratna Public Sector Enterprise, is one of the largest transmission utilities in the world. POWERGRID handles about 45 percent of the total power generated in India on its transmission network. POWERGRID has 77,000 circuit kilometers of transmission network and 124 extra-high-voltage ac and high-voltage dc substations, with a total transformation capacity of 89,000 mega-volt amperes. POWERGRID has also diversified into the telecom business and established a telecom network of more than 21,000 kilometers across India. POWERGRID has consistently maintained a transmission system availability of over 99 percent, which is comparable with international utilities.

About SEL

SEL has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001:2008-certified company serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, control, and monitoring. For more information, visit www.selinc.com, or contact SEL by phone: +1.509.332.1890; fax: +1.509.332.7990; or mail: 2350 NE Hopkins Court, Pullman, WA 99163, USA.

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SCHWEITZER ENGINEERING LABORATORIES, INC.

2350 NE Hopkins Court • Pullman, WA 99163-5603 USA
Tel: +1.509.332.1890 • Fax: +1.509.332.7990
www.selinc.com • info@selinc.com

