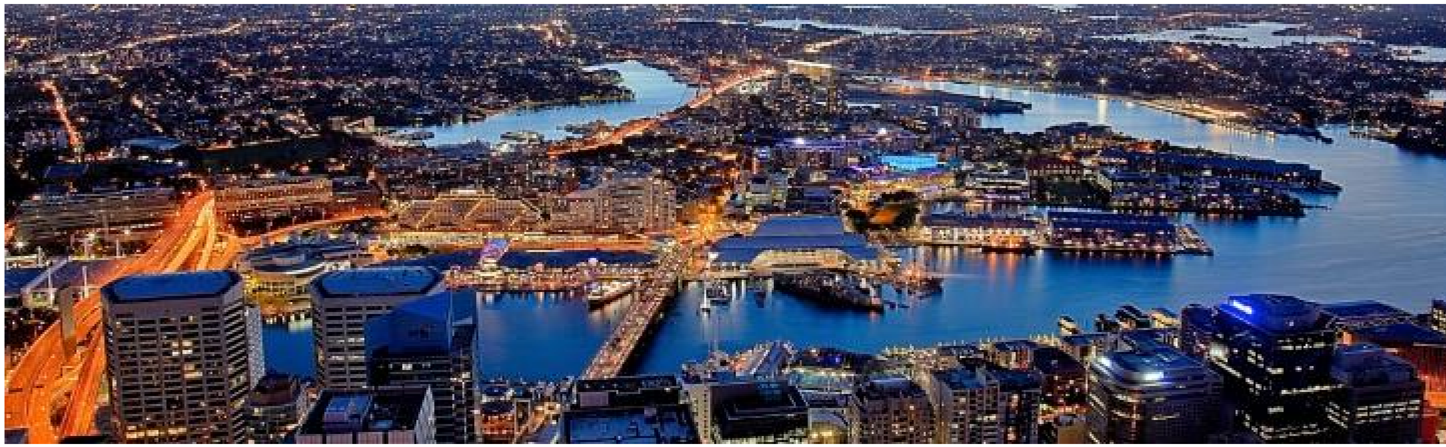
U.S. DEPARTMENT OF ENERGY
Office of Electricity



FOA 1861

Sandra Jenkins
Office of Electricity, Advanced Grid R&D

October 30, 2019

Transmission Data Research

Develop transmission system data sets for model and analytical development and validation.

Engage energy system operators and SMEs in human factor studies, and user feedback to inform data visualizing and processing.

Update transmission system scientific understanding to inform measurement, data analytics, and interconnected system research.

Program Objectives

Program Areas	Objective	Goal
Data Management & Analytics	• Facilitate data standards • Create an environment for data sharing • Build capability at scale to handle Big Data	High quality, accurate data for utilities, research community and policy makers
Transmission System Visualization and User Interface	• Accelerate Human Factors understanding • User feedback from system operators and data users	Visualize the complexity of Interconnected systems to provide more useful alarms and cues, and predictive information for grid operation and planning
Scientific and Physical Understanding of the Power System	• Utilize new sensors to inform physical understanding the grid • Update understanding of transmission system measurement and metrics	Develop new ways of measuring and characterizing the power system to inform data, model and tool development

Data Management & Analytics

Developing data analytics and practices to:

- Track changing system dynamics, such as those resulting from integration of renewables;
- Share data that could improve emergency response; and
- Inform investments that could improve resilience and emergency preparedness.

Improving data management and information practices includes:

- **Data governance**: a system of decision pathways and accountability that insure quality throughout the data's lifecycle
- **Standardization**: industry informed standards that are built on functional data formats and secure data exchange protocols
- **Storage and sharing**: methods/guides that inform how to efficiently and securely share information

Big Data Analysis of Synchrophasor Data
DE-FOA-0001861

- Derive additional value from the vast amounts of sensor data already being generated

- Provide actionable information on the use of Machine Learning and Artificial Intelligence methods on large PMU data sets

- Enable faster grid analytics and modeling and better grid asset management though new tools

FOA Award Recipients

Prime Recipient	Team Members	Project Title
Iowa State University of Science & Technology	Electric Power Group, Google Brain, IBM	Robust Learning of Dynamic Interactions for Enhancing Power System Resilience
Schweitzer Engineering Laboratories, Inc.	Oregon State University	Machine Learning Guided Operational Intelligence from Synchrophasors
The Regents of the University of California	Electric Power Group, Michigan Technological University	Discovery of Signatures, Anomalies, and Precursors in Synchrophasor Data with Matrix Profile and Deep Recurrent Neural Networks
Board of Regents, NSHE obo University of Nevada, Reno	Arizona State University, IBM, Virginia Tech	A Robust Event Diagnostics Platform: Integrating Tensor Analytics and Machine Learning Into Real-time Grid Monitoring
General Electric Company	GE Grid Solutions	PMU-Based Data Analytics using Digital Twin and PhasorAnalytics Software
Siemens Corporation, Corporate Technology	Siemens Digital Grid, Siemens Industries and Drives (Mindsphere), Southern Methodist University, Temple University	MindSynchro
Ping Things, Inc.	N/A	Combinatorial Evaluation of Physical Feature Engineering and Deep Temporal Modeling for Synchrophasor Data at Scale
Texas A&M Engineering Experiment Station	Temple University, Quanta Technology LLC, OSIsoft, LLC	Big Data Synchrophasor Monitoring and Analytics for Resiliency Tracking (BDSMART)

PMU Data for FOA 1861

DOE and PNNL have worked to create a dataset that:

- Covers a significant number of PMUs and substations in each of the three US interconnections
- Covers multiple years and includes event logs
- Is real field data from a variety of sources that includes a variety of errors, inconsistencies, quality levels, and flaws
- Is anonymized, to reduce the data's value in exposing potential information about power system operational vulnerabilities

FOA Analysis Objectives

1. Identify key events within each interconnection-specific dataset
2. Identify unusual or anomalous events and patterns not in the event log.
3. Catalogue the “signatures” (identifying patterns) including events that can be used to identify and diagnose events and grid conditions.
4. Identify precursor conditions that warn about forthcoming events.
5. Identify patterns that reveal the condition of power system equipment and insights into equipment modeling.
6. Identify apparent ground-induced currents (GIC) relating to geomagnetic disturbances.
7. Predict performance of power plants and other assets.
8. Identify actual load event and patterns, potentially including detection of DERS.
9. Identify factors that can improve wind integration and solar integration.
10. Identify factors that reflect weather and seasonality without the use of site-specific weather data.
11. Identify anomalies that may reflect cyber security issues and events rather than grid performance.