U.S. DEPARTMENT OF ENERGY
Office of Electricity

Department of Energy - NASPI

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North American SynchroPhasor Initiative (NASPI)

- 2003 – U.S.-Canada Blackout Report recommended use of synchrophasor technology for better wide-area situational awareness
- 2006 – DOE and NERC (later EPRI) started the North American SynchroPhasor Initiative (NASPI)
  - Until then there was uncorrelated activities among multiple entities in East and West trying to understand the grid behavior. NASPI consolidated these activities.
- 2009 – American Recovery & Reinvestment Act (ARRA) became law to stimulus economic growth
  - The SynchroPhasor Technology Roadmap was developed
- 2010 – DOE awarded SynchroPhasor Technology projects

North American Synchrophasor Initiative (NASPI)

- NASPI has been supporting rapid, industry-led deployment of synchrophasor technologies on the bulk transmission system as a result of ARRA grants
- NASPI provides a focused forum for timely exchange of information on synchrophasors among industry (both utilities and vendors), national labs, and university communities
- Some of the functions of NASPI are transferring to standing industry-led groups and committees including
  - NERC Synchronized Measurements Subcommittee
  - WECC Joint Synchronized Information Subcommittee
  - IEEE Power Systems Relaying Committee
- NASPI will evaluate opportunities for advancing in the grid monitoring for a better system monitoring and detection.

Government Role to Spur Synchrophasor R&D

Convening:

- Support North American Synchrophasor Initiative to convene complex working group of industry experts to realize the promise of synchrophasor technology throughout the country

Catalyzing:

- Assess and disseminate successful and innovative synchrophasor applications throughout the highly fractured electricity industry

Capacity Building:

- Support partnerships with, and between, academic institutions and utilities to create opportunities to research and utilize synchrophasor data

Office of Electricity (OE) Objectives

- Provide national leadership to ensure a secure resilient and reliable energy delivery system.
- Develop technologies to improve the infrastructure that brings electricity into our homes, offices, and factories.
- Support development of the federal and state electricity policies and programs that shape electricity system planning and market operations.
- Drive electric grid modernization and resiliency through research, partnerships, facilitations, and modeling and analytics.

OE's Initiatives

Existing capabilities are not sufficient for understanding and mitigating the reliability and resiliency of the grid.

1. **North American Energy Resiliency Model (NAERM)**

   Working with the national labs and relevant stakeholders OE will develop an integrated model of multiple infrastructures to study, analyze, and address vulnerabilities in the North American Energy System. This models is intended to allow us for sequencing of events to understand risk across critical energy infrastructure sectors and identifying key energy infrastructure interdependencies as well as identify potential infrastructure investments to improve resiliency and mitigate risks associated with energy system interdependencies

2. **Revolutionize Sensing Technology Utilization**

   In order to get the understanding of what the next generation of sensors should be in order to support the reliability and resiliency of the system, in December 2018 the department has put coordinated roadmap of sensor technology and data analytics to get a better understanding of:

   - Infrastructures interdependency;
   - System resiliency;
   - Fault detection and failure identification;
   - Behind the meter DER impact.

OE's Synchrophasor FY19 Goals

- Complete 4 industry cost-shared pre-commercial synchrophasor-based demonstrations of advanced applications under NETL FOA 1492
  - Real Time Applications Using Linear State Estimation Technology
  - Substation Secondary Asset Health Monitoring and Management System
  - Operationalizing Synchrophasors for Enhanced Electric Grid Reliability and Asset Utilization
  - Advanced Synchrophasor Protocol (ASP) Development and Demonstration Project
- Make awards under FOA-1861 (Big Data Analysis of Synchrophasor Data)
  - The goal of this FOA is to explore the use of big data, artificial intelligence and machine learning technology to discover insights and tools for better grid operation and management. This work is focused on discovery of additional information that might reside in the existing PMU data that could precursors to abnormal events
- Complete ESAMS demonstration with PJM, ISO-NE, NYISO, and MISO
- Continue development of next generation PMUs
- Initiate development of new dynamic load modeling techniques, based in part on advanced grid monitoring technologies
- Conduct two meetings of NASPI

OE's Synchrophasor FY20 Plans

- Transfer ESAMS (Eastern Interconnection Situational Awareness Monitoring System) to EIDSN (Eastern Interconnection Data Sharing Network)
- Re-focus NASPI to support next generation advanced grid monitoring technology and system analysis needs
- Emerging emphasis on high-speed point-on-wave measurements to characterize system-level impacts of inverter-based resources and other fast acting phenomena during off normal condition
- Support Development of combined Transmission/Distribution design and buildout.
- Continue improving data quality
- Data-sharing for real-time situational awareness and with researchers and transmission operators to do big data analysis for baselining, anomaly detection, mis-operations diagnosis and operator decision support tools

NASPI's potential areas of activities

DOE is considering leveraging NASPI for additional programmatic linkages that supports OE's Initiatives:

- Processing of data into information (data analytics)
- Further developing data practices for collection, sharing, and management of data to make efficient use of data
- Advancement in sensors and its application to the protective relaying
- Reducing high Operation and Maintenance cost associated with PMUs data quality and outages
- Further utilization of Artificial Intelligence and Machine Learning techniques
- Wide-Area Oscillation Assessment and Trending Analysis and automated, autonomous system protection schemes, including wide-area damping.
- Considering to incorporate the DOE's Sensing and Measurement Roadmap study recommendations into NASPI.

Current and Future SynchroPhasor Technology Functionalities

- Hybrid and Linear State Estimation
- Forensic analysis of abnormal events (Post Mortem Disturbance Analysis)
- System Model Derivation and Validation
- Determination of Operating Limits
- Processing of data into information for analytical analysis
    - Real-time situational awareness
        - Oscillation detection and analysis
        - Voltage stability monitoring
        - Linear state estimation
        - Trending, alarms & alerts
        - Wide-area visualization
        - Phase angle and frequency monitoring
        - Island detection and analysis
    - Blackstart and System Restoration
- Monitor equipment asset health and Determine impacts of grid operations on Wholesale markets (Studies on these topic awarded under FOA1492 form)
- Observing phenomenon that was not previously seen such as system oscillation

NASPI's New Point of Contact

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