SEVENTY-FIVE YEARS OF RELIABILITY THROUGH RELATIONSHIPS
SPP PMU
Project Overview for NASPI

Cody Parker
Supervisor Operations Support
Outline

1. Background
2. Project Overview
3. Working with our Members
4. Project Team
Background

OUTLINE ITEM 1
Our Beginning

• Founded 1941 with 11 members
  • Utilities pooled electricity to power Arkansas aluminum plant needed for critical defense

• Maintained after WWII to continue benefits of regional coordination
The SPP Difference

- Relationship-based
- Member-driven
- Independence Through Diversity
- Evolutionary vs. Revolutionary
- Reliability and Economics Inseparable
Operating Region

- Miles of service territory: 575,000
- Population served: 18M
- Generating Plants: 825
- 12.4 GW in-service wind capacity
- Substations: 4,729
- Miles of transmission: 56,142
  - 69 kV 14,970
  - 115 kV 15,261
  - 138 kV 9,376
  - 161 kV 5,480
  - 230 kV 7,838
  - 345 kV 10,158
  - 500 kV 391
Annual Average Wind Speed

United States - Land-Based and Offshore Annual Average Wind Speed at 80 m

WIND INTEGRATION STUDY

NDVER and DVER site locations with Constraints and Voltage Contour

Spring 44.9% Penetration
(Event 1 - 10,732 MW)
Solar in the U.S.

PV Solar Radiation
(Flat Plate, Facing South, Latitude Tilt)

This data represents annual average solar resource potential for 48 Contiguous United States and Hawaii, in High Resolution. The data for Hawaii and the 48 contiguous states is a 10 km, satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.

Source: National Renewable Energy Laboratory (NREL), U.S. Department of Energy
Synchrophasors at SPP

• Research projects in process include
  • EPRI/Baylor PMU pilot with KCPL, NPPD, OG&E, Sunflower & WAPA,
  • DOE-funded FOA970 openECA project to develop and test new open source synchrophasor applications with GPA, OG&E, BPA, Dominion/Virginia Power, Northwestern Energy and others

• 3 Year project approved in SPP budget for 2016-2018
openECA Project Summary
A better way to connect phasor data to analytics

Objective
To develop an open-source software platform that enables the production use and facilitates the development of analytics that use high-fidelity synchrophasor data

2-Year Project Schedule
October 2015 – September 2017
- Final design – 6/30/16
- Alpha Version – 3/31/17
- Demonstration Begins - 6/30/17
- Version 1.0 released - 9/15/17

Project Status
Project Awarded Sept. 2015

Value of Award
$ 5.1 M
(< 3% funds expended to date)

Prime
Grid Protection Alliance
Synchrophasor Symposium
Held Dec 15th

• Educational forum for staff and members involved with PMU deployments to date

• Key support from NASPI and OG&E staff

• Meeting agenda included highlights from NASPI Synchrophasor Starter Kit Training Sessions.

• Agenda and presentations are posted on our website at http://www.spp.org/spp-documents-filings/?id=18440 under our System Protection and Control Working Group.
PROJECT OVERVIEW

OUTLINE ITEM 2
Project Overview

- 3 Year Project Plan
- Leverage Lessons Learned from our Peers
- Leverage expertise from SPP members

Big Drivers
- Increase Reliability Capabilities
- Enhance Situational Awareness
- Event Analysis
- Model Validation
- Facilitate renewables integration
Project Overview – cont’d

• 2016 Overview
  • Receive PMU data from SPP members and MISO
  • SPP Member Engagement (add’l coverage in footprint)
  • Education of staff on: benefits, technology and capabilities
  • Evaluate open-source technologies
  • Evaluate commercial vendor products
  • Start implementation
Project Overview – Future Scope

• 2017 Overview
  • Receive more PMU member data from SPP footprint
  • Develop historical data analysis capabilities
  • Develop optimal architecture
  • Develop system integration to better utilize PMU data
  • Test OpenECA capabilities

• 2018 Overview
  • Deploy the system in highly available configuration in production environment
  • Implement CIP controls
  • Deploy mechanisms for receiving PMU data for production usage
Working with our Members

OUTLINE ITEM 3
Existing/Potential PMU Locations

EHV PMU Locations

Status
- In Operation
- Capable
- To Be Added

Voltage
- 230 kV
- 345 kV
- 500 kV

This map contains the intellectual property of SPP and may not be used, copied or disseminated by third parties without the express permission of SPP. All rights reserved.
Synchrophasor Strike Team

- Synchrophasor Strike Team will help in the development of:
  - Member business case
  - Member roadmap for PMU deployments
  - Requirements and criteria for sending PMU data to SPP
  - Review SPP roadmap for synchrophasor applications

- Share results, recommendations and next steps at educational workshop in advance of MOPC in October
**Strike Team – Key Questions**

- How will Synchrophasor data be used in SPP (real-time monitoring, wide-area situational awareness, model validation, etc.) and shared among members?

- What are current and planned uses by members?

- What are the best locations for PMU equipment and priorities of installations?

- What are the data latency and quality requirements and other specifications?

- Who should install and own the PMUs?

- Who is responsible for communications from the PMUs and PDCs?
Strike Team – Key Questions

- Who pays for PMU equipment and communications, and how should costs be allocated?

- What reporting should be established for synchrophasor data?

- What data retention should be established?

- What are the CIP implications/requirements for the use of this data and how are they best addressed?

- What data can be shared and with whom?
PROJECT TEAM
Roles & Responsibility

OUTLINE ITEM 4
## PROJECT TEAM LIST

<table>
<thead>
<tr>
<th>Project Role</th>
<th>Team Member Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Sponsor</td>
<td>Bruce Rew, VP Operations</td>
</tr>
<tr>
<td>Director</td>
<td>Philip Bruich, Director, Markets</td>
</tr>
<tr>
<td>Business Owner</td>
<td>Cody Parker</td>
</tr>
<tr>
<td>Technical Owner</td>
<td>Hunter Austin</td>
</tr>
<tr>
<td>Architecture</td>
<td>Srinivas Kolluru</td>
</tr>
<tr>
<td>Leadership Team</td>
<td>Cody Parker, Scott Aclin, Hunter Austin, Jay Caspary, Srinivas Kolluru, Philip Bruich</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Brenda Fite</td>
</tr>
<tr>
<td>Core Team Members</td>
<td>Cross-Departmental Ongoing Activities in: Operations, Engineering, IT and others</td>
</tr>
<tr>
<td>Requirements and Testing</td>
<td>Terry Rhoades</td>
</tr>
<tr>
<td>Impacted Departments</td>
<td>Customer Training, Legal...</td>
</tr>
</tbody>
</table>
Send SPP Synchrophasor Questions/Comments to:

SPPPMU@spp.org

Cody Parker
Supervisor Operations Support
cparker@spp.org  501.614.3297