NASPI Control Room Solutions Task Team Monthly Meeting

February 25, 2020

Agenda

- Introductions
- Review CRSTT Mission, Goals and Objectives
- Discuss status of CRSTT work products
  - ➢ Focus Area Documents
  - ➢ Video Event Files
  - ➢ Use Case Documents
- Short Brainstorming Session
  - ➢ Monitoring and alarming criteria for Inverter Based resources
  - ➢ "Real-time identification of non-modeled behavior
  - ➢ Inertia monitoring
- Panel Session at Upcoming NASPI - Challenges and Opportunities
- Reviewing nominations for CRSTT MVP (were due last Thursday)
- Adjourn

CRSTT Mission, Goals, and Objectives

- CRSTT's mission, goals, and objectives can be found on the NASPI CRSTT webpage: https://www.naspi.org/crstt

- Other items on the CRSTT web page:
  - CRSTT Work Plan
  - Use case document, mis-operations with PMU Data Summary Table
  - PMU versus SCADA video events summary video

Focus Area Documents

1. **[System Islanding Detection and Blackstart Restoration](#) – Posted June 2015.**

    ➤ (Kleitsch – ATC, Cassiadoro – TRS)

2. **[Using Synchrophasor Data for Voltage Stability Assessment](#) – Posted Nov. 2015.**

    ➤ **(**Farantatos – EPRI, Vaiman – V&R Energy)

3. **[Using Synchrophasor Data for Phase Angle Monitoring](#) – Posted May 2016.**

    ➤ (Cassiadoro – TRS, Nuthalapati – LCRA)

    ➤ **Requests for updates sent on 2/17/2020 by NDR. Please provide responses by 3/20/2020 so we can update the document prior to the April meeting.**

4. **Enhanced State Estimation Survey –Preliminary responses received; more analysis needed.**

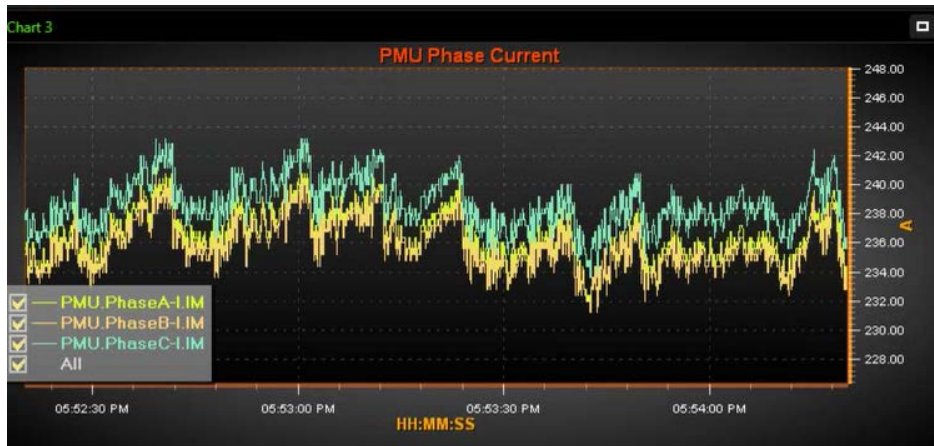   ➤ (Vaiman – V&R Energy, Kleitsch – ATC)

Focus Area Documents (cont'd)

5. **[Using Synchrophasor Data for Oscillation Detection](#) – Posted Feb. 2018.**

    ➢ (Nuthalapati –LCRA, Dyer –EPG, Blevins and Rjagopalan –ERCOT, Patel -EPRI)

6. **[Using Synchrophasor Data to Determine Disturbance Location](#) – Posted Feb. 2019.**

    (Nuthalapati – LCRA, Zweigle –SEL Inc., Cassiadoro –TRS)

7. **Using Synchrophasor Data to Monitor Reactive Power Balancing – FUTURE? May develop use case document instead**

    ➢ (Cassiadoro -TRS, Peak –Zhang, Vaiman –V&R Energy)

We will continue to update these documents but do not expect to develop any new documents in this format.

Video Event Files

Objective – Continue building library of events to demonstrate value PMU data provides when analyzing abnormal events and disturbances.

Video

PMU versus SCADA Video Events Summary. Please refer to EPG's template and the Synchrophasor Data File Format .CSV when creating a video event.

Video 1 - Current and voltage oscillations observed on the 138 kV system during testing of new generator controls (65 MW gas turbine).
  RTDMS PMU vs. SCADA Video 1

Video 2 - Voltage oscillations observed on the 230 kV system when a water pump was taken offline.
  RTDMS PMU vs. SCADA Video 2

Video 3 - Voltage oscillations observed following the loss of a 345 kV line during a period of high wind generation.
  RTDMS PMU vs. SCADA Video 3

Video 4 - Real and Reactive Power oscillations observed on the 69 kV system during a period of high wind generation with the plant radially connected (i.e. one of two normal source lines out of service).
  RTDMS PMU vs. SCADA Video 4

Video 5 - Real and Reactive Power oscillations observed during a period of high wind generation.
  RTDMS PMU vs. SCADA Video 5

Video 6 - Real Power and voltage oscillations observed following the loss of a large generator.
  RTDMS PMU vs. SCADA Video 6

Video 7 - Wind farm Oscillation Detection and Mitigation using Synchrophasor Technology
  Wind Farm Oscillation Detection and Mitigation

Video 8 - A 230kV fault followed by a loss of a large generation plant caused system frequency to drop approximately 72mHz momentarily, while having an impact on nearby system voltages and online generators (Clip 1, Clip 2 , Clip 3)

  Video 9 - Please be patient with the download, the video is very large. This video captures the actual synchronization of a large generator to the electric grid. The windows in the visualization tool capture frequency, output power, voltage angle, and voltage magnitude of the generator and at a reference point on the electric grid.
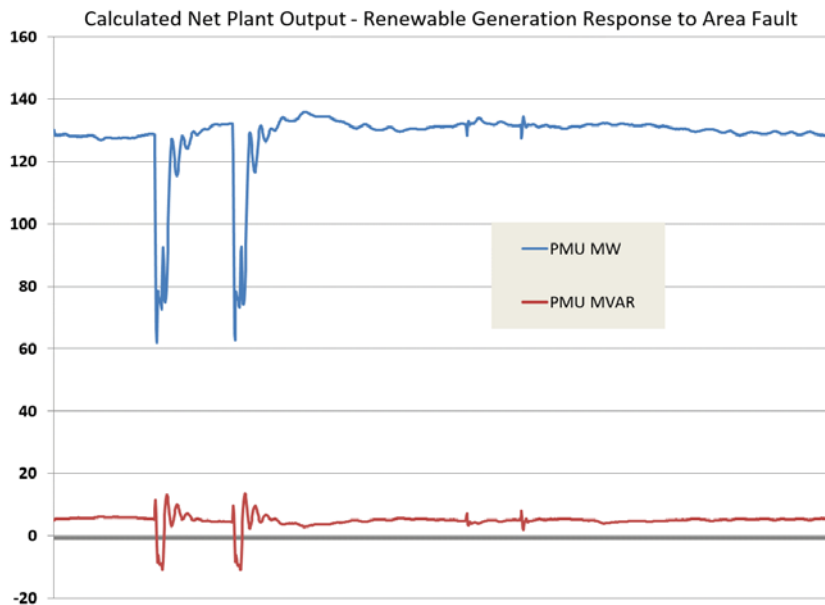
Use Case Documents

Objective – Develop docs that demonstrate ways that grid operators and electric utilities are using synchrophasor data to provide operational value.

Event ID	Event	Event Category	Entities Involved	Event Description	Extended Description in Related NASPI Technical Paper	Safety Impact	Reliability Impact	Budgetary Impact
TE02	Failing potential transformer	Transmission Equipment	ATC	Abnormal voltage signature found while reviewing PMU data led to discovery of a failing potential transformer which was subsequently isolated and replaced.	p.38	The utility avoided safety risk to personnel that might have been in close proximity to the PT during its failure.		Utility avoided costs associated with customer minutes of interruption that would have resulted from the potential transformer's failure had the condition not been identified and a mobile transformer placed in service to facilitate the outages necessary for its replacement.
TE03	Loose connections in potential circuits	Transmission Equipment	OG&E	Fluctuations observed in positive sequence voltage data collected from PMUs led to discovery of a loose fuse connection in a CCVT safety switch. PMU data has been used in a similar fashion to reveal faulty terminations, animal-damaged conductor and contact corrosion.	p.40			Utility avoided costs associated with equipment damage and customer minutes of interruption that might have resulted had the issues not been addressed.

Brainstorming Session

Objective – Open discussion about what we should be doing to prepare for the change in generation profile to provide situational awareness to Operators of the system

- Monitoring and alarming criteria for Inverter Based resources
  - Example response for one plant on our system. Compare to Blue Cut fire (NERC SMS report) with 2 GWs lost.
  - What do Operators (T&D) need to know in real time to respond to these events when penetration levels reach 40% - 50% - ….

Calculated Net Plant Output - Renewable Generation Response to Area Fault

Collector Station 138 kV Bus Volts

Brainstorming Session (cont'd)

- "Real-time identification of responses that don't match modeled responses
  - Now that we can see the dynamic response of resources on the system, how do we let the right people know when those responses don't look "right"
  - What tools do we need to compare modeled behavior to actual so we can flag when equipment doesn't respond as expected
  - Do we need real time identification or is post event acceptable?
  - Example plant response to breaker open with 25 degree phase angle

Net Plant Output Derived From Synchrophasor Data
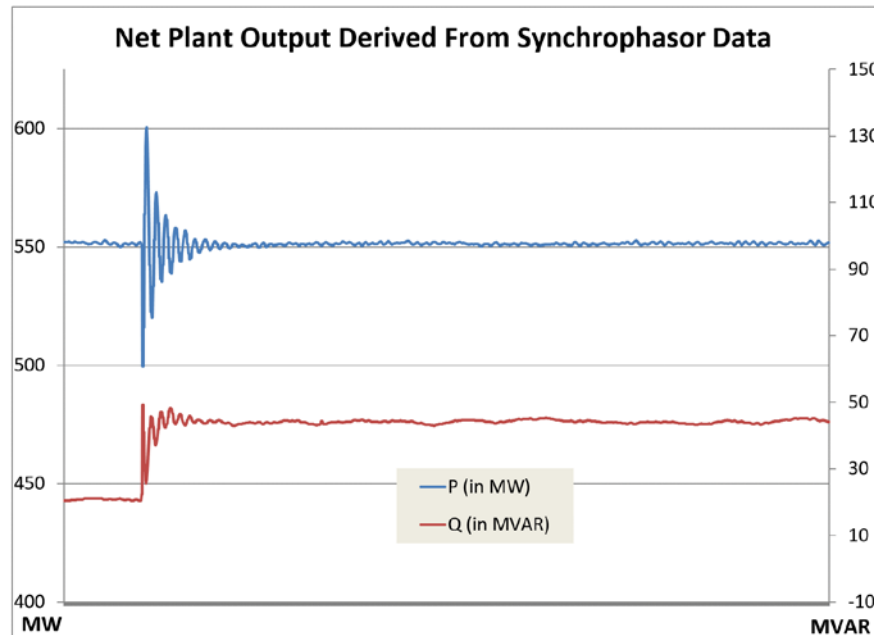
Brainstorming Session (cont'd)

- Inertia monitoring
  - Concerns being expressed regarding the loss of system inertia as we replace spinning mass with inverter based facilities
  - How do we determine what normal inertia levels are if we don't monitor them?
  - What, if any tools are needed to track and possibly make inertia information visible in real time to support real time operations?
    - Impacts to system protection operation
    - Stability impacts
    - Is this a synchrophasor problem or can other data be used to calculate?

- Other problems we need to think about solving in the 2-5 year time frame that synchrophasor data can help with?

Other Miscallaneous

- Proposed Panel Session at Upcoming NASPI Meeting- Minneapolis April 14-15, 2020
  - Use of Synchrophasor Technology : Challenges and Opportunities
  - Normally just cover success stories but want to share challenges with deployment to help others with similar issues work to identify solutions
  - Have two volunteers. Working to find 1-2 more.

- We are accepting nominations for CRSTT MVP
  - Let Mike, NDR, or I know by this Friday 2/28 if you want to nominate someone
  - See email from Teresa Carlon with nomination form and details – Sent Friday 2/21/2020 2:27 PM CST

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Next NASPI CRSTT Conference Call: March 24, 2020.
Next NASPI WG Meeting: April 2020 in Minneapolis, NM.