



SRP IBR Monitoring Challenges

NASPI Work Group Meeting October 2024

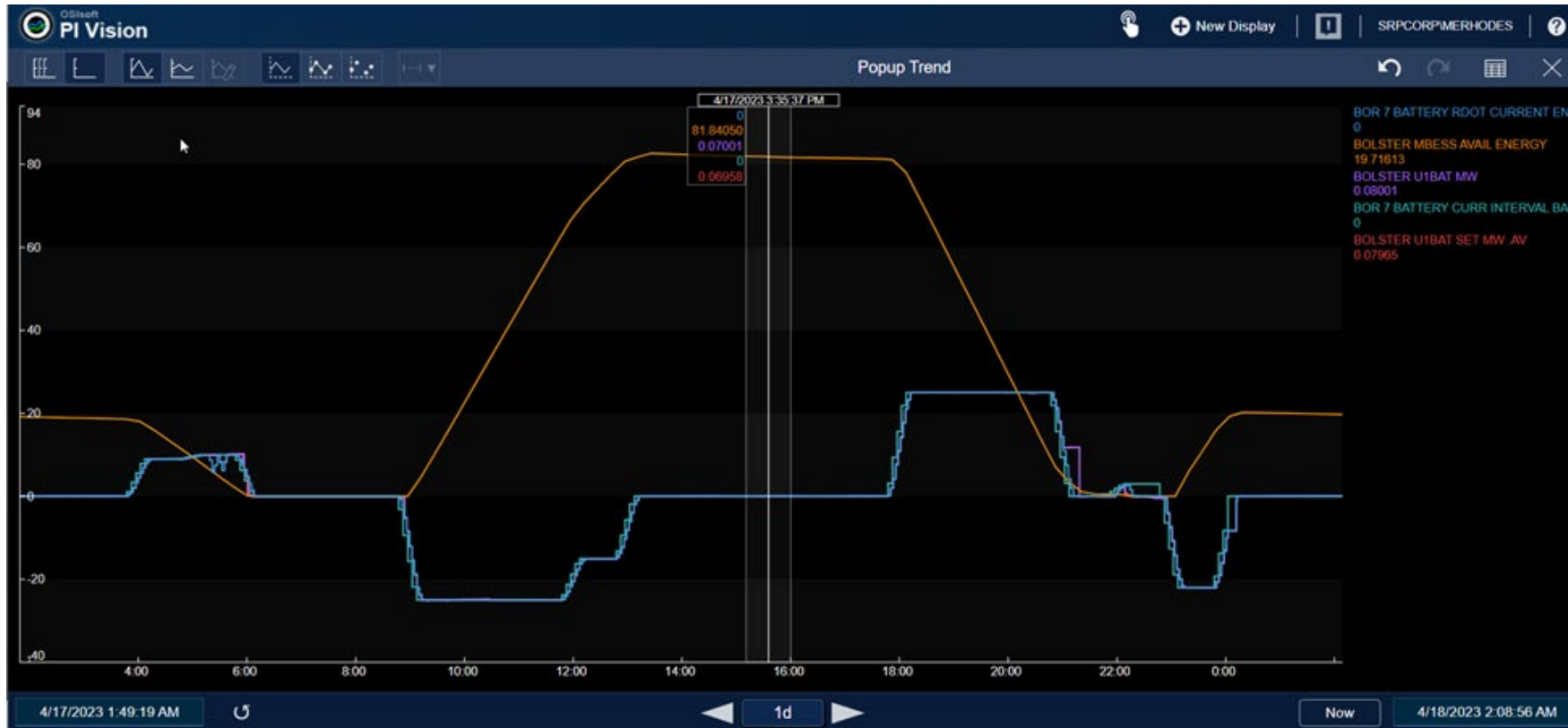


Delivering water and power™

SRP OWNED AND OPERATED
BOLSTER
25MW TOTAL GENERATION



Bolster Tracking State of Charge and Battery Dispatch



- Blue trace = EMS Ramped DOT
- Orange trace = Bolster Available Energy in MWHrs (State of Charge)
- Purple trace = Bolster Actual Output
- Cyan trace = Bolster Base Schedule

Bolster Site Level Dashboard (PI Data)

- Site level gives total battery output data including:
 - Auxiliary load
 - Full charge energy (amount of MWhr energy capacity available)
 - Real and reactive power setpoint commands from the site controller to the battery.
- Bolster is made up of 34 "Megapacks" each delivering 700kW
- Right hand side has Megapack overview alarms for:
 - General alarms
 - Critical battery thermal event (potential fire)



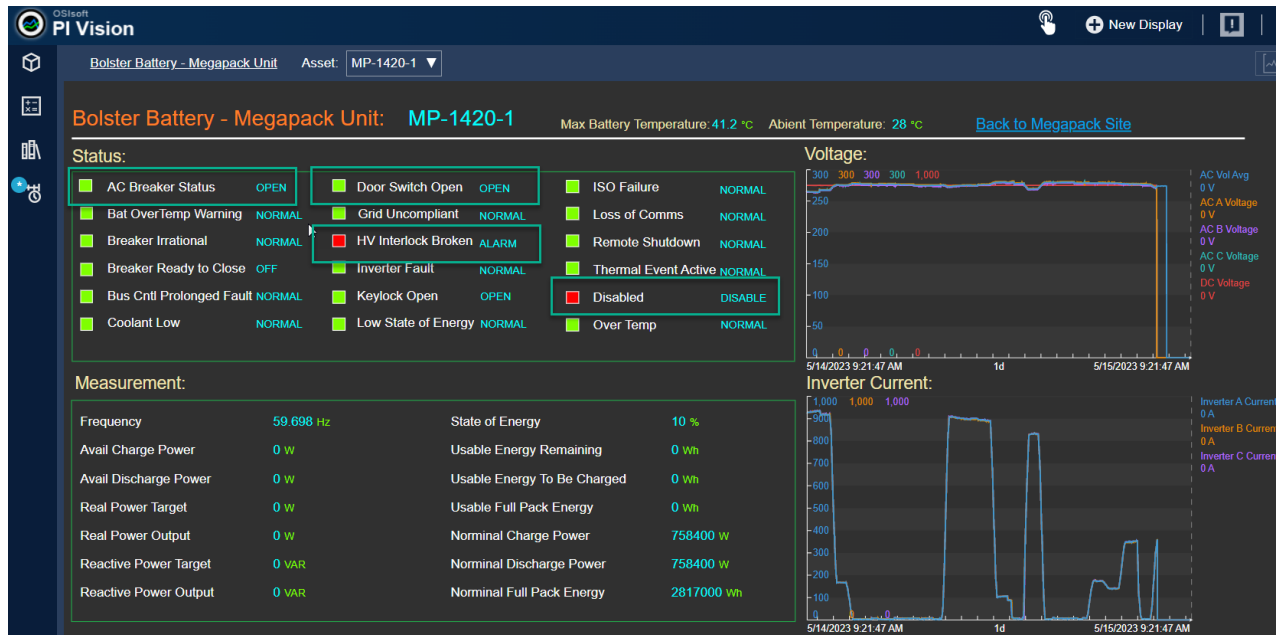
Bolster Megapack Level Dashboard (PI Data)



- Megapack level gives
 - Digital statuses
 - 480V AC breaker
 - Internal fault detection
 - Numeric data
 - Available power
 - Nominal power
 - Nominal energy
 - Real and Reactive Power command targets
 - Trending analog data
 - 480V AC voltage
 - 480V AC current
 - DC voltage

Battery Maintenance Semi-Live Dashboard (PI Data)

Tesla Maintenance performed on 4 Megapacks. Notice the PI point notifications that changed state in the green boxes.

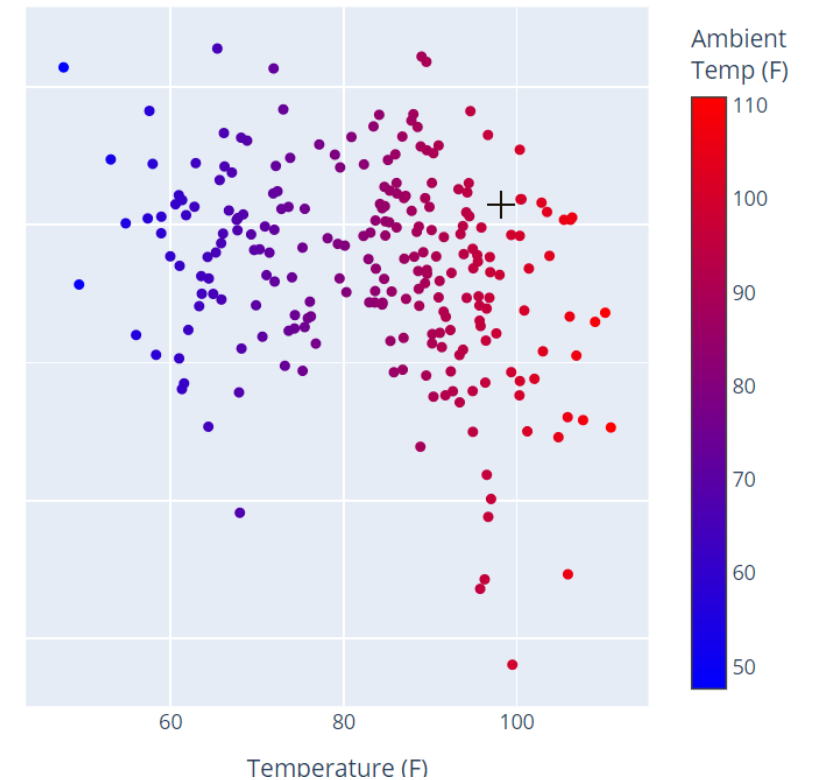
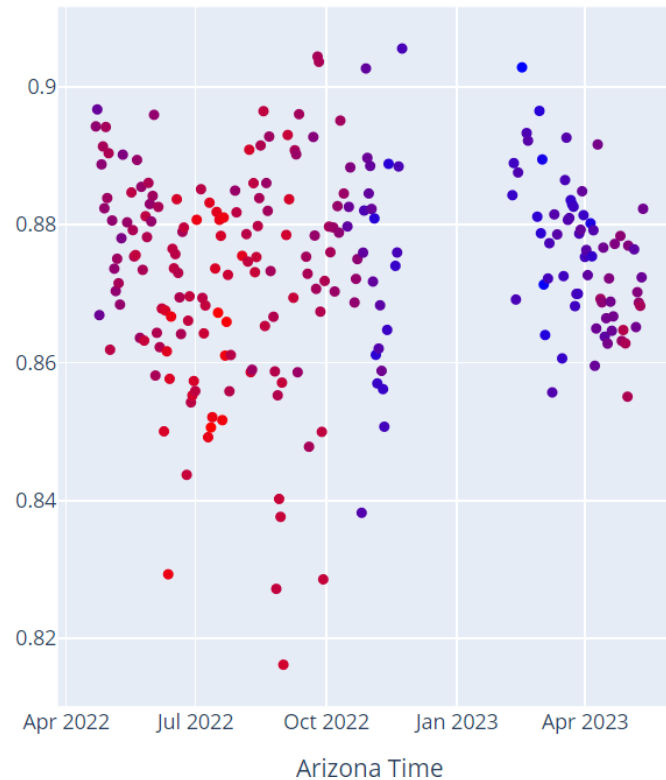


EPRI Storage Performance and Reliability Foresight Project (PI Data)

RTE vs. Time and Temperature

RTE vs Time and Temperature:

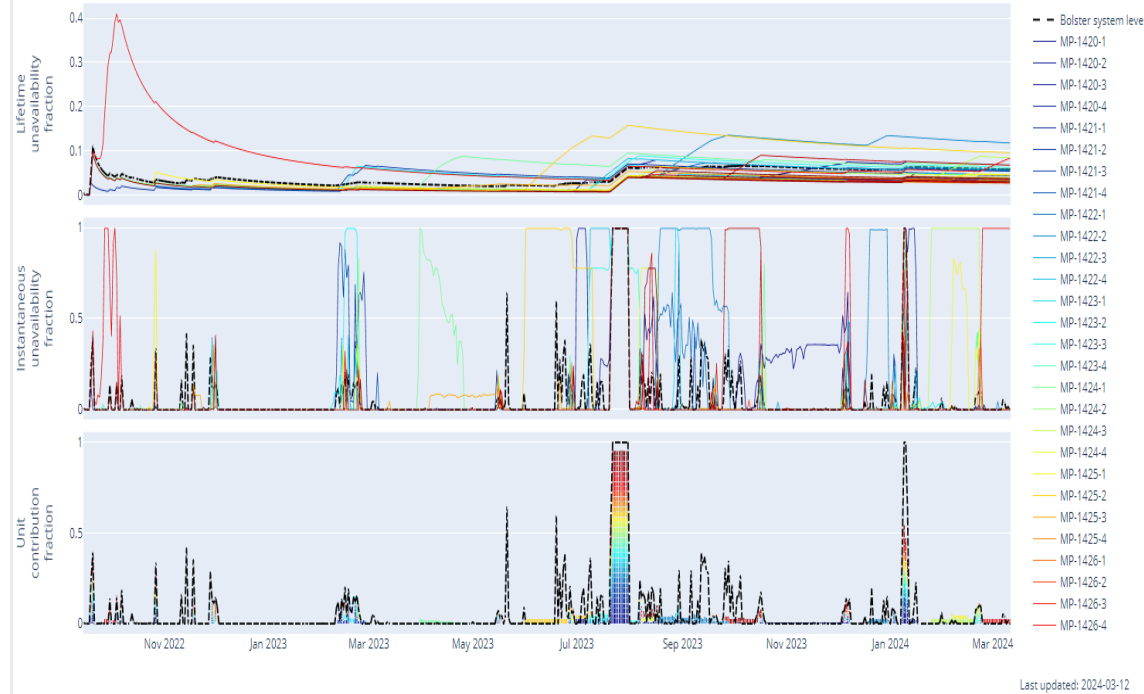
How does the total RTE change over time and over varying ambient Arizona temperatures. Particularly important with global warming trends and sustained high temperatures.



EPRI Storage Performance and Reliability Foresight Project (PI Data)

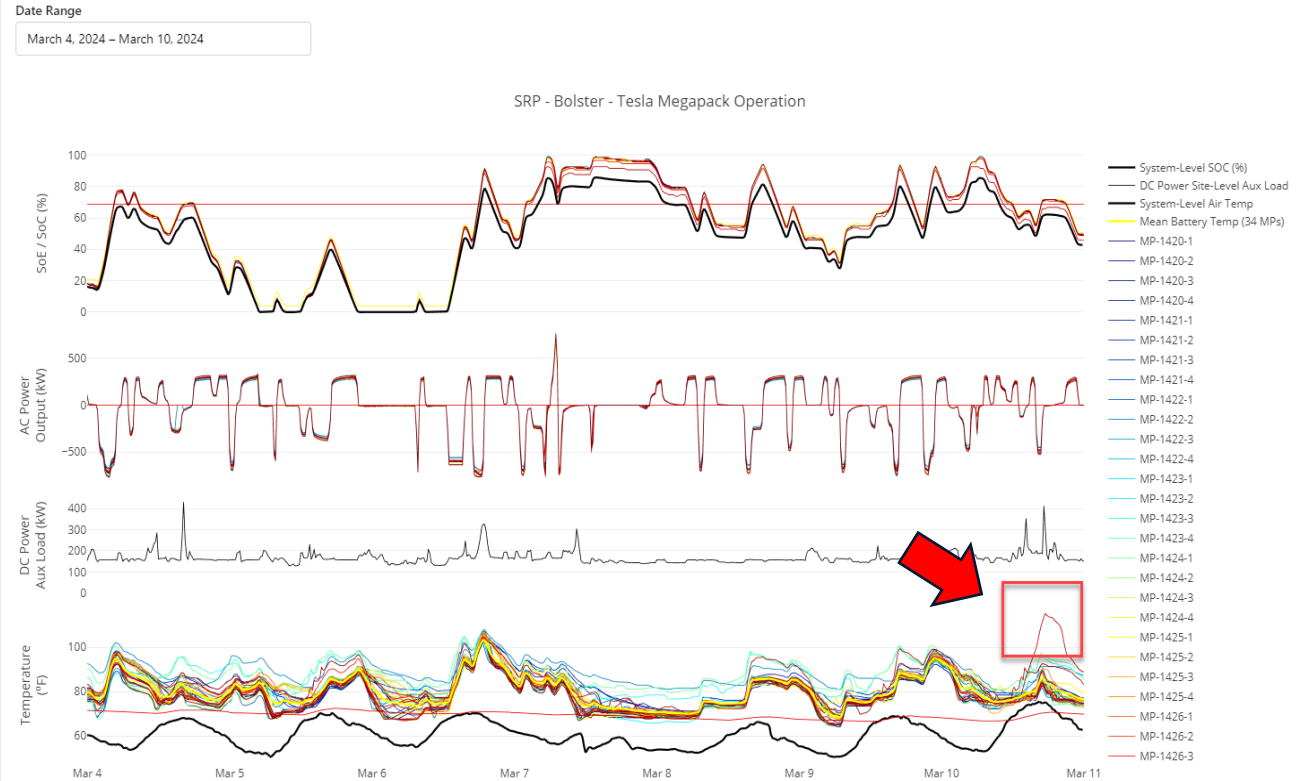
Lifetime/Instantaneous and Unit Contribution Data

SRP - Bolster - Tesla Megapack Unavailability



High Temperature and other DC Power/AC Power/SOC

Megapack Level





Plans to add new PPA Operated BESS data to Foresight Analytics Wiki

Real Time Value of PI Data

- Alarm trigger: Current State of Charge has reached to 95% of current available energy for greater than 10 seconds.

Alert - Bolster Battery Charge High

 PGPMC - DEPT ID
To  Matthew E Rhodes

Retention Policy SRP Deleted Items (60 days)

Start your reply all with:  Feedback

State of Energy Warranty Performance A 2023-05-12 15:09:18.000
Battery Charge High



Start Time: 5/12/2023 3:09:18 PM US Mountain Standard Time (GMT-07:00:00)

Value at Start Time: 95.005 Charged


Threshold for Notification: Above 95% Max Charge for >10 seconds.

Event Details: [Event Details Hyperlink](#)

ALERT - Bolster Battery Unexpected Power Output Shift

 PGPMC - DEPT ID
To  Matthew E Rhodes

Retention Policy SRP Deleted Items (60 days)

Start your reply all with:  Feedback

Event: Bolster Battery Unexpected Power Output Shift

Threshold for Alert: Battery output dropped by more than 600kW within 2 seconds.

Event Start Time: 5/8/2023 11:14:34 PM US Mountain Standard Time (GMT-07:00:00)

Notification Send Time: 5/8/2023 11:14:43 PM US Mountain Standard Time (GMT-07:00:00)

Event Details: [Event Details Hyperlink](#)

PI Server: pmcafprod

- Power output (MW) has changed by 600kW in less than 2 seconds. One Megapack is 700kW.

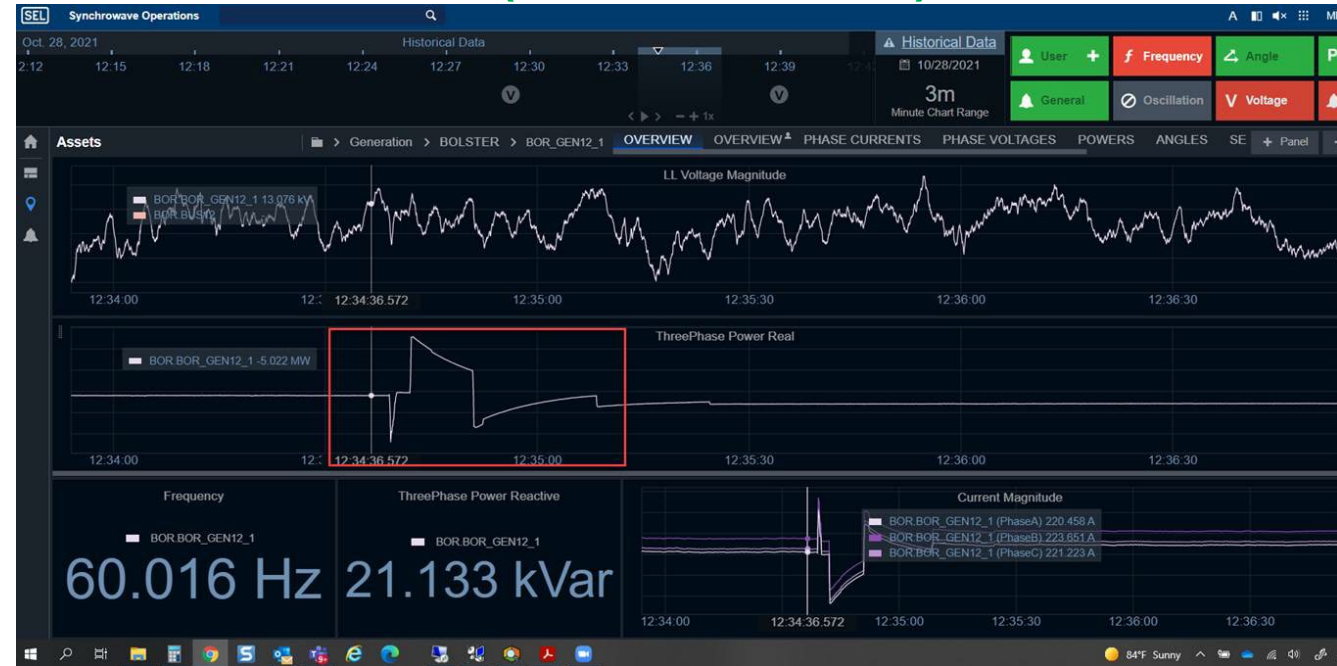
Notifications come from analytics outside of PI, not raw PI data*



Value Realized and Actions Taken (PMU Data)

Unexpected power output shift alarm

- Megapack dropout
- Ramped operation plateau ACE effect.



Megapack dropout – Action: Submit a service ticket to Tesla to investigate.

ACE Effect – Action: Contact SRP EMS teams or check ACE PI Vision display to investigate ACE action for verification of ramping commands interruption and prevent aggravating system balancing issues.

SRP THIRD PARTY OWNED AND OPERATED (POWER PURCHASE AGREEMENTS)

BESS+PV HYBRID

BESS+PV CO-LOCATED

BESS STANDALONE

PV STANDALONE

WIND STANDALONE

~2000MW TOTAL GENERATION



Power Purchase Agreement IBR Resource Data

Main Controls: MW Setpoint, Ramp Rate, Grid Charging Enable

Basic Data (Using)

- ESS Owner high/medium voltage and feeder status
- ESS high/medium voltage meter data
- ESS Aggregate Output
- PV Aggregate Output (if installed)
- POI Aggregate Output
- Unit Data
 - AVR status
 - Remote/Local Status
 - Battery metering data

Critical Data (Using)

- Ambient Temperature
- Humidity
- BESS Ramp Rate
- BESS SOC
- BESS Max Charge/Discharge MW and MVAR
- BESS Available Energy Capacity
- BESS Max Energy Capacity
- BESS Frequency Response MW
- BESS Number of Inverters Online

Advanced Data (NOT AVAILABLE)

- Individual Battery Data
 - Battery Cell Temperature
 - Battery Cell Voltage
 - Battery Failure Codes
- Individual Inverter Data
 - Inverter Failure Codes

SRP NOT RESPONSIBLE FOR INTERNAL PLANT MONITORING

NEED FOR ADVANCED IBR MONITORING FROM THE SITE LEVEL



SRP ADVANCED IBR MONITORING RESEARCH

DOE OPTIMA FOA Topic Area 3:
Rapid System Health and Risk
Assessment Tools for Grid
Operators
(PNNL)

SRP Participation: Demonstration Utility; Primary Investigator: Pacific Northwest National Laboratories (PNNL)

Project Title: Wave Apps: Distributed Waveform Analysis Platform for Grid Operation Applications

Project Description: This project aims to provide insights from high-speed, point-on-wave (POW) measurements to grid operators so they can effectively monitor and react to issues brought on by large amounts of inverter-based resources. The project team will develop and demonstrate Wave Apps, a distributed measurement-based platform that will enable a variety of high-value applications by analyzing POW measurements locally within substations. The results of these analyses will be streamed to the platform's central component for coordination, alarming, and visualization. This will provide operators with insights needed to integrate larger amounts of renewable resources while advancing secure and economic operation and reducing environmental impacts of electricity generation.

DOE OPTIMA FOA Topic Area
3:
Rapid System Health and Risk
Assessment Tools for Grid
Operators
(ASU)

SRP Participation: Demonstration Utility; Primary Investigator: Arizona State University (ASU)

Project Title: DASH-IBR: Dynamic Assessment of System Health for IBR-dominant Power Systems

Project Description: This project aims to develop and demonstrate real-time tools for bulk power systems that have large amounts of inverter-based resources. These tools will help to identify emerging security risks and unstable system dynamics, provide complete situational awareness, and recommend mitigation solutions. This work is enabled by an advanced analytics engine that ingests large amounts of data from wide-area phasor measurement units, digital fault recorders and relays, and energy management systems. The real-time monitoring, analysis and operator-support tools will be demonstrated in an operational utility environment with real-time data. This project has the potential to enhance the reliability, stability, and security of power systems that run mostly on inverter-based resources.

Detection and Analysis of Sub
Synchronous Oscillations in
Power Systems with High
Penetration of Inverter Based
Resources

SRP Participation: Advisor / Data Support

Project Description: The goal of this project is to detect SSOs in the SRP power system with high penetration of IBRs. The approach proposed is to utilize impedance/admittance methods to detect the presence of SSOs and use a combination of synchrophasor and POW metered measurements to assess candidate frequencies at which SSOs are likely to occur and utilize this frequency information in the impedance/admittance methods to ascertain the occurrences of SSOs

Institution Participants: ASU (SRP/ASU Joint Research)

Duration: 1 year

Questions?

