Energy Storage Demonstration Team Fielded-System Data Collection




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Org. 8811 – Energy Storage Technology & Systems

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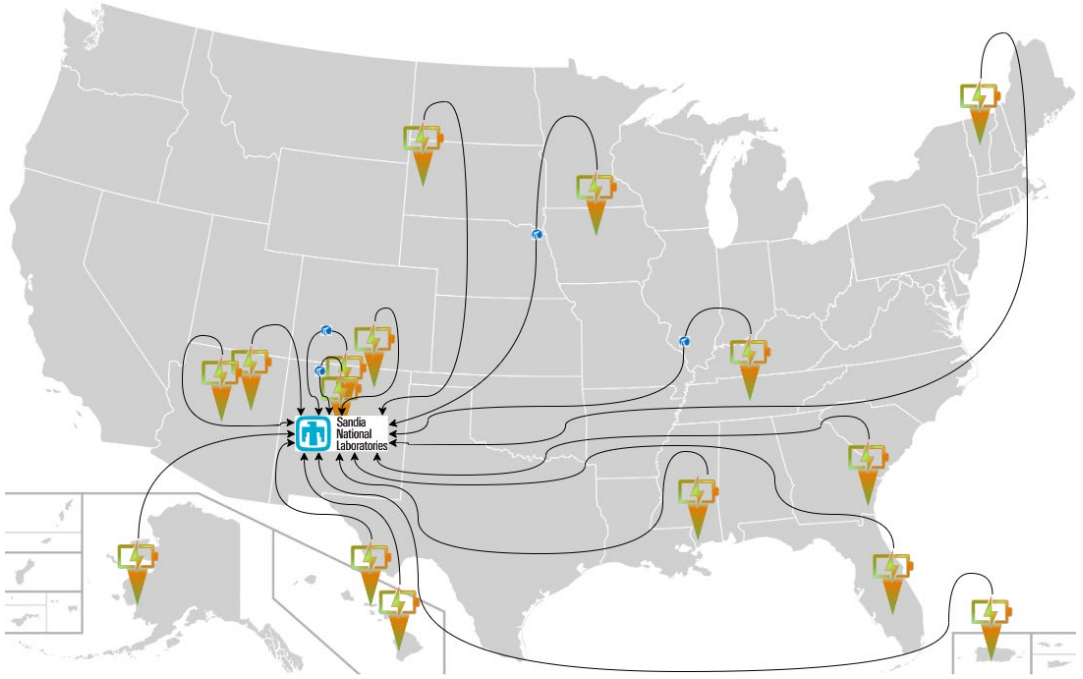
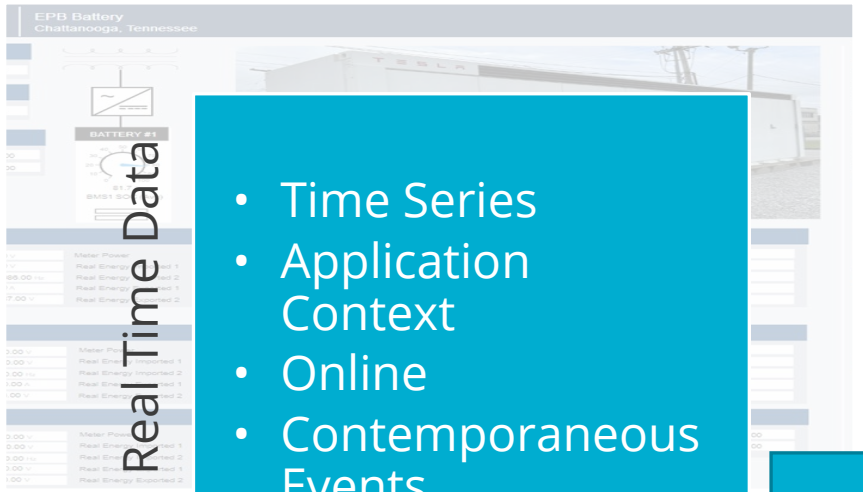
ESS Demonstrations Data Collection

- Multiple ES deployments across US of various scales
- Wide-ranging environmental conditions
- Varied ES technologies (Li-ion, flow, etc.)
- Different dispatch applications (resiliency, demand reduction, etc.)



GOAL: Collect data from deployed battery energy storage systems, share data with stakeholders and interested parties, and leverage analytics & current models to better understand the operation of these systems in the field.

Overview of Data Collection



Real Time Data

- Time Series
- Application Context
- Online
- Contemporaneous Events

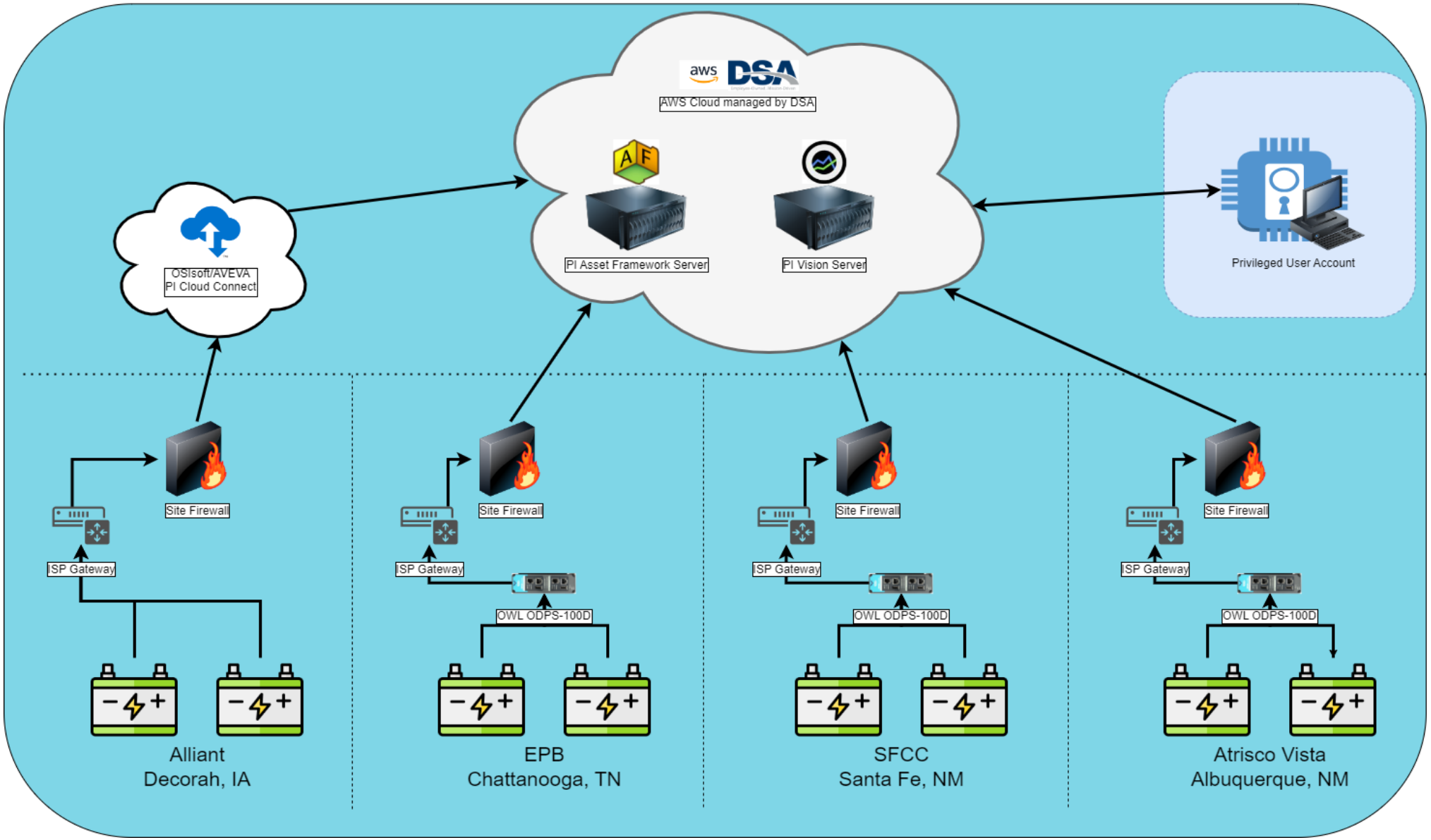
Retrospective

- Time Series
- Application Context
- Offline
- Historical Events

Sandia Demonstration Team Data Collection

Analysis

Real-time data collection (PI System) architecture



Cyber Security Data Diode

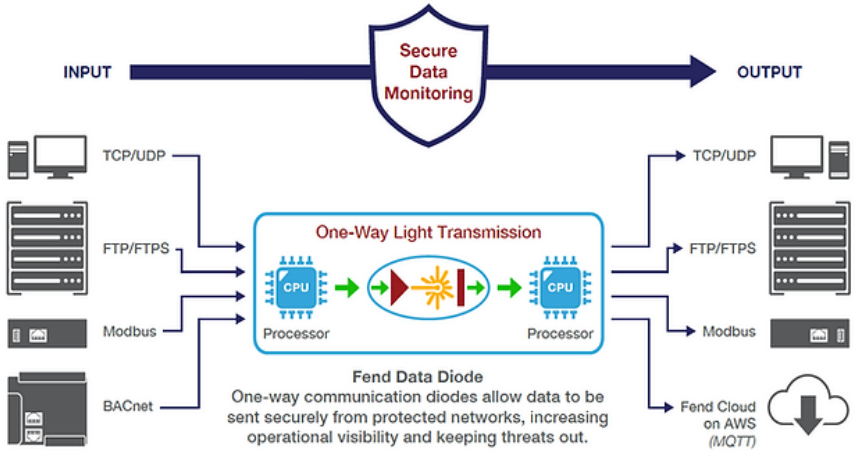


Image Credit: Fend, Inc.

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Image Credit: Owl Cyber Defense

Cyber security is critical

- **Enables file transfer, real-time data streaming, database replication, remote monitoring of IACS**
- **Uni-directional gateway provides secure monitoring & data transfer**
- **Physical “air-gap” or “valve” to protect client (trusted) network**
- **Supported Protocols: ModBus, MQTT, FTP, TCP, UDP, BACNet**

Network Cyber Security

Firewall

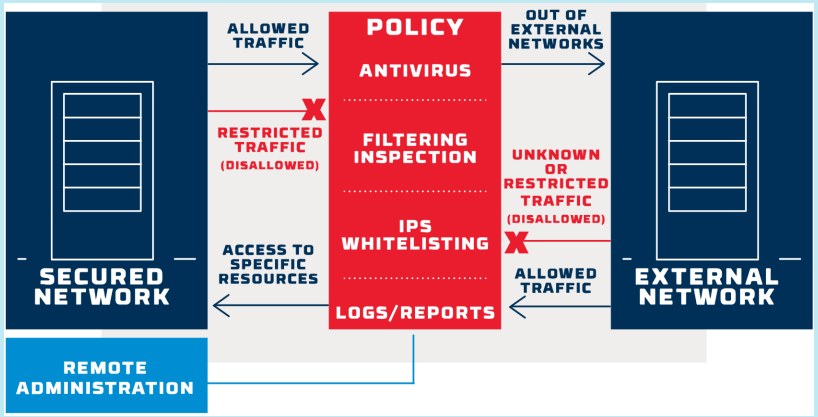


Image Credit: Owl Cyber Defense

- OSI Layer 3 (Network) or 4 (Application) Device
- Bi-directional data transfer
- Can be physical, software, or virtual

VS

Data Diode

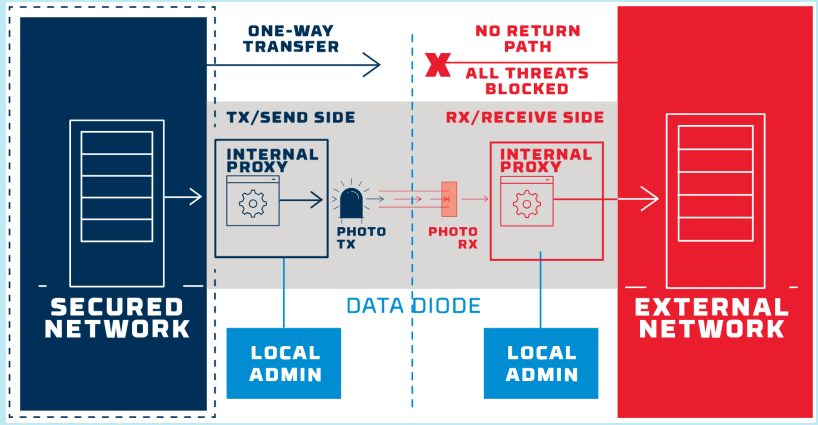
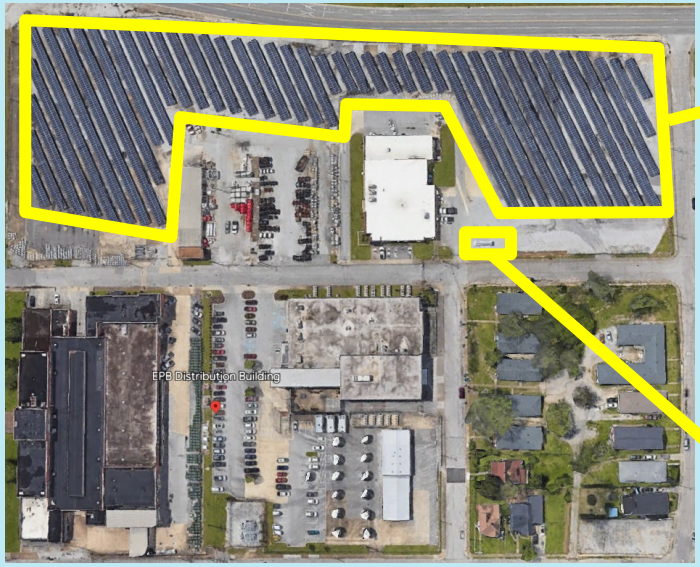


Image Credit: Owl Cyber Defense

- OSI Layer 1 (Physical) Device
- One-way data transfer
- Can be used in conjunction with cybersecurity devices on other layers (firewall, IDS/IPS, etc.)

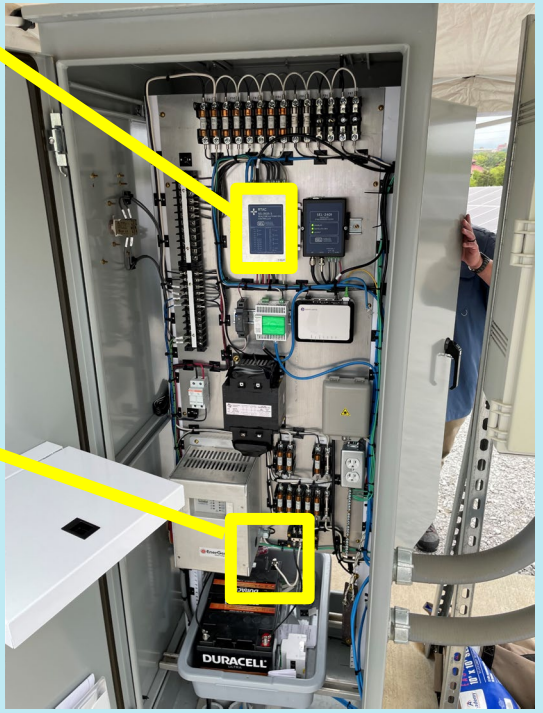
EPB Chattanooga Diode Installation



1.4 MW Community Solar Field

Data Diode

Real-time Automation Controller (RTAC)



Tesla Megapack Battery

Site Firewall

AVEVA (formerly OSISoft) PI System

- Historian/Visualization (PI Vision)
- Storage (PI Data Archive)
- Organization & Digital Engineering (PI Asset Framework)
- Add-ons available for analytics, alerting, digital twin
- Wide adoption in utility industry
- 3rd-party managed (Cloud Service Provider)
- Not open-source
- Challenges exist with on-premises data storage & data extraction

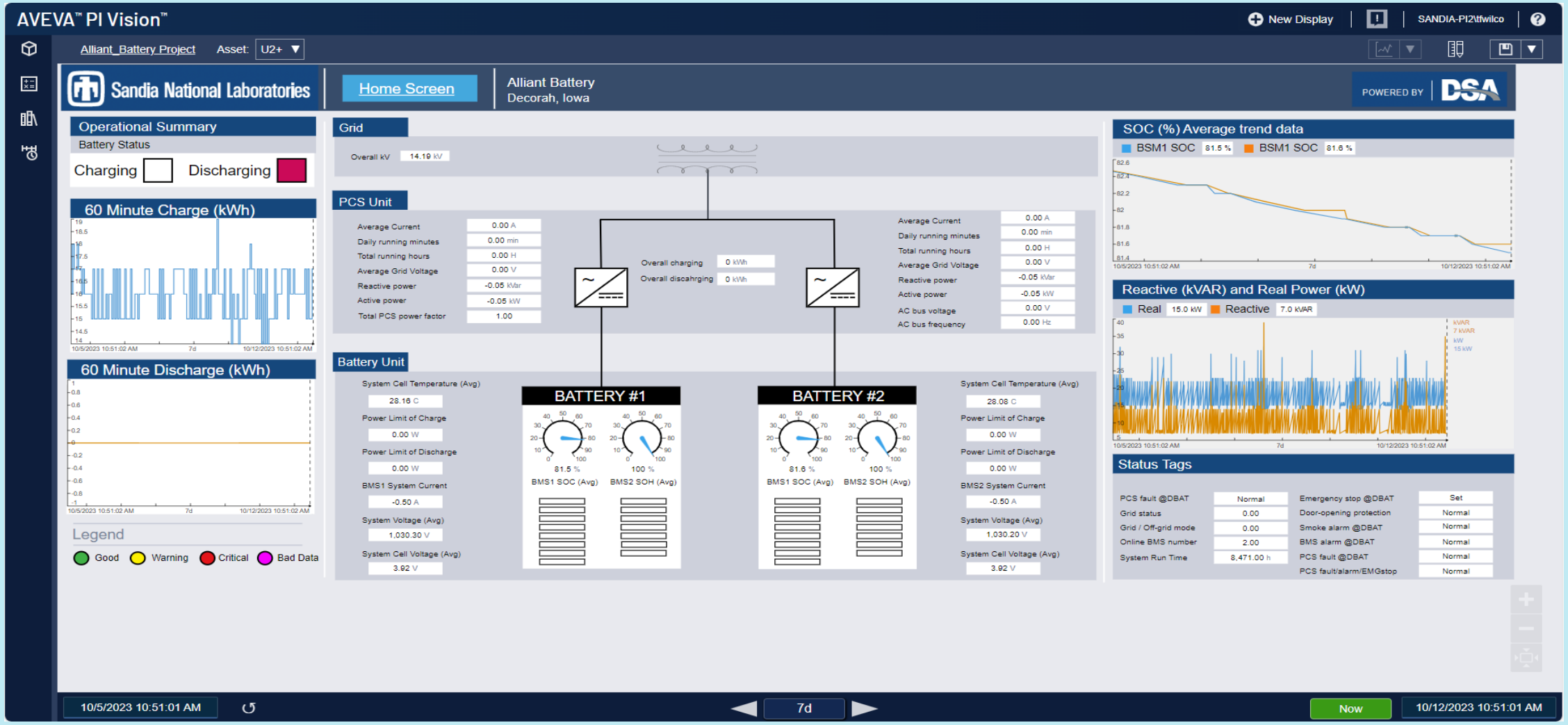
AVEVA

OSIsoft®

DSA

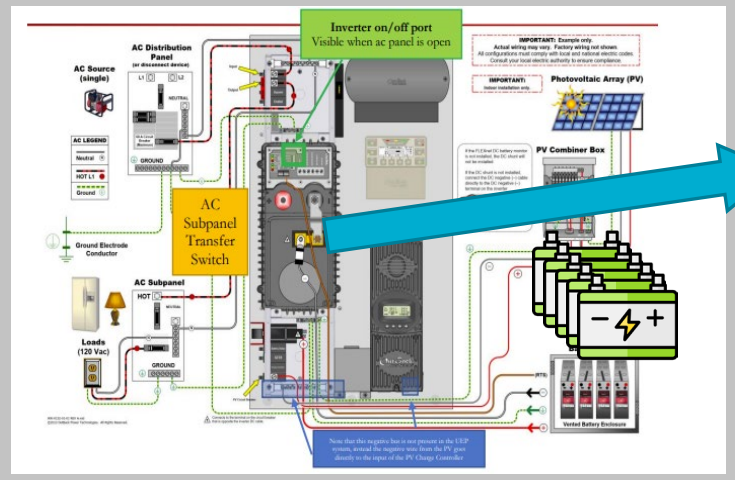
Employee-Owned, Mission-Driven

Alliant Energy Li-Ion BESS Deployment (PI Vision)



Data Collection: Off-grid Zn-MnO2 BESS Deployment

Dilkon, AZ



Single Board Computer (SBC)

Cell Modem

Pearl River, NY

URBAN ELECTRIC POWER

InfluxDB

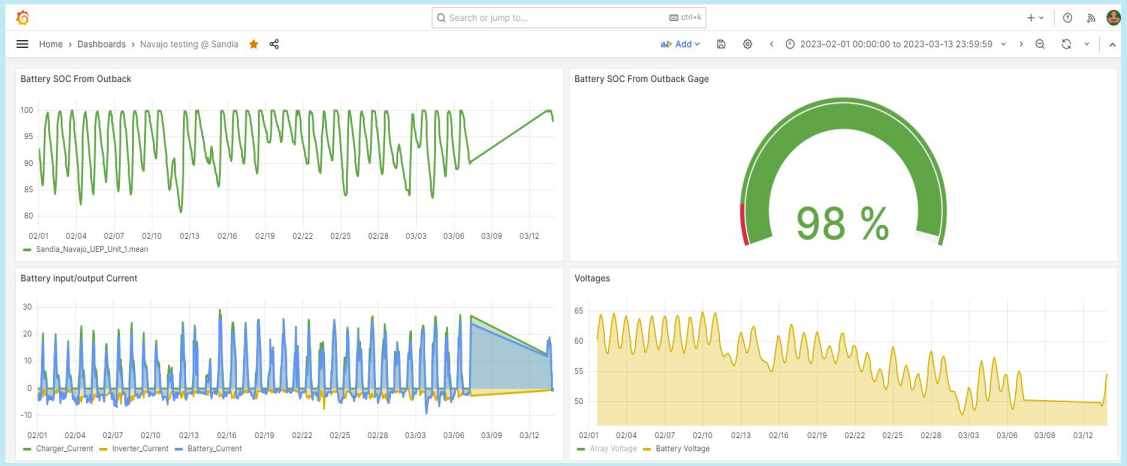
Database

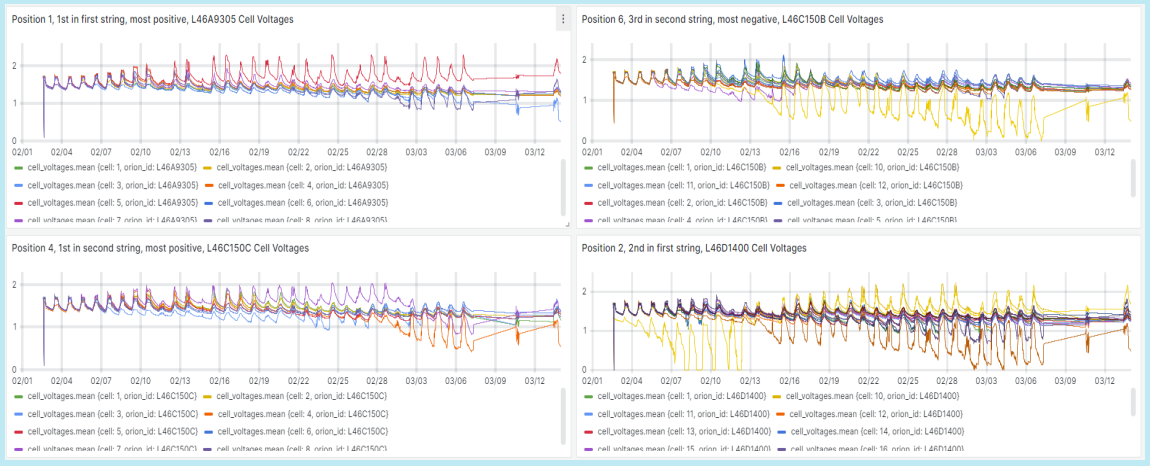
Grafana

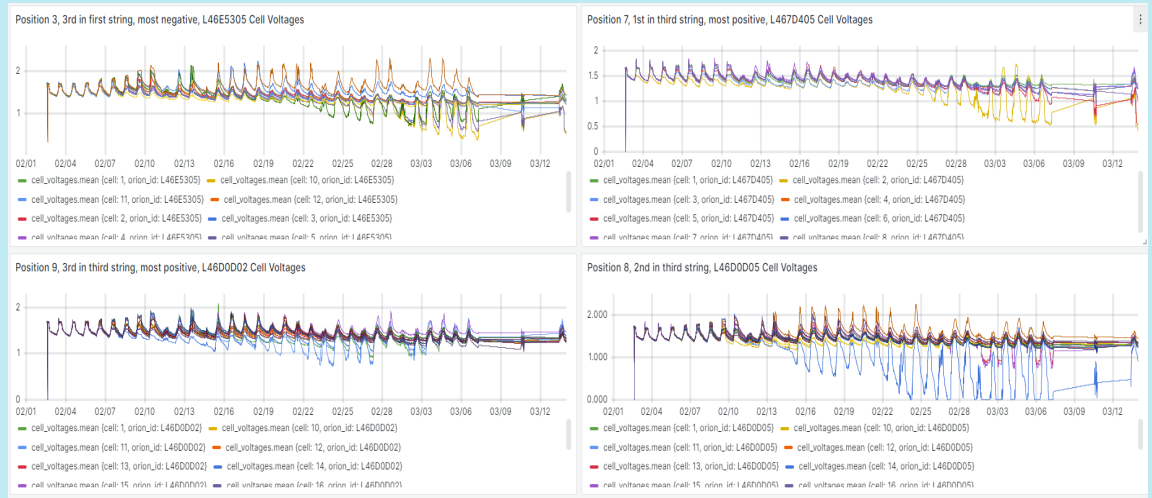
Viz

Data Export

NTUA – Dilkon Zn-MnO2 Deployment (Grafana)







Data Collection Current State

Real time monitoring of 4 deployed Li-ion systems* at BESS system-level using PI software with the following partners:

- Electric Power Board (EPB) Chattanooga
- Santa Fe Community College
- Albuquerque Public Schools (APS)
- Alliant Energy, Madison, WI

Real time monitoring of ZnMnO2 off-grid system- & cell-levels with partners Navajo Tribal Utility Authority (NTUA) and Urban Electric Power (UEP)

International Transmission Company (ITC) Redox Flow Battery (RFB) data

Data Collection Look-Ahead

- More SCADA data from ITC for UET redox flow batteries
- Data from approx. 500 NTUA-deployed off-grid systems
- Exploring data extraction tools available in current PI System environment (PI Web API)
- Creation of a robust data warehouse for RTD as well as historical data
- Development of Deployed System analytics
  - SOC estimation
  - SOH estimation
  - Degradation
  - Failure Prognostication

Thank You

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