AVEVA PI WORLD

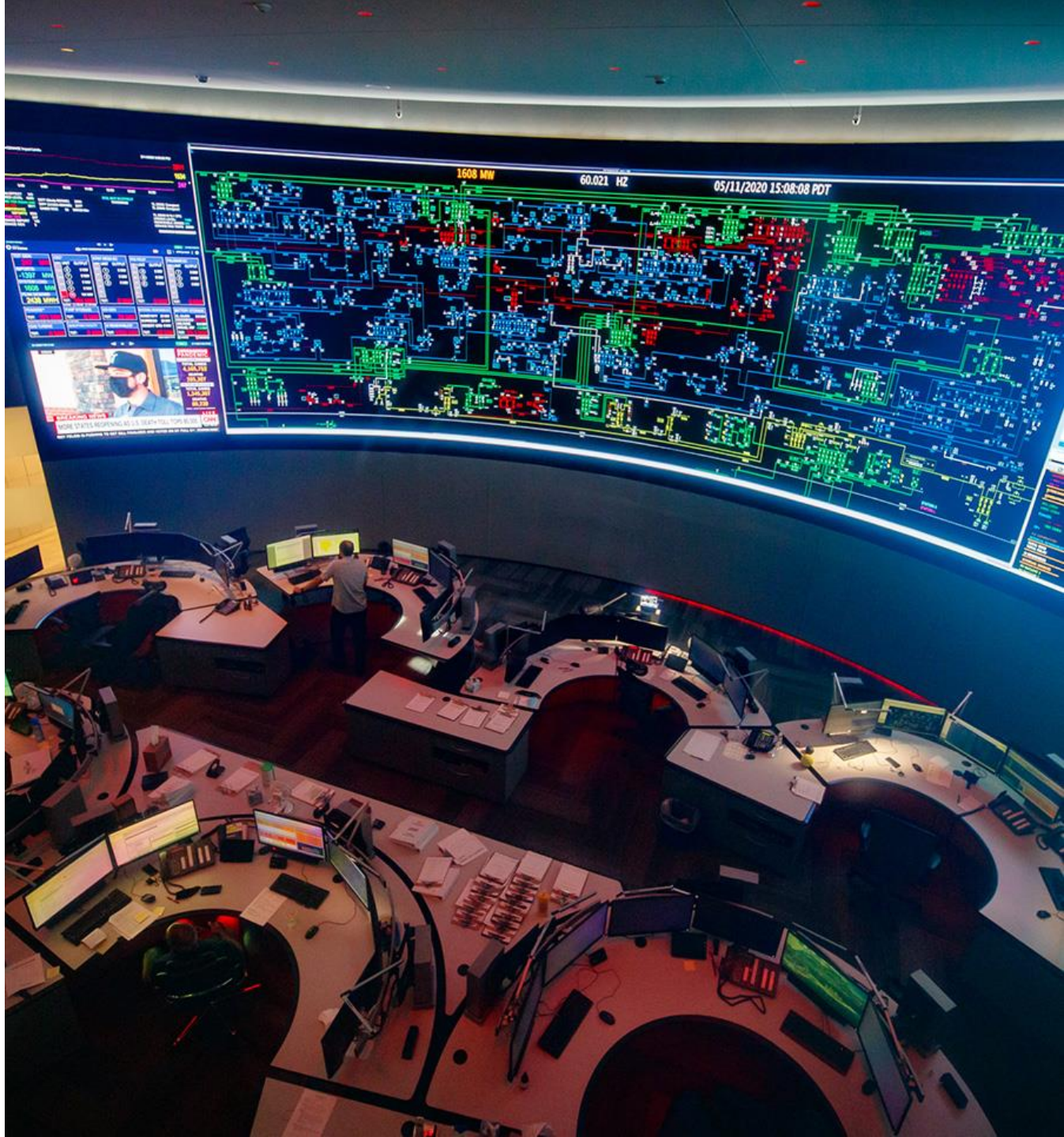
SDG&E Data-Driven Community-Based Approach to Attain Grid Reliability

San Diego Gas & Electric (SDG&E®)

Subbu Sankaran

Kyle Kewley

SDG&E Data-Driven Community-Based Approach to Attain Grid Reliability



Agenda

- Introduction of SDG&E
- Utility Industry Facing New Challenges
- PI System at Sempra Energy Utilities
- SDG&E Enterprise PI System Use Cases
- SDG&E PI New Development
  - Condition-Based Maintenance (CBM)
  - Distribution Energy Resources (DER)
  - Phase Identification
  - Smart Meter - Voltage Exceedance
  - Phase Balance – Real Time & Historical
- OCS Cloud Services
- Conclusion

San Diego Gas & Electric

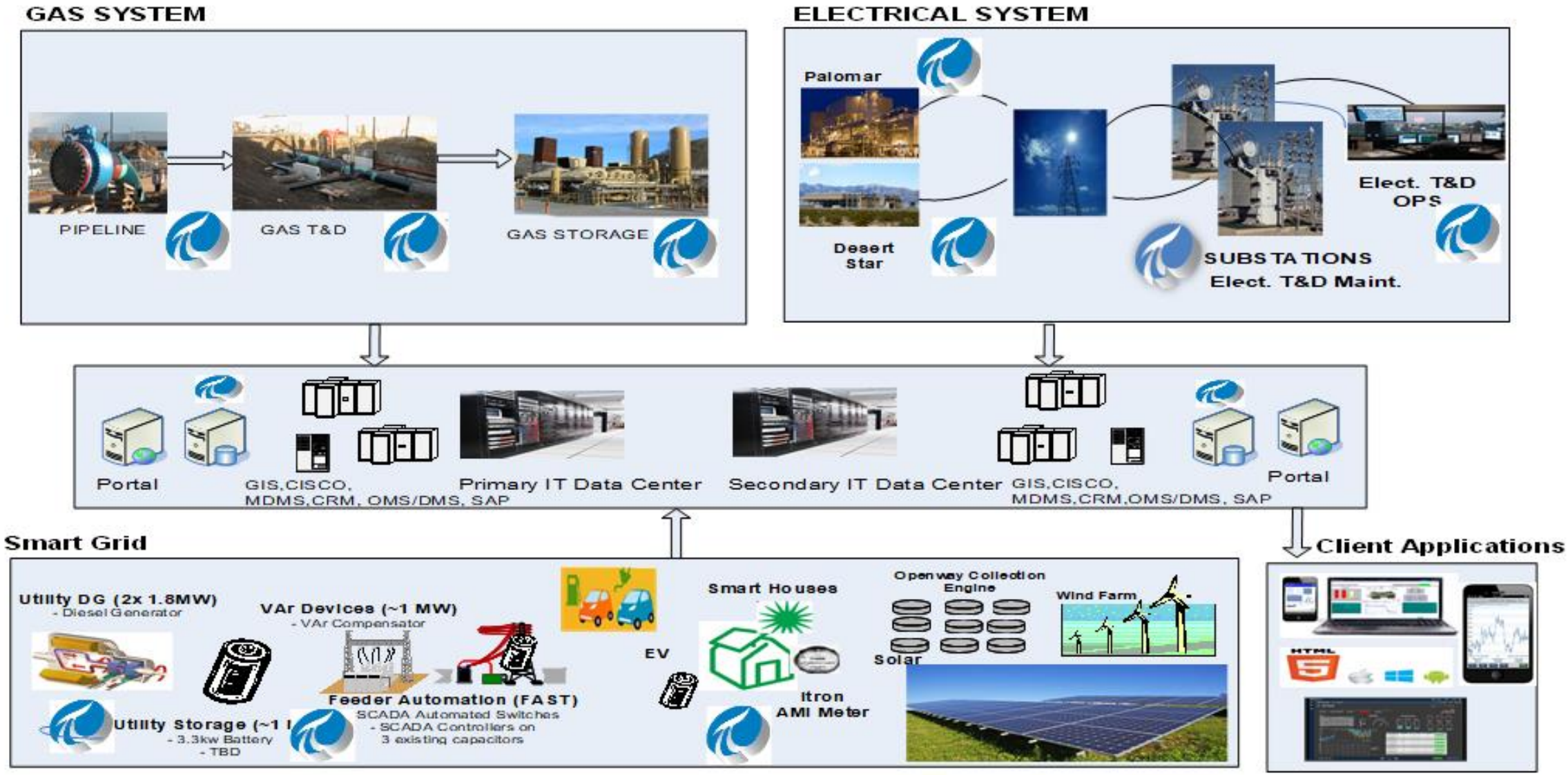
SDG&E is a regulated public utility that provides energy service to **3.6 million** people through **1.4 million** electric meters and **873,000** natural gas meters in **San Diego** and **southern Orange** counties. Our service area spans **4,100 square miles.**

Named “Best in the West” for electric reliability for fifteen years in a row.

Utility Industry Facing New Challenges

- Renewables and Distributed Energy Resources-DER
- Reliability
- DER-Regulation/Legislation
- Increasing Number of Renewables on The Grid
- Net Zero GHG Emissions by 2045
- Cost of PV/Storage Decreasing Rapidly
- Changes from Customer Behavior
- EV Adoption
- California PSPS (Public Safety Power Shutoffs)

PI System at SDG&E



SDG&E Enterprise PI Use Cases

Enterprise Level Monitoring
Operations, Engineering,
EOC-Emergency Operations Center, Planning

Advanced Analytics & Visualization

Business Applications
CBM, OMS/DMS, GIS, SAP
Work & Asset Management (CASCADE)

3rd Party Services
(CBM Doble, SPS, GE Smart Signal)

Enterprise Operations Infrastructure

Generation

Transmission EMS

Substation Data Integration (CBM & PMU)

Distribution Automation

Distribution SCADA

Distributed Energy Resources

Residential Smart Meters

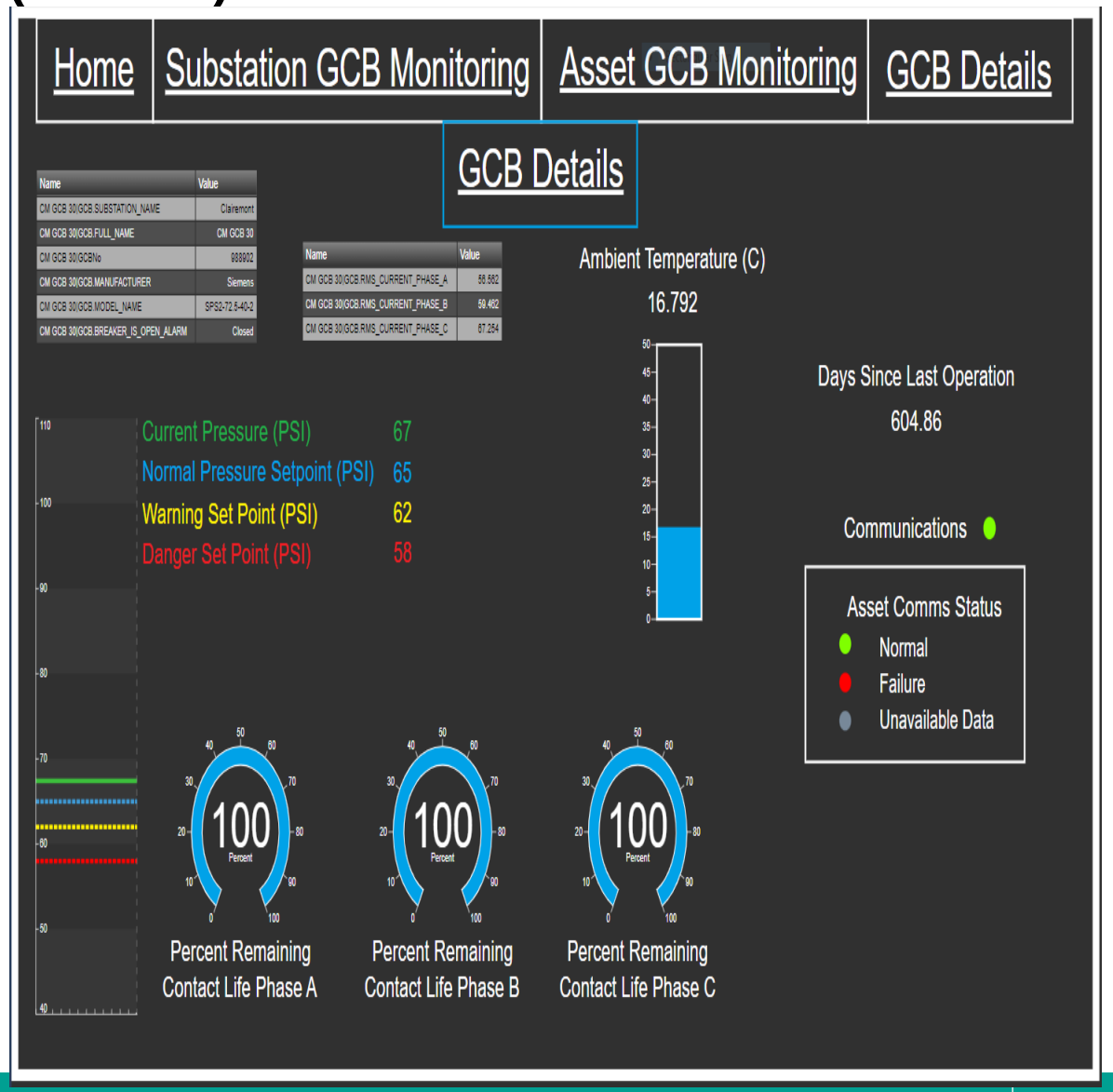
Generation
-Combined Cycle
- Peaker Plants
Renewables
- BESS
- PV Solar
Synchronous Condensers

Grid Application	Advanced Sensing and Measurement Technology
Protection and Control	Line Protection Relay, Transformer Protection Relay, Bus Protection Relay, Circuit Breaker Protection Relay, Feeder Protection Relay
Monitoring & Control	Smart Recloser, Recloser Control, Voltage Regulator Control, Capacitor Bank Control, PQ Monitor, Smart Switch
Asset Condition Monitoring	Dissolved Gas Monitor, Moisture Monitor, Circuit Breaker Condition Monitor, Load Tap Changer Monitor
Fault Indicators and Sensors	Overhead Fault Indicator, Underground Fault Indicator
Metering	Smart Meter, Power Quality Meter, Revenue Meter

Distributed Energy
- Solar
- Wind
Energy Storage
- Batteries
- EV
Microgrids

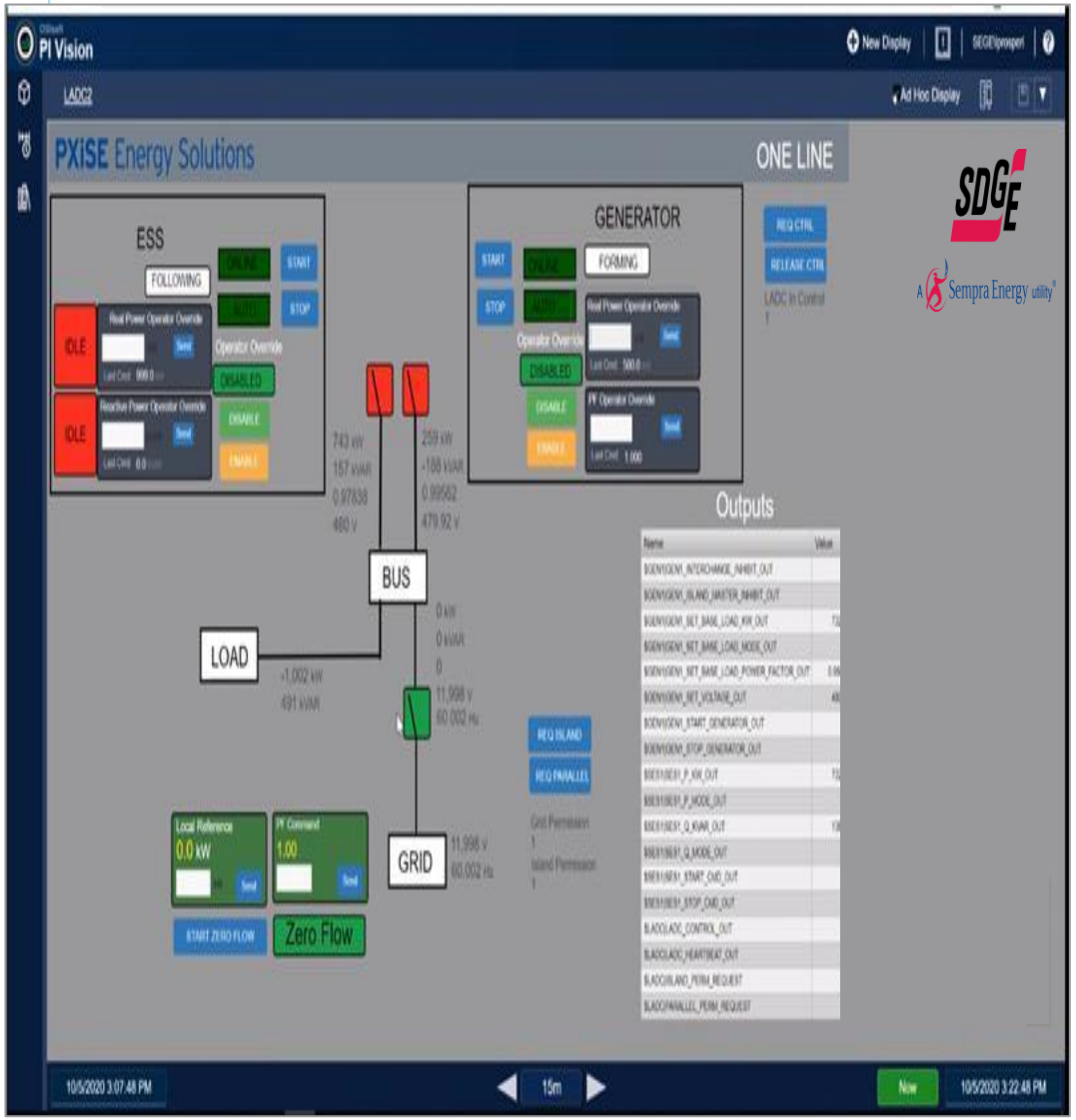
SDG&E PI New Development - Condition Based Maintenance (CBM)

- Extend the useful life and make greater utilization of transmission and distribution substation assets
- Use technology to measure the performance and condition of equipment to make better maintenance decisions
- A maintenance strategy that monitors the actual condition of an asset to decide what maintenance needs to be done
- Over 1,000 GCBs & over 300 Transformers have monitors



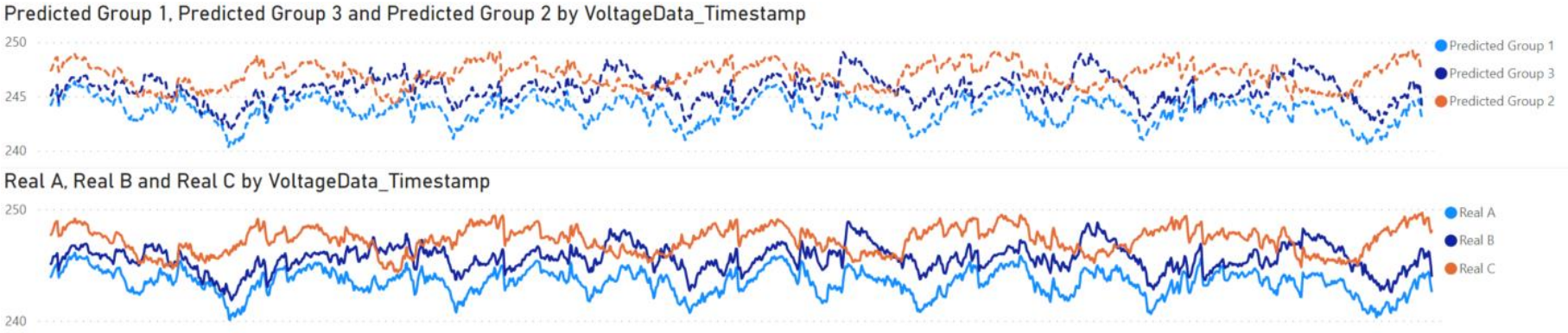
SDG&E PI System New Development - Distribution Energy Resources (DER)

- Integrate and leverage various generation and storage configurations.
- Reduce the peak load feeders and enhance system reliability.
- Enable customers to become more active participants in managing their energy usage.
- PXiSE Energy Solutions (with PI System) has developed an impressive real-time controls solution for LADC (Local Area Distribution Controller aka Microgrid) that enables the integration and management of renewable and distributed energy.



SDG&E PI System New Development - Phase Identification

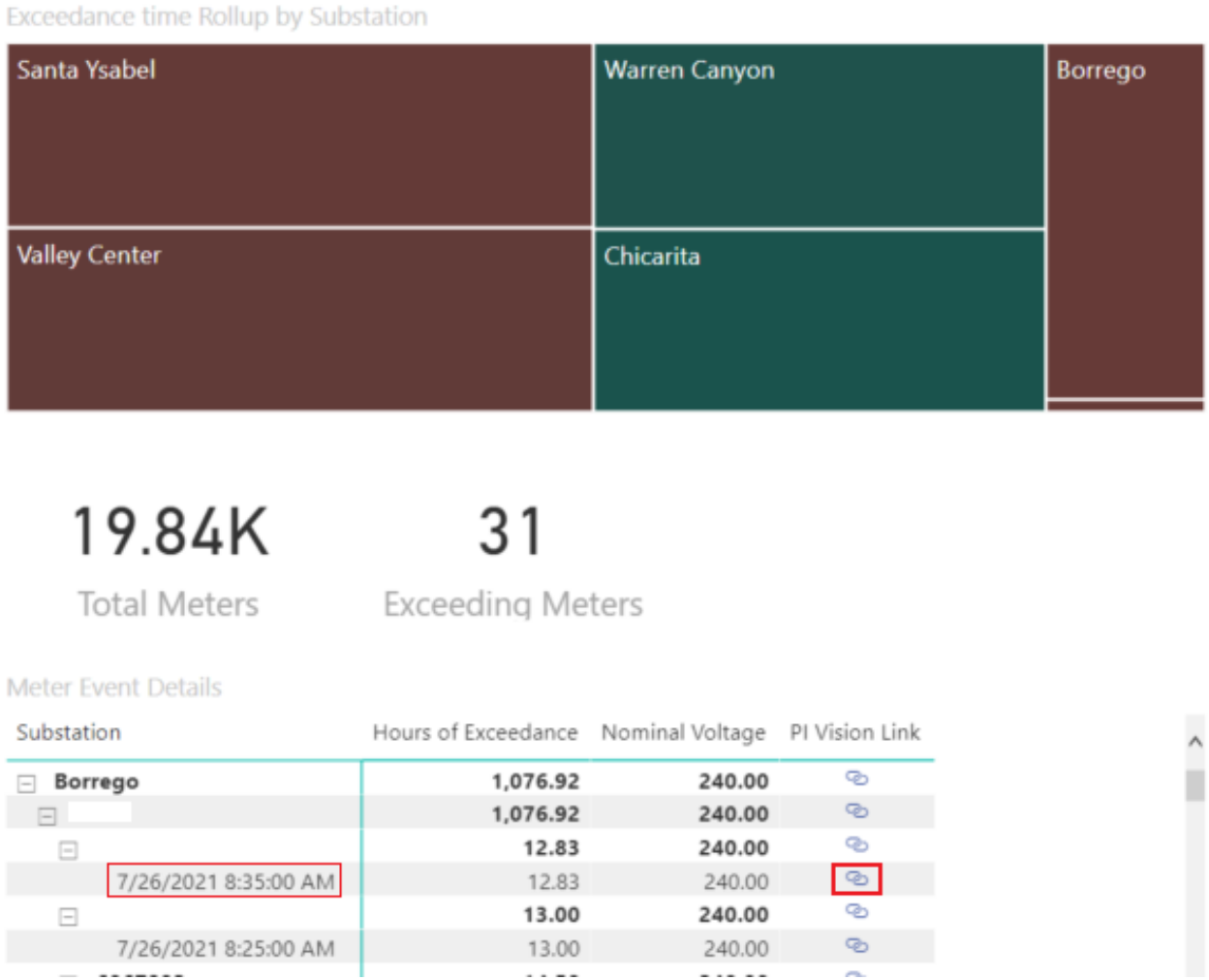
- Using PI AMI interface to ITRON to feed smart meter data into PI System
- Currently collecting voltage data for 100k meters
- Phase ID study focused on two circuits and two meters per transformer
- Used an internally developed script to apply k-means clustering to the voltage data
- Gained knowledge of Phase ID and a baseline to compare results from different vendors
- Resulted in 95% accurate phasing on first circuit, 73% accurate phasing on second



PredictionPhase	TruePhase	Count of prediction
A	A	235
A	B	11
A	C	3
B	A	1
B	B	269
C	A	13
C	B	7
C	C	237
Total		**776**

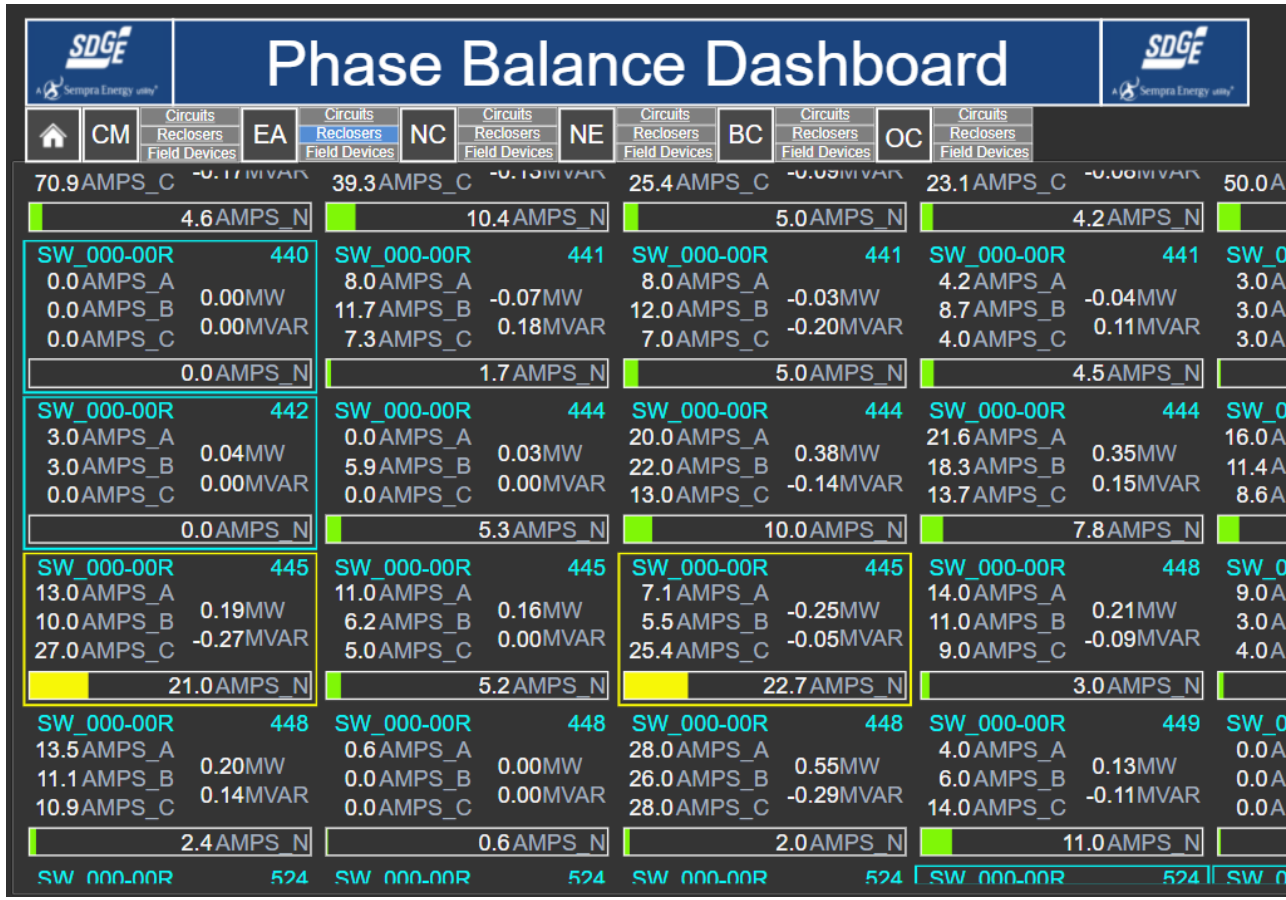
SDG&E PI New Development - Smart Meter Voltage Exceedance

- Using the voltage data loaded in PI System further analysis is done to identify voltage exceedance events
- Events consist of consecutive meter voltage readings exceeding a threshold
- Power BI dashboard created to analyze meters, transformers, and circuits with voltage compliance issues
- Quarterly report created for each district to allow district engineers to act based on the voltage data
- Links from dashboard to PI Vision for further event analysis
- Data also used for compliance reporting to CPUC



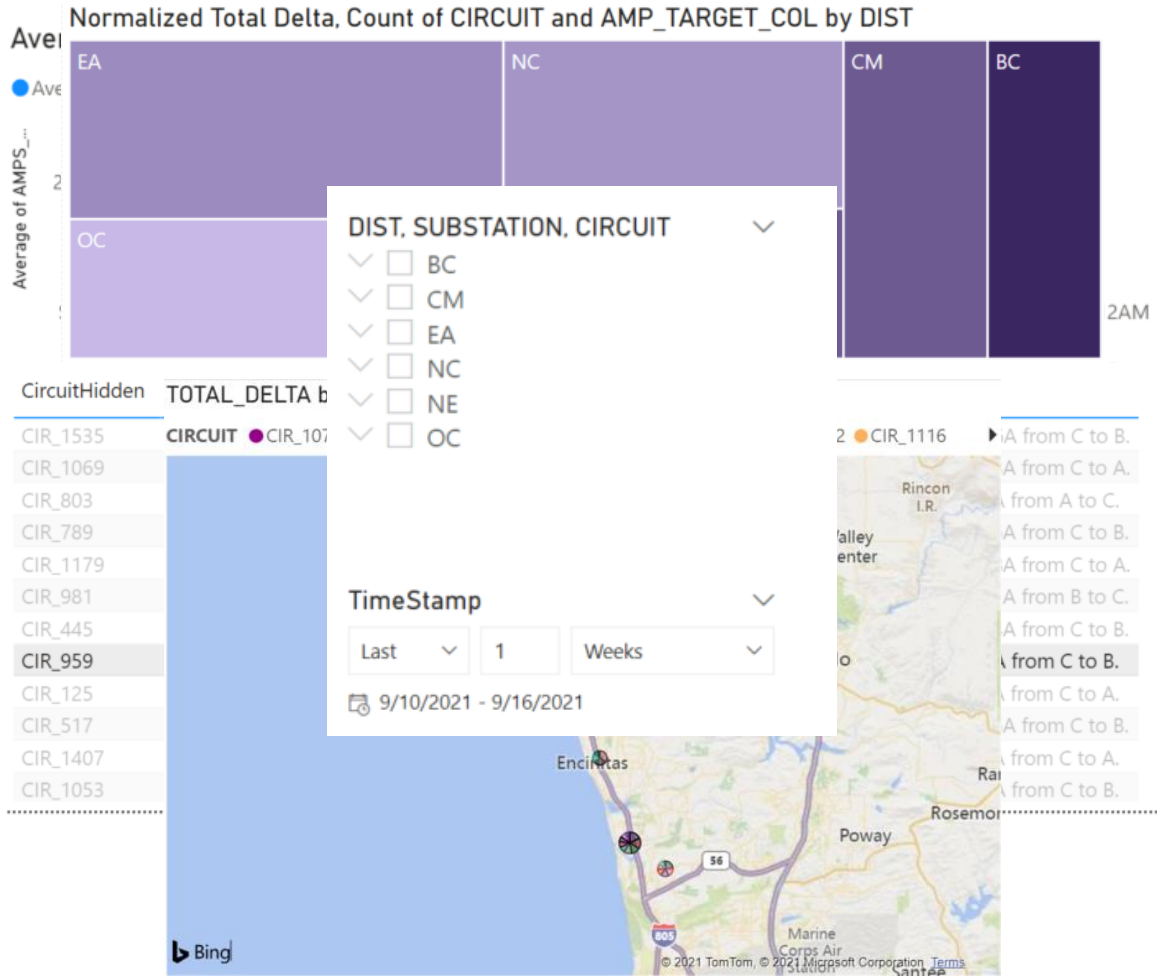
SDG&E PI New Development - Phase Balance (Real-Time)

- Dashboard requested by System Protection Engineering group to view phase balance and neutral current on circuits
- Multi-state symbols change color based on AMPS_N
- Developed screens for circuits, reclosers, and other field devices in each district



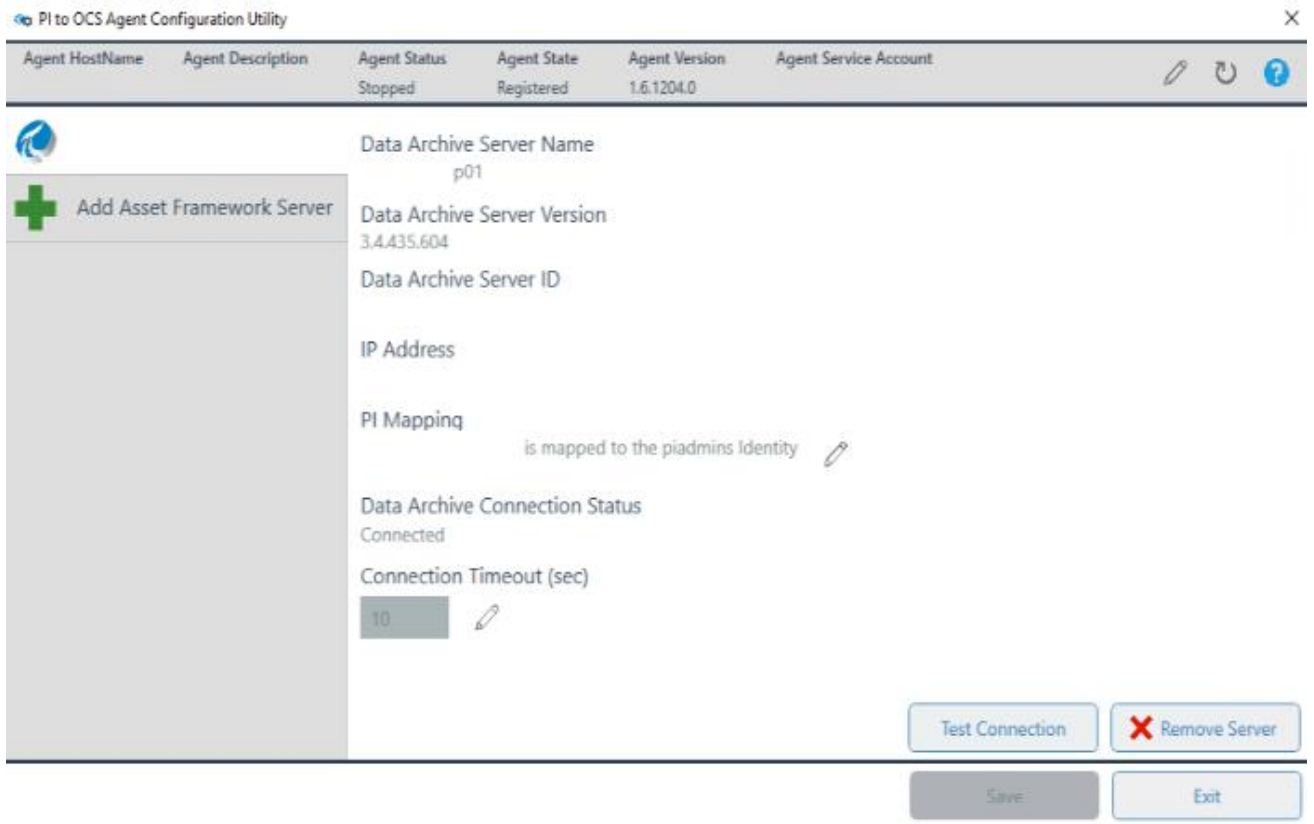
SDG&E PI System New Development – Phase Balance (Historical)

- Used PI BA Integrator for Business Analytics to push circuit and recloser load data to SQL
- Aggregate phase unbalance over time to show consistent issues
- Calculate a “Correction Text” explaining load changes that would correct the unbalance over the selected time range
- Additional visuals include treemap for aggregating unbalance based on circuit, substation, and district
- Map visual to provide geospatial context
- Various slicers to view data within a specific time range or area



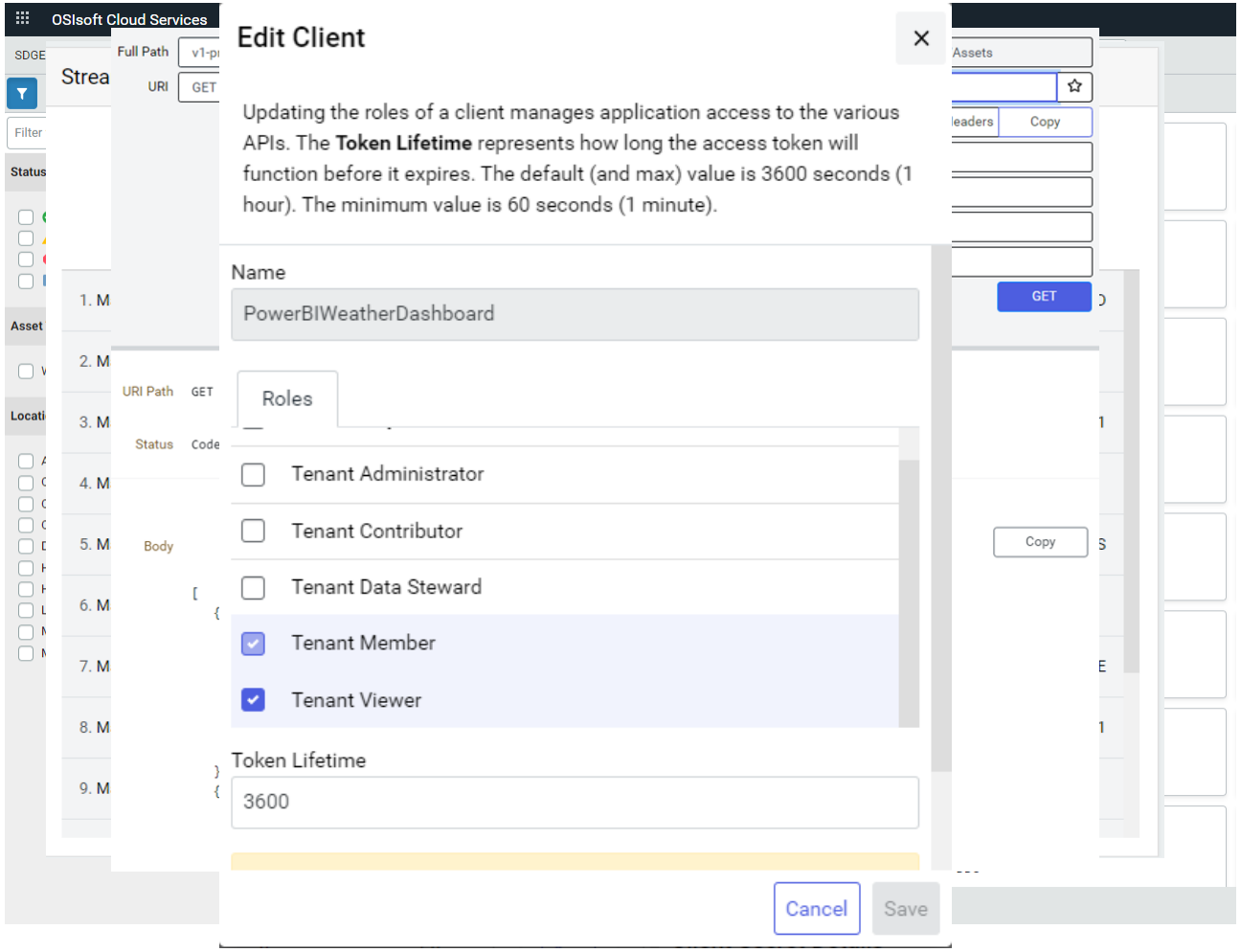
OCS Cloud Services

- Had the opportunity to participate in OCS Lighthouse to support Emergency Operation Center (EOC) cloud migration for internal and external community data sharing
- Sent weather data from PI System to OCS and tested the functionality/capabilities of the system
- Used the configuration utility to select which data points from PI System to push to OCS
- Sent about 4k points that update every 10 minutes
- Backfilled the data for 12 years to include our full weather data history



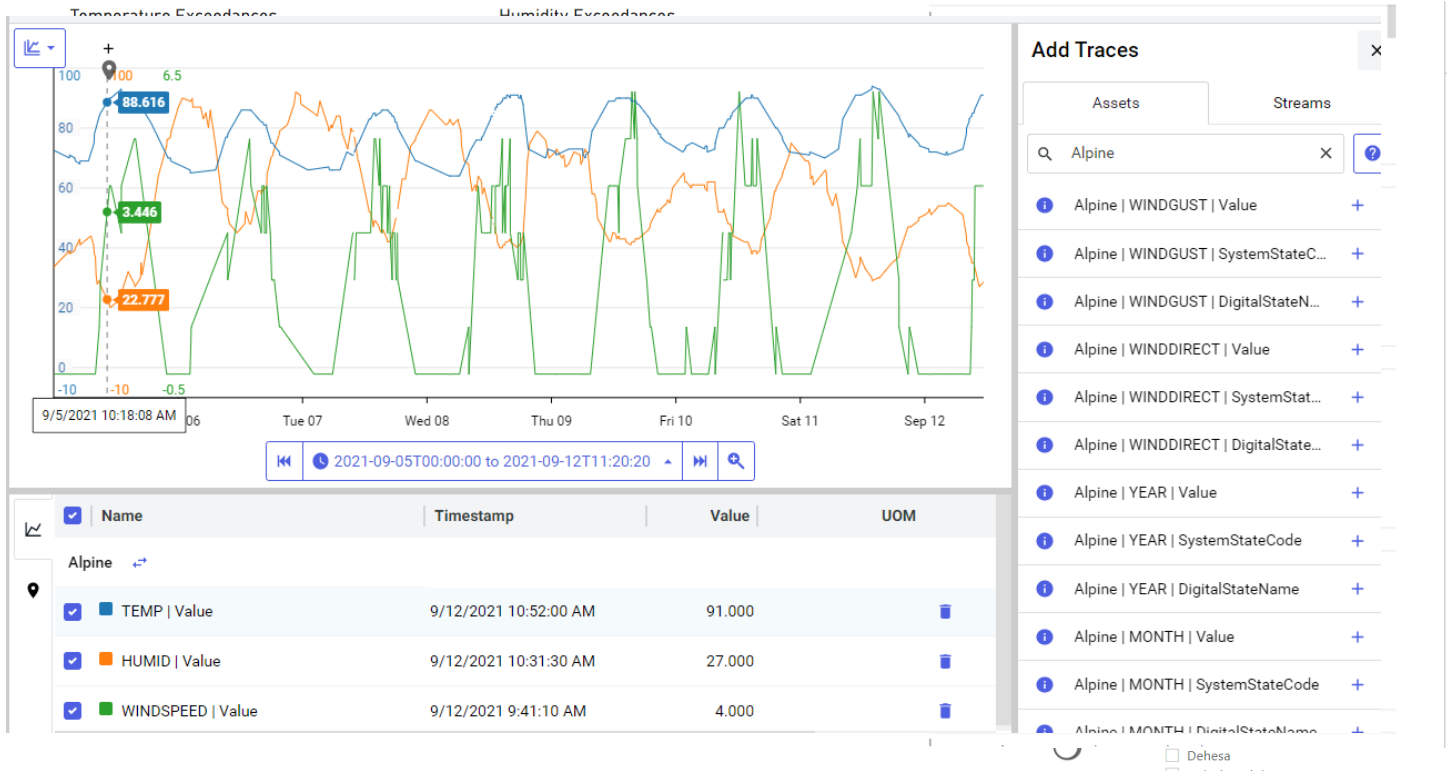
OCS Experience

- Like PI AF we can organize our data streams into assets based on a template
- Using a token mapping tool within OCS, we can split apart our tag names into a pattern and organize the stations
- We used the API tool interface to load additional metadata into OCS that was required for our dashboard
- Generated a token for PowerBI to read weather data from OCS



OCS Power BI Dashboards

- Used a PowerM query within Power BI to pull data into Power BI
- Query uses the OCS API to generate a token and then to pull data for a specified time range
- The JSON response is formatted into a table using native Power BI functionality
- By using incremental refresh, we can load the data in one day at a time instead of reloading 13 years of data each day
- Also created a dashboard to pull the snapshot value from each weather station
- Liked out to OCS to get details from the selected station

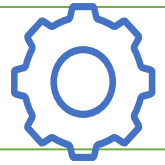


OCS Impressions and Takeaways

- Learned a lot by working on this project
- OCS interface is very polished and well documented
- New features have been added frequently
- Would like to see a better integration to bring in Metadata or some connection to PI AF
- Would like to see more PI Vision-like display building features in the OCS visualization
- One of the easiest to navigate API Consoles ever used (autocompletion, endpoint documentation, any HTTP method in the UI)

Conclusion

Challenge

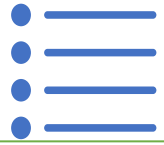


- Maintain reliability and increase data availability, visibility and values for critical events such as during fire season
- Meet sustainability goals by increasing renewable & DER and reducing company owned data center footprint
- Provide a long-term platform for future data sharing with internal entities, external public organizations and communities

Solution

- Continue expanding enterprise PI System footprint horizontally and vertically
- Develop innovative applications with PI System data, such as integrating with Power BI for advanced visualization/analytics
- Adopt PI System-based solutions such as for DER to bring more values and synergies within company

Benefits



- Utilize the unified PI System data platform and self-service visualization tools familiar to user communities
- Embrace data-driven approach for all application/solution development
- Pave a path to increase sustainability and achieve corporate and state carbon emission goals

Subbu Sankaran

IT Solutions Architect

- San Diego Gas & Electric
- SSankaran@sdge.com

Kyle Kewley

Senior Software Developer

- San Diego Gas & Electric
- KKewley@sdge.com

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

linkedin.com/company/aveva

@avevagroup

ABOUT AVEVA

AVEVA, a global leader in industrial software, drives digital transformation for industrial organizations managing complex operational processes. Through Performance Intelligence, AVEVA connects the power of information and artificial intelligence (AI) with human insight, to enable faster and more precise decision making, helping industries to boost operational delivery and sustainability. Our cloud-enabled data platform, combined with software that spans design, engineering and operations, asset performance, monitoring and control solutions delivers proven business value and outcomes to over 20,000 customers worldwide, supported by the largest industrial software ecosystem, including 5,500 partners and 5,700 certified developers. AVEVA is headquartered in Cambridge, UK, with over 6,000 employees at 90 locations in more than 40 countries. For more details visit: www.aveva.com

AVEVA