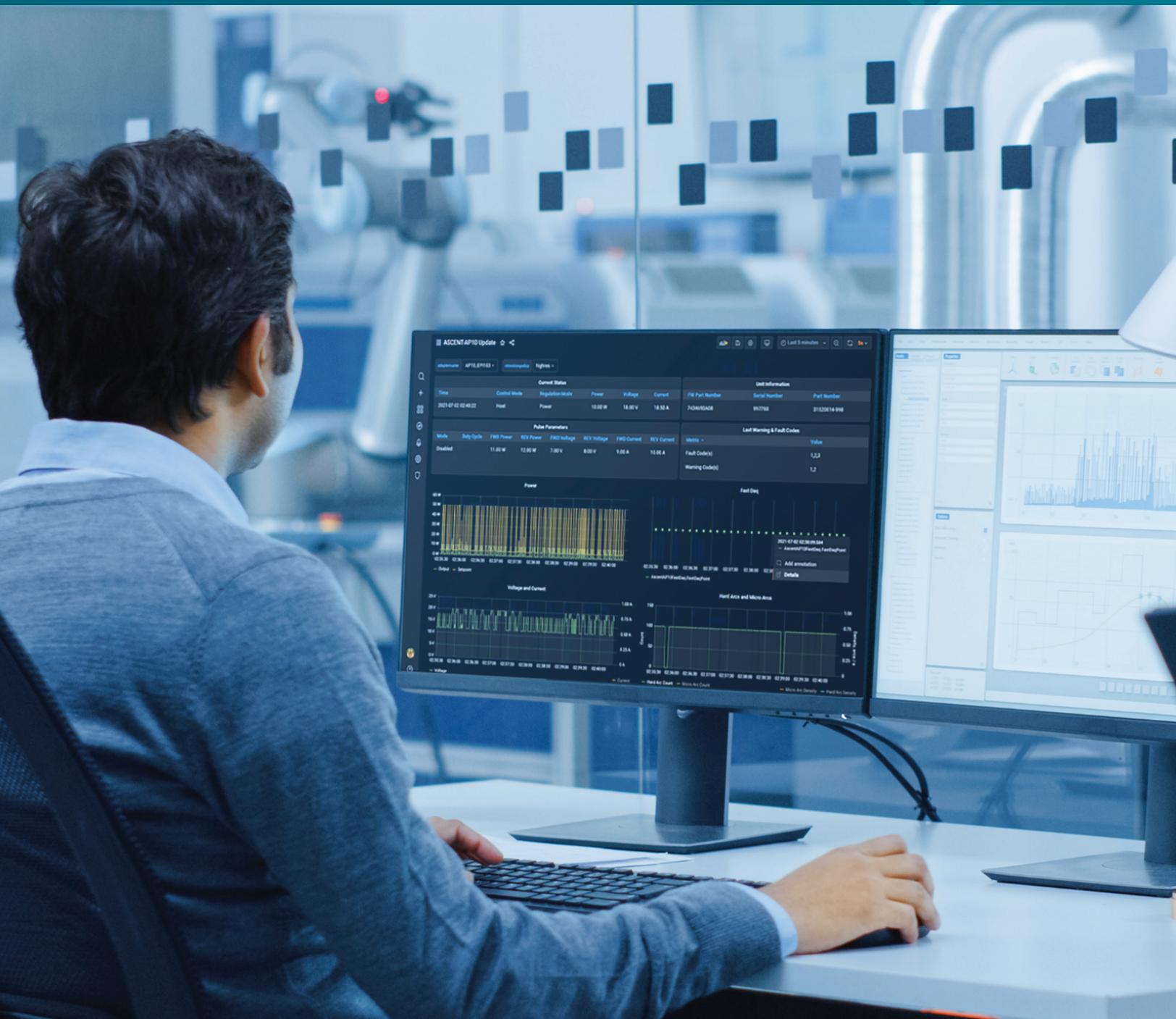


POWERINSIGHT BY ADVANCED ENERGY™ DATA ACQUISITION AND ANALYSIS PLATFORM

OPTIMIZE POWER DELIVERY SYSTEM PERFORMANCE
WITH IOT-ENABLED INTELLIGENCE





AE's IoT solution provides a window into device performance.

This independent, plug-and-play platform enables interaction with rich data sets via a web browser.

PowerInsight by Advanced Energy™ Data Acquisition and Analysis Platform

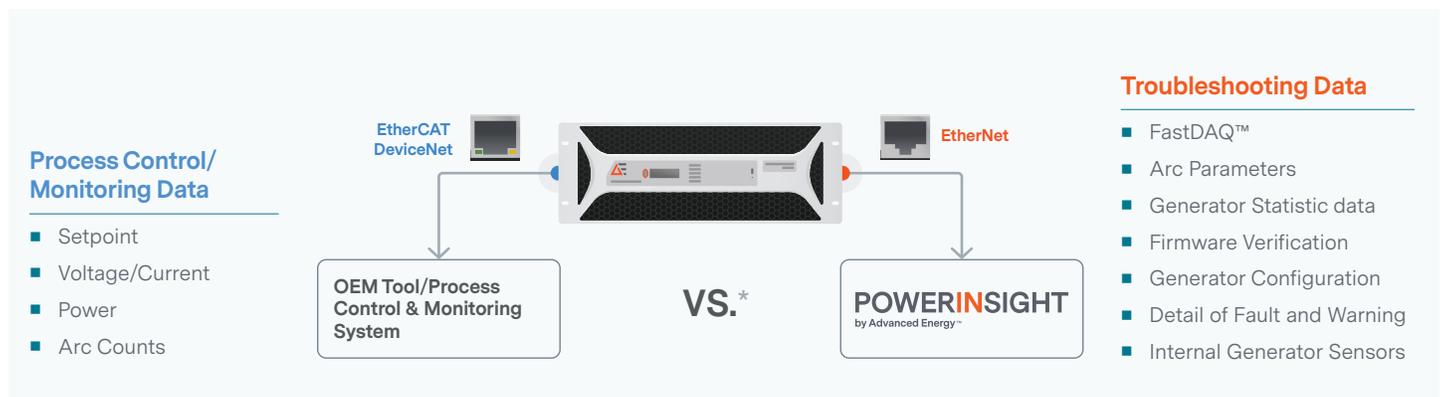
AE's IoT solution acts as a flight recorder, capturing AE power delivery system performance data — including configurable onboard oscilloscope data in nanoseconds for critical events. By reducing "no problem observed" returns and troubleshooting turnaround time, it improves key measures of operations success such as OEE.

BENEFITS

- Reduced "No Problem Observed" returns and faster troubleshooting turnaround
- Reduced need to open chamber to install an oscilloscope
- Continuous, long-term data collection
- Plug-and-play operation
- Actionable insights and data-driven decision making
- Cybersecurity

FEATURES

- Auto-reconnect after generator power cycle
- Configurable onboard oscilloscope data recording in nanoseconds for critical events (FastDAQ™)
- Comprehensive list of data fields for troubleshooting, unit health monitoring, and correlation analysis
- Real-time and historical data access via web browser without installing software
- Customizable dashboards
- Tailor-made algorithms based on AE's decades of experience
- Virtually unlimited historical data storage



*Using DC power supply as an example for comparison

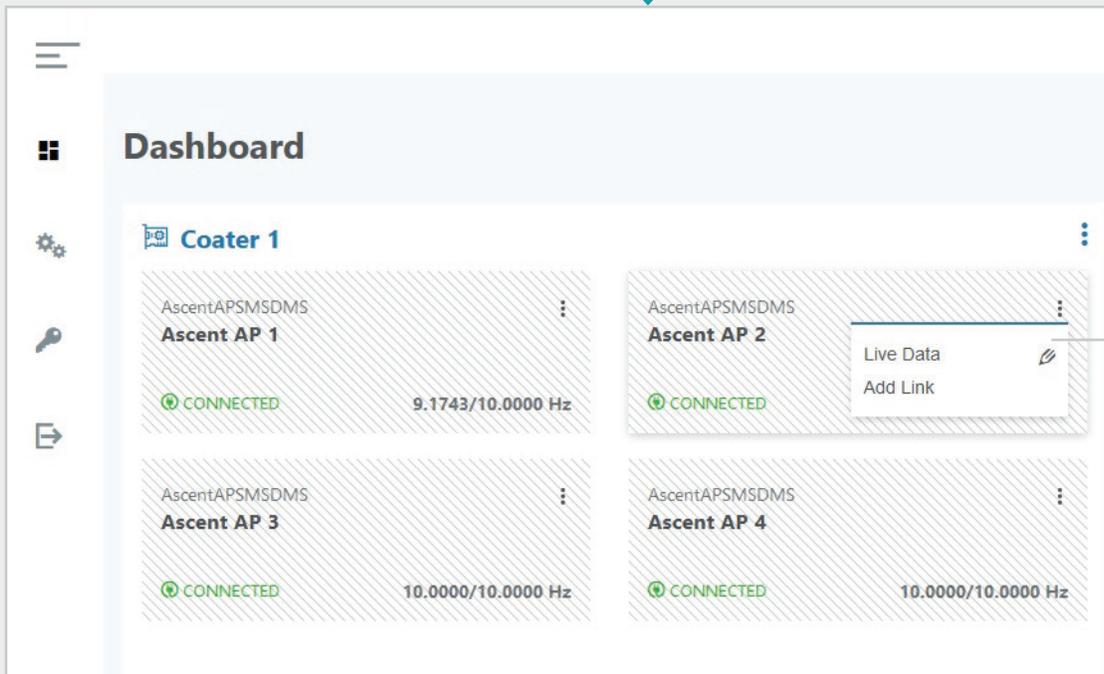
LANDING PAGE

WHERE THE USER EXPERIENCE STARTS

- Users access data on a web browser without installing any software.
- All data is saved locally; easily navigate real-time and historical data for unit-to-unit and tool-to-tool condition monitoring.



Different credentials for viewer, editor, and admin



New browser tab shows selected dashboard data.

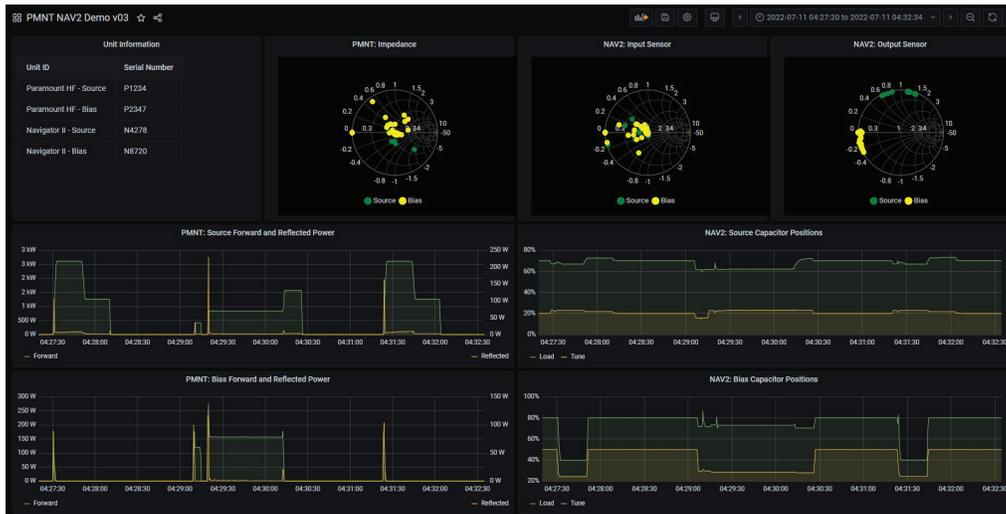
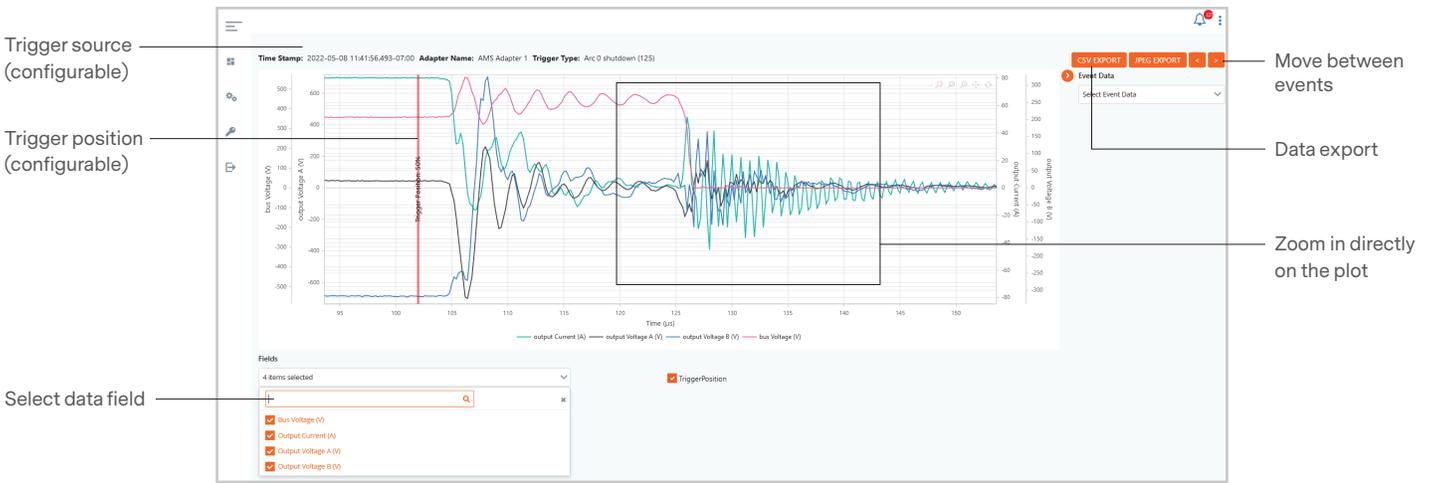
CUSTOM DASHBOARDS

DEFINE YOUR OWN WAY TO INTERACT WITH DATA

Securely interact with rich data sets via browser-based custom dashboards:

- Up to 40 MHz event visualizer and recorder (FastDAQ™)
- Multiple target-unit connectivity for crew performance monitoring
- Cybersecure data control; customer exclusively controls data with local or remote access
- Access to real-time and historical data without the need to install software on user's computer
- Customizable monitoring views using interactive query builders
- Customizable alerts for user-defined conditions
- Virtually unlimited historical data storage





Example custom dashboard for monitoring match network and RF generator data with Smith chart:

Aggregate data from different target units on the same dashboard for process monitoring, unit-to-unit comparison, and tool-to-tool comparison.



Construct a custom panel via a query builder: Choose which parameters to analyze; Apply mathematical methods, such as max, min, average, total, etc. to parameters; Choose visualization, such as Smith Chart, Bar gauge, Table, Graph, Stat, etc; Overlay data from different target units, and more.

Set up custom alerts; for example, receive email notifications when parameters go beyond a defined threshold.

PowerInsight Troubleshooting and Diagnostics Case

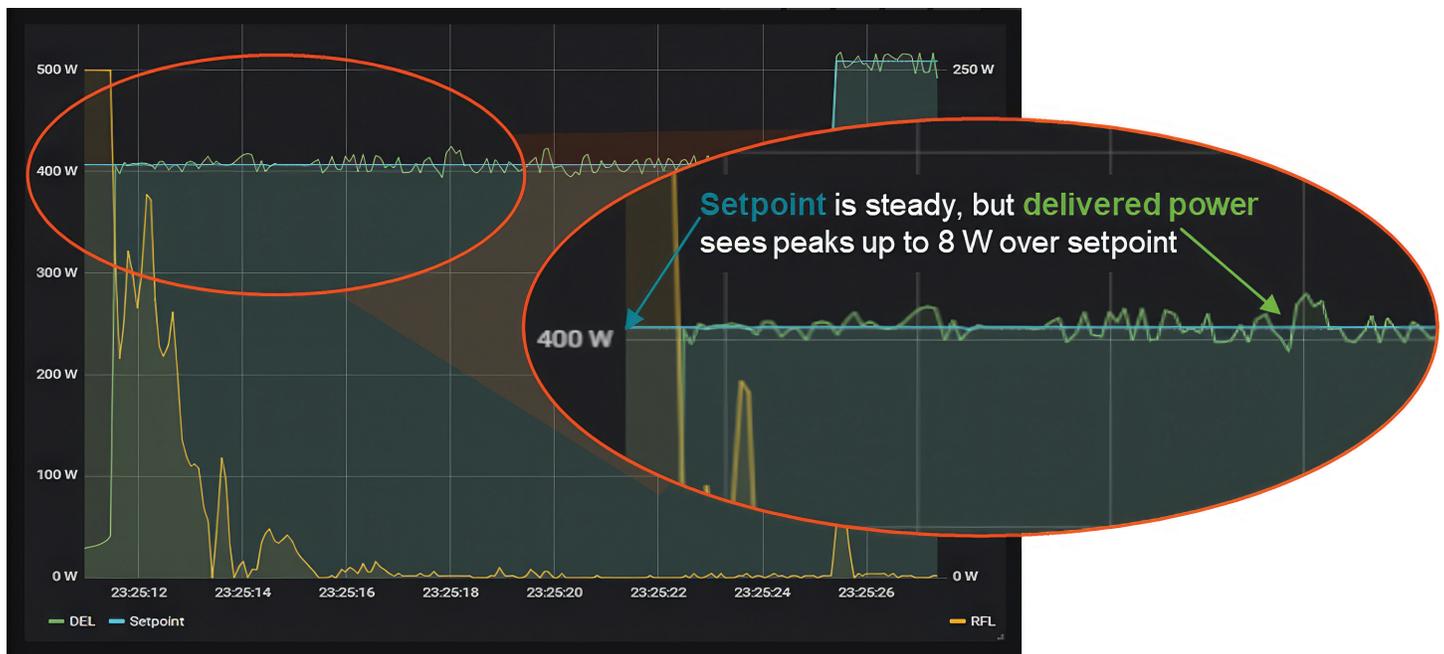
CHALLENGE

A customer's data monitoring interface indicated a new RF generator's reflected power went beyond defined threshold; however, to accurately find the root cause, the customer needed more critical data.

PowerInsight has access to a comprehensive list of data on the RF generator that is critical for troubleshooting.

SOLUTION

PowerInsight high-resolution data and multi-parameter dashboards show a steady setpoint but unstable generator output. This level of detail enabled a data-driven decision to adjust firmware settings and reduce noise to bring the new generator's performance within required parameters.



DEDICATED DATA ANALYTICS SUPPORT BY DATA SCIENTISTS AND POWER DELIVERY SYSTEM EXPERTS

Transform data into actionable insights by teaming with AE data-scientist consultants who utilize their extensive application experience and expertise to create a customized visualization and analysis ecosystem.

- Apply machine learning, modern data science, and advanced analytics to optimize power delivery system performance.
- Correlate events for root-cause analysis with recorded long-term data and FastDAQ events.
- Develop health metric and severity calculations.
- Tailor-make algorithms for baselined performance and anomaly detection.
- Predict component and unit failures.
- Access AE researchers, engineers, and technicians.
- Access remote technical support based on recorded data.



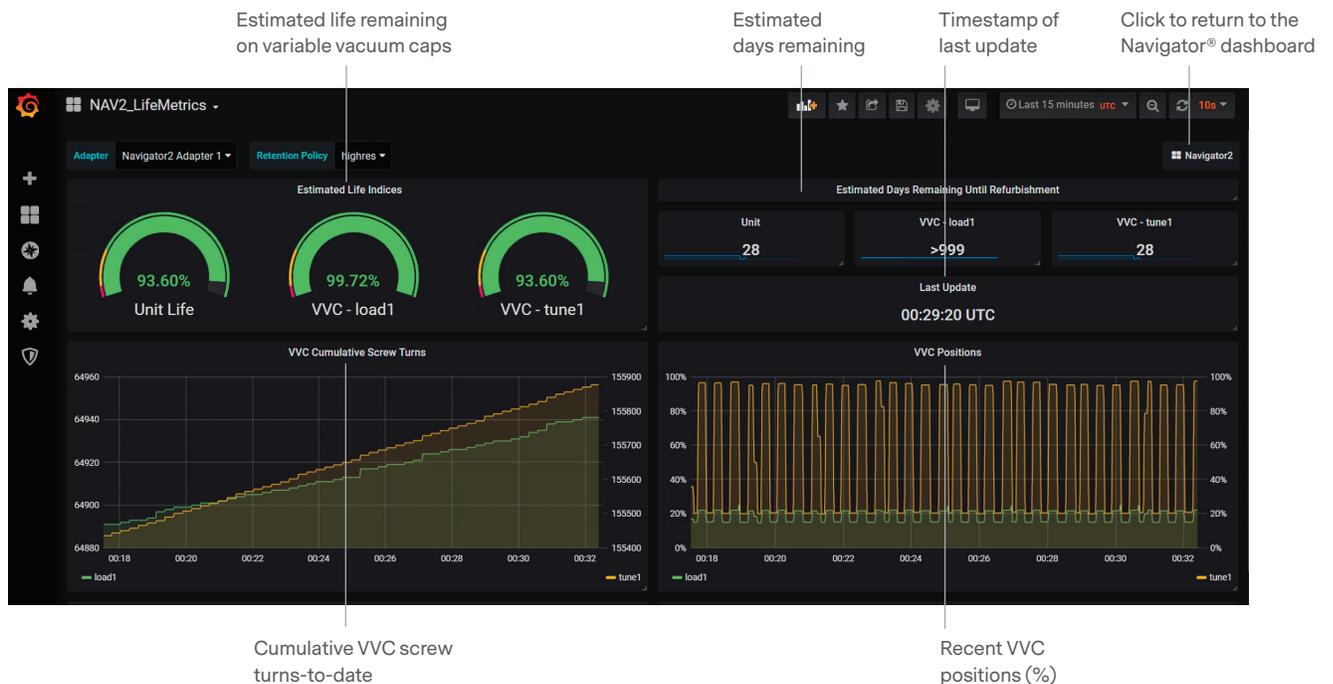
Each algorithm is executed through program codes and will be modified periodically based on customer request.

PowerInsight Algorithm — Predictive Maintenance Case

CHALLENGE Vacuum capacitor failures can cause downtime and reduce throughput. The ability to estimate mechanical life consumed/remaining would enable more accurate prediction of required maintenance cycles.

SOLUTION PowerInsight data consultants created and embedded an algorithm to estimate the mechanical life consumed and/or remaining for the vacuum capacitors found within AE RF matching networks. The reliability/survival model uses the actual movements of the capacitors as they tune to balance the load as the primary input; small "dithering" movements have little to no impact on vac-cap lifespans over time, whereas large movements (typically exceeding 50% of the range) have a significant, negative impact on lifespan — the relationship is highly non-linear.

The dashboard publishes the estimated life remaining (upper left panel) and projected days remaining until a maintenance service should be performed (upper right panel), assuming the recorded usage patterns continue. The algorithm employs a statistical learning method to adjust its estimates as usage patterns change or evolve.



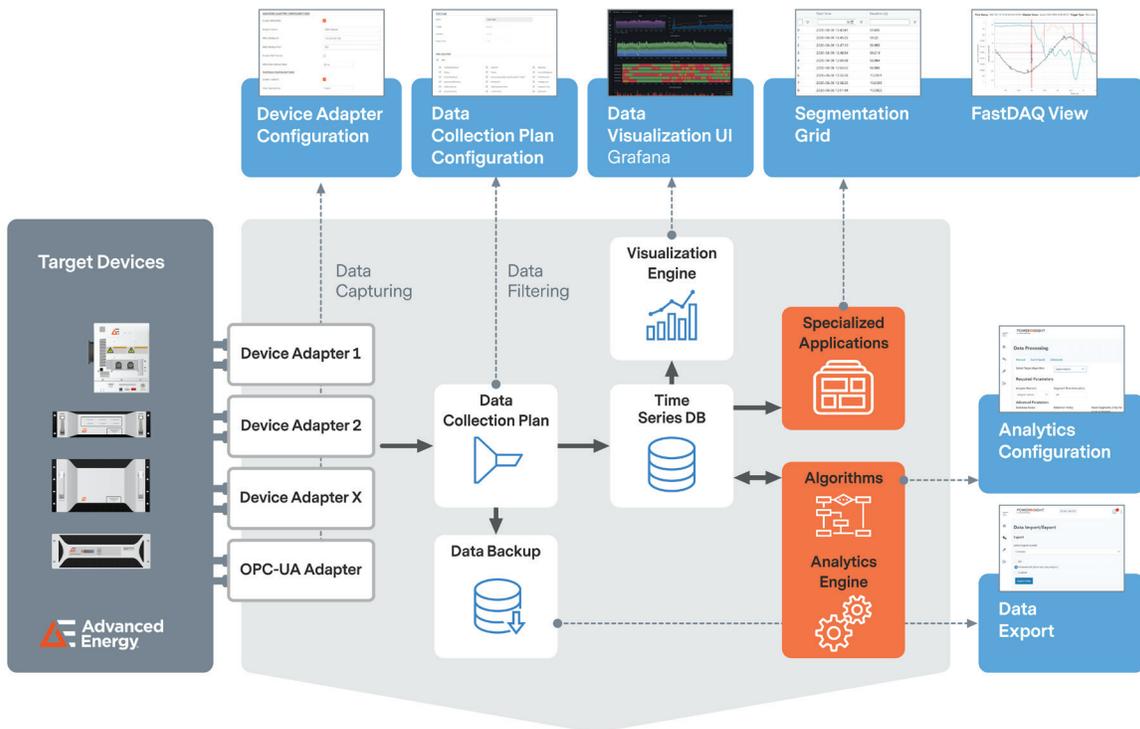
A CLOSER LOOK AT THE EDGE ECOSYSTEM

PowerInsight Edge hardware consists of an industrial computer running the Linux OS. It hosts all the required software for data collection, time series database management, visualization, and algorithms.

While these functions typically are available only via separate software, the PowerInsight platform integrates them into an ecosystem that better supports data scientists in the creation of custom solutions to meet specific user needs.

This unique architecture:

- Enables access to high-resolution data (default setting 12 weeks)
- Transforms raw data into actionable insights that users can interact with on a browser-based dashboard
- Provides the ability to customize dashboards with a comprehensive list of data fields
- Enables users to apply and configure the appropriate data science metrics for their system
- Ensures that all data is fully cybersecurity



POWERINSIGHT
by Advanced Energy™

SETTING UP YOUR POWERINSIGHT SOLUTION

PowerInsight is compatible with a comprehensive list of AE's power supplies and can be integrated with other platforms, such as PLC, per customer request.

PowerInsight Compatible		Sample Rate	FastDAQ Sample Rate ¹	Onboard Algorithms
DC Power Source Systems	eVoS™	10 Hz	12.5 MHz	
	Pinnacle® III	10 Hz		Process Segmentation, Arc Monitoring
	Pinnacle® II	4 Hz		
	Ascent® SMS AP10	10 Hz	40 MHz	Arc Monitoring
	Ascent® AMS	10 Hz	40 MHz	Arc Monitoring
	Ascent® DMS	10 Hz	40 MHz	Arc Monitoring
	Ascent® AP	10 Hz	40 MHz	Arc Monitoring
	Ascent® AMS/DC	10 Hz	40 MHz	Arc Monitoring
	Ascent® MS	10 Hz		Arc Monitoring
	Crystal	4 Hz		
RF Plasma Generator	eVerest™	10 Hz	15 MHz	
	Paramount® HF	10 Hz		Reflected Power Events Monitoring CEX Unlock Events Detection Excessive Resonator Oscillating Excessive Setpoint Changes
	Paramount® 5002	10 Hz		
	Paramount® VHF	10 Hz		
	Paramount® Plus	10 Hz	15 MHz	
	Paramount® Plus MLP	10 Hz	15 MHz	
	Apex® Refresh	10 Hz		
	HFV®8000	4 Hz		
RF Match Network	Navigator® I Refresh	4 Hz		Vacuum Capacitor Predictive Maintenance
	Navigator® II	10 Hz		
Plasma Abatement	MAXstream™	10 Hz		
	Litmas® RPS	4 Hz		RPS Chamber Clean
Other Devices	Optical Temperature Sensor (FOT)	20 Hz		
	Analog Input Modbus® TCP Module	10 Hz		
	TEGAM® RF Power Sensor	1 Hz		

Email PowerInsight@aei.com to set up a free demo!

1

You identify the scope of your target devices.

2

AE installs the PowerInsight demo according to your schedule.

3

You experience an on-site, hands-on training using the PowerInsight dashboard.

4

Start interacting with recorded data on custom dashboards.



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ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

PRECISION | POWER | PERFORMANCE | TRUST

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