

WHITEPAPER

Asset optimization in power generation

Moving from preventative to predictive
maintenance with the PI System™

Executive summary:

Power-generation companies are moving on from traditional time-based maintenance, and they're leveraging real-time operations data to boost plant and system efficiency. With condition-based maintenance (CBM), power-generation companies reduce maintenance costs while improving asset reliability and availability.

How to implement CBM with the PI System

The PI System is an industrial data-management platform that enables users to analyze real-time and historical data to extract critical insights about asset health. By connecting disparate data sources, plant management, subject-matter experts, and engineering, operations, and maintenance staff have access to a single source of truth and can share information and insights across the organization.

The PI System seamlessly manages the data-collection process, enabling engineers to spend their time analyzing collected data and making recommendations. Unlike tools that employ calendar-based inspections and periodic assessments, the PI System detects small but critical equipment changes so teams can quickly take action.

By using the PI System for CBM, power utilities gain multiple advantages:

- Using the PI System alters the procedure from a static, or periodic, assessment to an online, dynamic, real-time assessment of asset health.
- The PI System enables engineers to conduct streaming analysis and create a subsequent condition score.
- Engineers can create additional context by organizing real-time PI System data by critical events. They can also perform calculations and leverage analytics to derive subsequent insights. These events supplement this new, highly detailed data analysis (see Figure 1).

Beyond real-time condition monitoring and preventative maintenance, the PI System lays the groundwork for future predictive maintenance strategies. Users can leverage historical and real-time asset data from the PI System to train artificial-intelligence (AI) and machine-learning (ML) models.

Asset Framework (AF) provides necessary data structure and context, while PI Connectors and interfaces ensure a seamless data transfer to any external solutions. Once users leverage AI/ML tools to determine maintenance predictions, those predictions can be visualized by operators or maintenance staff directly within the PI System. Not only do these predictions offer unprecedented situational awareness, but teams can also easily see – and mitigate – potential catastrophic issues while optimizing asset availability.

Power-generation suppliers use the PI System to better manage entire fleets of generator units, including reducing forced unit outages. A tiny decrease in forced outages can increase margin by millions of dollars. In addition, converting other forced outages to planned outages further increases margins by allowing the outage to be scheduled during a lower margin window.

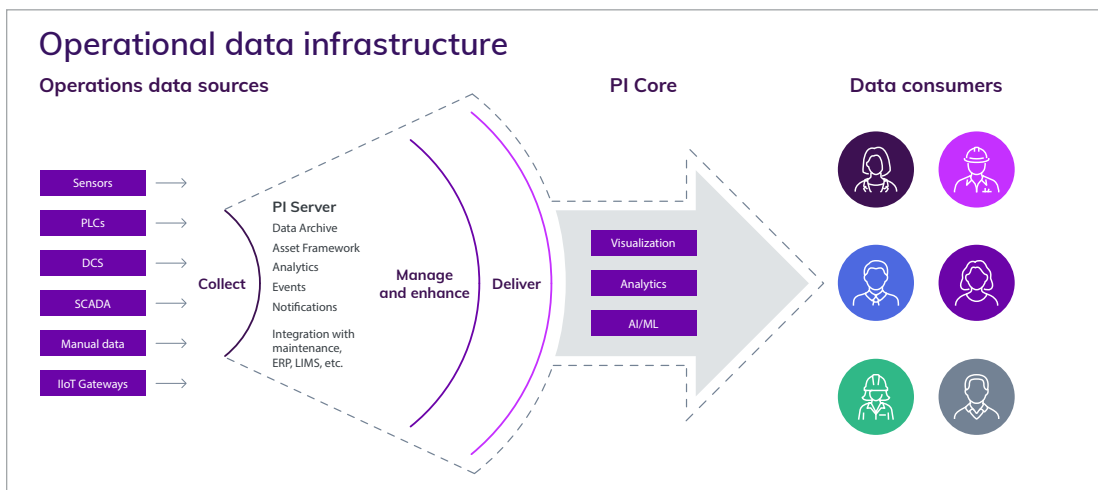


Figure 1. The PI Core software portfolio collects, enhances, and delivers real-time operations data in mission-critical environments.



Australian Gas Light: Democratizing predictive insights

Australian Gas Light (AGL) Energy was completely data blind and had no access to real-time data. That needed to change, so the company deployed the PI System to connect to all controllers and make real-time data available to everyone across the organization. After a single day of training, employees across the company were building displays, alarms, screens, and more. In just three months, AGL saw a 7% lift in the availability of its hydro units.

However, AGL was not content with real time; it soon moved to predictive modeling. Employees built 2,700 models to monitor 45,000 critical data points every five minutes. ECG Predict-It, a PI System partner solution, correlates incoming PI System data with historical data. When correlations vary, the team knows something is amok. While it cost \$1.2 million AUD for initial setup and \$620,000 AUD in annual operating costs, AGL quickly recouped a massive return on investment.

In the first three years, AGL saved \$18.7 million AUD in reduced forced outages and optimized maintenance. But that was not all. In 2017, the company caught and prevented a catastrophic failure in a 560 MW hydrogen-cooled stator. PI System alarms informed the team that hydrogen exit temperatures were abnormal. The unit was inspected, but no one could identify the issue. After a recalibration, the data showed the problem was getting worse.

The team partially dismantled the unit and found that they were just a few short days away from a number of coils catching fire. Thanks to predictive insights from the PI System, AGL saved \$50 million to \$70 million AUD by preventing the catastrophic outage.



Key PI System components for CBM

Data collection

PI Interfaces and PI Connectors are a foundation of the PI System infrastructure and provide a standard mechanism for collecting time-series data and asset metadata from disparate data sources. The PI System supports more than 400 standard interfaces and a growing number of connectors.

Power-generation plants can use PI Interfaces and connectors to link to data sources such as DCS, supervisory control and data acquisition (SCADA) systems, and energy-management systems, sensors, servers, applications, networks, and other databases.

Capabilities include:

- Efficient, secure, and real-time data management from a variety of sources.
- Standardized and centralized data accessible across the enterprise.
- Numerous ways to display asset-health information, including custom dashboards and visualizations.
- Performance trending and analysis to determine each asset's maximum capacity.
- Organization of data streams and related processes through AF, giving critical context for future analysis.
- Conversion of raw data streams into meaningful events through Event Frames.
- Predictive warning notifications send alerts, enabling rapid response.
- Data served up to other advanced analytical tools and engines.
- Integration of business and operational systems to connect employees, business partners, suppliers, and markets.

Storing, managing and enhancing data

Data Archive, an essential PI System component, receives, archives, and distributes real-time and historical process data from operations and other sources. By organizing streams of business-critical data into a single comprehensive format, PI Server enables plant managers and executives to maximize plant productivity and efficiency and more accurately plan future business operations.

AF enhances data comprehension through a consistent naming convention or representation that can all PI System users can understand. AF specifies each asset and its attributes in an easy-to-navigate infrastructure for accessing data, naming assets, and defining processes for an entire organization, ranging from the fleet level down to individual pieces of equipment. The use of standard templates simplifies the definition and addition of models, assets, processes, and calculations to the framework (see Figure 2).

Analytics allows consistent equations, counters, and calculations to be applied to similar equipment across a generating system. Analytics can be simple, like counting starts on a 4-kilovolt motor, or more complex, like equipment-efficiency or system-efficiency calculations.

Event Frames automatically bookmark process events, and PI System data is related to a specific asset and related condition. Each event frame has a start and end time, enabling users to calculate the duration of an event and capture the associated data or condition.

Notifications leverages the flexibility of AF by allowing users to configure custom alerts based on any data source. With Notifications, users can configure the platform to send alerts whenever specified equipment exceeds preset parameters. Notifications can also integrate with line-of-business systems such as SAP or Maximo. With Event Frames and Notifications, one can automate condition detection through work-order generation for inspection or maintenance of an asset.

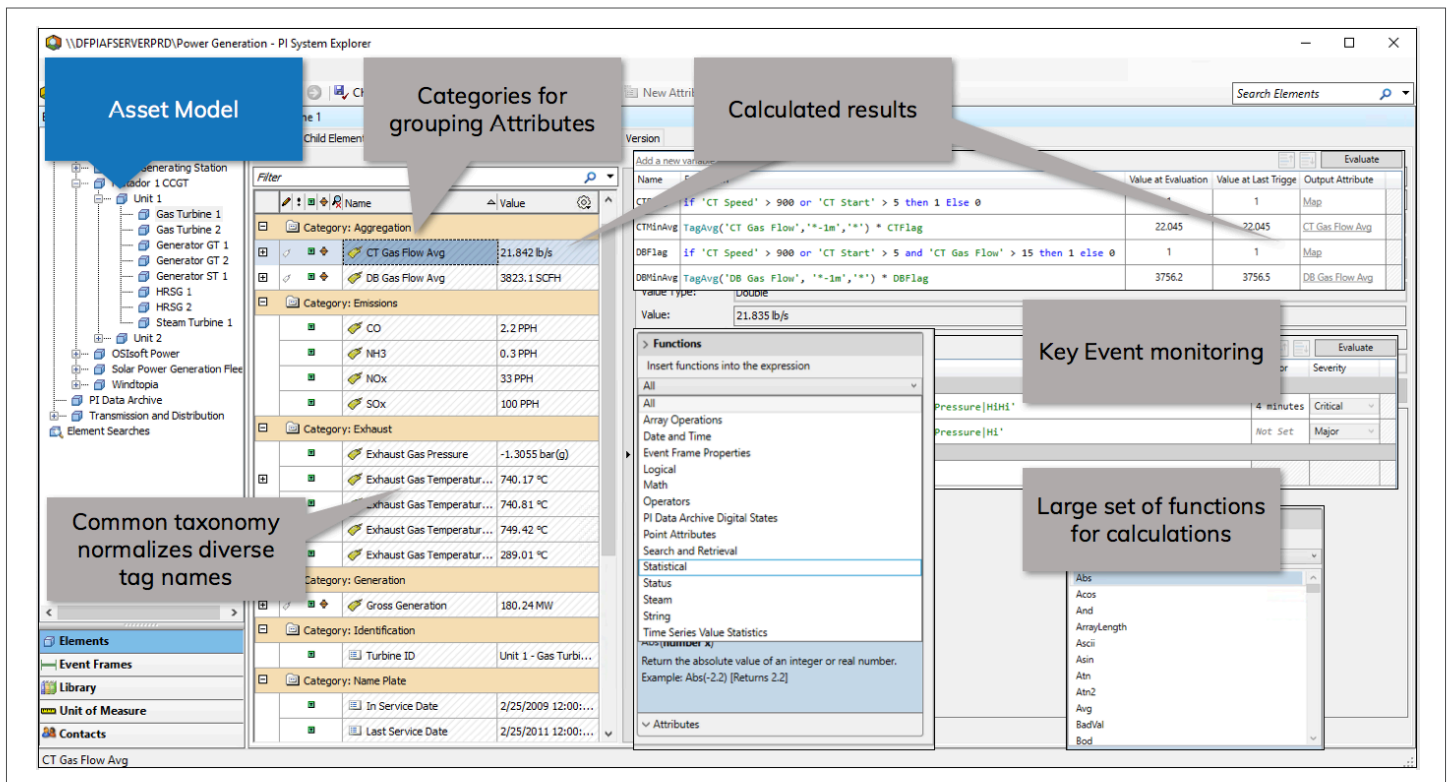


Figure 2. Asset Framework identifies organizational assets and equipment using a consistent naming convention

Data visualization and delivery

PI DataLink is an add-in for Microsoft Excel, enabling direct access to PI System data within a worksheet. PI DataLink offers powerful tools for gathering, monitoring, analyzing, updating, and displaying PI System data and events.

PI Vision is an intuitive web-based visualization tool that delivers fast, easy, and secure access to all PI System data. Users gain insight into plant operations by creating interactive graphical displays or conducting ad hoc analyses. Users can create displays using either real-time or historical data residing in the PI System.



Figure 3. PI Vision display of Wind Turbine operations and asset health.

Maximizing today's resources drives future benefits

Today's power-generation market demands that electric utilities deliver high reliability, assured availability, and high efficiency – all at a low cost. However, many facilities still use multiple, disparate data systems, limiting visibility and leaving companies to rely on static equipment-condition assessments and reactive maintenance strategies. Reducing maintenance costs and preventing catastrophic failures hinges on proactive CBM-based techniques that leverage real-time operations data.

Not only can CBM reduce overall maintenance costs, it can also impact processes across the enterprise. CBM data can inform asset-management strategies and vendor-performance reviews. CBM also enables root cause analysis techniques as well as environmental monitoring and regulatory compliance.

As CBM strategies mature, power-generation companies can optimize operations well beyond the control room to boost plant and system efficiency and optimize outage planning.

The PI System provides utilities with a single source of truth for operations data. The PI System collects and manages information from multiple, isolated sources across the enterprise and presents that data in a way that allows management, engineering, operations, and maintenance staff to share and analyze information. From there, stakeholders can work together to optimize operations, maximize asset life cycles, predict outcomes, and – ultimately – drive bottom-line results.

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