

OSIsoft LLC Response to SEBIZ RFI

Energy Efficiency & Renewable Energy (EERE) Solutions

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|----------------------|---|
| Business Name: | OSIsoft, LLC |
| Primary address: | 777 Davis Street San Leandro, California 94577 United States of America |
| Contact person: | Cary Huang Hai Territory Manager |
| Contact information: | caryhuang@osisoft.com +86-21-2327-8619 |
| Technologies: | The PI System can collect data from the various systems that will be part of any Sustainable Energy solution. It provides tools to analyze the data, include the data in reports and makes it possible to view the data on PCs, tablets and smart phones. |

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Executive Overview

OSIsoft is pleased to provide our response to the China Energy Efficiency & Renewable Energy (EERE) Solutions. OSIsoft has read, understood and responded to the known requests as outlined in above noted RFI. Our response is based on OSIsoft's real-time data infrastructure and tools, commonly known as the PI System, which is comprised of state-of-the-art server-based real-time and historical data platform software, data collection/connection interfaces and various client visualization tools. After carefully reviewing the well-articulated objectives it is clear that OSIsoft PI System reliable, agile, real-time data infrastructure can contribute to ensure a successful implementation.

With over 3,300 PI Systems in the power & utilities industry being utilized by over 300 different companies OSIsoft has been providing information management systems to manufacturing and utilities for over 30 years and is the recognized world leader in the power industry. OSIsoft's real-time data infrastructure, based on the PI System, has been a critical component to reliably and competitively exceed the operational requirements of our customers in today's demanding business climate while providing an agile infrastructure to meet future needs.

Our summary of needs of establishing an Enterprise Data Platform as part of the project are as follows:

- To provide reliable acquisition, accurate storing and systematic processing of physical and field data from control systems, equipment, devices, laboratory and external systems.
- To provide business users with an intuitive and effective means to access, manipulate, visualize and report on the asset data.
- To integrate with technical/business systems and processes to increase operational effectiveness and efficiencies.
- To provide trusted real-time and historical data for compliance & regulatory reporting, dashboards & high-level performance business indicators across the enterprise.

Rather than implement various different data platform technology with a view to solving a handful of problems, OSIsoft PI System allows users to implement a robust and flexible infrastructure that supports numerous initiatives and helps the business quickly react to market place changes and easily implement new initiatives on top of the existing infrastructure when needed.

To facilitate the strategic needs, a project by project data acquisition of technology and implementation services is cumbersome and difficult to maintain momentum.

In Sustainable energy Business Districts SEBIZ' best interest, we highly suggest OSIsoft's PI System is best suited to meet the known business needs today and provide an infrastructure to expand into the future. PI is a multi-faceted solution that serves as a real-time data management system, a core technology, an infrastructure for the build-out of complex applications, a rapid development environment for new ideas, and

investigative environment for 'what-if' scenarios. The PI System infrastructure is extensively used by all areas of the Utilities industry including Generation (fossil, thermal, hydro and nuclear), Renewables (wind and solar), Independent System Operators, Transmission Substations, Distribution Control Centers, Distribution Substations, Distributed Generation Resources, Water and Waste Water Management, Gas Transmission, Gas Storage, Gas Distribution, microgrid, Smart Grid, Smart Campus, Smart Facilities and Smart Cities.

With a dedicated development team, 200 strong, OSIsoft has an unmatched track-record of moving our products forward at the staggering pace of technological change so our customers can adapt and evolve without ever having to re-license our software products. Using OSIsoft's desktop environments and web portal, everyone, everywhere, from operations engineers all the way up to the President of the organization, are empowered with real-time data in an actionable format. The PI System allows users to make strategic decisions on how to better manage their business and therefore directly affect their bottom line.

We look forward to the opportunity of serving SEBIZ program as a valued business partner and working together to achieve success.

SECTION I: Company Background and Qualifications



The OSIsoft Mission

- *Deliver on the promise of real-time performance management.*
- *Unlock the value of data across the enterprise.*
- *Continue to develop and support technology in which customers and partners have already invested.*

OSIsoft was founded in 1980. The company's headquarters are in San Leandro, California. Our company is a global operation with over 1,000 employees. The company is privately held and has always been profitable. We have offices in the United States, Canada, Mexico, Brazil, the United Kingdom, Spain, Germany, the Czech Republic, Russia, Bahrain, Japan, China, Singapore, and Australia.

We develop and deliver the PI System[®], the industry standard in enterprise infrastructure, for management of real-time data and events. With installations in 110 countries spanning the globe, the PI System is used in manufacturing, energy, utilities, life sciences, data centers, facilities, and process industries. Our customers gain rapid return on investment and sustained results from PI System infrastructure and its:

- **Pervasive Connectivity.** Weaving an event-driven data fabric is easy and cost-effective with the PI System's extensive library of interfaces to all data sources.
- **Scalable Architecture.** From its inception, the PI System was designed to collect, store, manage, and retrieve data accurately and efficiently. Today, the PI System simultaneously supports retrieval of data in real time at high speeds and in large volumes, while scaling to support global enterprises.
- **Fast Deployment.** Unlike many information technology investments and custom solutions that are high risk and require long implementation cycles, the PI System is easy to deploy and use.
- **Evergreen Platform.** The PI System has evolved to meet the changing business needs of OSIsoft customers.
- **Security.** Security is an ongoing and growing concern for many industries. OSIsoft is dedicated to providing a robust and comprehensive solution that uses the highest levels of infrastructure security protocols.

OSIsoft primarily uses direct sales but utilizes distributors in regions with lower sales volumes. The company is based in the USA and has subsidiaries with direct sales agents, and support personnel. All software is licensed from OSIsoft, LLC in the United States, and sales transactions are conducted in USD. Annual support services, which include both 24/7 support and software updates, are also ordered from OSIsoft LLC, in USD.

Operations in China

PI System software has been exported for over 20 years, and international business accounts for much of OSIsoft's revenues. Much of the company's growth is driven by exports and services for energy firms.

OSIsoft currently has two offices in China: in Shanghai and in Beijing. Established as a representative office in 2007, OSIsoft (Shanghai) Technology Co. Ltd. is now a wholly-owned subsidiary of OSIsoft Asia Pte. Ltd. The Beijing branch office is fully equipped with a technical center and a training center. Both offices provide specialized technical support in Mandarin.

OSIsoft focuses on supplying its software and leverages partnerships with small local system integrators as well as with large consulting firms to provide additional services. Our technology is also embedded into other companies' products via OEM agreements.

Creating development opportunities

OSIsoft has participated in Trade missions and reverse trade missions to the United States. We will be meeting with a delegation from China that will visit our headquarters offices in October. The goal of this delegation is to explore effective ways to use US based technology for projects in China.

On September, 2014, our customer Petrobras in Brazil received an award from the US Department of Commerce recognizing their use of our US based technology. Cemex, a customer based in Mexico, has received similar recognition. In 2012, OSIsoft received a Presidential "E" Award for Exports by U.S. Department of Commerce.

We have undertaken projects which involve both USTDA and Exim and World Bank where funding needed to be secured by the end customer.

ATTACHMENT A: Company Qualifications Questionnaire

| Informational Item | Response |
|---|--|
| COMPANY BACKGROUND | |
| Company Name | OSIsoft, LLC |
| Address | 777 Davis Street |
| City, State/Province, Postal Code | San Leandro, California 94577 USA |
| Other Major Location(s) | Shanghai, Beijing, Frankfurt, Singapore, |
| Website | www.osisoft.com |
| Number of Employees (2013) | 1026 employees world wide |
| Number of Years In Operation | 34 years |
| Number of Years In Operation (in China) | 7 years |
| Description of operations in China | OSIsoft has offices in Beijing and Shanghai. The Beijing office includes a technical center and training center. Both offices provide technical support in Mandarin and English. |
| Description of operations in the US | OSIsoft is a US based software development company. The software is developed in the USA. The company has multiple offices located throughout the USA to provide technical support, services, training, sales and business operations. |
| Primary Products/Services | OSIsoft delivers the PI System software product, a software infrastructure used to integrate information from disparate sources such as BMS, power plants, solar arrays, wind turbines, EMS and other sources of data. The PI System makes this data available for analysis and reporting. |
| Primary Market/Customers | The PI System is used in over 110 countries by customers in a wide range of industries, including Power Utilities (Generation, T&D), Data Centers, Oil & Gas, Chemicals. Customers use the PI System to improve their operations through improved efficiencies. |

COMPANY CONTACT PERSON

| | |
|-----------------|-----------------------|
| Office Location | Shanghai |
| Name | Cary Huang Hai |
| Title | Territory Manager |
| Email | caryhuang@osisoft.com |
| Phone | +86-21-2327-8619 |

CUSTOMERS USING PROPOSED TECHNOLOGY

Project 1

| | |
|-----------------------------|---|
| Client Name | Carnegie Mellon University |
| Technology and Project Size | Energy Management and Facilities Monitoring |
| Project Location | Pittsburg PA |
| Project Contact Name | Bertrand Lasternas |
| Title | Researcher, Building Diagnostic and Performance |
| Email | blastern@andrew.cmu.edu |
| Phone | +1 412-925-0094 |

Project 2

| | |
|-----------------------------|---|
| Client Name | University of California San Diego |
| Technology and Project Size | Clean Energy Technologies, Microgrid R&D site |
| Project Location | San Diego CA |
| Project Contact Name | Dr. Raymond de Callafon |
| Title | Professor, Mechanical & Aerospace |
| Email | callafon@ucsd.edu |
| Phone | +1.858.534-3166 |

Project 3

| | |
|-----------------------------|--|
| Client Name | Iberdrola Renewables |
| Technology and Project Size | Renewable Energy Monitoring (Wind) |
| Project Location | Toledo Spain |
| Project Contact Name | Eva Lopez |
| Title | Direccion de Operaciones, Renewables Center (CORE) |
| Email | elopez@iberdrola.es |
| Phone | +34 925 229 801 |

COMPANY CERTIFICATIONS

| | |
|---|---|
| <p>Certifications that the company has obtained and/or meets in China and globally.</p> | <p>The PI System is certified by Microsoft and by Idaho National Laboratories (security).</p> |
|---|---|

FINANCING

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|--|--|
| Available financing methods (direct purchase, energy savings performance contract, shared savings model, etc.) | <p>OSIsoft distributes its software directly using a perpetual software license.</p> <p>OSIsoft customers have financed projects with the USTDA and Asia Development Bank.</p> |
|--|--|

Project Financing Partner 1

| | |
|-----------------------------|--|
| Project Location | |
| Customer | |
| Technology and Project Size | |
| Project Financing Amount | |
| Financing Type | |
| Project Contact Name | |
| Project Contact Email | |
| Project Contact Phone | |
| Project Company Name | |
| Financing Company Name | |
| Financing Contact Name | |
| Financing Contact Email | |
| Financing Contact Phone | |

Project Financing Partner 2

| | |
|-----------------------------|--|
| Project Location | |
| Customer | |
| Technology and Project Size | |
| Project Financing Amount | |
| Financing Type | |
| Project Contact Name | |
| Project Contact Email | |
| Project Contact Phone | |
| Project Company Name | |
| Financing Company Name | |
| Financing Contact Name | |
| Financing Contact Email | |
| Financing Contact Phone | |

SECTION II: Proposed Product or Service Description

OSIsoft has reviewed the requirements in the RFI. The two business districts are exploring the potential benefits to be gained from many different energy efficiency programs and technologies. In order to pursue a successful energy efficiency programs, you must be able to accurately measure information about energy supply and/or consumption, and to monitor changes, improvements and other Key Performance Indicators.

We believe that since the districts expect to deploy technologies from many different vendors they will also need to be able to monitor how well these systems are reducing energy usage and costs. We recommend adding an overall data infrastructure to the list of interest areas. OSIsoft's PI System can provide a data infrastructure to acquire data and provide context on the performance, value, reliability and operations of the various hardware assets.

No matter what technologies are selected for district efficiency projects, each of the equipment vendors will have their own unique control systems and data protocols. The PI System can provide data collection and infrastructure for the assets, buildings, processes and operations that is independent of the vendor choices that the building owners and developers make.

The PI System from OSIsoft allows users to gather and integrate all of their data and utilize this data to measure the results of many kinds of energy management projects, to improve the operations of many energy related processes.

Some of the ways the PI System is used today include:

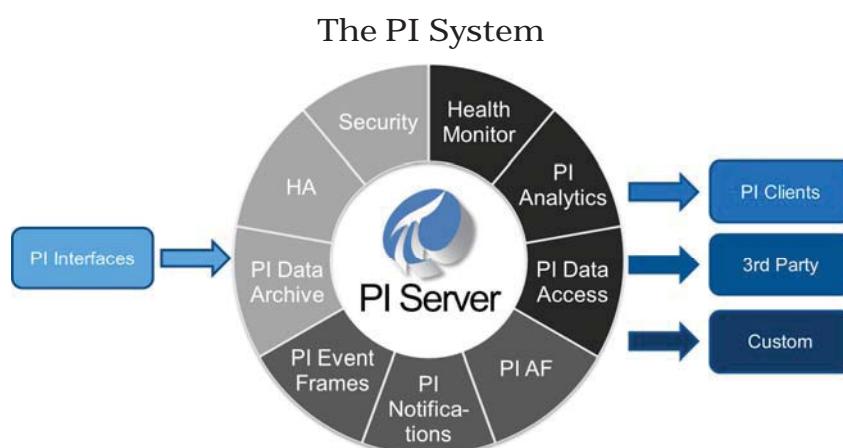
- Energy management in data centers, buildings and facilities
- Management of Renewable Power (Large and small scale power companies)
- Asset Management of Power Plants and many other operations
- Real time monitoring of power grids, including microgrids
- Facilitating "make or buy" decisions by industrial operations with power generation
- Operations optimization in power plants, water treatment facilities, refineries and chemical plants, and most major industrial processes

The out-of-the-box, standard functionality of PI system interfaces will allow the business districts to begin collecting data quickly, providing rapid ability to measure and analyze the results of new programs in Green Dragon and efficiency programs in WIZ. The PI System also facilitates continued data gathering and storage over the long term, which enables ongoing improvement, including in areas that might not be immediately obvious, but may become clear after gathering data for a longer time.

While the RFI has not specified a "data infrastructure" to connect all of these assets/buildings as part of the RFI, we believe it will be needed to enable personnel and consultants in both districts to understand how the selected programs and interest areas improve efficiency and contribute to the defined sustainability goals.

Introduction to the PI System

The PI System is an enterprise-wide solution for collecting, storing, analyzing, and delivering data to users. It has many options for visualizing data. The PI System is highly scalable and provides: high-speed data retrieval and storage, cross-time zone information management, integration of multiple data sources, desktop and Internet presentation of information, automatic connection between people and systems when critical events occur, IT infrastructure monitoring, and more. The PI System supports both large volumes of data and high speed (sub-second) data. It can seamlessly deliver data to geographically dispersed users and systems. The PI System uses multi-layered security to protect your data and ensures that only authorized users and systems can access your data. It is certified by Microsoft to take advantage of security enhancements available in Windows Server® 2008 R2. Even if you take servers offline or have planned or unplanned network interruptions, the PI System continues to collect, store, and make your data available.

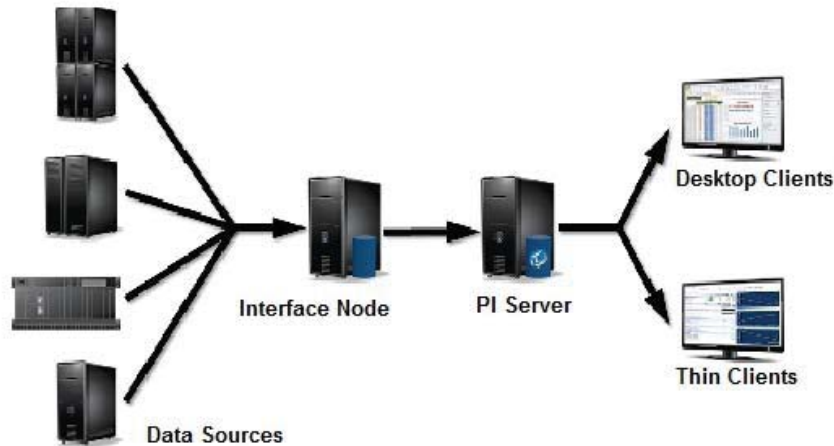


The data from your systems is stored in the PI Server for many years at the desired fidelity and rate. You can organize your data by assets and events and use PI Analytics options, such as PI Advanced Computing Engine or PI Notifications. When you are ready to use your data, you have different options. PI Clients provide a graphical, intuitive, and easy way to visualize the data with products provided by OSIsoft. PI System Access provides different methods for accessing data and integrating it with business intelligence systems, enterprise reporting programs, and customized applications, using standard protocols, such as OLEDB or Web Services. Your data is always securely available to be consumed by any person or system.

Interfaces for the PI System

The flow of real-time data to the PI System starts from a DCS, PLC, SCADA, SAP, HVAC system, or other source. OSIsoft has a well-earned reputation for providing the highest quality interfaces in the industry. We have developed over 400 standard interfaces that collect data from devices, control systems, and supervisory systems. PI System Interfaces provide connectivity to all major automation vendor systems and support

popular standards including C37.118, OPC, Modbus, OLEDB, SNMP, BACnet, TCP/IP, SOAP, and Web Services, to name a few.



PI Interfaces create high-speed links to data sources to provide real-time, fault-tolerant data to the PI Server.


- **Native Interfaces** are customized interfaces to collect data directly from equipment, control systems, and supervisory systems.
- **PI OPC Clients** allow applications to access OPC compliant plant floor process data in a consistent manner.
- **PI Manual Logger** lets you manually record data on PCs and mobile devices.
- The **PI Interface for Relational Database (PI RDBMS Interface)** transfers data to and from the PI System and any relational database management system that supports Open Database Connectivity (ODBC) drivers.
- The **PI Interface for Universal File and Stream Loading (PI UFL Interface)** parses data in various ASCII file formats and stores the data in the PI System. A configuration file controls how the interface parses the data files and stores data to the PI System.

PI Server

The PI Server is the engine that stores and organizes your data. The PI Server brings the data collected by PI System Interfaces into a single system, secures the data, and delivers it to authorized users. The PI Server collects high-speed real-time data even at sub second speeds. The PI Server uses the least amount of disk space possible to store data while still providing excellent data fidelity. You can retrieve data—no matter how old—quickly, accurately, and securely. Our customers keep years of data online in the PI Server. Many of our customers have all of their data

Visualization

"Within a few hours, I had a trend that gave me the power to analyze twenty-three individual systems at one time. With PI, problems are found and solved before any systems show up. Systems run in control nearly 100% of the time."



John Sanders
Production Engineer
Appleton Coated, LLC

online—in many cases over ten years of data. The only thing that limits the amount of historical data that you can keep online and available to your users is the capacity of your disk storage space.

PI Data Archive stores time stamped data. It can store data for up to 20 million tags and capture hundreds of thousands of events per second. It can provide up to millions of time-stamped events per second to thousands of concurrent client application connections. Typical queries take just a few seconds to retrieve millions of time-stamped events from the PI Data Archive.

PI Asset Framework stores metadata in a Microsoft SQL database. With PI Asset Framework, you define consistent representations of organizational assets and equipment and use the representations in simple or complex analyses. You can configure an asset model to organize and structure PI System data and other data according to objects that your users are most familiar with, such as physical objects in production processes. You can define and build connectivity models that reflect the process flow between assets.

PI System Access gives you access to PI System data and lets you develop custom applications and integrate PI System data into other products and business systems.

PI System Management Tools is a set of easy-to-use, Windows-based graphical applications to administer the PI System.

Visualize Real-time and Historical Data

The PI System gives you complete flexibility for analyzing specific parts of an operation and for monitoring all operations across your enterprise. PI System users can view data using desktop tools and Web-based tools. The PI System does not just show users data. It provides them with intuitive tools that they can use to analyze data. The PI System visualization tools integrate with Microsoft® Office, so your users can easily collaborate with non-PI System users.

Desktop Clients

PI ProcessBook is an easy-to-use display interface to the PI System. Users can create, modify, and enhance displays without using consultants or custom code. PI ProcessBook is an off-the-shelf product with a Microsoft-style GUI interface and extensive design tools. PI ProcessBook includes a symbol library with over 3,000 images that feature configurable fill styles and orientation options. PI ProcessBook supports smart connections between design elements. As symbols are moved, the lines connecting them automatically move as well. PI ProcessBook supports multistate symbols that change color, flash, or disappear based on tag values and parameters that you define. PI ProcessBook displays can include layers, so elements in a display can be viewed or made invisible as layers are toggled on and off. With PI ProcessBook, you have a robust and easy-to-use design environment.

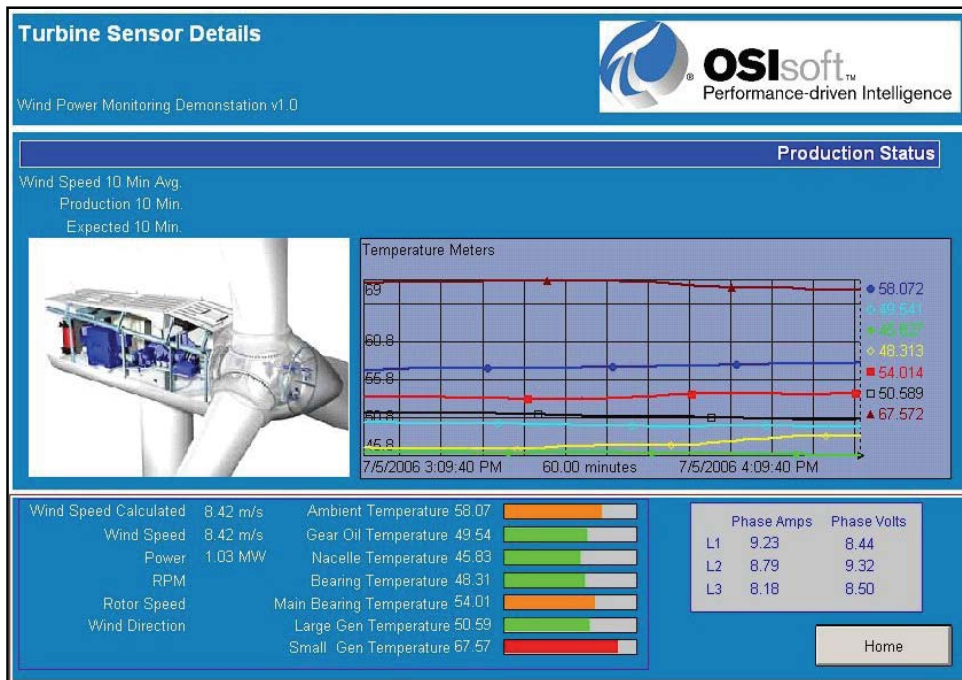


Figure 1: PI ProcessBook display

PI DataLink is an add-in to Microsoft Excel that creates a direct, bi-directional connection between Excel and the PI System. With PI DataLink, users have access to all of their PI System data and they can use that data with the familiar and powerful analytic capabilities of Microsoft Excel. PI DataLink makes tasks such as data gathering, reporting, modeling, analysis, forecasting, and process planning fast and easy.

Thin Clients

PI DataLink Server makes PI DataLink spreadsheets available to web users. From the web, users can refresh data, specify tags and time ranges using parameters, and share workbooks.

PI WebParts is a Microsoft SharePoint-based application that provides intranet and Internet access to PI System data through a library of auto-updating SharePoint web parts.

PI Coresight is a web-based tool that gives users access to all PI System data. PI Coresight includes integrated searching, intuitive controls, a streamlined user interface, and powerful visualization tools that let you perform ad hoc analysis, discover answers, and share your insights with others.

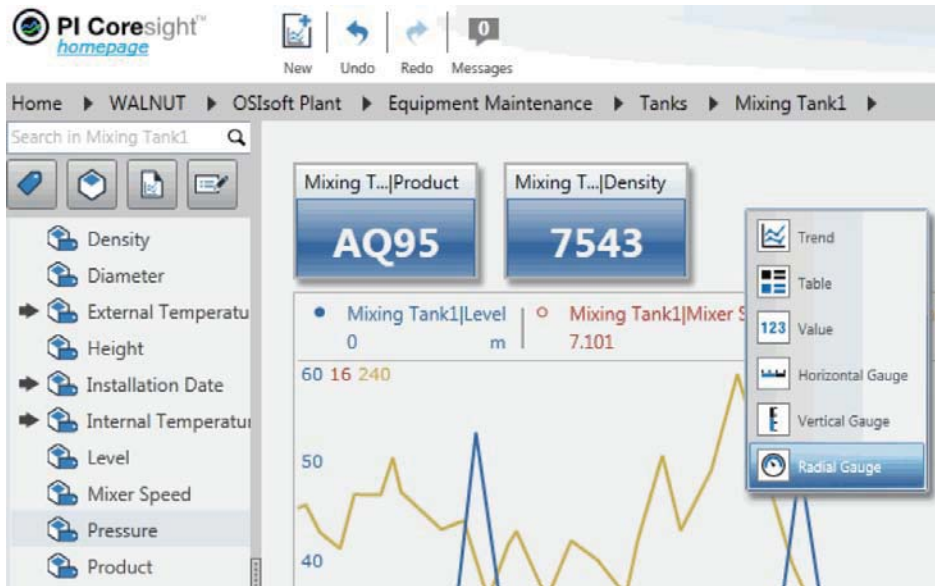


Figure 2: PI Coresight displays data in trends, tables, values, and gauges.

Analyze Real-time and Historical Data

You can transform data from the PI System into actionable information using a comprehensive suite of computation and analytic tools. The PI System's calculation capabilities support everything from simple averages, minimums, and standard deviations to complex predictive equipment models, what-if analyses, and multifaceted logic. With the PI System, real-time and historical data and events can be analyzed and aggregated into actionable information or key performance indicators. When meaningful information is readily available, you can quickly react and make informed decisions to improve your business processes.

PI Totalizer establishes totals, averages, and other calculations using the time-ordered data from the PI System. PI Totalizer is especially practical for totaling measurements or other process variables at the end of specific time periods, such as monthly total and end-of-day yields.

PI Advanced Computing Engine provides an environment for users with little or no programming experience to create calculations that solve business problems using data from the PI System. Calculations are created in Microsoft Visual Studio with a Wizard to assist in the configuration and deployment of calculations. By utilizing Visual Studio, you can create simple or complex calculations, including calculations that use third party libraries such as MATLAB® for data modeling. You can also access data from OLEDB and other sources for use in calculations.

Technical Support

"My history of working with OSIsoft has been wonderful. I've worked with OSIsoft for over ten years now and if I get nothing but exactly the same type of service throughout my retirement, I will be very happy. OSIsoft has been very responsive to my needs and in the past we've asked for things that a lot of other companies would have A, either charged for, or B just plain wouldn't have done. OSIsoft has been at my service in technical support and upgrades without extraordinary charge and very pleasant and quick in their service. I have no complaints whatsoever."

Steve Spurlock
Southwest Gas



PI Event Frames lets you analyze batch processes and other repeatable events—such as days, shifts, startups, and downtime—that have a start and end time. For each event type, you can create an index for the attributes that you search the most.

PI Asset Based Analytics is a new feature of the PI Server that is introduced with PI Server 2014. Users can now configure, schedule and run calculations written using PI Performance Equation (PI PE) syntax acting on their PI Asset Framework (PI AF) attributes. The results can be stored as PI tags thereby preserving history of the results over time. In addition, results can be included in a report or used by other components of the PI System.

PI Performance Equations provides 110 built-in mathematical, transcendental, aggregate, archive, time, string, alarm, and logic functions. PI Performance Equations allows you to easily program routine calculations.

PI Notifications delivers real-time alerts, enabling personnel or systems to be informed when key events occur. You can customize and control all aspects of your notifications.

PI SQC Client lets you create and view SQC charts in PI ProcessBook.

Software Reliance Program

The OSIsoft Software Reliance Program protects and enhances our customers' investment in the PI System with these benefits:

- Phone, email, and web-based technical support available 24 hours a day, year-round.
- Access to the [OSIsoft support website](#) for the latest product documentation, release notes, product announcements, patches, alerts, and a searchable knowledge base to help users increase their product knowledge, learn about new features, and resolve technical issues.
- Access to the technical support RSS feed so you can stay up-to-date with our most recent product releases or bug announcements.
- Updates to installed products that add value and help keep users current with expanding and changing technology.
- Access to YouTube "[Show Me How](#)" real-time videos designed to help you get more value from your system.

From the RFI:

- A detailed description of each proposed product and/or service that addresses one or more of the technical areas of interest listed in Section 2 of this RFI.
- Supporting information that demonstrates commercial viability of the product and/or service, such as case studies and past projects, including successful deployment in China, if applicable.

- Product technical specifications and associated warranties must be clearly listed and described.
- A technology design and deployment plan for each participating business district.
- The energy and carbon reduction benefits of the proposed product and/or service as well as the

SECTION III: Proposed Financing Method

OSIsoft distributes its PI System software directly using a perpetual software license. Software is invoiced when delivered. Services are generally limited to installation, and are billed upon completion or at predefined milestone events.

Since OSIsoft is a software vendor, we expect to be working with one of our partners who will provide needed hardware, equipment installation and configuration services. They would also provide a proposal for financing methods. We have defined processes for working with customers that purchase through third parties.

We have undertaken projects which involve both USTDA and Exim and World Bank where funding needed to be secured by the end customer.

SECTION IV: Cost Proposal and Representative Savings

OSIsoft license software using a perpetual license that grants the right to use the licensed for as long as wanted. The initial system(s) are priced based on the number of real time data streams (server products) and the number of users (client modules). Expansions are priced based on the additional software acquired; customers do not need to repurchase the software as they grow. Software updates and bug fixes are included in the annual Software Reliance Program.

The warranty is defined in the OSIsoft Software License Agreement, which can be provided upon request.

OSIsoft recommends that SEBIZ deploy a PI System infrastructure to integrate information from new and existing sources (such as PV systems, batteries and storage devices, wind turbines, BMS, EMS, and power plants) for use in both districts energy efficiency programs. Until these projects have been better defined, it is not possible to determine the architectures and estimate the costs..

Case studies

OSIsoft customers who are using the PI System for energy management have made presentations at The OSIsoft User Conferences in the past several years. Customers have reported on how they have reduced water usage, improved asset management, reduced energy usage and decreased costs by using the PI System to improve operations. Power companies have discussed how the PI System is used to integrate renewable power into their power grid without impacting grid stability and performance.

Several examples are described below, including case studies from two universities who use the PI System to display present campus energy usage and report decreased usage. Another example is from a large wind power company that described the benefits of using PI technology in their operations.

Carnegie Mellon University

The Robert L. Preger Intelligent Workplace is a 7,000 square foot laboratory at Carnegie Mellon University¹. The university uses the PI System to collect data from ventilation, heating, cooling, lighting, and day lighting systems. The PI System collects data from more than 10 different BAS manufacturers, such as Siemens, Automated Logic, and National Instrument. Carnegie Mellon uses the PI System's real-time data collection, analytic, and visualization capabilities to integrate, monitor, and diagnose the building's energy performance. Individual behaviors, such as opening windows when heating

¹ This example is from the presentation "PI System for Monitoring Building Performance, Environmentally Sustainable Behavior, and Energy Conservation" that Carnegie Mellon University made at the OSIsoft 2013 Users Conference.

ventilation and air conditioning systems are heating or cooling the building, waste a lot of energy. Because individual behavior has such a big impact on the overall energy performance of a building, the university uses the PI System's visualization tools to display real-time energy data about the building to its occupants. All data, such as heating and cooling, plug loads, and real-time energy consumption, are displayed to occupants in the Preger Workplace on a dashboard using PI ProcessBook. The dashboard displays energy consumption, provides energy conservation recommendations, and lets occupants adjust individual pieces of equipment in their workspaces using the BACnet protocol. The goal of the dashboard is to motivate individual building occupants to save energy. Integrating multiple building automation systems into the common platform provided by the PI System and displaying useful information to building occupants has drastically reduced the cost of building maintenance and operations.

UC Davis

UC Davis² uses the PI System to collect, historize, and report real-time operational data that is crucial for assessing and improving campus energy use and sustainability. The PI System provides access to data from numerous campus systems such as building energy and utilities metering and central plant controls and metering. UC Davis is focusing on:

- Standardizing data collection and quality control processes across operational units
- Automating reporting to help decision makers optimize operations
- Collaborating with sustainability research efforts using the campus as a proof of concept
- Integrating the use of campus data into the academic curriculum
- Incorporating other campus data including occupancy-based building lighting controls, HVAC control systems, smart thermostat feedback, and campus water and wastewater systems
- Developing a state-of-the-art interface for data visualization

The campus has already deployed a web interface that uses PI System data from both the building energy metering and a smart thermostat system to provide energy feedback to dormitory residents through an energy competition. They are exploring more ways to visualize and analyze building energy usage to encourage stakeholders across campus to conserve energy.

² This example is from the presentation "A Robust Data Management System for Integrating Campus Sustainability Goals" that UC Davis presented at the OSIsoft 2014 Users Conference.

Iberdrola Renewables

Iberdrola's Renewables³ division is a world leader in wind power generation with a total installed capacity of 14,169 MW all over the world. They are also a leader in offshore wind energy development. Iberdrola uses the PI System to centralize optimization of their wind and assets. Benefits of the WindCORE Project include:

- 1% estimated increase in Operation and Maintenance cost reduction (availability)
- Operations and Maintenance resources optimization
- Trading operations are optimized through very precise production forecast
- Remote assistance
- Fault/lost energy calculations for economy dispatching

Typically curtailment set points were sent individually to every wind farm. When added to all the individual inefficiencies this method caused unnecessary production losses. To improve production during service restrictions mandated by the transmission system operators (TSO), Iberdrola takes advantage of the capability of the PI Asset Framework (PI AF) and PI Advanced Calculation Engine (PI ACE) to sum up real and theoretical production from wind farm to business level. This means that instead of needing to curtail or stop many turbines in different wind farms they can stop a few wind farms and allow the rest to continue to produce power.

The resulting benefits that Iberdrola Renewables has seen since implementing the PI System include:

- In terms of income: significant increase in production
- Other intangible benefits:
 - Less mechanical wear out of turbines
 - Less local and urgent calls on site
 - Better adjustment to set points
 - Easier to manage for operation shifts: more secure and less errors

Appendix B

References Groups Customers (China)

1. China Huaneng Power Group
2. China Guodian Power Group
3. China Datang Power Group
4. China Huadian Power Group
5. China CLP Group
6. China South Grid Group
7. China State Grid Group
8. China CNPC Cooperate
9. China Sino Chemical Cooperate
10. China CGNPC Group
11. China CNNC Group
12. Blue Star Chemical Group
13. Tangshan Iron & Steel Group
14. Wuhan Iron & Steel Group
15. Anshan Iron & Steel Group
16. Jiangsu BASF-YPC Group
17. Shanghai SECCO Group
18. Shanghai ShengNeng Group
19. Shanghai Huayi Group
20. Southeast University
21. Zhejiang University