

Digital Transformation of Thermal Power Plants using the PI System

From the Kansai Electric Power, Tadahiro Nakazawa, Akira Kozakai



Agenda

- Overview and Business Environment of KANSAI Electric Power
- Optimization of O&M at our Thermal Power Plants
- Development of New Products and Services
- “Value Creation” Services for Domestic and Overseas Power Producers
- Summary

Overview and Business Environment of Kansai Electric Power

Company General Information (FY2016)

- Established in 1951
- 2nd largest EPCO* in Japan

27^B
US\$ REVENUE

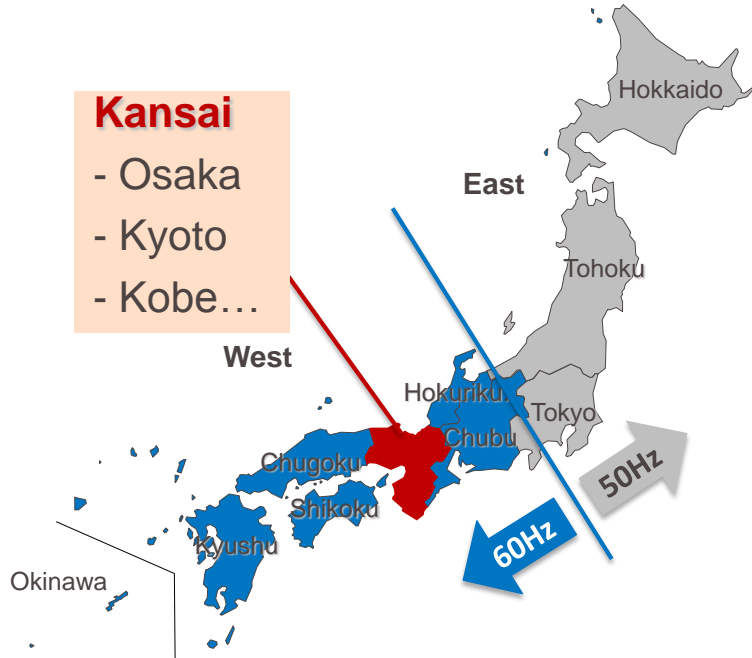
121^{TWh}
ENERGY SALES

36.6^{GW}
TOTAL CAPACITY

19^{THOUSAND}
EMPLOYEES

65^{YEARS}
EXPERIENCE

19^{GW}
THERMAL CAPACITY



Himeji #2 P/S

- CCGT
- 2,919MW



Maizuru P/S

- USC Coal Fired
- 1,800MW



*capacity of power-generating facilities

Overseas IPP Projects

Ireland : Evalair 223MW Wind
Kansai: 24% since 2017

Taiwan : Ming-Jian 17MW Hydro
Kansai: 24% since 2005



Taiwan : Kuo Kuang CCGT
480MW CCGT
Kansai: 20% since 2006



US (New York) : Empire
635MW CCGT
Kansai: 25% since 2017



Philippines : San Roque
436MW Hydro
Kansai: 50% since 1998



Singapore : Senoko Power
3,300MW
(CCGT:2810, Conventional:490)
Kansai:15% since 2008



Laos : Nam Ngiep Hydro
(291MW, 45%)



Indonesia : Tanjung Jati B EXP.
(2140MW, 25%)



US (Pennsylvania) : Hickory Run
(1000MW, 30%)



Thailand : Rojana SPP
505MW (CCGT Co-generation)
Kansai:39% since 2003

Australia : Bluewaters
459MW(Coal-fired)
Kansai: 50% since 2013

Indonesia : Rajamandala Hydro
(47MW, 49%)

US (New Jersey) : West Deptford
768MW CCGT
Kansai:17.5% since 2016

9
COUNTRIES

13
IPP PROJECTS

2.57 GW
TOTAL NET CAPACITY

2.15 GW
THERMAL NET CAPACITY

Business Environment



Before

- 10 Electric Power Companies dominated and controlled the market.



After

- Full liberalization of the electricity market in 2016
- Opening a new market
 - 200 billion USD market scale

Our Business Growth Vectors

Know-How
Experience

New Services & Products

Existing

New

Our existing
Power Plants

Enhance Existing Business Profits

- ❑ Reform Cost Structure
 - **O&M Optimization**
 - Fuel Conversion

Develop New Services & Products

- ❑ Integrate our Know-How with Advanced Digital Technology
 - **Operation Optimization using AI**

New
(Customer)

Expand Business Domain

- ❑ Provide Solution Services
 - **Engineering Services**
 - O&M Support

Challenges to New Field

- ❑ Provide New Services & Products to New Markets
 - **Remote Monitoring Service**

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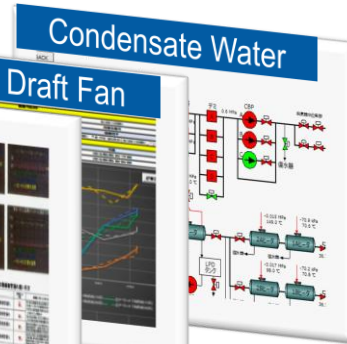
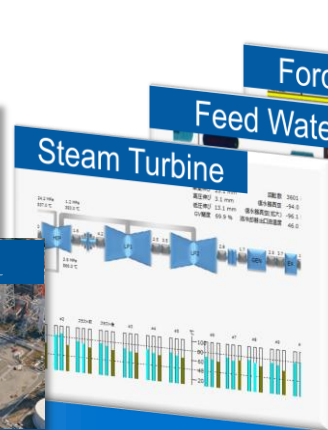
Optimization of O&M at our Thermal Power Plants

Installation of PI System to All Thermal Power Plants

2015

2016

2017



- Built the system in two months.

- Deployed to 3 Power Plants / Coal, Oil & GTCC Plants
- Created 200+ surveillance displays

- Installed to All Power Plants
- Started Remote Monitoring Service for overseas plant

Challenges in optimizing O&M at thermal power plants

Performance

- Enhancing plant power output and efficiency
- Operation Optimization

Availability

- Anomaly Detection
- Unplanned Down Time Reduction

Optimized Maintenance

- CBM
- Optimized Maintenance Planning



Operation

Maintenance



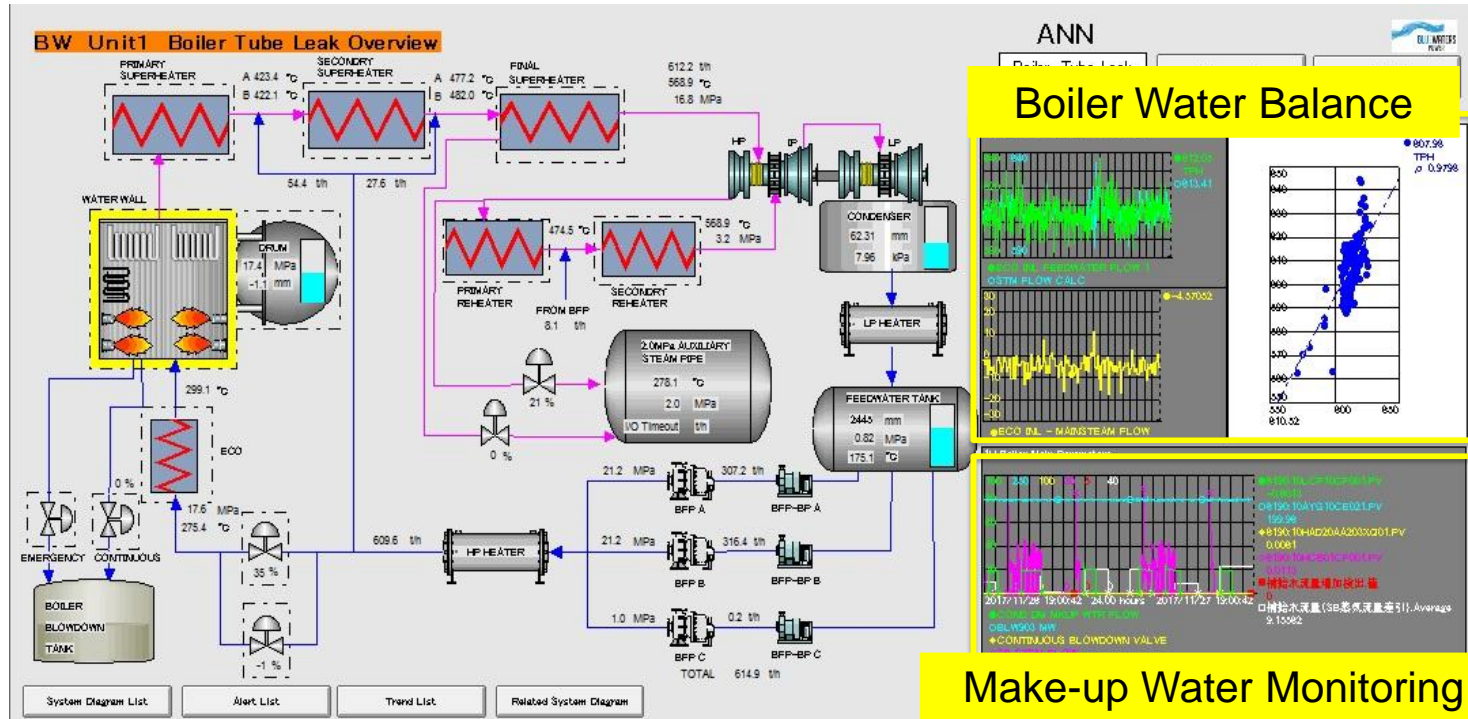
Data Management Infrastructure – The PI System

Operating Data

Sensors, Digital Devices

Knowledge, Experience

Example – Down-Time Reduction



- Early anomaly detection by intensive monitoring of plant's weak points

Example – Down-Time Reduction

The screenshot displays the OSiSoft PI Vision interface for '1u_IGV監視強化'. It features three main panels: a real-time monitoring graph on the left, a list of past troubles in the center, and an FTA diagram on the right. The FTA diagram shows a flow from 'IGV駆動ストロブ' to various components like 'アクチュエータリング' and 'IGV本体', leading to different failure modes such as '駆動不良' and 'IGVスリップ'.

- Real-Time Monitoring
- Pre-Alarm Function
- Link to past troubles information
- FTA diagrams
- Recovery Schedule

Predictive Monitoring

Recovery Planning Support

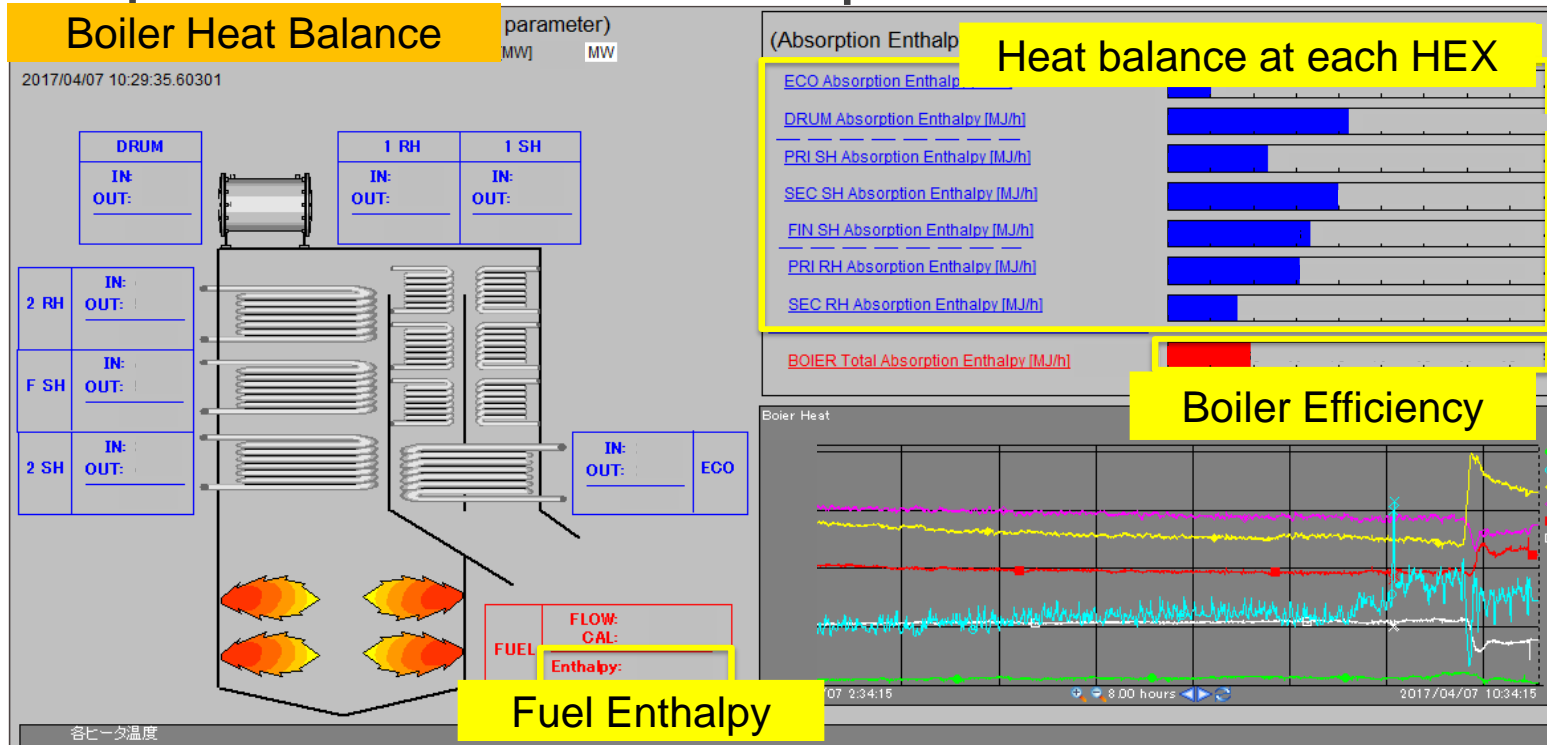
- Predictive monitoring by intensive real-time trends and pre-alarm function
- Recovery Planning by utilizing integrated equipment information

Example – Maintenance Cost Reduction



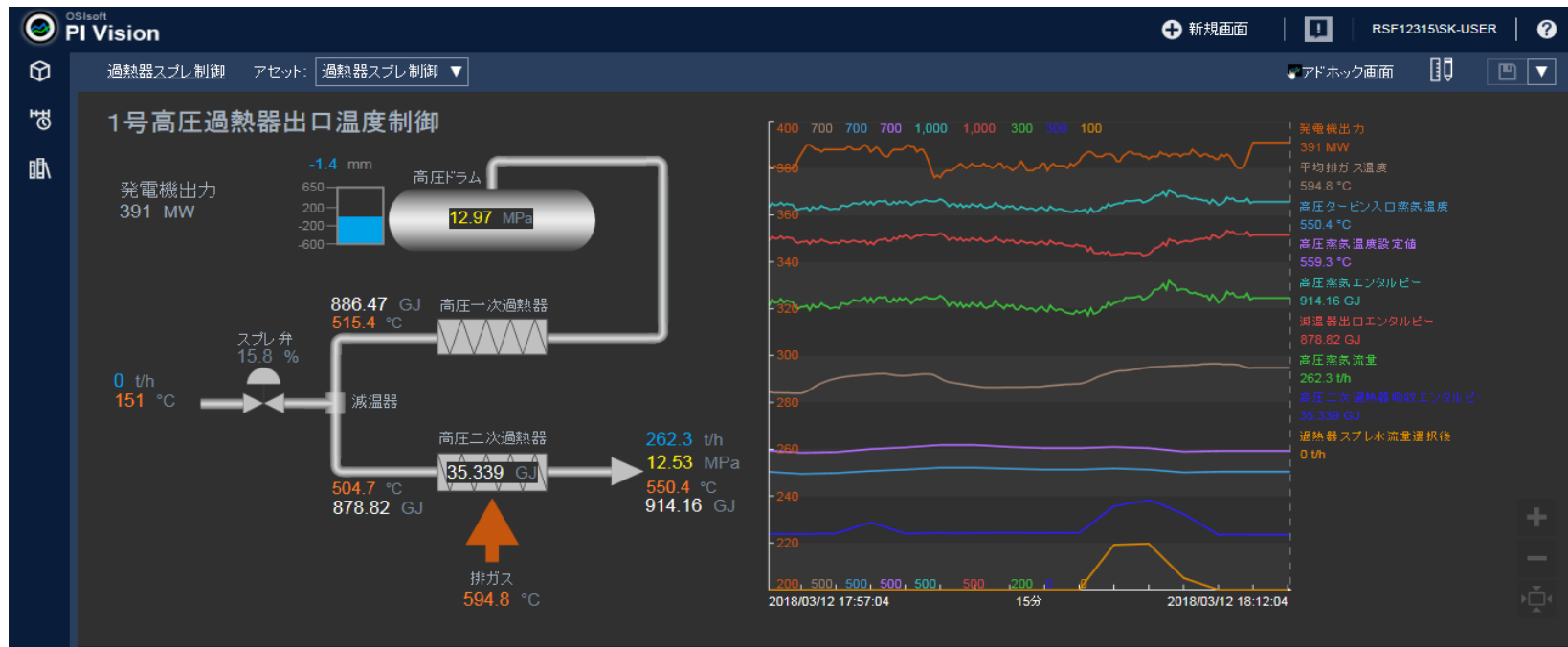
- Monitor parameters relevant to the lifetime of equipment and estimate the remaining lifetime for a proper maintenance plan

Example – Performance Improvement with AF 1



- Advanced Real-Time Monitoring of Boiler Performance

Example – Performance Improvement with AF 2



- Optimize the control of the spray water flow in HRSG superheater

Cost Savings at CCGT Plant with the PI System

Item	Description
Plant Performance Improvement	Monitoring of GT Intake Air Filter Differential Pressure
	GT Performance Monitoring (Fine-tuning of IGV setting)
	Monitoring of Economizer Inlet Water Temperature
	Monitoring of Fuel Gas Heater Outlet Gas Temperature
Unplanned Down Time Reduction	Monitoring of Circulation Water Pump
	Monitoring of IGV
Maintenance Cost Reduction	Equipment Remaining Life Management
Quality Improvement	Automation of Performance Test Record Collection

■ Estimate approx. **\$3,000,000** / year cost savings at our CCGT Power Station

	Existing	New
Our existing Power Plants	<u>Enhance Existing Business Profits</u> <ul style="list-style-type: none"> ❑ Reform Cost Structure <ul style="list-style-type: none"> • O&M Optimization • Fuel Conversion 	<u>Develop New Services & Products</u> <ul style="list-style-type: none"> ❑ Integrate our Know-How with Advanced Digital Technology <ul style="list-style-type: none"> • Operation Optimization using AI
New (Customer)	<u>Expand Business Domain</u> <ul style="list-style-type: none"> ❑ Provide Solution Services <ul style="list-style-type: none"> • Engineering Services • O&M Support 	<u>Challenges to New Field</u> <ul style="list-style-type: none"> ❑ Provide New Services & Products to New Markets <ul style="list-style-type: none"> • Remote Monitoring Service

Development of New Products & Services

Boiler Operation Optimizer Using AI



Kansai Electric Power

power with heart

- Plant Operation Knowledge

Coal Fired Power Plant



MHPS

Mitsubishi Hitachi
Power Systems

- Plant Design Knowledge

Digital twin(Virtual power plant)



Operation
Data

Optimal
Control

- Apply to our coal fired power station in 2018 and provide this system for domestic and overseas customers

Existing

New

Our existing
Power Plants

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“Value Creation” Services for Domestic and Overseas Power Producers

What is K-VaCS?

K-VaCS



Remote Monitoring Center

K-VaCS



REMOTE MONITORING CENTER

Remote Monitoring Service

K-VaCS

Bluwaters Power Station
in South West Australia



Real-time
Operating Data



Expert Operators

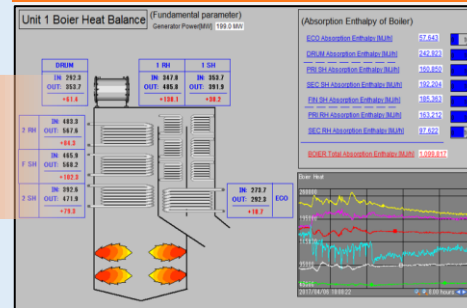


K-VaCS

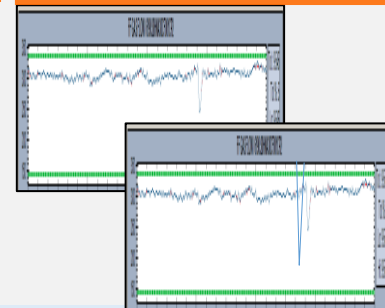
Technical Support
& Best Solutions



PI System



Analytic tool with AI



Collaboration between Kansai Electric Power and OSIsoft

K-VaCS

 **Kansai Electric Power**

power with heart

PI System Adoption Support

- ❑ Consulting Service for Introduction
- ❑ Preparation of Surveillance Displays
- ❑ Creation of Anomaly Detection Models

 **OSIsoft**

- ❑ PI System Installation
- ❑ Product Training
- ❑ Customer Support

Customer

O&M Optimization

✓ **Efficient Operation**

✓ **High Availability**

✓ **Maintenance Cost Reduction**

Summary



COMPANY AND GOAL

Kansai Electric Power is the 2nd largest power company in Japan, and our goal is to be the foremost power company competing successfully in the power market.



CHALLENGE

- 1) To maximize optimization of O&M at our power plants.
 - Minimizing forced outages
 - Optimizing maintenance plan
 - Making plant operations more efficient.
- 2) To Develop “Value Creation” services for Japanese and overseas customers

SOLUTION

- To merge our knowledge and expertise in O&M with recent remarkable developments in digital technology.
- PI System
 - IoT devices
 - Big Data Analytics tools

RESULTS

- 1) Estimated cost savings by \$3,000,000 / year through improving plant performance, reducing unplanned down time and O&M cost reduction.
- 2) New Services
 - Boiler optimization with AI
 - Remote monitoring service
 - Support for the PI System adoption

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Thermal Power Division

The Kansai Electric Power Co., Inc.

Merci

谢谢

Спасибо

Danke

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado

Optional: Click to add a takeaway you wish the audience to leave with.