Empowering operations with PI System

Presented by Marcin Błasiak – Chief Production Management Systems Specialist
Agenda

• About PGNiG Termika

• PI System at PGNiG Termika – business case

• Examples of PI applications

• Conclusions
History

- 1904 – first power plant in Warsaw – CHP Powiśle
- 1914 – CHP pruszków
- 1954 – first turbine in CHP Żerań
- 1961 first turbine in CHP Siekierki
- 1974 – HOB Wola
- 1983 – HOB Kawęczyn
- 2000 – Vattenfall Heat Poland
- 2012 – PGNiG Termika
About PGNiG Termika

- Since January 2012 Vattenfall Heat Poland became PGNiG Termika
- 5 Power plants (3 CHP’s and 2 HOB’s)
- **First Heat Accumulator in Poland CHP Siekierki**
- PGNiG Termika produces over **40 mGJ** of heat covering **70 %** of Warsaw’s heat demand
- Annual electricity sales covers **50 %** of Warsaw’s electricity consumption (cogeneration)
- PGNiG Termika supports district heating grid owned by Dalkia Polska
- Fuels: **hard coal, biomass**
Background

The beginning ...

5 independent Power Plants
Lack of detailed central planning
Lack of central monitoring of production process
Not optimal production process

Target... efficiency improvement

The beginning of Production Dispatch
Need for detailed information exchange with partners
A lot of calculations & reporting… very quickly
Quick access to information about production process
Need for production process optimization
Challenge

**Dispatch Centre**
- Production Planning
  - short-term
  - long-term
- Production process control
  - Emission reporting
  - efficiency reporting
  - on-line optimization
- Production coordination
- Portfolio management
  - fuel register
  - products register
- Analysis

**Information exchange layer**
- Main devices status
- Information about services
- Production plans
- On-line analysis and reporting

**CHP**
- Production coordination
- Asset Management

**Distributed Control Systems**
- Power grid coordination
- Heat network coordination
- Trading

**External partners**
- Distributed Control Systems

**Support required !!!**
**Business case**

**VHP: Operational Data Protected**

“We needed to gather the complex information about technological process and store it in one place. We needed a system that would make these information easily accessible for many persons. We also needed system that would provide tools for analyses and reporting.”

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**Customer Business Challenge**

- Providing the possibility of central production management
- Providing complex information about technological process and tools for analysis
- Making the system user-friendly and easily accessible for many users
- System should be flexible for upgrades and development

**Solution**

- Implemented PI system to provide data from production area to all production and business area
- Provided view to the data using ProcessBook (synoptic screens) and DataLink (analysis)
- Provided ACE for continuous advanced calculations
- Provided MCN Health monitoring to secure the system efficiency

**Customer Results / Benefits**

- Increased number of analysis in the same amount of time
- Decreased variable costs caused by on-line cost calculations (ca. 50 KEUR per year)
- Increased efficiency in consequence of on-line efficiency calculations (3-5 %)
- Increased accessibility to information about production process
Areas of benefits

Production Process Monitoring and reporting
- Process KPI’s
- Condition of devices
- Settlements
- Reporting

Production coordination
- Exchange of production plans
- Devices status reporting
- Production monitoring

Production optimization
- Data for scenario analysis
- On-line calculation and analysis
- Support for decision making

Main goal: Implementing user-friendly and time-saving tool for data analysis and reporting
Infrastructure

Business Network
(5 locations)

Office workstations

IFS, Optima etc.

PI Servers

ACE / RtWebParts

Production VLAN
(5 locations - >40 int.)

PI Interfaces

DCS Systems
DCS 1
DCS 2
DCS n
IT Systems at PGNiG Termika

Business IT

- IFS
- Data Warehouse
- Optima Controlling
- LM system Pro
- Weibull Analysis
- RCM++
- ESSII
- BOFIT

DCS Systems

- AC800xA – Melody ABB
- SYMPHONY ABB
- Ovation – Westinghouse
- MetsoDNA – Metso
- WIZCON
- Freelance 800F – ABB
- Asix - Askom
Implementation of PI System

First implementation of PI System was done by PlantSoft – German based company operating mostly in Germany, Czech Republic and Poland

Implementation was done in two steps:

1. PI Server implementation with few major interfaces – apx. 2000 data streams
2. Upgrade of server cluster and 50000 data streams

PGNiG Termika has SLA with OSIsoft (Server maintenance) and Plantsoft (PI applications maintenance)
Implementation of PI System

Installed packages:

- PI ProcessBook
- PI DataLink
- PI WebParts
- PI Notifications
- PI MCN Health Monitor
- PI ACE (Advanced Computing Engine)
- PI Module Database -> PI AF
- PI Universal File Loader
- PI ComConnector

Over 60,000 tags in use
Implementation of PI System

PI applications:

- PI ProcessBook screens
- PI Datalink reports
- Efficiency calculation and monitoring
- Reports
- Manual data storage (laboratory analysis)
- Data source for other systems
Benefits: Monitoring & reporting

Process of settlements before PI System Implementation

Process of settlements after PI System Implementation

Providing data from each system requires a person responsible for data export

Providing data from each system requires no extra staff - we need only interface (ex. OPC).

In Termika we saved ca 500 hours per year with PI
Benefits: Monitoring & reporting

PI System is an important place of data preparation for Data Warehouse
Benefits: Optimization

- Optimal operating point & Condition based maintenance
- Production optimization support with PI System
- On-line data analysis
- KPI’s
- Variable cost On-line calculation
Benefits: Operating Point

On-line efficiency monitoring helps us to operate only the most efficient units at their optimal point and save up to 2...3% of fuel.
Benefits: KPI monitoring

Data acquisition

- on-line values
- Manually entered data

Data analysis

- On-line data validation
- KPI’s analysis engine

Results

- Efficiency calc.
- Variable costs calc.
- Data validation
- Thermal calc.

Values that are inputs for other calculations

PI graphics

- Data analysis processed by ACE engine.
- Input and output data stored in PI archive
- Calculation time-triggered
Benefits: KPI monitoring

KPI monitoring helps us to define strategic goals and take the right actions in the right time.
Benefits: KPI monitoring

Basic info on KPI monitoring tools:

- All KPI’s are calculated in PI ACE environment
- Input data come from live objects (raw data) and manual entry (manual data)
- Input data is tested and verified in validation algorithms

KPI’s that are monitored:

- Efficiency indicators (losses, specific energy consumption, specific production costs etc.
- Performance & condition indicators (key maintenance parameters, availability etc.)
Benefits: Condition based maintenance

Neural networks (production parameters prediction)

By finding relationships between device operational parameters and overall efficiency we can easily indicate device failure or bad condition.
Benefits: Efficiency monitoring

Instead of complex measurement procedure twice a year we provide online calculation (in connection with neural networks) to see how device (boiler behaves)

On-line calculation = another 50.000 EUR saving per year
Benefits: Variable cost monitoring

Variable cost in function of load

On-line variable cost calculation gives possibility to choose between optimal devices set to provide optimal configuration.

Optimal configuration = ca. 50,000 EUR saving per year

Variable cost in function of time
Summary of benefits

- Improvement of data storage safety.
- Improvement of efficiency and quality of analysis.
- Improvement of production efficiency.
- Improvement of data accessibility.
- Large scalability of PI System.
- Quick and easy integration with other IT Systems

... 

- And many more depending on user requirements...
Key benefit...

What is the real benefit of PI system implementation from the perspective of a decade of operation?
Organization transformation

• „How can PI help us?” instead of „We need to implement something…”
• „Always think about synergies before you act”
• Information brings more value to organization than just storing data
• We should always give users freedom of organizing their workspace.
Transformation into a global system

Past

PL

Other IT systems:
- Data warehouse
- SCADA systems
- Physical connections
- ERP systems
- Dedicated applications

Areas of operation

Process monitoring

Reporting

Production settlements

KPI definition and monitoring

Advanced performance calculation

Communication with external partners

Production & Asset management

Now

PI:
- Data validation
- ACE calculations
- Integration via OLEDB / web services
- AF for process representation
## New areas of development

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<tr>
<th>Data exchange with partners</th>
<th>PI as a system for settlements</th>
<th>Communication event handling</th>
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<tbody>
<tr>
<td><strong>Before</strong></td>
<td><strong>Before</strong></td>
<td><strong>Before</strong></td>
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<tr>
<td>- Data exchange via industrial protocols</td>
<td>- Settlements done by many systems</td>
<td>- Communication to shift engineers by email – not everybody know about production strategy</td>
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<tr>
<td>- Number of data streams limited to end-devices capacity</td>
<td>- Complicated data exchange between settlements processes</td>
<td>- Shift reports in excel sheets</td>
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<td>- Scalability requires hardware modification</td>
<td><strong>After</strong></td>
<td><strong>After</strong></td>
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<tr>
<td>- Communication via Web services</td>
<td>- PI as a settlement system</td>
<td>- Communication via PI using data streams for information visualization</td>
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<td>- Large scalability with assets consumption</td>
<td>- Data validates by ACE</td>
<td>- Shift reports in PI</td>
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<tr>
<td>- No data exchange problems</td>
<td><strong>After</strong></td>
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<td>- Communication via PI using data streams for information visualization</td>
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