Improving power plant performance in ČEZ by using the power of PI System Infrastructure

Presented by Marek Mynařík
Content

- Introduction of CEZ Group and Porici Power Plant
- CÚTD Project – data from 18 Power Plants
- Project of PowerOPTI
  Thermodynamic Modelling & Data Reconciliation
- Expected benefits of the PowerOPTI implementation
Introduction of CEZ Group

- CEZ Group is an integrated electricity company with operations in a number of countries in Central and Southeastern Europe and Turkey, with its headquarters in the Czech Republic (Installed capacity 15 199 MW).

- CEZ Group currently operates:
  - 2 nuclear power plants
  - 15 coal-fired power plants
  - 35 hydropower plants, including 3 pumped storage plants
    - in the Czech Republic.
  - 2 locations with wind power plants (Fantanele 600MW)
  - 3 coal-fired power plants abroad.

- CEZ is the largest electricity producer in the Czech Republic
  - producing nearly 60 TWh a year (approximately 50% in NPP)
Introduction of Porici Power Plant

Commissioned in 1957
Bus arrangement
Fluidized bed boilers K7, K8
(1997-8) (CNIM)
178 MWt, 250 t/h, eff. 92.5 %

TG 1, 2, 3 – 55 MWe,
8.8 MPa, 510 °C

2013
Esv – 481 429 MWh,
Qtep – 1 502 608 GJ
Net efficiency 42.9 %
CÚTD Project

(Central storage of process data)

Purpose:

• unification of data base technology data
• savings in other systems and subsequent projects

The project includes:

• replacement of existing storage
• migration of all necessary data from the original storage
• switching applications to new storage
Project of PowerOPTI

Aim - to get real information about the operation using validation

Implementation process
2012 – model of the boiler FK7
2013 - model of the entire Porici power plant
2014 – final tuning of the model validation
Model of the entire Porici power plant

Validation model consists of the following sub-models:

- Boiler FK7
- Boiler FK8
- chemical water treatment
- machine room
Expected benefits may be divided into groups

- Monitoring of faulty functioning measuring points and components
- Real time monitoring of production block condition
- Monitoring of water/steam loss on production blocks
- Operational tests to establish the optimal operating mode
- Increase of the block efficiency - Implementation of the correction factors
- Early warning of bad equipment condition

### Direct impact on efficiency

- Implementation of the correction factors  + 0.15%
- Real time monitoring of production block condition  + 0.1%
- Tests run on system  + 0.2%

### Impact on efficiency - unachievable

- Lambda value management  + 0.06%
- Avoiding condensate subcooling  + 0.03%

### Without influence on efficiency

- Monitoring of faulty functioning measuring points and components
- Evaluation of the start-up costs of the production blocks
- Monthly energy balance reports
Marek Mynařík

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• Improving power plant performance in CEZ by using the power of PI System infrastructure
• CEZ, a. s.
PI System & PowerOPTI Project in ČEZ from Implementer Point of View

Presented by Petr Hoření
PI System in ČEZ – CÚTD Project

- Implementation 12/2012 – 6/2014, 16 facilities
- 3 PI Servers, 120,000 PI Tags (more than 56,000 used)
PI System in ČEZ – Integration

Applications are integrated using PI Web Services or using standardized SQL Interface on MS SQL Server 2012.
PI System in ČEZ – Identity Delegation

- Security as key issue
- Effort to use tag based authorization in PI System
- Client identity is propagated through SharePoint or MS SQL to PI Server and to PI Asset Framework (PI AF) Server
PI System in ČEZ – Platform of Future

• Single store and hub of all operational data for IS
• SharePoint applications using PI WebParts are preferred
• Developed solutions:
  – PowerOPTI
  – Operation Economy
  – Valves Diagnostics
• Solutions in progress:
  – ChemPack
  – Vibro Diagnostics
PowerOPTI – Data Reconciliation

Measurement: $X_m$

Reconciliation: $X_r$

Calculation: $Y_{cal}$

Measured values are processed through thermodynamic model

Measurement penalty: $V_{corr} = X_r - X_m$
PowerOPTI – Data Reconciliation

Reconciled values are obtained by solution of optimization task:

\[ \min \chi^2 \equiv \sum_i \frac{V_{corr}^2}{\sigma_i^2} \]

Mathematical model is based on analytical redundancy of measurements - more measurements than independent equations

\[ \downarrow \]

Greater reliability and truthfulness of measured values &
Calculated values of unmeasured quantities &
Detection of faulty meters
PowerOPTI – Architecture
PowerOPTI – PI WebParts
Petr Hoření

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- Head of Information System Development Department
- OT Energy Services a.s. (Olajterv Group)
Improving plant performance on a power generation fleet

“using the power of PI System infrastructure we have been able to increase our power plant performance through a centralized data collection program combined with the PowerOPTI Project to achieve high valuable business results as reducing our operational costs and monitoring faulty equipment conditions on a fleet basis”

Mr Marek Mynařík, CEZ, Production Manager

Business Challenge

- Wide power generation portfolio (Nuclear, coal, hydro and renewable)
- Current Electrical market conditions require efficient power plants with the lower operational and maintenance costs.

Solution

- CUTD Project: Centralized PI System for data collection across the power generation fleet.
- PowerOPTI Project: using data from PI System on Porici Power Plant as starting point

Results and Benefits

- Real time monitoring of production block condition
- Evaluation of the start-up costs of the production blocks for improvement
- Monthly energy balance reports for performance improvement
Questions

Please wait for the microphone before asking your questions.

State your name & company.
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