Net Power Generation Monitoring for the Orlen Group Power Plants

Presented by

ORLEN
Agenda

• About PKN Orlen
• Business Challenge
• The Solution
• Solving the Business Challenges
PKN ORLEN – international oil and energy company

- Integrated downstream assets in **three countries** in Central Europe
- 2,700 fuel stations - The largest retail network in Central Europe
- 30 m tons throughput of various types of crude oil
- Over 50 products from refinery & petrochemicals sold in more than 80 countries around the world
- 1.4 m transactions per day
- Over 20 th. highly-skilled employees
- 100 m boe 2P reserves in Poland and Canada

THE LEADER IN CENTRAL EUROPE
PKN ORLEN - energy sector

The second largest investor in new power units in Poland (more than 1000 MWe under construction in 2016)

Integrated energy assets in 9 locations, in 3 countries of Central Europe

- 6.1 GWt* Installed thermal power
- 1.8 GWe* Installed electric power

The largest industrial producer of electricity and heat in Poland

- ~40 PJ Annual heat production
- ~7 TWh* Annual electricity generation

*Including CCGT Włocławek and CCGT Płock. In 2016, electricity generation was about 2 TWh, installed power – 5.2 GWt and 750 MWe.
PKN ORLEN PI System

• Direct customer since: 2002 (user since 1998)

• PI Servers: Total 326,000 tags including 300 clients

• PI PVS is present in main locations
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PKN ORLEN Power Generation – The Challenge

• Common place for all real-time data to implement Net Power Generation Monitoring for the Orlen Group Power Plants

• On-line analysis of power plants performance

• Corporate level production and financial management
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Włocławek-Trading

CCGT Włocławek - Marginal Cost

Cost of additional electricity production vs. Additional Electricity Production

Variable cost of electricity production

Incremental cost of electricity production

Electricity spot price in time

Incremental cost of electricity production bridge

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Włocławek - KPI

CCGT Włocławek - KPI
24.08-30.08.2017

KPI PERFORMANCE vs BENCHMARK

Effect of electricity production deviation from the schedule
Effect of efficiency deviation from the benchmark
Effect of electrical own needs indicator deviation from the benchmark
Effect of other indicators deviation from the benchmark

<table>
<thead>
<tr>
<th>KPI</th>
<th>UOM</th>
<th>Performance</th>
<th>Benchmark</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy overall efficiency</td>
<td>%</td>
<td>100 %</td>
<td>100 %</td>
<td>87.3 %</td>
</tr>
<tr>
<td>CCGT availability</td>
<td>%</td>
<td>100 %</td>
<td>100 %</td>
<td>-</td>
</tr>
<tr>
<td>Electricity production deviation from the schedule</td>
<td>%</td>
<td>5 %</td>
<td>0 %</td>
<td>-</td>
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<tr>
<td>Steam production for Amel</td>
<td>th</td>
<td>100 %</td>
<td>100 %</td>
<td>98.0 %</td>
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<tr>
<td>Cogeneration support level</td>
<td>%</td>
<td>100 %</td>
<td>100 %</td>
<td>70.3 %</td>
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<tr>
<td>Electrical own needs</td>
<td>%</td>
<td>100 %</td>
<td>100 %</td>
<td>2.33 %</td>
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<tr>
<td>Thermal own needs</td>
<td>%</td>
<td>3 %</td>
<td>X</td>
<td>64.34 %</td>
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<tr>
<td>Demi water consumption indicator</td>
<td>m³/h</td>
<td>100 %</td>
<td>100 %</td>
<td>1,161</td>
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<tr>
<td>Decarlo water consumption indicator</td>
<td>m³/MMBtu</td>
<td>100 %</td>
<td>100 %</td>
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<td>Ammonia exit consumption</td>
<td>%</td>
<td>0 %</td>
<td>X</td>
<td>-</td>
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<td>Water losses in boiler cycle</td>
<td>m³</td>
<td>0.2 %</td>
<td>X</td>
<td>13.2 %</td>
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<tr>
<td>Losses and differences on steam transition</td>
<td>%</td>
<td>100 %</td>
<td>100 %</td>
<td>-3.860 %</td>
</tr>
</tbody>
</table>

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PI in PKN ORLEN – conclusions

**PI as useful communication platform with the potential of new users**

- Common platform with the business information of the energy segment
- Monitoring of the technical and economic performance of the energy assets
- Expansion of the group of users in the company – managers, traders

**PI as Business Intelligence tool**

- Deep analysis of the historical data to build the mathematical models of the installations
- Online analysis based on the advanced algorithms in AF
- VBA to make the graphic layer more attractive

**PI as catalyst for automation**

- Automatic generation of the recurring reports – saving time and human resources
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Thank You

Danke

Merci

Dziękuję

Obrigado

謝謝

ありがとう

감사합니다