The Digital Productions Process @ RHI

From Process Information Management System in one plant of RHI AG to the global infrastructure for Industry 4.0 and BigData

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DI Daniel Neubauer - Team Manager Business Applications Production
RHI – an overview

Key facts

- Focus on production, sale and installation of high-grade refractory products
- Revenues of €1,651 million and operating EBIT of €123 million in business year 2016
- 30 production sites and more than 70 sales and service sites, roughly 7,500 employees (>170 in R&D)
- Global partner for over 10,000 customers in more than 180 countries
- Technology leadership with close to the market R&D facilities and tailor-made products

Video – what is refractory?
Our manufacturing process - schematic

Raw material mining (Magnesite) → Crushing → Firing in the rotary kiln (1800°C) → Mixing → Packaging

Unshaped Refractory Products

Unfired Refractory Products

Fired Refractory Products

Pressing (max. 350°C) → Quality Assurance → Packaging

Example Steel Industry

Recycling → Removal → Use → Installation

Pressing (> 2.000 to) → Firing in tunnel kiln (1800°C, 3 days) → Quality Assurance → Packaging

Pressing (max. 3291)
definition of PIMS @ RHI
(PIMS = Process Information Management System)

Intelligent and smart application of process data
saving, analyzing, visualizing and sharing of process-data *without* PIMS:
saving, analyzing, visualizing and sharing of process-data *with* PIMS:
Demands on PIMS

Production processes live and historical visualized for analyzing, investigating and optimizing

- Fully automated data archiving
- **Internal experts react to your needs**
- Easy handling for use of the data
  - graphically ("PI ProcessBook")
  - calculations and reporting in Excel
- Availability in real time
- Network solution
- Defined user rights:
  - data are visible only for own plant-members and
  - Central units (central technicians, R&D, project groups)
- Very low costs
PIMS as a part of the “production-applications”
From the first application to new ideas

New Ideas (Values) will appear!

- 2006: 1st plant connected as a test
- 2007: start up phase of a tunnel kiln in China supervised remote
Examples of application

OT with our Process-Information-Management-System
<table>
<thead>
<tr>
<th>Question</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a decrease in cycle time since the new adaption of settings?</td>
<td>Are there any abnormalities in yesterday’s production?</td>
</tr>
<tr>
<td>How many bricks were produced?</td>
<td>Are the criteria agreed upon with the supplier in compliance?</td>
</tr>
<tr>
<td>How accurate are the control parameter?</td>
<td>How much is the average productivity (TEEP, OEE)?</td>
</tr>
<tr>
<td>How stable is the brick thickness of press 1 compared to press 2?</td>
<td>How often do all equipments run together?</td>
</tr>
<tr>
<td>How often is the hydraulic oil temperature in the critical range?</td>
<td>What was the pressure distribution of the production at 3rd September 2014?</td>
</tr>
</tbody>
</table>

**Why do the answers take so long?**  
**Can you prove it?**

**PI ("PIMS") – Process Information Management System**
Only what we measure can be improved:

The way to process stability:

- Problems & Topics
  - Visualize processes
  - figures, data, facts
  - process- and quality data analysis
  - observations
  - trials
  - know-how exchange
- Decisions & Improvements
  - Optimizations
  - Innovation
- Validation
  - Visualize processes
  - figures, data, facts

PIMS
PIMS Tools – PI ProcessBook

- “The truth is visible in PI ProcessBook” – always have a look on the real side of data
- Basis for all other analysis (quick check, tag selection, corrections and outliers)

Timeline of process data

- SCADA - background
- Expert tools (e.g.: SQC)
PIMS Tools - DataLink

- Fast and powerful application of process data
- Interface to other standard analysing tools

Timeline of process data

Excel-Reports

Expert Tools (Statistics, Visual Computing)
PIMS Tools – PI Coresight (Vision)

- Visualization tool of the future
- Web & mobile!

In RHI actually only 1 “test-license” - not general in use
PIMS Tools – PI Manual Logger and UFL

- Flexible and affordable tool for digitally collecting manual data;
- Direct combining with other, automated, instrumented PI System data;

- Combination of PLC-Tags and data via logger

- Temperature and status message
- External measurement (e.g.: gas-content)
PIMS Tools – PI AF & PI Notifications

- Asset relation and clear structure in tags
- Notify users or systems when key events occur;
PIMS Interfaces

- PI is only process data (one of our data silos)
  - **PI System**=> **SAP QM**
    > Export of quality relevant process data to SAP QM („PI System as measurement device“)
    > example: mixing temperature and energy at the end of a batch
  - **SAP QM** => **PI System**
    > Transmission of quality data from SAP QM to the PI System
    > example: combined visualization of product and quality data
  - **PI System**=> **SAP PM**
    > Transmission of signals for running time- or status condition-based maintenance (as opposed to the usual periodic maintenance)
    > example: maintenance order after a defined count of robot-moves / press strokes, running time
  - **SAP MII** => **PI System**
    > Transmission of product data to the PI System (article, order number,...)
  - **PI System** => **BI <= SAP**
    > Transmission of process data to merge data with SAP in MS BI
Technical setup

IT supports OT
PIMS @ RHI – Data Flow & Interfaces

- Process data
  - PIMS
  - OPC

- Manufacturing Integration and Intelligence
  - SAP MII

- Operations Monitoring
  - Plant Maintenance
    - SAP-PM
  - Production Planning
    - SAP-PP
  - Quality Management
    - SAP-QM

- Control Center
  - Mixing Tunnel kiln

- Visualisation
  - WinCC
  - InTouch

- Automation Controller
  - S5/S7
  - Allen Bradley
  - GE

- Testing Instrument
  - Balances
  - Sieves, RFAs
2 redundant PI Interfaces per plant are connected with the central PI Server.

At least 1 configured OPC Interface

- Option 1 (blue):
  Connection with an existing OPC Server on an existing automations-Server

- Option 2 (red):
  Installation of a new OPC servers on a PI Interface and Connection of the PLC with the new OPC Server (new standard = Softing)
Globales Layout of the RHI PIMS Installation

- One server in Vienna and one Dalian (CN)
- Synchronisation the data from China to Vienna („PI to PI interface“)
PIMS @ RHI – Key figure

Counter for predictive maintenance
227 counter every 3 hours
31 counter daily
(From PIMS via MII to SAP-PM)

~ 900 GB

PIMS
~ 430 connected equipments
~ 60,000 tags

2008
~ 10,000 tags
500 MB / ~ week

2010
~ 30,000 tags
500 MB / ~ 4 days

2014
~ 50,000 tags
500 MB / ~ 2 days

2017
~ 60,000 tags
500 MB / ~ 1 days

10 years process data
~ 900 GB
## PI System - Support Structure: the key to our success

<table>
<thead>
<tr>
<th>second level (central)</th>
<th>first level (plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Administration</strong></td>
<td><strong>System Administration</strong></td>
</tr>
<tr>
<td>IT</td>
<td>Ensuring PI System operation,</td>
</tr>
<tr>
<td></td>
<td>Monitoring</td>
</tr>
<tr>
<td></td>
<td>trouble shooting</td>
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<tr>
<td></td>
<td>system documentation</td>
</tr>
<tr>
<td></td>
<td>IT</td>
</tr>
<tr>
<td></td>
<td>system devices</td>
</tr>
<tr>
<td></td>
<td>licenses</td>
</tr>
<tr>
<td></td>
<td>Installation guidelines</td>
</tr>
<tr>
<td></td>
<td>Standardization</td>
</tr>
<tr>
<td><strong>Tag Administration</strong></td>
<td><strong>Tag Administration</strong></td>
</tr>
<tr>
<td>OT</td>
<td>providing data</td>
</tr>
<tr>
<td></td>
<td>Tag selection</td>
</tr>
<tr>
<td></td>
<td>Tag configuration</td>
</tr>
<tr>
<td></td>
<td>Standardization</td>
</tr>
<tr>
<td></td>
<td>Calculated Tags</td>
</tr>
<tr>
<td></td>
<td>Notifications</td>
</tr>
<tr>
<td><strong>PI Application</strong></td>
<td><strong>PI Application</strong></td>
</tr>
<tr>
<td>OT</td>
<td>“Key User”</td>
</tr>
<tr>
<td></td>
<td>support for local users</td>
</tr>
<tr>
<td></td>
<td>Training</td>
</tr>
<tr>
<td></td>
<td>sharing information</td>
</tr>
<tr>
<td></td>
<td>contact to central support</td>
</tr>
</tbody>
</table>

- 26 plants
- >60,000 tags
- >500 User
Summary
What we have achieved:

- **global tool for process analysis**: PI ProcessBook, PI Data Link, PE, PI AF, UFL, …
- **Advantages of centralized support**: standardization, Best Practice, trainings,…
- **Integration of manual data**: additional information, live analysis
- **10 years of success**: reporting & benchmarking, trouble shooting, optimizations
- **PI System = daily business**

Outlook:

- **Transfer to “Enterprise Intelligence”**
The Digital Productions Process @ RHI – Contact

www.rhi-ag.com

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