

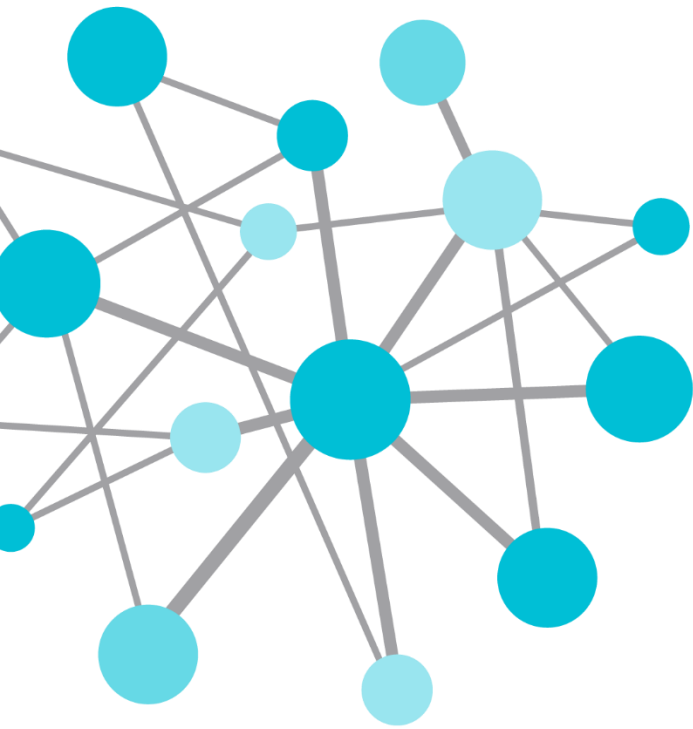
Overview of OSIsoft in the Global Power and Utilities Industry

Presented by **Miguel Chavero**

EMEA Power and Utilities Industry Principal



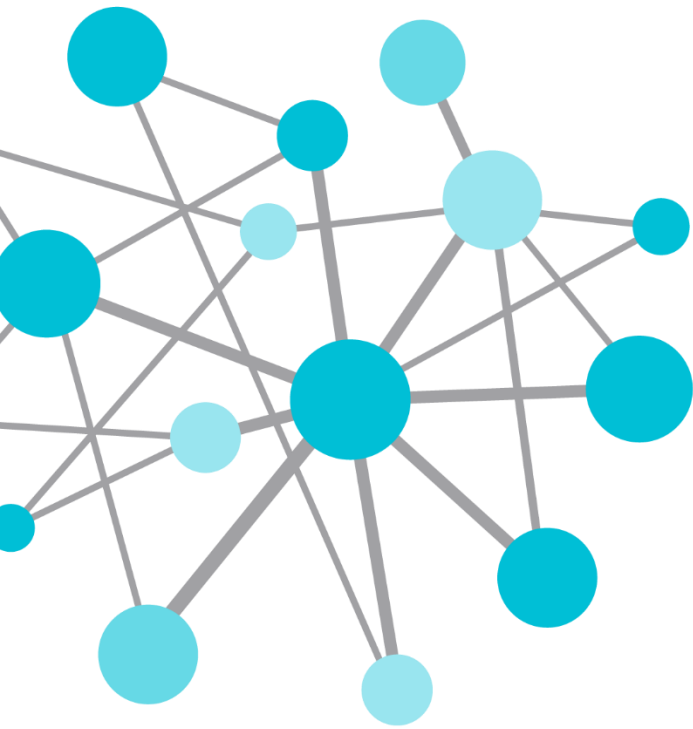
INDUSTRY FORUM



Agenda

Agenda

- Introduction
- Uses cases
 - CCGT
 - Coal
 - Hydro
 - Renewable
 - T&D
- Summary



Introduction

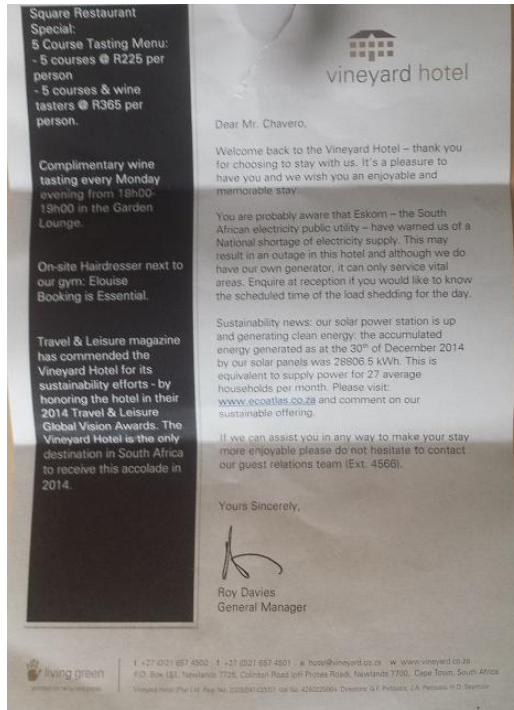
EMEA References PowerGen (non exhaustive)



European T&D references (non exhaustive)



Big Challenges...

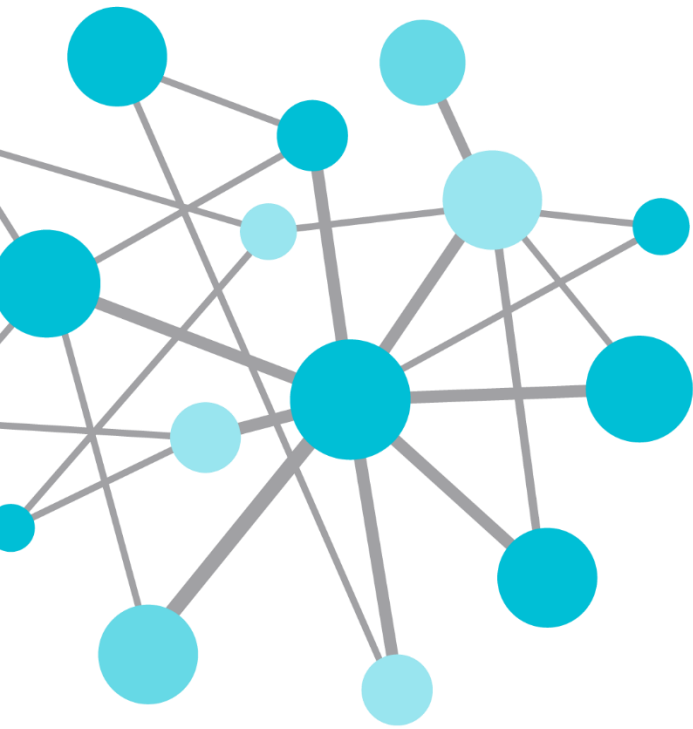


What's coming?



Smart Microgrid





Use Cases

Use Cases



Real-Time Infrastructure use cases deployment in leading companies



EDP

EDP worldwide



Renewables

EDPR-NA

Installed Capacity

3,667 MW

Electricity generated

10,146 GWh

EDPR-EU

Installed Capacity

4,283 MW

Electricity generated

9,527 GWh

EDPR-BR

Installed Capacity

84 MW

Electricity generated

230 GWh



Portugal

Installed Capacity

8,911 MW

Electricity

22,723 GWh generated

43,858 GWh distributed

5,718 thousand Customers

Gas

6,938 GWh distributed

224 thousand Customers



Brazil

Installed Capacity

2,157 MW

Electricity

8,360 GWh generated

25,880 GWh distributed

3,045 thousand Customers



Spain

Installed Capacity

3,853 MW

Electricity

9,961 GWh generated

9,147 GWh distributed

1,118 thousand Customers

Gas

51.535 GWh distributed

796 thousand Customers

* MW EBITDA

SKIPPER

System, Knowledge, Information, Plant Performance & Environment

Business Challenge

- Provide an integrated information system to support management and monitoring of generation assets.
- Support to internationalization of EDP Group.
- Implement a plan to deal with future organizational challenges.
- Sharing of best practices and technology as well to retain knowledge.

Solution

- Connection of different data sources - DCS, SCADA, energy meters to PI Systems.
- SharePoint portal with PI WebParts and PI DataLink for Excel Services.
- Relational databases for other sources and Business Intelligence.
- Business Objects (BO) reporting.



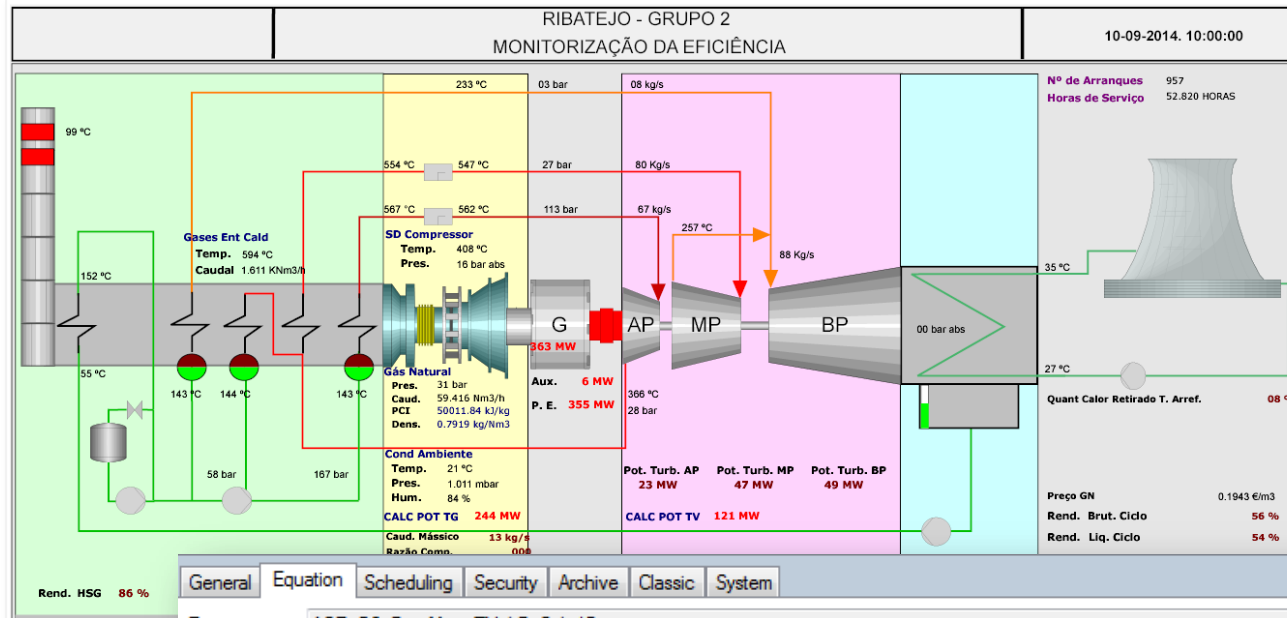
Portal

A work environment

- Provides an accessible way to the underlying data of the activity of the company in an environment that allows sharing best practices and technologies and the collaboration between people.
- Giving life to data, transforming it into information to enhance competitive advantages.
- Organize and add sense to the data in order to make it understandable.
- Allow to identify, locate and ease access to knowledge assets (organizational memory).
- Increase the creation of new paradigm, leading to the formation of competitive advantages.



Monitoring



A set of displays with raw and a calculated data.

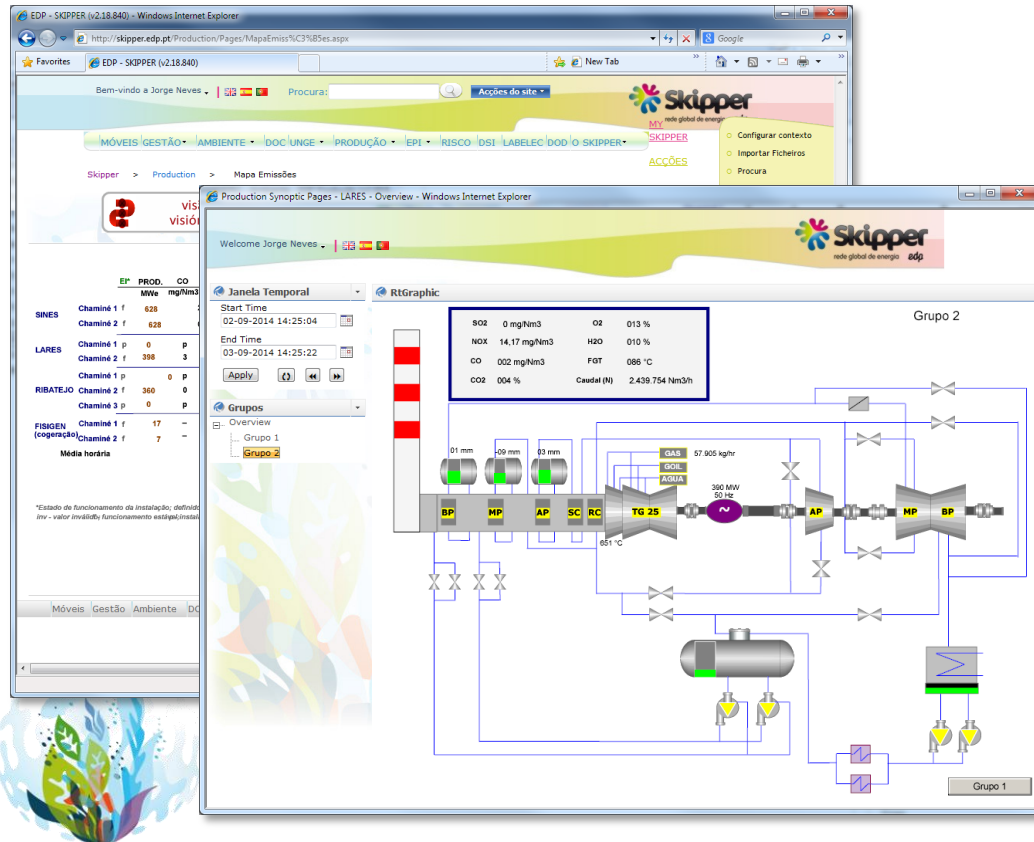
Intensive use of Performance Equations and Steam Functions to monitor the efficiency of turbo-groups, boilers and other machines with special importance in thermodynamic performance.

Event tag: ACE_G2_Pot_Mec_TV_LP_Calc15

Equation:

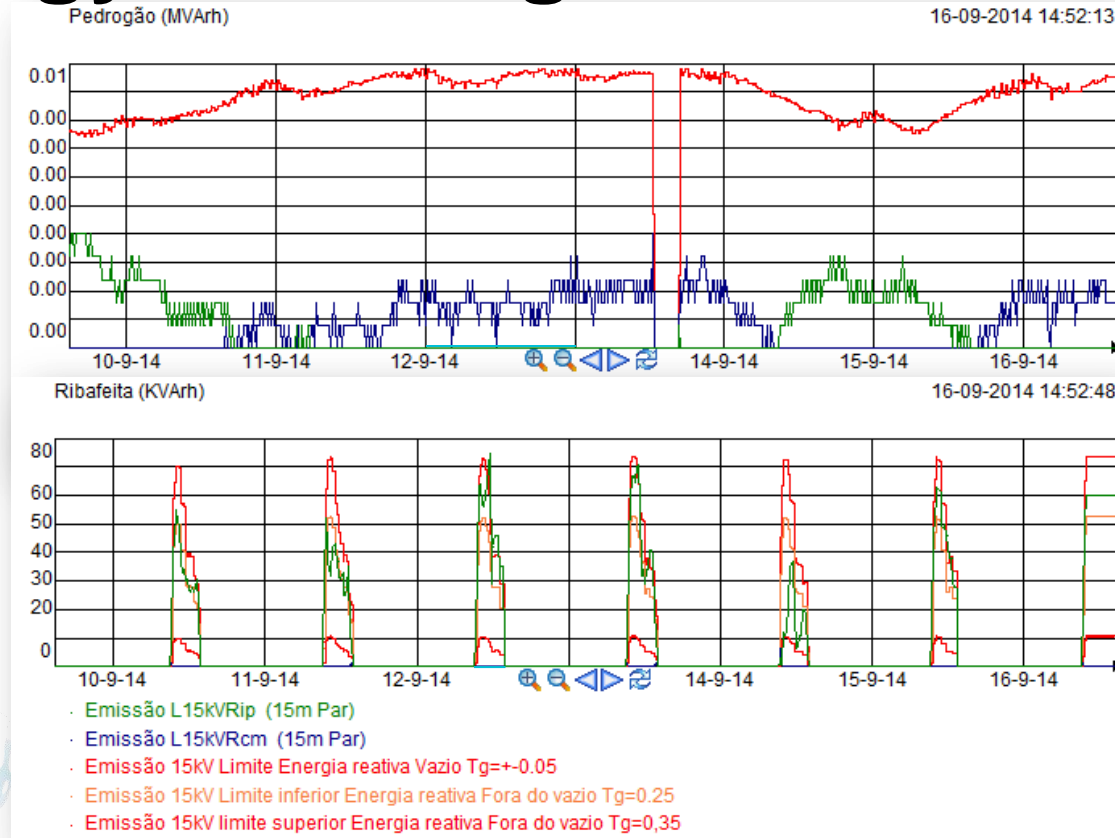
$$\left(\text{Avg}(\text{TagAvg}(20\text{PAB}21\text{CF}001.\text{e}', '','', '-15\text{m}'), \text{TagAvg}(20\text{PAB}21\text{CF}001.\text{v}', '','', '-15\text{m}')) * (\text{StmEng_HPTL}(0.9 * \text{Avg}(\text{TagAvg}(20\text{PAB}11\text{CP}001.\text{XQ}01', '','', '-15\text{m}'), \text{TagAvg}(20\text{PAB}12\text{CP}001.\text{XQ}01', '','', '-15\text{m}')) * 14.504, (32 + (9/5) * \text{TagAvg}(20\text{PAB}31\text{CT}001.\text{XQ}01', '','', '-15\text{m}')) - \text{StmEng_HPTL}(0.9 * \text{Avg}(\text{TagAvg}(20\text{PAB}11\text{CP}001.\text{XQ}01', '','', '-15\text{m}'), \text{TagAvg}(20\text{PAB}12\text{CP}001.\text{XQ}01', '','', '-15\text{m}')) * 14.504, (32 + (9/5) * \text{TagAvg}(20\text{PAB}21\text{CT}001.\text{XQ}01', '','', '-15\text{m}')))) * 2.326 / 1000 / 0.98 \right)$$


Environment



- Provide the tools for the management of environmental data - atmospheric emissions, air quality, water consumption and wastewater.
- Consolidation of environmental data.
- Automatic data validation based on operation of the facility and state of the measuring instrument.
- Manual data validation using (in house) developed applications on PI SDK.
- Automatic integration of data on an Oracle database for reports with Business Objects (BO).

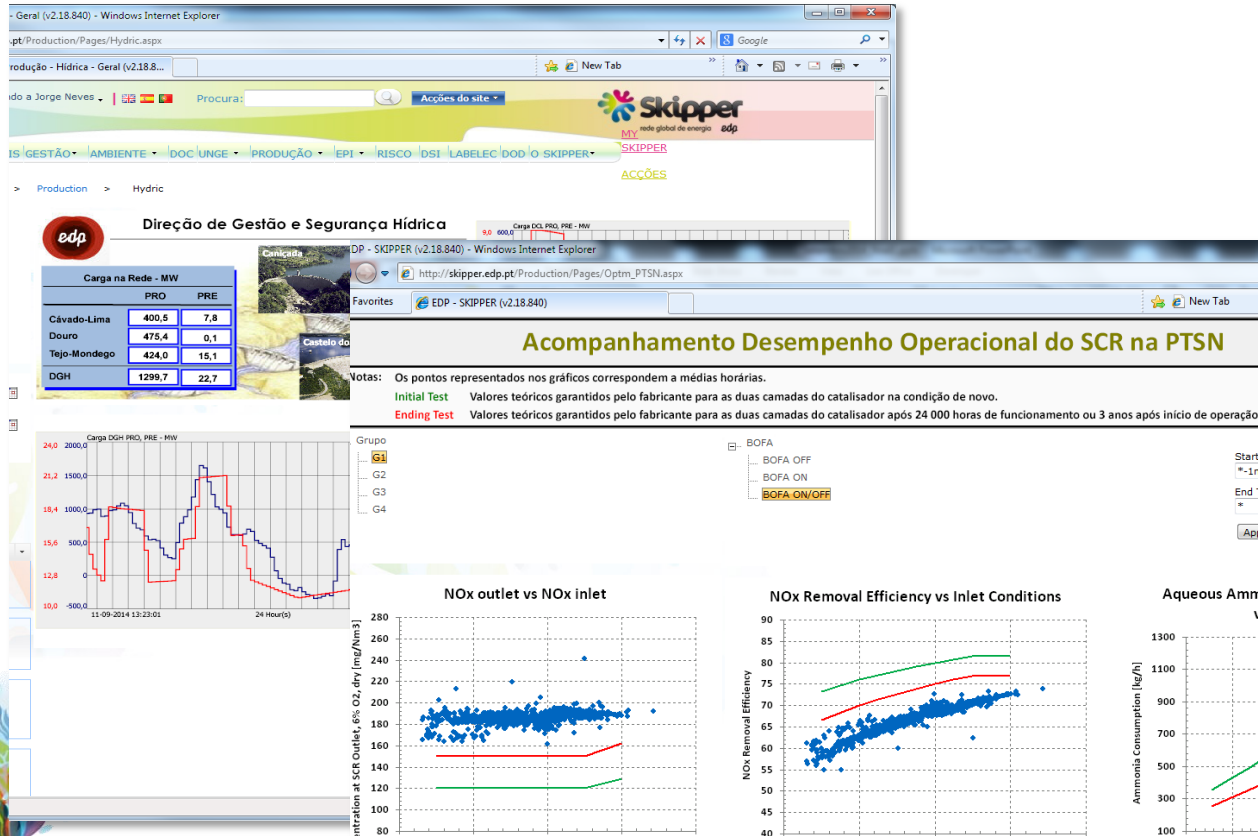
Energy metering



- Cost control of the production process.
- Optimization of operation in order to energy efficiency – control of reactive power.
- Billing control.
- Identifying areas for improvement.



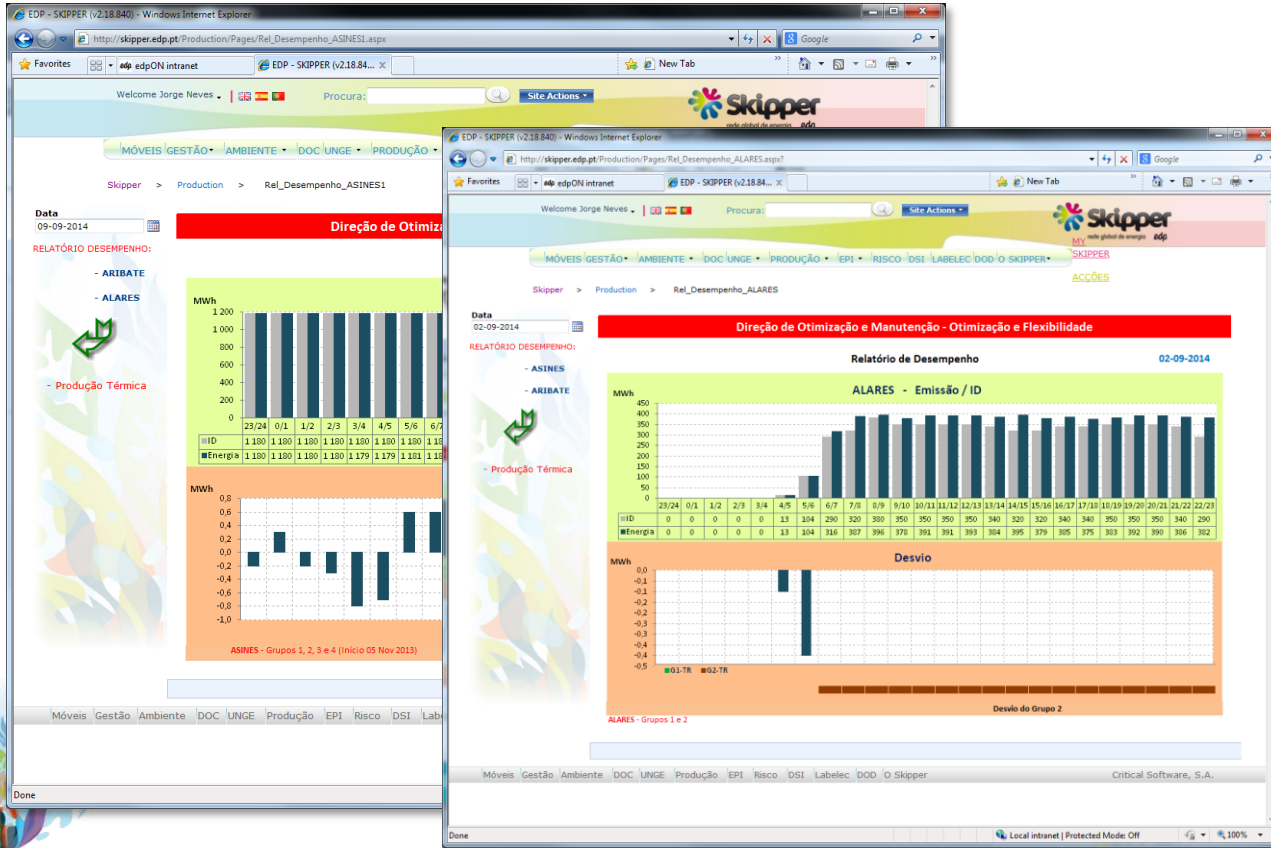
Operation analysis



Optimizing the operating processes and optimizing performance in power generation plants.

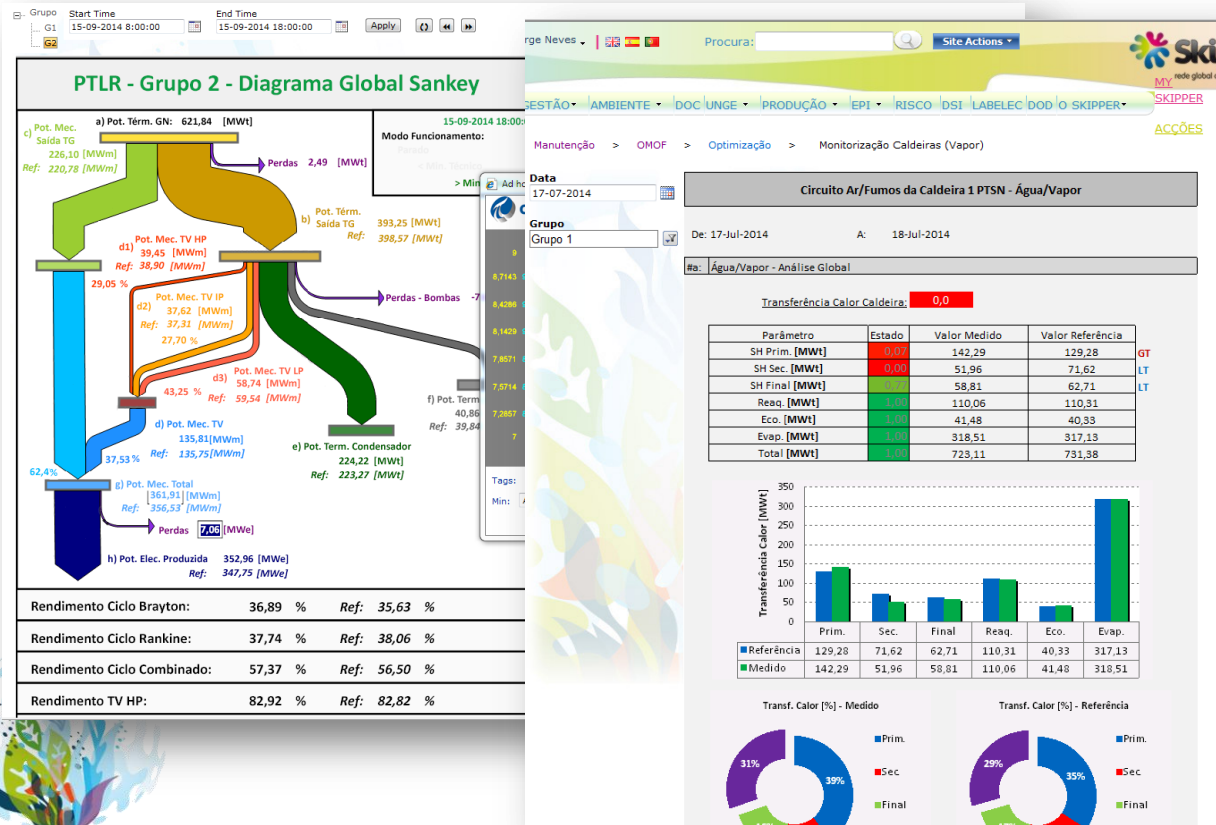
Analysis of operational and critical variables.

Performance



Analyzing performance of generation versus demand.

Maintenance



Examples of applications for maintenance:

- Thermodynamic cycle to control the degradation of operation.
- Air and flue gas cycle control.
- Water and steam cycle control.

Conclusion

Business Challenges

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Solution- SKIPPER

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- SharePoint portal with PI WebParts and PI DataLink for Excel Services.
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- Business Objects (BO) reporting.

Results

- Accessibility to data and knowledge sharing without technological, organizational or geographical barriers.
- Putting the focus on assets' knowledge with the potential to create value by eliminating monopolies in data access.
- Evolve from a vertical organization to a networked organization.
- Obtain, maintain and analyze data from all units of EDP Produção.
- Optimize efficiency's management of existing assets.





CEZ

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)

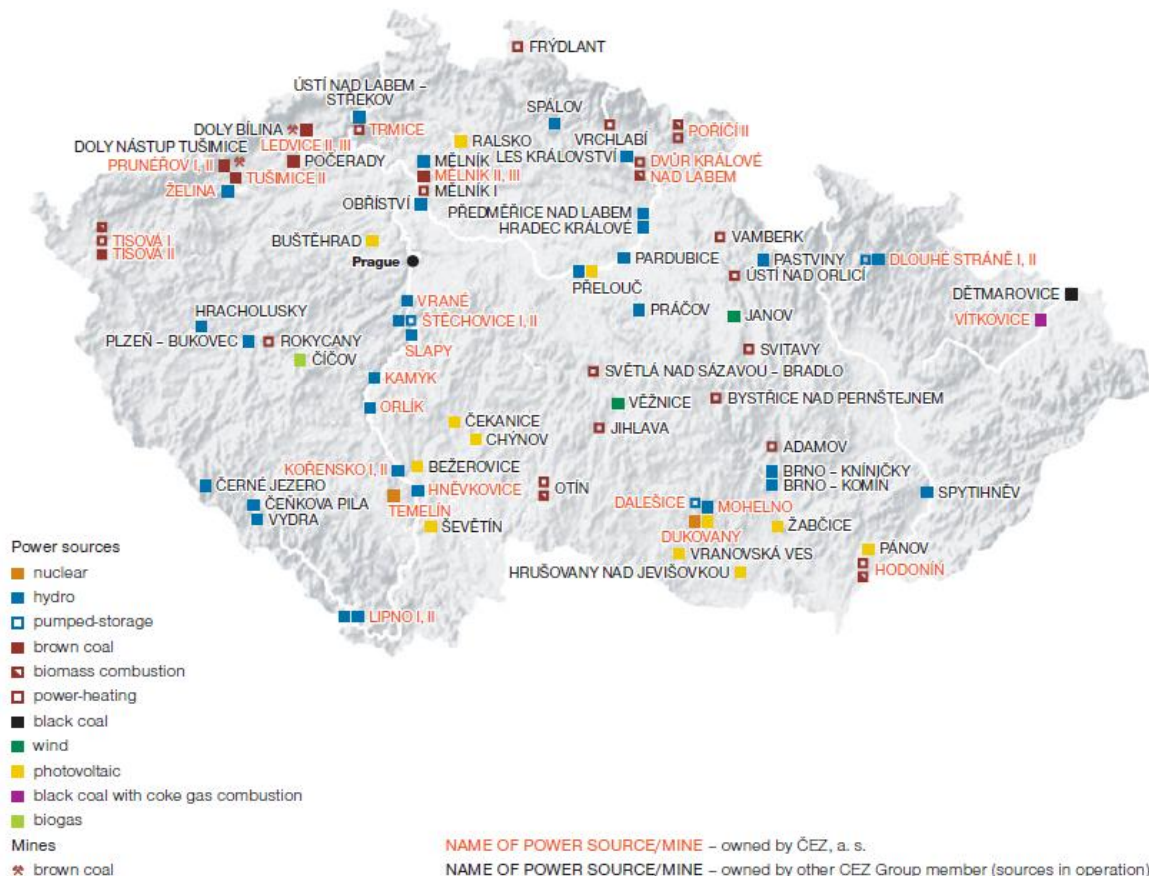


CÚTD Project

(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

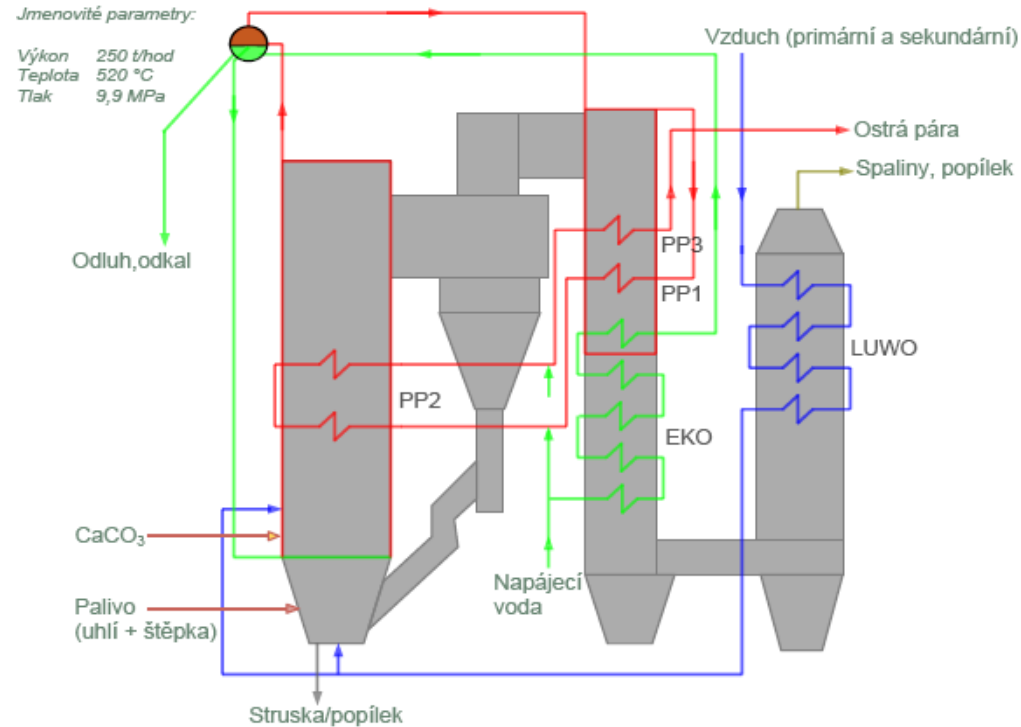
Aim - to get real information about the operation using validation

Implementation process

2012 – model of the boiler FK7

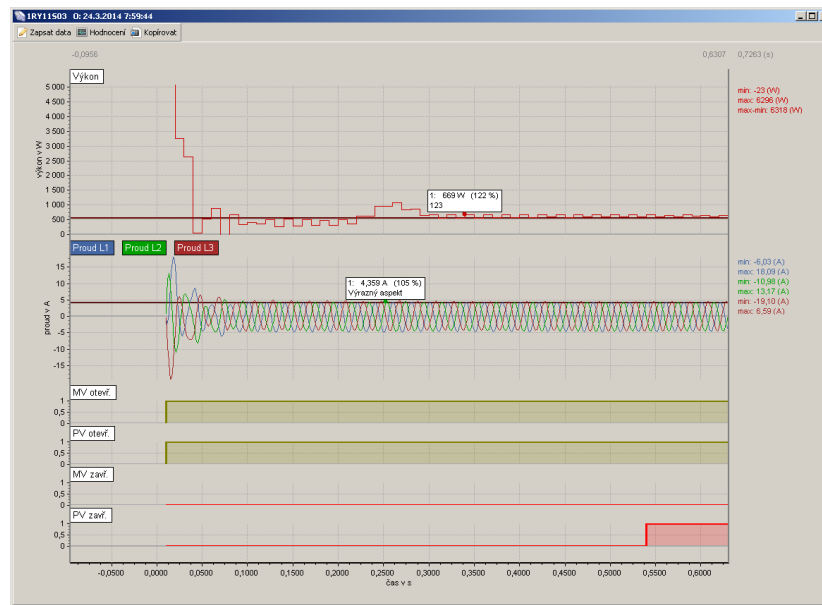
2013 - model of the entire Porici power plant

2014 – final tuning of the model validation

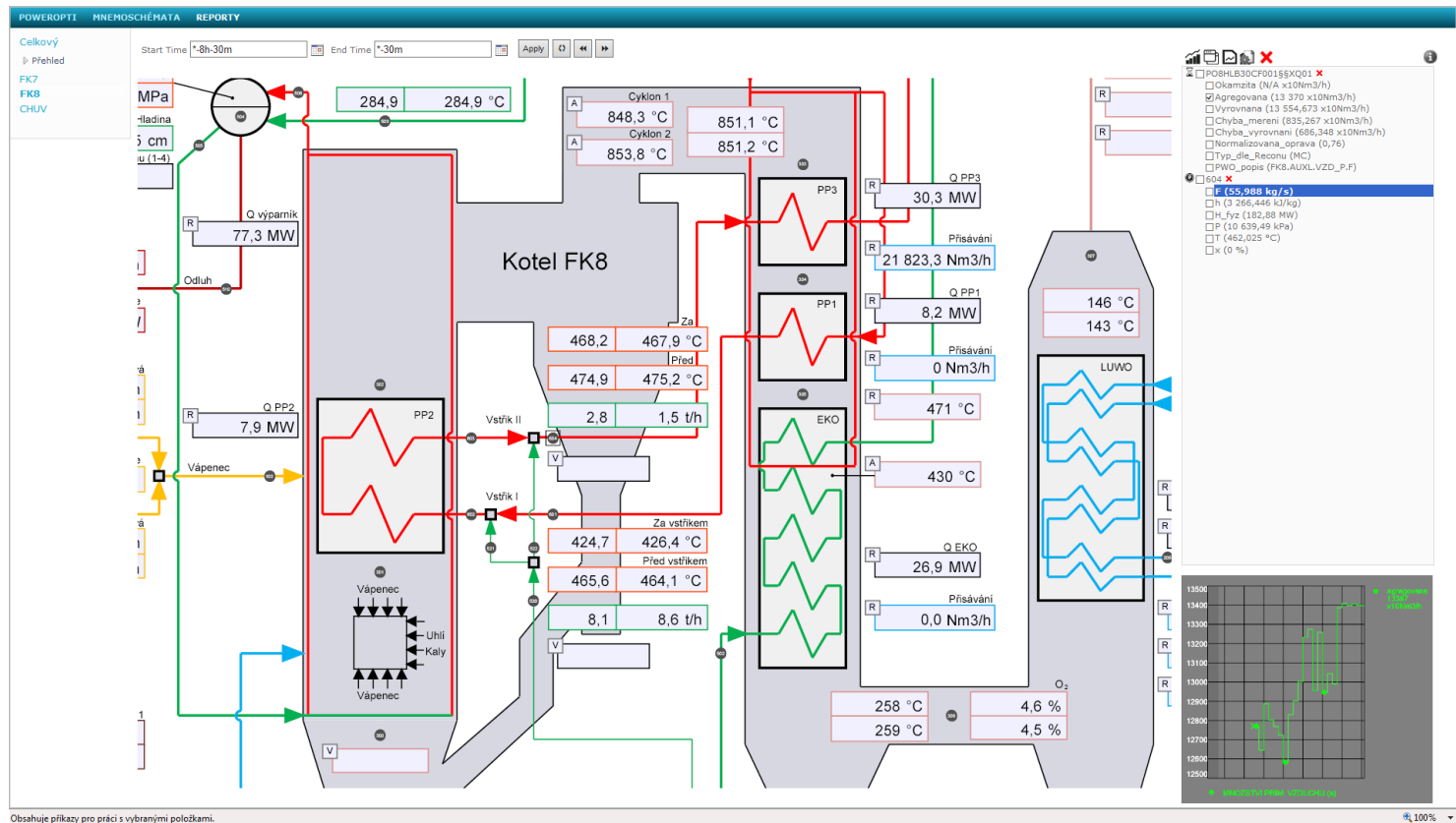


PI System in ČEZ – Platform of Future

- 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



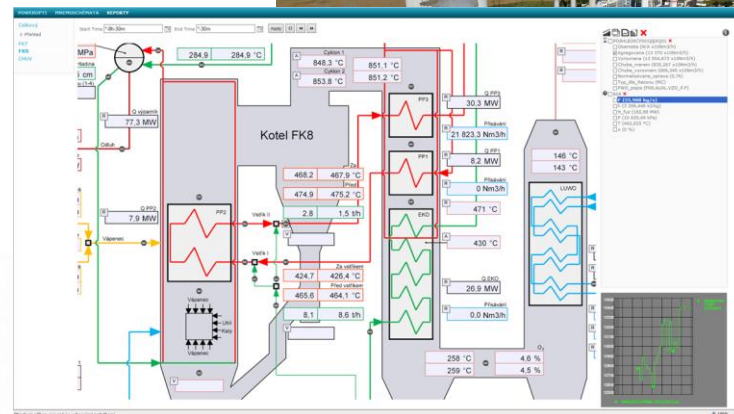
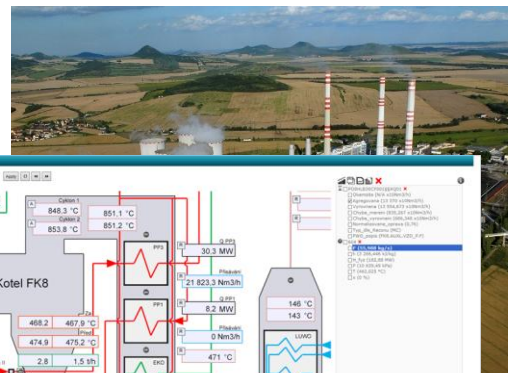
PowerOPTI – PI Webparts



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 start-up costs and monitoring faulty equipment conditions on a fleet basis”

Mr Marek Mynařík, CEZ, Production Manager



Business Challenge

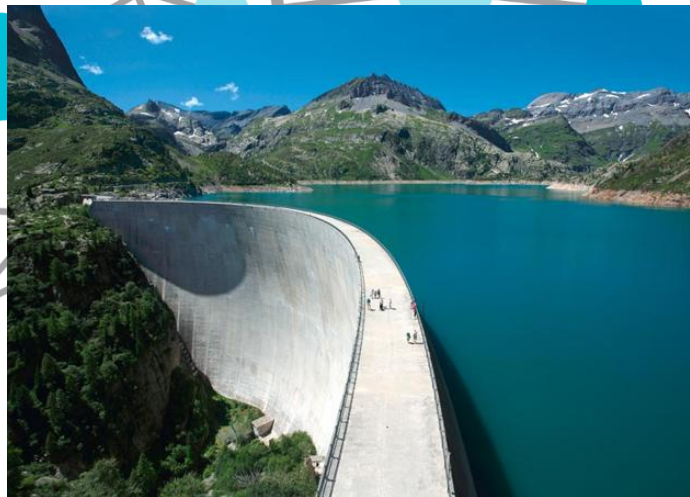
- Wide power generation portfolio (Nuclear, coal, hydro and renewable)
- Current Electrical market conditions require efficient power plants with the lower operational and maintenance costs.

Solution

- CUTD Project: Centralized PI Data System for data collection across the power generation fleet.
- PowerOPTI Project using PI Data 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



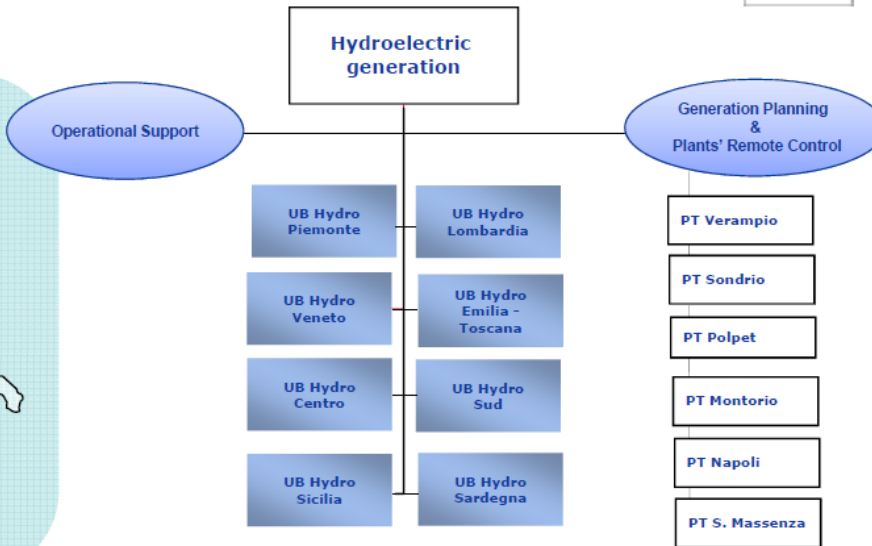
ENEL



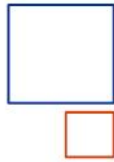
Hydroelectric Generation Business Area



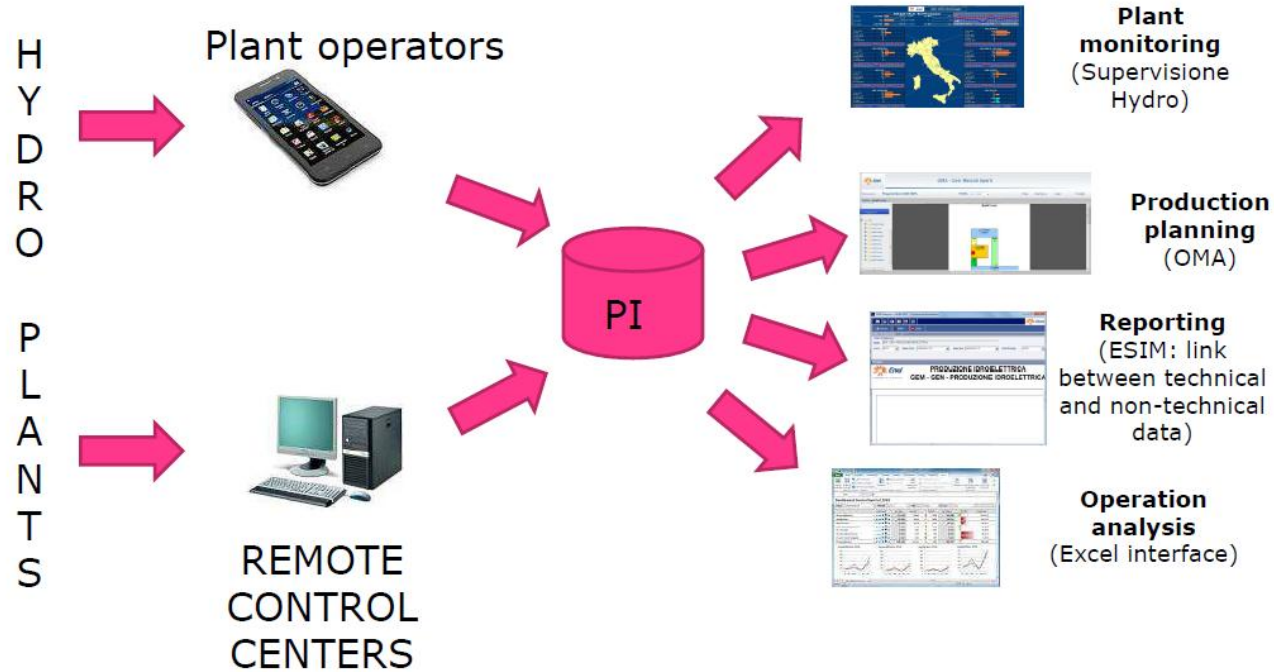
★ Control Rooms



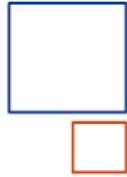
Hydro Business Units	→	8
Remote Control Rooms	→	6
Power plants	→	~200
MW installed	→	~11.000



Technical information management



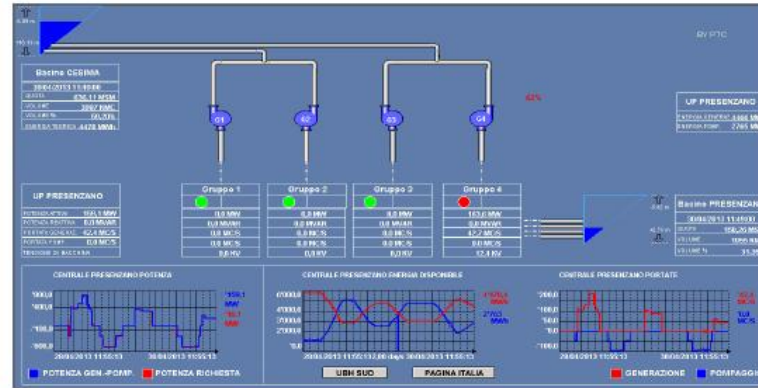
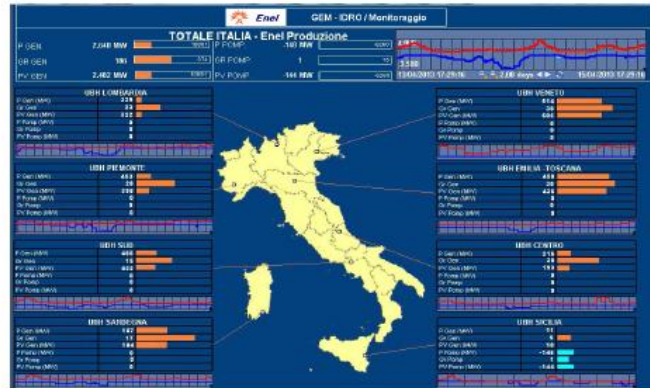
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“Supervisione Hydro” 1/2



The system has been developed by Enel using Process Book OsiSoft tool in order to allow the operators access main plants information in real time, both with **synthetic** and **detailed views**.



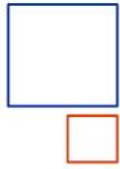


“Supervisione Hydro” 2/2



The main features and advantages of the system are:

- Visualization of **real time** situation and **historical trends**
- Easy implementation of **dedicated views** and **dedicated calculations**, especially views not useful for remote control rooms operators but only for plants operators (both for usual and temporary needs). For example:
 - view for flood management
 - view for water management in case of drought
 - view for imbalance analysis
 - view for power plants tests
- Flexible implementation of different **aggregated data** (by geography, by technology, by market participation, etc.)
- System available also on **tablet** and **smartphone**.



OMA (Production Planning)



In order to offer Enel's generation fleet in an optimal way in the Italian electricity market, hydro plants need to elaborate in advance many data to determine minimum and maximum power and energy outputs. The tool used in Enel for this goal is OMA and all data necessary about water availability (reservoirs levels, natural flows and discharged flows) come from PI archive.





JUWI

We make it happen

juwi at a glance

Organization

- Founded in 1996 by Fred Jung and Matthias Willenbacher (juwi), pioneers for renewable energies
- juwi AG is an owner-managed group of companies and not traded on the stock exchange

Total capacity

Around 3,100 megawatt (approx. 2,300 systems)

Annual energy output

Approx. 5.8 billion kilowatt-hours, corresponds to the annual power demand of around 1.7 million households

Investment volume (since 1996)

Approx. 6,0 billion Euro

Employees & turnover

- Approx. 1,100 employees (worldwide)
- Approx. 1.0 billion Euro in 2012



The Challenge

Multiple assets



Multiple Clients

- Public funds
- Private funds
- Insurances
 - Private individuals
 - Ecologist
 - Wealthy individuals
- Companies
- Communities
- Banks
-



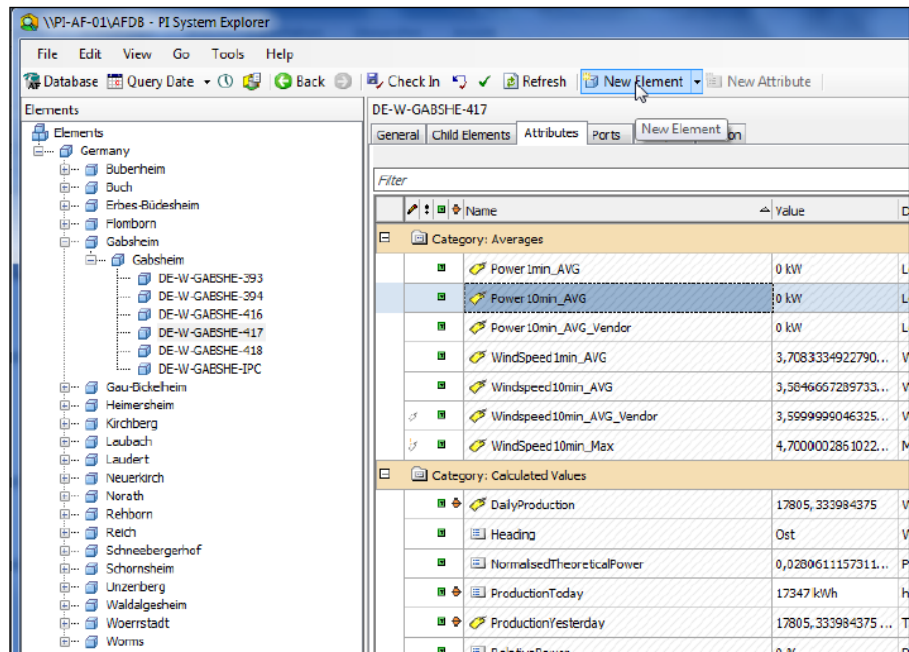
Our Vision

- A unified user interface for all assets
- Transparent O&M business to the customer (all our steps are visible to the customer online)
- Data transparency from the source to the customer
- Ability to verify all kind of data delivered by subsystems
- Easy add-on of new assets
- Consistent Database internally, individual customer reporting
- Data source for new regulation demand in the future
- Data exchange with customer's energy trading systems, grid operators and public authorities
- Ability to track challenging environmental requirements and market situations and being able to evaluate them monetary



“Look and Feel“ - Asset view in PI Asset Framework

- “Copy/paste” tree structure
- Standardization of Assets using Templates
 - generic (90%)
 - specific (5%)
 - analytics (5%)
- Triple structure views
 - Assets by location
 - Assets by owner
 - Assets by energy flow
- **Benefits of using PI AF**
 - Big time savings
 - No errors when adding new assets

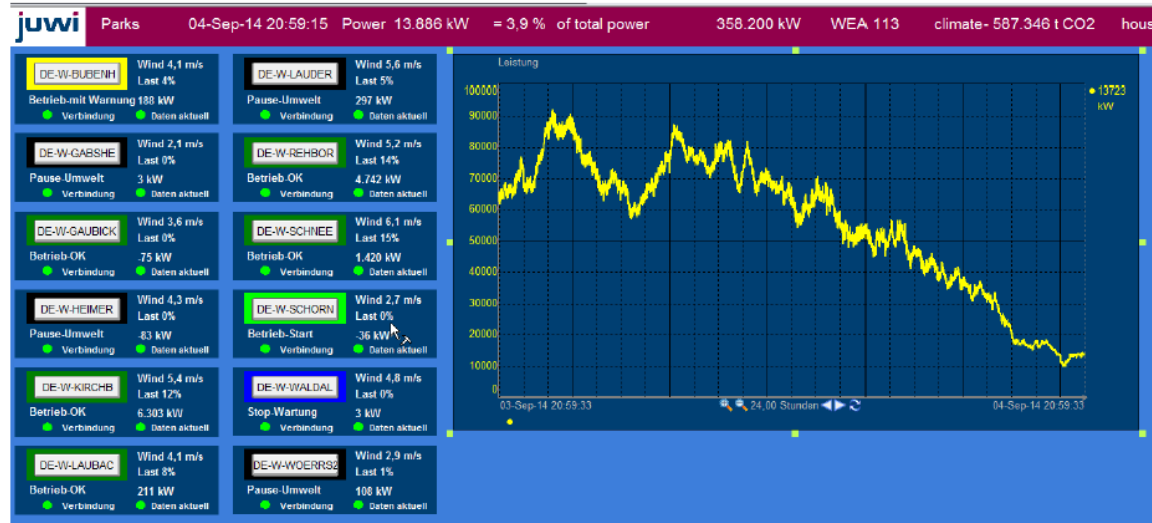


“Look and Feel” – park overview

being able to drill down the assets



- overview of connected Wind farms
- each button one park
- colors represent the park status
- just main information
 - power
 - wind
 - data quality



“Look and Feel“ - park overview

- each asset same view
 - regardless of manufacturer
- information limited to the essentials

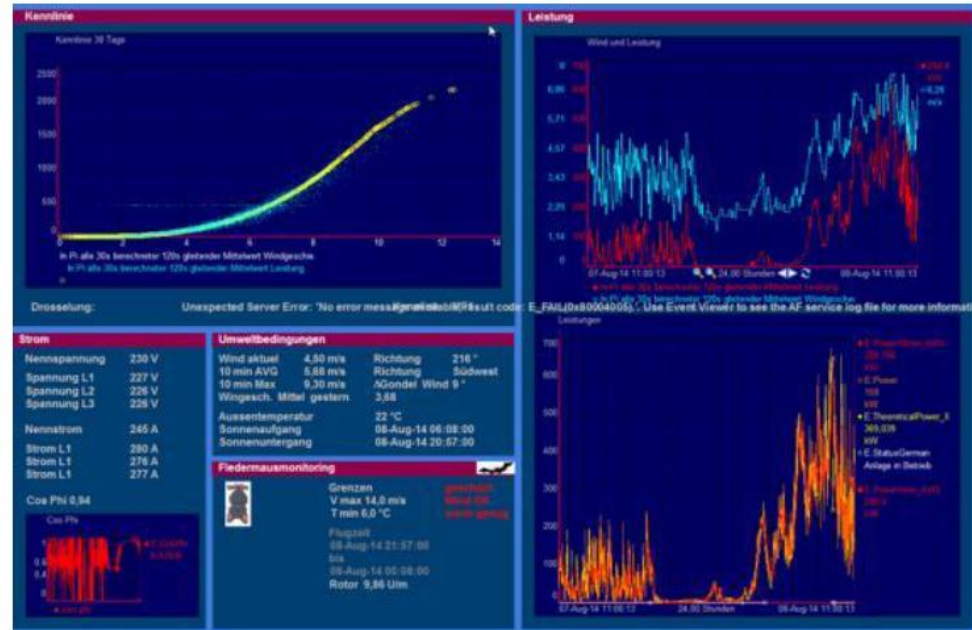


juwi		DE-W-KIRCHB	Wind 5,8 m/s	6.545 kW	Auslastung 12%	Hersteller	Status
	DE-W-KIRCHB-364	Betrieb-OK	Wind 5,8 m/s	203 kW	Auslastung 9%	Code	0 0
	DE-W-KIRCHB-365	Betrieb-OK	Wind 7,2 m/s	593 kW	Auslastung 26%	Code	0 0
	DE-W-KIRCHB-366	Betrieb-OK	Wind 4,9 m/s	201 kW	Auslastung 9%	Code	0 0
	DE-W-KIRCHB-367	Betrieb-OK	Wind 5,3 m/s	215 kW	Auslastung 9%	Code	0 0
	DE-W-KIRCHB-368	Betrieb-OK	Wind 6,1 m/s	248 kW	Auslastung 11%	Code	0 0
	DE-W-KIRCHB-369	Betrieb-OK	Wind 5,7 m/s	272 kW	Auslastung 12%	Code	0 0
	DE-W-KIRCHB-370	Betrieb-OK	Wind 5,0 m/s	223 kW	Auslastung 10%	Code	0 0
	DE-W-KIRCHB-371	Betrieb-OK	Wind 5,0 m/s	180 kW	Auslastung 8%	Code	0 0
	DE-W-KIRCHB-372	Betrieb-OK	Wind 4,7 m/s	132 kW	Auslastung 6%	Code	0 0
	DE-W-KIRCHB-373	Betrieb-OK	Wind 6,3 m/s	319 kW	Auslastung 14%	Code	0 0



“Look and Feel“ - detailed view

- drill down
- on line power curve check
- detailed “bat” monitoring



Summary

“We are convinced that we will be able to continue in creating the worldwide energy transition with our experience in planning, constructing and operating renewable energy plants.

The PI System will help us to achieve this goal. “



Business Challenge

- many scattered assets
- multiple technologies
- Dial-in vs. online monitoring
- “maturing” Customers
- limited resources

Solution

- Implementation of PI System Infrastructure
- Standardization of connectivity
- multiplication from one to many assets using PI AF
- one unified view for the control room as 1st level support

Results and Benefits

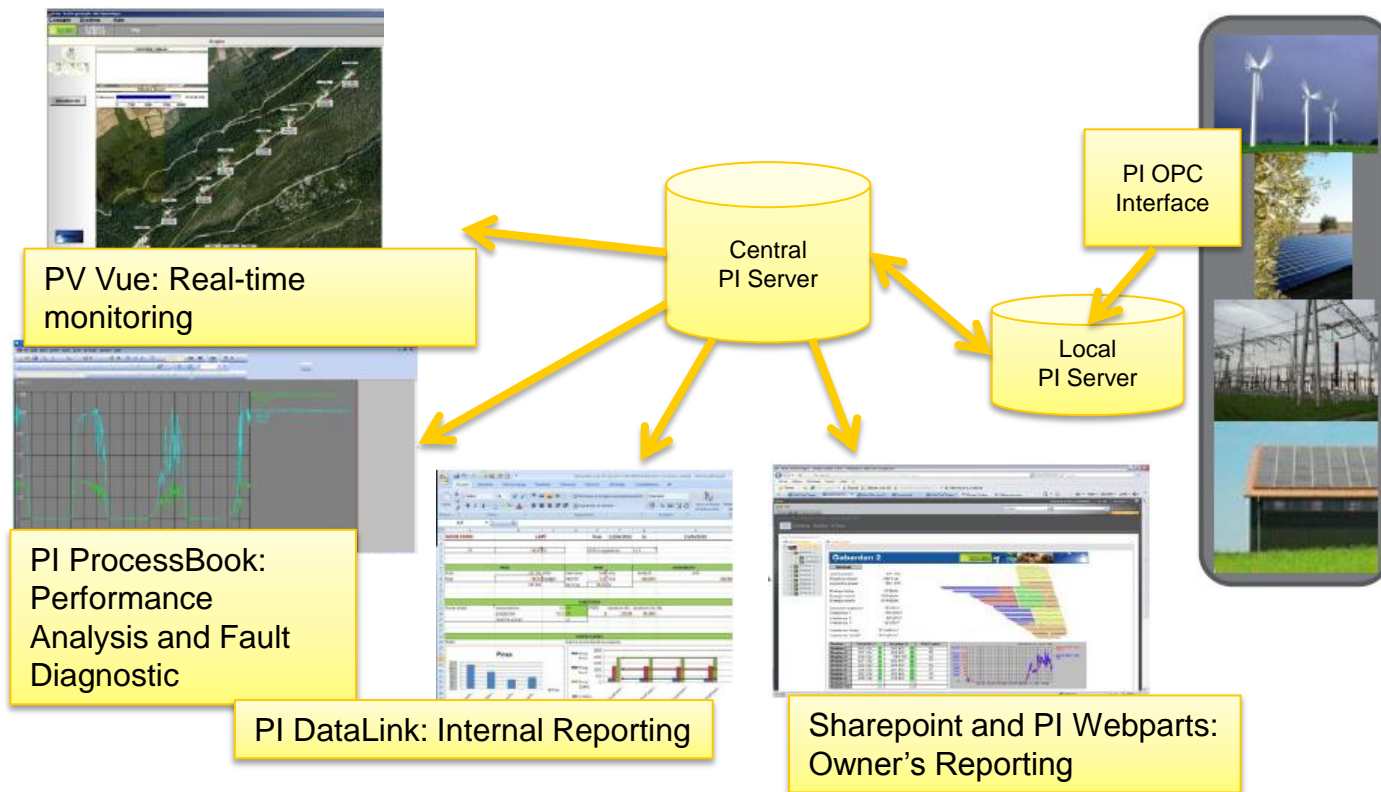
- online monitoring
- unified user interface
- Improved users experience
- efficiency increase 1%
- € 2.600.000.- pure benefit for our customers per year





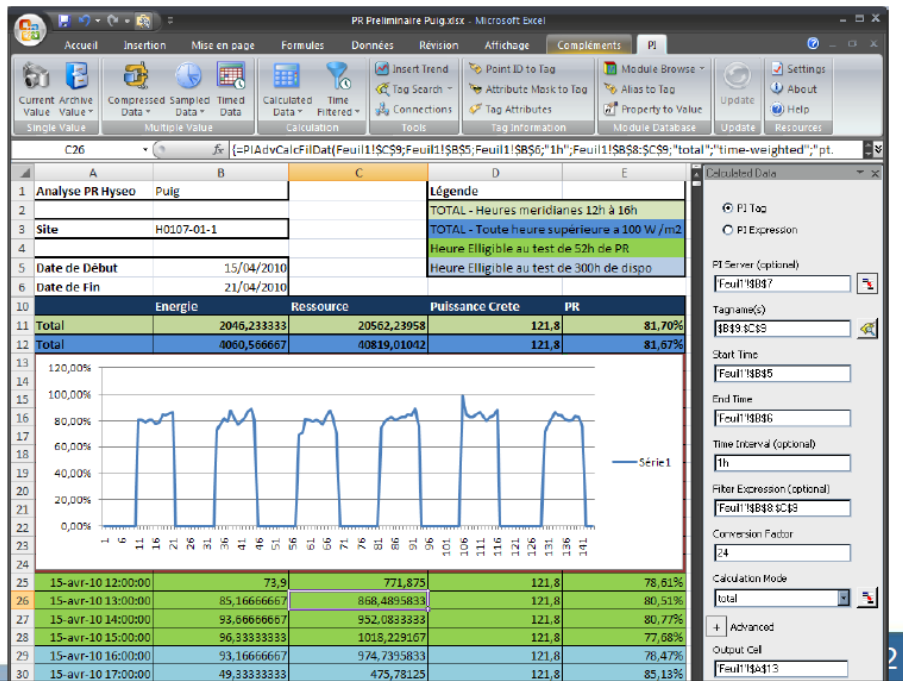
EDF-EN

EDF-en: Single tool for Asset Monitoring



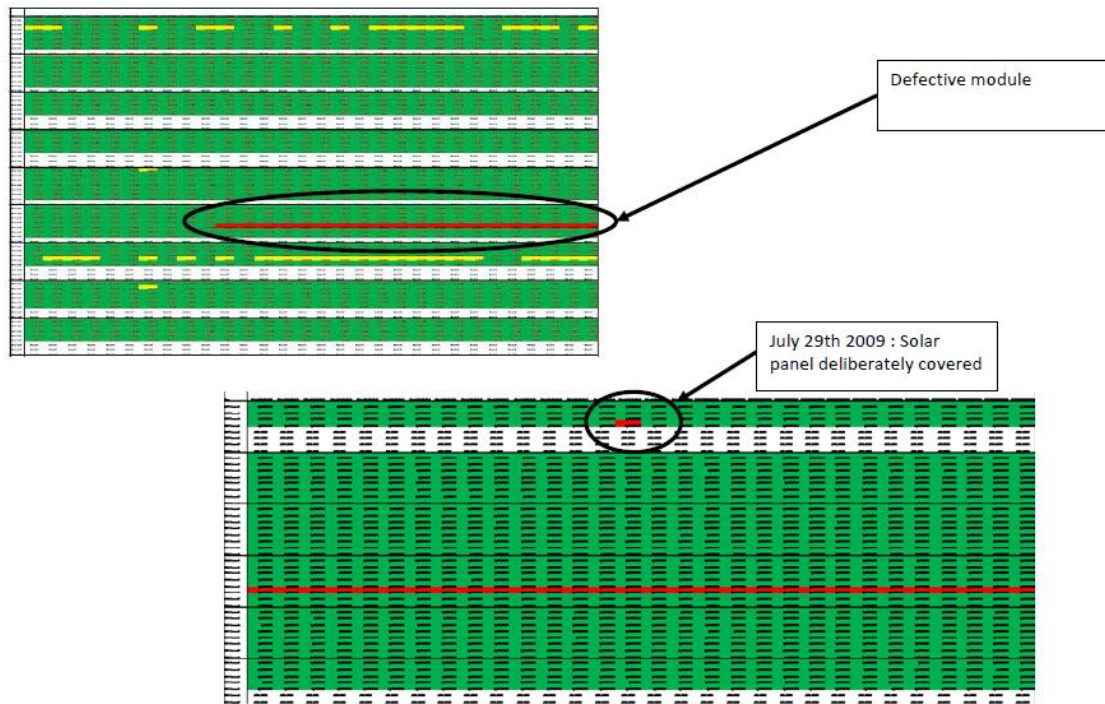
Asset Management

- Daily Capacity Factor
- Daily Performance Ratio



PV Diagnostics using PI

- Remote identifications of defective strings



PV Diagnostics using PI

EXAMPLE : NARBONNE-SHELTER 4 (2)

RESULT :



Site visit following detection in PI





FINGRID

Our vision of the Condition Monitoring System

Smart visualization

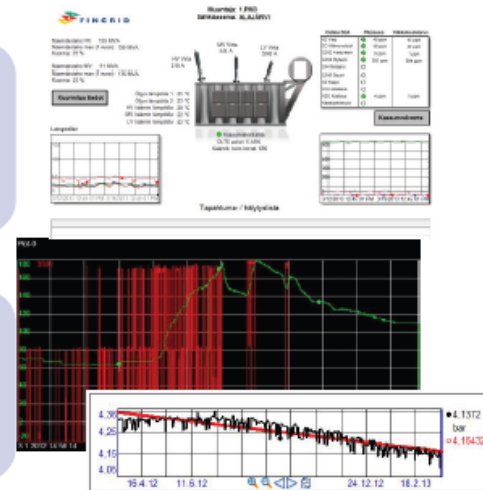
- different kind of displays
- traffic lights based on alarm values
- gauges, embedded trend windows
- drill-down UI

Easy analysis tools

- differences between two points
- maximum, minimum
- ratios (e.g. gas ratios)
- trend curves

Automatic alarms

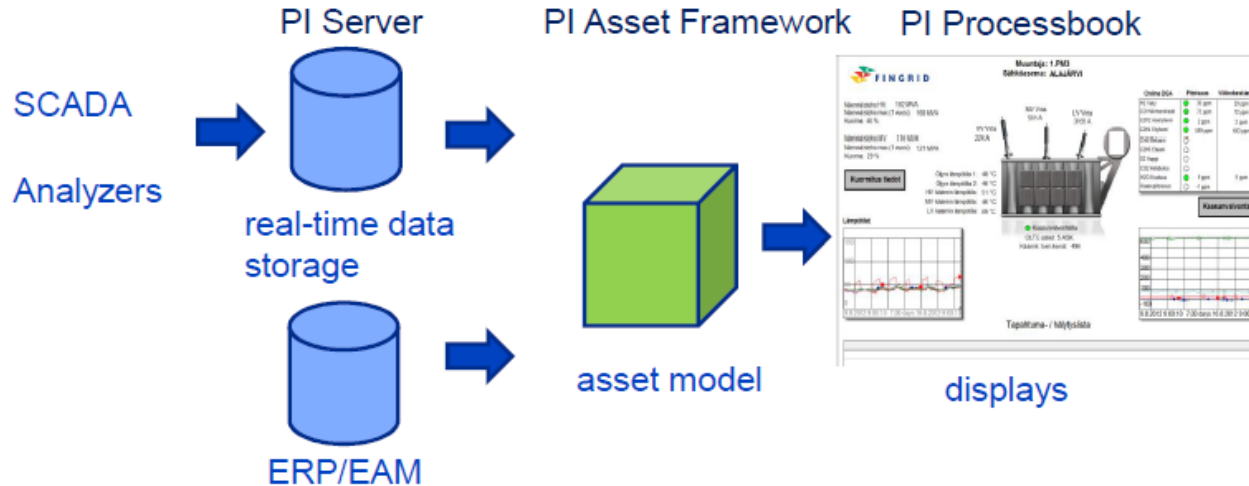
- notifications and alarms based on trigger rules
- generate tasks to our asset management system in the future



12.6.2014

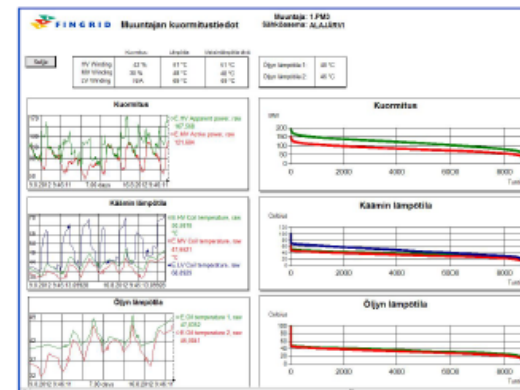
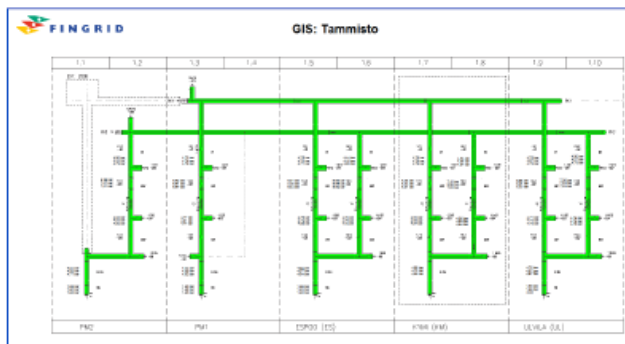
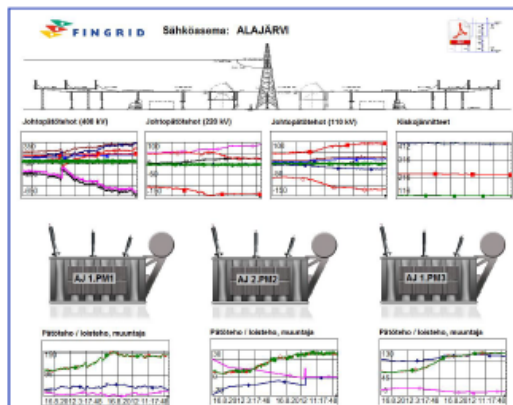
Kari Suominen

How it works ?



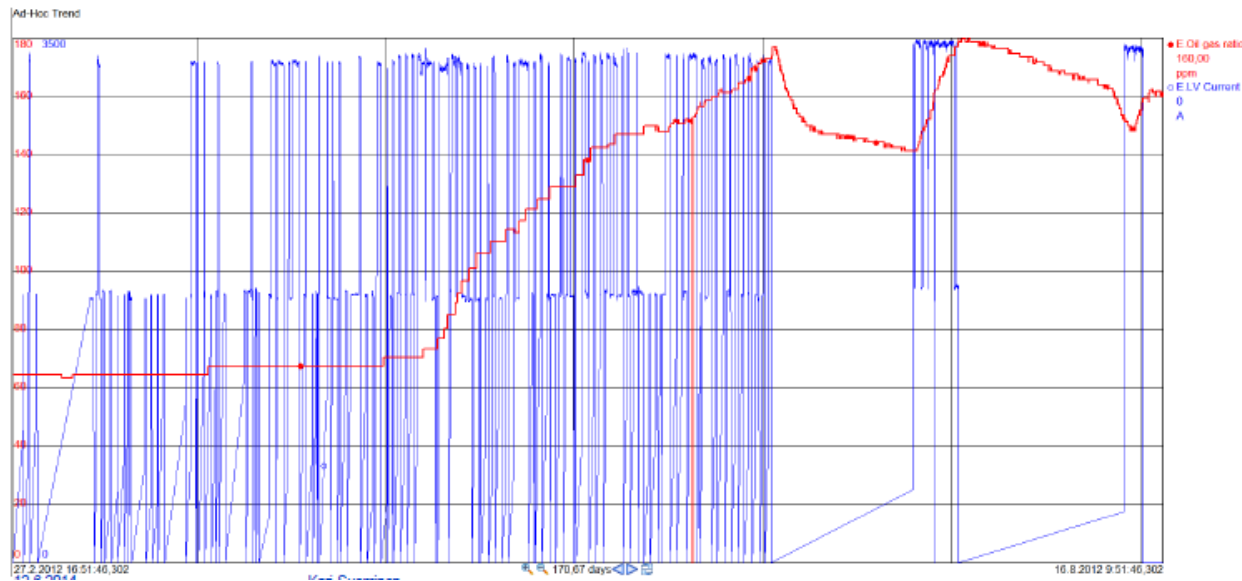
- Transformers, breakers, GIS, serie capacitors, reserve powerplants
- ~ 5 years of online data and ~ 20 years of offline data is ready to be used
- Light implementation by existing PI tools = system is easily configurable and users can make own displays

How does it look like?



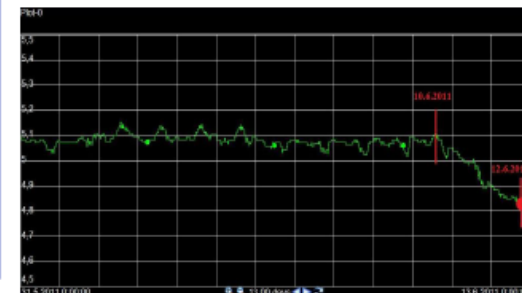
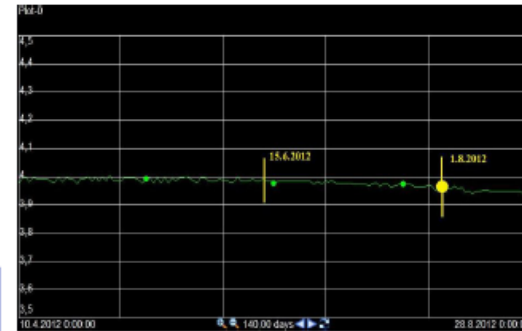
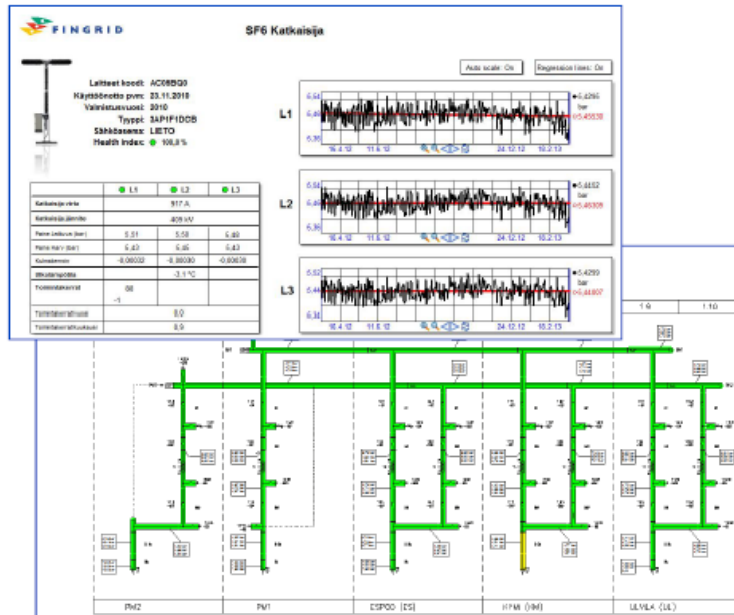
Transformer fault

- Increasing oil gas ratio was noticed and taken under observation in May 2012. Strong correlation between LV current and oil gas ratio was detected by CMS and confirmed with diagnostics measurements. The early notice gave time to react and remedial actions were launched in time.



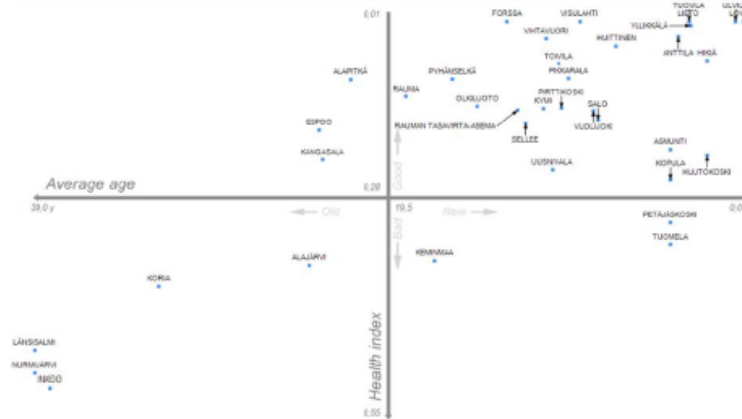
SF6 gas leaks in breakers and GIS

- Several gas leaks and detector failures has been detected by monitoring and automatic notifications.



Health index analysis tool for substations

Health index / age distribution: 400 kV switchyards

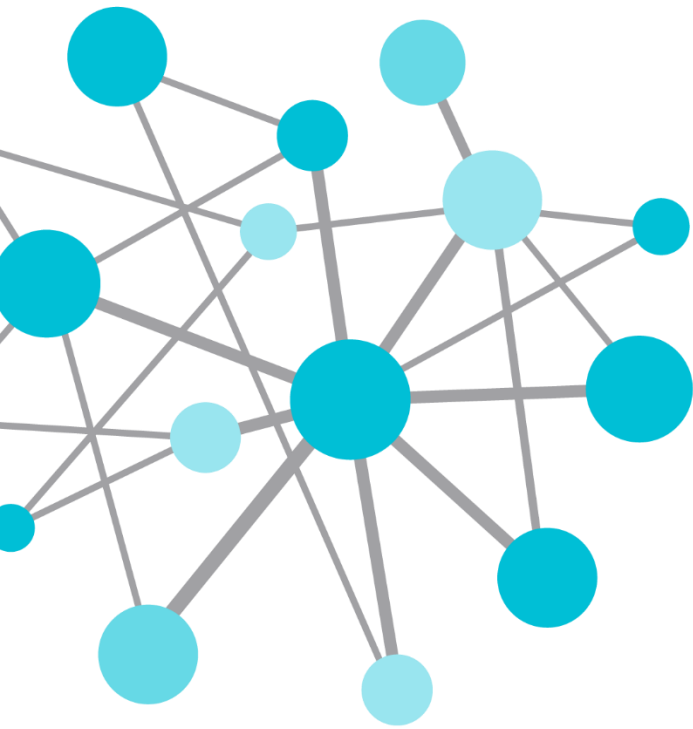


	HIVA 400 kV	Average age	Standard deviation	MUTINEN 400 kV	Average age	Standard deviation	KUUSINKOSKI 110 kV	Average age	Standard deviation
Circuit breaker average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Disconnector average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Earthing switch average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Current transformer average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Voltage transformer average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Isolator	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Total	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
	HEIKKILÄ 400 kV	Average age	Standard deviation	RAUTA 110 kV	Average age	Standard deviation	BRID 110 kV	Average age	Standard deviation
Circuit breaker average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Disconnector average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Earthing switch average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Current transformer average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Voltage transformer average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Isolator	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Total	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
	BRID 400 kV	Average age	Standard deviation	OKKALA 110 kV	Average age	Standard deviation	OKKALA 110 kV	Average age	Standard deviation
Circuit breaker average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Disconnector average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Earthing switch average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Current transformer average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Voltage transformer average	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Isolator	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
Total	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	
	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	27.7 y	5.0	

12.8.2014

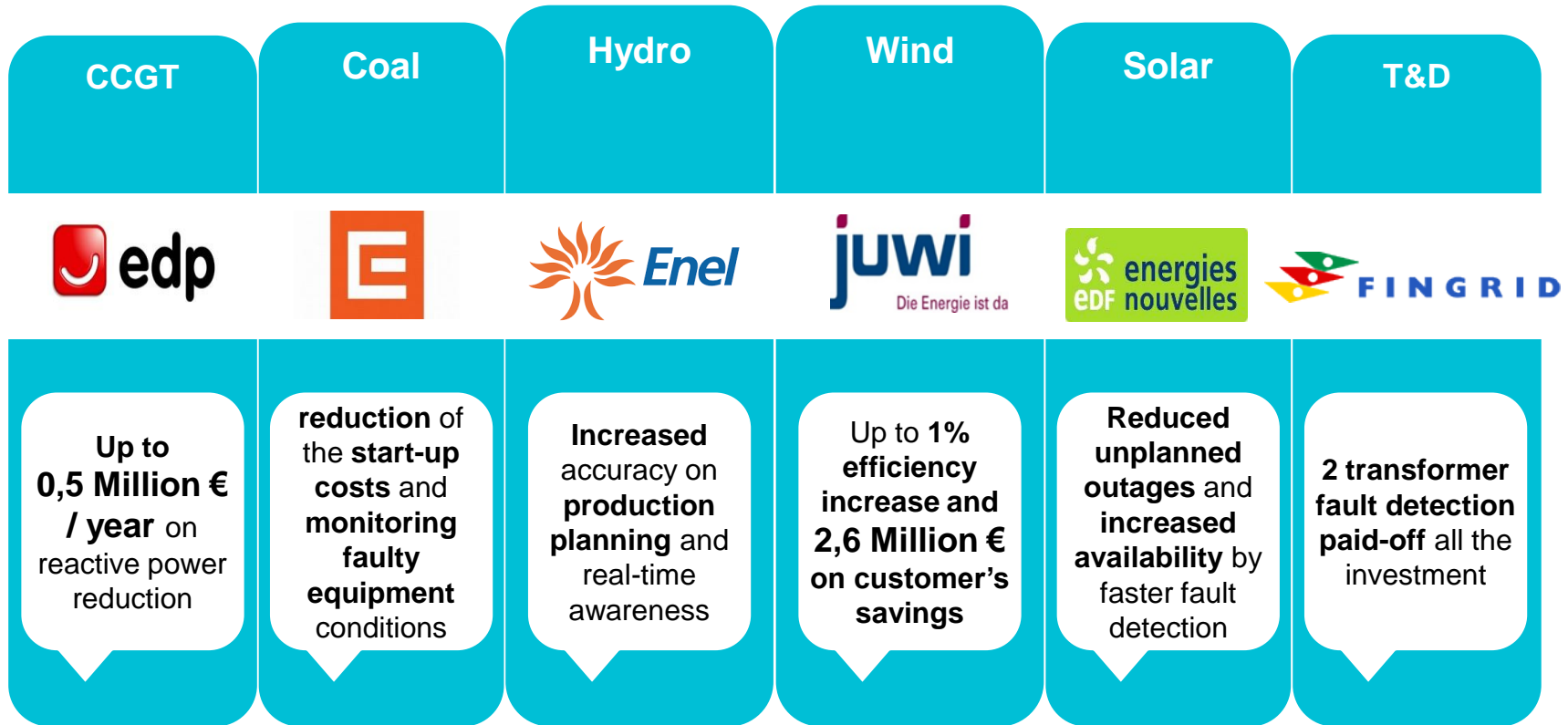
Kari Summanen

- 'Health index' identifies the priority in terms of additional maintenance or need of renewal
- Especially essential when the population of components is very large, e.g. circuit breakers and disconnectors.
- Based on the defect statistics in the asset management system over a long time period (>20 years) and weighting coefficients
- The tool enables the user to update all these views and visualize the affects by changing easily the free choice factors and source variables.
- This analysis can strengthen already known component weaknesses but may also point out additional needs for further clarification from different perspectives.

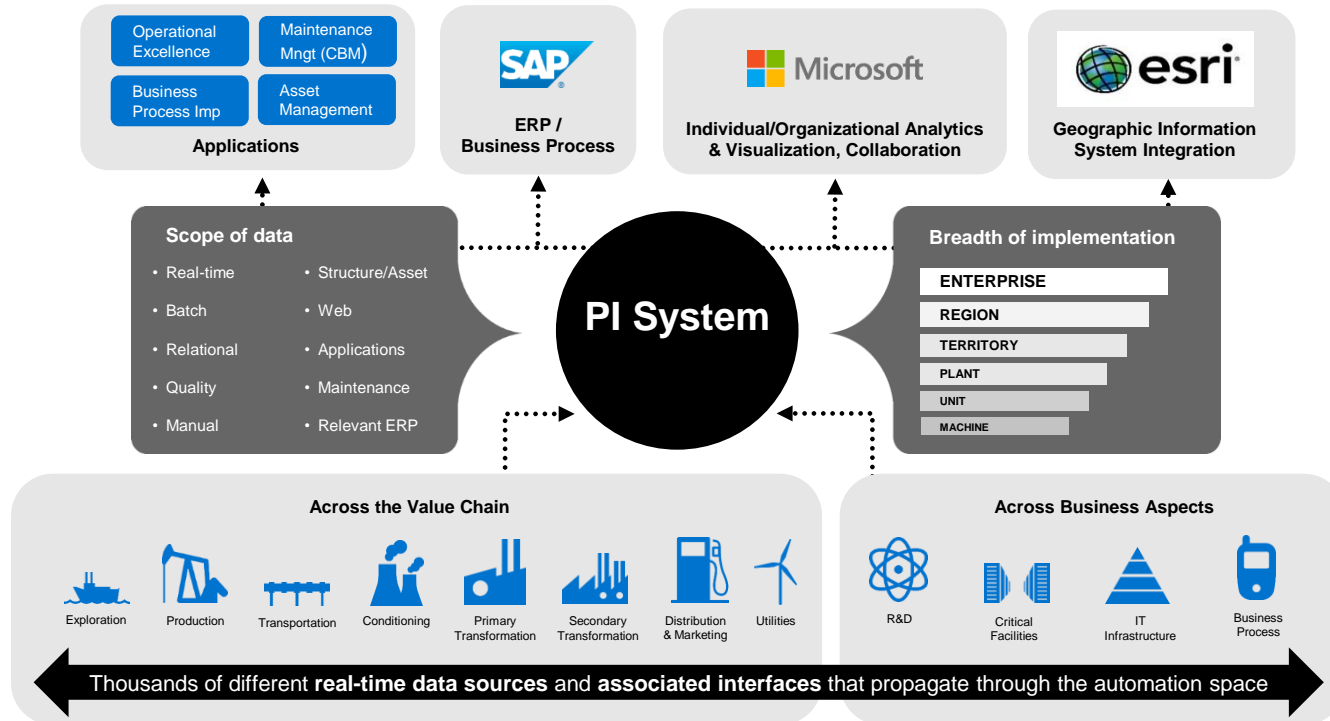


Summary

Business Impacts: An agent for change



Industry and Supplier Agnostic



Operational Excellence Program (OEP)

Smart Asset Management (SAM)

Condition Based Maintenance (CBM)

Business Process Improvement (BPI)



***Proven
Outcomes***



Performance



Downtime



Margin



esri



PI Cloud Connect
Connecting your supply chain in real-time

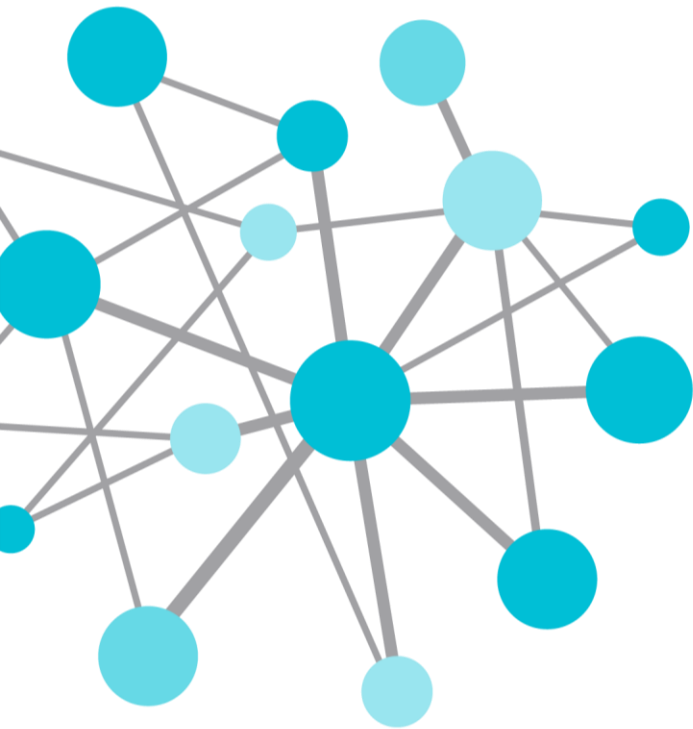


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