Efficiency Monitoring in CEZ using PI System tools

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CEZ GROUP

Agenda

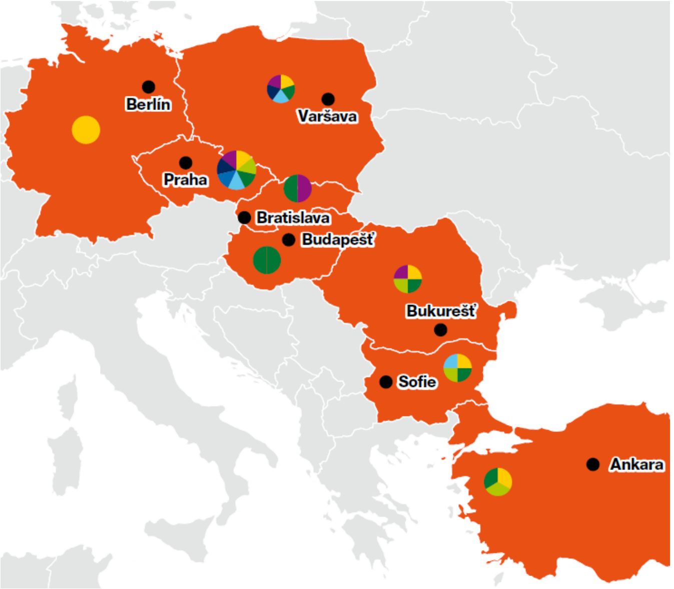
- Introduction of the CEZ Group
- PI System implementation at CEZ
- Efficiency monitoring transformation: Past and Present
- Examples of Applications & functions
- Benefits of online efficiency monitoring
- Water consumption monitoring
- Future Plans
- Q&A

Introduction of the 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 15 620 MW). Employs almost 27 000 people.

- CEZ Group currently operates:
  - 2 nuclear power plants (4 290 MW)
  - 15 coal-fired power plants (5 527 MW)
  - CCGT power plant 840 MW
  - 35 hydropower plants, including 3 pumped storage plants in the Czech Republic.

  - 2 locations with wind power plants (Fantanele 600MW)
  - 2 coal-fired power plants in Poland (678 MW)
  - CCGT power plant 904 MW in Turkey



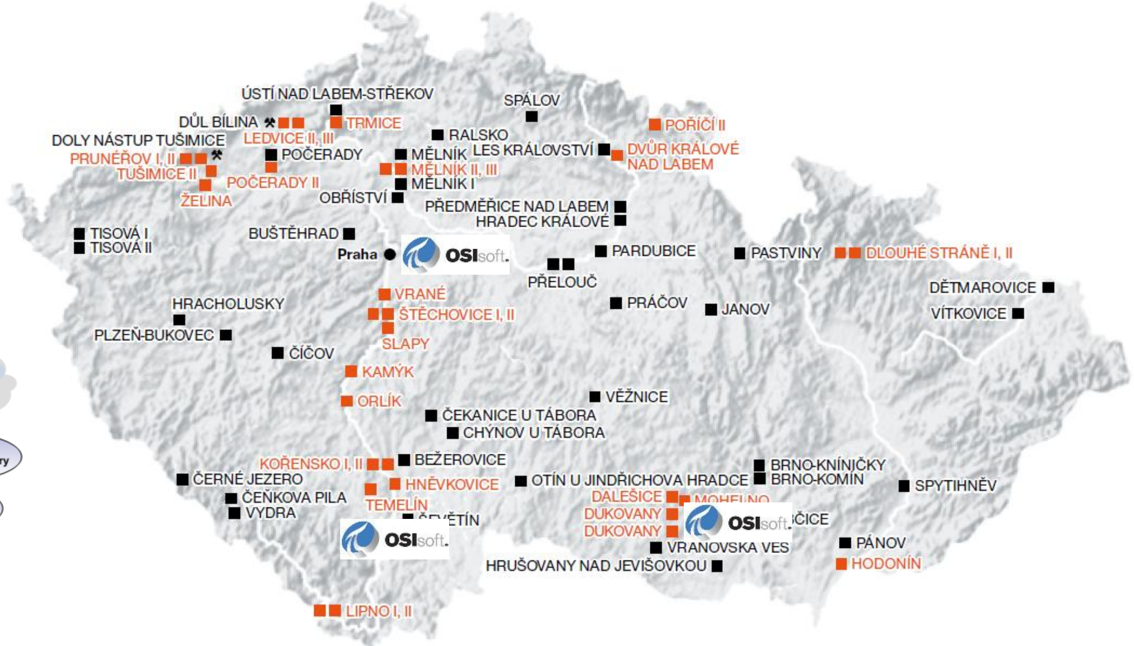
- CEZ is the largest electricity producer in the Czech Republic
  - producing nearly 61 TWh a year (approximately 50% in NPP)

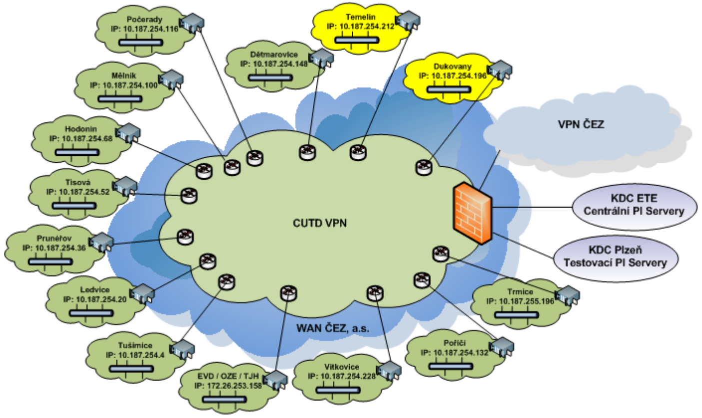
The PI System at CEZ: Central Storage of Process Data (CUTD) Project

(Central storage of process data)

- Implementation window 12/2012 – 6/2014
- across 16 facilities
- 3x PI Servers
- 300.000 tags capacity

- power plants operated by CEZ
- power plants operated by daughter companies





The PI System at CEZ: CUTD Project

Purpose:

1. Unification of data base technology & data. Consolidating multiple technologies at multiple sites.
2. Operations & maintenance savings
3. Increased availability of operations data

- The project included:
  - Replacement of existing storage
  - Migration of all necessary data from the original storage
  - Switching applications to new storage

Efficiency Monitoring: Transformation

Past	Present
No online data - difficult to monitor efficiency in real time	Real-time, Online monitoring
The real heat rate after month energy balance	Immediate information on the device status
Partial non - fulfillment hidden in monthly averages	Clear information for service personnel (maintenance, operators)
Incomprehensible information for service personnel	Real time decision making

Efficiency Monitoring: Past Method

Výrobna: *EPOC*
Blok: *B2*

Poř. číslo	Parametr	Jednotka	Norma
	Výkon bloku	MW	180
1	Tepl. přehř. páry na kotli	°C	540
2	Teplota spalin za OV	°C	169
3	Obsah O_2	%	7
4	Nedopal struska	%	22
5	Nedopal popílek	%	1,1
6	Teplota napájecí vody	°C	240
7	Teplota emisní páry	°C	36,9

7 parameters with the biggest influence on efficiency

Blok: *B3*

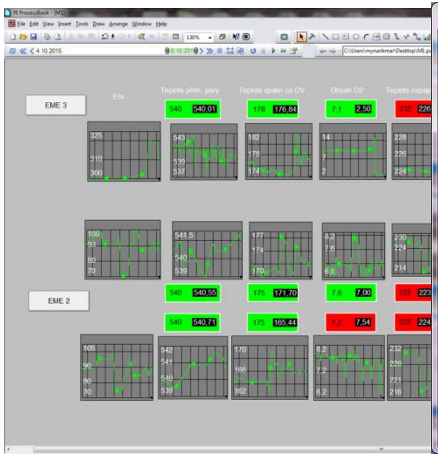
Poř. číslo	Parametr	Jednotka	Norma
	Výkon bloku	MW	180
1	Tepl. přehř. páry na kotli	°C	540
2	Teplota spalin za OV	°C	175
3	Obsah O_2	%	4
4	Nedopal struska	%	14
5	Nedopal popílek	%	1,1
6	Teplota napájecí vody	°C	240
7	Teplota emisní páry	°C	38,0

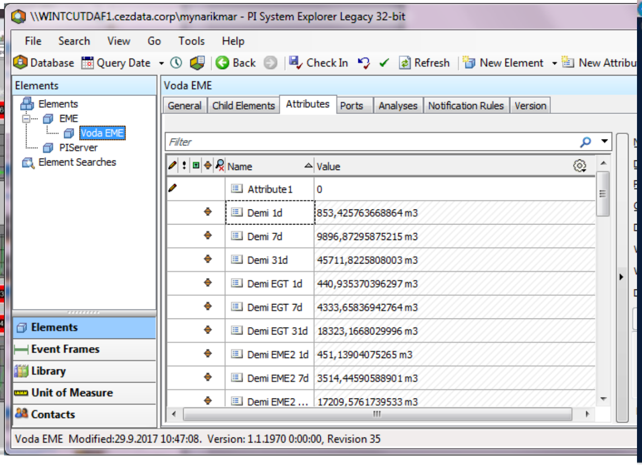
Ekonomie provozu

Elektrárna	Blok	Veličina	Jedn.	Odchylka	Finanční vyjádření *(Kč)*	Komentář
ETE	B1	Stř. teplota emisní páry	°C	5,36	2 231 631	Vliv povětrnostních podmínek - vysoká venkovní teplota. Zanesení kondenzátorů (rozhodnuto o vyčištění HK v rámci 1GO17).
EME3	B11	Teplota napájecí vody	°C	76,60	1 926 253	Provoz bez VTO.
EPO2	K7	Teplota spalin za OV	°C	21,84	266 421	Vliv rekonstrukce kotle na spalování biomasy. Nánosy na teplosměnných plochách. Posuzovány možnosti řešení.
EPOC	B3	Teplota napájecí vody	°C	14,92	190 115	Často otevírán ochoz VTO z důvodu signalizace vysokého tlaku páry za A-kolem TG.
EPO2	K8	Teplota spalin za OV	°C	10,67	181 384	Vysoký průměrný výkon kotle.
EPOC	B4	Teplota napájecí vody	°C	14,37	177 860	Často otevírán ochoz VTO z důvodu vysoké teploty spalin -> ochrana odsíření.
TTR	K5	Obsah O2	%	1,75	167 119	Netěsnosti v plášti kotle. Vyšší distribuce vzduchu do kotle.
EPOC	B6	Teplota spalin za OV	°C	2,80	113 407	Častý provoz krajních mlýnů.
EPOC	B2	Nedopal struska	%	1,83	106 490	Formou technické pomoci byl požádán Orgrez o objasnění příčin dlouhodobě vysokých nedopalů bloku.
EPOC	B5	Nedopal struska	%	2,59	76 181	Častý provoz krajních mlýnů.
ETU	B23	Teplota spalin za OV	°C	2,45	71 280	Netěsnosti odstraněny v rámci PO, průtoky vzduchů zůstávají stejné jako před odstávkou. Možnost úpravy normativu dle aktuálního stavu.
EHO	TG4 K1	Tepl. přehř. páry na kotli	°C	7,70	67 857	Provoz FK1 na čistou biomasu při minimálním výkonu v kombinaci FK1 + FK2 + TG4. FK1 bez úprav palivových cest - spotřeba kvalitní biomasy.
EPOC	B6	Nedopal struska	%	1,20	64 360	Častý provoz krajních mlýnů.
EPOC	B6	Obsah O2	%	0,61	61 893	Častý provoz krajních mlýnů.
TTR	K5	Teplota spalin za OV	°C	5,43	58 371	Vynucená vyšší distribuce vzduchu do kotle kvůli špatnému stavu výhřevných ploch (snížení teploty plamene).

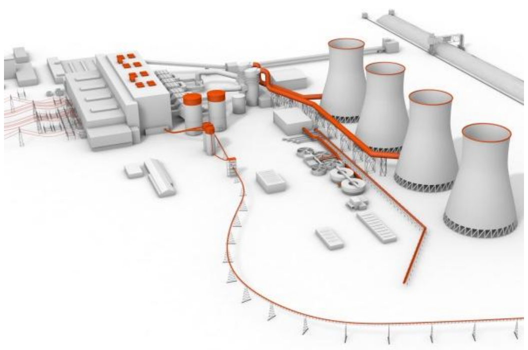
Efficiency Monitoring Transformed: Year 2017

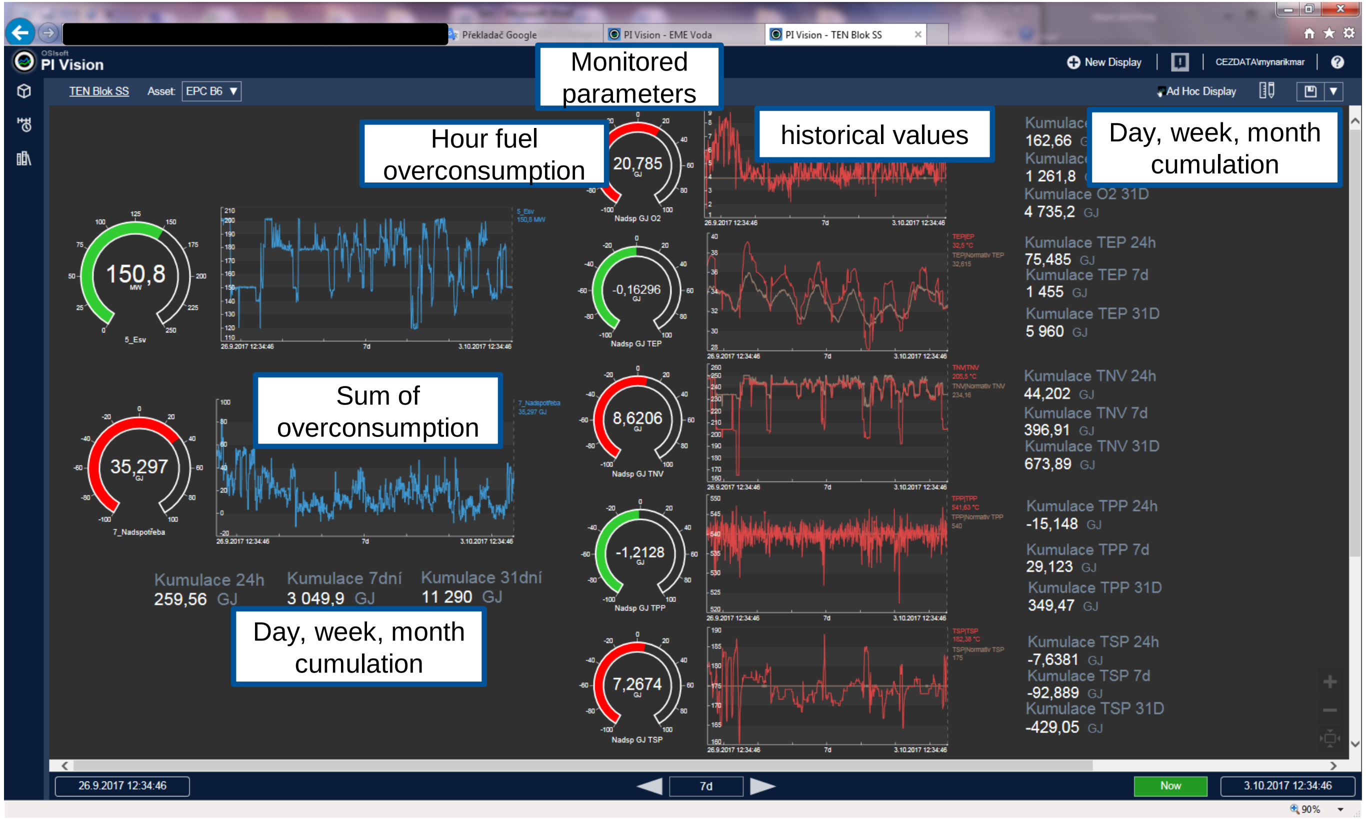
- Originally considered creating screens in PI Process Book
- Decided instead to utilize PI Asset Framework & PI Coresight
- Now also using PI Vision (Coresight)





Efficiency Monitoring: Block Power Plant

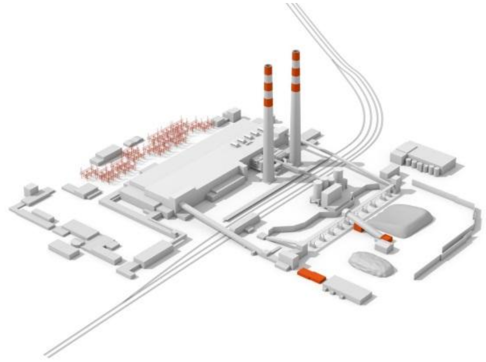




Key KPI’s being monitored

- Fuel Consumption
- Power Generation

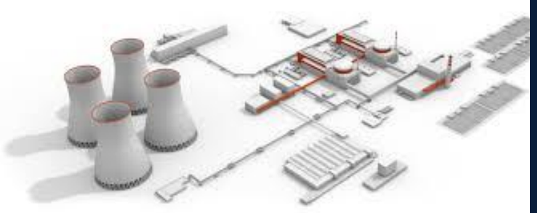
Efficiency Monitoring: Power Plant with Steam Collector



Key KPI’s being monitored

- Fuel Consumption
- Power Generation
- Boiler Power

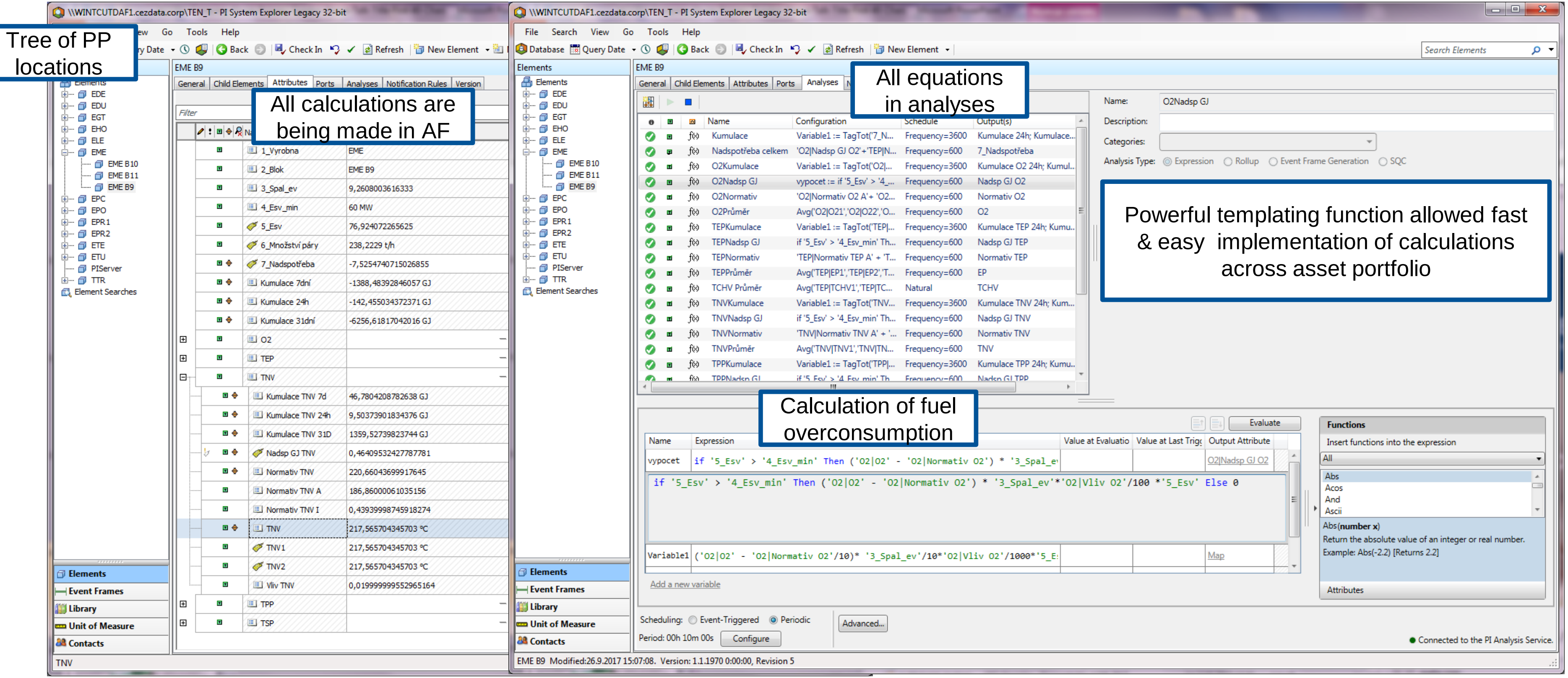
Efficiency Monitoring: Nuclear Power Plant



Key KPI's being monitored

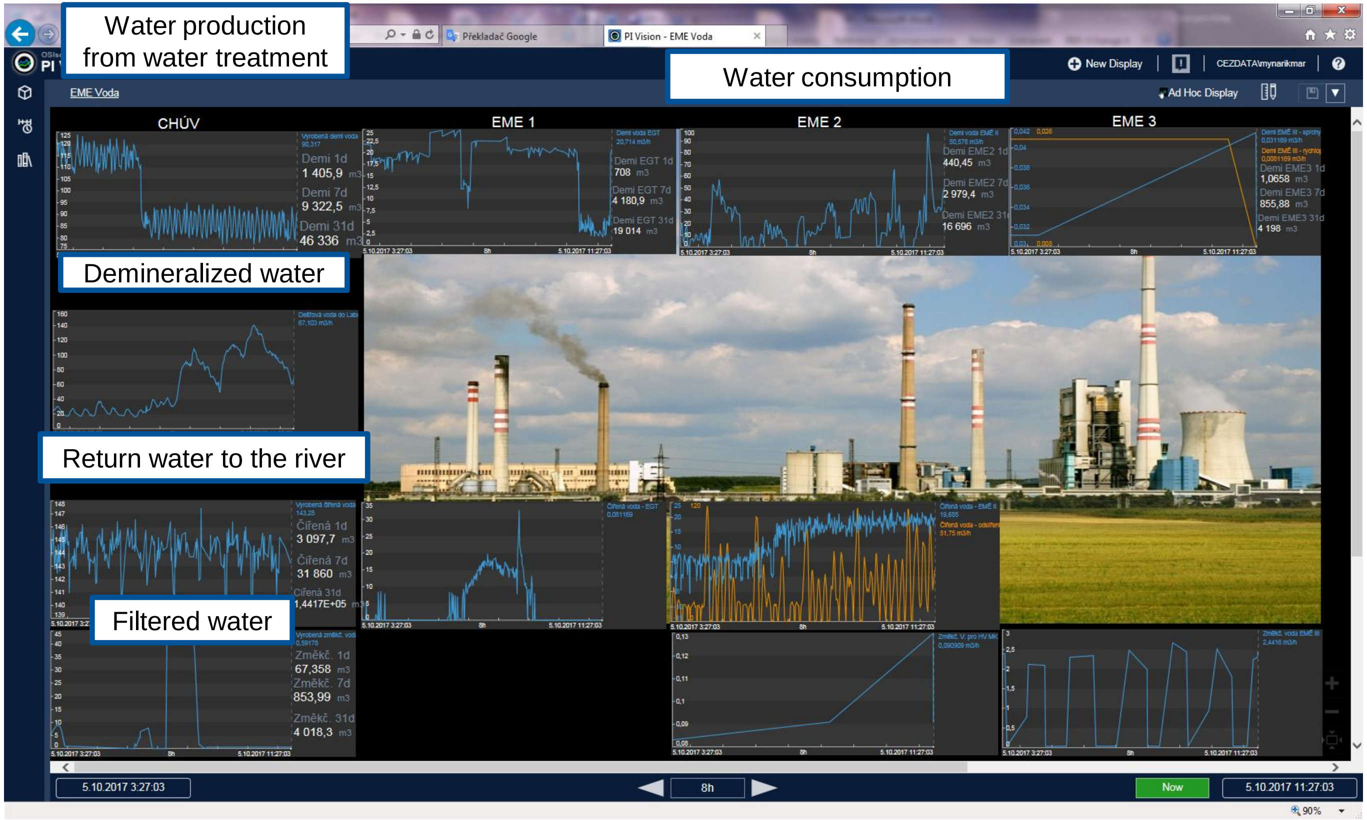
- Fuel Consumption
- Power Generation

Efficiency Monitoring: Use of Asset Framework (AF)



Water consumption monitoring

- Water consumption is significant variable cost
- Need for Immediate information
- Manage cost for fees, chemicals and energy savings



Future plans

- Assist end users to utilize the new applications & services now available to them
- Consolidate all power generation sites into a single view for overall fleet visibility
- Provide more mobile access to applications and data for operational personnel

Leveraging the PI System to improve Efficiency & Water Consumption

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COMPANY and GOAL

CEZ Group operates more than 20 thermal power plants and wanted to reduce loss in variable caused by the late response of service personnel to degraded parameters.

CHALLENGE

- No real-time efficiency monitoring
- Incomprehensible information for service personnel
- No information about water consumption

- Late response of service personnel to degraded parameters

SOLUTION

- Creating the efficiency monitoring center
- Creating the water monitoring screen

- Using tools PI Vision and Asset Framework (AF)

RESULTS

- Real-time efficiency monitoring
- Informed service staff
- Real-time water consumption monitoring

- Savings in variable costs in the order of millions CZK/year

Thank You

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Questions

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Danke

谢谢

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado