Empowering Business Operations with the PI System

Presented by

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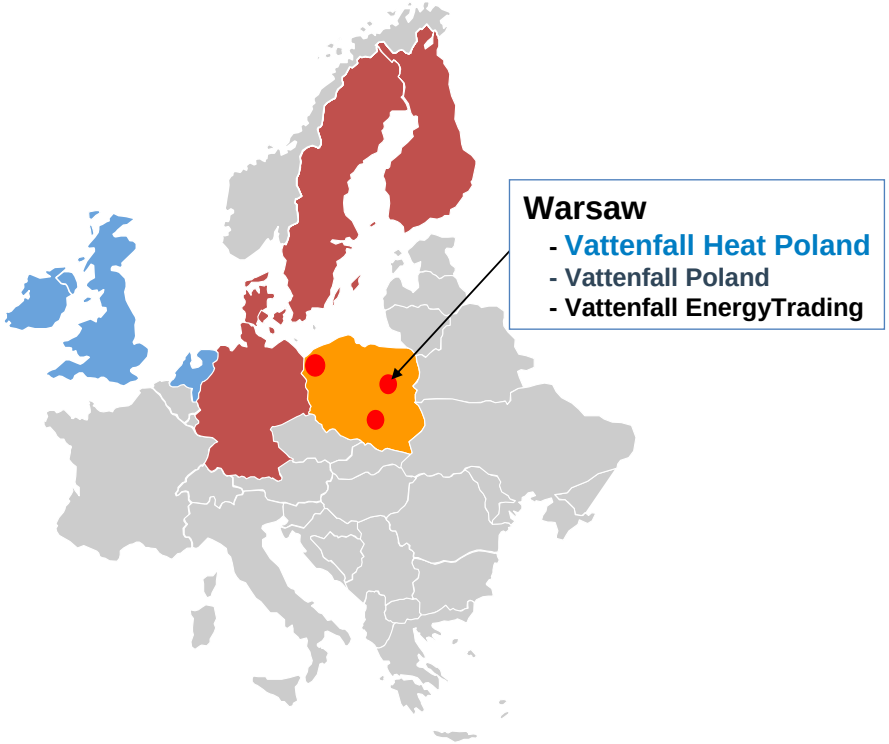
Vattenfall Heat Poland

Agenda

- About Vattenfall Heat Poland
- PI System in Vattenfall Heat Poland – business case
- Examples of PI System utilization – added value

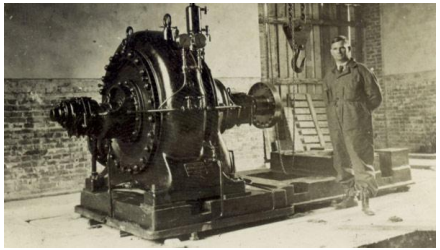
About “Vattenfall Heat Poland”

- Heat and electricity producer
- **70%** share in Warsaw heat market and over **22%** share in Polish heat market
- **5** power plants with over **4 684 MW** of heat and **929 MW** of electricity generation capacity installed
- First site with heat accumulator running in Poland



Background

The beginning …

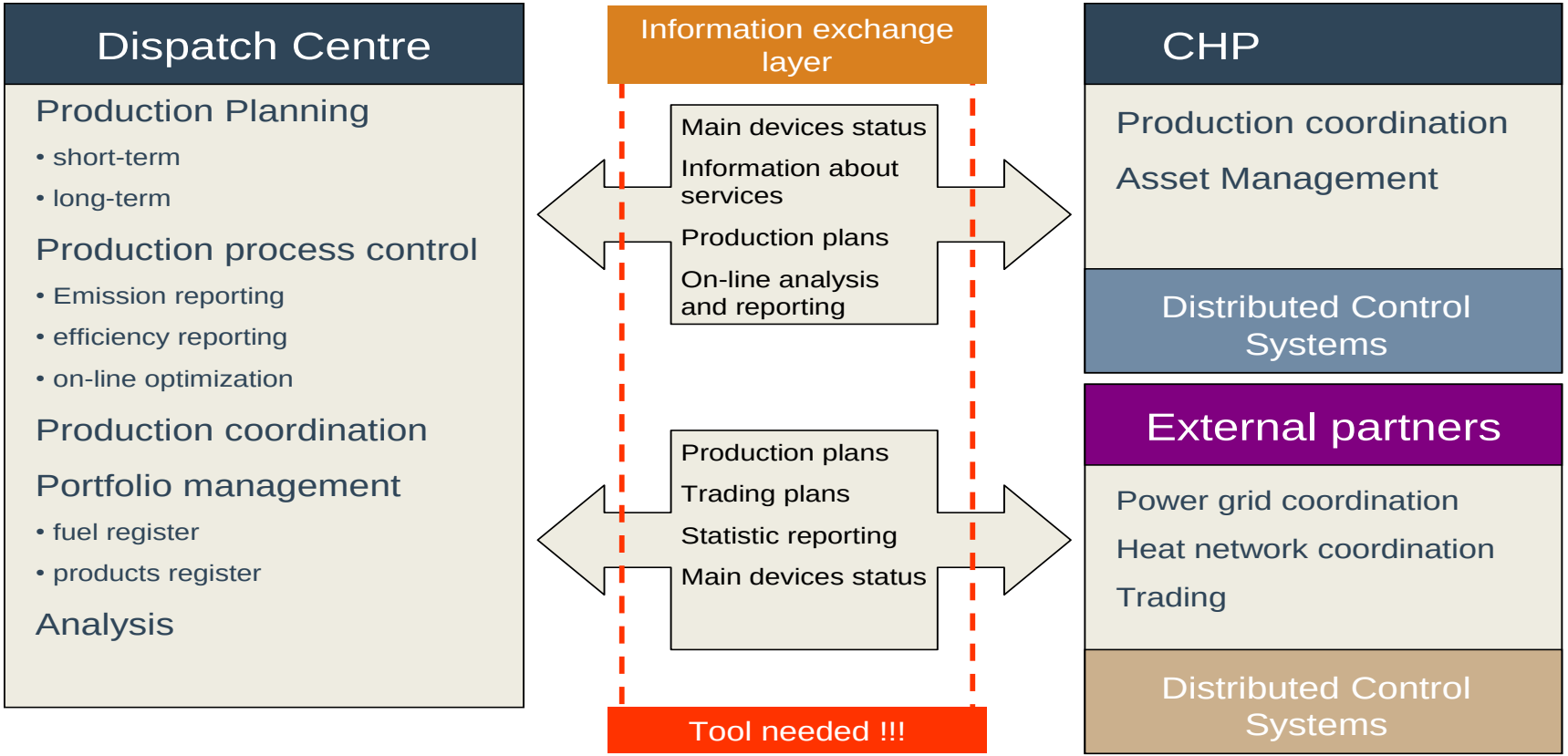


5 independent Power Plants
Lack of detailed central planning
lack of central monitoring of technological process
Not optimal production process

Target… operational excellence

The idea of centralized dispatching
Need for detailed information exchange with partners
A lot of calculations & reporting… very quickly
Quick access to information about production process
Need for production process optimization

Challenge

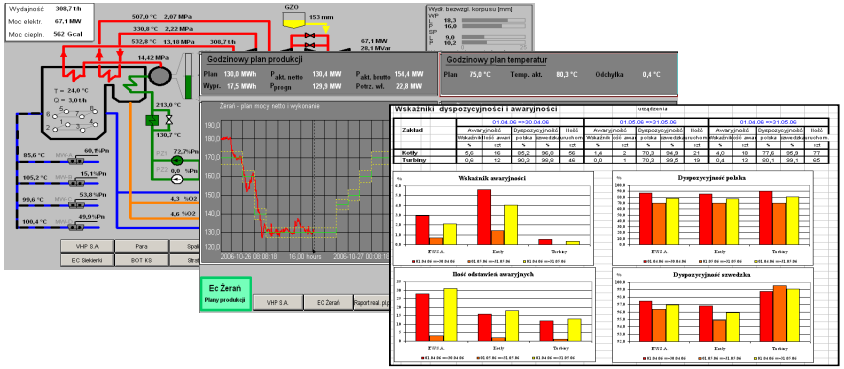


Solution

VHP: Operational Data Protected

*"We needed to **gather the complex information** about technological process and store it in **one place**. W needed a system that would make these information **easily accessible** for many person. We also needed system that would provide tools for **analyses and reporting**"*

VATTENFALL



Customer Business Challenge

- Providing the possibility of central production management
- Providing complex information about technological process and tools for analysis
- Making the system user-friendly and easily accessible for many users
- System should be flexible for upgrades and development

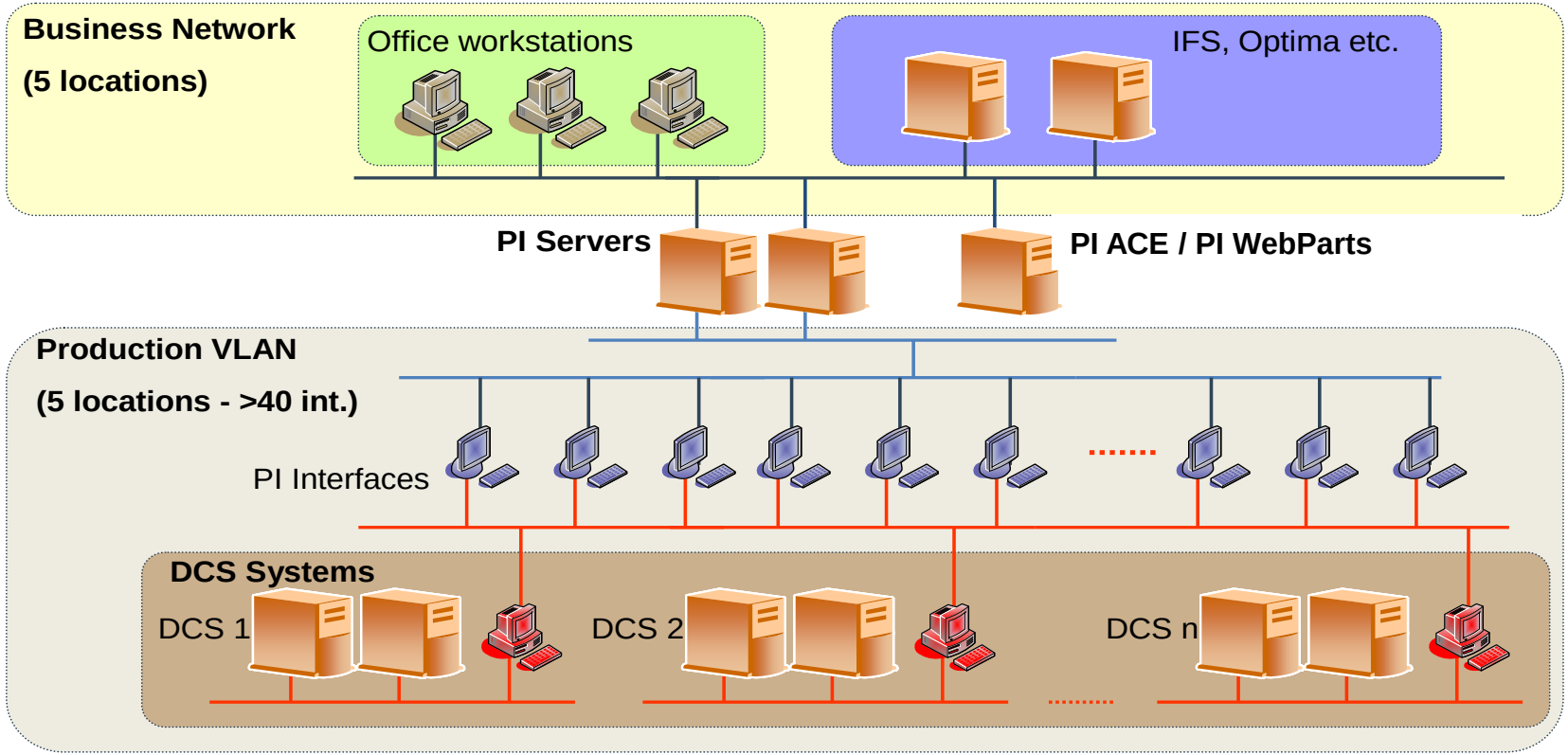
Solution

- Implemented PI system to provide data from production area to all production and business area
- Provided view to the data using ProcessBook (synoptic screens) and DataLink (analysis)
- Provided ACE for continuous advanced calculations
- Provided MCN Health monitoring to secure the system efficiency

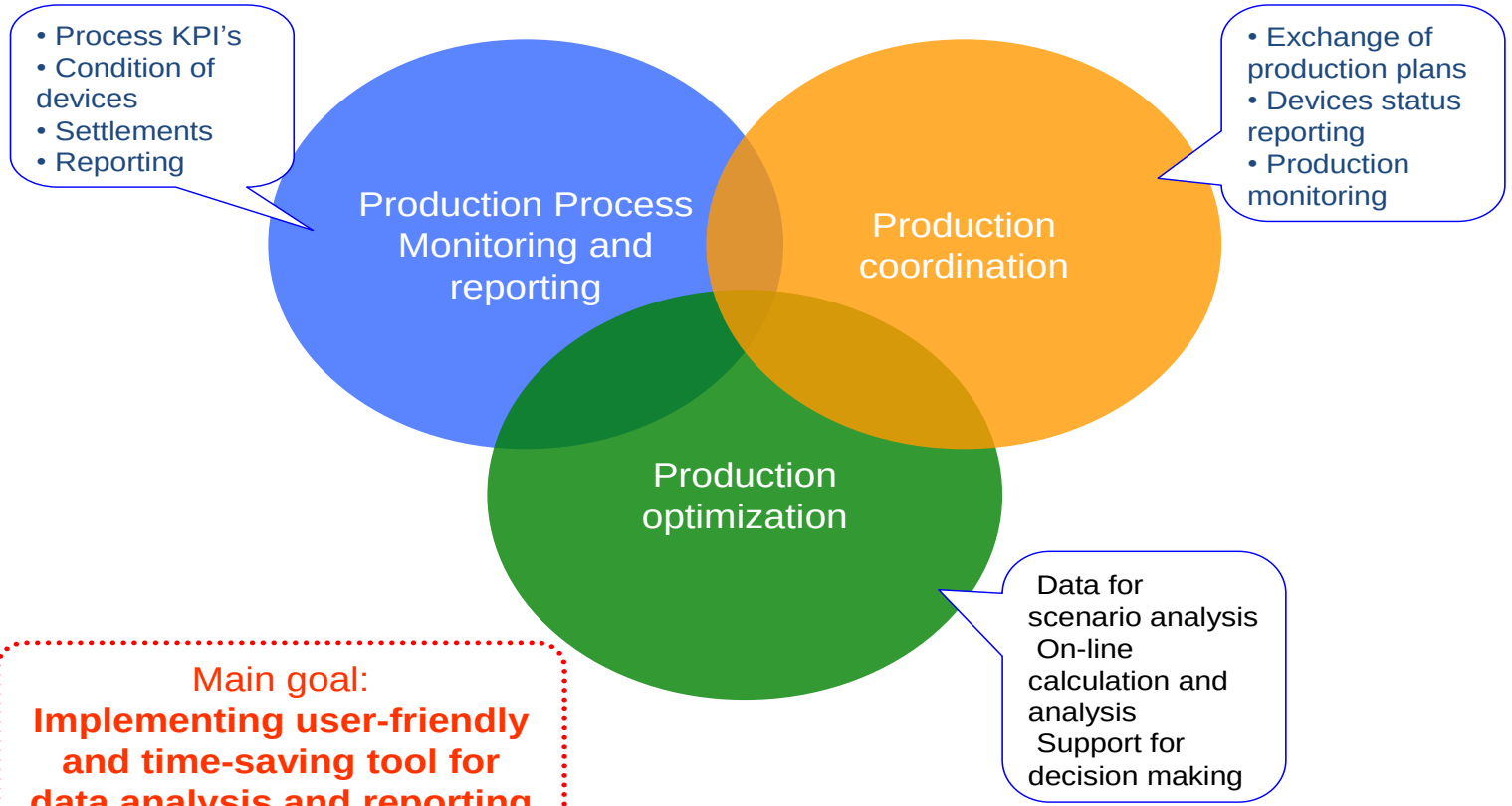
Customer Results / Benefits

- Incrased number of analysis in the same amount of time
- Decreased variable costs caused by on-line cost calculations **(ca. 50 kEUR per year)**
- Increased efficiency in consequence of on-line efficiency calculations **(3–5 %)**
- Increased accesibilty to information about production process

PI System Architecture



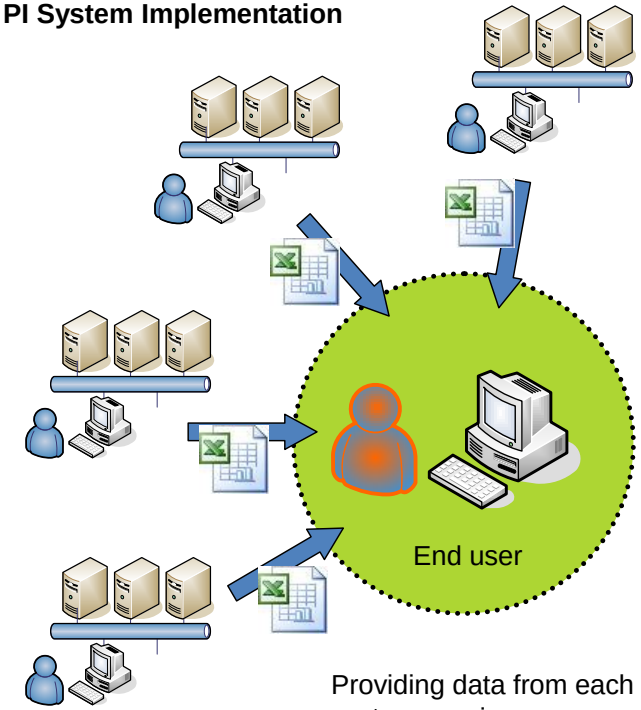
Definition of specific areas of benefits



Main goal:
Implementing user-friendly and time-saving tool for data analysis and reporting

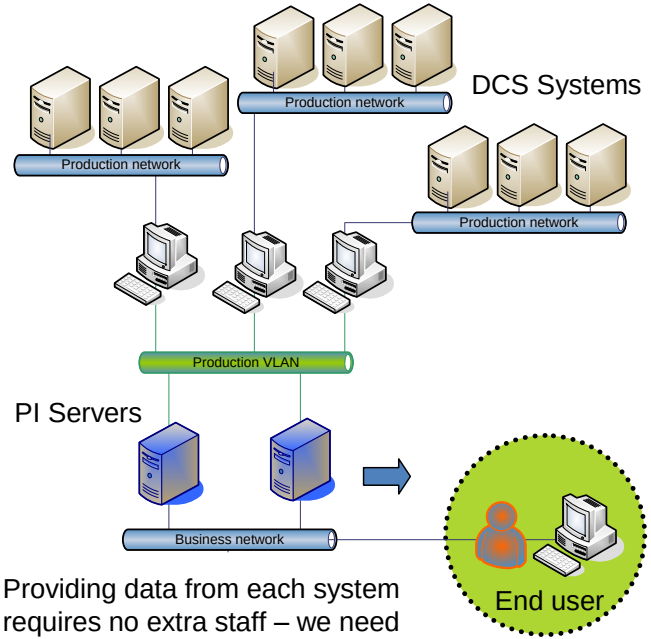
Production monitoring and reporting

Process of settlements before PI System Implementation



Providing data from each system requires a person responsible for data export

Process of settlements after PI System Implementation



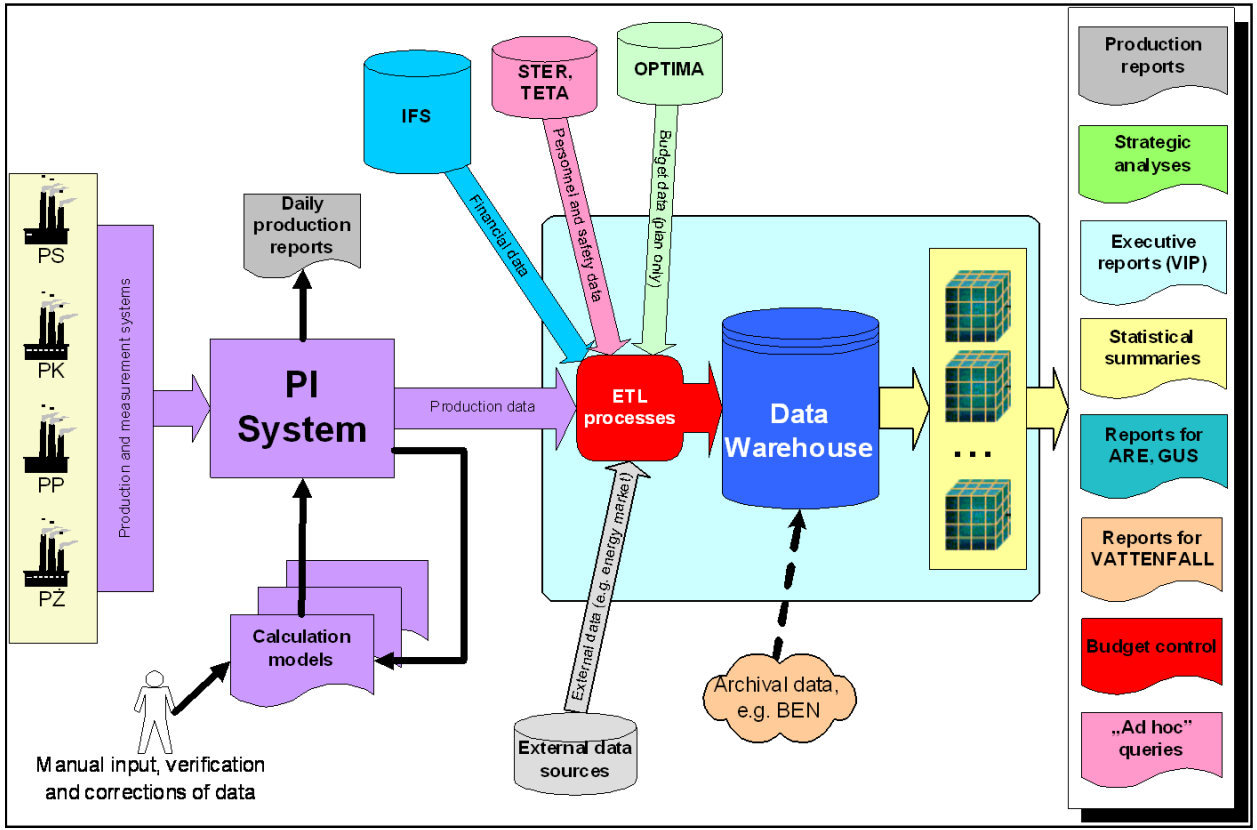
Providing data from each system requires no extra staff – we need only interface (ex. OPC).

The only system that has access to all data used for reporting is the **PI System**

In VHP we saved ca 500 hours per year with PI System

Production monitoring and reporting

PI System is an important component in the process of feeding Data Warehouse with production data



Production monitoring and reporting

Excel reports based on PI DataLink functions allow user to calculate times when the production process parameters were out of the limits and present results in reports

Raport dobowy pracy urządzeń podstawowych VHP SA 2006-01-15

Turbiny 1 - 10

		Tz 1	Tz 2	Tz 3	Tz 5	Tz 6	Tz 7	Tz 8	Tz 9	Tz 10
Czas pracy	h									
Maksymalna moc	MW	48,1	30,3	24,1	27,9	30,4	107,5	123,1	97,4	0,0
Przekroczenie mocy osiągalnej	'	0h 0m	0h 0m	0h 0m	0h 0m	0h 0m	1h 33m	0h 0m	0h 0m	0h 0m
Maksymalna moc w kondensacji	MW	33,0						120,2		
Maksymalne ciśn. pary do TZ	Mpa	8,86	9,35	9,02	9,11	9,12	12,99	13,29		
Przekroczenie ciśn. pary do TZ	P>max	0h 0m	0h 0m	0h 0m	0h 0m	0h 0m	0h 0m	0h 0m		0h 0m
Przekroczenie ciśn. pary do TZ	P<min	0h 3m	0h 0m	0h 0m	0h 0m	0h 0m	0h 14m	21h 34m		0h 0m
Maksymalna temp. pary do TZ	C	553,8	535,8	538,2	544,2	543,6	538,7	539,6	537,5	538,2
Przekroczenie temp. pary do TZ	T>max	11h 39m	0h 0m	0h 0m	0h 27m	4h 10m				
Przekroczenie temp. pary do TZ	T<min	0h 0m	0h 0m	0h 0m	0h 1m	0h 0m				
Przekroczenie przewodności kond.	'	0h 0m	0h 0m	24h 0m	0h 0m	0h 0m				

Zakład EC Żerań

Kotły 1 - 5

		Kocioł 1	Kocioł 2	Kocioł 3	Kocioł 4	Kocioł 5
Czas pracy	h					
Maksymalna wydajność	t/h	233,8	232,3	241,6	231,8	234,3
Minimalna wydajność	t/h	196,7	195,4	0,5	177,4	197,6
Przekroczenie wydajności	F>250 t/h	0h 0m	0h 0m	0h 0m	0h 0m	0h 0m
Przekroczenie wydajności	F<140 t/h	0h 0m	0h 0m	9h 38m	0h 0m	0h 0m
Maksymalna temperatuta pary św.	C	516,3	514,5	529,9	513,5	513,3
Przekroczenie temperatury pary św.	T>515'C	0h 3m	0h 0m	0h 8m	0h 0m	0h 0m
Przekroczenie temperatury pary św.	T<505'C	13h 37m	23h 10m	23h 48m	14h 11m	13h 47m
Przekroczenie temperatury wody zas.	T<130'C	0h 0m	0h 0m	0h 0m	0h 0m	0h 0m
Przekroczenie zawartości O2 w sp.	>5%	0h 7m	0h 0m	10h 17m	1h 53m	0h 0m
Przekroczenie emisji CO	>250	0h 0m	0h 0m	0h 0m	0h 1m	0h 0m

		SI - K1...4; K10...15	
		Dopuszczalne warunkowo	Warunek
Wydajność	250 t/h (K1-4) 460 t/h 400 t/h (K11)	K1-4: 4 h / dobę, przy tw = 215 °C; K10-15: tw = 210 °C	
K1	od pocz. roku		0h 42m
	od pocz. m-ca		0h 0m
K2	od pocz. roku		0h 40m
	od pocz. m-ca		0h 0m
K10	od pocz. roku		1h 19m
	od pocz. m-ca		0h 3m
K11	od pocz. roku		0h 10m
	od pocz. m-ca		0h 4m
K14	od pocz. roku		0h 0m
	od pocz. m-ca		0h 0m
K15	od pocz. roku		1h 4m
	od pocz. m-ca		0h 0m

Data: 2006-03-11 Monitor

SI: K1 K2 K10 K11 K14 K15

ZE: K1 K2 K3 K4 K5 KFA KFB

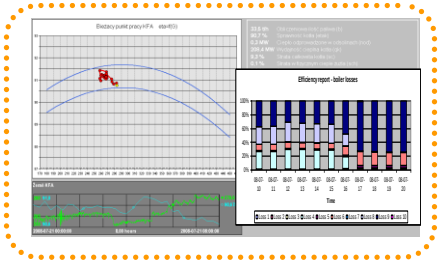
		ZE - KFA, KFB	
		Dopuszczalne warunkowo	Warunek
Wydajność	450 t/h		brak danych odnośnie czasowych przeciążalności
KFA	od pocz. roku		1h 8m
KFA	od pocz. m-ca		0h 11m
KFB	od pocz. roku		#ARG!
KFB	od pocz. m-ca		#ARG!

		SI - K1...4; K10...15	
		Dopuszczalne warunkowo	Warunek
Wydajność	250 t/h		przy tw > 210 °C
K1	od pocz. roku		0h 0m
	od pocz. m-ca		0h 0m
K2	od pocz. roku		0h 0m
	od pocz. m-ca		0h 0m
K3	od pocz. roku		0h 14m
	od pocz. m-ca		0h 0m
K4	od pocz. roku		0h 6m
	od pocz. m-ca		0h 0m
K5	od pocz. roku		0h 0m
	od pocz. m-ca		0h 0m

Production optimization

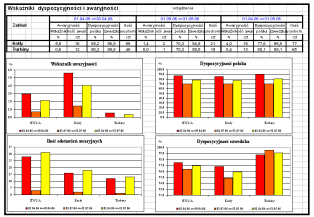
Production optimization support with PI System

Optimal operating point
&
Condition based maintenance

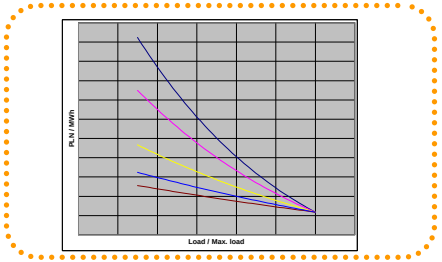


On-line data analysis

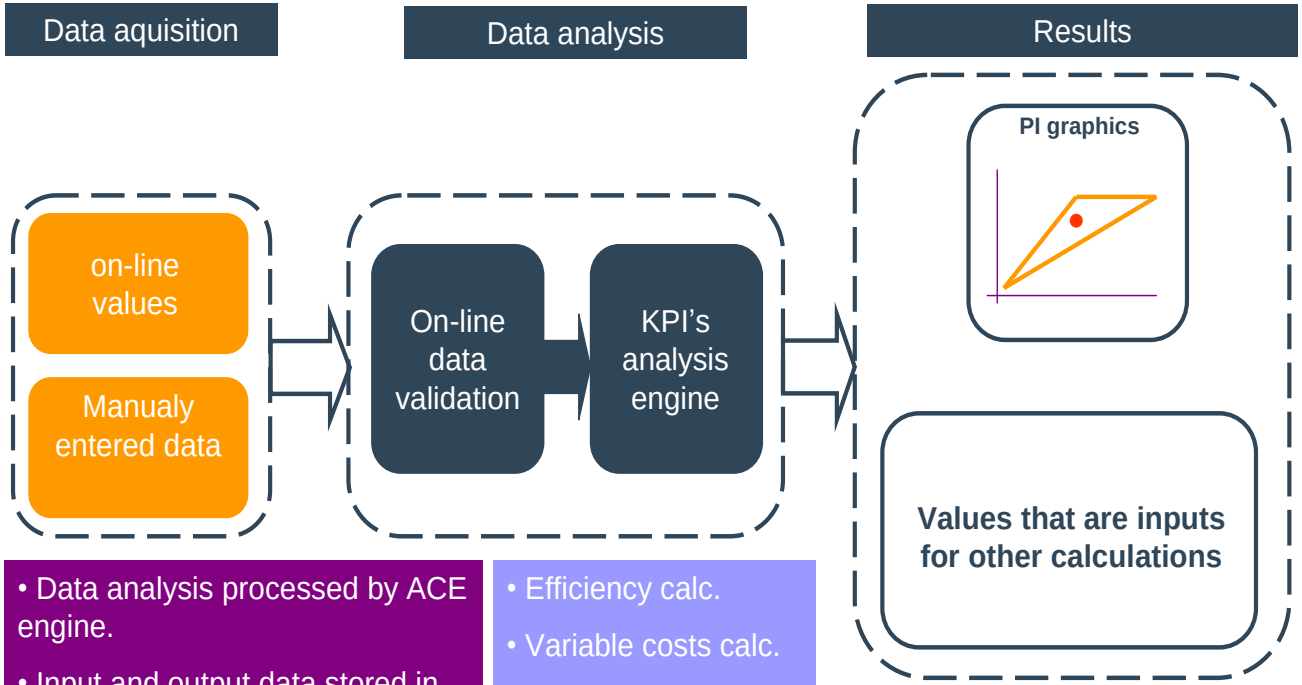
KPI's



Variable cost
On-line calculation



Production optimization – KPIs



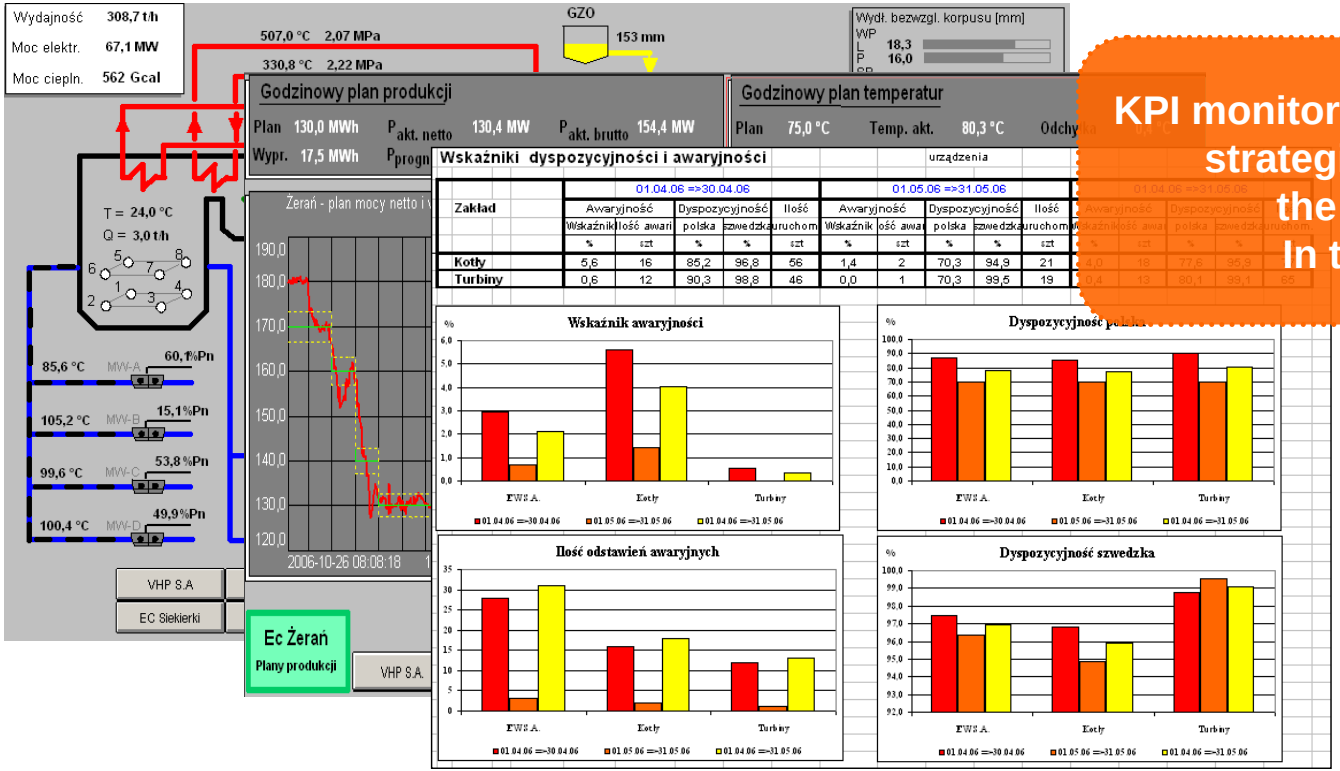
- Data analysis processed by ACE engine.
- Input and output data stored in PI archive
- Calculation time-triggered

- Efficiency calc.
- Variable costs calc.
- Data validation
- Thermal calc.

PI Performance Equations and PI ACE Server allows us to define every KPI that we can calculate in order to improve quality of our processes.

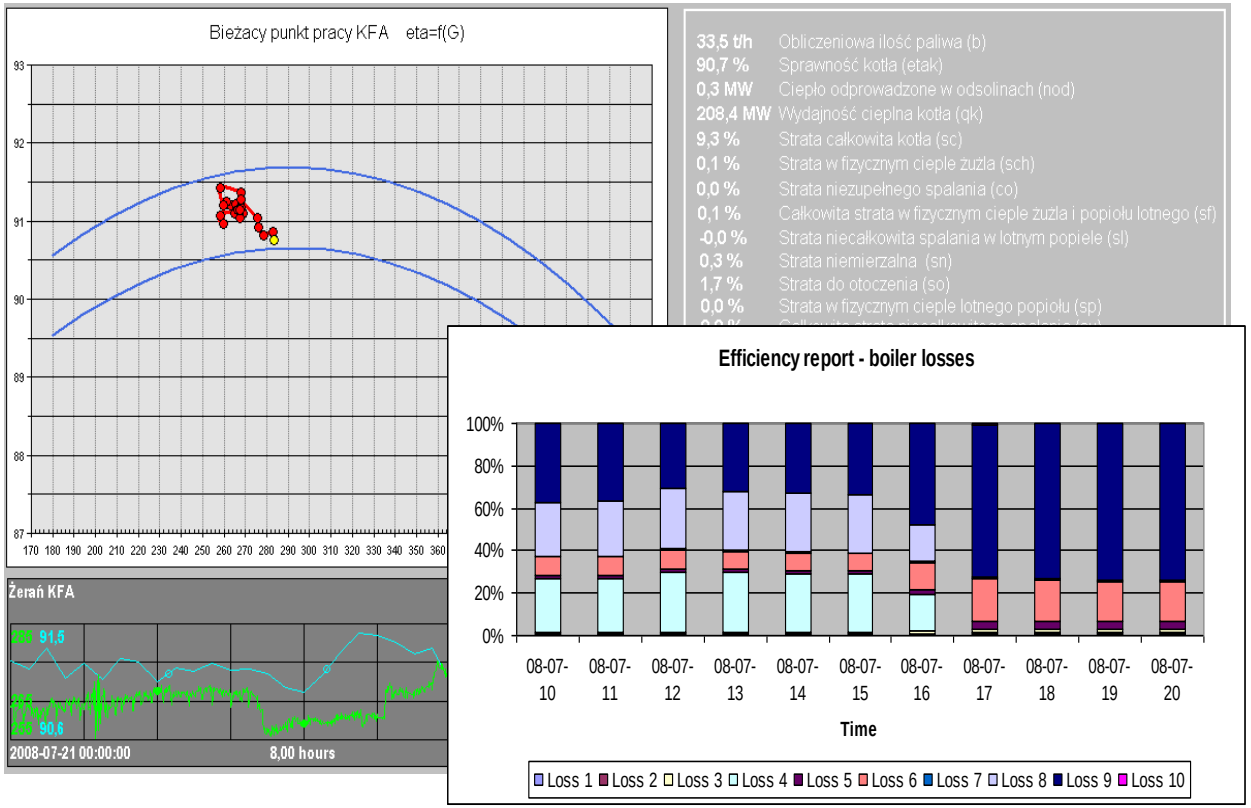
We can easily combine manual and on-line values.

Production optimization – KPIs



KPI monitoring helps us to define strategic goals and take the right actions In the right time

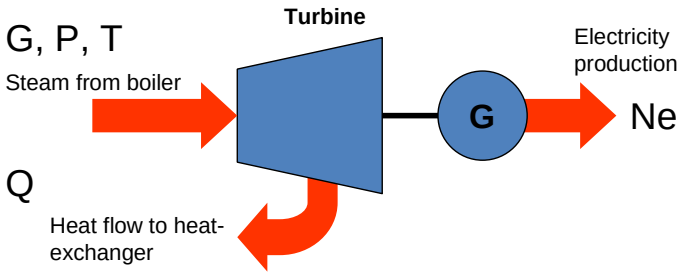
Production optimization – operating point

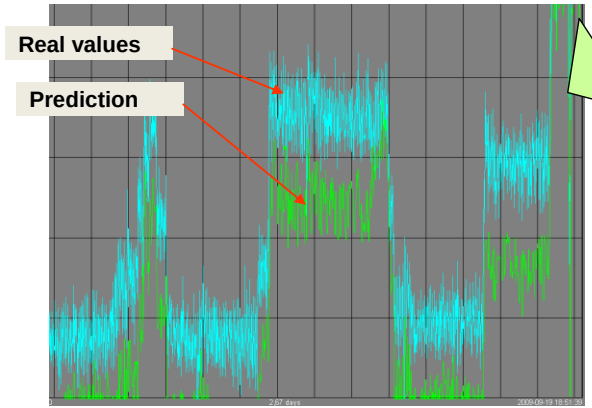


On-line efficiency monitoring helps us to operate only the most efficient units at their optimal point and save up to 2…3% of fuel

Production optimization – Condition Based Maintenance

Neural networks (production parameters prediction)





3 steps to define a calculation

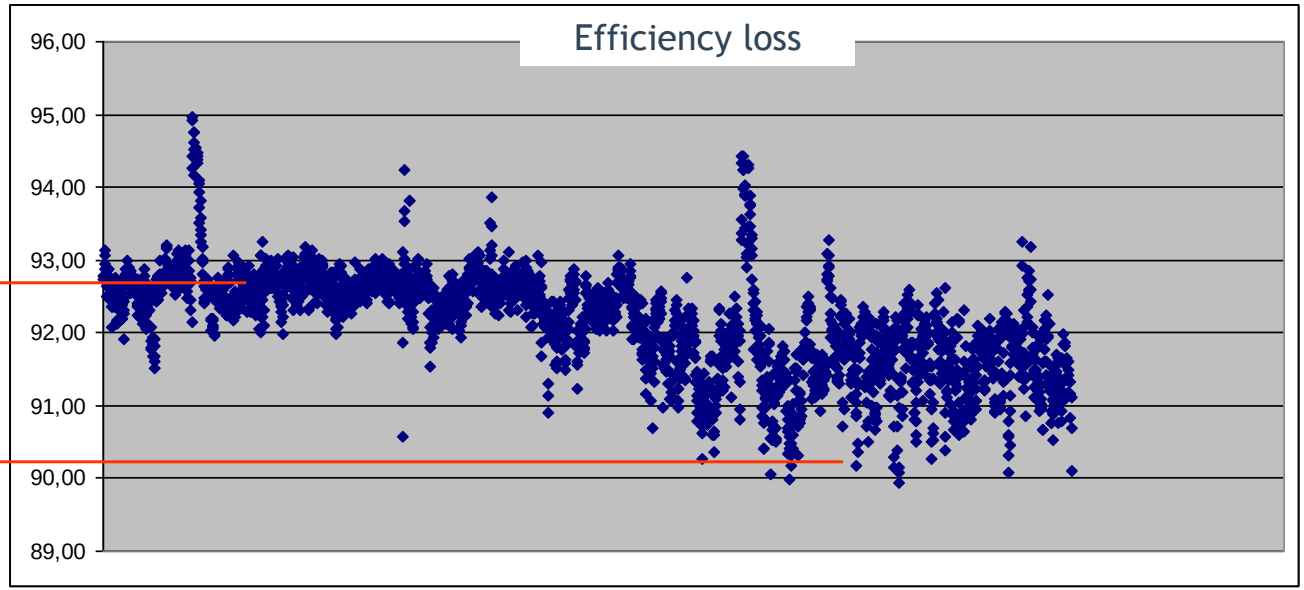
Ne = f(G,P,T,Q)

- Model definition – Neural networks
- Translating model into ACE module
- Applying ACE calc. Into PI graphics

By finding relationships between device operational parameters and overall eficiency we can easily Indicate device failure or bad condition

Production optimization – Condition Based Maintenance

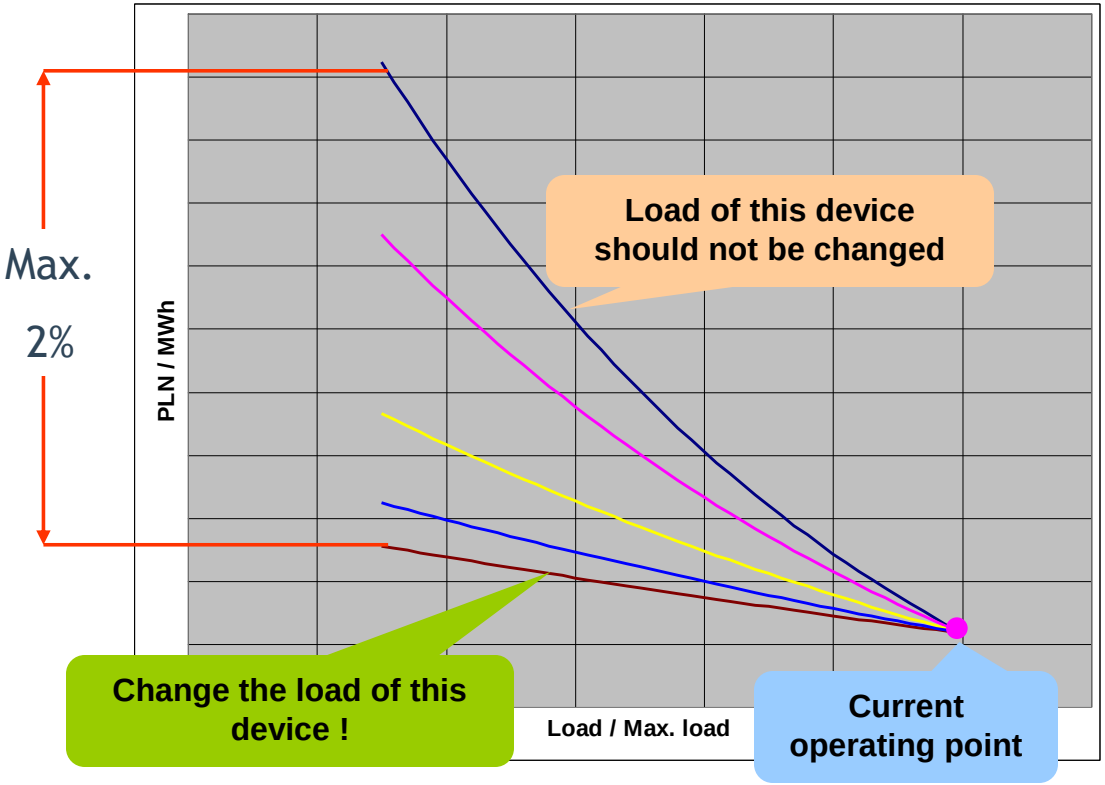
Using the PI ACE Server we defined on-line efficiency calculations that help us to run only the most efficient units.



Instead of complex measurement procedure twice a year we provide online calculation (in connection with neural networks) to see how device (boiler behaves)

On-line calculation = ca. 2 - 3% of overall efficiency increase

Production optimization – variable costs optimization

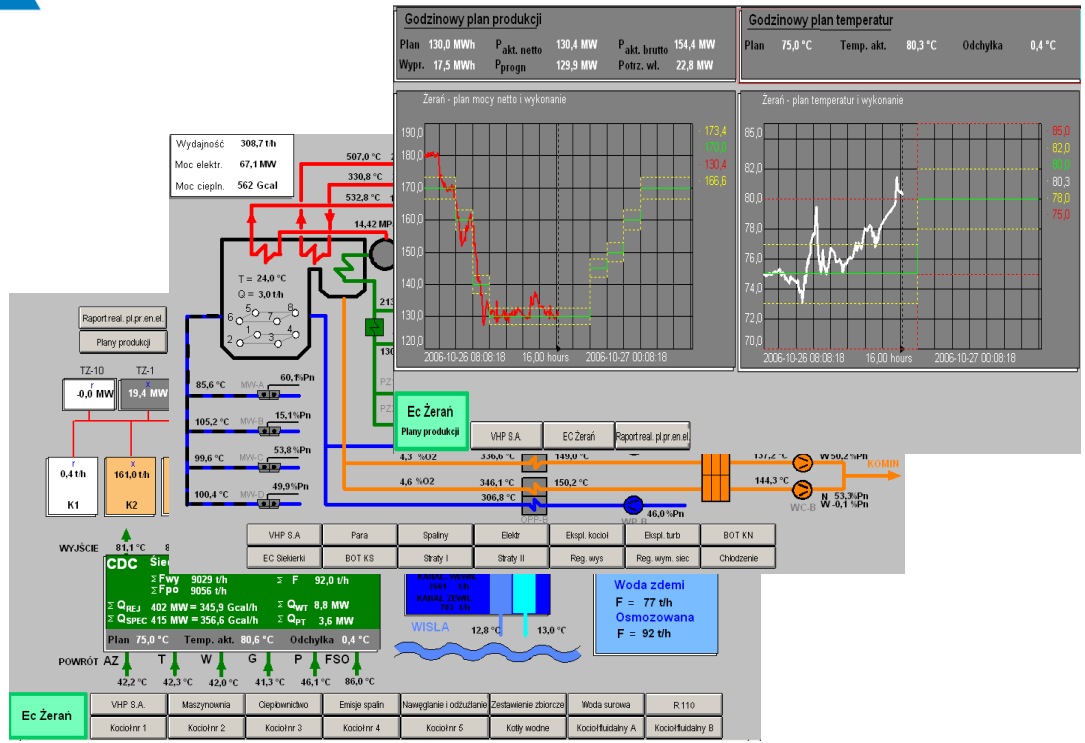


„Which device should be adjusted in order to minimize variable costs ?”

On-line variable cost calculation gives possibility to choose between optimal devices set to provide optimal configuration

Optimal configuration = ca. 2 – 3% of variable cost reduction per year

Production coordination



PI Processbook is the major tools for production process visualization.

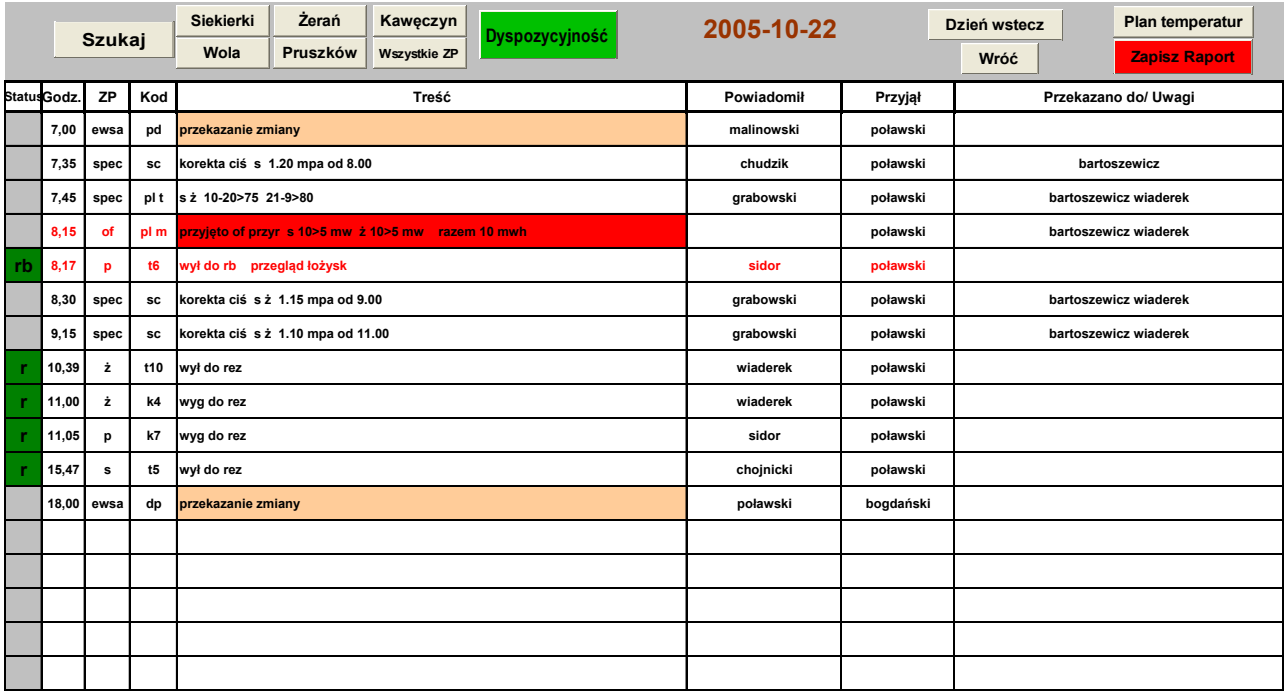
Data that we observe comes directly frm DCS and also manual imput.

We use performance equation and ACE to process the data before presenting on graphics.

Production coordination

Every important event is registered in shift report.

Every status change is immediately recorded and sent to PI System



Szukaj | Siekierki | Żerań | Kawęczyn | Dyspozycyjność | 2005-10-22 | Dzień wstecz | Plan temperatur
Wola | Pruszków | Wszystkie ZP | Wróć | Zapisz Raport

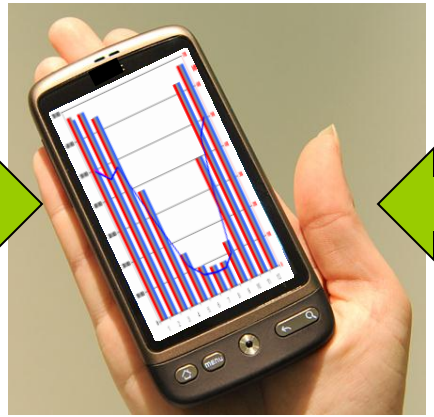
Status	Godz.	ZP	Kod	Treść	Powiadomił	Przyjął	Przekazano do/ Uwagi
	7,00	ewsa	pd	przekazanie zmiany	malinowski	poławski	
	7,35	spec	sc	korekta ciś s 1.20 mpa od 8.00	chudzik	poławski	bartoszewicz
	7,45	spec	pl t	s ż 10-20>75 21-9>80	grabowski	poławski	bartoszewicz wiaderek
	8,15	of	pl m	przyjęto of przyr s 10>5 mw ż 10>5 mw razem 10 mwh		poławski	bartoszewicz wiaderek
rb	8,17	p	t6	wył do rb przegląd łożysk	sidor	poławski	
	8,30	spec	sc	korekta ciś s ż 1.15 mpa od 9.00	grabowski	poławski	bartoszewicz wiaderek
	9,15	spec	sc	korekta ciś s ż 1.10 mpa od 11.00	grabowski	poławski	bartoszewicz wiaderek
r	10,39	ż	t10	wył do rez	wiaderek	poławski	
r	11,00	ż	k4	wyg do rez	wiaderek	poławski	
r	11,05	p	k7	wyg do rez	sidor	poławski	
r	15,47	s	t5	wył do rez	chojnicki	poławski	
	18,00	ewsa	dp	przekazanie zmiany	poławski	bogdański	

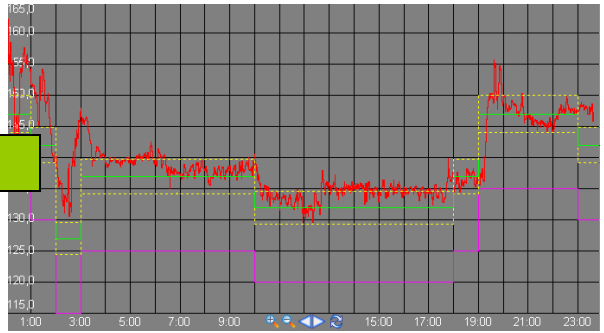
Benefits from PI System installation

- Important data from production area are secured
- Improved quality and efficiency of analysis process
- Improved efficiency of production process
- Possibility of central dispatching
- IT tool easily accessible for end users
- Large possibilities of user interface customization
- Easy integration with other systems

Next steps

- PI System infrastucture improvement due to increasing number of interfaces in order to improve overall system availability and data accessibility
- Standarization of interfaces to DCS
- Provide of complex dashboards system based on PI System data accessible by standard web browser and smartphone





Questions

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Thank you