

Operational Data to Real Time Financials

Presented by





ORLEN

Agenda

- About PKN ORLEN
- PI in PKN ORLEN
- Business Challenge
- The Solution
- Results and benefits
- Next steps



PKN ORLEN – international oil and energy company



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- Integrated downstream assets in **three countries** in Central Europe



30 m tons throughput of various types of crude oil



Over **50 products** from refinery & petrochemicals sold in more than **90 countries around the world**



Over **2,700 fuel stations**

The largest retail network in Central Europe

1.4 m transactions per day



Loyal customer base



100 m boe

2P reserves in Poland and Canada



Over **20 th.**

highly-skilled employees



**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)



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



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



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



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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 Bussines Challenge



Corporate level production and financial management in Energy Segment PKN ORLEN:

- Many locations, many technologies, many data sources - need for integration and common communication platform with business information
- Combination of technical data and the economics
- Real time, effective conducting of advanced analysis
- Attractive visualization layer



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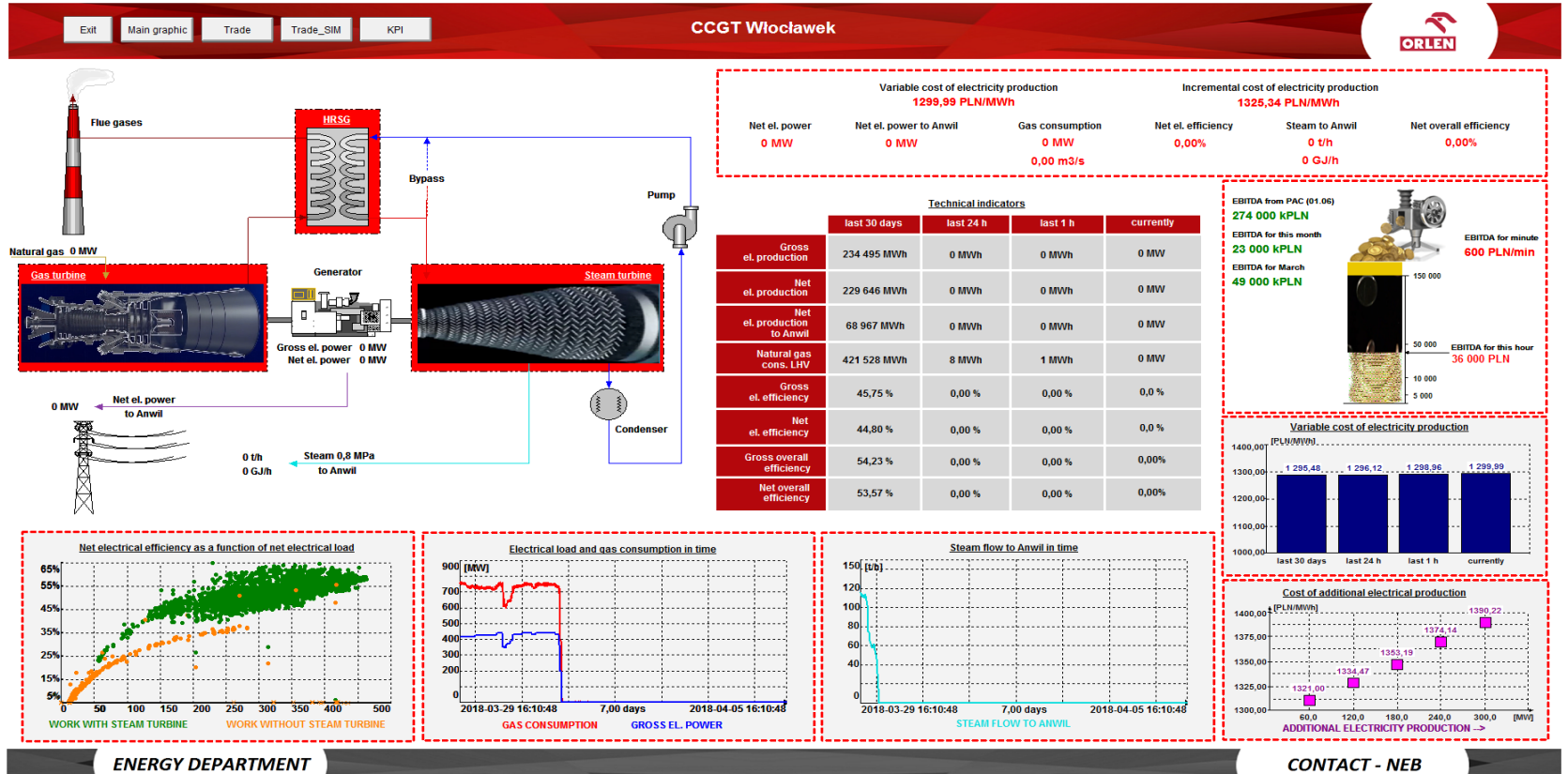
- About PKN ORLEN
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Main graphic



CCGT Włocławek



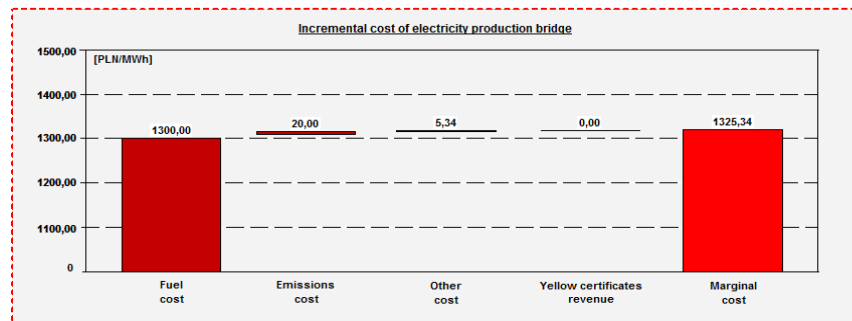
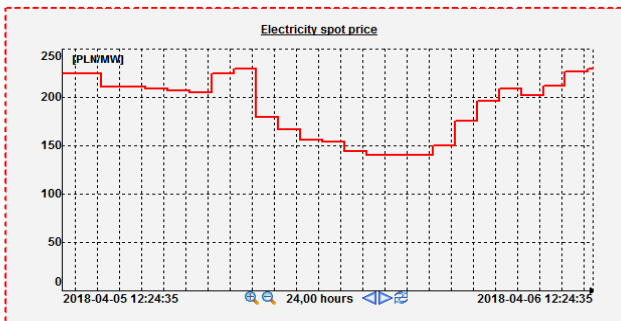
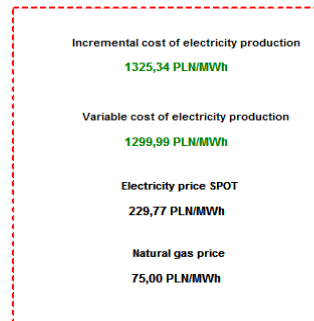
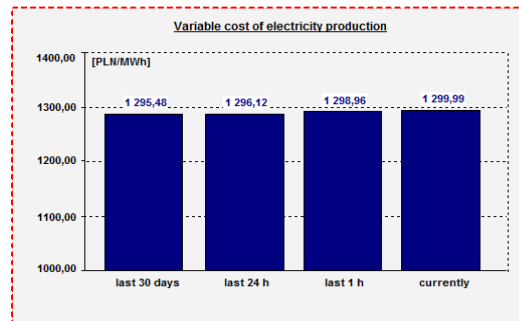
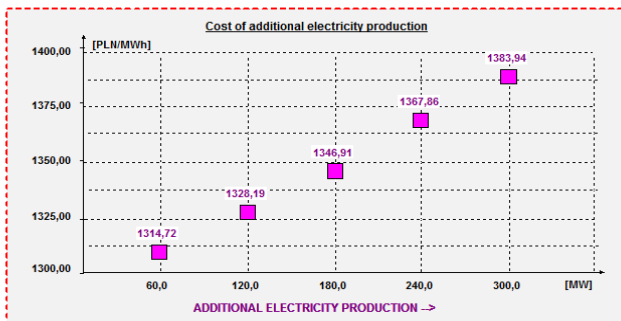
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CCGT Wloclawek - Trading

Exit Back

CCGT Wloclawek - Marginal Cost



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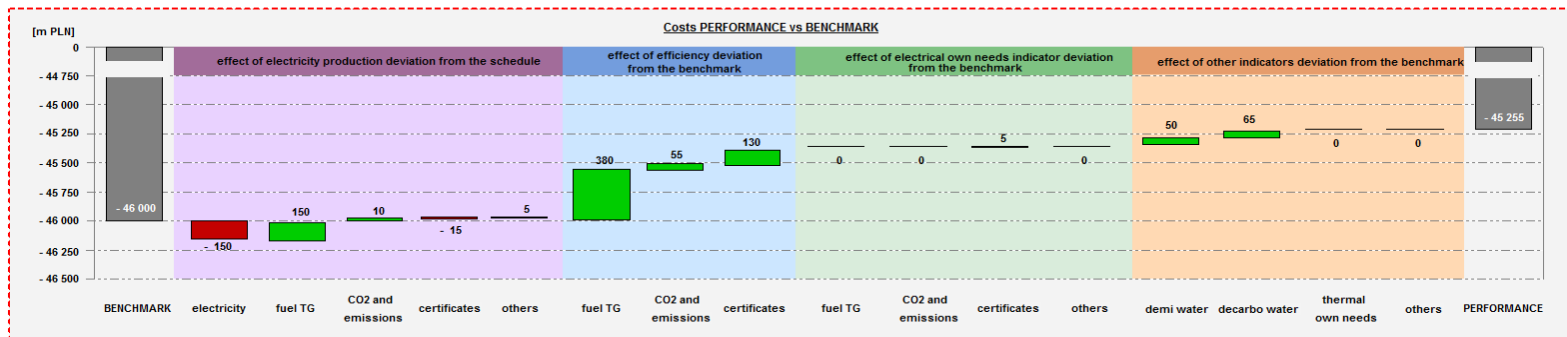
CCGT Włocławek - KPI

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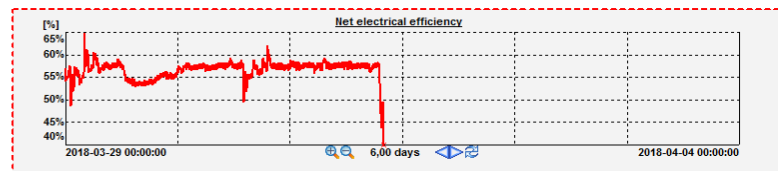
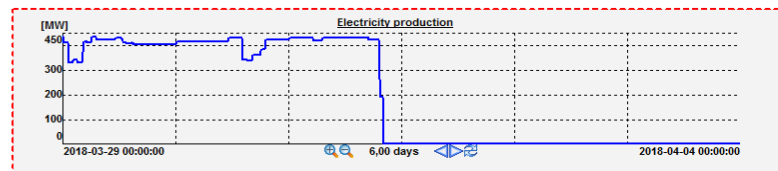
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CCGT Włocławek - KPI

29.03-04.04.2018



Lp.	KPI	UOM	Performance	Benchmark	Current
1	Net overall efficiency	%	100 %	100 %	0,0 %
2	CCGT availability	%	100 %	100 %	-
3	Electricity production deviation from the schedule	%	0 %	0 %	-
4	Steam production for Anwil	t/h	100 %	100 %	0,0
5	Cogeneration support level	%	100 %	100 %	0,0 %
6	Electrical own needs	%	100 %	100 %	0,00 %
7	Thermal own needs	%	0 %	0 %	0,000 %
8	Demi water consumption indicator	m3/t	100 %	100 %	0,000
9	Decarbo water consumption indicator	m3/MWh	100 %	100 %	0,000
10	Ammonia unit consumption	%	0 %	0 %	-
11	Water losses in boiler cycle	m3	0 %	0 %	0,0
12	Lossess and diferences on steam transition	%	100 %	100 %	0,000 %



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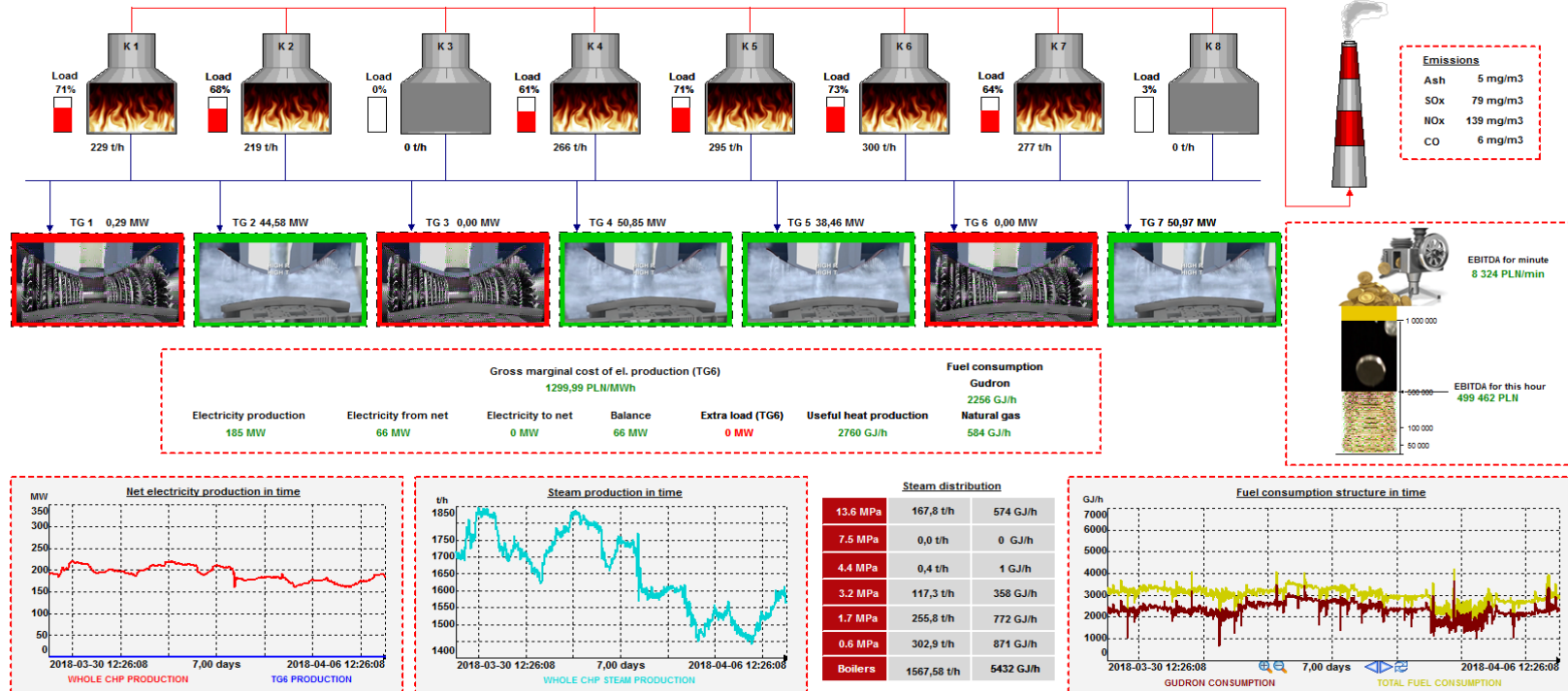
CHP Plock

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Main graphic

Trade

CHP Plock



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CHP Płock - trading

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TG6 - Marginal Cost



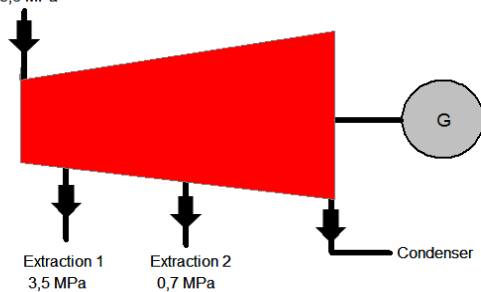
Gross marginal cost of electricity production

1299,99 PLN/MWh

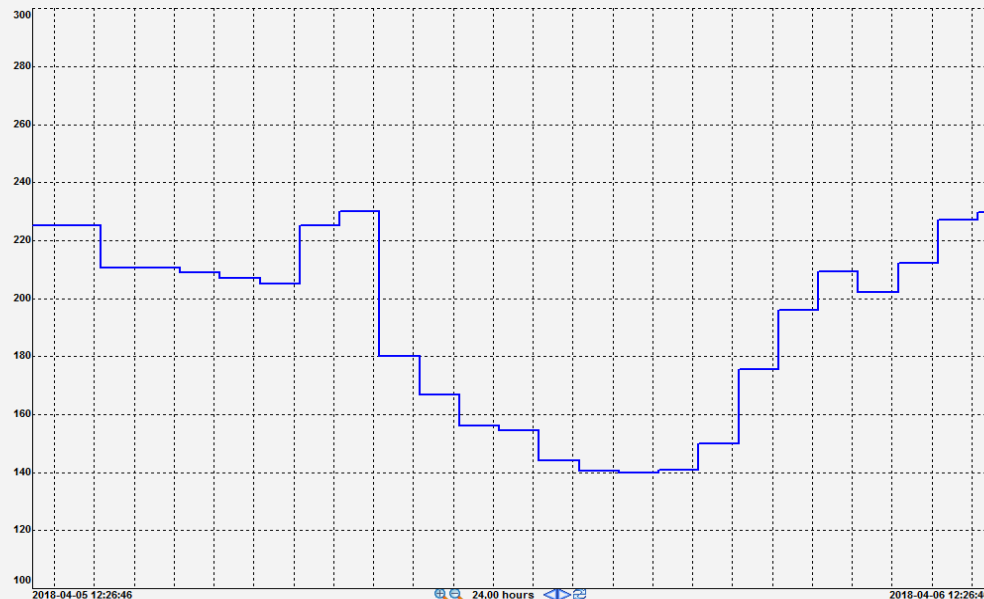
Electricity price SPOT

229,77 PLN/MWh

Admission Steam
13,6 MPa



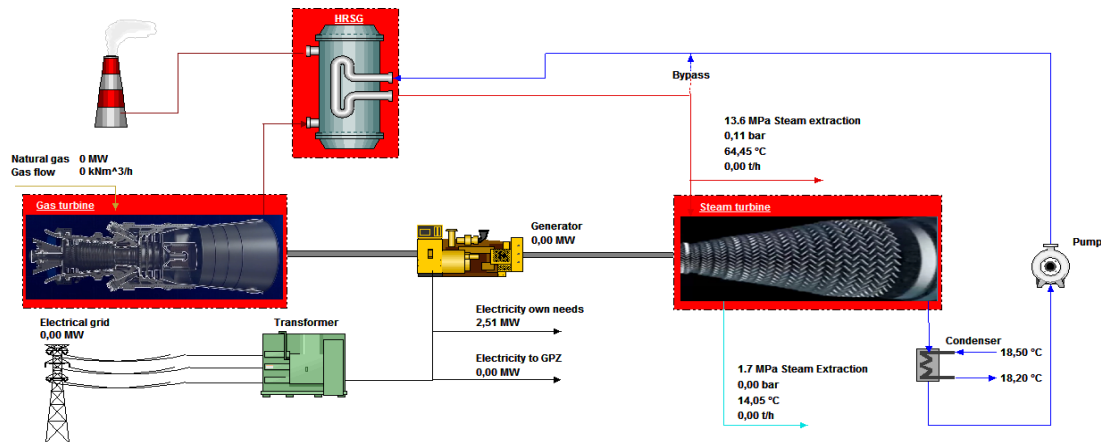
Electricity spot price



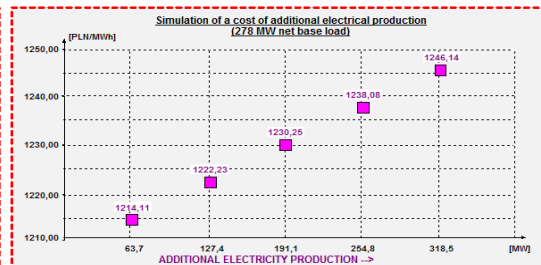
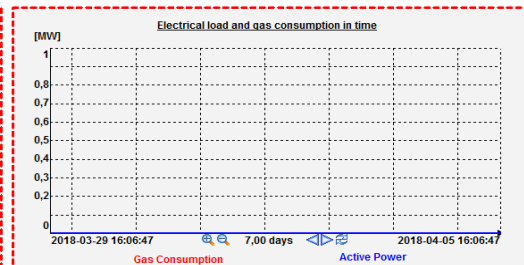
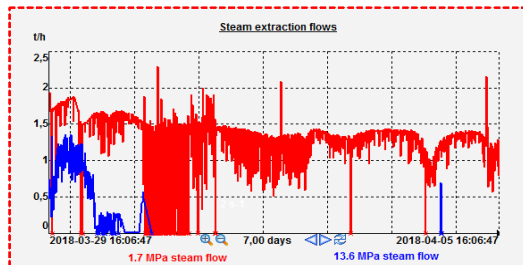
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Active power 0,00 MW	Own electrical needs 2,51 MW
Fuel consumption 0,00 MW	Gas flow 0 kNm ³ /h
13.6 MPa Steam Extraction 0,00 t/h	1.7 MPa Steam Extraction 0,00 t/h
Net el. efficiency 0,00%	Net overall efficiency 0,00%



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CCGT Plock - trading

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Back

CCGT Plock - Marginal Cost

SIMULATOR



Incremental cost of electricity production

1220,42 PLN/MWh

Variable cost of electricity production

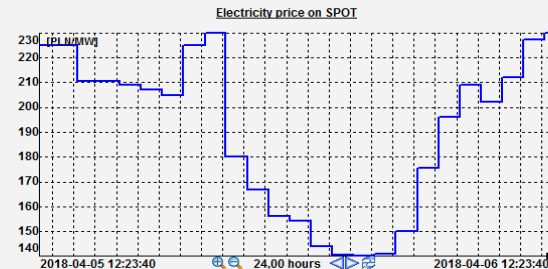
1225,19 PLN/MWh

Electricity price SPOT

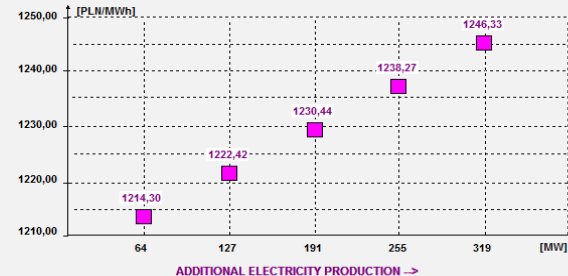
229,77 PLN/MWh

Natural gas price

82,00 PLN/MWh



Cost of additional electricity production



Technical assumptions

Net electricity production
278,00 MW

13,6 MPa steam flow
0,00 t/h

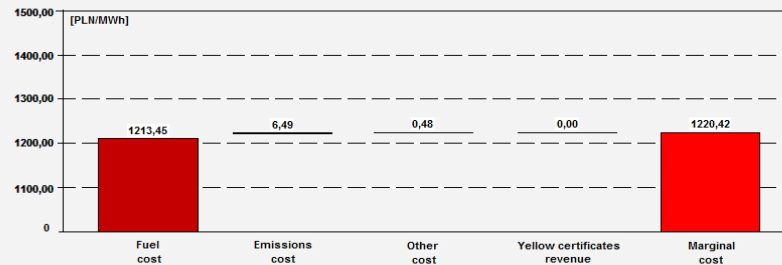
1,7 MPa steam flow
0,00 t/h

Net overall efficiency
51,95%

Steam energy
0,00 MW

Ambient temperature
8,00 °C

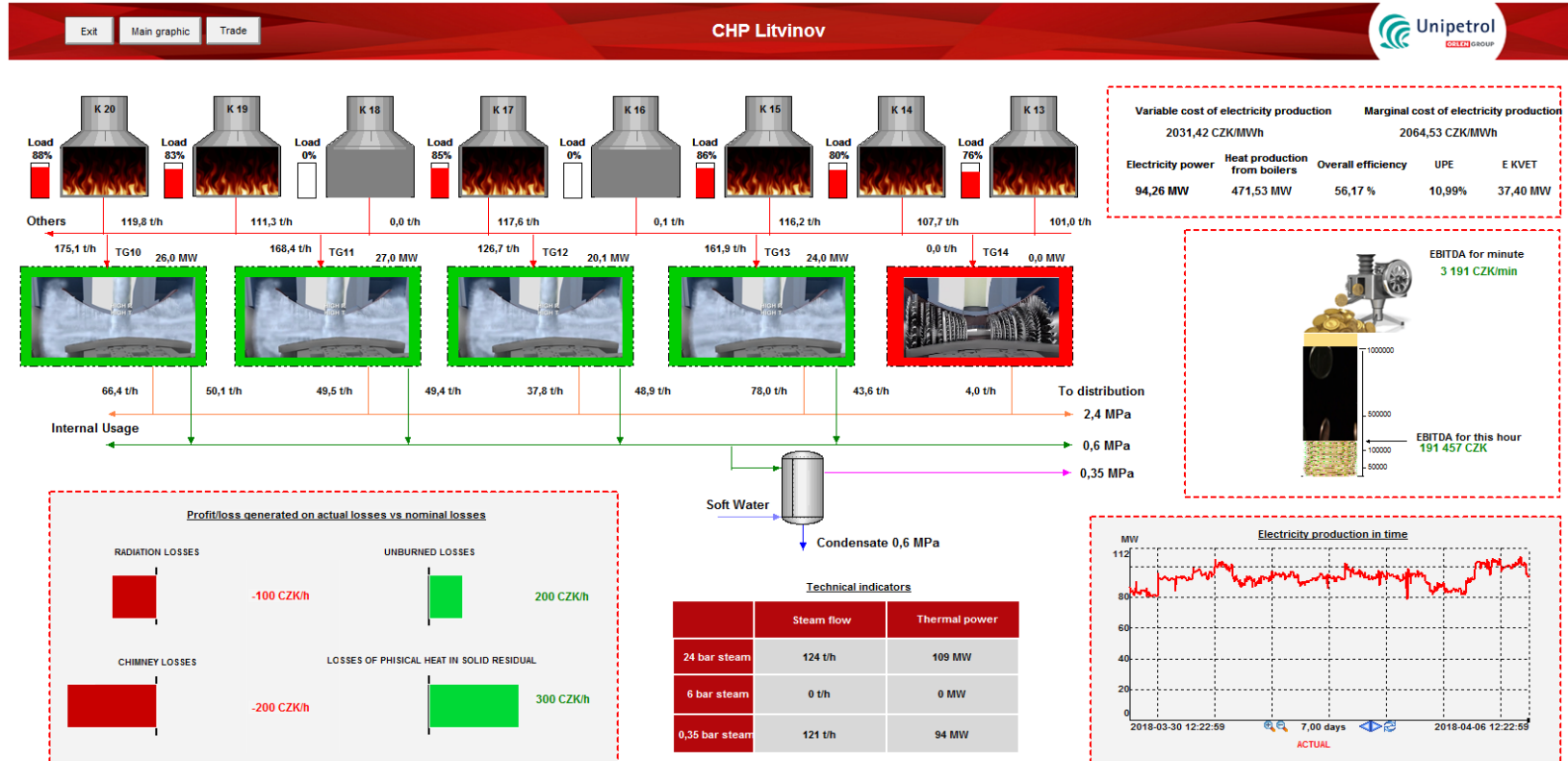
Incremental cost of electricity production bridge



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CHP Litvinov - Marginal Cost



Marginal cost of electricity production

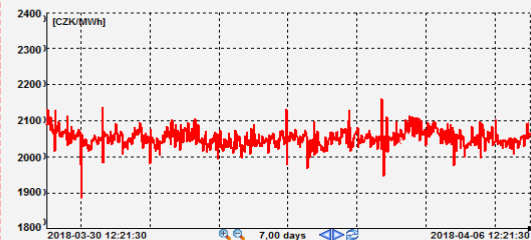
2064,53 CZK/MWh

Boilers efficiency	Overall efficiency	Gross marginal efficiency of condensation	Net marginal efficiency of condensation
89,03 %	56,17 %	29,89 %	27,78 %

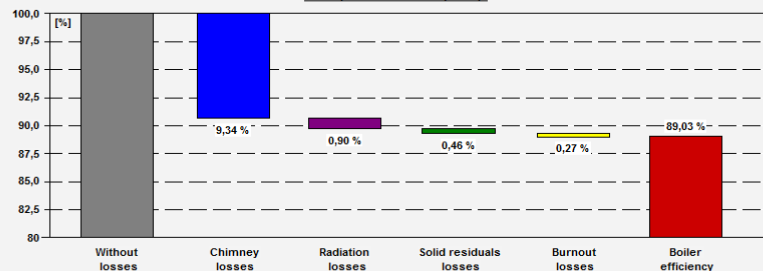
Generation factors

	UOM	TG-10	TG-11	TG-12	TG-13
x1	[t/MWh]	13,62	13,00	14,32	12,97
x2	[t/MWh]	7,75	7,49	7,92	7,69
x3	[t/MWh]	3,61	3,38	3,61	3,49

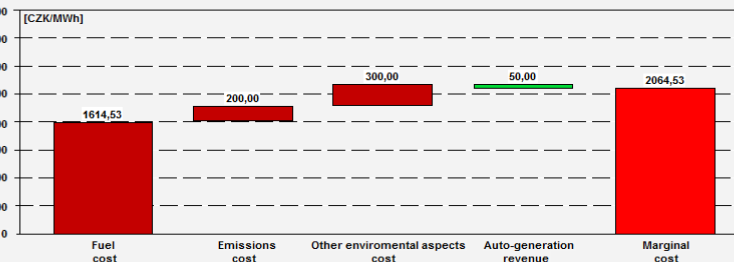
Marginal cost of electricity production in time



Average boilers efficiency bridge



Marginal cost of electricity production bridge



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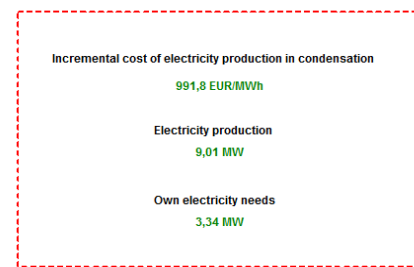
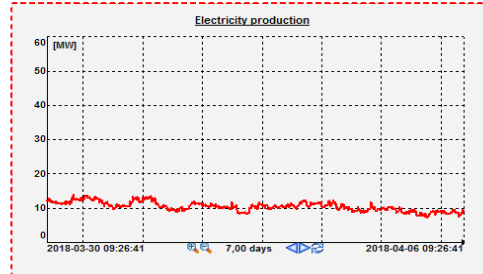
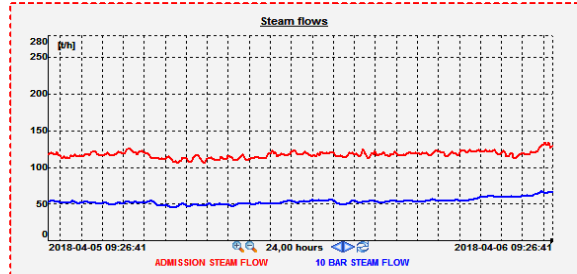
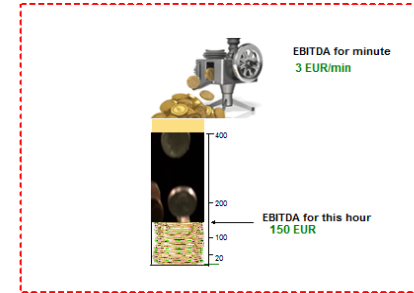
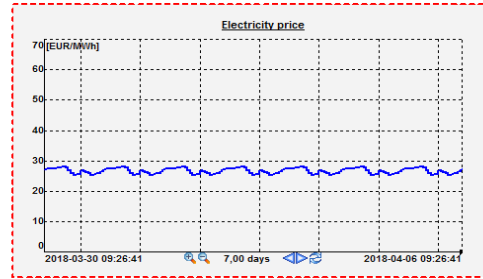
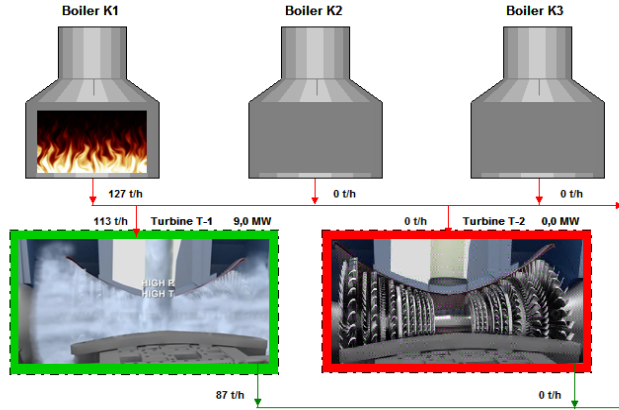
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CHP Mažeikiai

Exit Main graphic

CHP MAŽEIKIAI

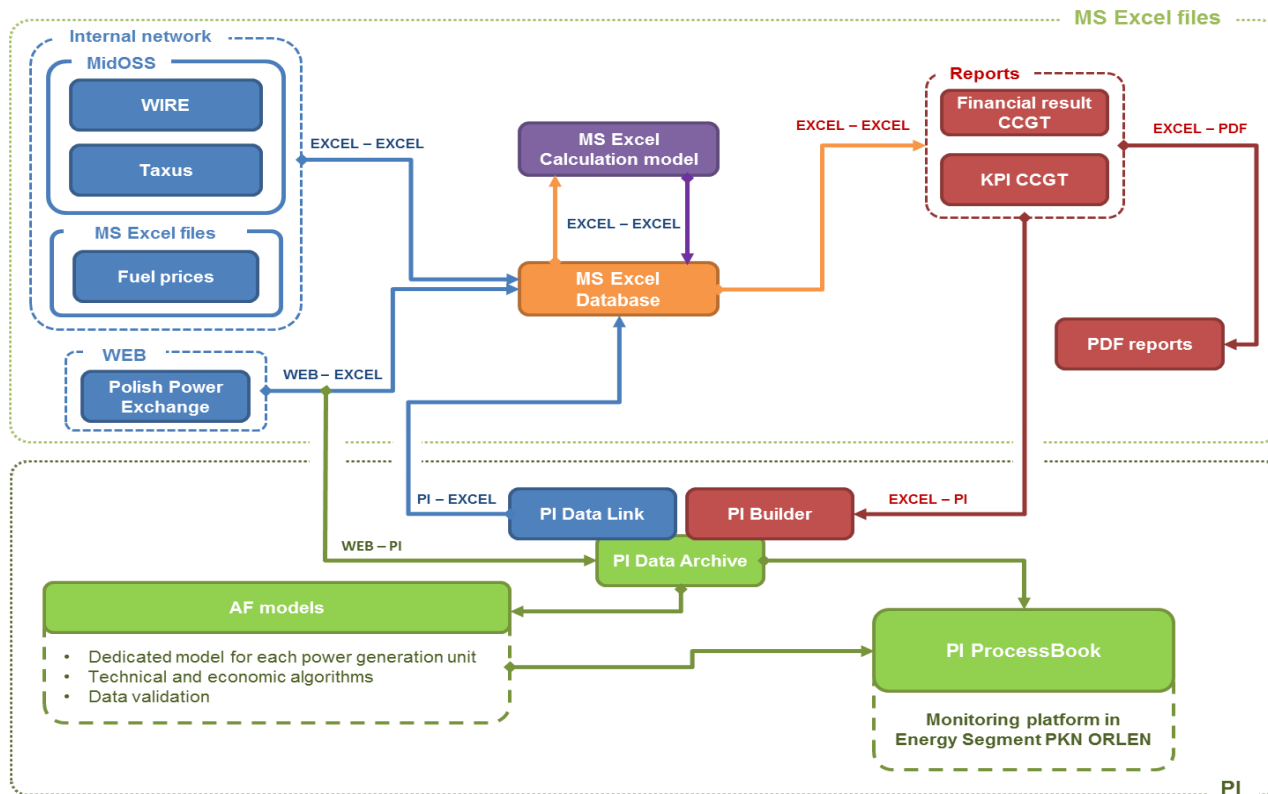
ORLEN Lietuva



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PI-based monitoring platform in Energy Segment - details





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PI in PKN ORLEN – results and benefits



PI as useful communication platform with the potential of new users

- Interactive 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
- On-line analysis based on the advanced algorithms in AF
- Attractive visualisations based on VBA

PI as catalyst for automation

- Increased efficiency of analyzes
- Automatization of reporting process – saving time and human resources



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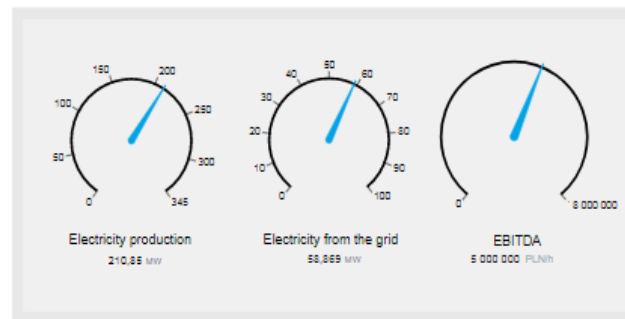
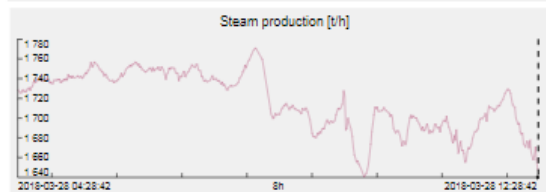
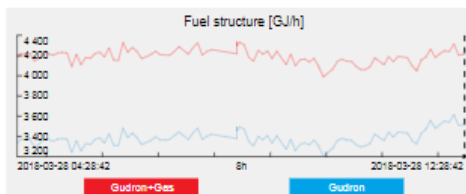
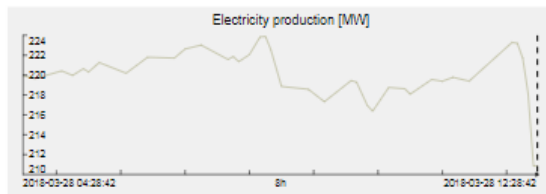
PI in PKN ORLEN – Next Steps



- Central Data Repository powered, among others, by PI
- External advanced calculating engine replacing excel
- Dedicated BI tool for data visualization
- PI Vision as a step towards web applications usage
 - simplified access to graphics
 - customized widgets (JavaScript, HTML5)
 - notification system
 - managing permissions to show and change displays

CHP Plock – PI Vision

CHP Plock



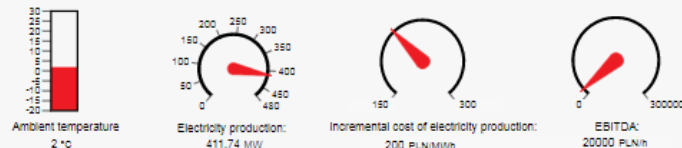
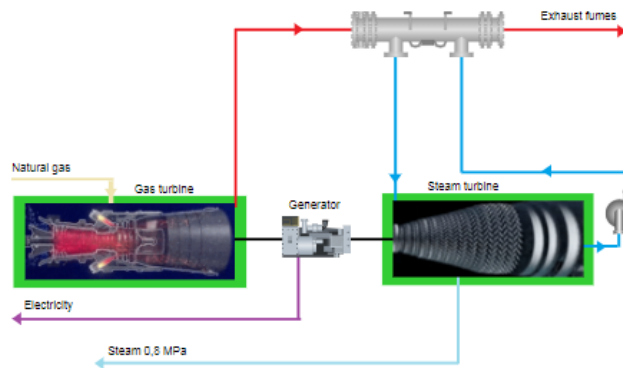
Nazwa ▲	Wartość	Jednostki	Trend	Minimum	Maksimum
EBITDA	5 000 000	PLN/h		5 000 000	5 000 000
Total fuel	2 604,18	GJ/h		1 928,38	4 423,62
Guđron	1 909,34	GJ/h		1 137,66	3 639,72
Useful heat production	3 248,41	GJ/h		3 239,75	3 417,99
Electricity balance	58,87	MW		28	28
Electricity production	210,85	MW		210,85	223,90

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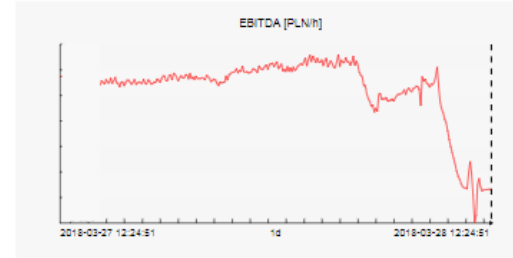
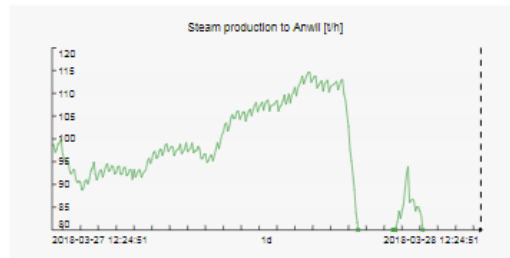
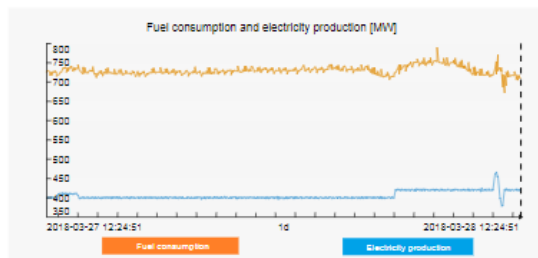
CCGT Włocławek – PI Vision

CCGT Włocławek



Turbines status: Gas turbine status ■ Steam turbine status ■

Nazwa ▼	Wartość	Jednostki	Trend	Średnia	Minimum	Maksimum
Electricity to Anwil	138,1	MW		133,2	121,7	143,0
Gross electric power	420,91	MW		406,02	377,76	467,23
Gross efficiency	0,58152			0,58752	0,54991	0,59152
Variable cost of electricity production	200	PLN/h		200	200	200
EBITDA	20000	PLN/h		20000	20000	20000
EBITDA for this month	20000	kPLN		20000	20000	20000
EBITDA from PAC (01.08.2017)	20000	kPLN		20000	20000	20000

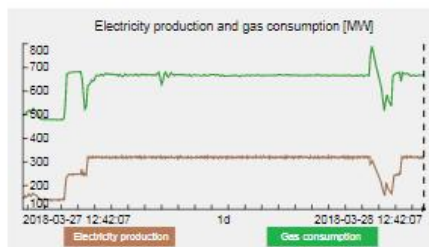
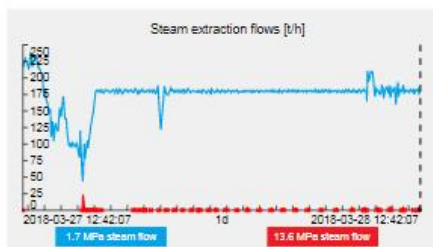
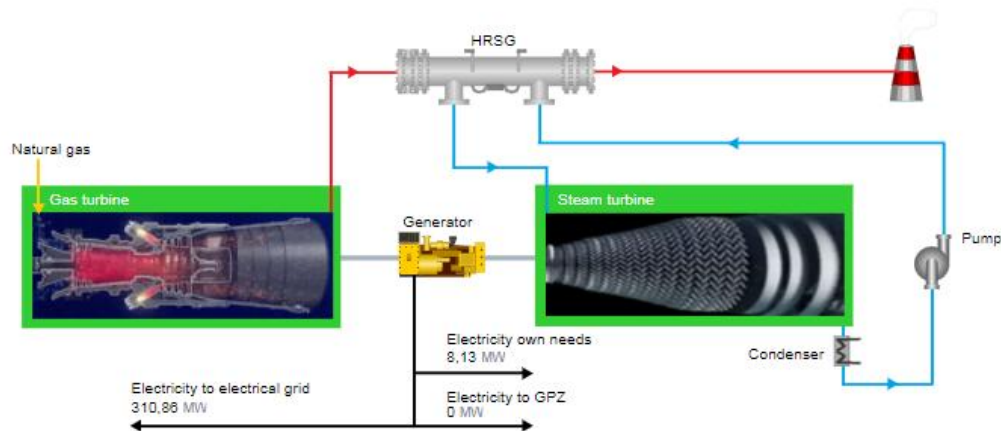


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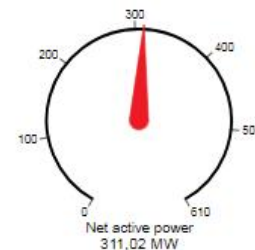
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CCGT Plock - PI Vision

CCGT Plock



EBITDA
2500 PLN/h



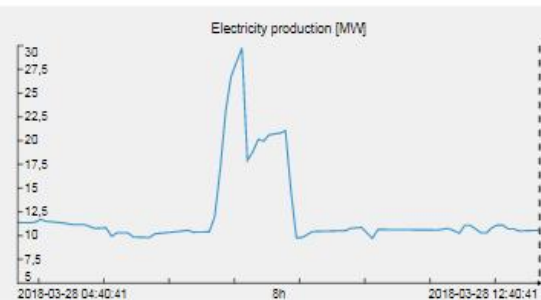
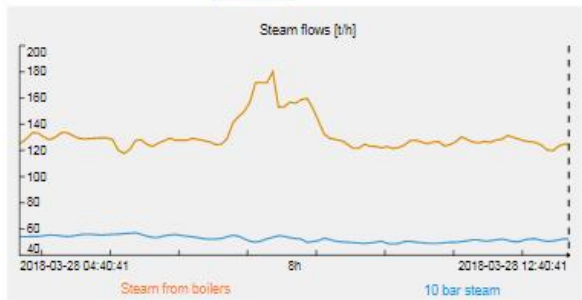
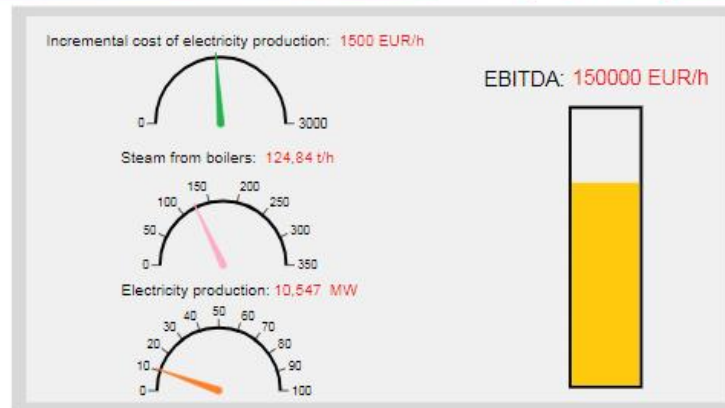
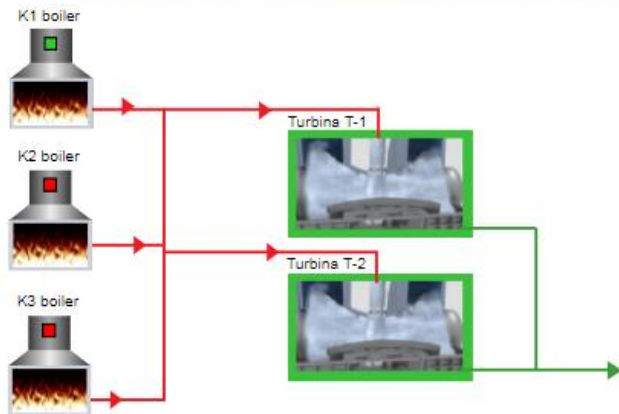
Nazwa	Wartość	Jednostki	Minimum	Maksimum
13.6 MPa steam flow	181,09	t/h	43,323	239,06
1.7 MPa steam flow	4,131	t/h	0	23,831
Fuel consumption	667,15	MW	478,31	790,16
Electricity to the electrical grid	310,86	MW	130,6	314,21
Electricity to the GPZ	0	MW	0	0
Electricity own needs	8,13	MW	5,12	12,18
Net overall efficiency	72,306	%	45,649	73,679
Net electrical efficiency	46,619	%	27,333	49,567

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CHP Mažeikiai - PI Vision

CHP Mažeikiai



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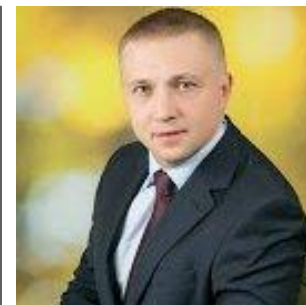
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Merci

Danke

谢谢

Спасибо

Dziękuję

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado

Questions

Please wait for the **microphone** before asking your questions

State your **name & company**



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