IntBioCHP

POLISH - GERMAN
SUSTAINABILITY RESEARCH PROGRAMME STAIR

System integration of biomass fired cogeneration plants

STATUS REPORT

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Narodowe Centrum Badań i Rozwoju

Federal Ministry of Education and Research

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Agenda

- Project background
- Project objectives
- Methodology
- Expected results
- Implementation and problems
- Current activities

Project background

One of today's challenges for the energy sector is to ensure the ***continuity of supply of price competitive and affordable energy*** *to consumers under rigorous environmental constraints. This requires rational decisions about the operation of generation assets and networks as well as about repairs and modernizations.*

Resource efficient, price competitive and low-carbon energy management *requires in production plants relevant decision support systems (DSS) implemented in the form of* ***software tools*** *with a specific functionality. Key features of such system are optimal control of plant operation and on-line diagnostics.*

Project background

Status of biomass fired cogeneration in Poland:

- *Several conventional steam plants (P > 2 MWel)*
- *Several gasification + ICE plants (R&D)*
- *11 ORC plants (0.2 MWel < P < 1.5 MWel)*
- *ORC plants of single manufacturer (Turboden + VAS; Turboden + Politechnik)*

Project background

To trigger implementation of new solutions the following are required:

- *technical studies for demo systems;*
- *control and diagnostics tools;*
- *transfer of knowledge and dissemination of new solutions.*

Therefore the IntBioCHP project include applied research activities oriented on 'proof of concept', pre-commercial demonstration and market uptake studies.

Project objectives

- *Operational tests and calibration of control system of cogeneration plant of the Polish Wood Cluster in Żory.*
- *Development of alternative schemes of the biomass fired ORC plant integration with industrial and municipal heat consumers.*
- *Development of mathematical simulation models of the proposed technological systems and energy management scenarios.*
- *Development of the predicted municipal heat load profiles using tools already developed by German partners.*

Project objectives

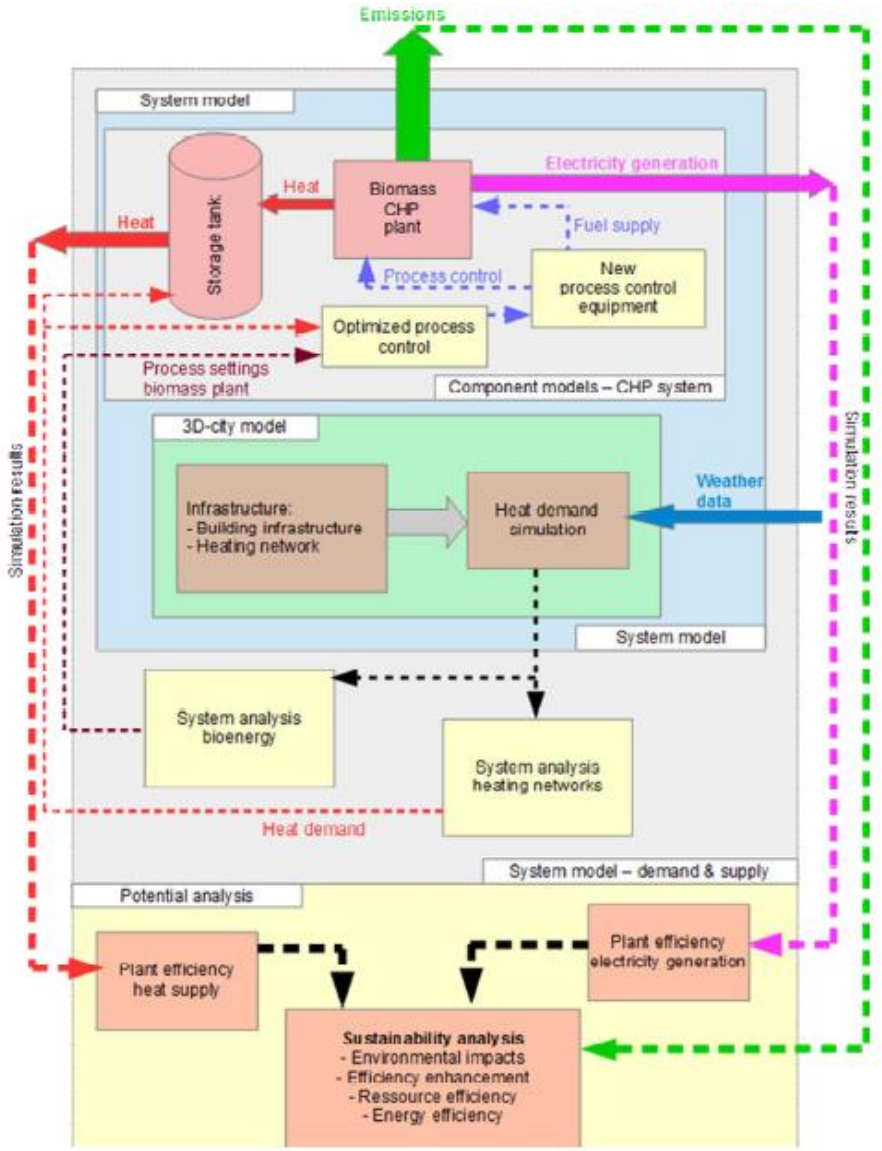
- *Simulation based studies of power plant operation*
- *Development of a monitoring and control systems, which will enable the optimization of the heat and power plants in a daily operation.*
- *Assessment and analysis of effectiveness of the proposed solutions.*
- *Development and implementation of an online diagnostic system based on a mathematical power plant model.*

Methodology

Plant modelling and development of software tools

Load predictions

Sustainability and market studies



Methodology

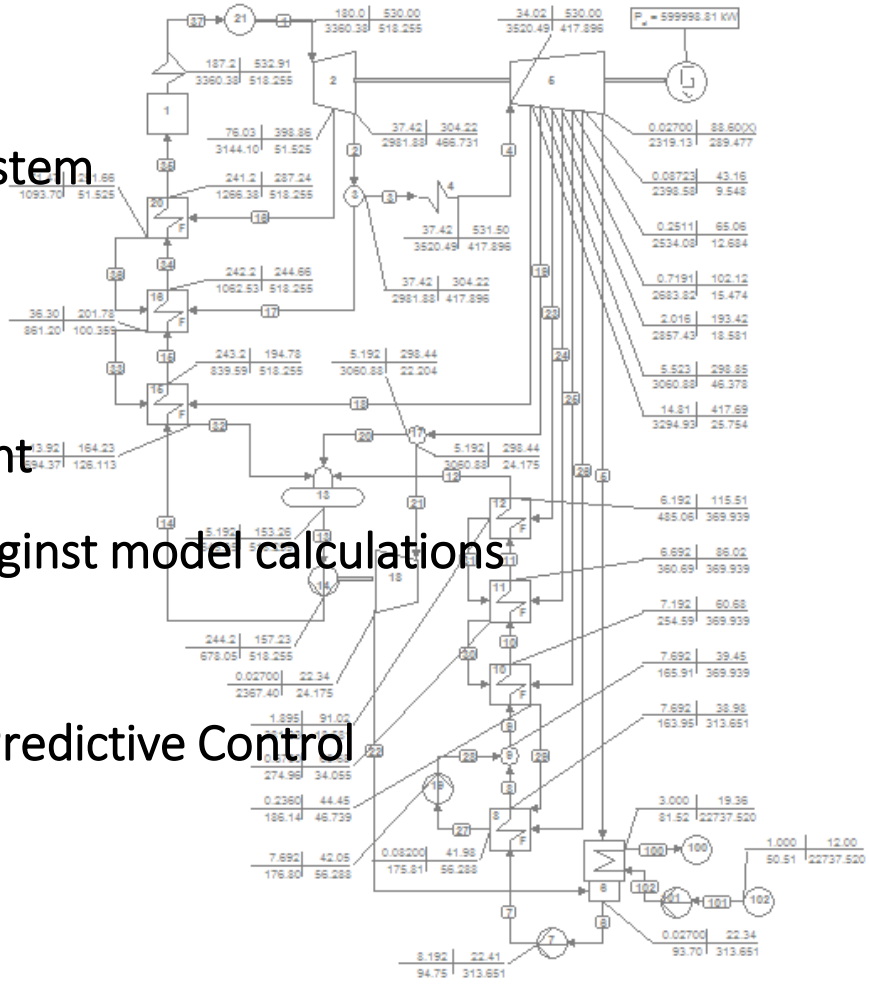
Thermal diagnostics and optimization of operation of cogeneration plants

New automation systems oppened possibilities for development of software tools for supporting decisions in the fields of plant operation parameters as well as in modernisation projects.

Methodology

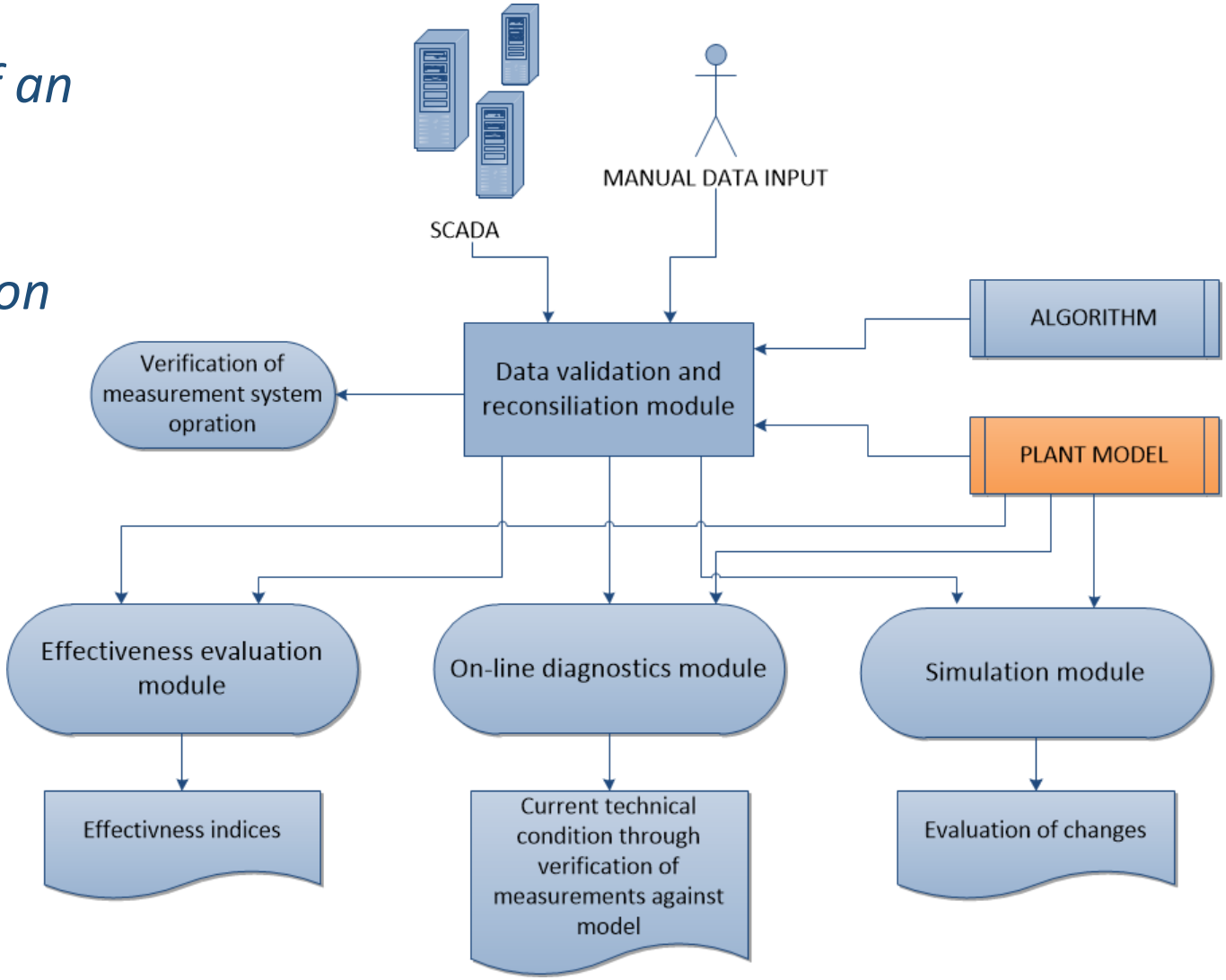
System functionalities:

- Mathematical model of the existing system
- Data acquisition
- Data validation and reconsiliation
- Verification of measurement equipment
- Verification of measured parameters aginst model calculations
- Load predictions
- Optimal operation decisions – Model Predictive Control
- Optimal future investment decisions



Methodology

Block diagram of an advanced Plant Operation Decision Support System



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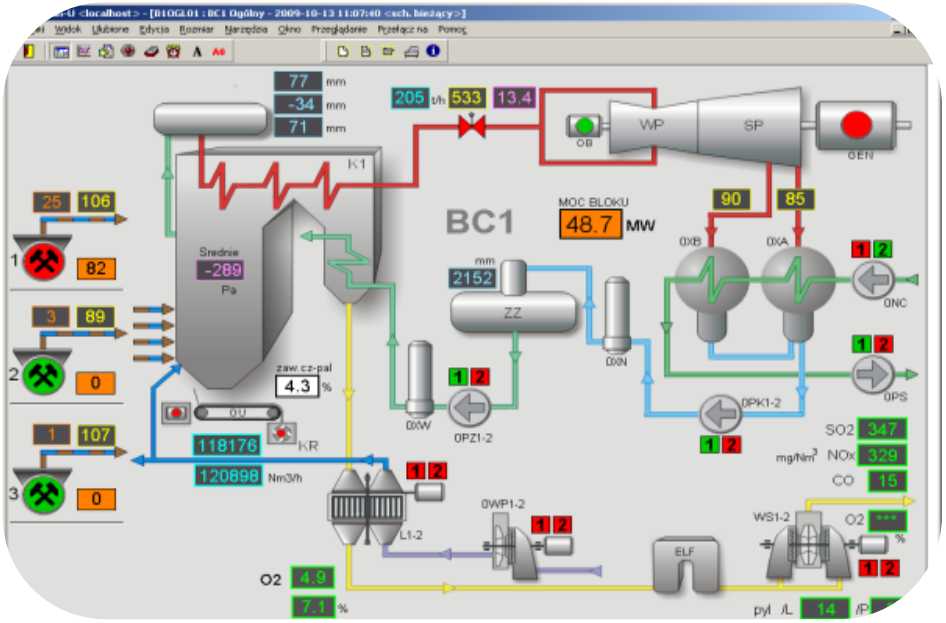
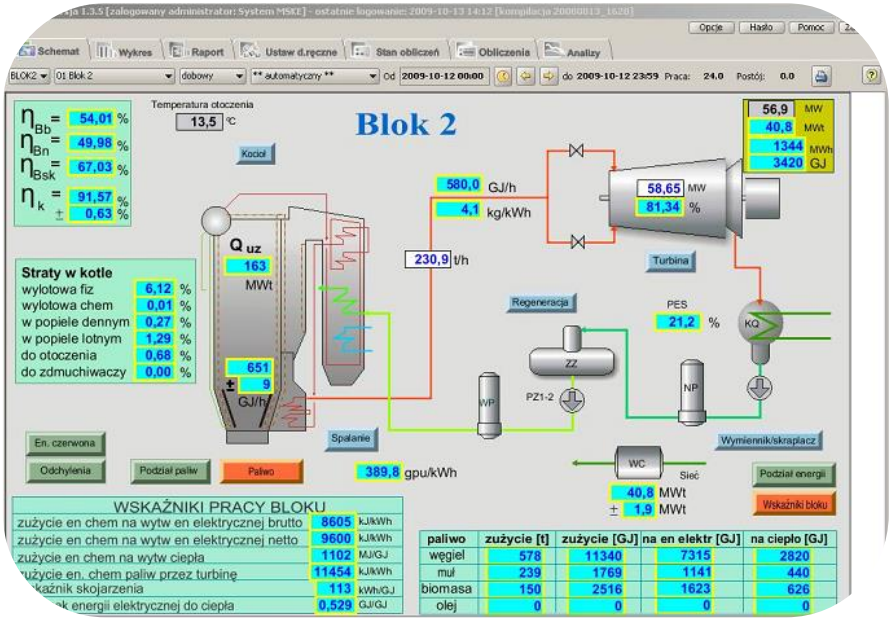
References

Meskan System

meskan

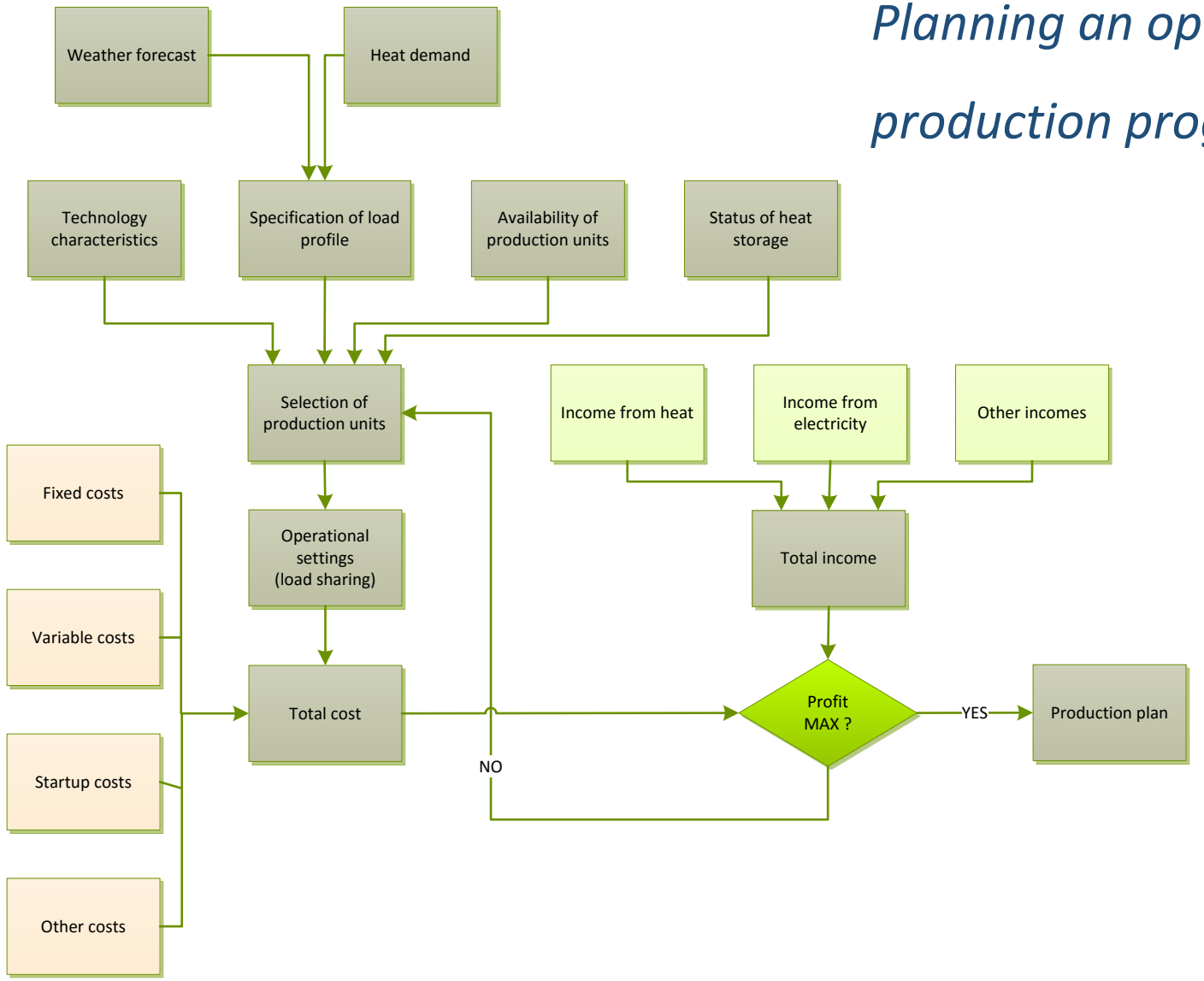
- Opole power plant (4 power blocks)
- FORTUM Wrocław Cogeneration (2 blocks)
- Jaworzno II power plant (2 cogeneration blocks)



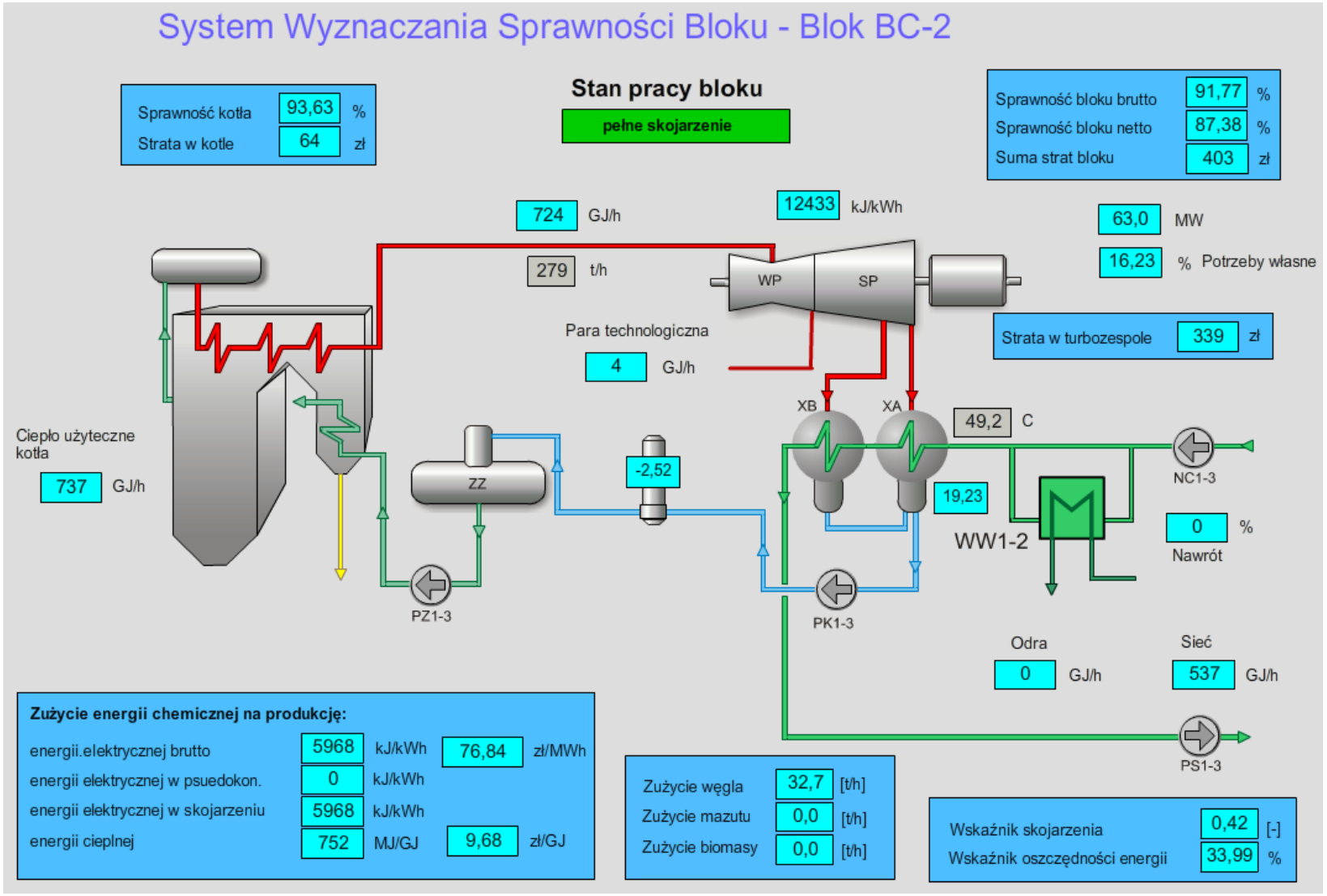


Methodology

Planning an optimal production programme



Methodology



Methodology

Implementation of heat storage

- Reference: Białystok cogeneration plant

IntBioCHP expected results

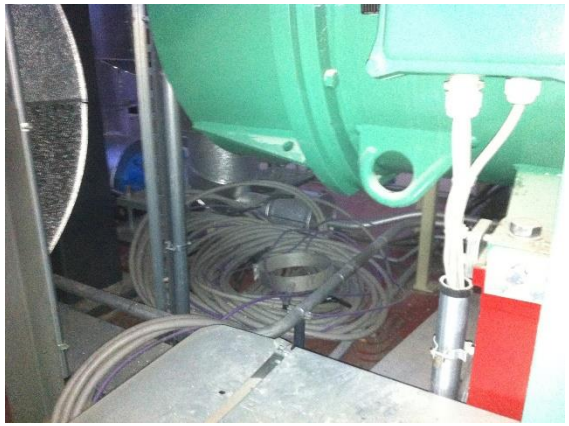
- Improvement of load forecasting
- Adaptation of the methodology to small-scale biomass fired plants
- Identification of biomass combustion and ORC processes
- Combination of plant model and SCADA system into MPC algorithm
- Relevant design documentaion

Project implementation

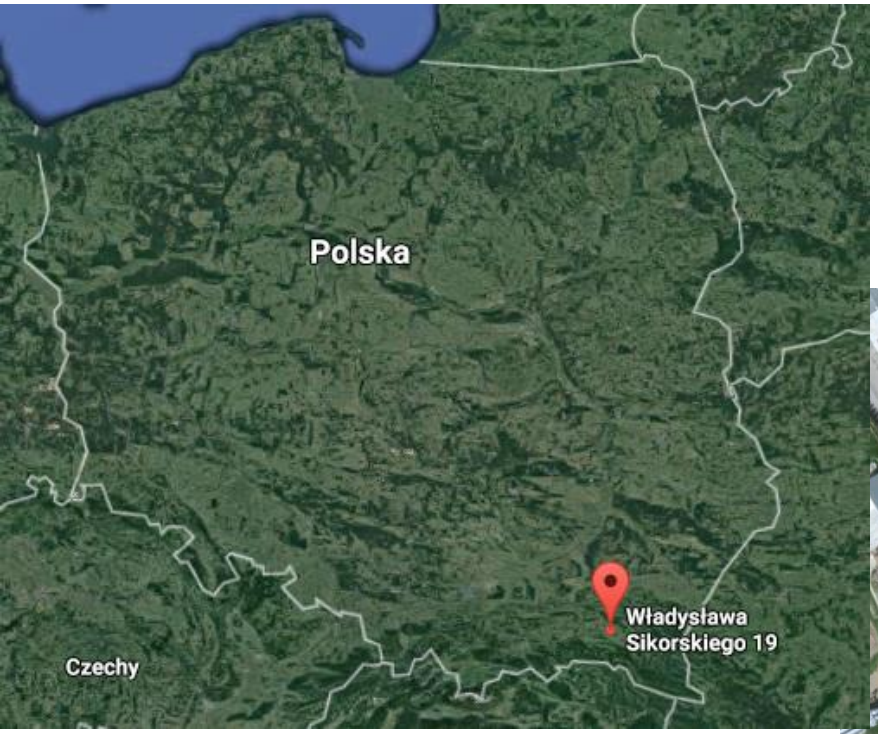
- 01.10.2016 – Project start date
- 09.12.2016 – Agreement on project financing was signed
- 09.12.2016 – 31.12.2016 – Audit and inventory at ORC plant in Żory. Serious problems were encountered.
- 17.11.2016 – Agreement was signed between SUT and ARP that the plant will be ready until 31.01.2016.
- 19.12.2016 – Talks started with MPGK Krosno Ltd.
- 31.01.2016 – ARP has not fulfilled the obligation.
- 02.02.2016 – Consortium agreement between Polish partners was terminated.
- 03.02.2016 – Procedure has started in order to change the partner.
- 10.02.2016 – Relevant documentation is going to be submited to NCBiR

According to NCBIR 6 to 8 weeks are required to implement changes

Status of the Żory plant



New partner


Polska
Władysława
Sikorskiego 19
Czechy


START
MPGK Krosno - Oddział
Energetyki Cieplnej

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Krosno DHS

Local oil and natural gas resources

New partner

- Consequences to the project
  - No change of objectives
  - The same milestones
  - The same implementation schedule
  - The same technology
  - Lower budget

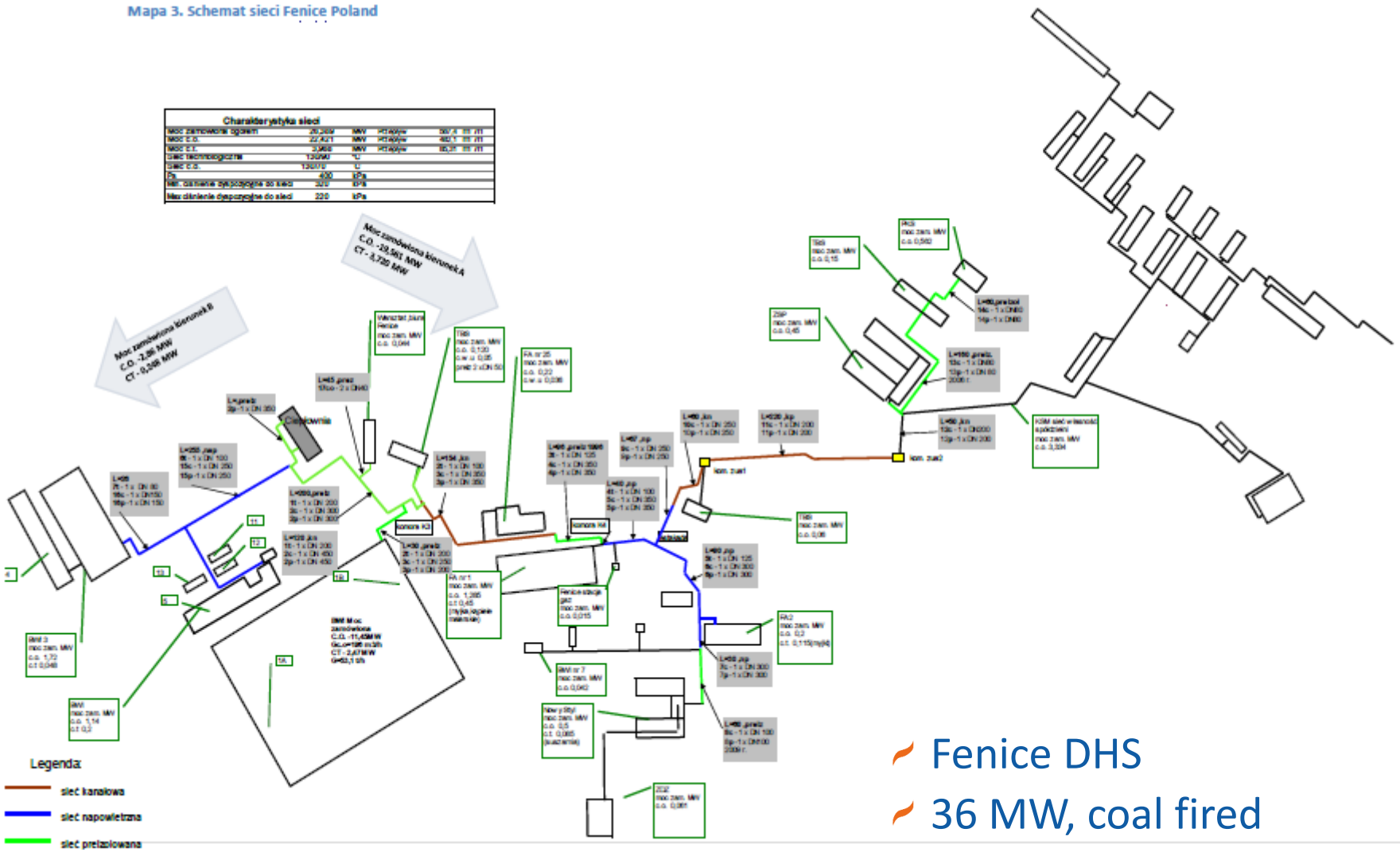
New partner

- MPGK Krosno Ltd – Municipal Holding
  - 1.255 MWe, 6.7 MWth ORC cogeneration plant in operation since 2013
  - 4 x WR coal fired boilers of 34,8 MWth

New partner

- ORC plant in Krosno is operated simultanously with coal fired boilers

Two DH systems



- Fenice DHS
- 36 MW, coal fired

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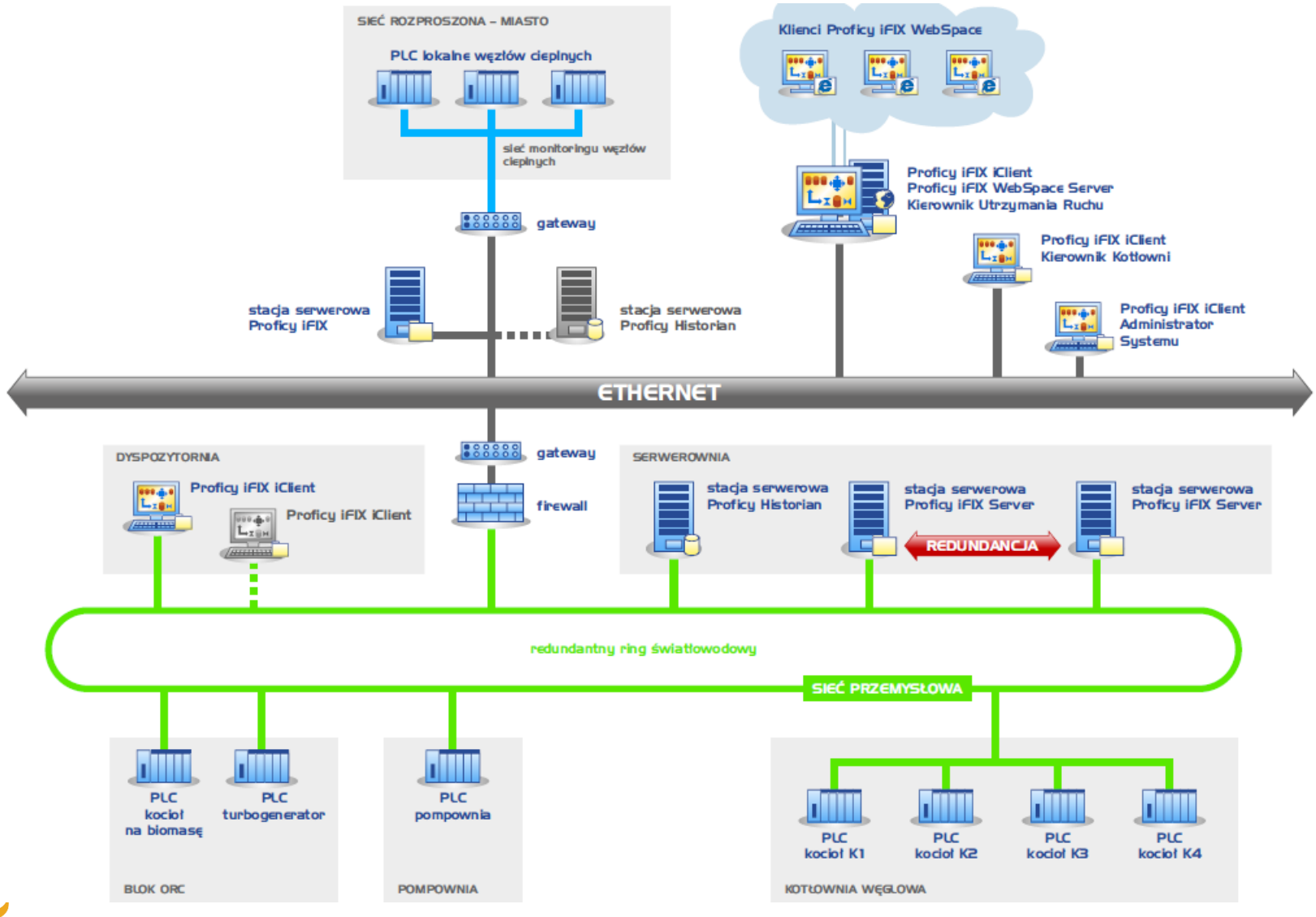
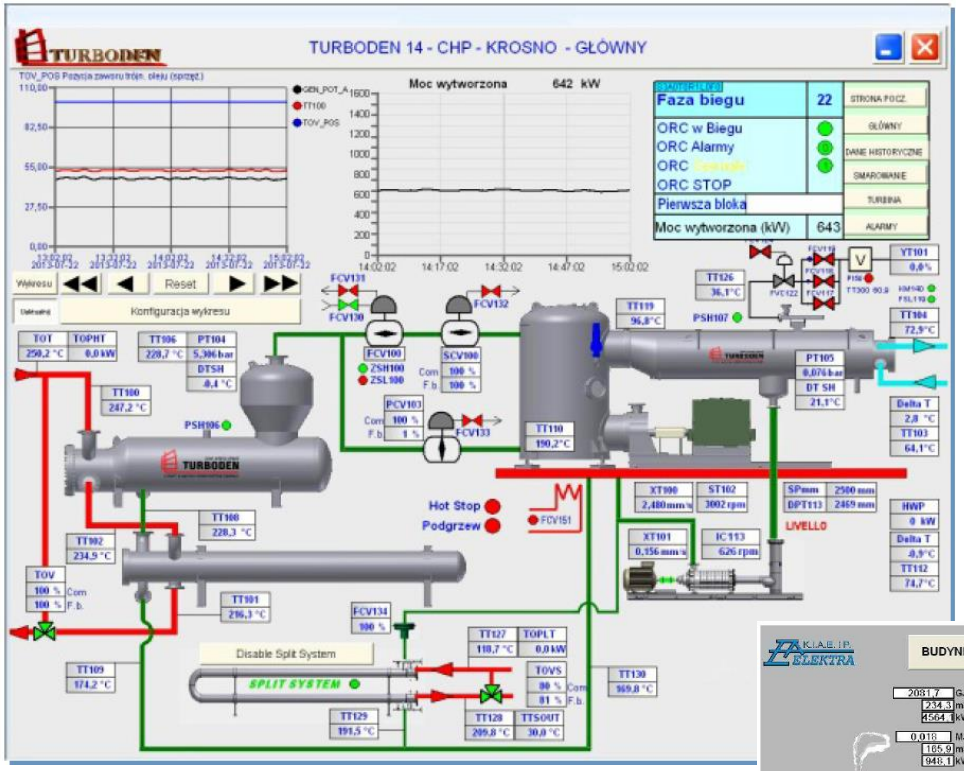
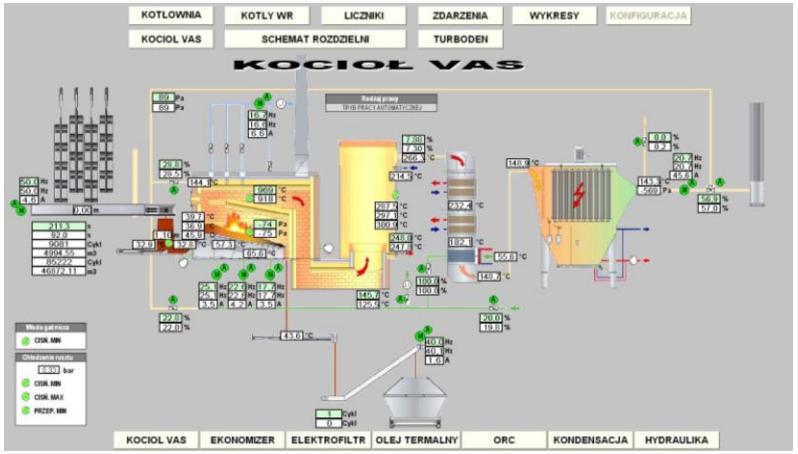
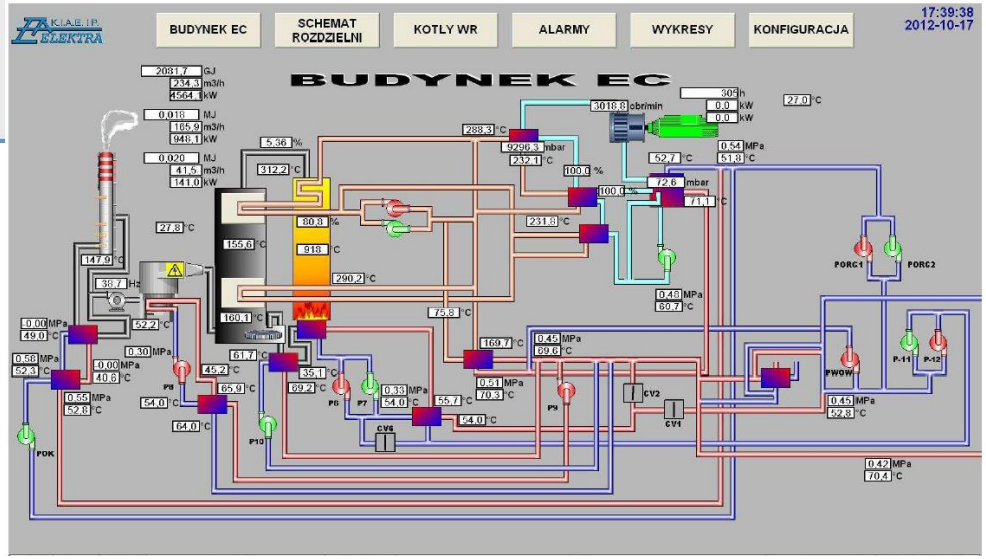
Krosno Plant SCADA



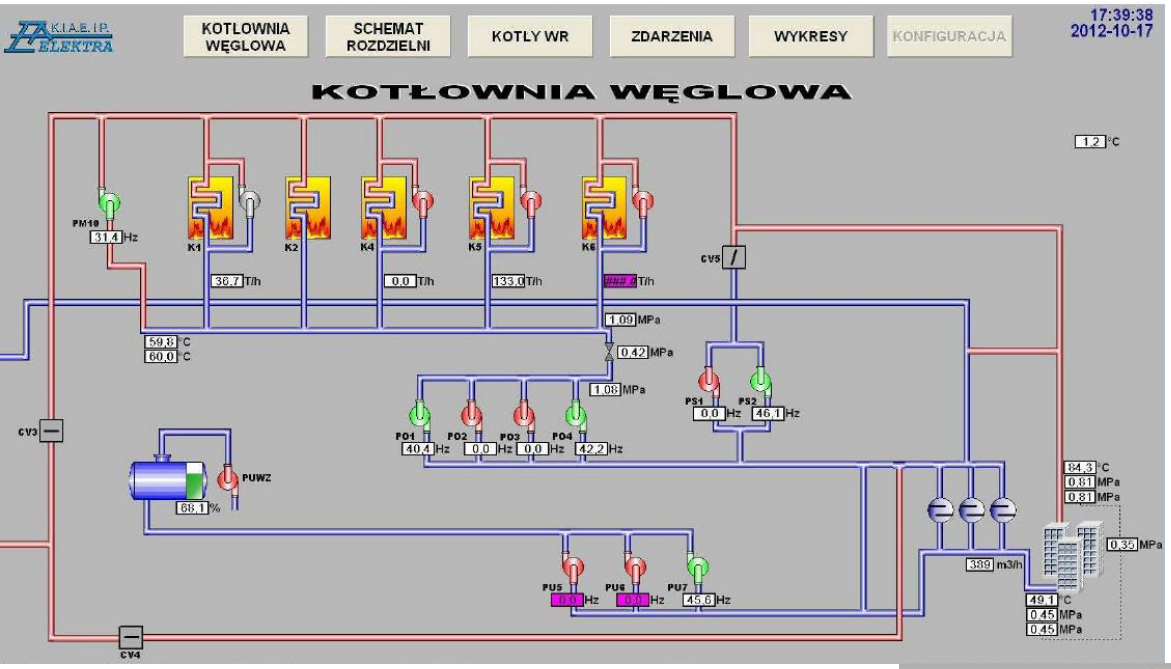
Krosno Plant ORC

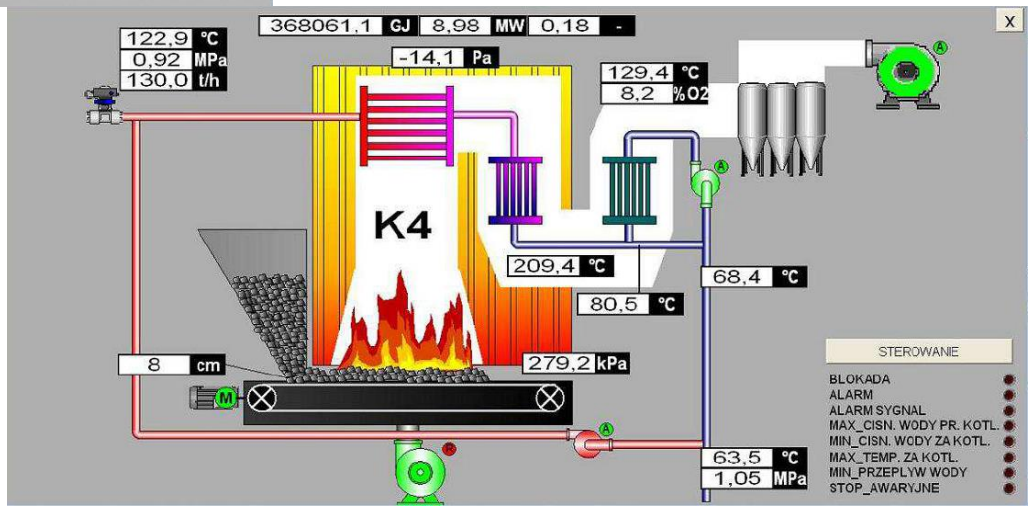






Krosno Plant WR Boilers





Budget

Total: 828,303 EUR; DE: 496,234 EUR; PL: 332,069 EUR

Hochschule für Technik Stuttgart	263,714 €
APOS	125,220 €
Biop-GmbH	107,300 €
Politechnika Śląska; ITC www.itc.polsl.pl	120,691 €
Polish Wood Cluster; ARP Agencja Rozwoju Przedsiębiorczości Sp. z o.o.	113,638 €
proen gliwice	97, 740 €

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Work plan

WP 1 – Data acquisition and analysis
(Partners: HFT, SUT, ARP, Proen)

WP 2 – System inventory and development of assumptions
(Partners SUT, APOS, Proen, ARP, HFT)

WP 3 – Process identification – Biomass CHP
(Partners: Biop, SUT, HFT, ARP)

WP 4 – Load modelling and management
(Partners: HFT, ARP, APOS, SUT, Proen)

WP 5 – Development of predictive control concept
(Partners: APOS, BIOP, SUT, HFT, ARP, Proen)

WP 6 – Preparation for product implementation
(Partners: APOS, Proen, BIOP, ARP, SUT, HFT)

WP 7 – Sustainability and market potential analysis
(Partners: HFT, SUT, APOS, BIOP, ARP)

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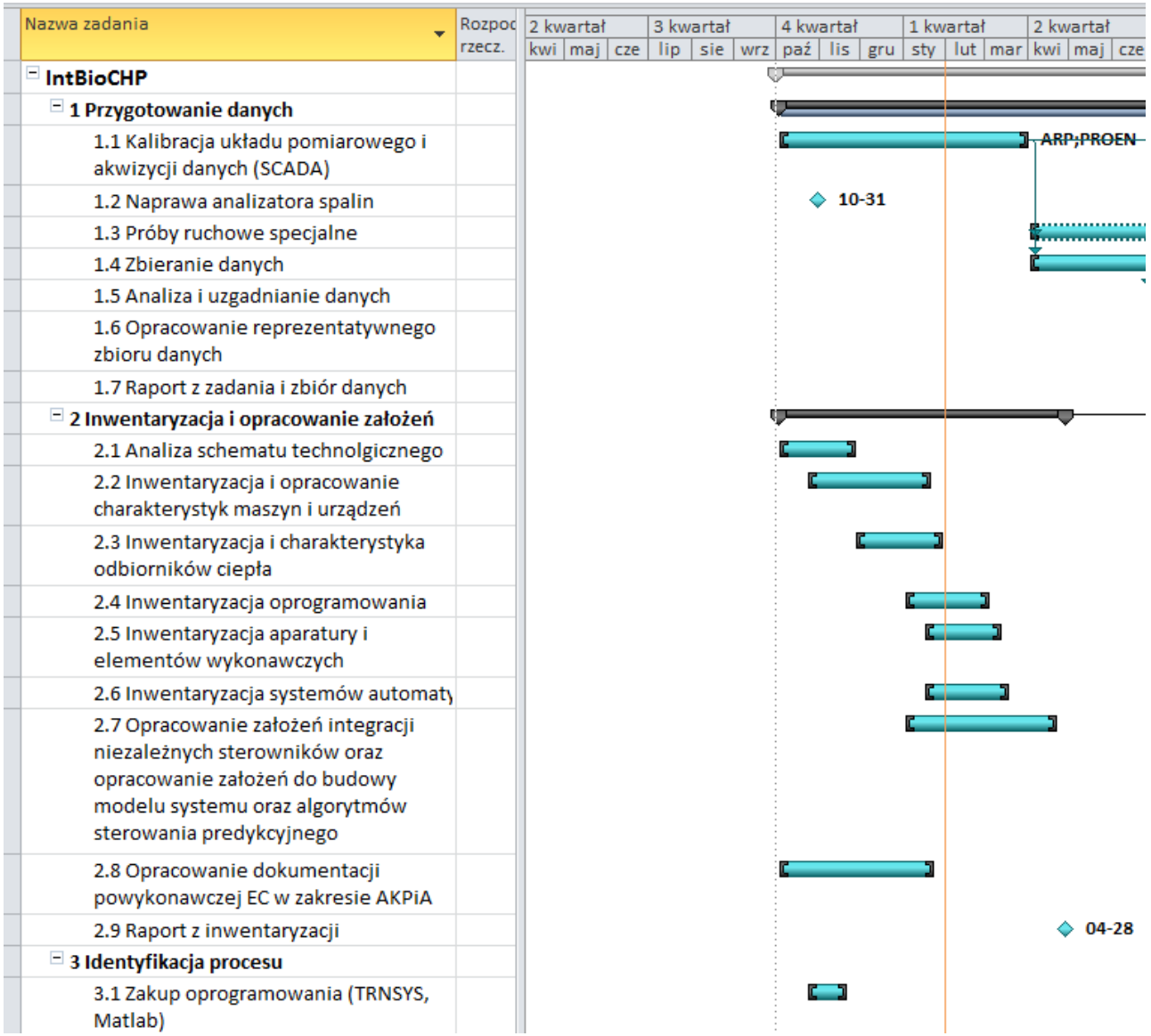
Implementation schedule

Work package	Period	
	Start date	End date
WP 1	**1.10.2016**	**30.09.2017**
WP 2	**1.10.2016**	**30.04.2017**
WP 3	1.10.2017	30.11.2018
WP 4	1.05.2017	30.04.2018
WP 5	1.11.2018	30.04.2019
WP 6	1.01.2019	30.09.2019
WP 7	1.10.2017	30.09.2019

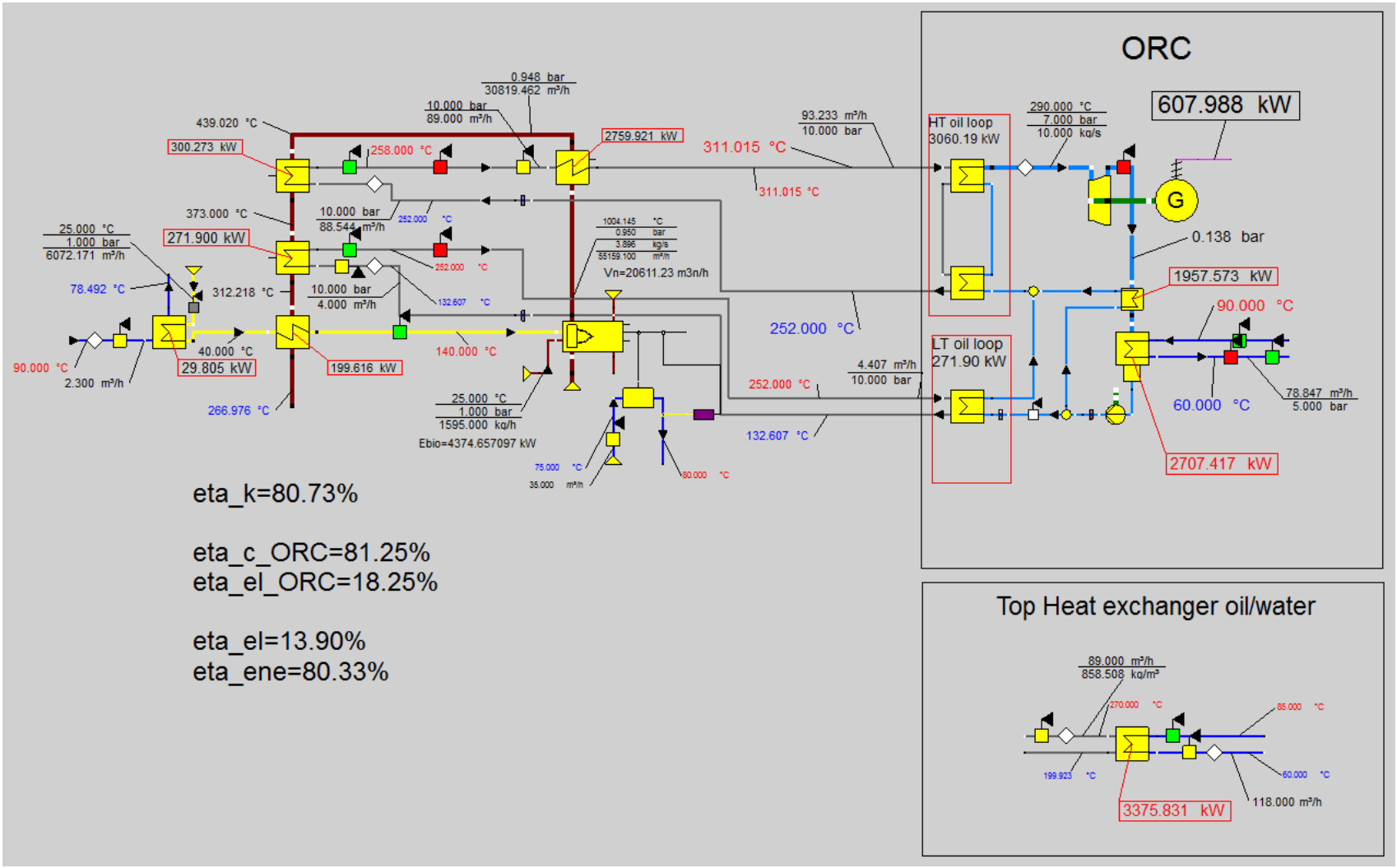
Implementation schedule



Current activities

- Administration and exchange of documents
- Plant modelling
  - Ebsilon models – sensitivity analysis
  - Matlab models – general plant models
- Technical data inventory
- Data acquisition and analysis

Plant modelling



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Thank you for your attention

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