CONCEPT OF THE GEO-BIO MICRO POWER PLANT

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Localisation of the polish existing geothermal facilites

UNIEJÓW THERMAL FACILITY

- Geothermal water temperature: 70ºC
- Mass flow rate: 33.3 kg/s (120m^3/h)

Geothermal conditions in Uniejów

Discovered in 1978

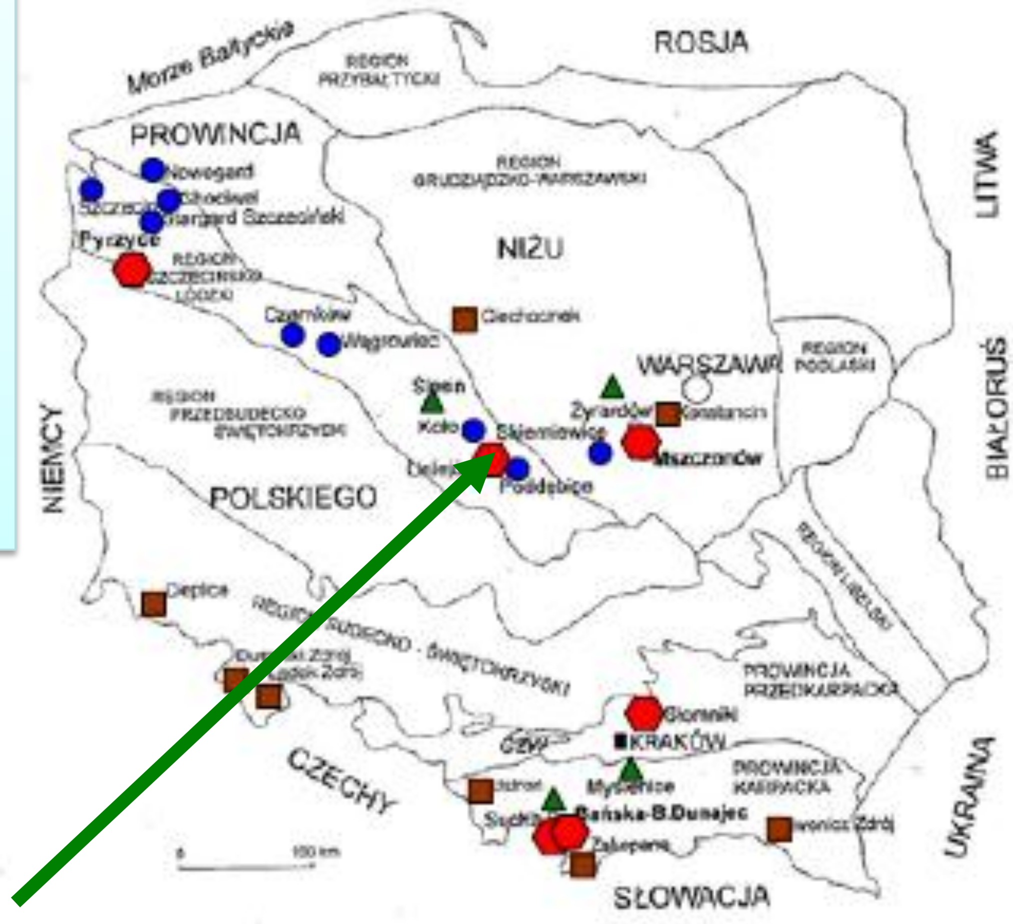
Run in 2001

Temperature of water at the production well [°C]: 67-70

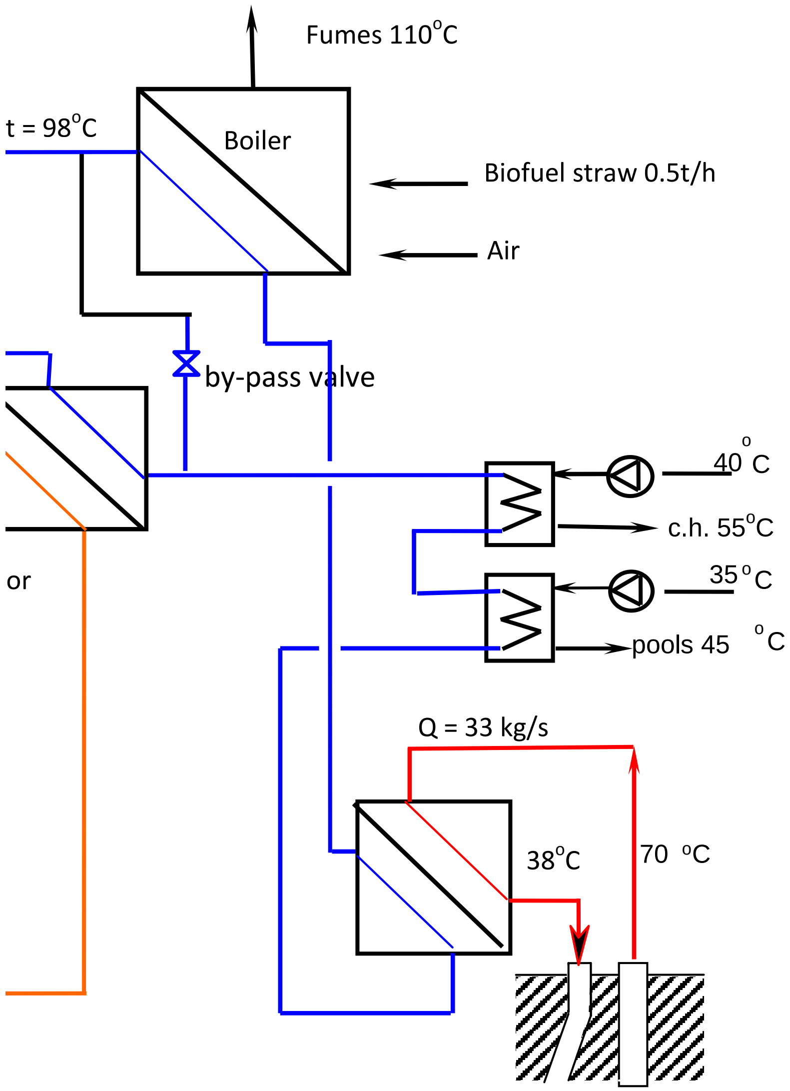
Lower Cretaceous sandstone at a depth of [m] 2000

Mineralization [g/l]: 6,8-8,8

Mass flow rate: 33.3 kg/s (120m3/h)



The scheme of heating system in Uniejow



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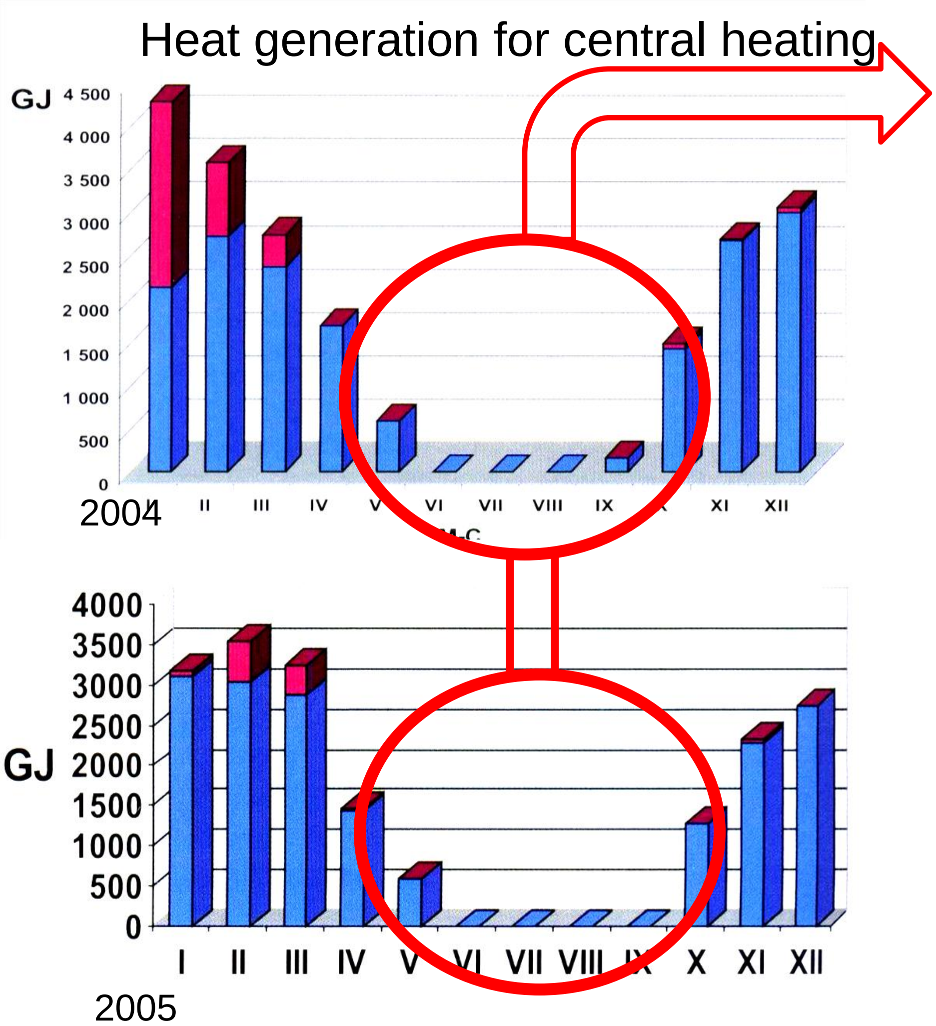
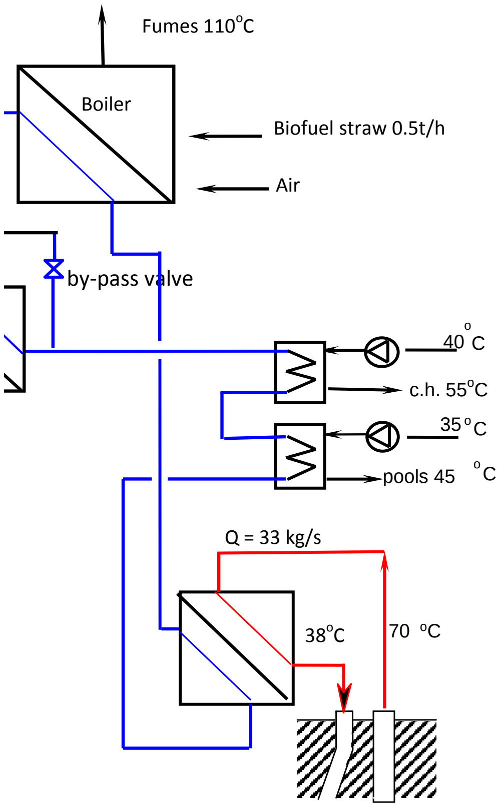
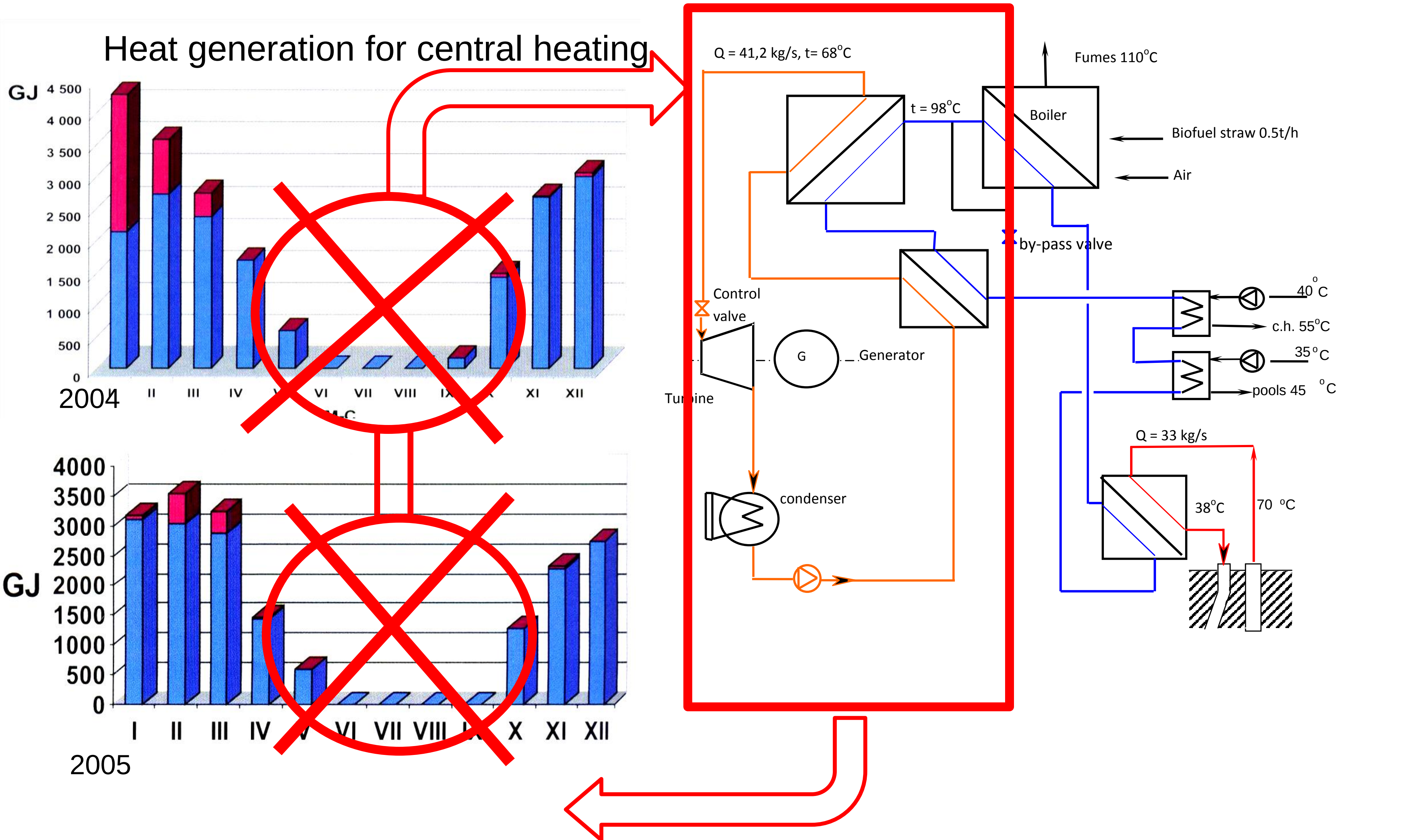




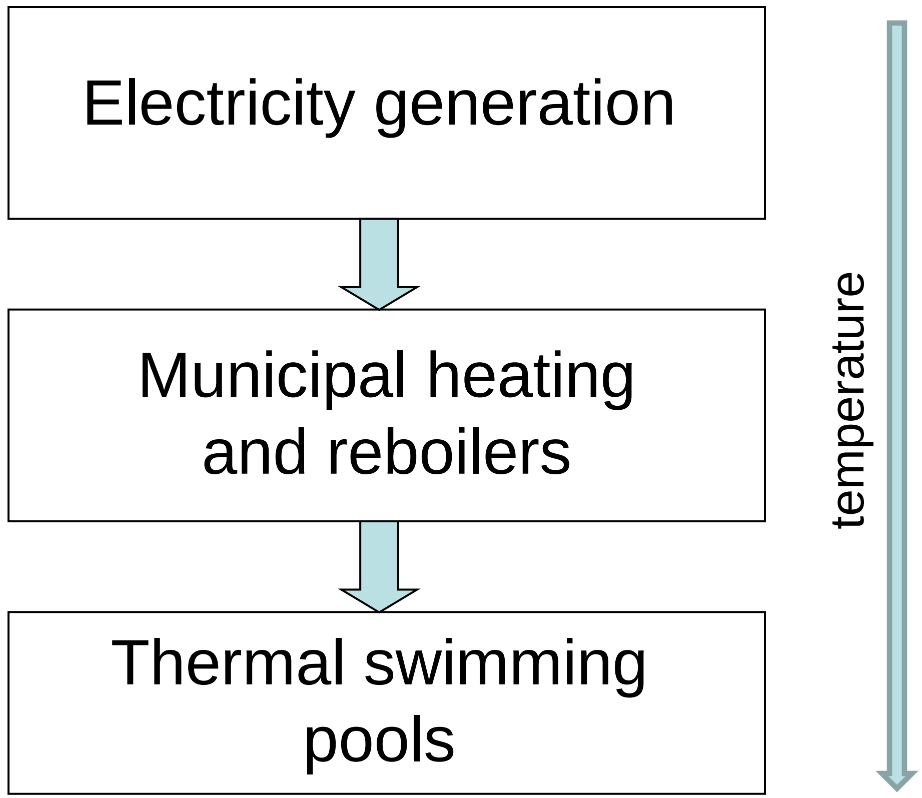
Identified problems…

- Considerable diffrences in heat consumption in summer and winter – this means a lack of utilization of available geothermal resources in case of a traditional power plant.
- Lack of the geothermal water consumption in summer creates a danger of the flow blockage

Why a geothermal power plant?



Concept of the full utilization of energy from geothermal waters



Low temperature heat sources?

- **Q:** What if the energy source is water of the temperature 100°C (for e.g. geothermal water, waste heat)?

- **Ans:** Using water in the cycle is problematic due to low pressure, low density of the steam and low cycle efficiency.

- **Solution:** Organic Rankine Cycle (ORC)

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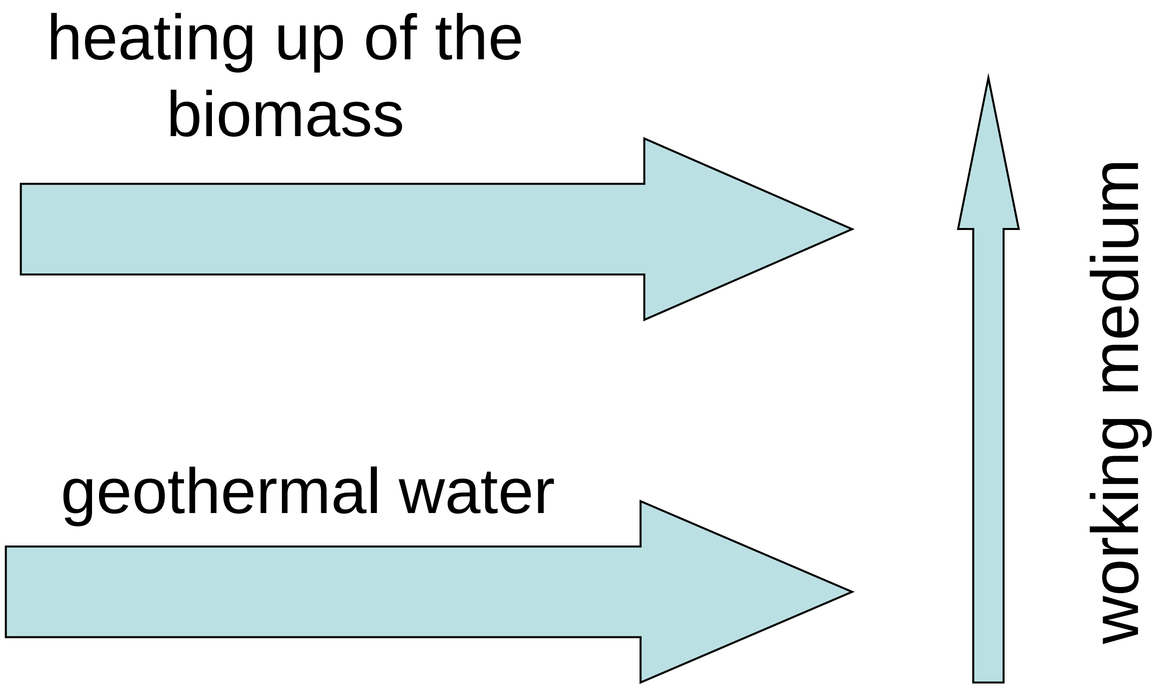
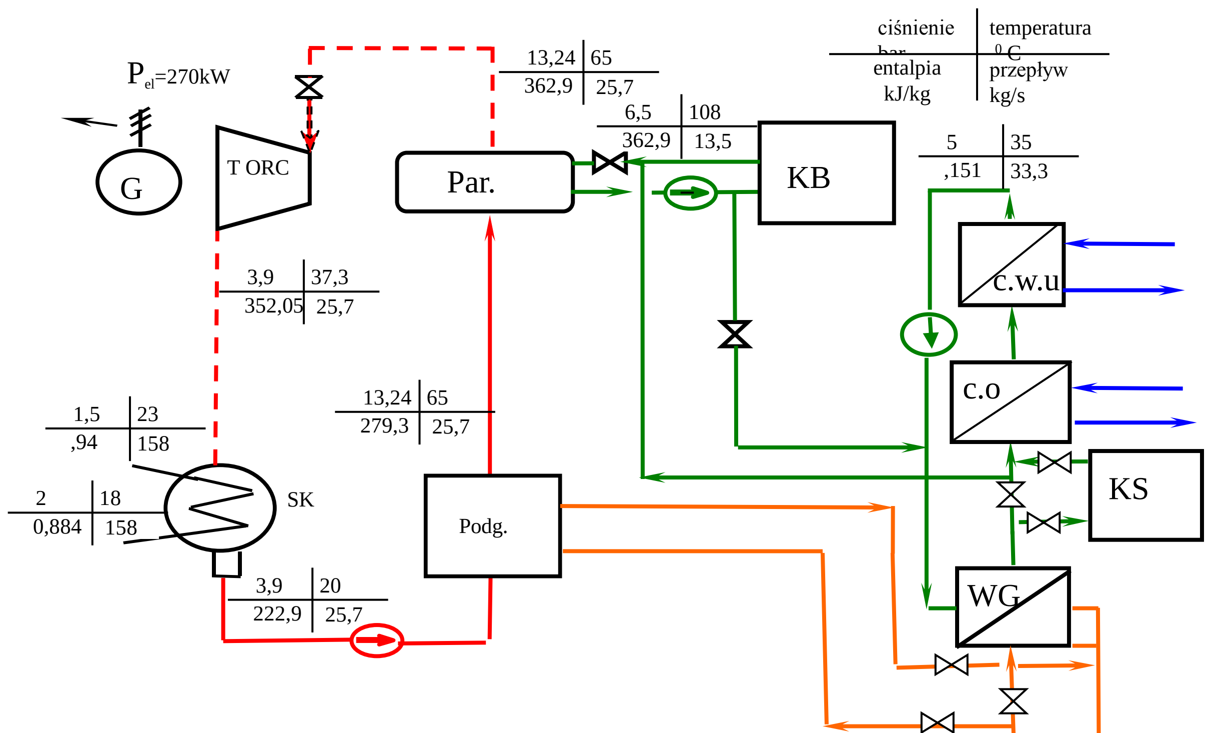
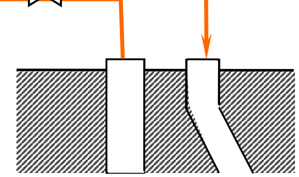
Concept of the ”geo-bio” hybrid power plant



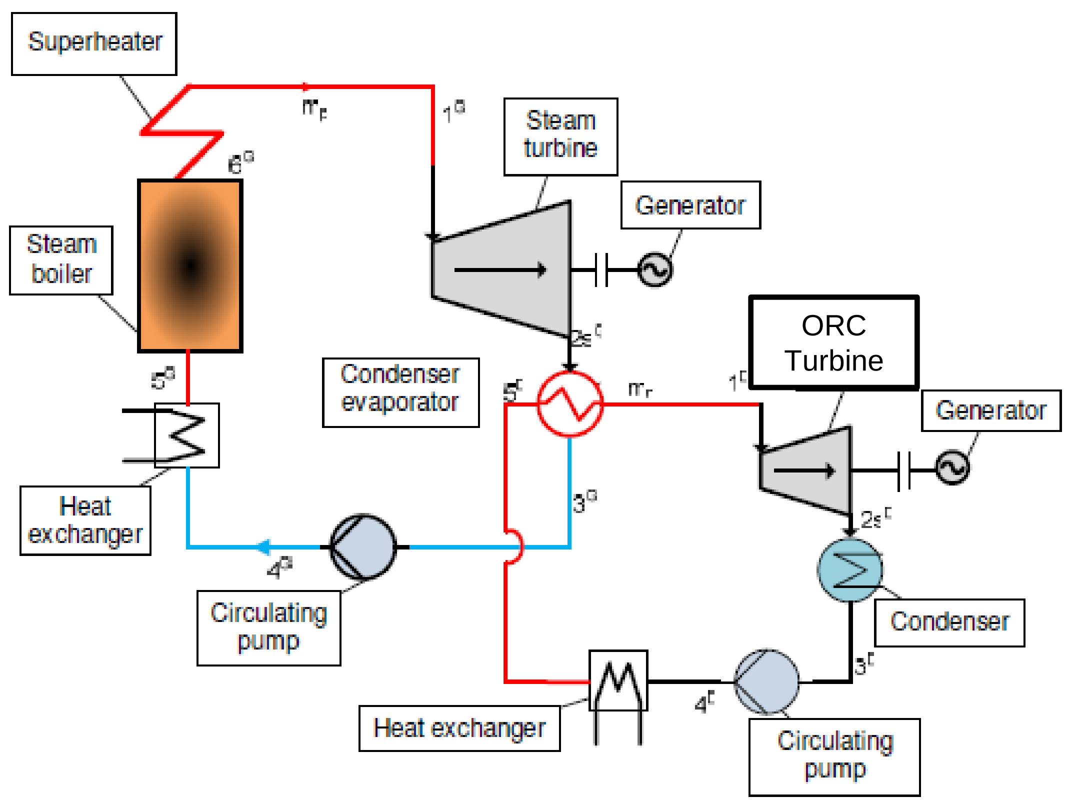
Schematic view of the ”geo-bio” hybrid power plant (Version ”A”)



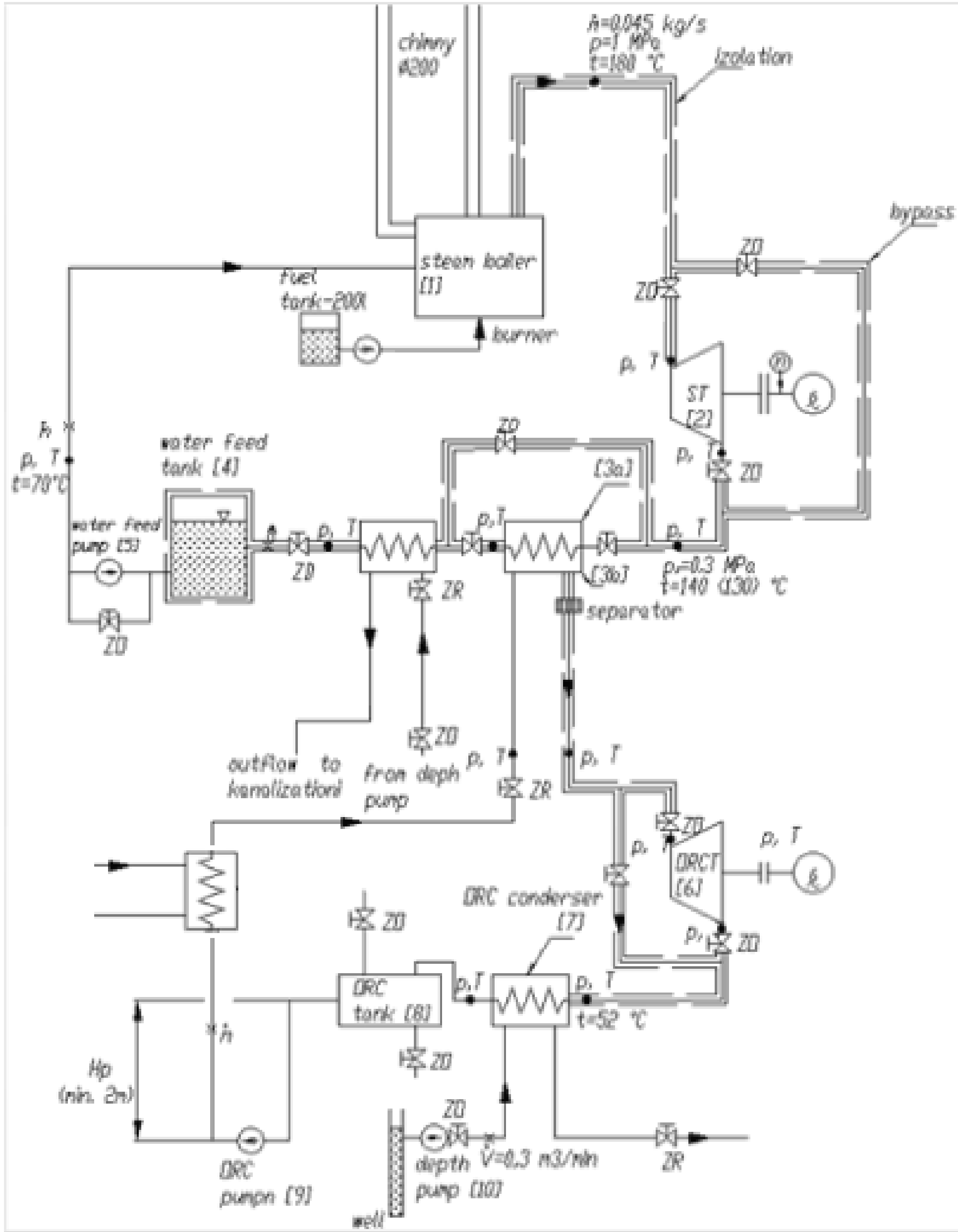


Liguid and steam cycle of the low-boiling temperature medium – **red**; cycle water – **green;** geothermal water – **orange**; central heating water and reboilers - **blue**.

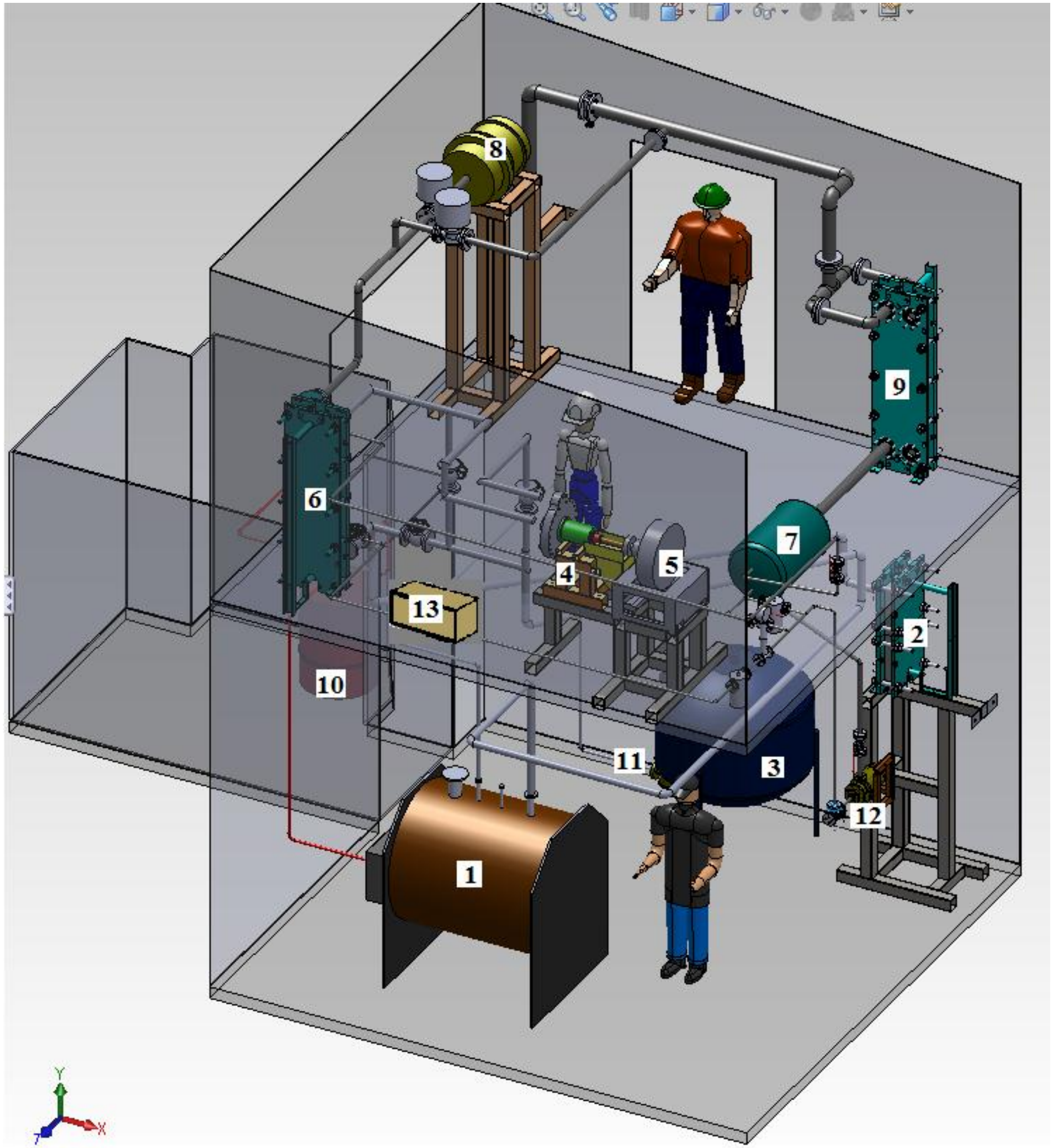
Schematic view of the ”geo-bio” hybrid power plant (Version ”B”)



Scheme of the experimental stand



Experimental stand



A test stand :
1-steam boiler,
2-condenser,
3-water tank,
4-steam turbine,
5-eddy curent brake,
6-condenser/evaporator,
7- HFE 7100 tank,
8-ORC turbine ,
9-condenser ORC,
10-fuel tank,
11- pump,
12- ORC pump,
13-resistance heater

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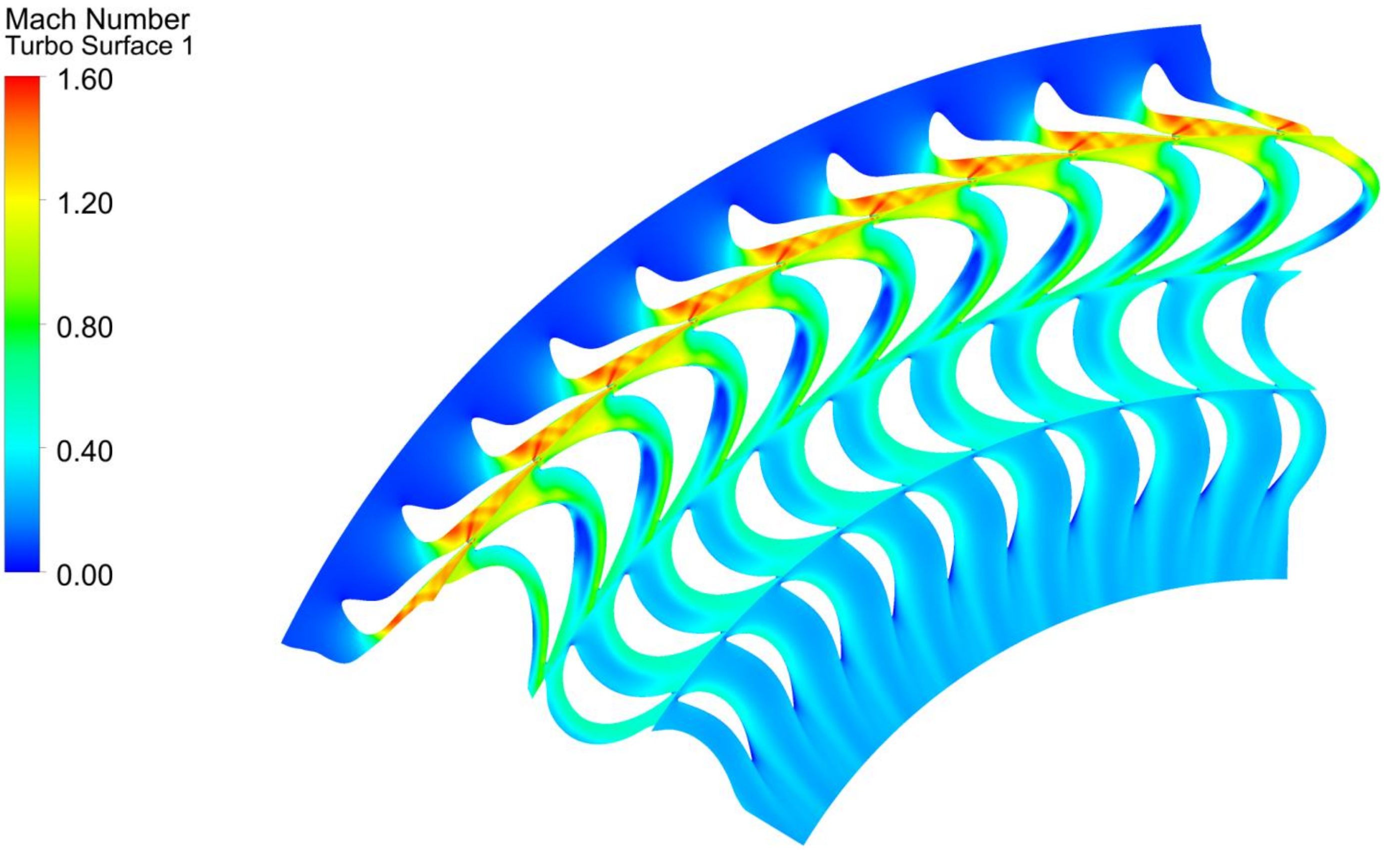
Steam turbine – general view

Mach number distribution in the steam turbine blading system



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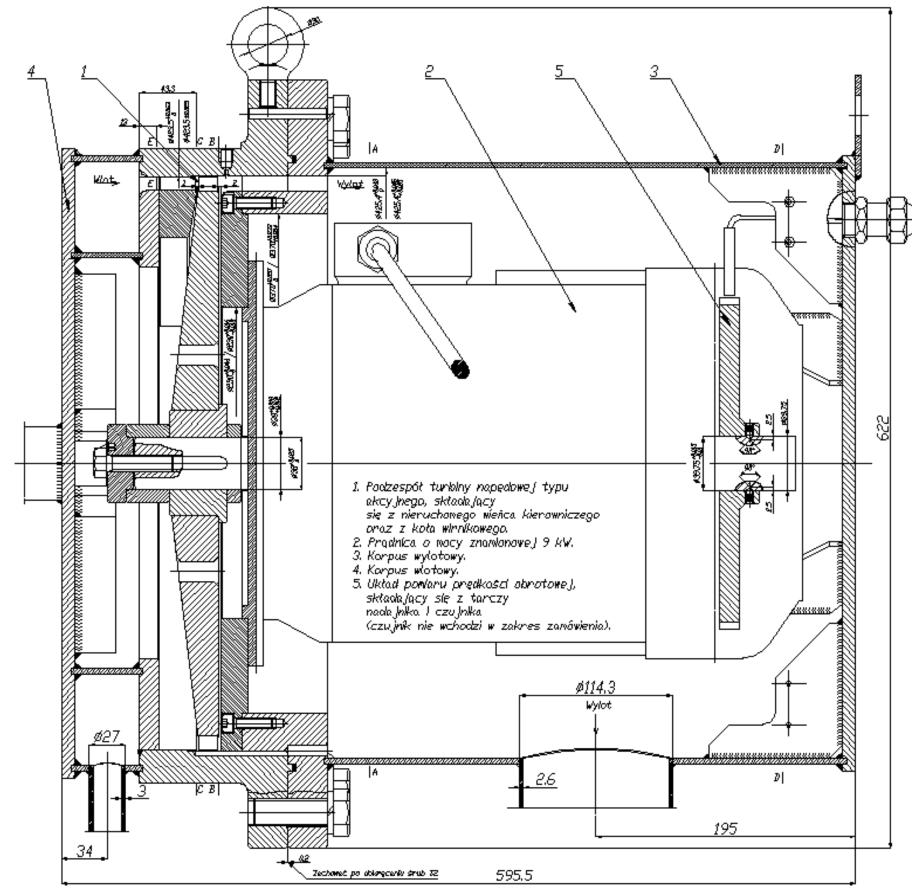
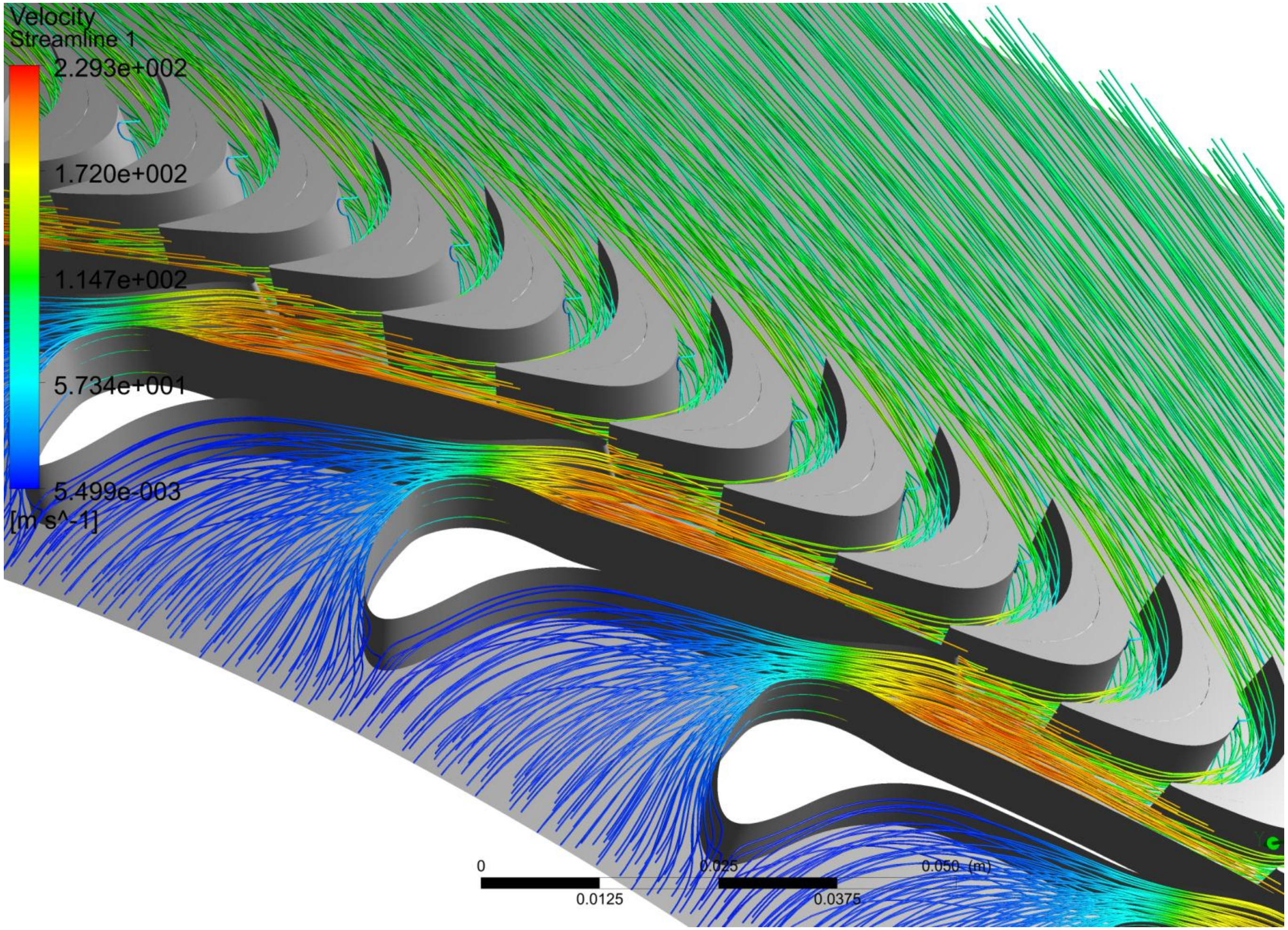
ORC turbine – general view



Streamlines distribution in the ORC blading system



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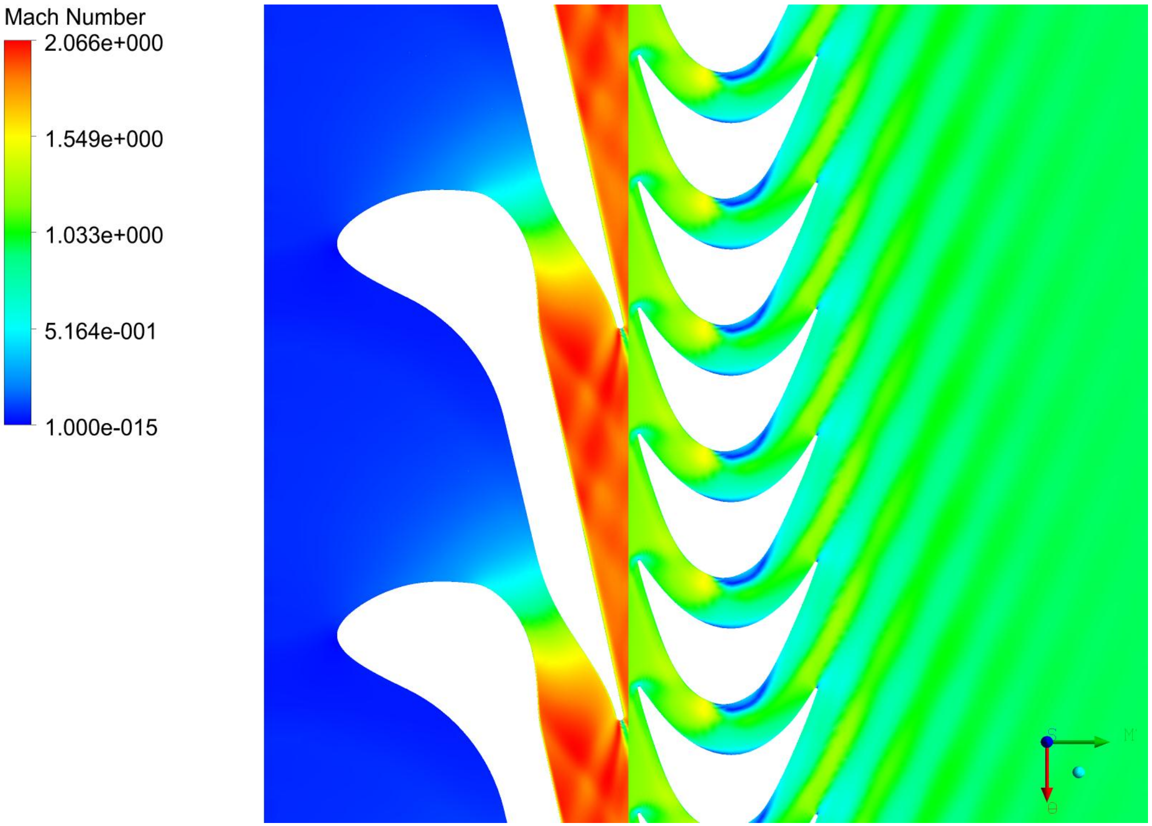

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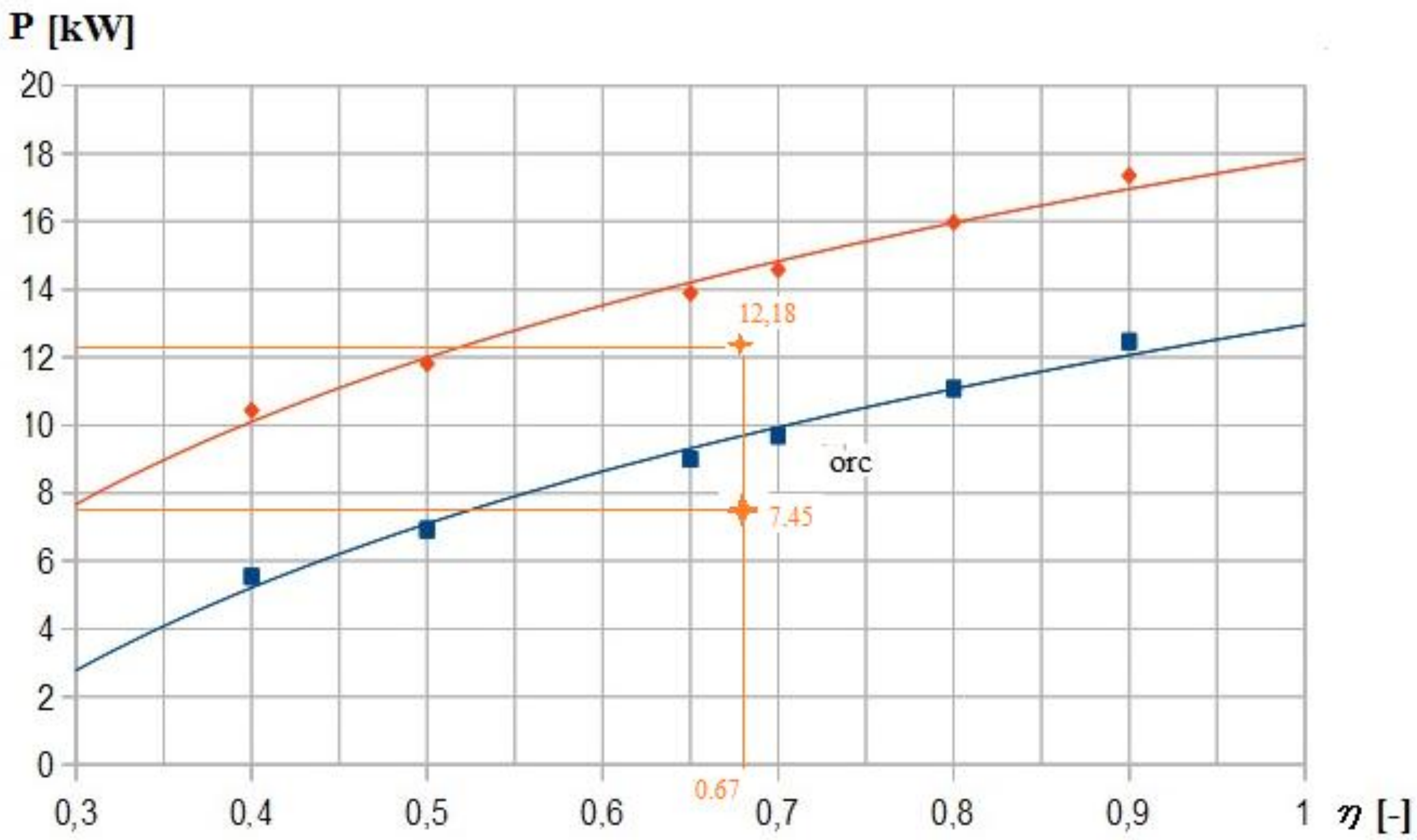
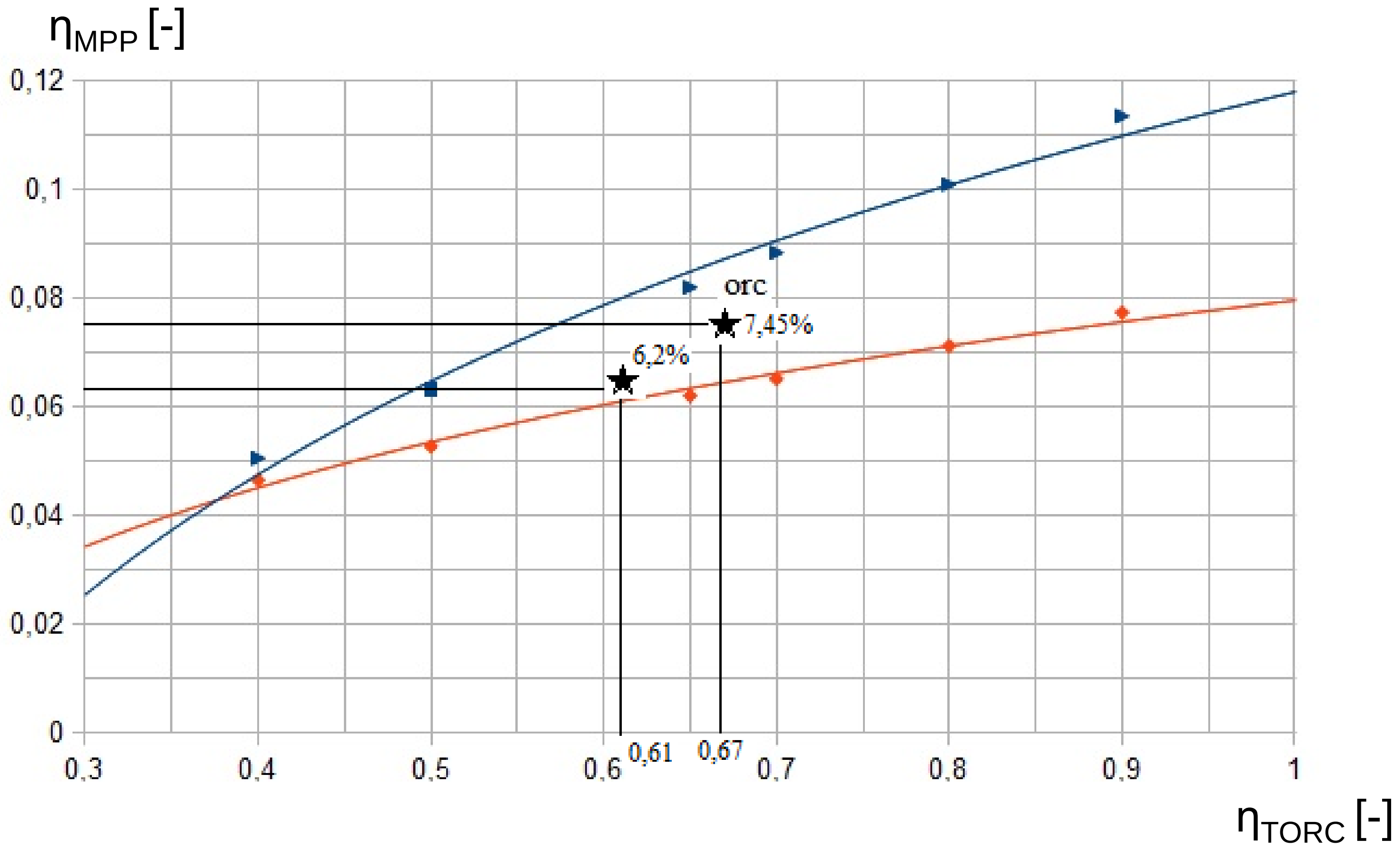
Power in function of effciency of the ORC turbogenerator



Effciency of the micro power plant in function of effciency of the ORC turbogenerator



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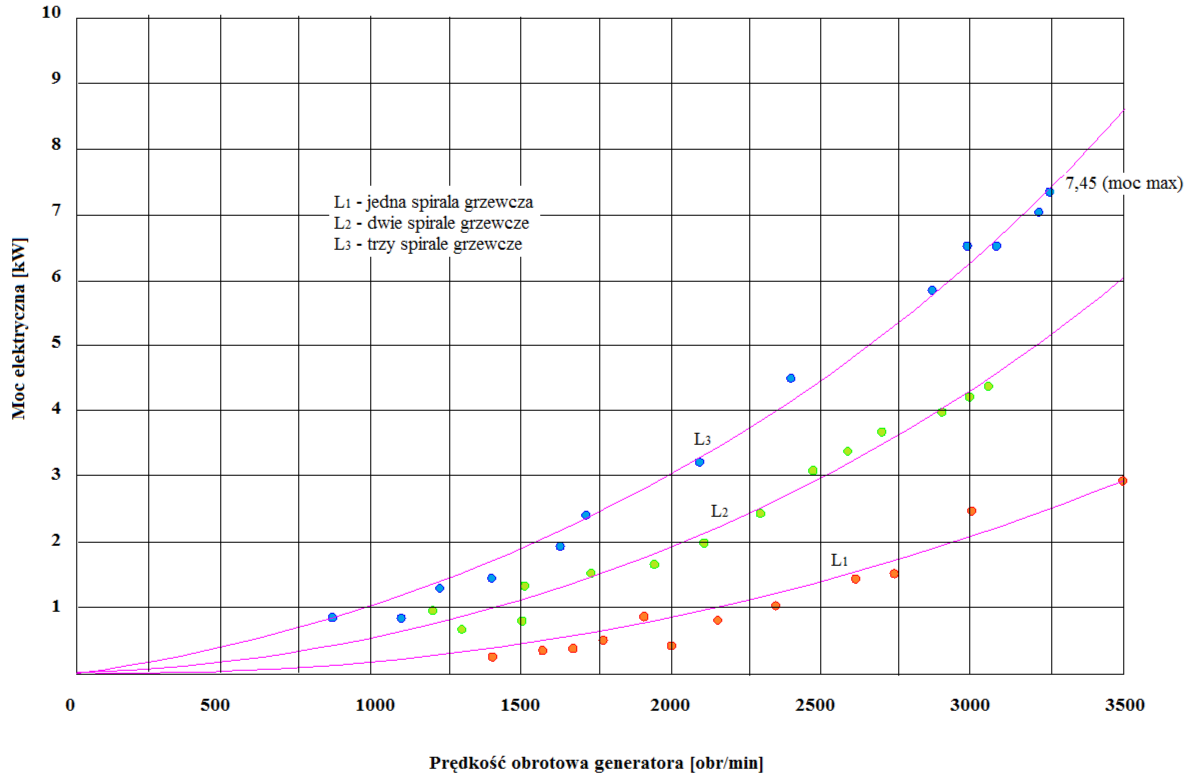
Electric power in function of generator speed



Ecological effects

The quantities of pollution emissions to atmosphere are reduced by replacing the power and heat generation based on the coal-fired power plant by a geo-hybrid power plant with similar output:

- dust and ash: 95 tons
- CO_2 approx. 18950 tons/year
- SO_2: 13.8 tons/year
- NO_x: 4.8 tons/year

See you in Uniejow ☺