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Pre-feasibility studies of geothermal energy uses for heating in selected towns and pilot project proposals

Konstantynów Łódzki

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Pre-feasibility studies of geothermal energy uses for heating **Konstantynów Łódzki**

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The projected operating parameters of the geothermal borehole Konstantynów Łódzki GT-1:

- **planned geothermal horizon: Lower Jurassic,**
- **planned depth interval: 2 200-2 770 m ugl (under the ground level),**
- **projected head temperature of thermal water: 60-75°C (70°C assumed in calculations). Reservoir temperature 71°C,**
- **projected output 100-160 m^3/h (130 m^3/h assumed in calculations),**
- **estimated total mineralisation 40-120 g/l (depending on the origin of the main influx of water: Lower Jurassic bottom or ceiling),**
- **static water level 50 m ugl, dynamic: 180 m ugl (assumed unitary depression 1 $m/m^3/h$).**

Pre-feasibility studies of geothermal energy uses for heating
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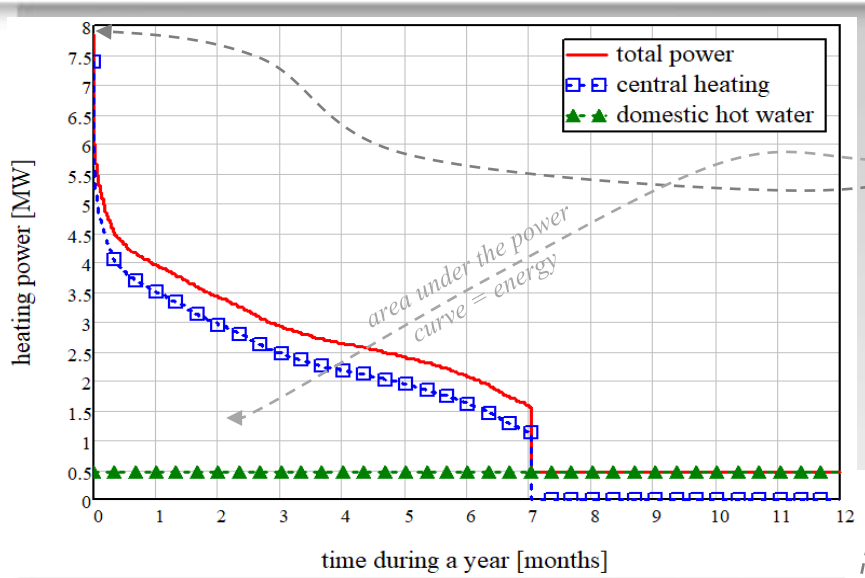


CURRENT SITUATION

Energy source: Veolia Energia Łódź S.A.

~8 MW, ~45 TJ/yr

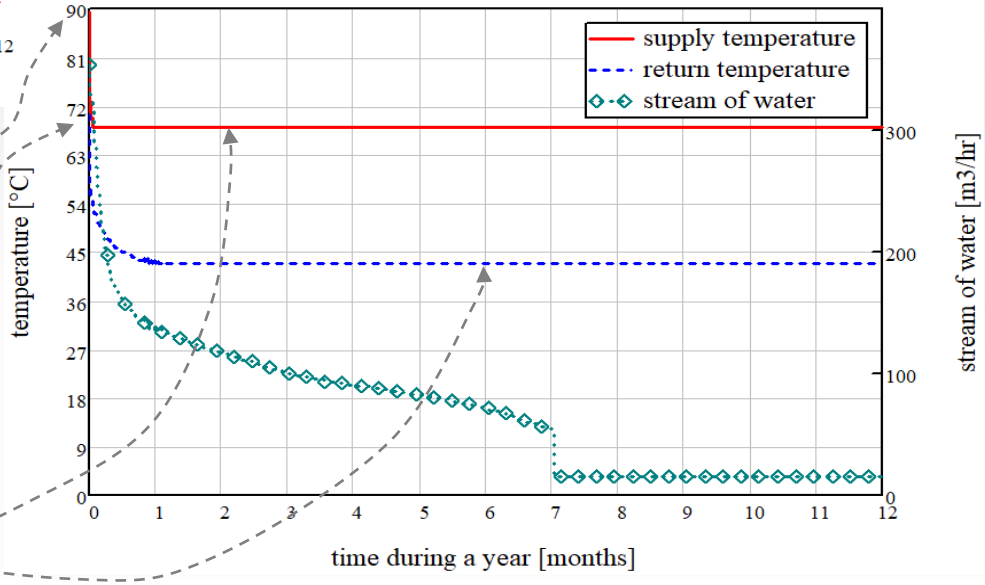
Characteristic of the thermal power demand for the recipient currently served vs time.

Curves ordered by power demand

Control of thermal power delivery - dynamic curve (heat user in the option dhA)

Space heating 90/70/20/-20°C

Hot tap water 70/45°C



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Options considered:

dhA (dh – district heating, A–ctual energy user)

dhGeoA (dh – district heating, Geo – geothermal, A-ctual Energy user)

ahpEhw (ahp – absorption heat pumps, E-xtended energy user, hw – hot tap water)

chpEhw (chp – compressor heat pumps, E-xtended energy user, hw – hot tap water)

ahpEhwCh (ahp – absorption heat pumps, E-xtended energy user, hwCh – hot tap water and central heating)

chpEhCh (chp – compressor heat pumps, E-xtended energy user, hwCh – hot tap water and central heating)

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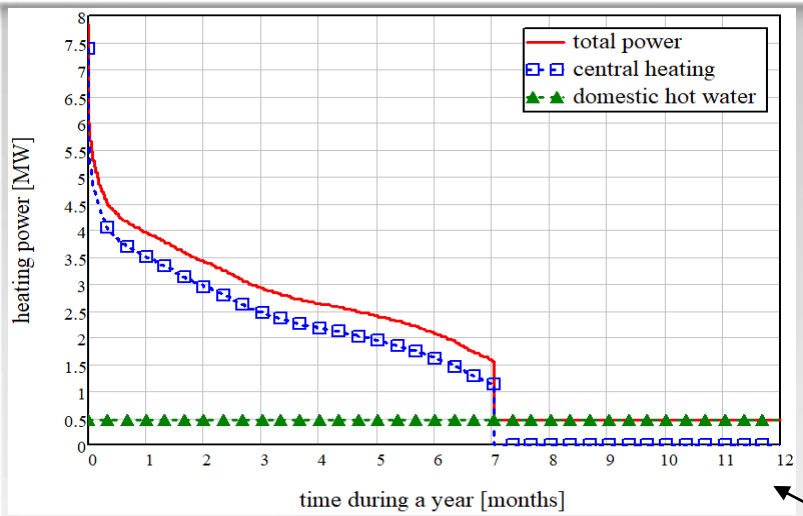
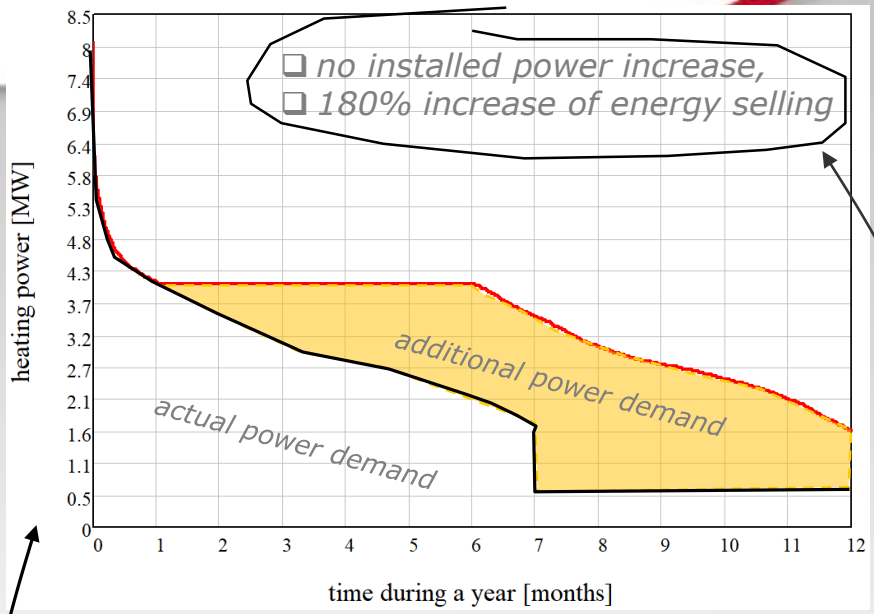
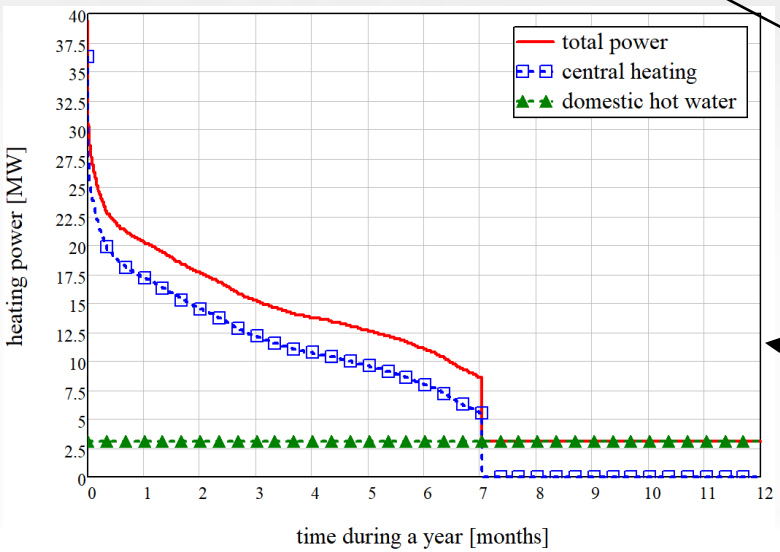
Power demand vs. time







A–ctual energy user (8 MW, 61 TJ/yr)

E-xtended energy user, hw – hot tap (additionaly ~3.6 MW, 48 TJ/yr)

E-xtended energy user, hwCh – hot tap water and central heating

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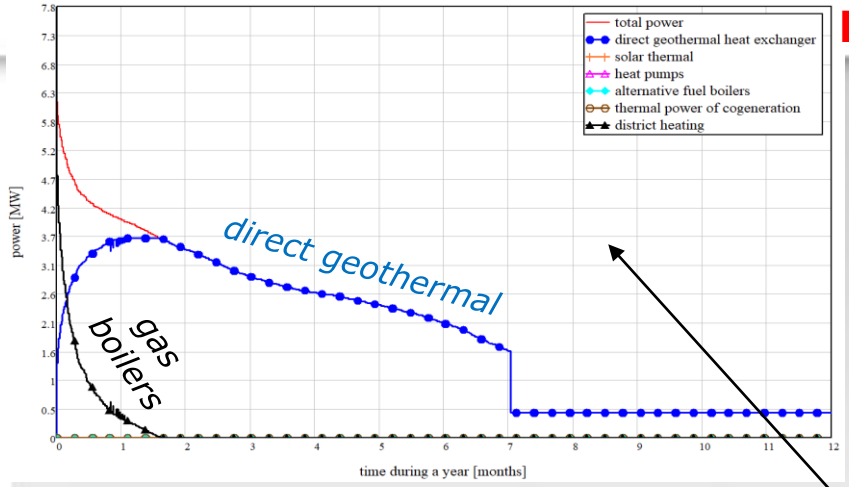
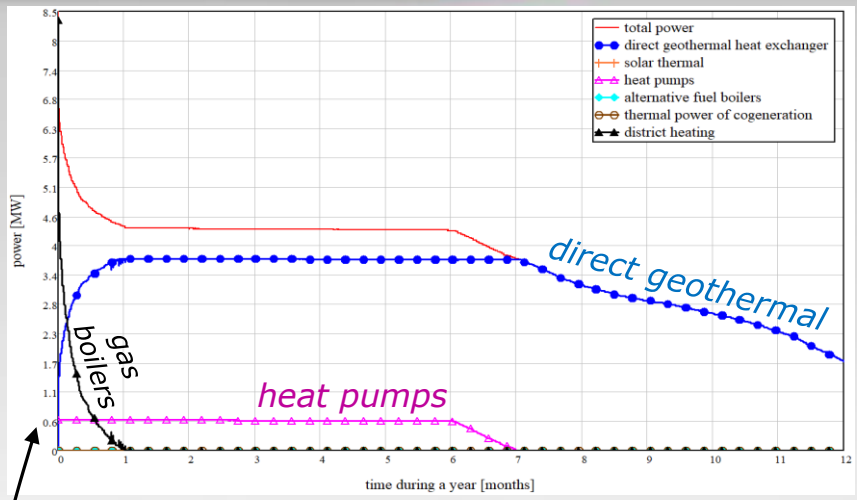
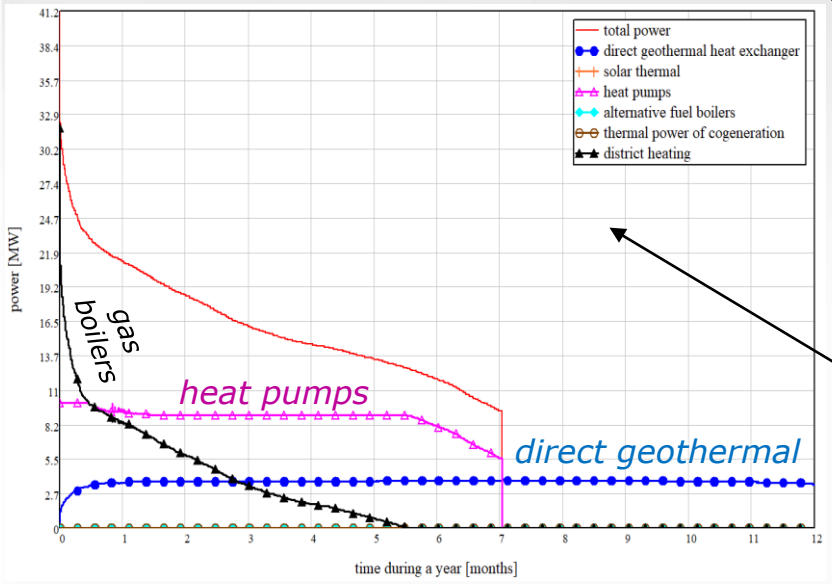


Power production vs. time





A–ctual energy user

E-xtended energy user, hw – hot tap

E-xtended energy user, hwCh – hot tap water and central heating

Summary
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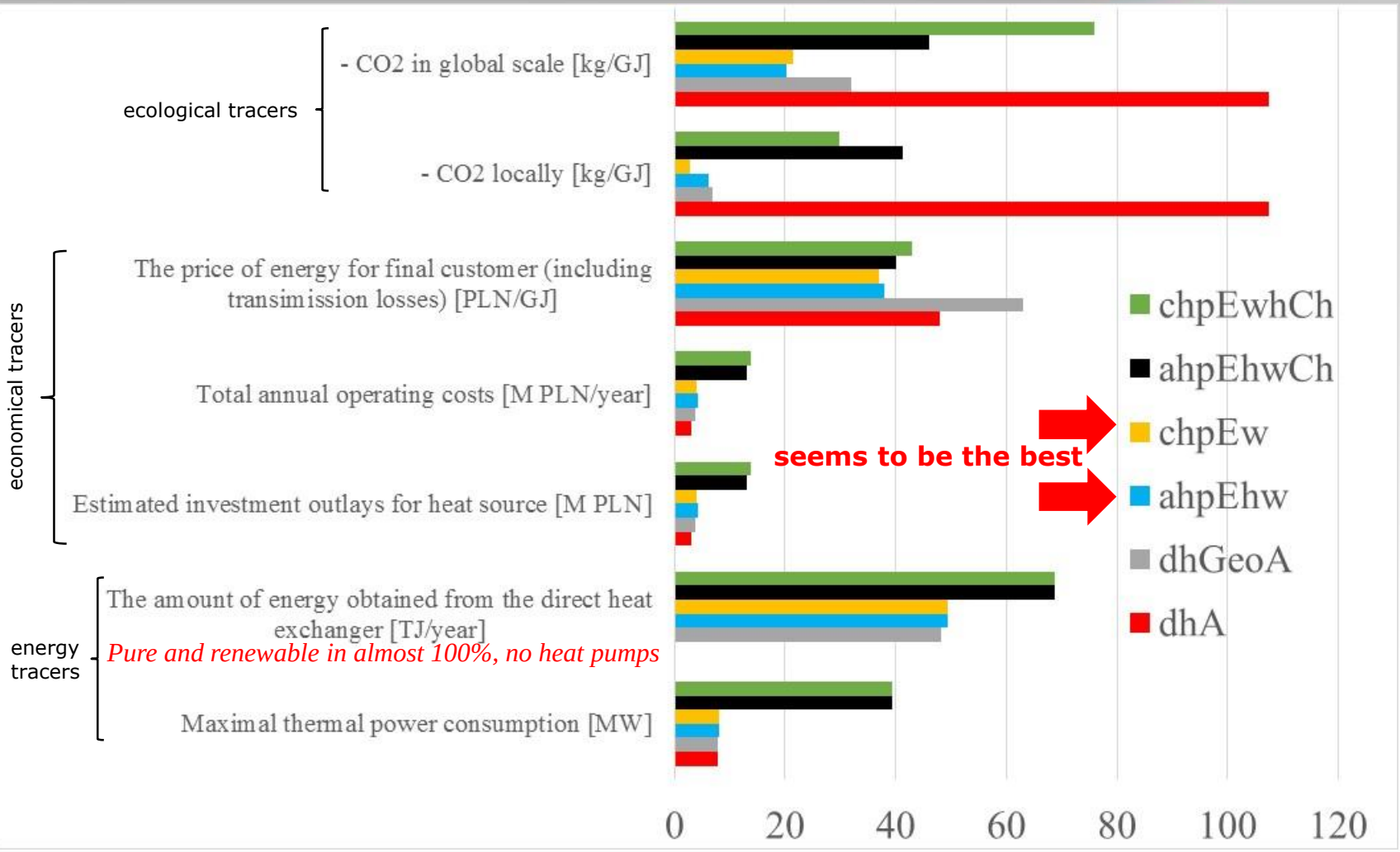

Pure and renewable in almost 100%, no heat pumps

Summary

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O.P. Einarsson – **OS**

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The most interesting idea so far that has been proposed for this project is to use geothermal fluid to de-aerate cold water used for make-up water in the distribution system of both Lódz and Konstantinów Lódzki. Estimated water leakage is around 20 m³/hr, so the capacity of the geothermal well would be more then adequate.

Geothermal fluid at 70°C would be used to heat cold water at around 10°C through a heat exchanger, to 65-67°C. The return geothermal fluid would thus be between 12-15°C. The heated cold water would require de-aeration at 65°C, in a vacuum tank at 0,25 bar_{abs} (-0,75 bar_g) vacuum pressure.

What is needed is the following components:

A liquid ring vacuum pump, capacity = 20 m³/hr, approx. 3 bar pressure (2-3 kW motor)

Vacuum tank, control valves, etc., needed for flow control in the de-aeration installation

Communication line between water level tank in closed-loop district heating system and heat central in Konstantinów Lódzki (where the proposed geothermal well is to be built)

Other local electronic controls, using signal from Lódz that asks for more make-up water

The cost of such an installation would probably be several hundred thousand PLN. The heated make-up water would be sent through the return water pipeline, from Konstantinów Lódzki to the pump substation in Western Lódz. No additional transmission pipelines would be needed for this installation

Pilot proposition, next steps
Konstantynów Łódzki
Jankowski Sławomir

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1. **Drilling the well, testing and preparing data for future activities (next well for reinjection needed).**

2. **Cooperation with the Łódź heating system gives the possiblility of almost full geothermal power consumption (all year long)**

To make this cooperation possible following steps should be done:

- ❑ verification of the technical condition and possible modernization of the heating centers in Konstantynów Łódzki - equipped with modern electronic controllers with return temperature control function,
- ❑ connection of heat exchangers into telemetry and telecontrol systems to facilitate demand side management,
- ❑ adaptation of buildings in buildings to use low temperature heat, including modification of the local heat supply plan,
- ❑ construction of low temperature networks with heat pumps as a cascade element to reduce the return temperature,
- ❑ private switching of buildings with low-temperature heating system to the return network.

Pilot proposition, next steps
Konstantynów Łódzki

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3. Use of geothermal to heat the treated water to cover the water losses in the district heating.

Estimated water loss in Łódź heating system is around 20 m^3/hr, so the capacity of the geothermal well would be more then adequate (100-130 m^3/hr).

Geothermal fluid at 70°C would be used to heat cold water at around 10°C through a heat exchanger, to 65-67°C. The return geothermal fluid would thus be between 12-15°C. The heated cold water would require de-aeration at 65°C, in a vacuum tank at 0,25 bar (-0,75 bar) absolut pressure.

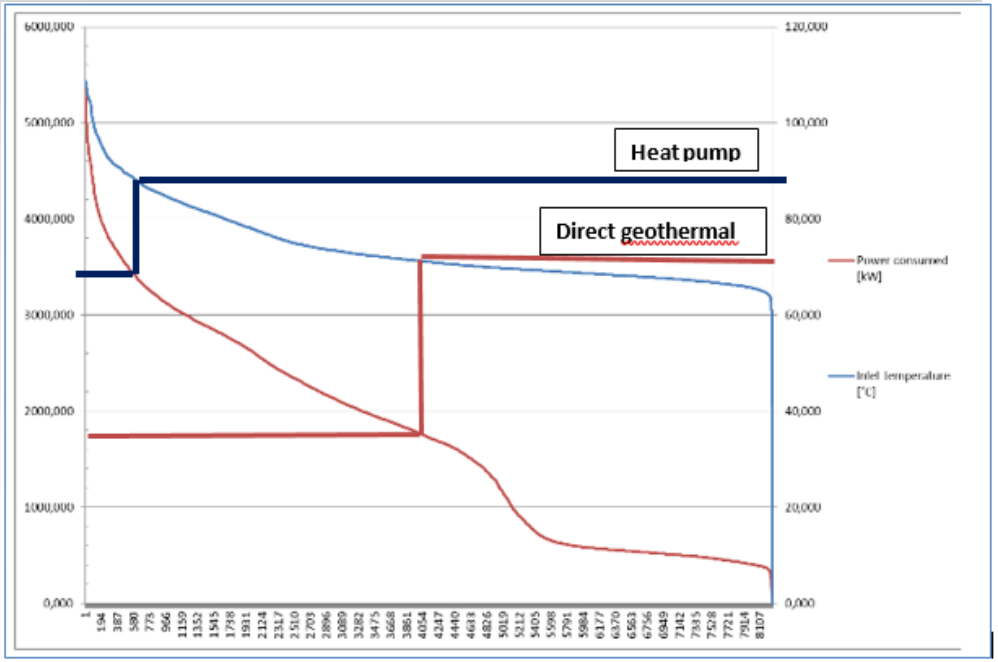
We get about 1,2 MW and (assuming all year long with 70% of nominal power) ~26 TJ/yr (reduction of CO_2 emission ~2 800 kg_{CO2}/yr).

Konstantynów Łódzki
Recommendations from Norway

Kirsti Midttømme

- Low temperature heating systems
  - Future district heating networks should move towards lower temperatures, so it can be successfully integrated to renewable energy supplies
- Heat pump application for increased capacity

  Applying state of the art HP solutions for the district heating network



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