

Geothermal4PL

Wsparcie zrównoważonego rozwoju i wykorzystania płytkiej energii geotermalnej na terenie obszarów objętych programem Mieszkanie Plus w Polsce

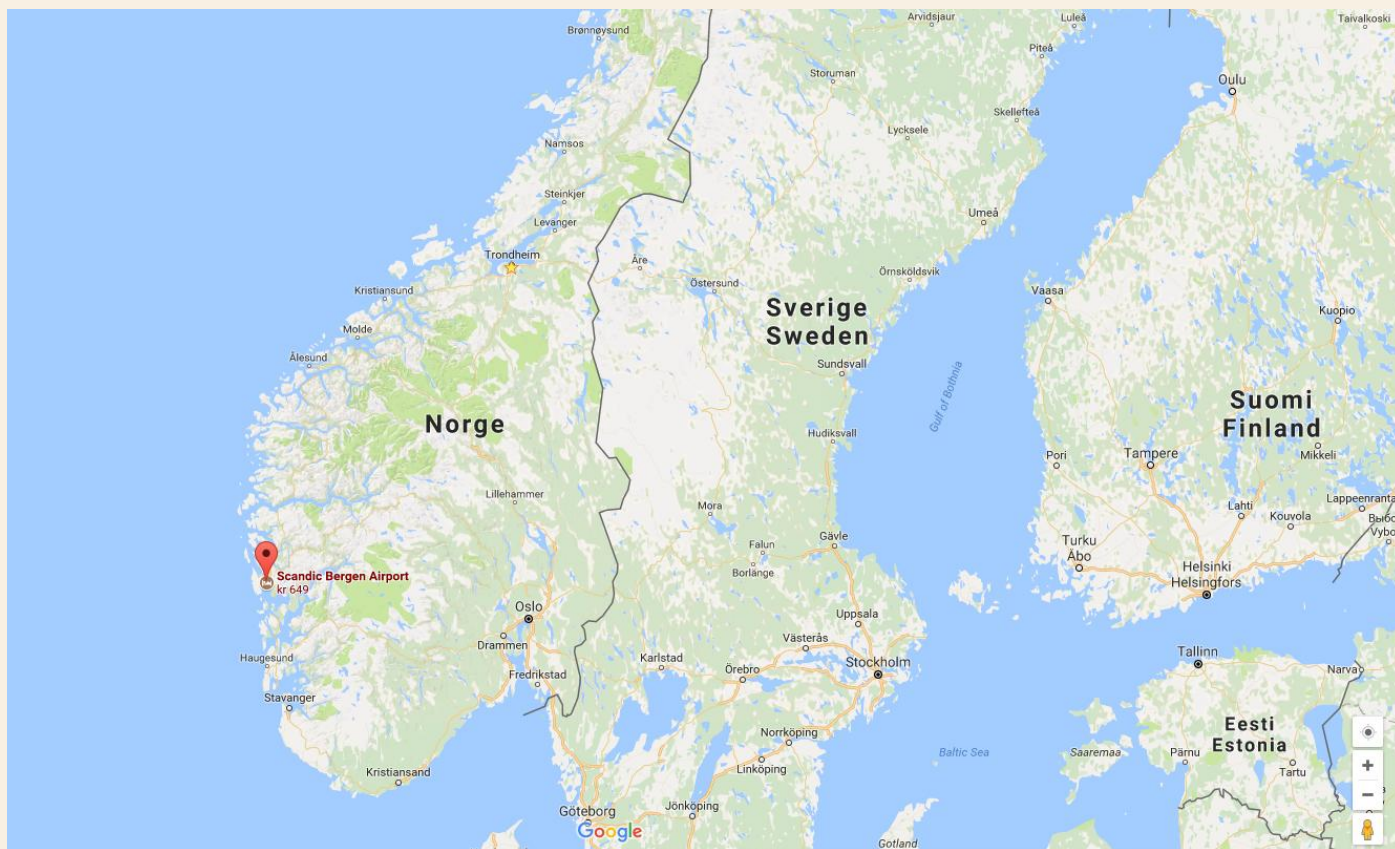
Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy
Christian Michelsen Research AS
25 października 2017r., Warszawa

Norwegian case study

Scandic Airport Flesland Hotel, Bergen

Kirsti Midttømme, Christian Michelsen Research,
Ove Sivertsen, B. Fondenes,
Henrik Holmberg, Asplan Viak
Randi K. Ramstad, Norwegian University of Science and Technology

Scandic Airport Flesland, Bergen





Scandic Flesland Airport Hotel

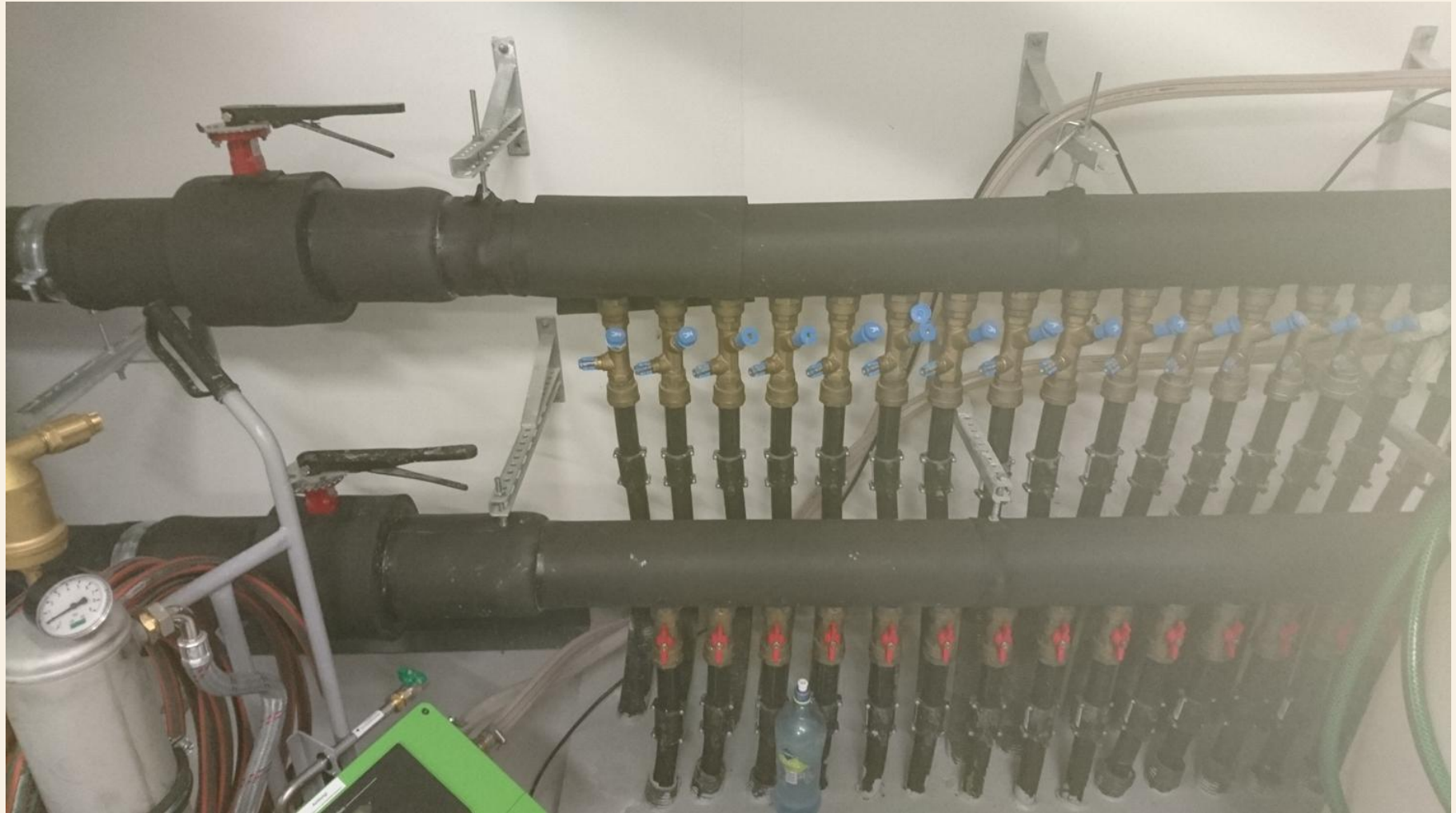
- Largest congress hotel in Bergen
- 27 meeting rooms
- Capacity of the largest meeting room: 1100 persons

→ High cooling peak loads

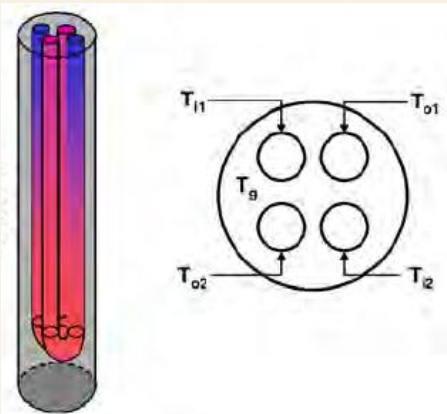


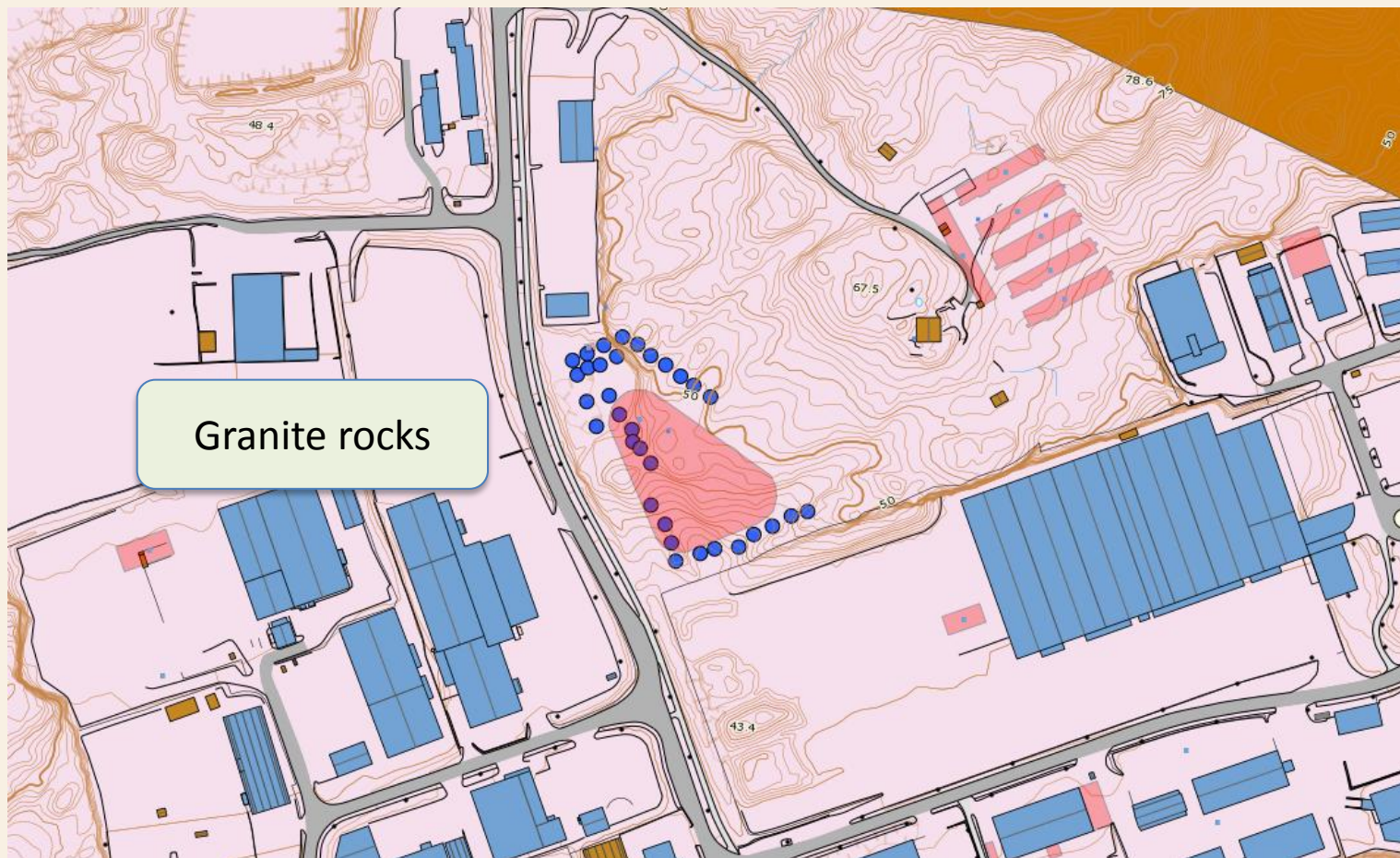
4 x two- steps heat pumps, $4 \times 80 \text{ kW} = 320 \text{ kW}$ (Bosch)





- 50 BHEs to 200 m depth
- Localized due to available area
- Double U-pipe BHE
 $d = 32\text{ mm}$





Thermal response test

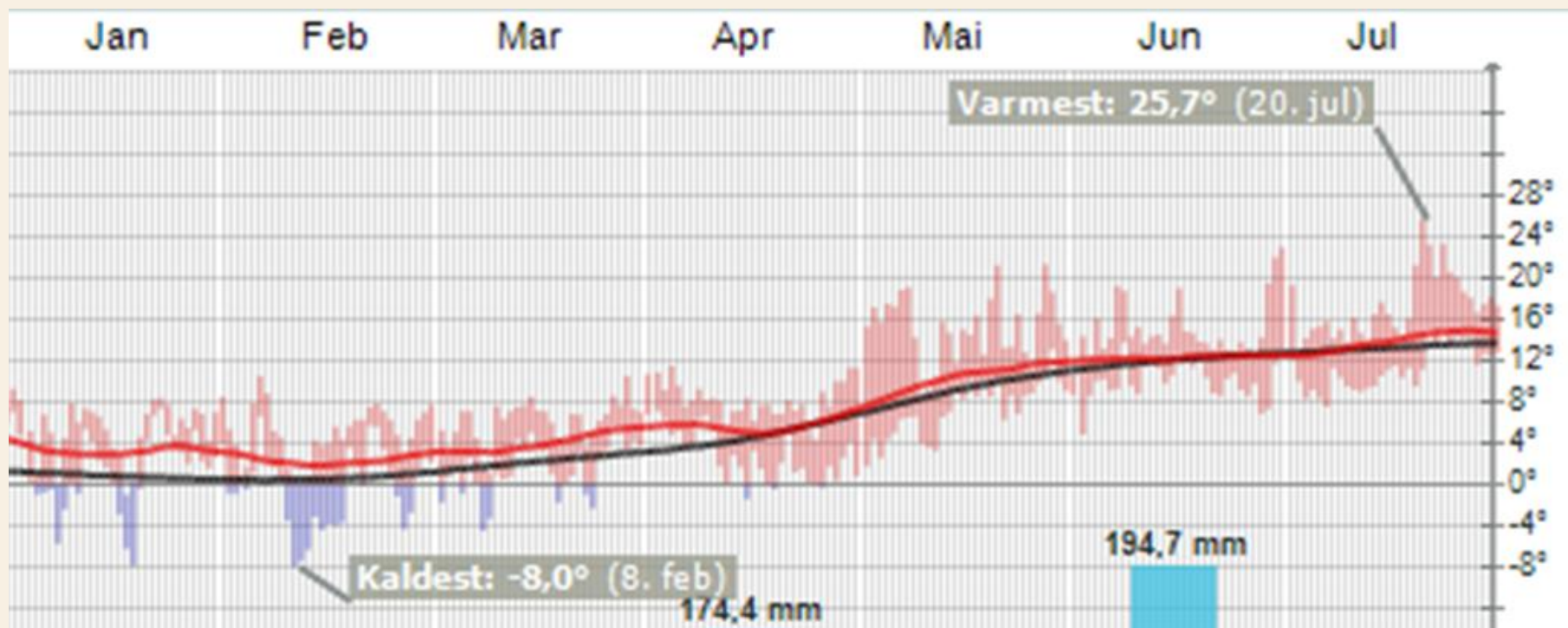
- Effective thermal conductivity
5.0 W/mK
- Thermal borehole resistance:
0.085mK/W
- $T_{\text{middle}}(\text{in situ}) = 8.8\text{ }^{\circ}\text{C}$



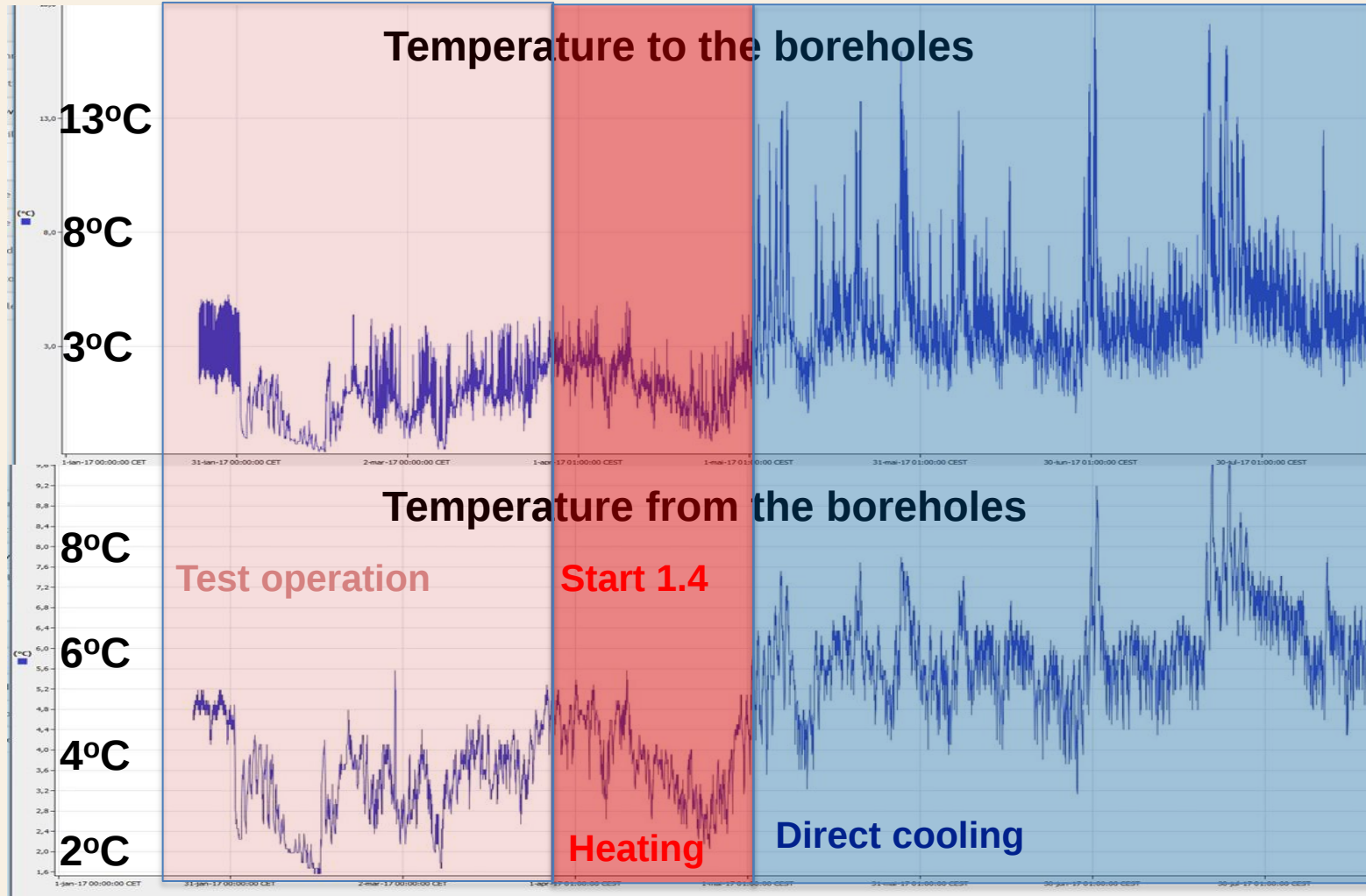
- Estimated direct cooling capacity 450kW
- Delivered energy 1.1-28.9.2017: 1071 MWh
- Delivered direct cooling 1.1-28.9.2017: 43MWh
- Average COP (SPF) heat pumps **5,5**
- The property owner (BGO eiendom AS) sell heat and cooling to the hotel



Air temperature, Flesland 2017

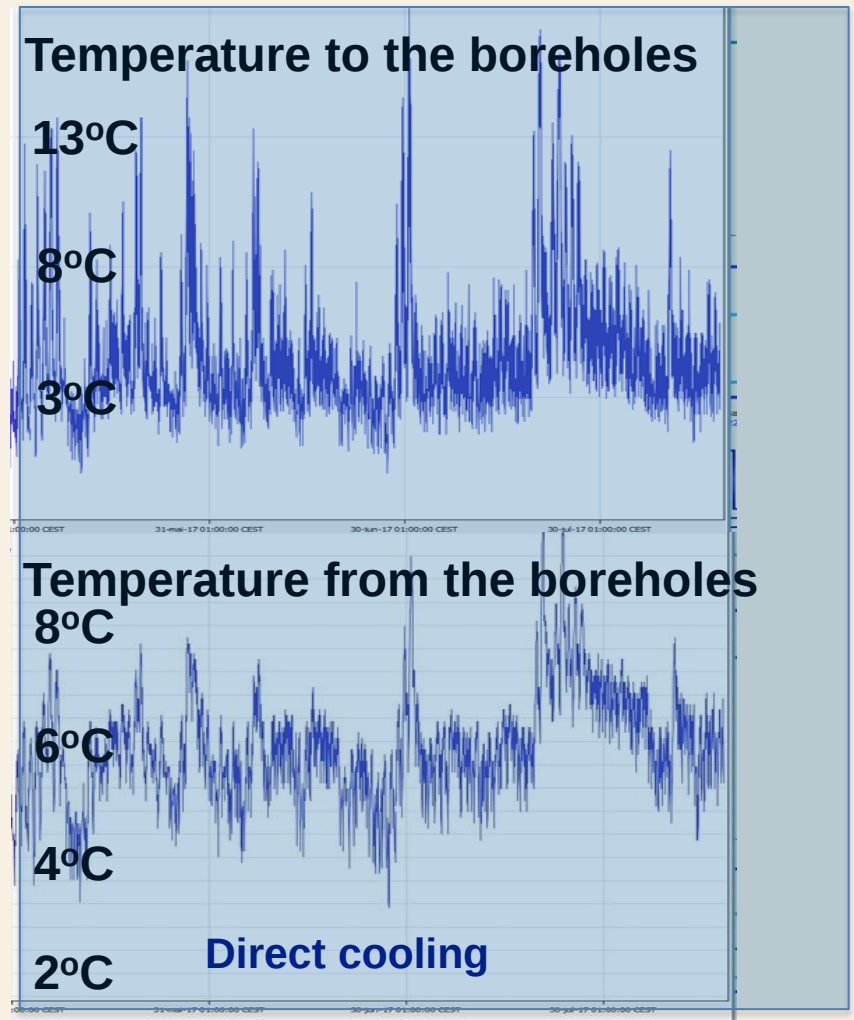


Brine temperatures in the period 1.1-20.8.2017



Brine temperatures cont.

- Notice the peaks and instant temperature response in the boreholes
- Depending on heat and cooling demand, i.e. balanced energy extraction per year, trends of increasing or decreasing temperatures will be seen over time.



Summary:

- Successful closed loop installation for heating and cooling.
- The peak cooling demand was the design criteria of the borehole storage.
- High average COP (SPF) heat pumps **5,5**
- Quick response in brine temperature due to heat and cooling demand. Need years to see longer trends on imbalance between heating and cooling extraction from the boreholes.
- The property owner (BGO eiendom AS) sell heat and cooling to the hotel – a success criteria for profitability and good operation.

