

## Geothermal4PL

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

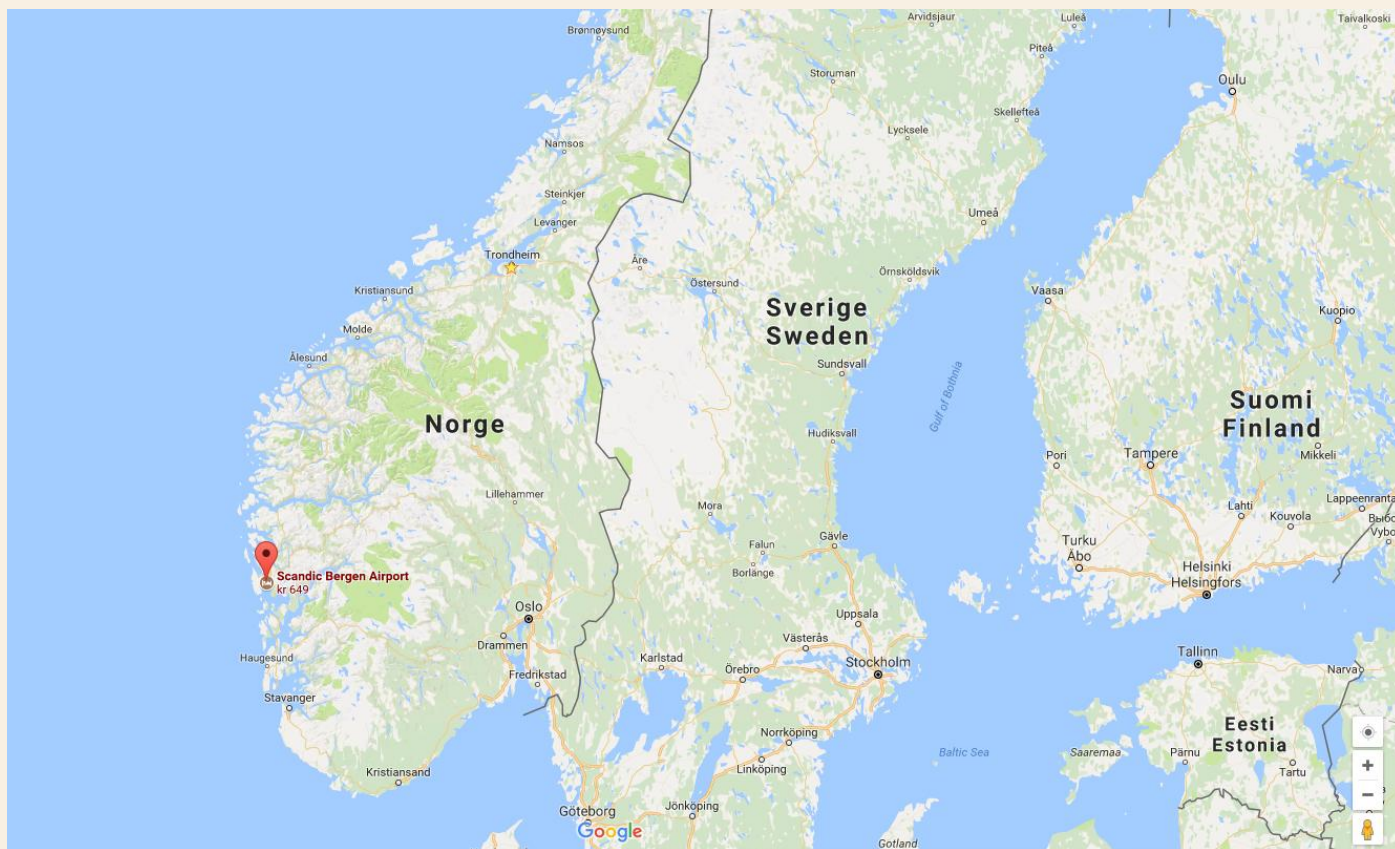
Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy  
Christian Michelsen Research AS  
5-6.10.2017, Chęciny

# Norwegian case study

## Scandic Airport Flesland Hotel, Bergen

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## Scandic Airport Flesland, Bergen





## Scandic Flesland Airport Hotel

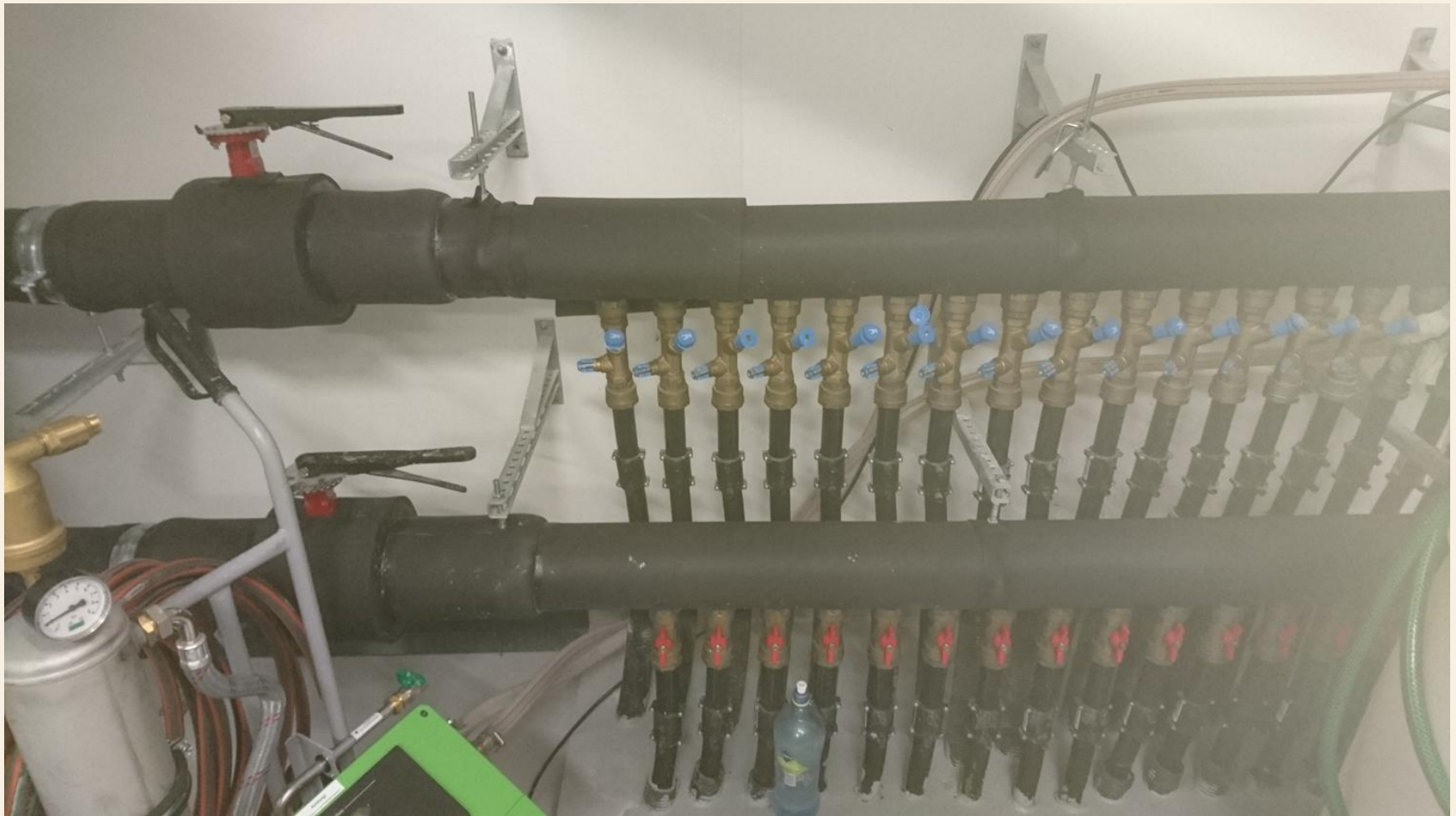
- Largest congress hotel in Bergen
- 27 meeting rooms
- Capacity of the largest meeting room: 1100 persons

→ High cooling peak loads

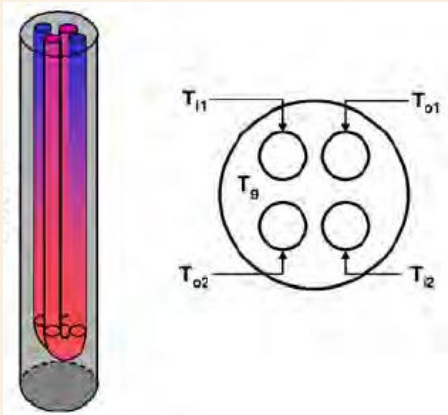


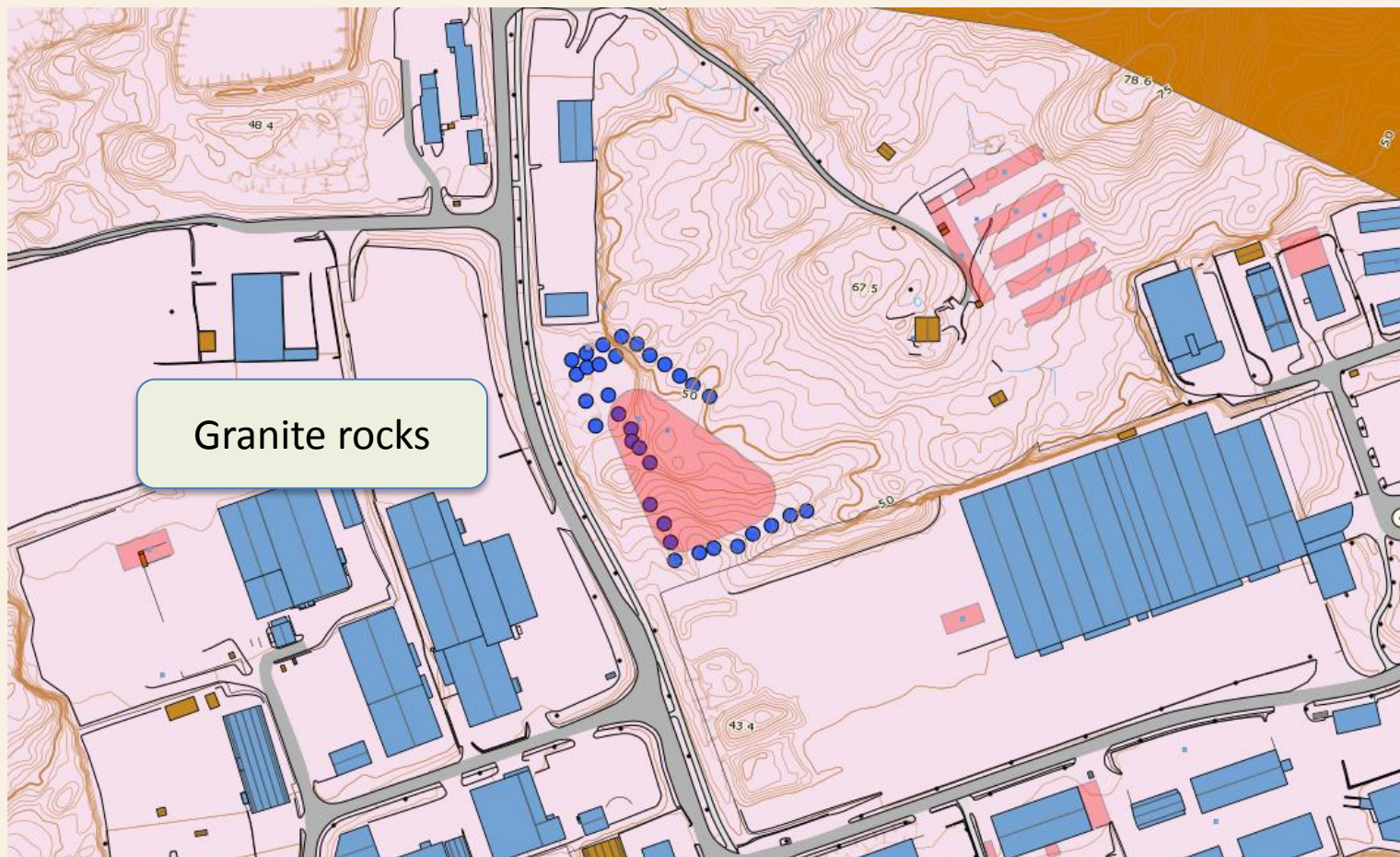
4 x two- steps heat pumps,  $4 \times 80 \text{ kW} = 320 \text{ kW}$  (Bosch)





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





## Thermal response test

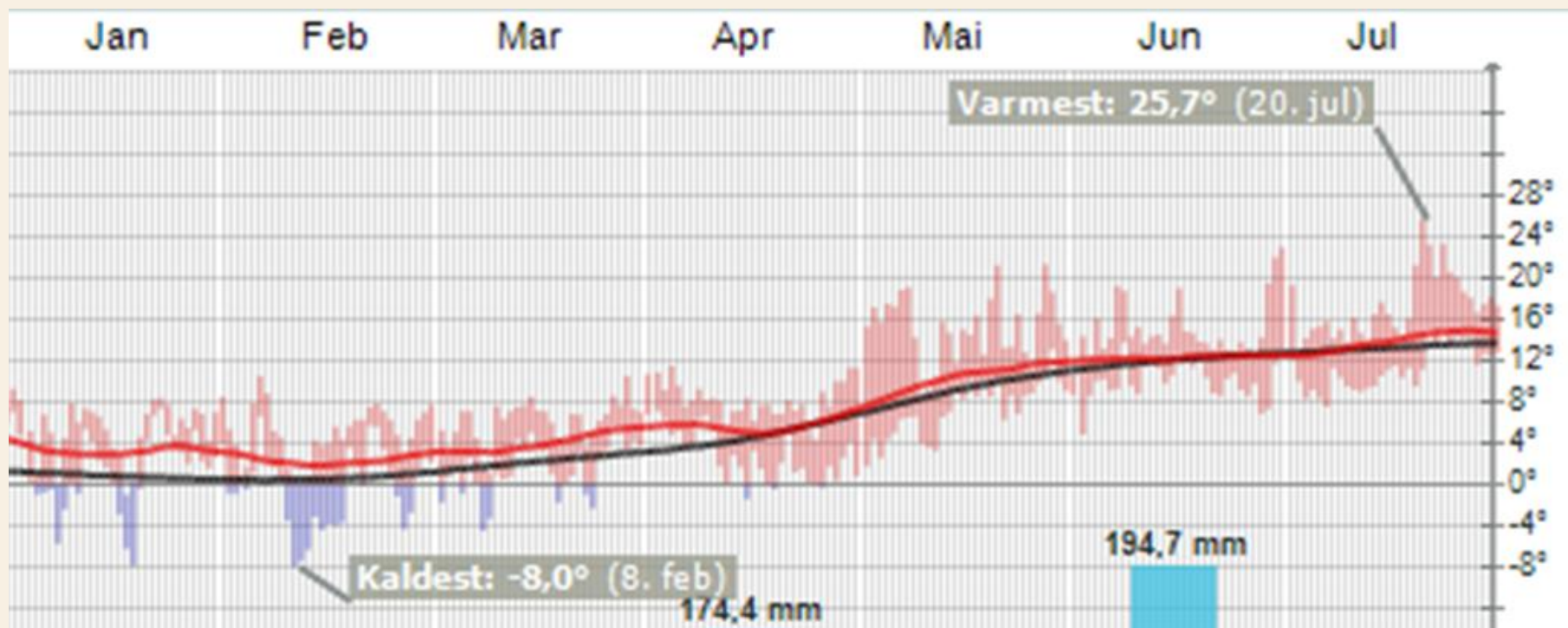
- Effective thermal conductivity  
5.0 W/mK
- Thermal borehole resistance:  
0.085mK/W
- $T_{\text{middle}}(\text{in situ}) = 8.8\text{ }^{\circ}\text{C}$



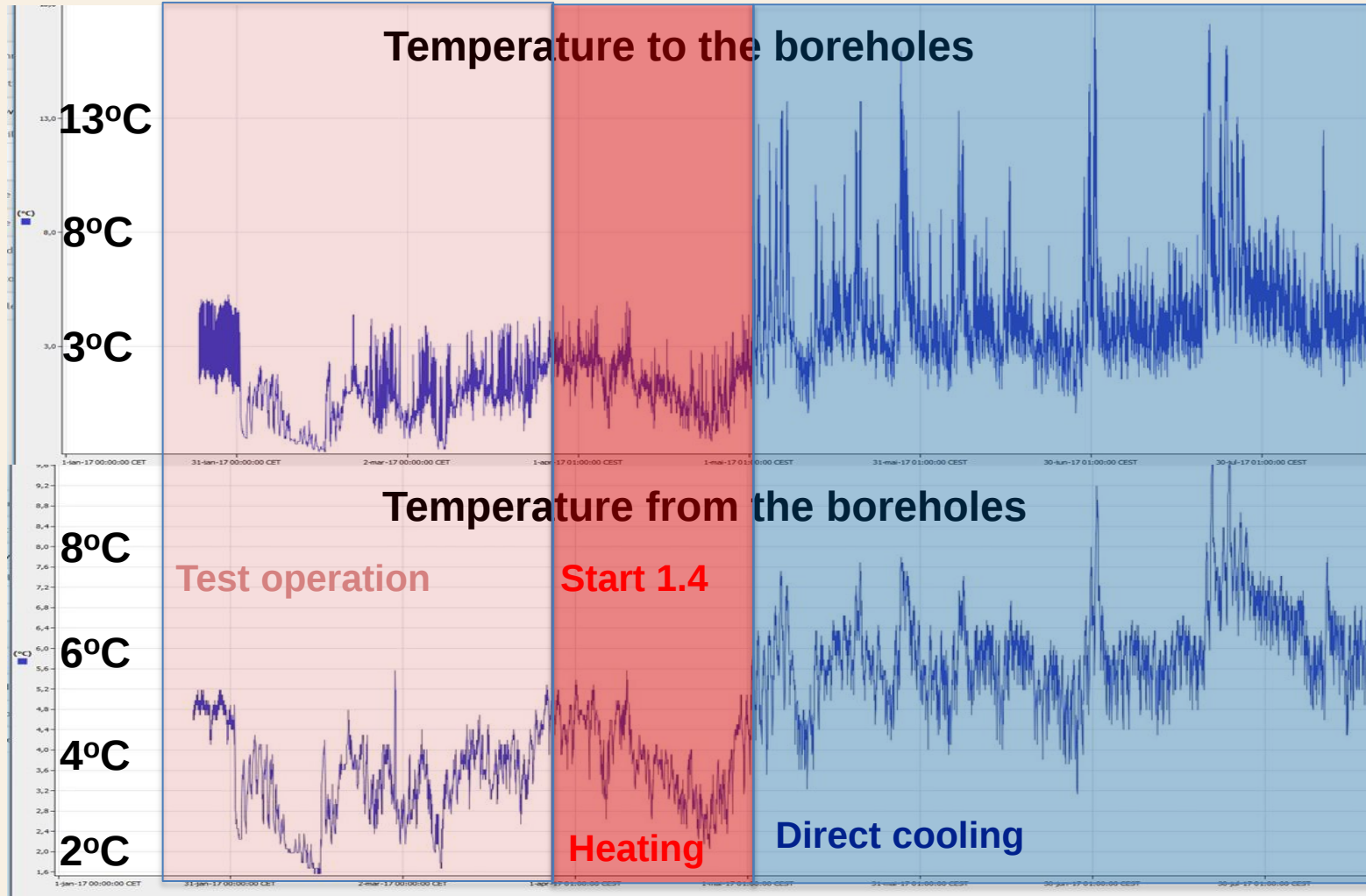
- Estimated direct cooling capacity 450kW
- Delivered energy 1.1-28.9.2017: 1071 MWh
- Delivered direct cooling 1.1-28.9.2017: 43MWh
- Average COP (SPF) heat pumps **5,5**
- The property owner (BGO eiendom AS) sell heat and cooling to the hotel



## Air temperature, Flesland 2017

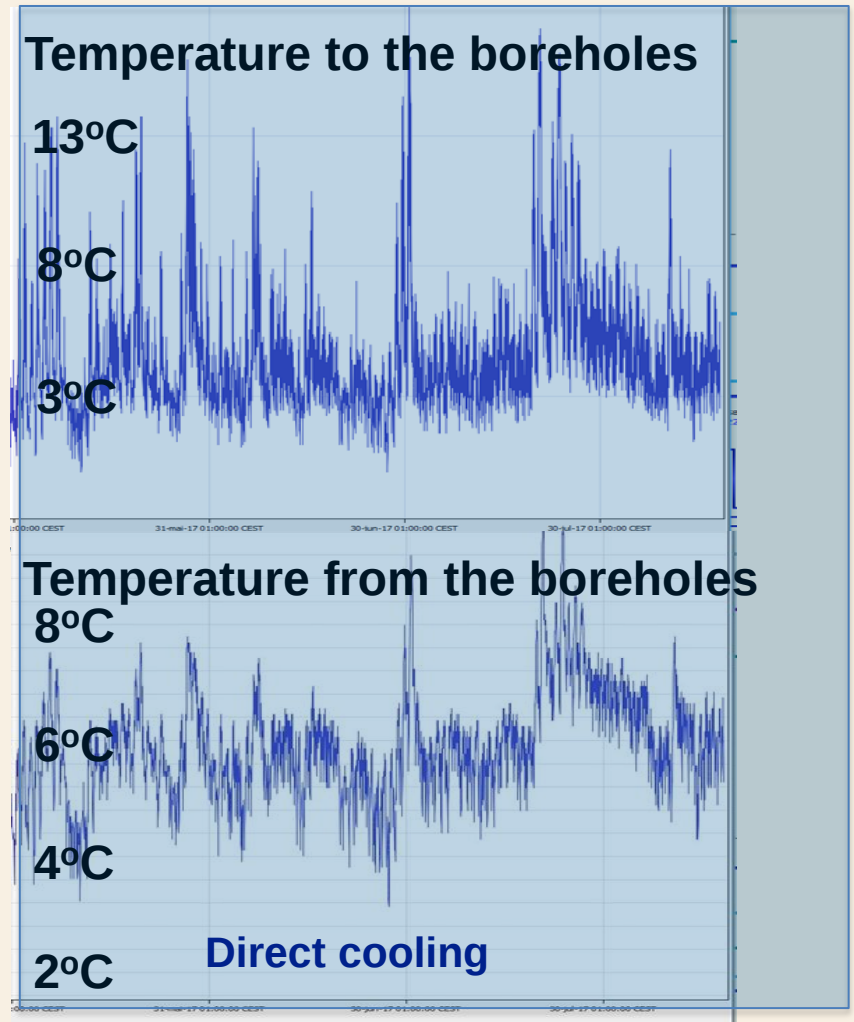


## Brine temperatures in the period 1.1-20.8.2017



## 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.





**Tusen takk for  
oppmerksomheten**

**Thank you for your  
attention**