Current status and emerging trends in medium and deep geothermal energy use for district heating and cooling in European countries

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GEOTHERMAL DHC

Towards Decarbonized Heating and Cooling!

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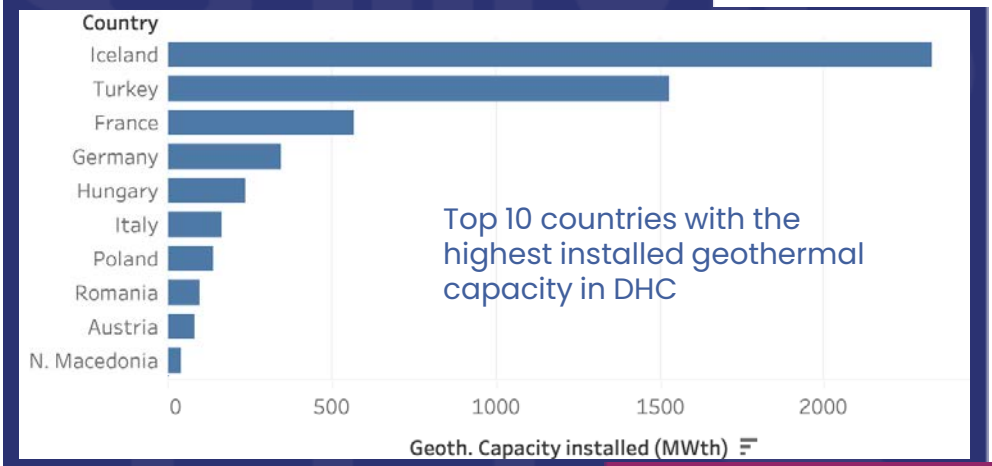
Deep geothermal capacity installed for DHC purposes in European countries



- In Europe, the heating and cooling sector accounts for roughly 50% of energy consumption, with 75% of that energy still supplied by fossil fuels[2]

Key geothermal players in DHC

- **Iceland** stands out with capacity of >2300 MW_{Th}
- **Reykjavik** has the biggest DHC system in EU with 1237 MW_{Th} for 120,000 residents[1]
- **Turkey** follows with 3 second largest plants (2 plants in Afyonkarahisar of 355 MW_{Th} and 305 MW, and 260 MW_{Th} plant in Izmir)[1]

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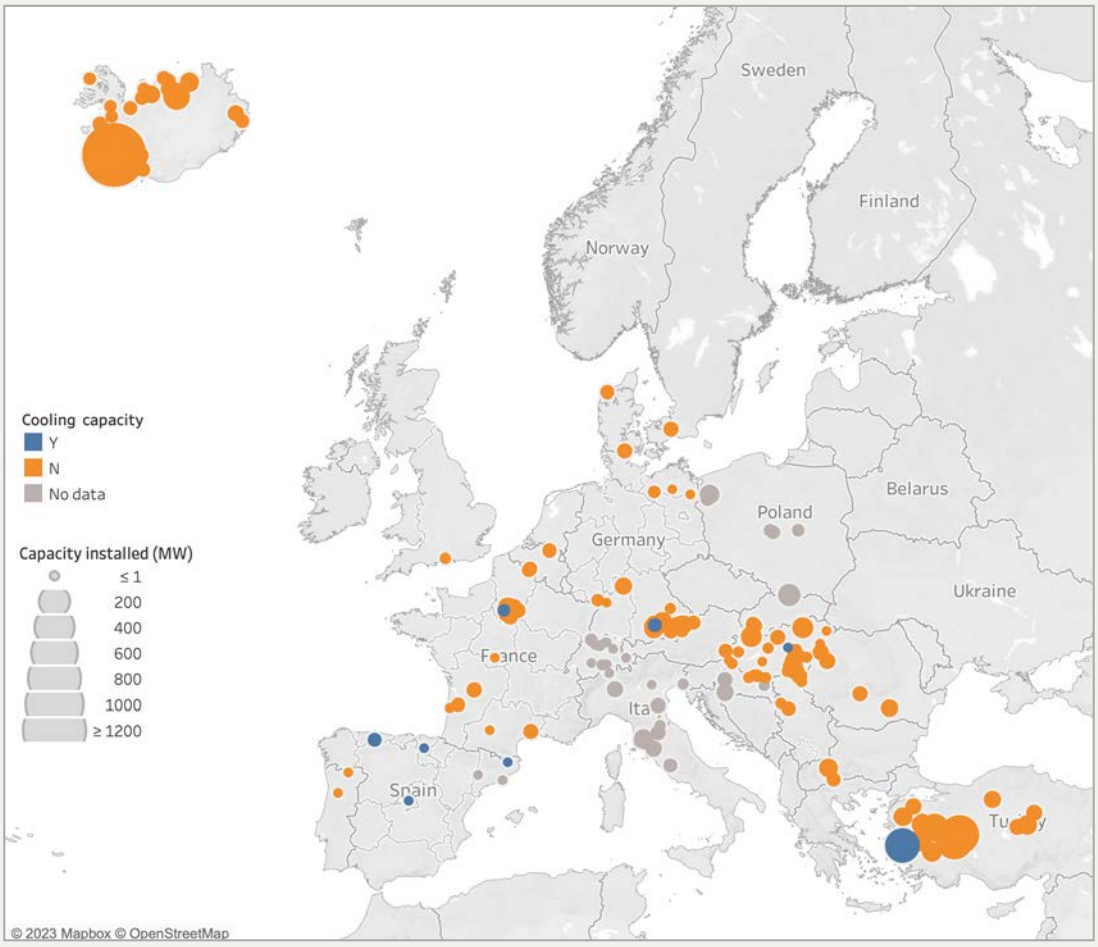
Utilization of geothermal energy for DHC

April 2024



Deep Geothermal Capacity installed for DHC, derived from Summary of EGC 2022 Country Update Reports on Geothermal Energy in Europe (Sanner et al., 2022)

Geographic distribution

- In the areas with high geothermal gradient geothermal plays an important role for many years
- However, in recent times, there have been new entrants to the market, e.g., in the Netherlands, in Spain and UK.

Cooling capacity

- The majority of plants do not have **cooling capacity** (or it has not been reported)
- So far cooling capacity is only common in **southern European countries** like Spain and Turkey.
- This trend is likely to change in the next decade due to **global warming** and longer heat waves happening across EU

Market Situation and future trends

April 2024

Key barriers and opportunities for acceleration of geothermal energy use in DHC sector

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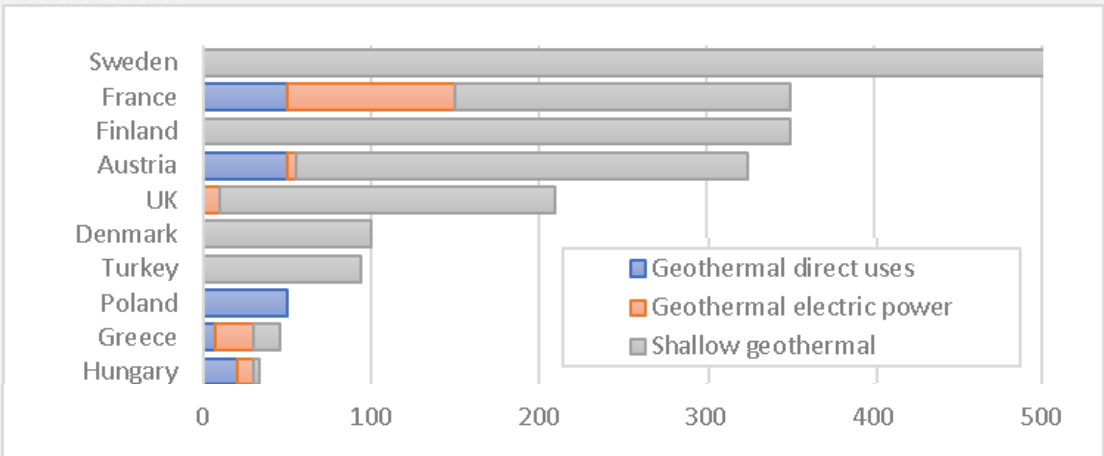
Existing hurdles

- High initial capital costs (drilling costs are one of the biggest constraining factors)
- Complex regulatory procedures and very long permitting timing
- Lack of incentives for geothermal development
- Need to redesign existing DH network

Future development opportunities

- Utilization of oil&gas shut-down or old exploration wells to minimize drilling costs (successfully tested in California, Canada and China)[2]
- Advancement in drilling technology
- Closed-loop U-tube heat exchanger, combining laser and cryogenic gas into a single technological drilling solution[1]
- Further improvement of characterization, mapping, and understanding of the crustal thermal conditions to improve drilling success rate

- Comparing the investments in different sectors of geothermal, the highest share of funds among reporting countries for 2023 went in shallow geothermal.
- Only a few countries (Turkey, France, Poland, and Austria) stated major investment and expectation for deep geothermal heat development



Reported investment in different sectors of geothermal (Million €) for 10 top EU countries. Data derived from Sanner et al., 2022.

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