‘Present state of new developments in research and usage of geothermal energy in Europe’

Philippe Dumas, Secretary General

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1. **Geothermal Market trends**

2. **Costs comparison**

3. **Innovation: roadmap, technological trends, costs**

- **Check out the EGEC website & Key Findings 2021 of the Market Report.**

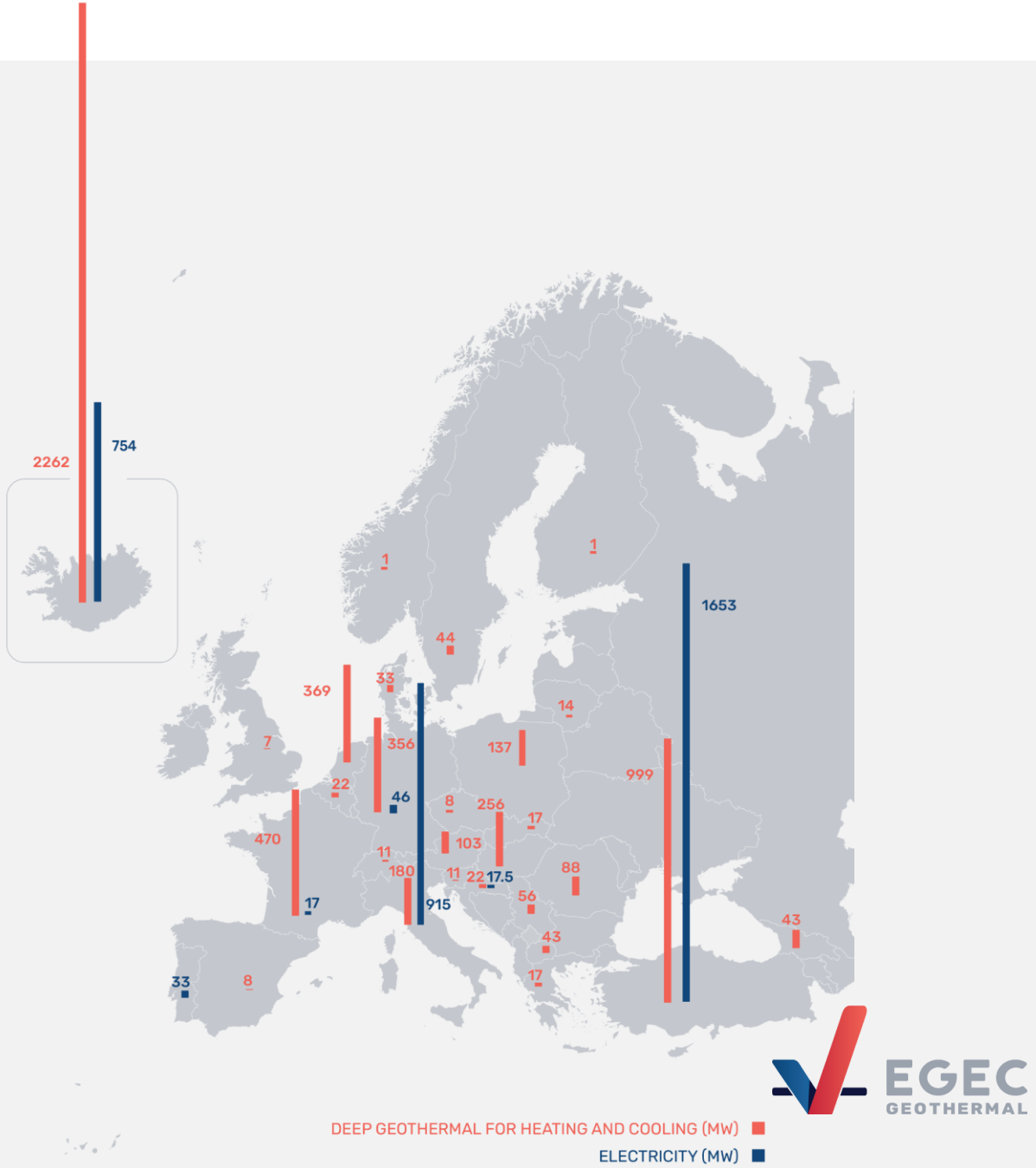
1. Geothermal market trends



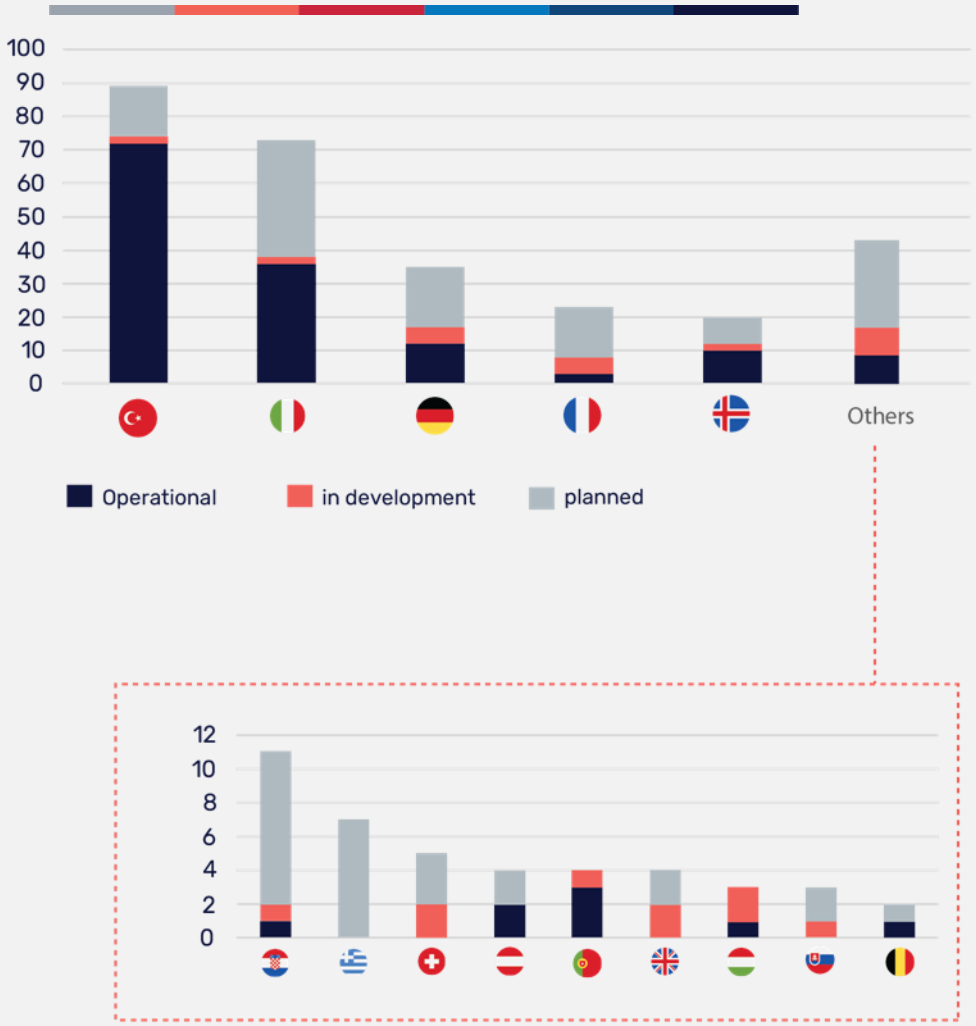
Overview

Some key figures

- 142 Geothermal electricity plants, with 6 new in 2021: 3,4 Gwe installed and more than 19 TWh produced
- 364 geothermal DH systems in operation, with 13 new in 2021: 5,6 GWth capacity
- More than 2 million geothermal heat pumps in Europe at the end of 2021



Electricity

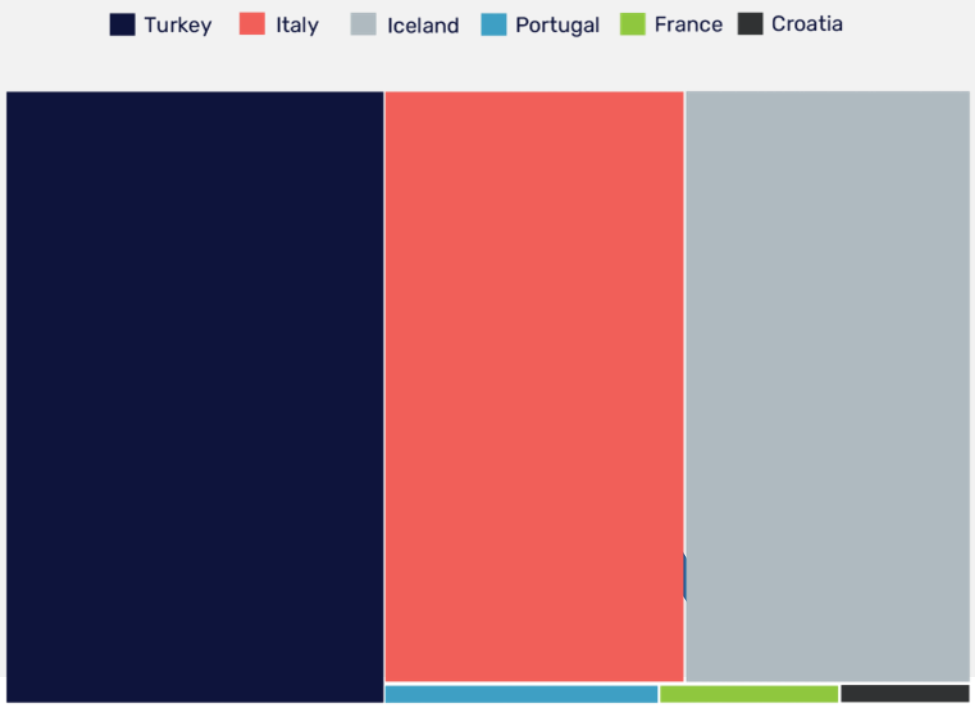


2021

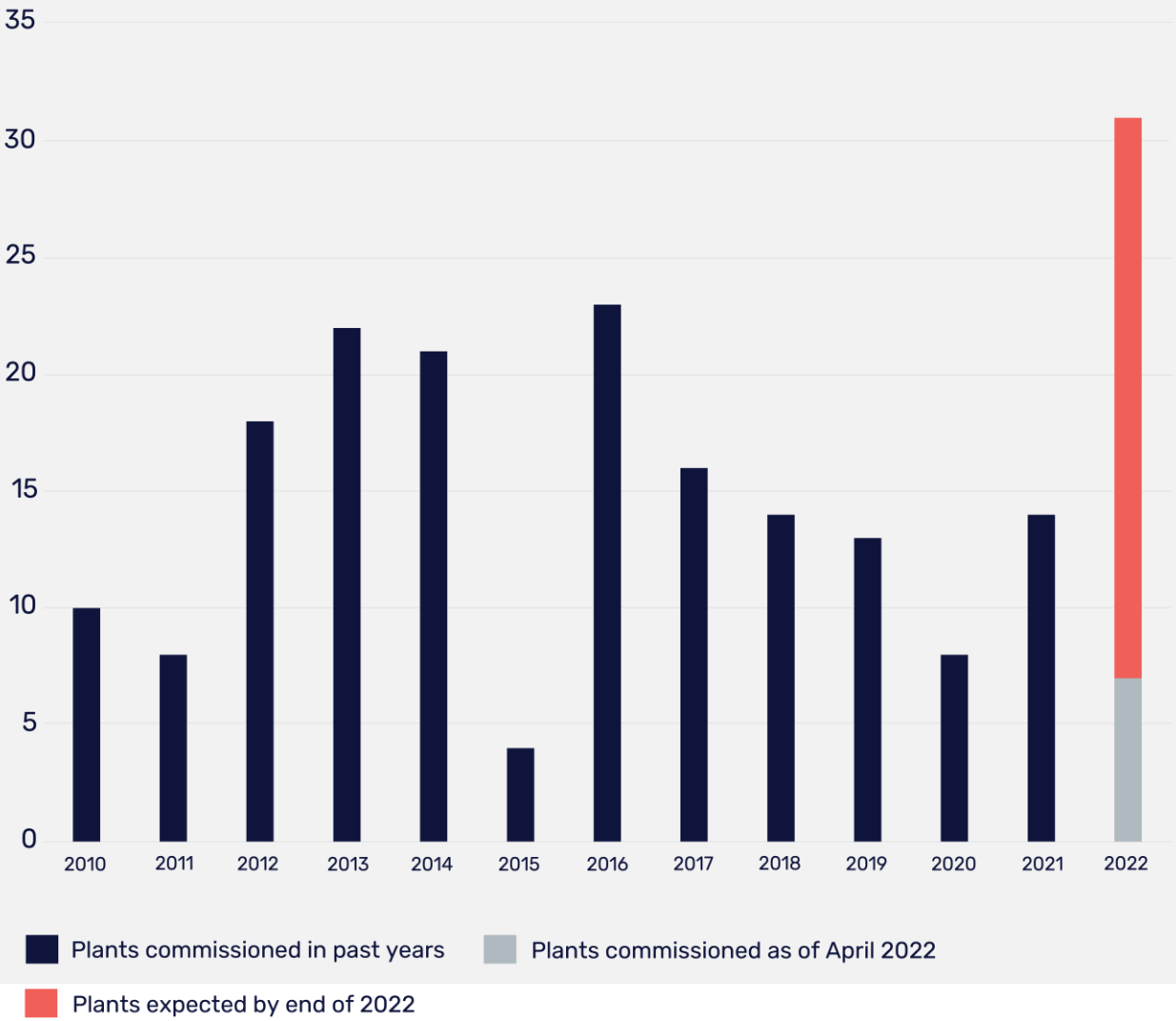
- 4 new plants in Turkey
- 2 new plants in Germany

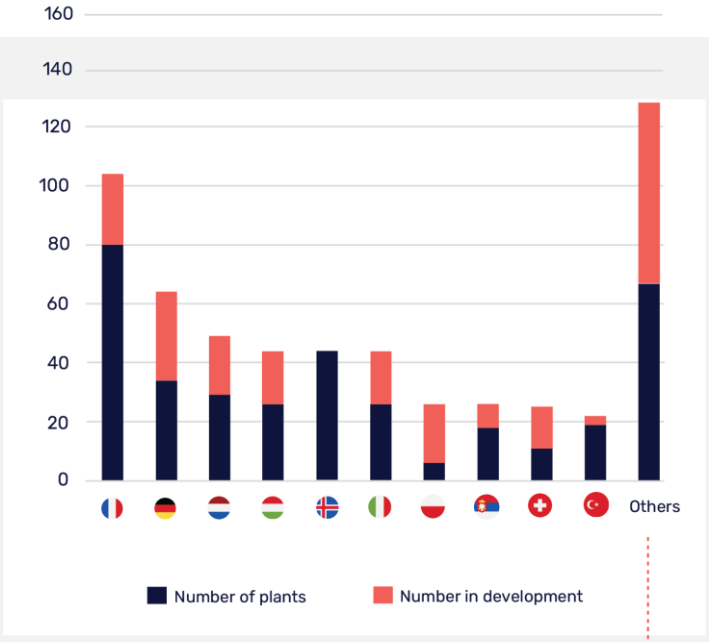
Number of Geothermal power plants per country

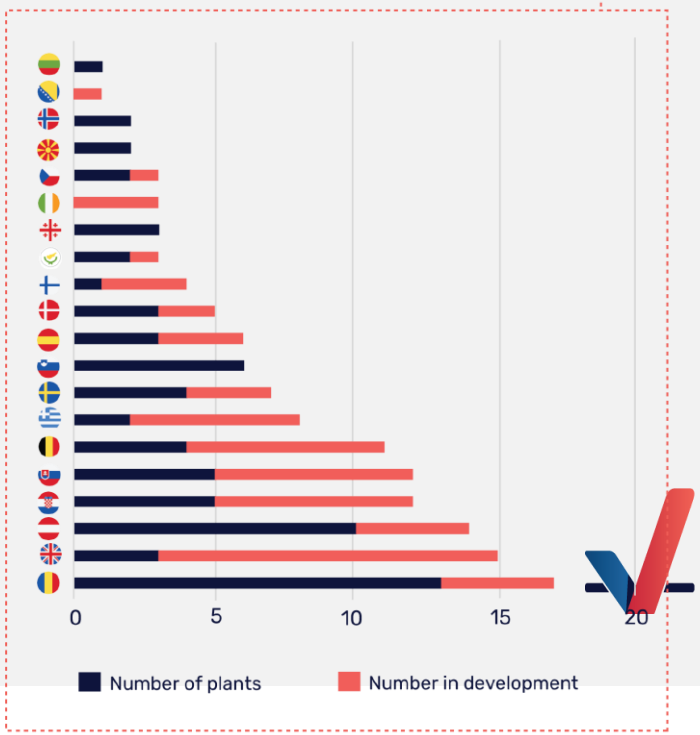
and production in selected countries



District heating



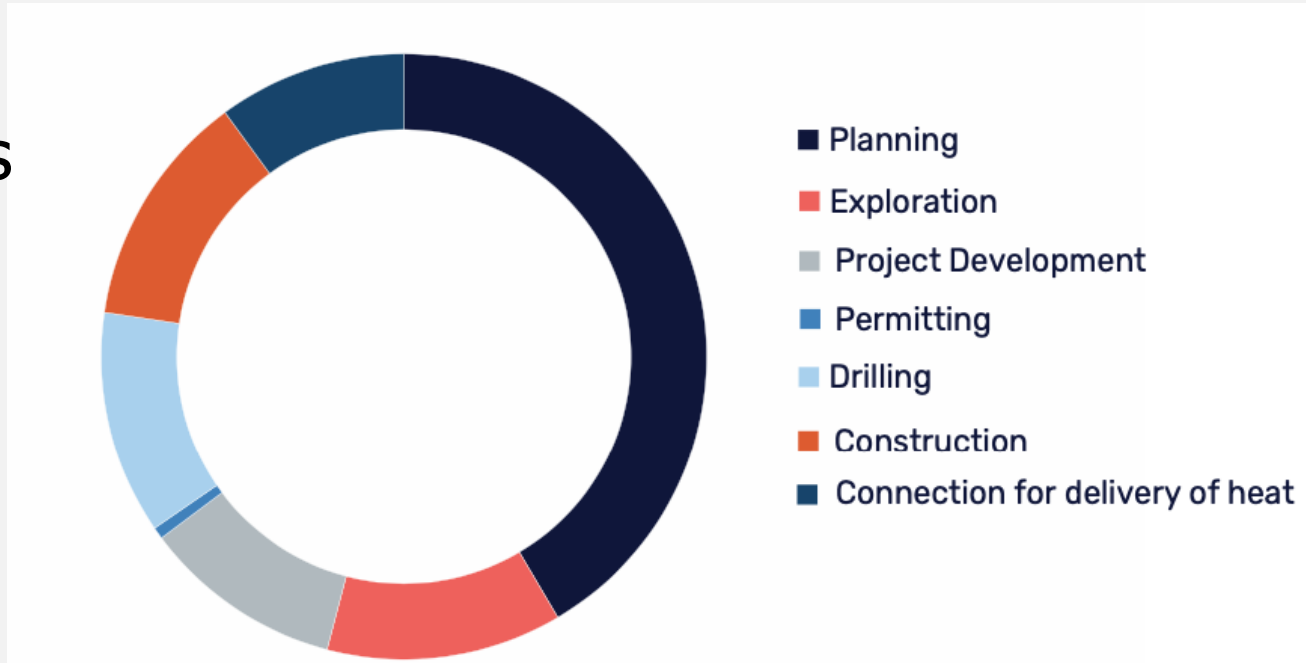




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Geothermal DHC project pipeline

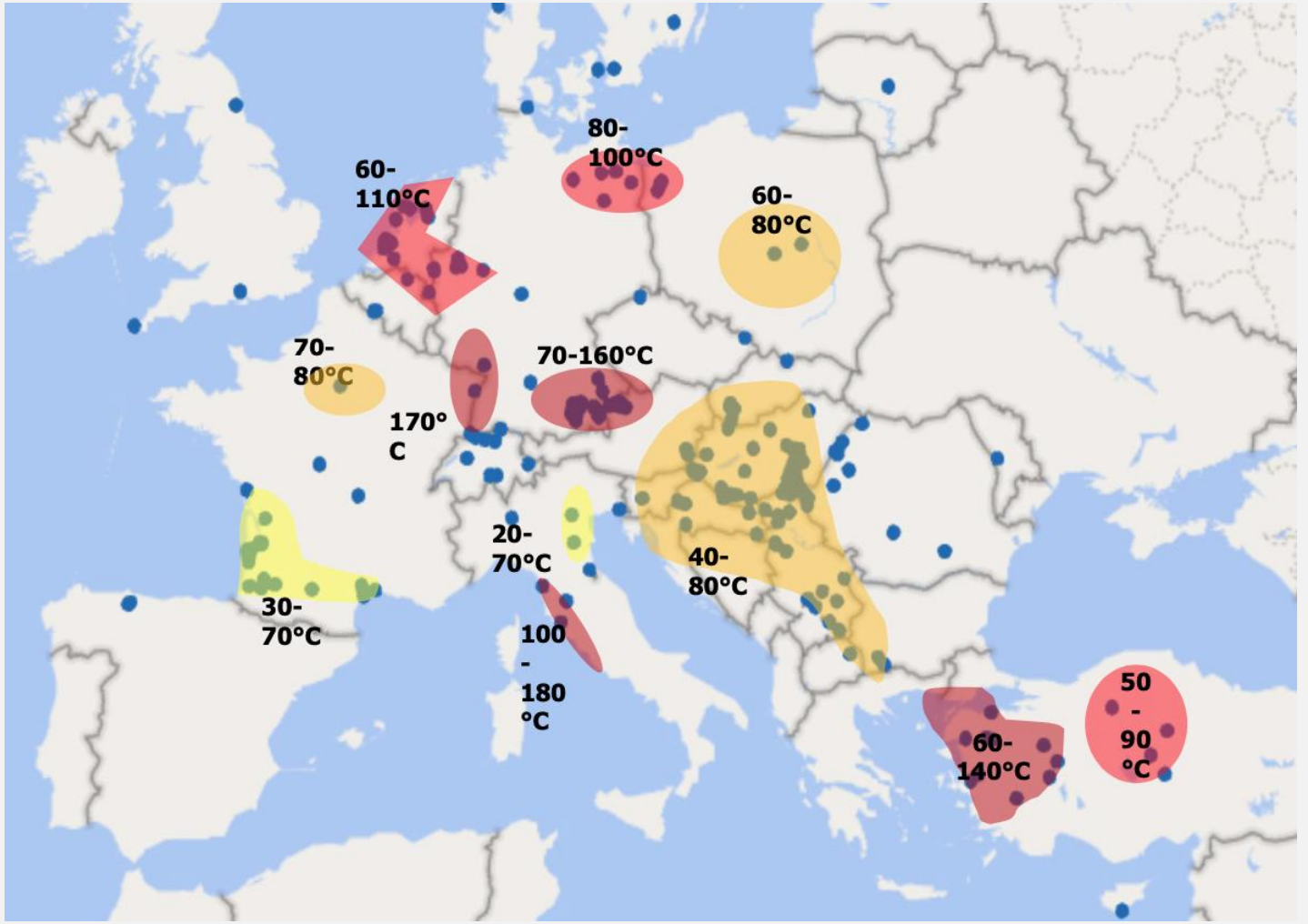
- 14 new projects commissioned in 2021 - An additional 154 MWth.
- France and the Netherlands both commissioned 3 new projects.
- The Netherlands also commissioned its first DHC system for buildings.
- Germany, Poland and Switzerland also commissioned new projects.



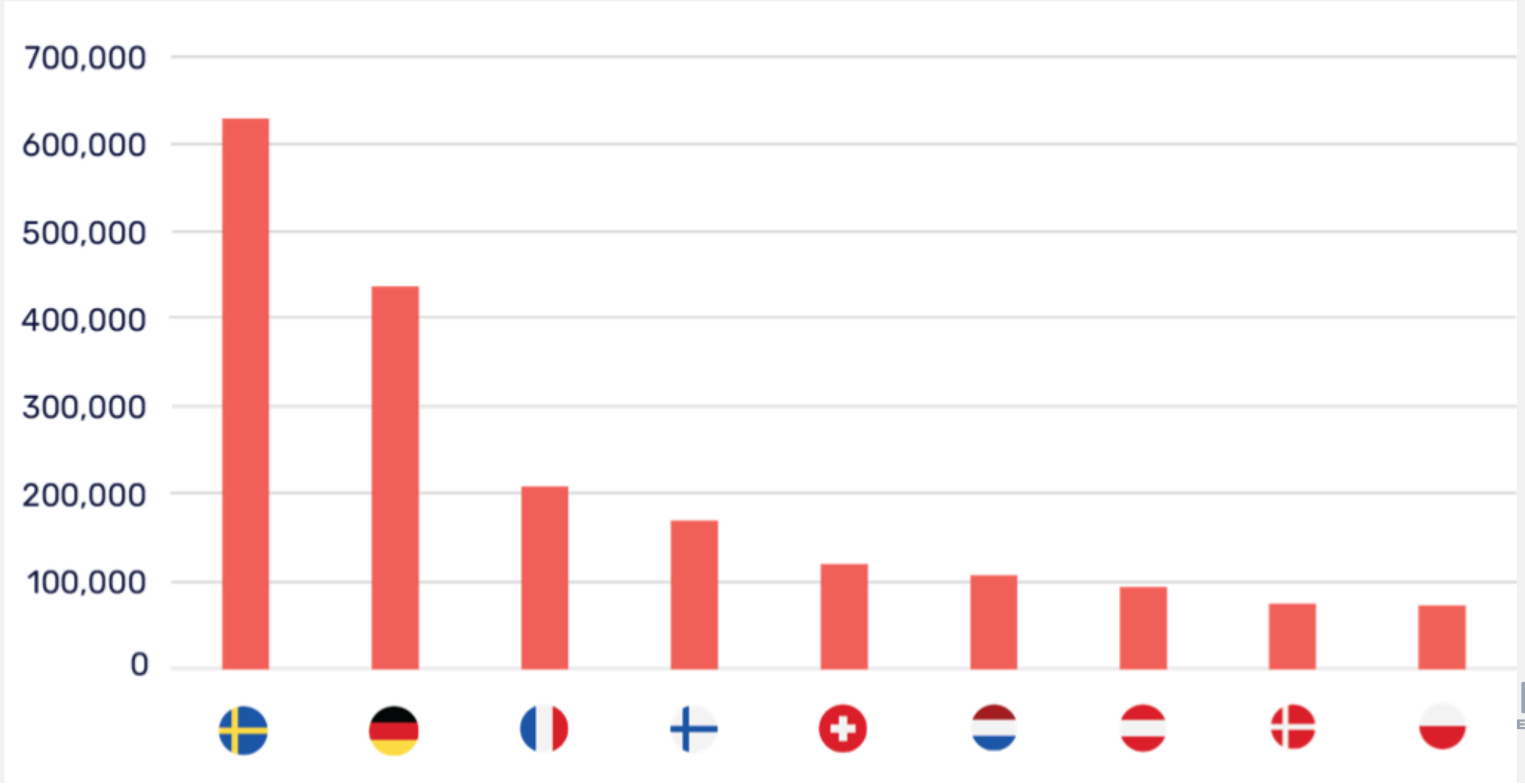
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Resource and flow rates

- Most projects centre on reservoirs with temperatures in the 60-80°C range in the EU.
- Greater effort needed for resource mapping.

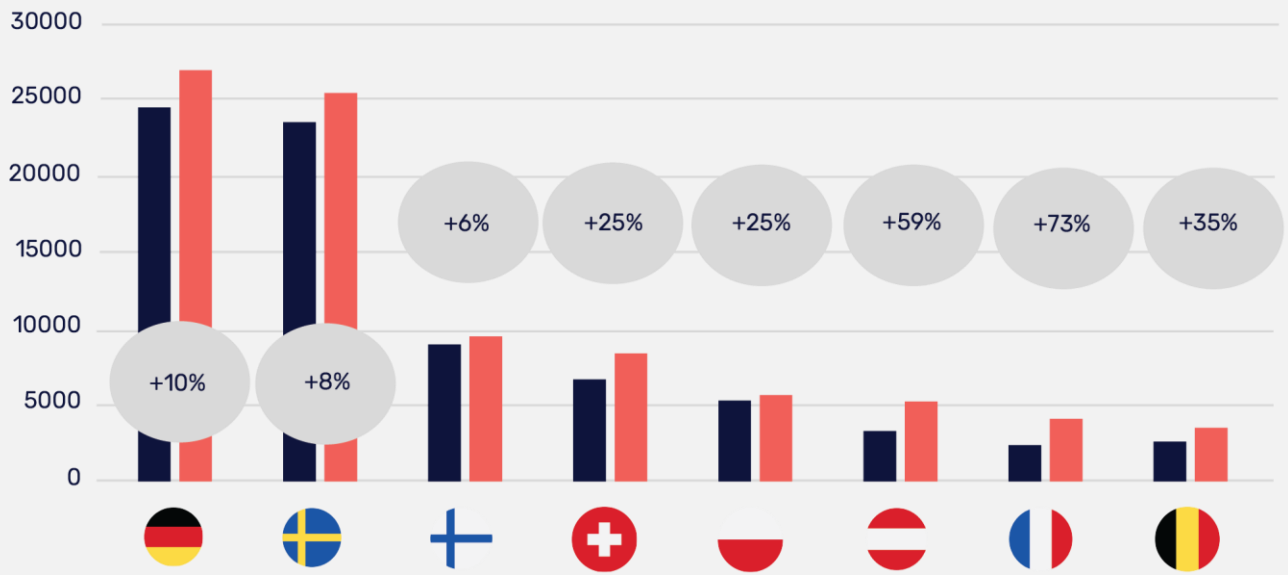


Number of GHPs installed in Europe



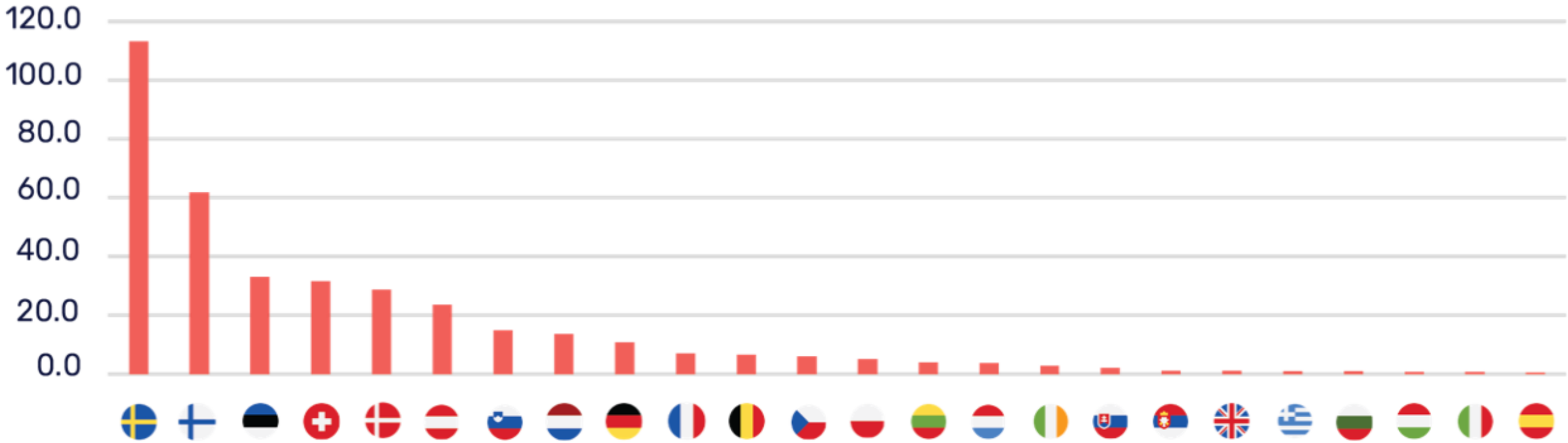
Growing sales in old and new markets

- **Germany** sold 27,000 units (10% growth compared to 2020).
- **Sweden** added 25,500 new systems (8% growth).
- **Finland** added 9,500 units **(**6% growth).
- Strong sales growth in **France** (73%), **Austria** (59%) and **Belgium** (35%).



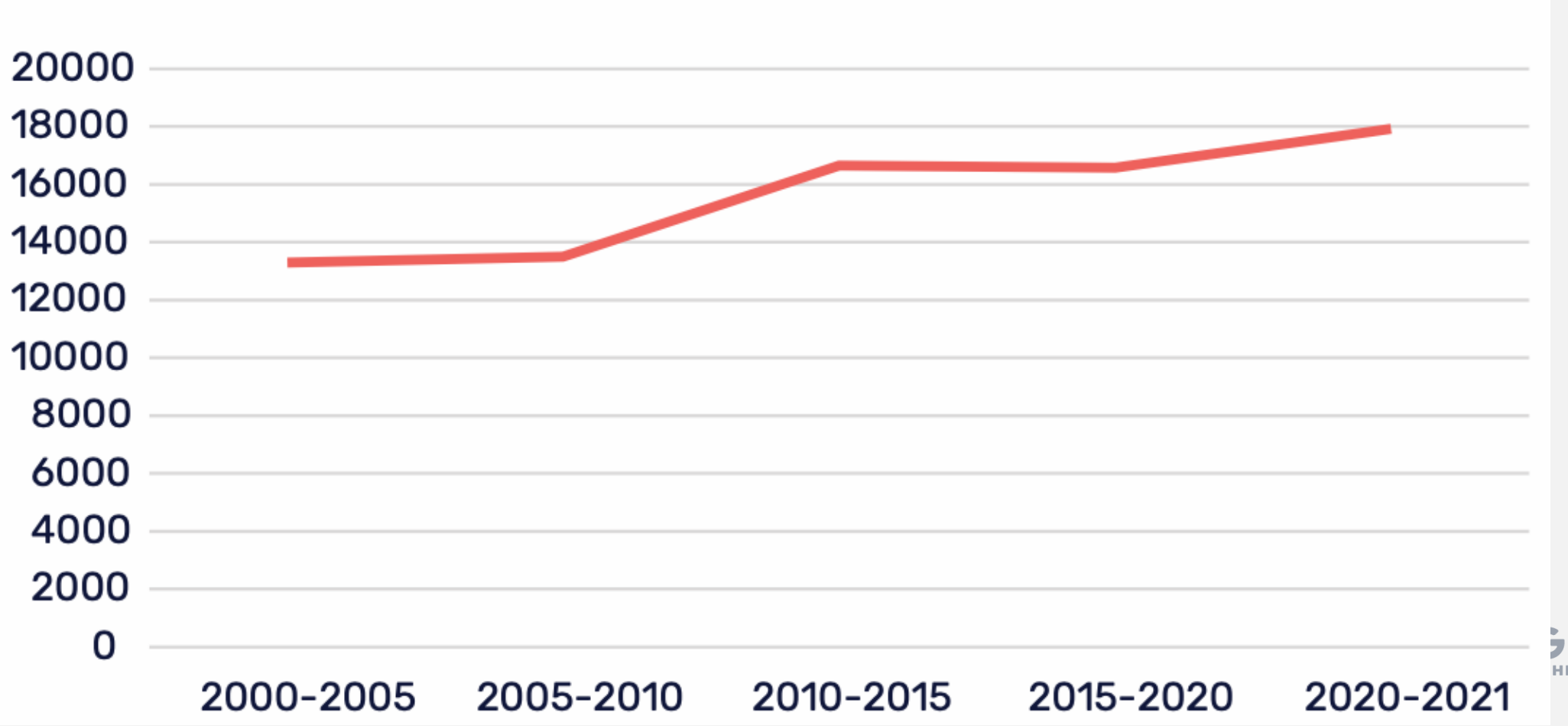
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Heat pumps per 1,000 households

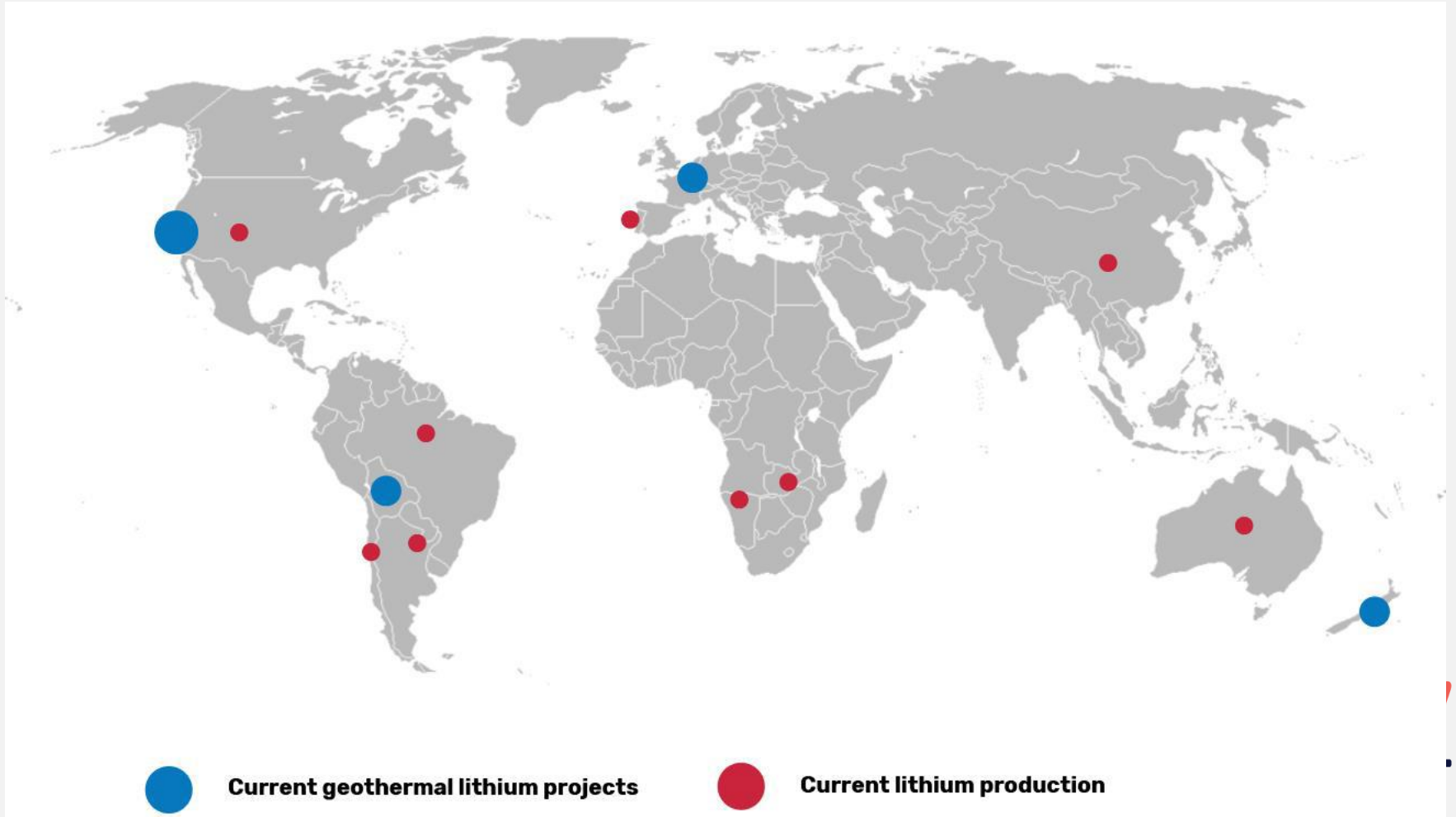


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Large-scale heat pumps have continually increased their capacity (BHE length in meters)



The Global race for geothermal lithium



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2. Costs comparison



GEOTHERMAL POWER COSTS

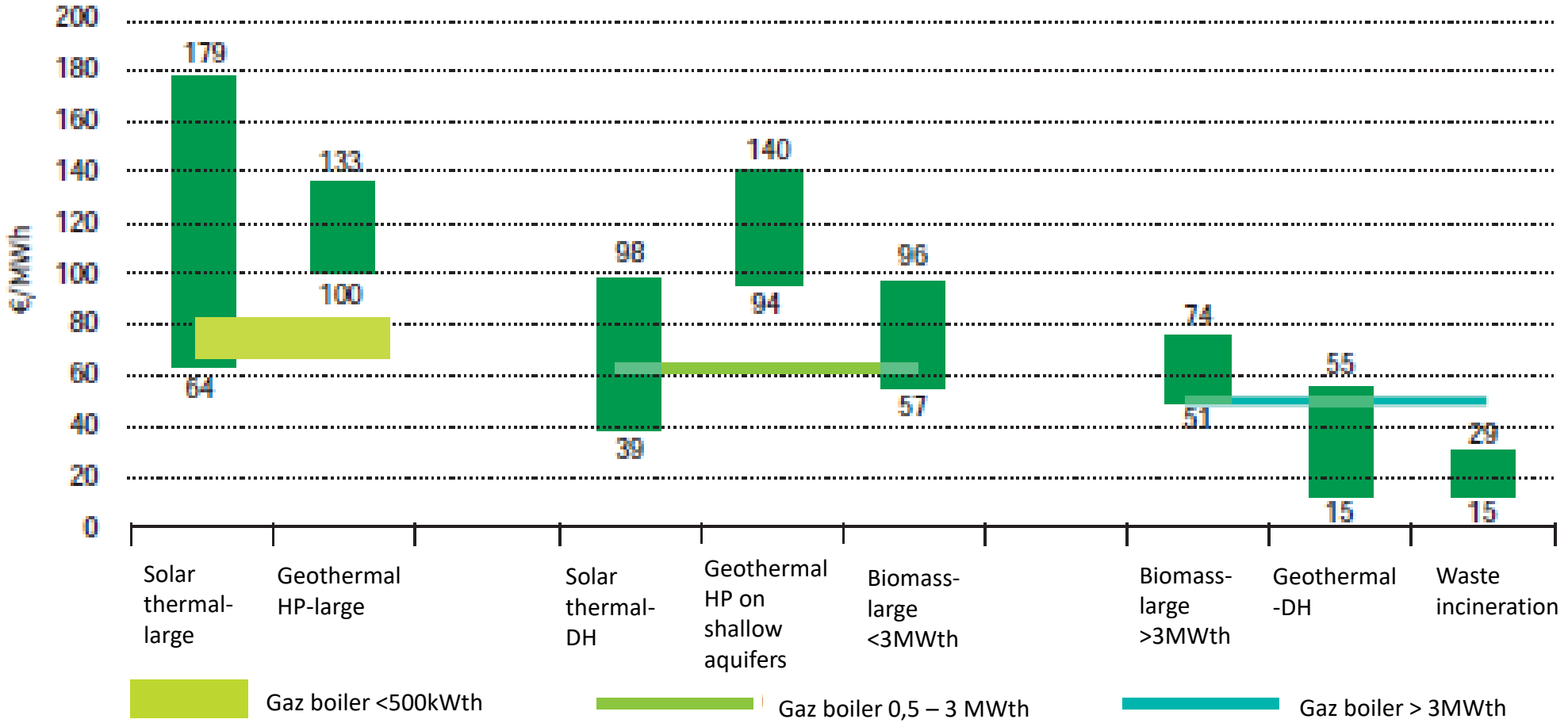


Source: ETIP-DG

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The competitiveness in the heat sector– Large buildings

LCoE of heating in large buildings, comparison with gaz boilers (France, 2019)

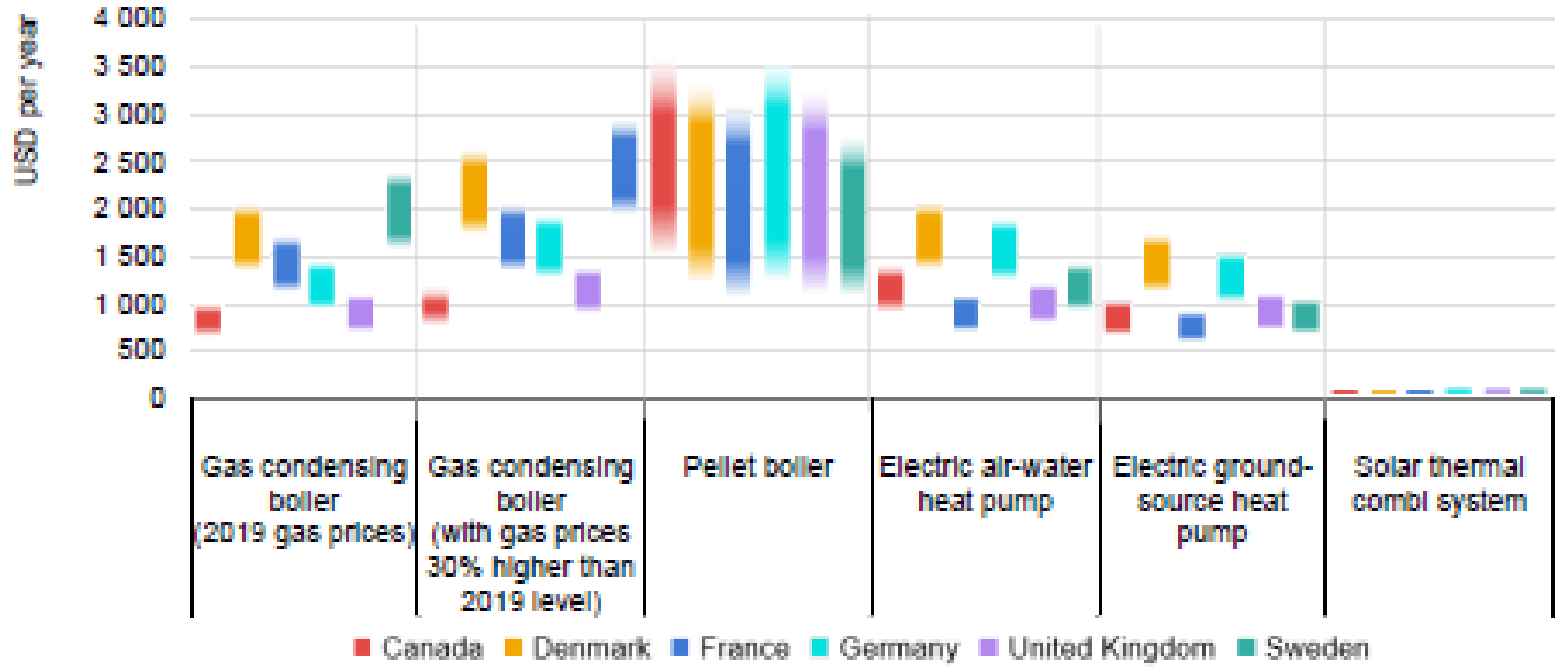


Source: ADEME

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The competitiveness in the heat sector– Individual buildings

Figure 4.24 Average annual operating cost range for selected space and water heating technologies and regions



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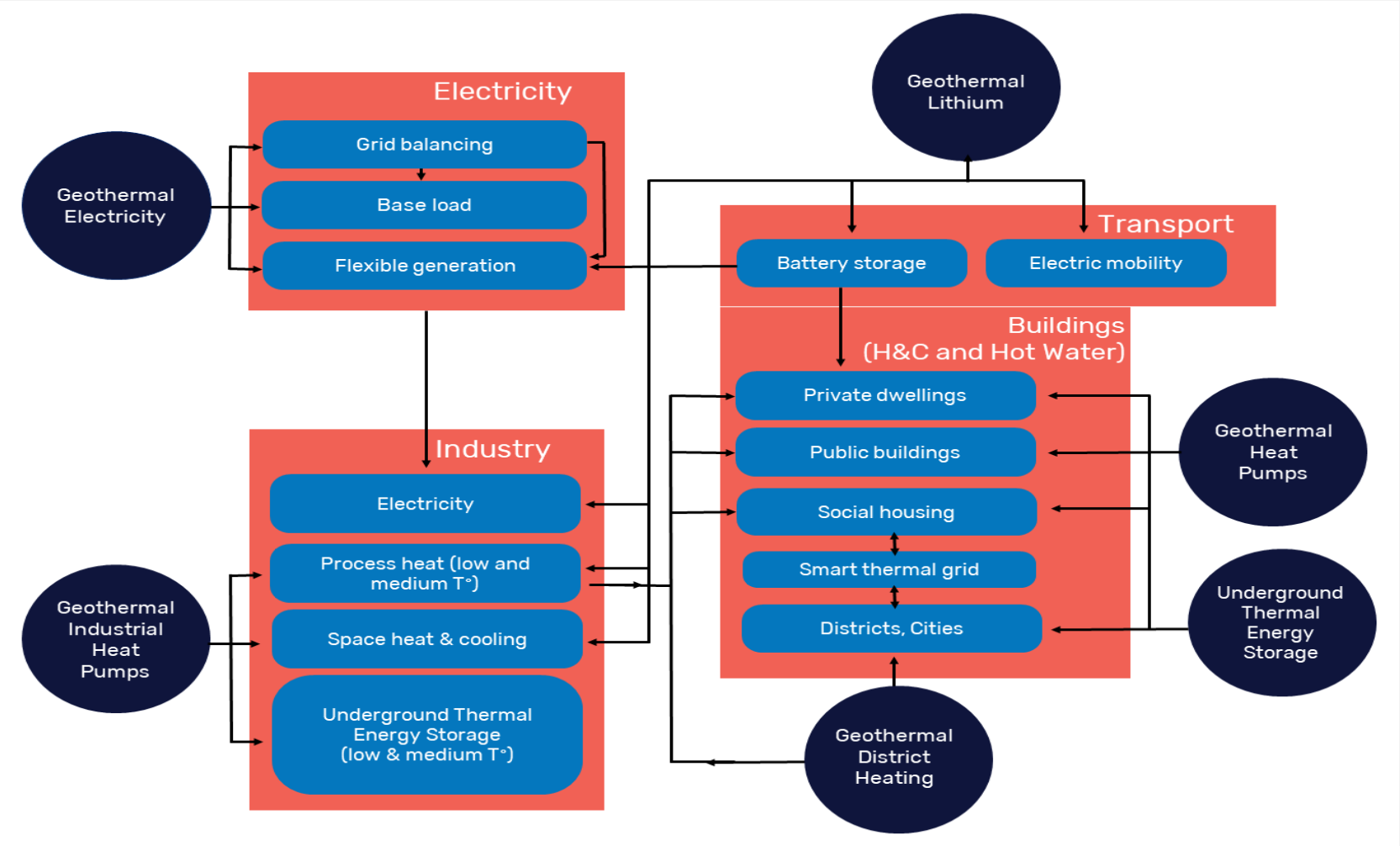
Note: Operating costs shown in this figure are calculated based on national average dwelling heat demand, technology efficiency, fixed operation and maintenance costs and 2019 end-user fuel cost for each country.

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3. Innovation: Roadmap and Technological trends



Visualising smart sectoral integration for geothermal energy



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Power production

- Cost-effective baseload/dispatchable electricity production
- Innovation and bold thinking can boost the potential for Europe
  - Super hot – Super critical
  - Magma Energy
  - Offshore Geothermal
  - New technologies / new materials
- 10% **baseload** power demand in 2050







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Unlocking Geothermal Energy: Power development

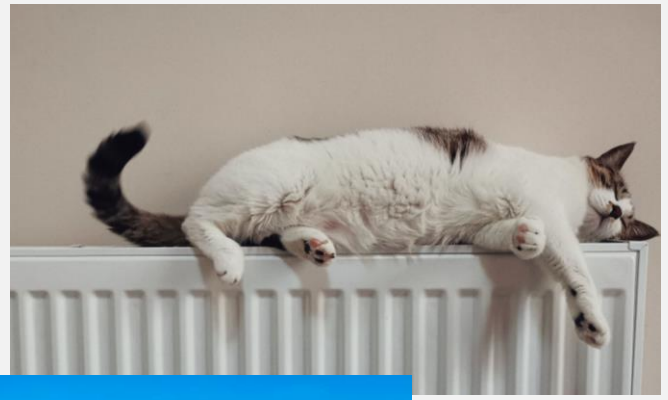


Combined biomass and geothermal plant in Cornia, Italy

> Improved efficiency, optimization of material, processes, cycle design
> Hybrid, proper combination
> Cutting edge technologies for any kind of resource (super-hot, off-shore, geopressurized) and any place (from remote islands to urban areas)

Heating and cooling

- Indigenous dispatchable source, main use of geothermal in West/Central Europe
- 25% of European cities are located in regions suitable for direct use
- Expecting increased momentum!
- Heating and cooling transition
- Innovation - for geothermal in a wider range of geological settings

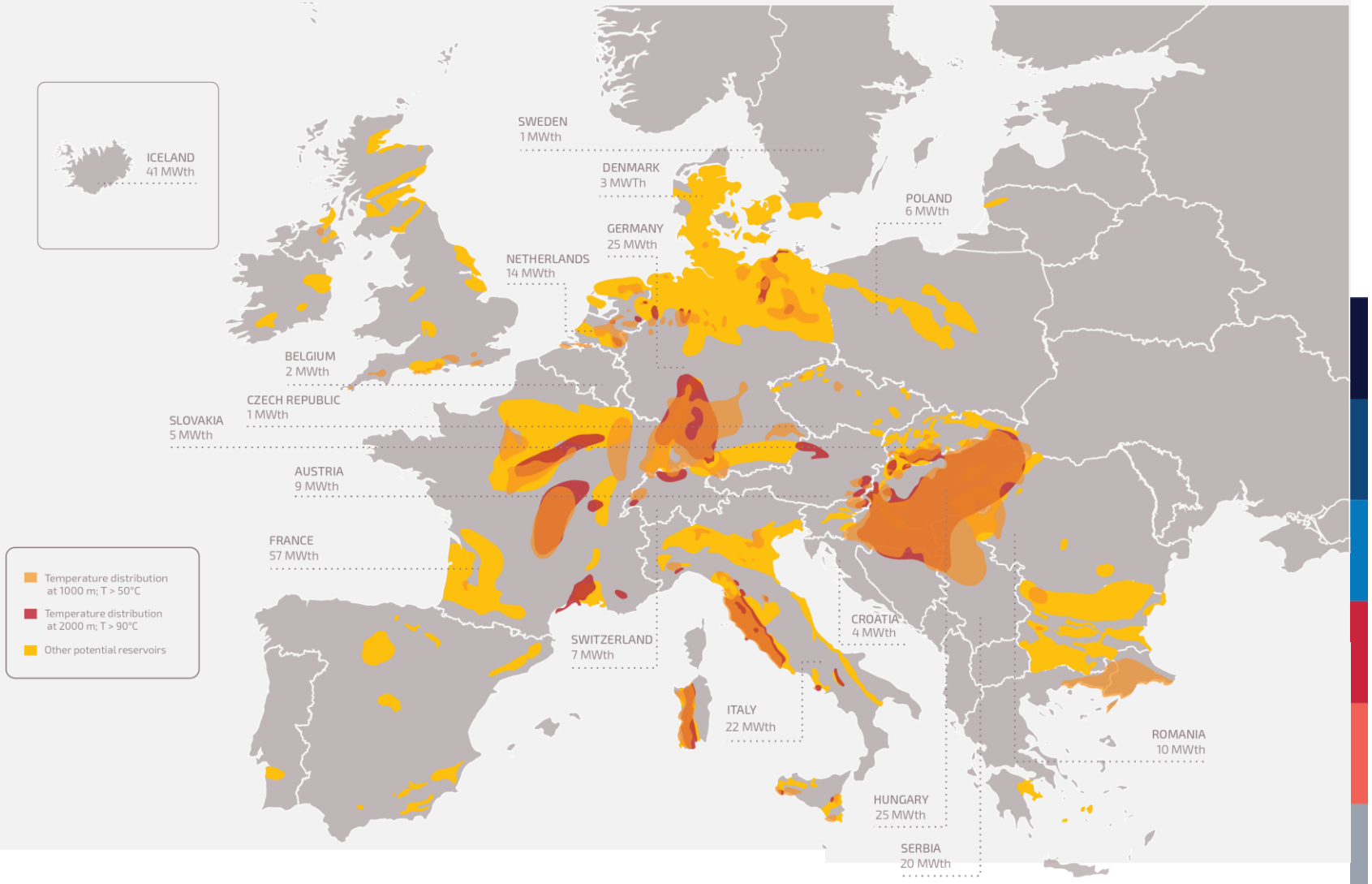






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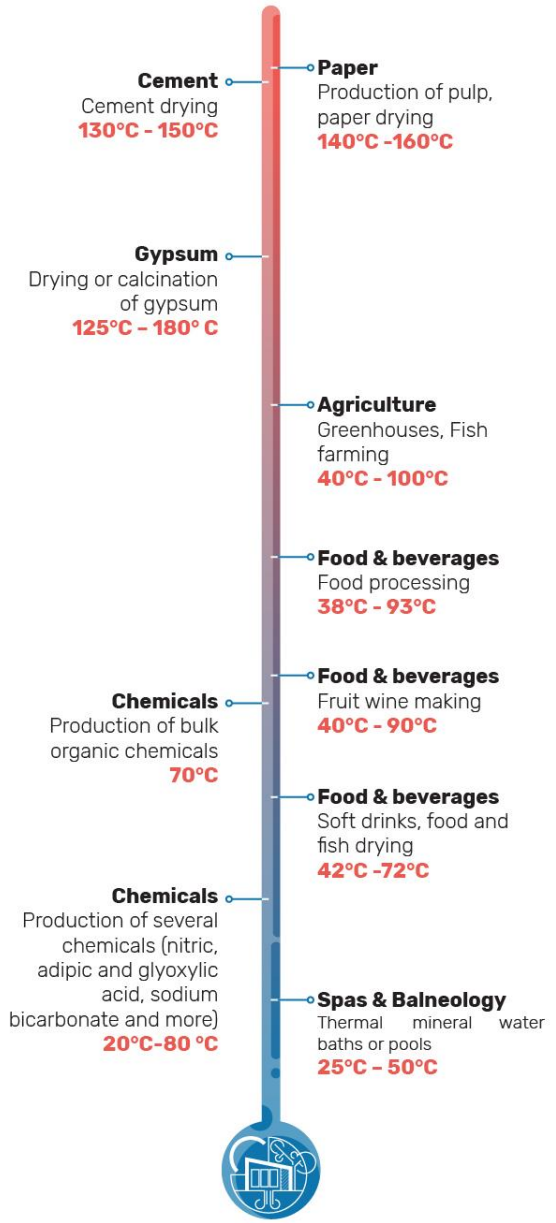
More than 25% of the EU population lives in areas directly suitable for geothermal district heating



Map of areas suitable for geoDH networks and actual geoDH installed capacity according to available geological data

Source: ETIP-DG, adapted from GEODH and EGEC market report

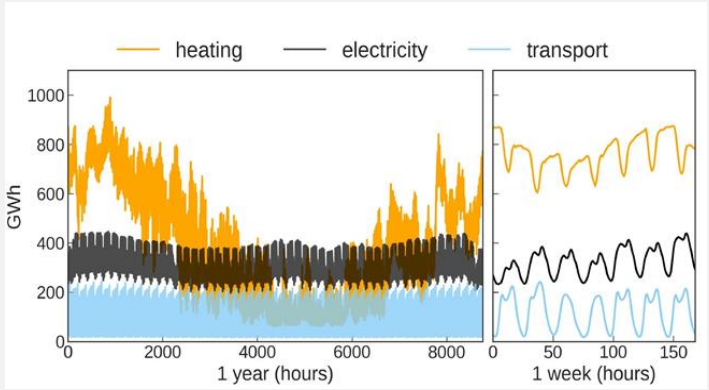
Supply affordable heat to Industry



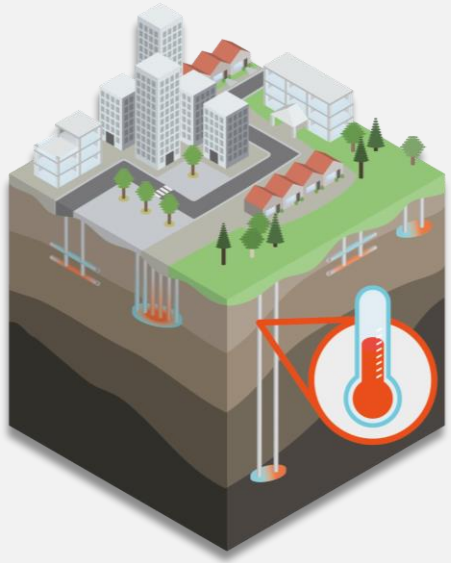
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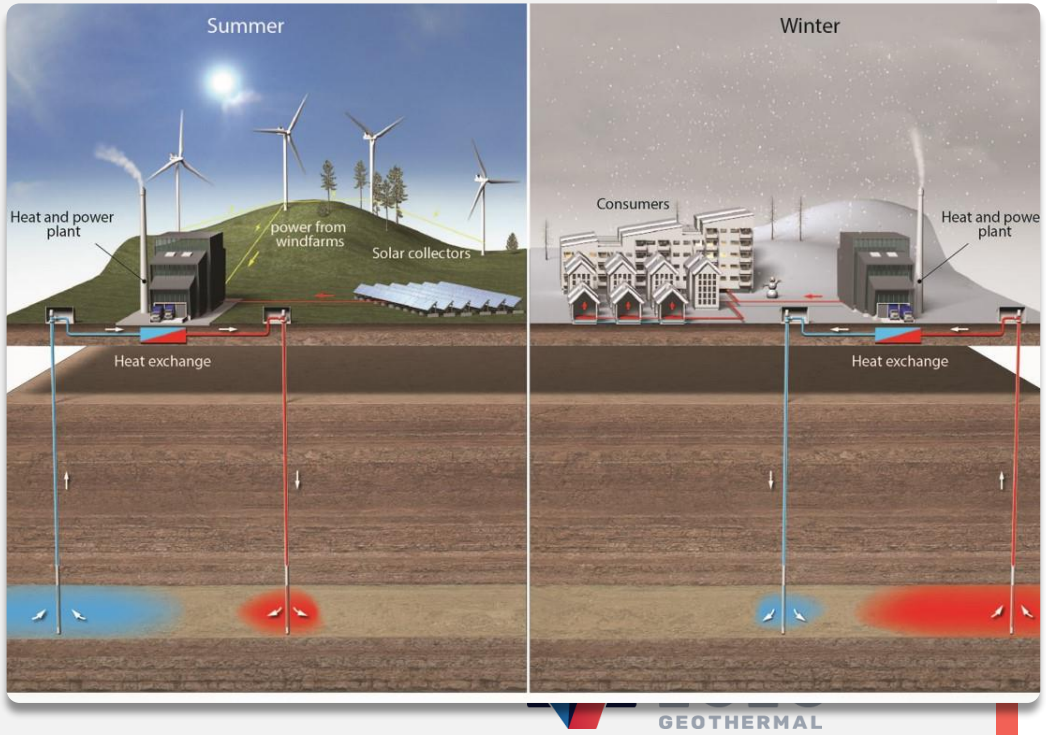
Storage

- 50% of the European energy demand is for heating
- Bridging the winter peak is essential
- Scale of subsurface needed
- Similar but not the same!



Source: M. Victoria, K. Zhu, et all, Energy Conversion and Management 201 (2019) 111977



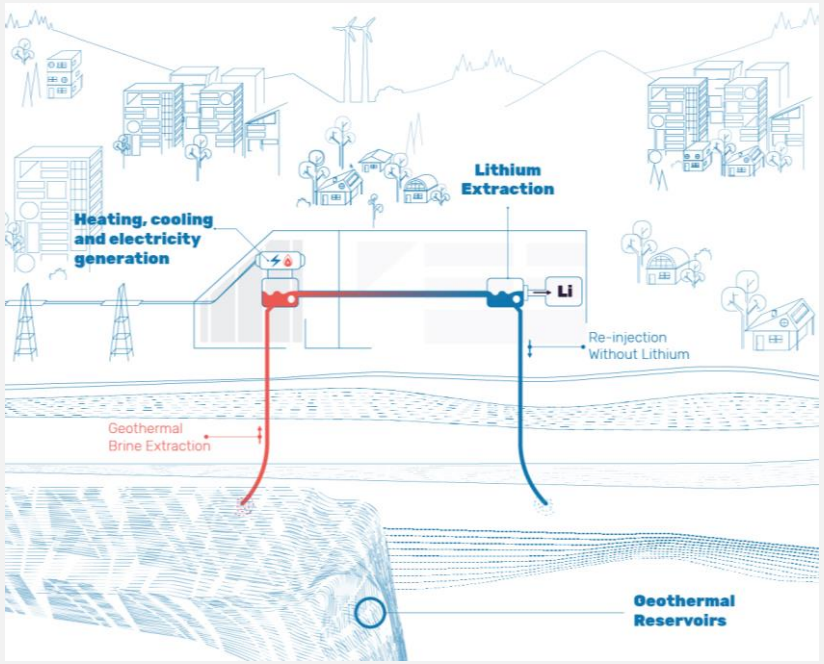


Graphics courtesy HEATSTORE www.heatstore.eu

Geothermal minerals

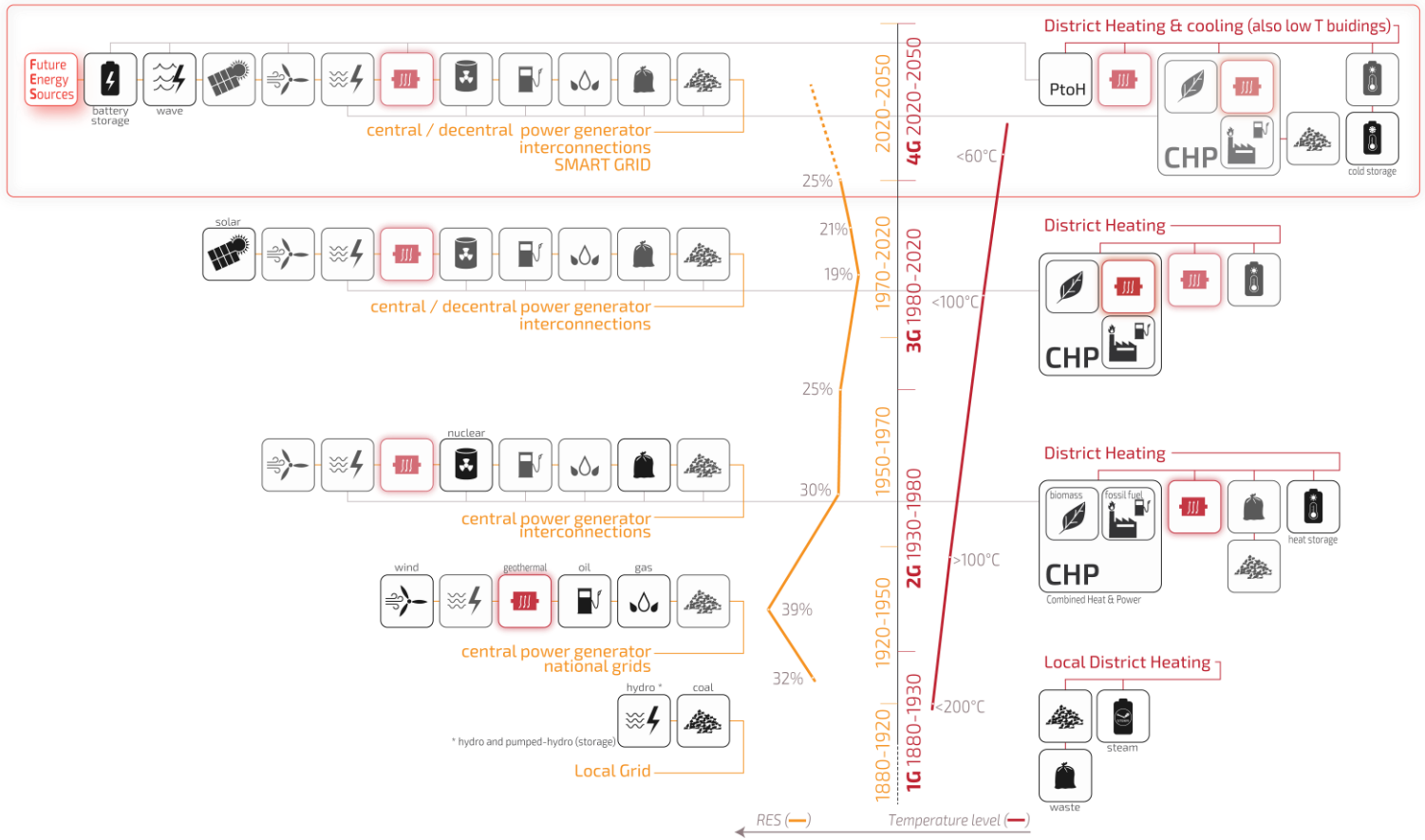






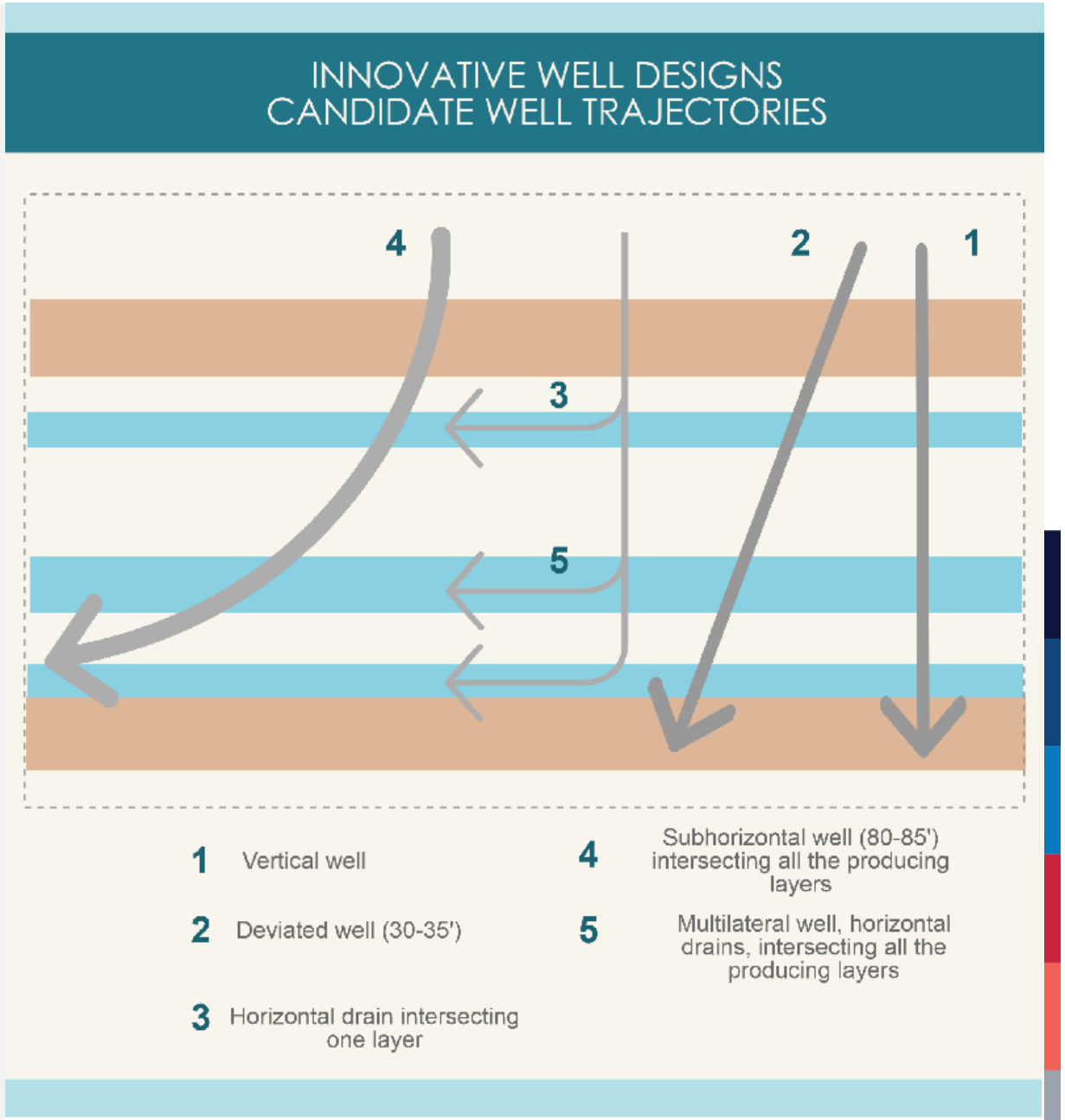
Unlocking Geothermal Energy: Heat development

> Operative temperatures of the DHC network can be reduced
> By demand site management or by thermal energy storage it will be possible to balance heat demand and supply in a DH network.
> Cascade applications
> CHP



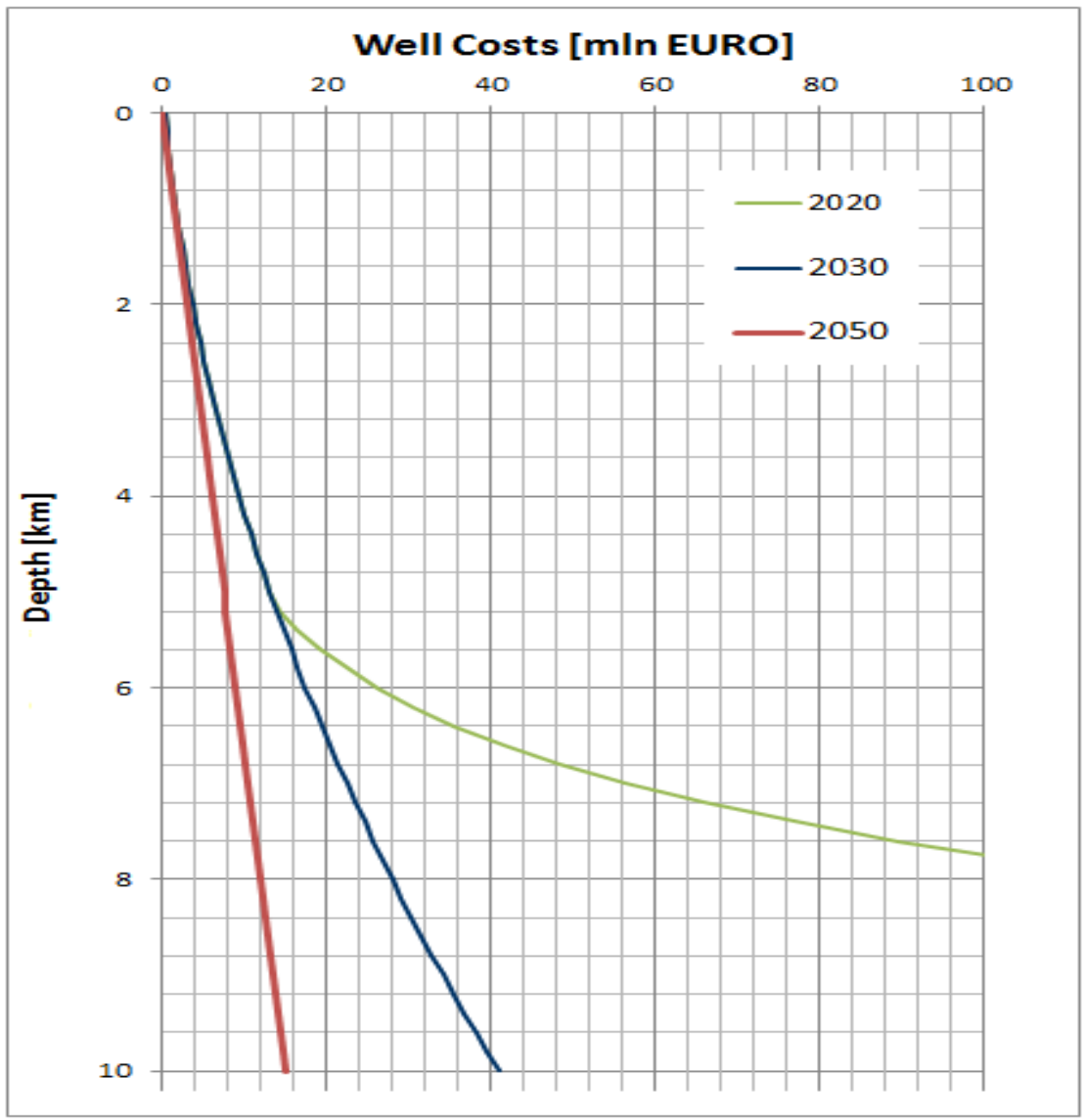
Evolution of power generation and district heating

Trends in drilling technology



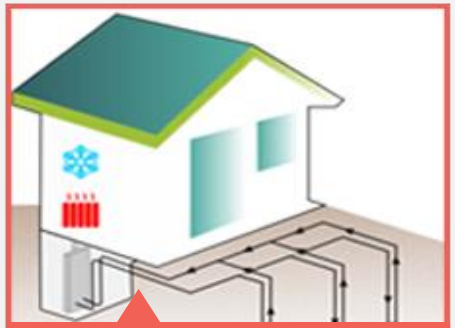
Reducing drilling costs with RD&I

The challenge of Well costs: from exponential to linear curves

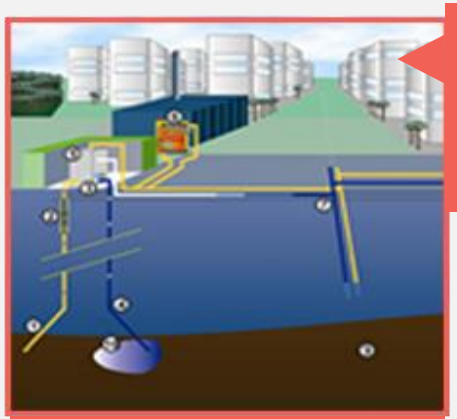


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Geothermal heating and cooling technologies



Heat pumps

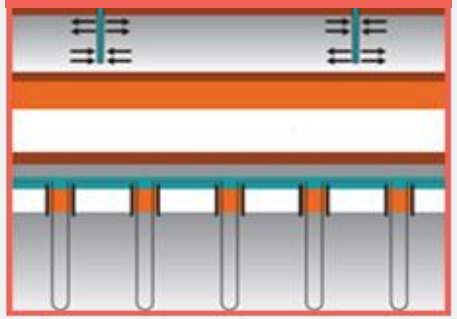


District heating and cooling

EGS and cogeneration



Underground thermal storage





Industrial uses: e.g. in agro-industry

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2022 - #Geothermaldecade



- Exponential growth by 2030
- New and diverse applications for geothermal energy

- Geothermal energy is bound to become the **bedrock of energy transition**. This will be the **#GeothermalDecade**.

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