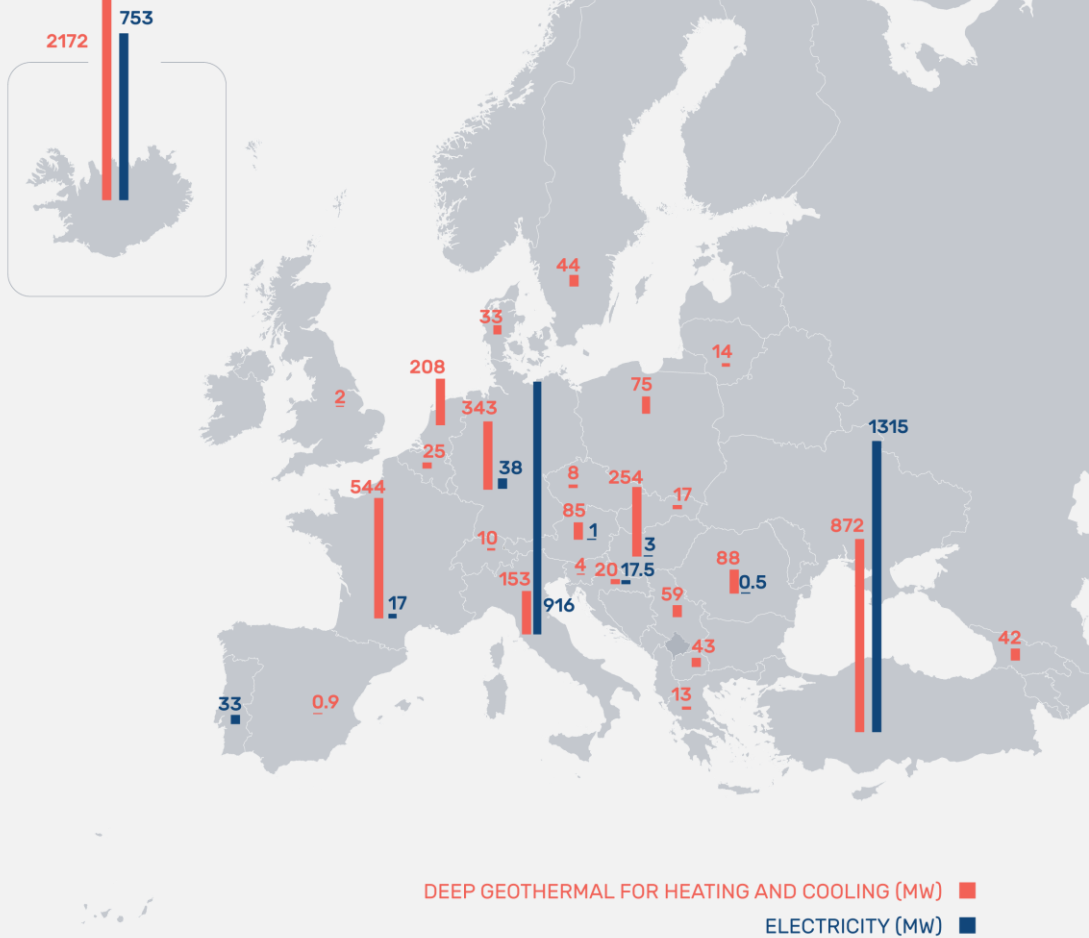


EGEC Geothermal Market Report 2018

20/06/2019

Deep geothermal in Europe: market overview



Two important milestones:

- 1) More than 3 GWe installed
- 2) More than 300 Geothermal DH in operation

...and soon 2 millions geothermal HPs !

Geothermal electricity in Europe:

- 3.1 GWe capacity
- 10% average annual growth rate over the last 5 years

Geothermal district heating in Europe:

- 5.1 GWth capacity



Electricity // Summary of key conclusions

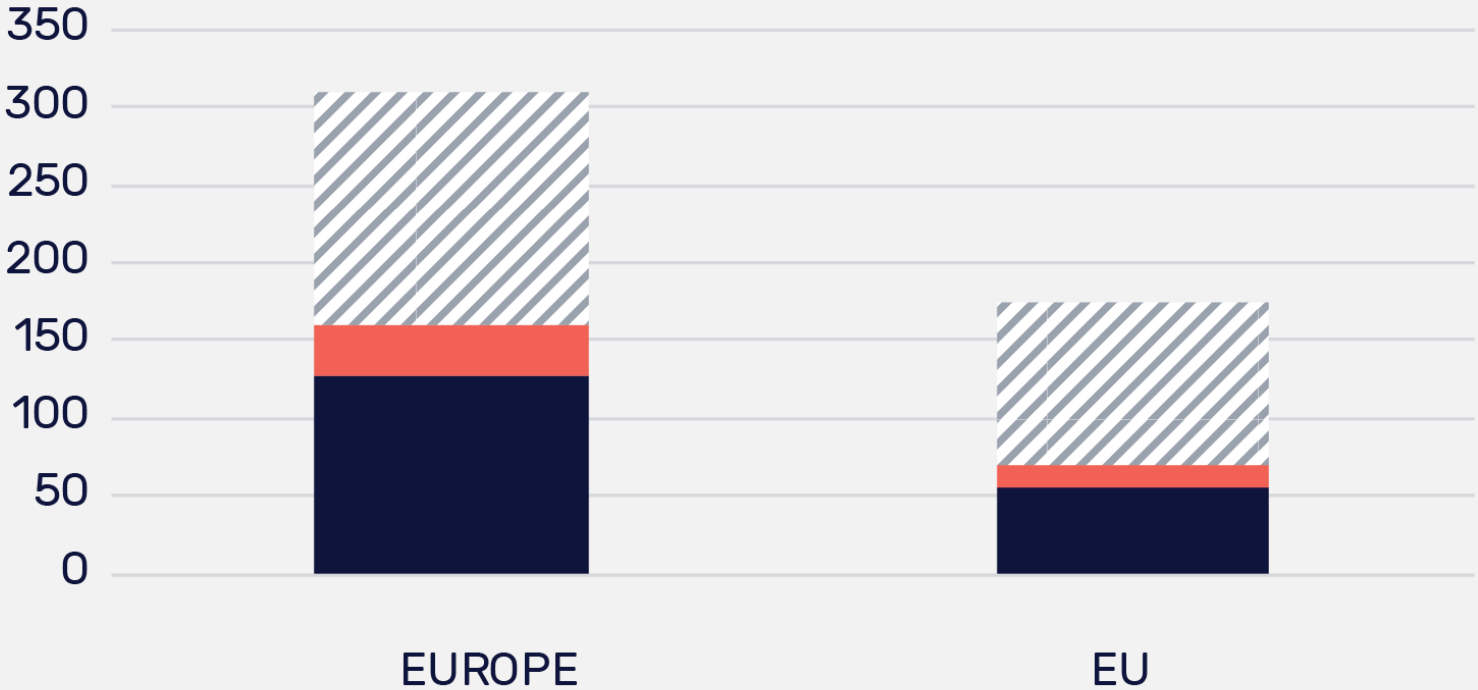
State of Play in 2018

- Europe passes the 3 GWe threshold for installed capacity
- Sustained growth rate of 10%/year
- 2018: 352 MWe added

127 Geothermal Power Plants

- 13 new power plants in 2018 in Turkey, 1 new in Iceland
- Croatia becomes a geothermal electricity producer

Number of power plants in Europe in 2018



■ In operation

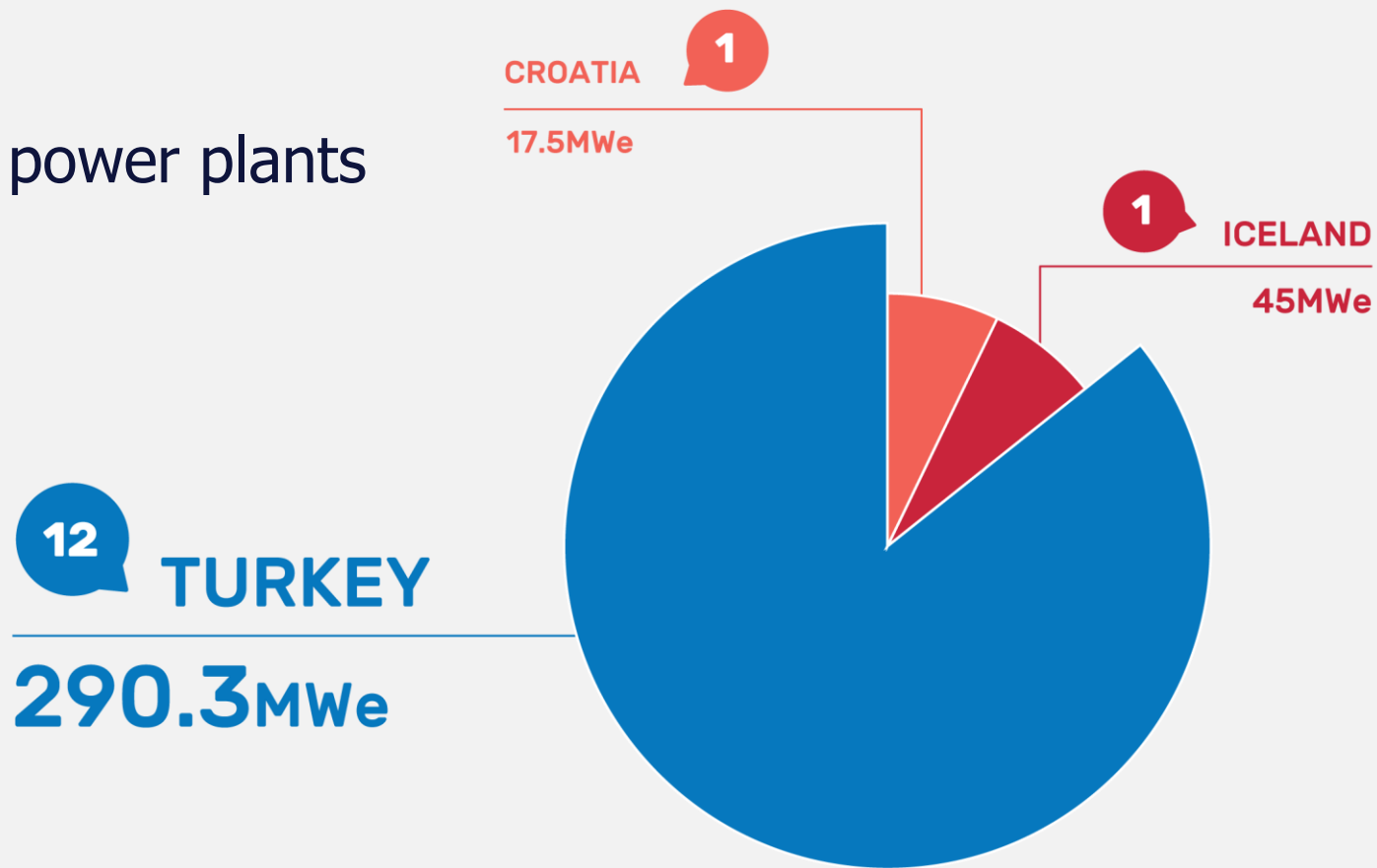
■ Under development

▨ Under investigation

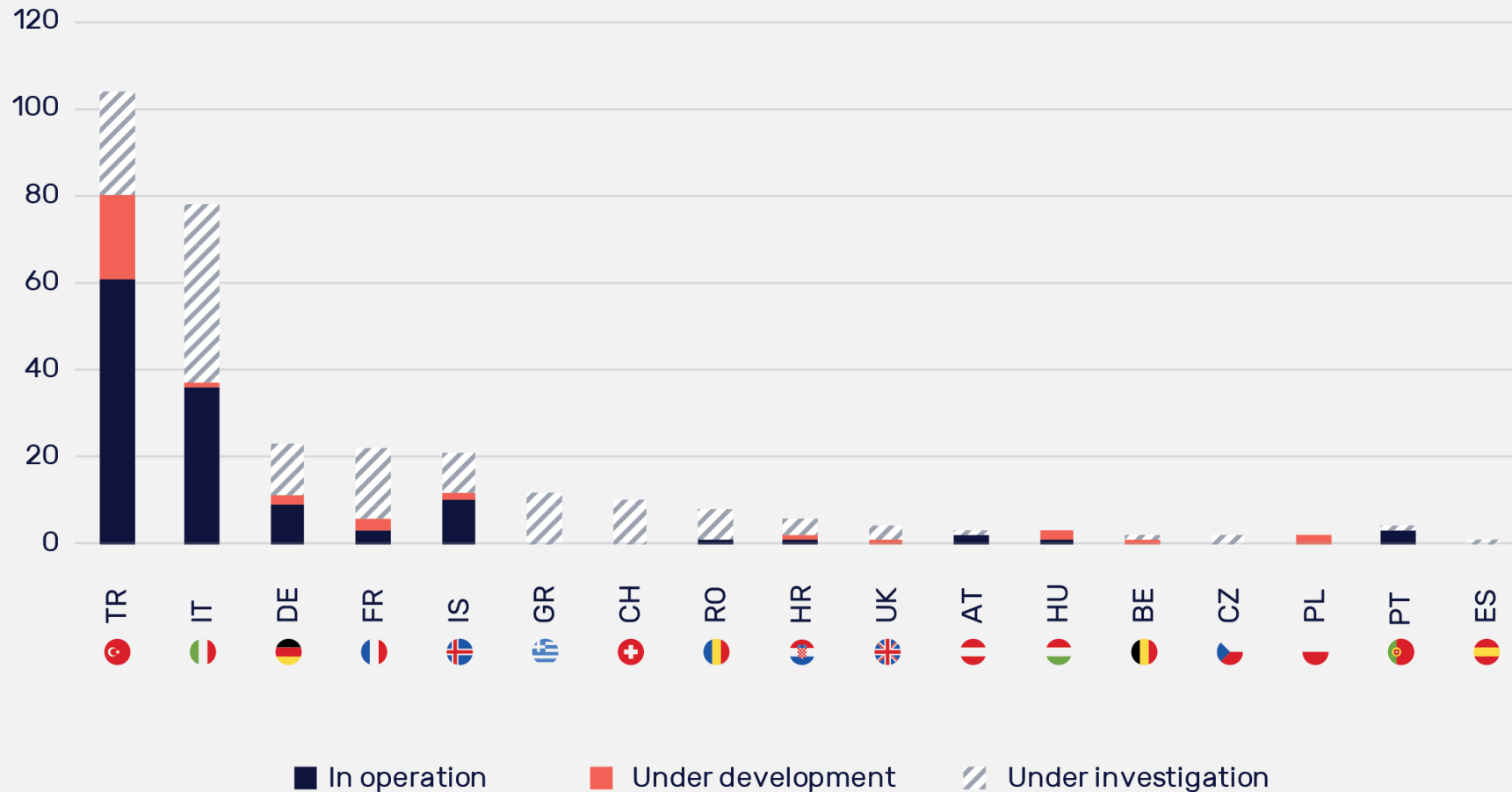


New installed capacity in 2018 by country

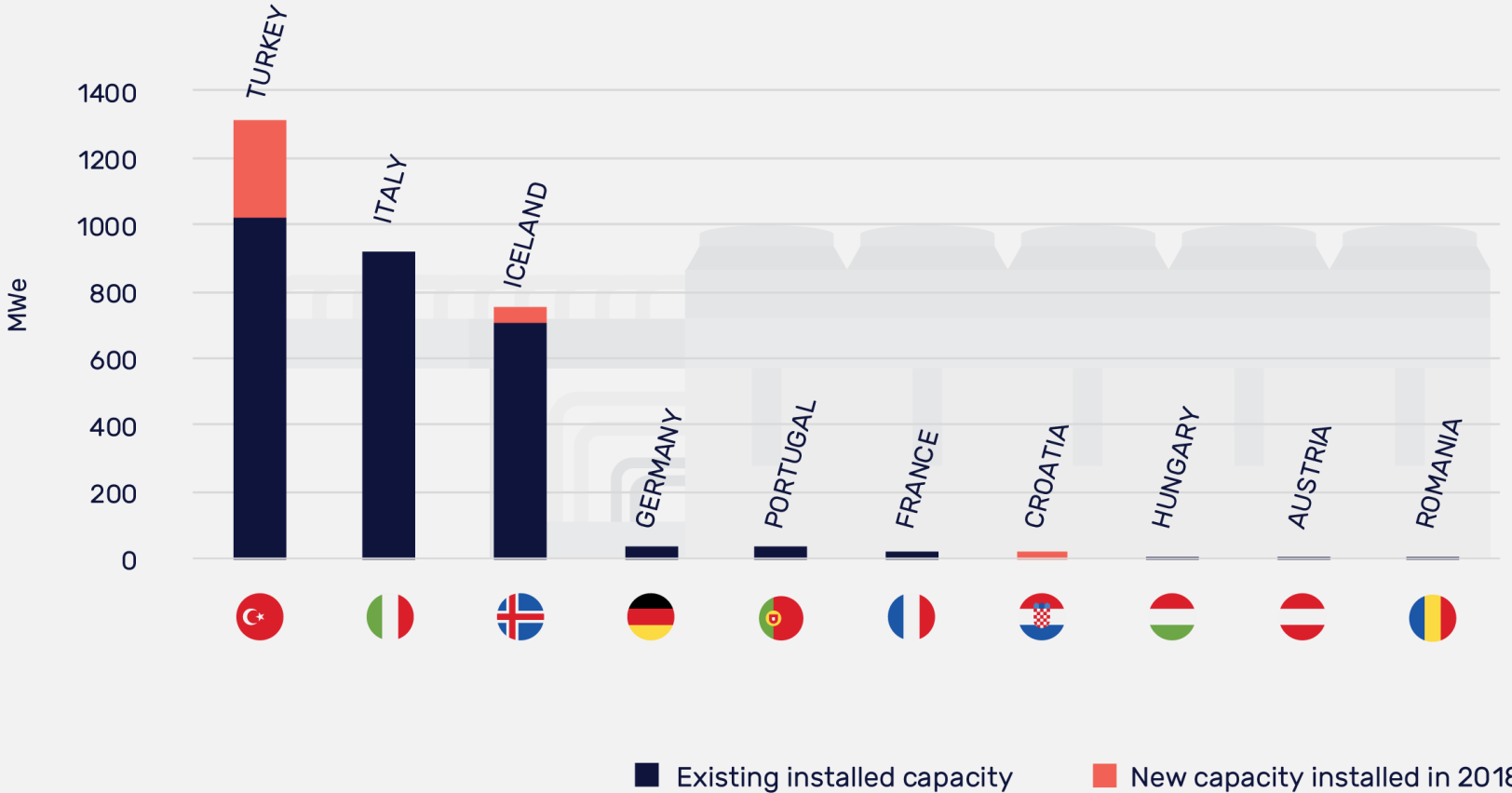
And number of geothermal power plants



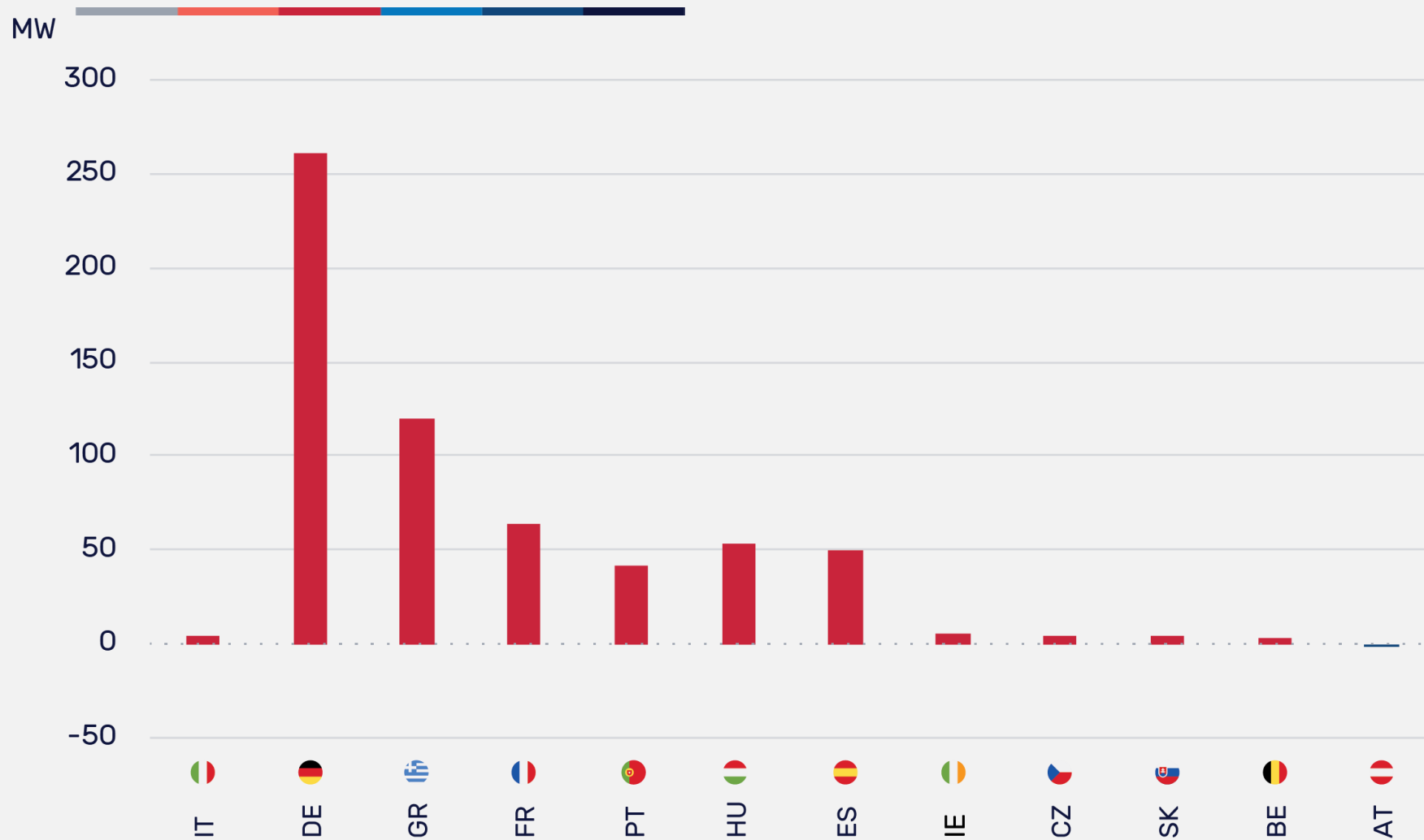
Number of geothermal power plants per country



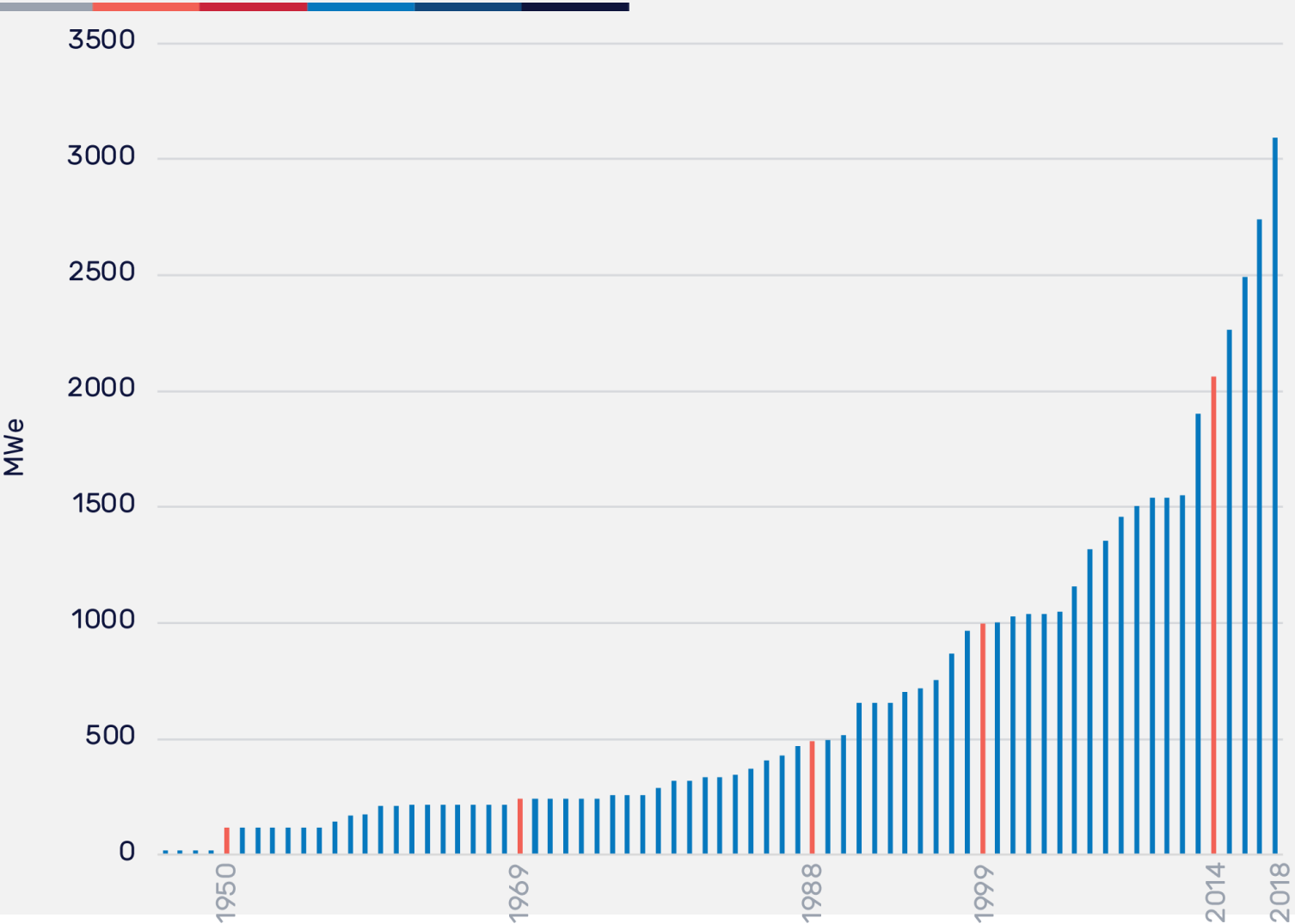
Installed electricity capacity by country in Europe (MWe)



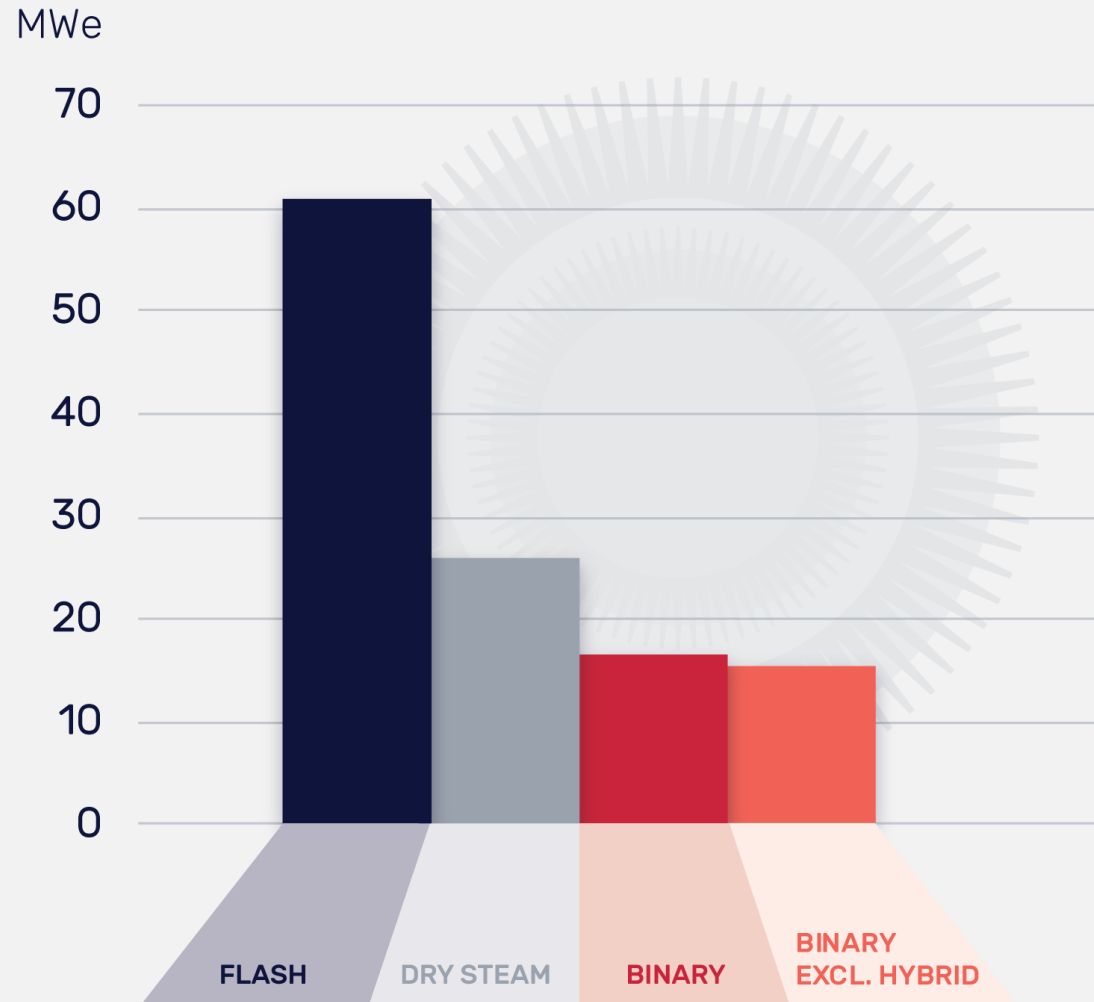
Gap to achieving the geothermal electricity 2020 target in NREAPs (MWe)



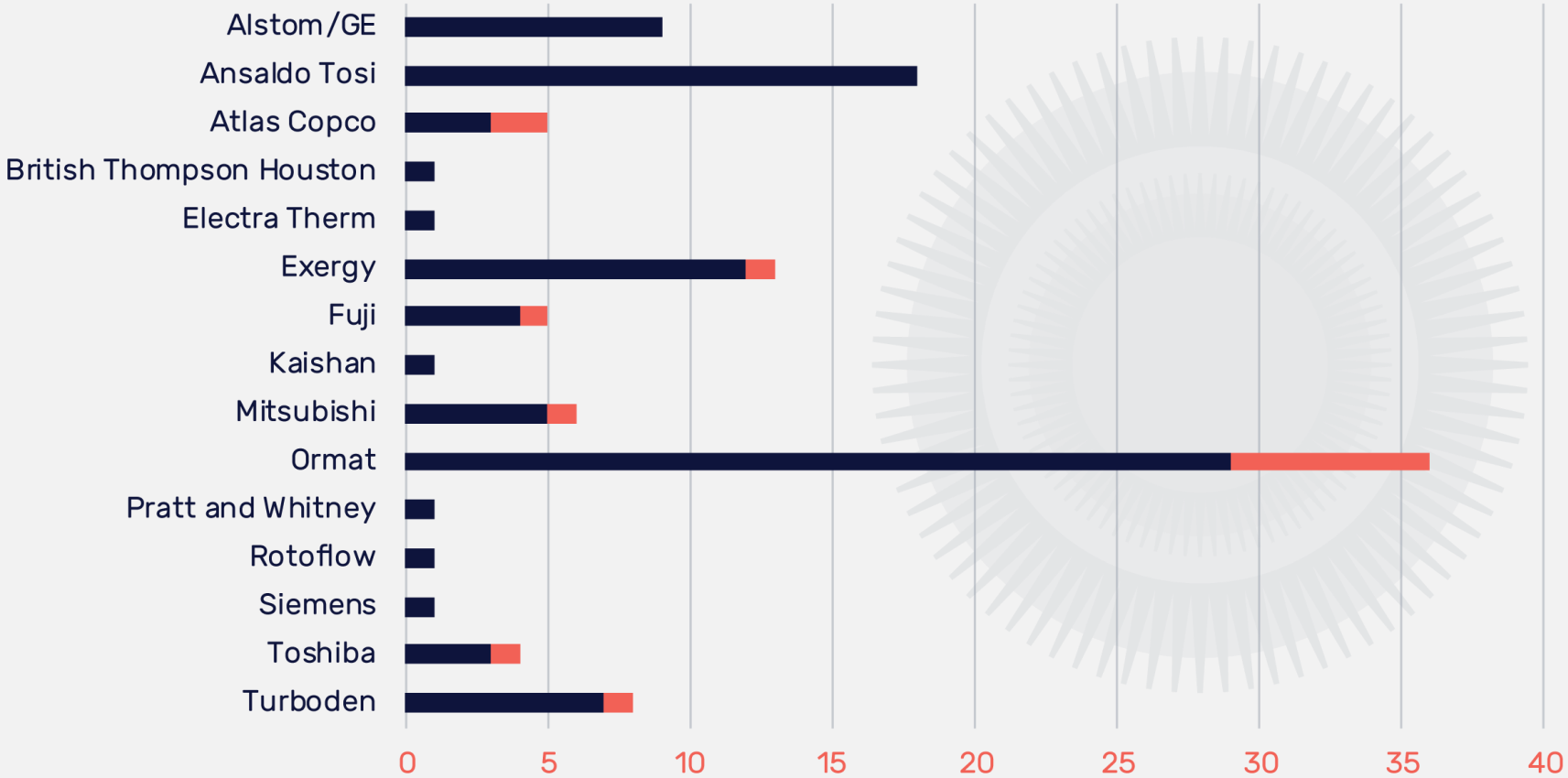
Geothermal electricity capacity in Europe



Average size of geothermal electricity turbines by types of plants

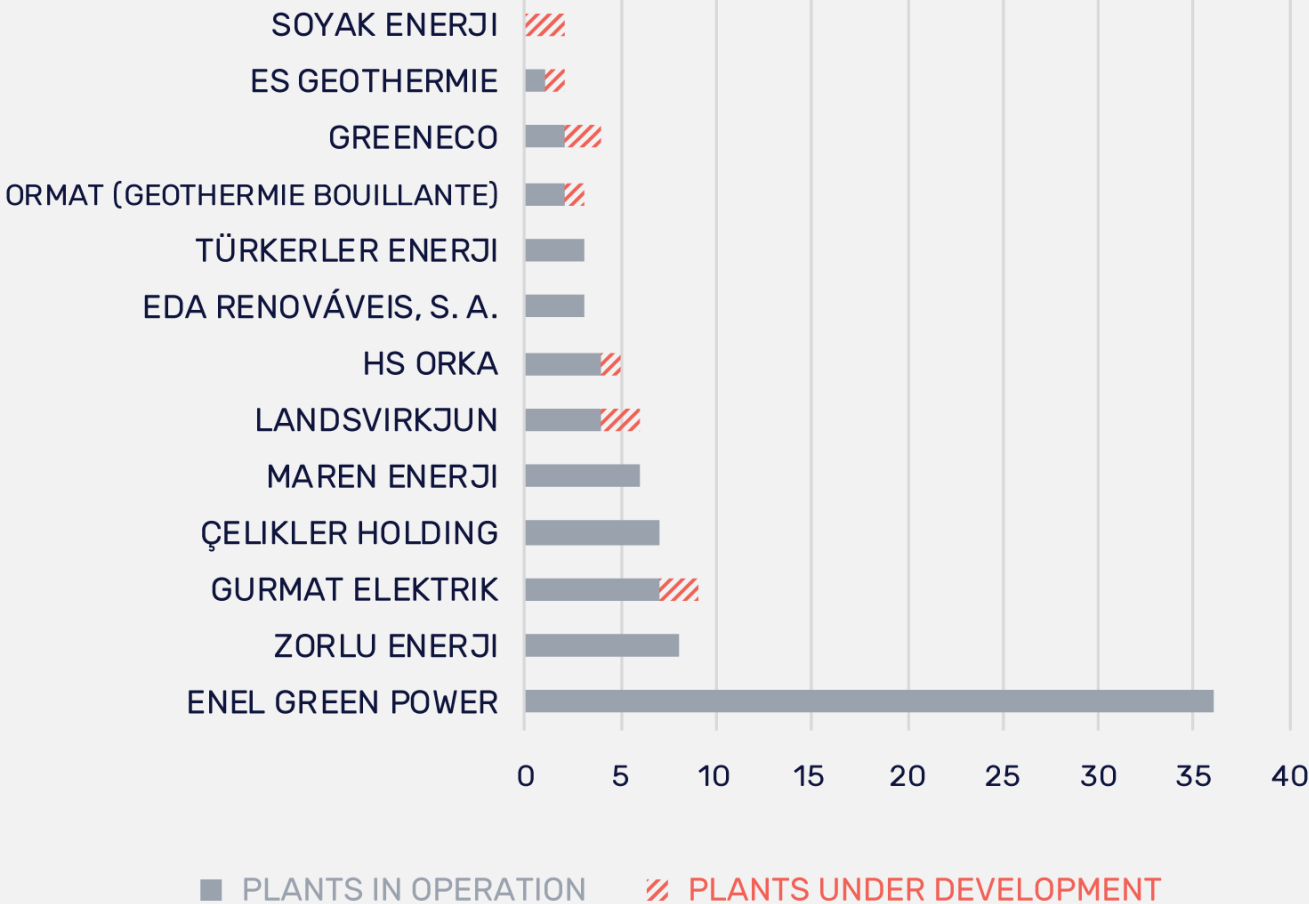


Number of installed turbines by manufacturer



■ NEW IN 2018

Main operators geothermal power plants in Europe



Main geothermal power operators in Europe	Country	Oldest plant in operation (year)
ENEL GREEN POWER	ITALY	1986
ZORLU ENERJİ	TURKEY	1984
GURMAT ELEKTRİK	TURKEY	2009
ÇELIKLER HOLDING	TURKEY	2013
MAREN ENERJİ	TURKEY	2011
LANDSVIRKJUN	ICELAND	1969
HS ORKA	ICELAND	2006
EDA RENOVÁVEIS, S. A.	PORTUGAL	1998
TÜRKERLER ENERJİ	TURKEY	2014
GREENECO	TURKEY	2016
ORMAT (GEOTHERMIE BOUILLANTE)	FRANCE	1986



Main Geothermal electricity developers in Europe



Main developers of geothermal power plants in Europe

Developer	Country
Fonroche Géothermie	France
Sorgenia	Italy
PPC Renewables & ELLAKTOR	Greece
HS Orka	Iceland
Tosco Geo	Italy
ENEL Green Power	Italy
MB Geothermal	Turkey
Greeneco	Turkey

District heating // Summary of key conclusions

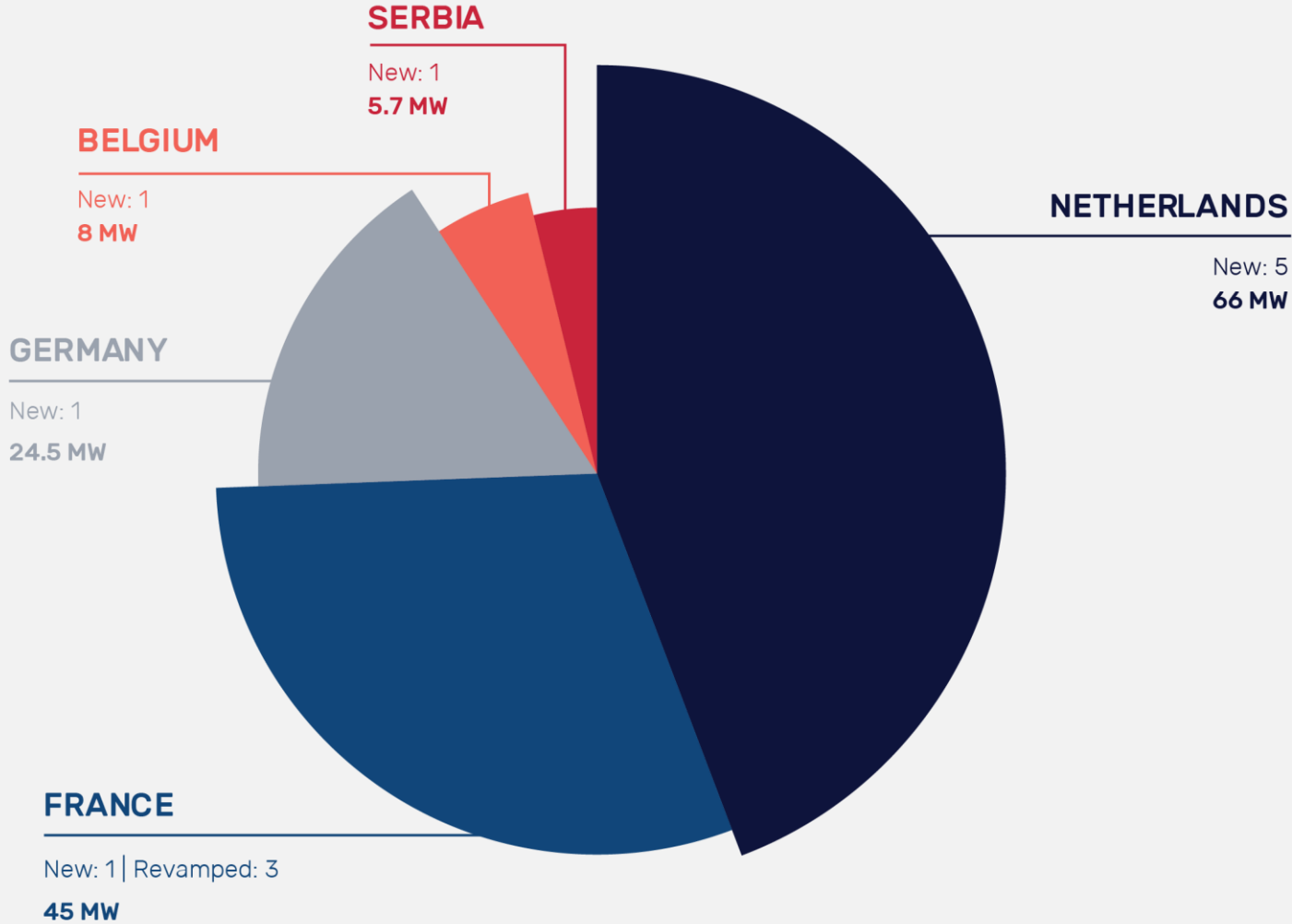
State of Play in 2018

- Over 5 GWth of geothermal DH
- 12 new or renovated plants over the last year, 150MWth

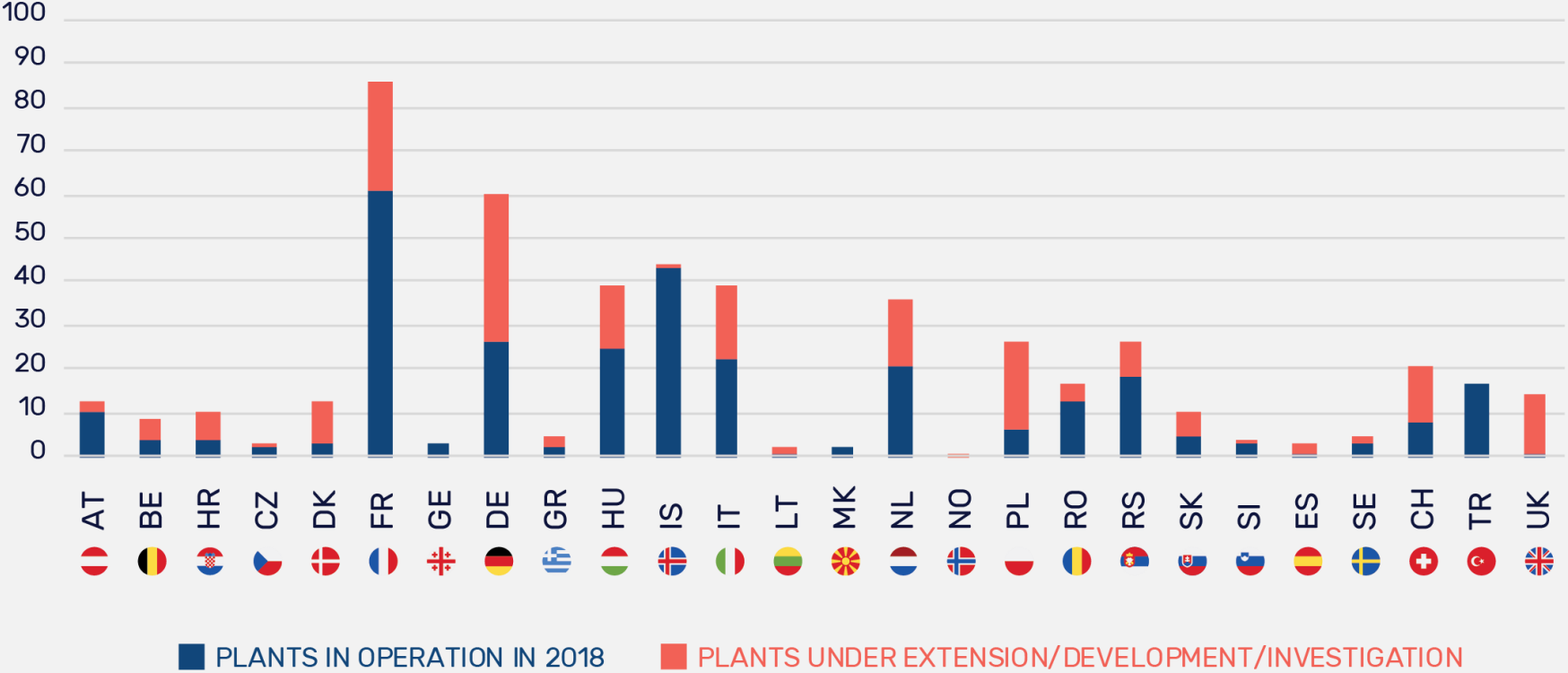
300 Geothermal DH Plants

- 5 new project commissioned in the Netherlands
- 1 new and 3 renovated plants in France
- 1 new project in Serbia
- 1 new project in Belgium
- 1 new project in Germany

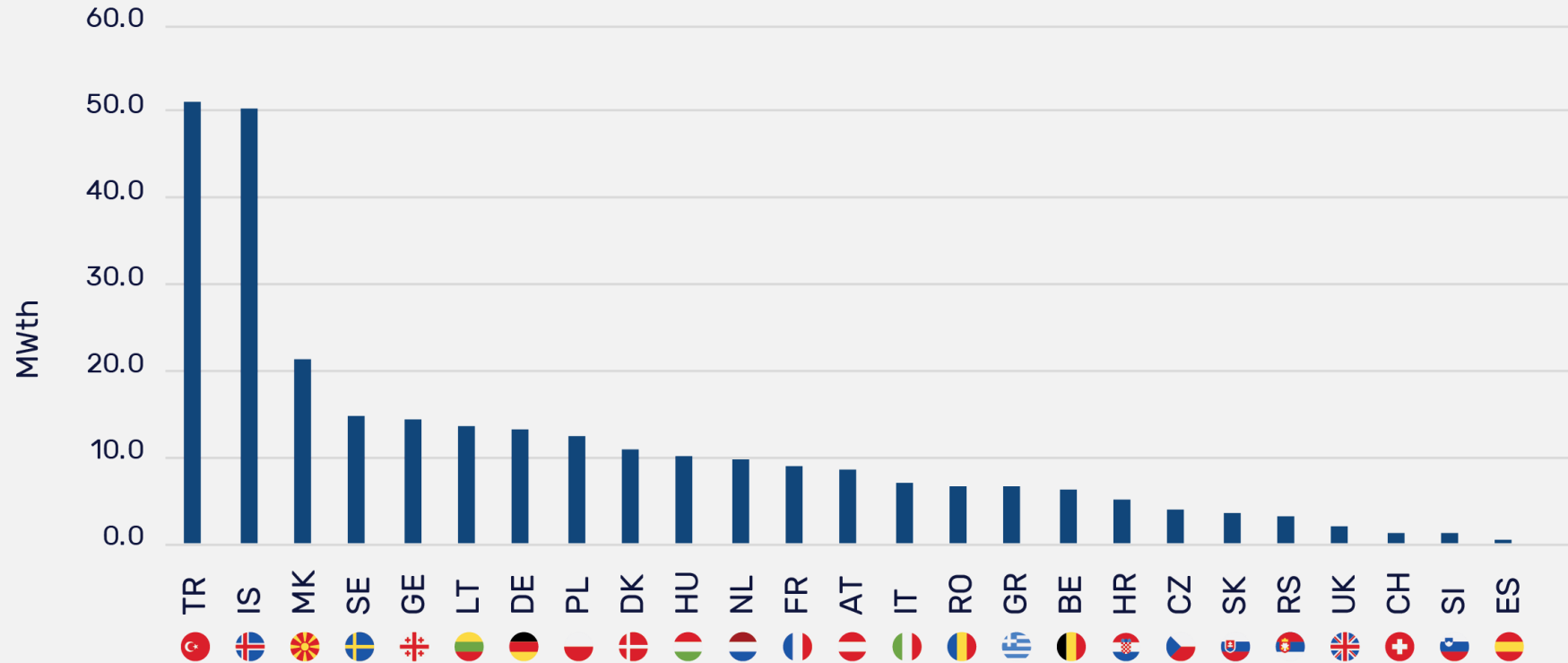
New plants for deep geothermal for heating and cooling in 2018 (capacity and number)



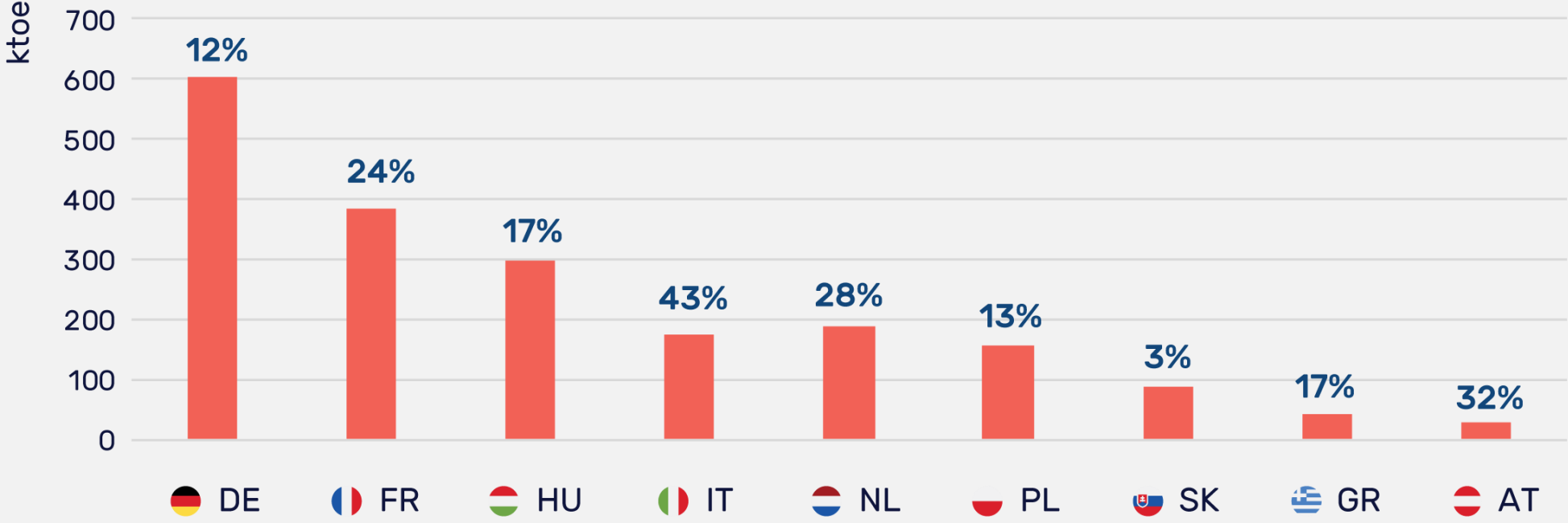
Number of GeoDH plants in operation and under development-investigation per country



Average size of deep geothermal heating and cooling plant per country



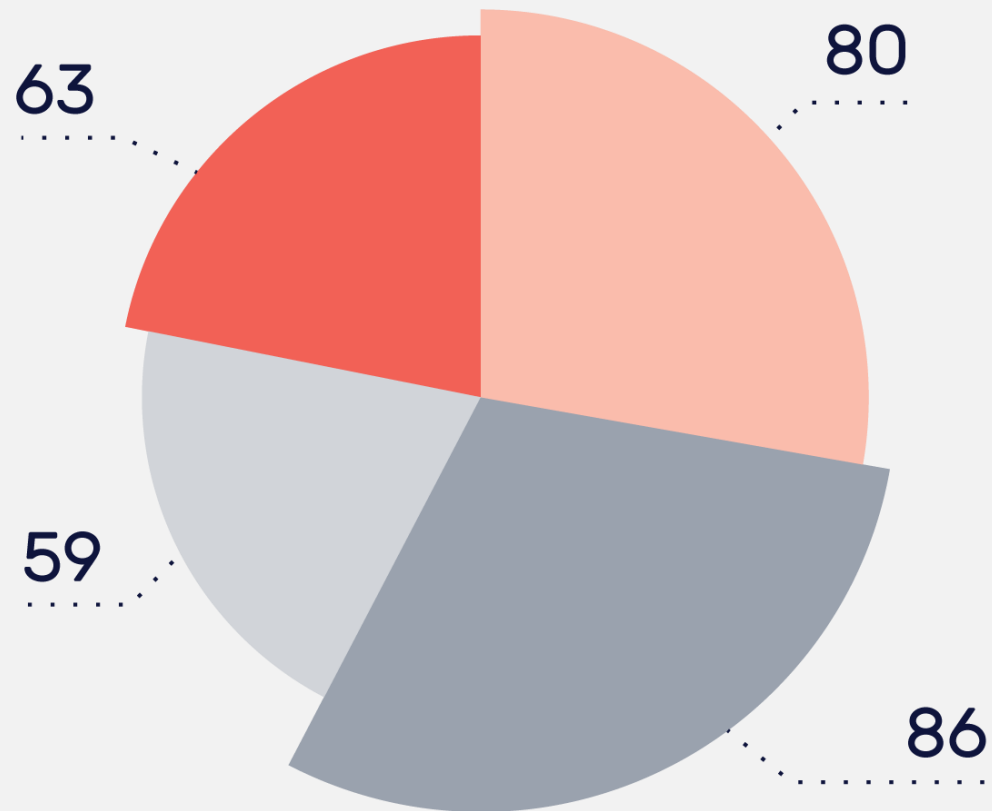
Gap to deep geothermal heating and cooling objectives in NREAPs



% COMPLETION NREAP OBJECTIVE



Typology of geothermal heating and cooling projects operators in Europe

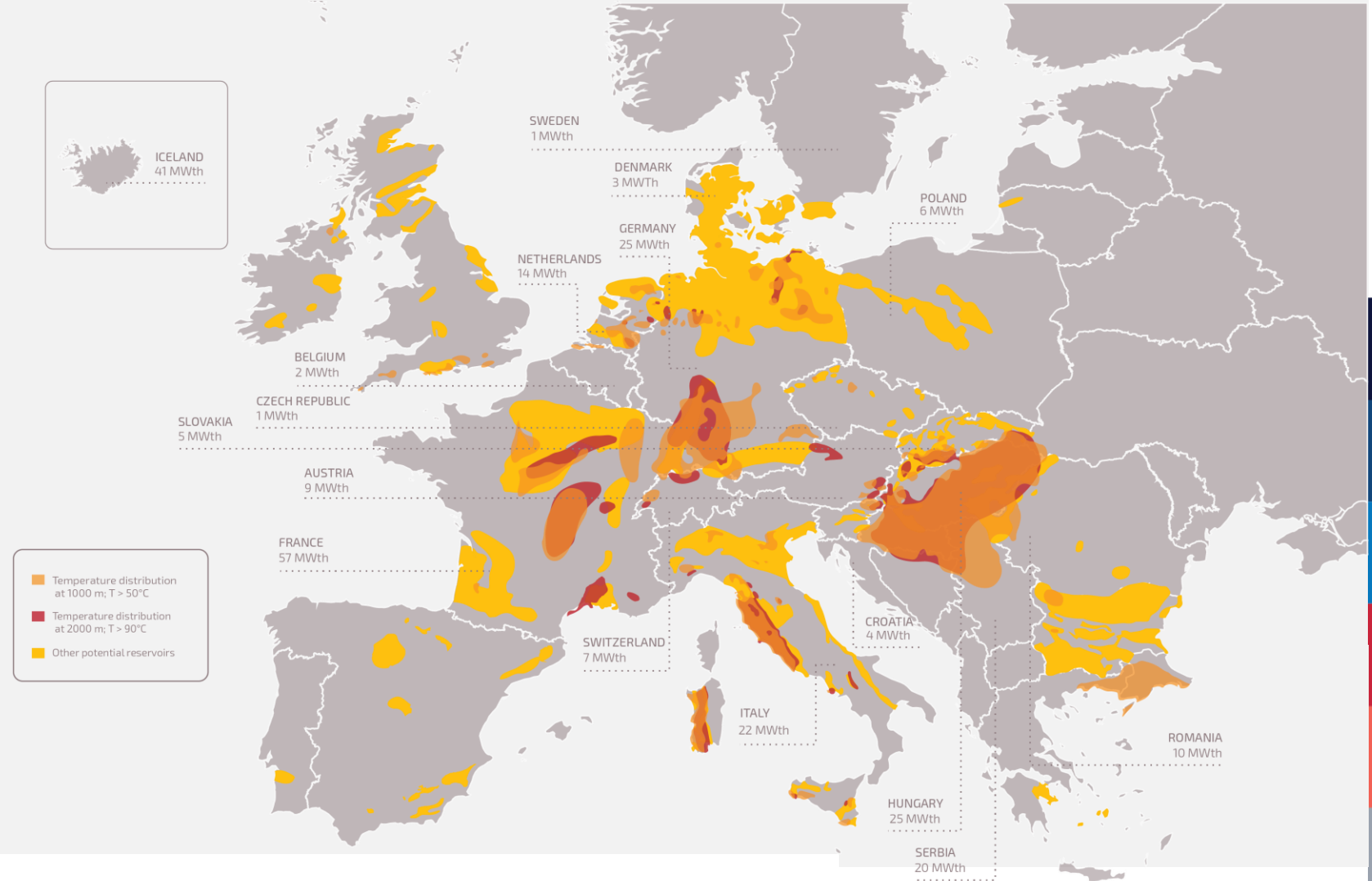


- Public authority
- Local energy company
- Large private operator
- Smaller private operator

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

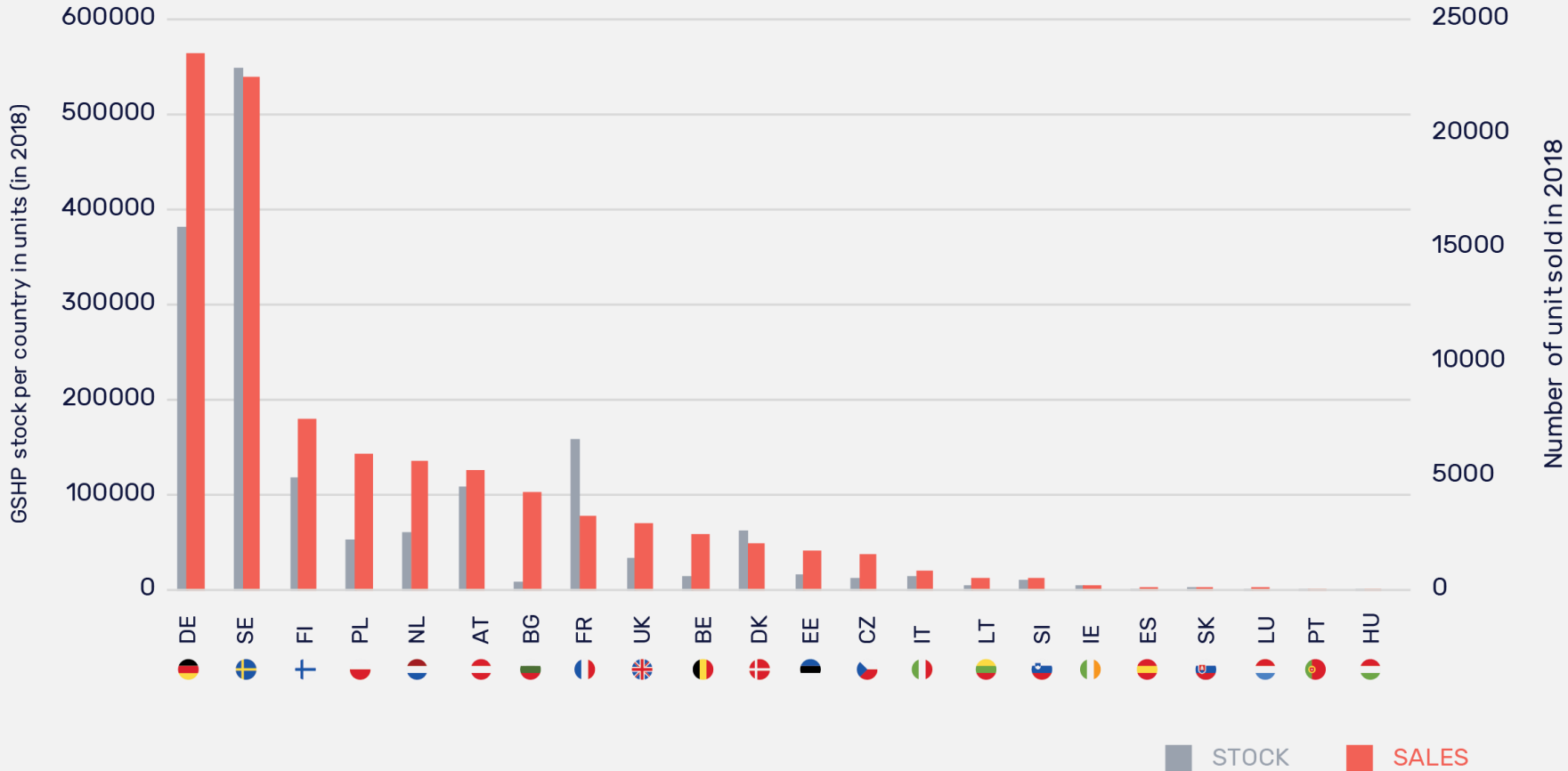


Shallow geothermal // Summary of key conclusions

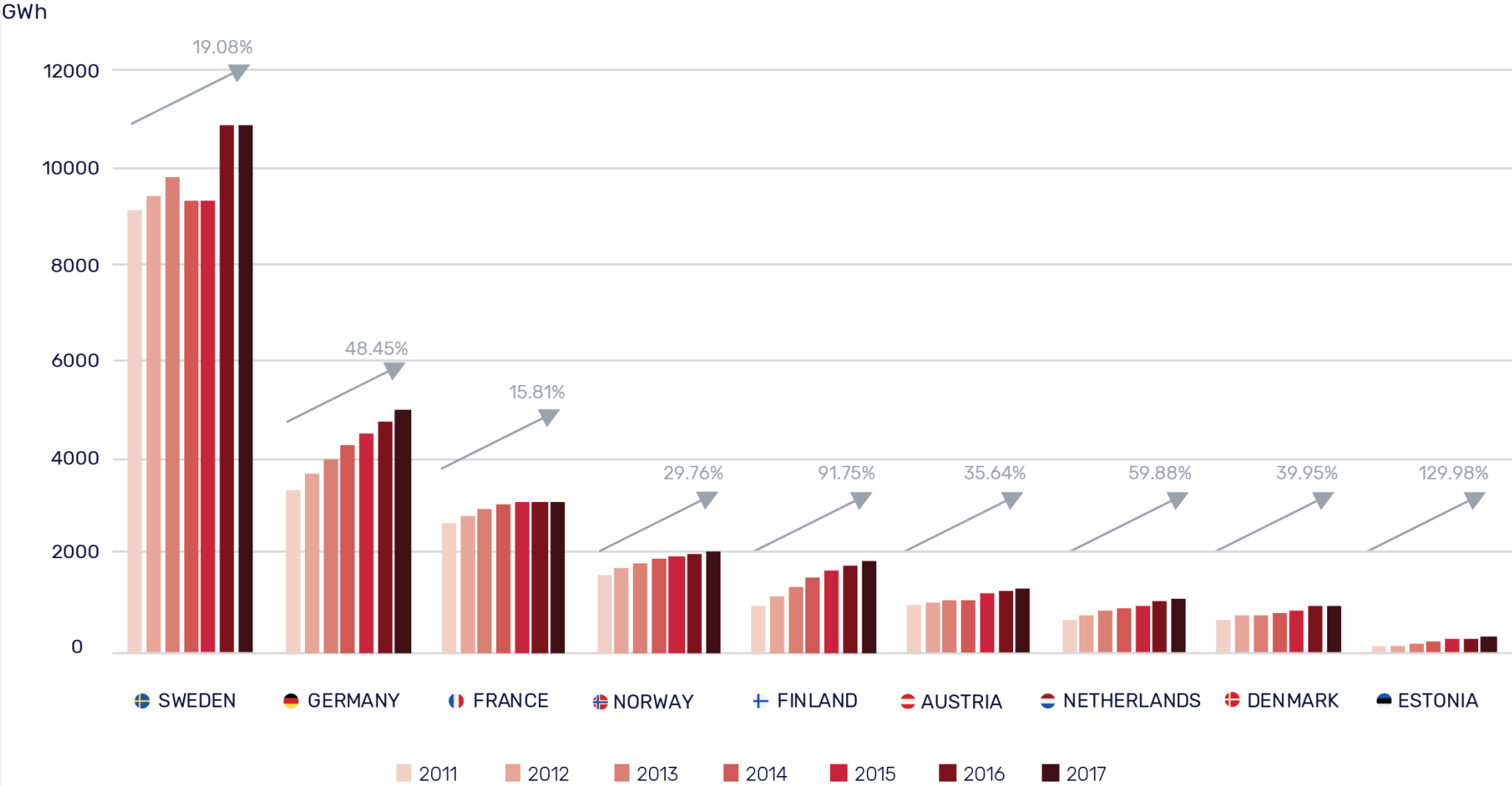
State of Play in 2018

- Total Installed Capacity in Europe: ca.23.000 MWth
- More than 1.9 million units

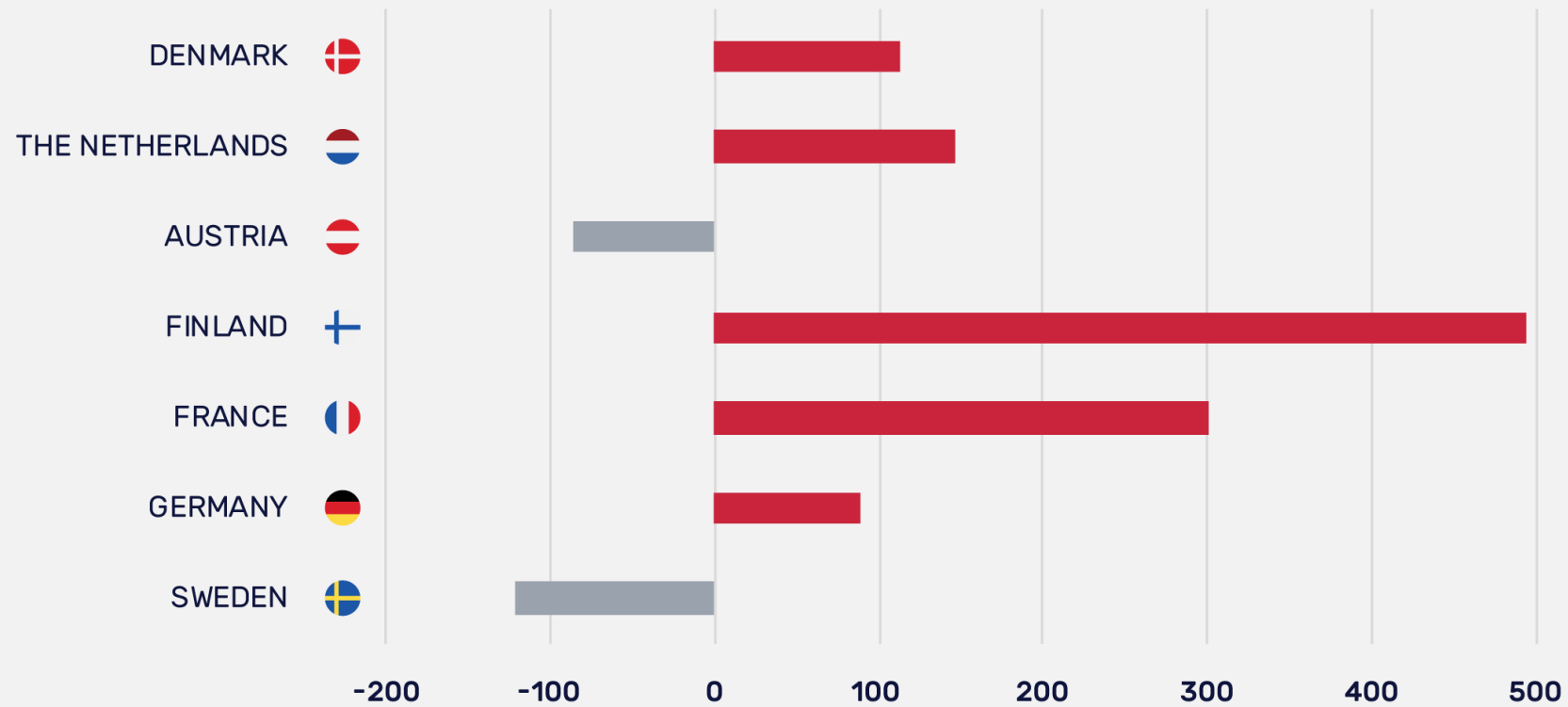
Stock and sales geothermal heat pumps in 2018



Shallow geothermal energy production in selected European countries

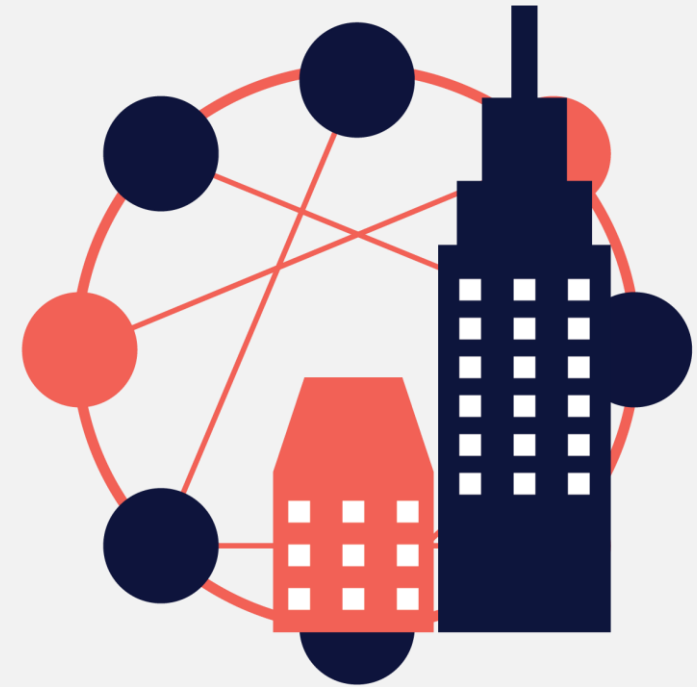


Gap to completion of NREAP objectives on shallow geothermal (ktoe)



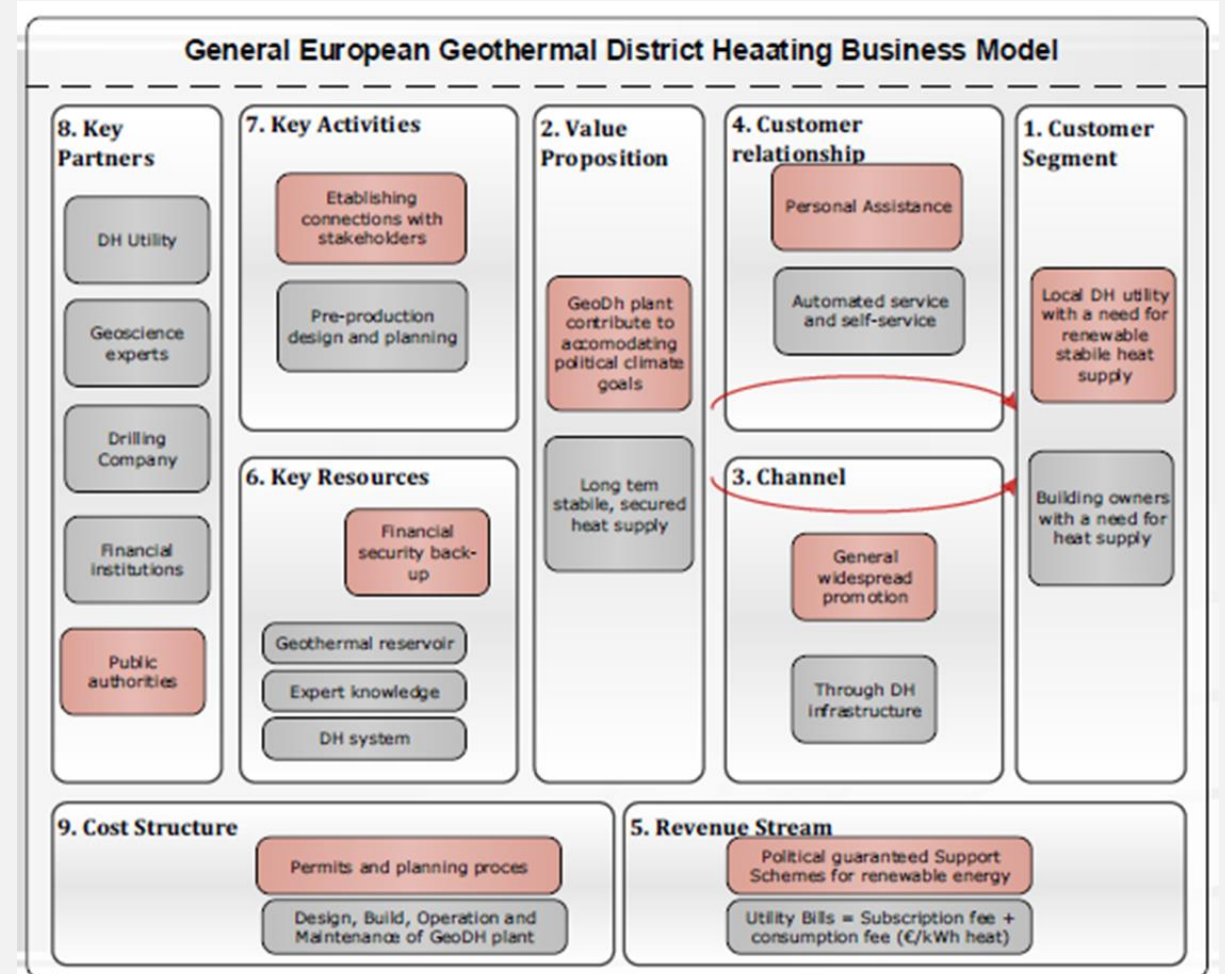
Supplying heat & power to companies

- **CORPORATE** (physical and virtual) PPA (also to cooperatives and through networks)
- **PPP & JOINT VENTURES**: example of ECOGI (France)
- **PROJECT DEVELOPERS**: example of greenhouses in Netherlands

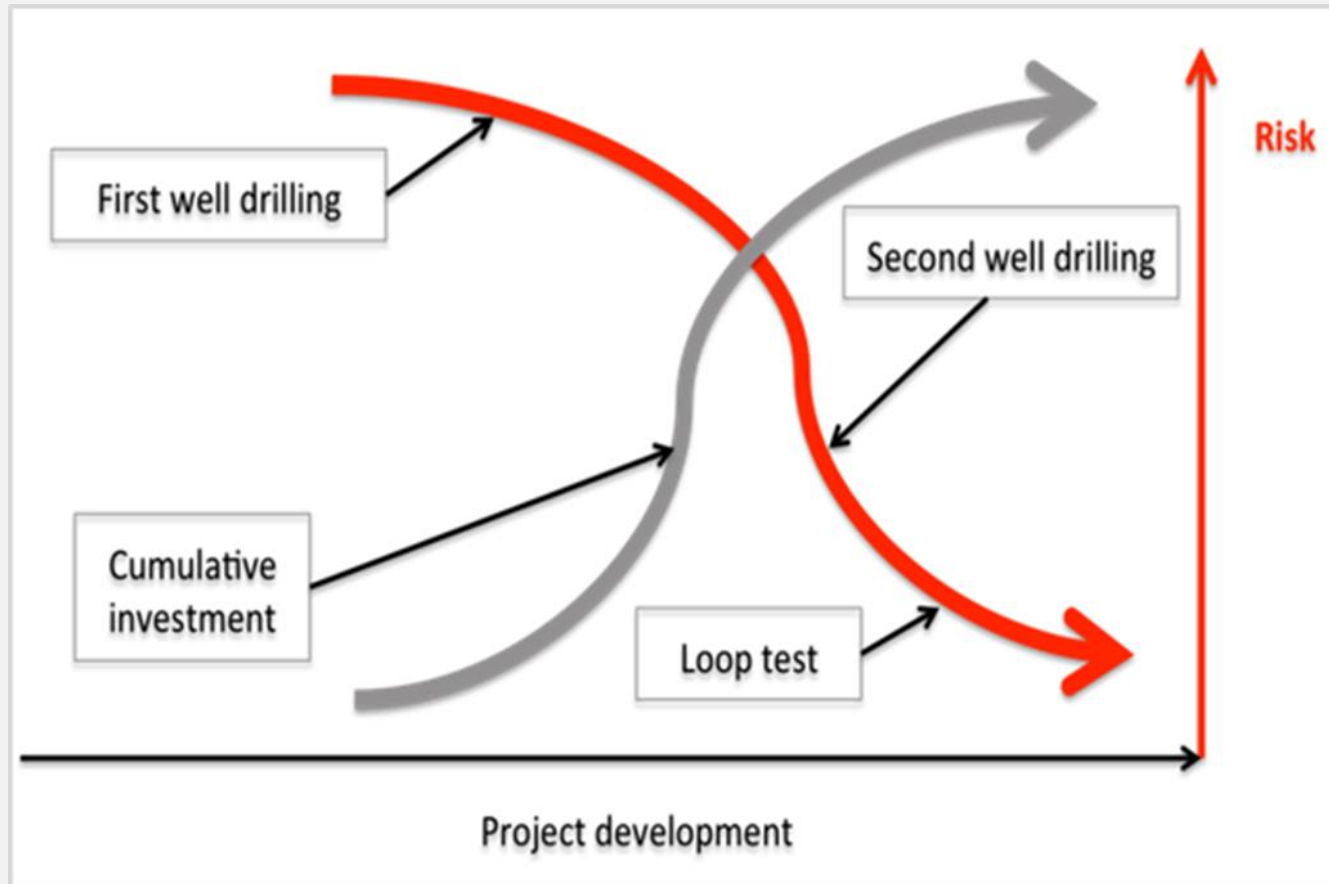


Challenges

- Demand for Heat supply
- Firmness of electricity supply



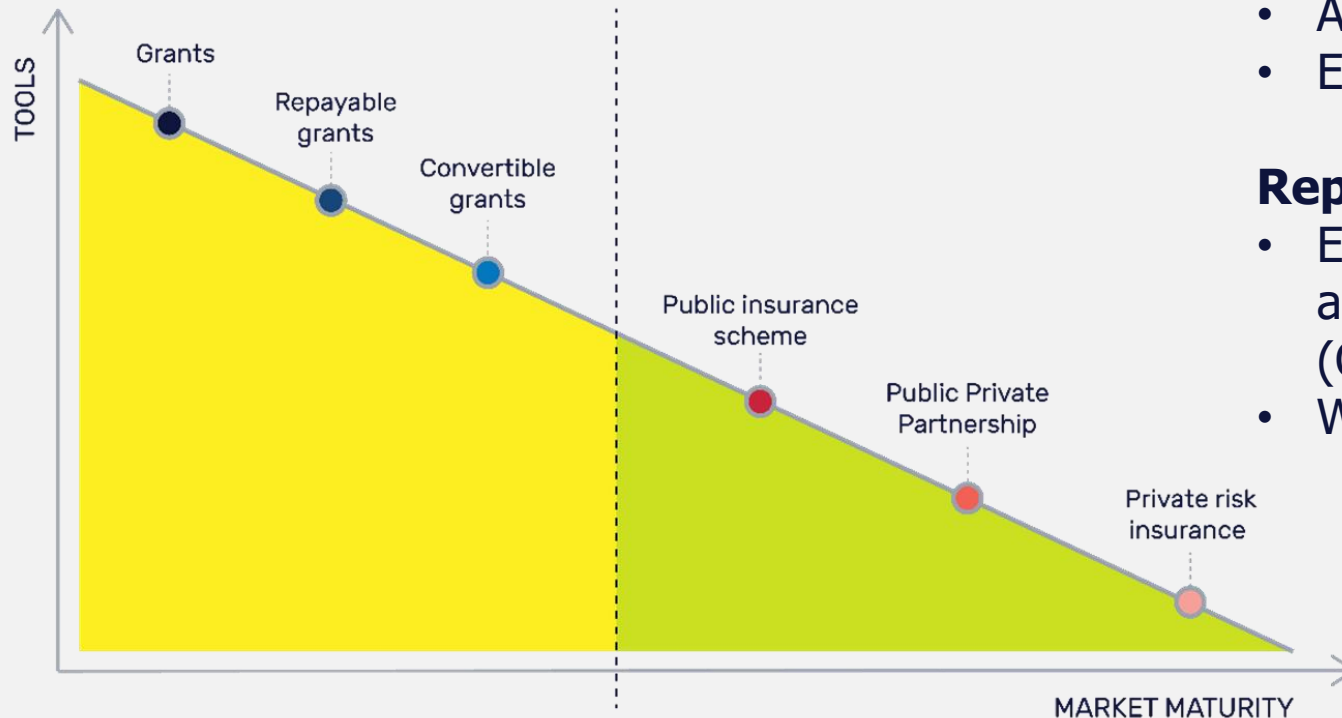
Risks in investments



Two important news:

- **New scheme established in 2018 in Denmark and in Flanders (Belgium)**
- **New scheme accounced for 2019 in Walloon region (Belgium)**

The GEORISK project



Target countries in Europe

- Assess transition in FR, DE, TR, CH
- Establish new schemes in HU, PL, GR

Replication in

- Europe: such as transition in Denmark, Belgium and the Netherlands + New in Croatia, Spain (Canaries Islands)
- Worldwide: transition in Chile, Kenya & Mexico



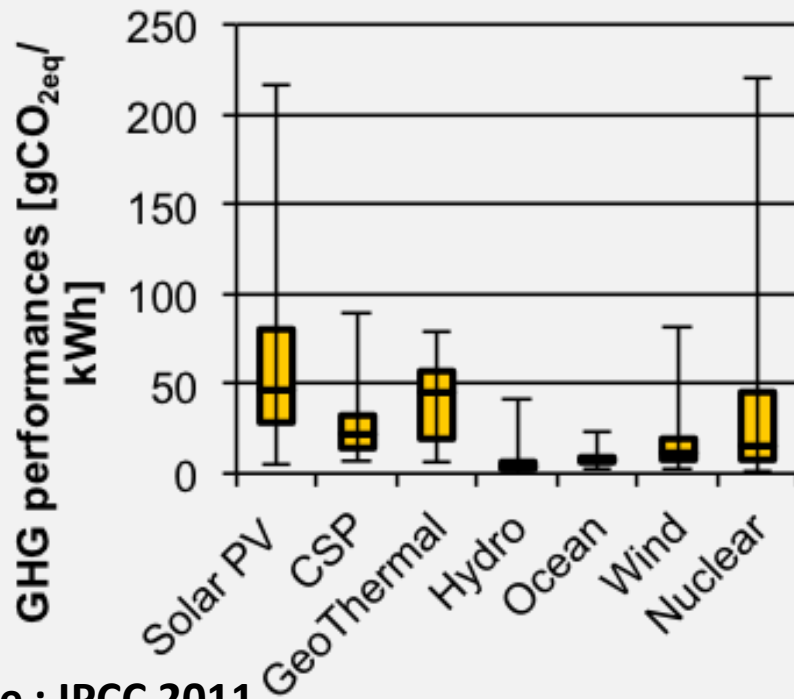
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [818232 — GEORISK]



The GEOENVI project



Carbon footprint of energy pathways



Source : IPCC 2011

Target countries in Europe

- Cover FR, BE, TR, HU, IT, IC

Actions:

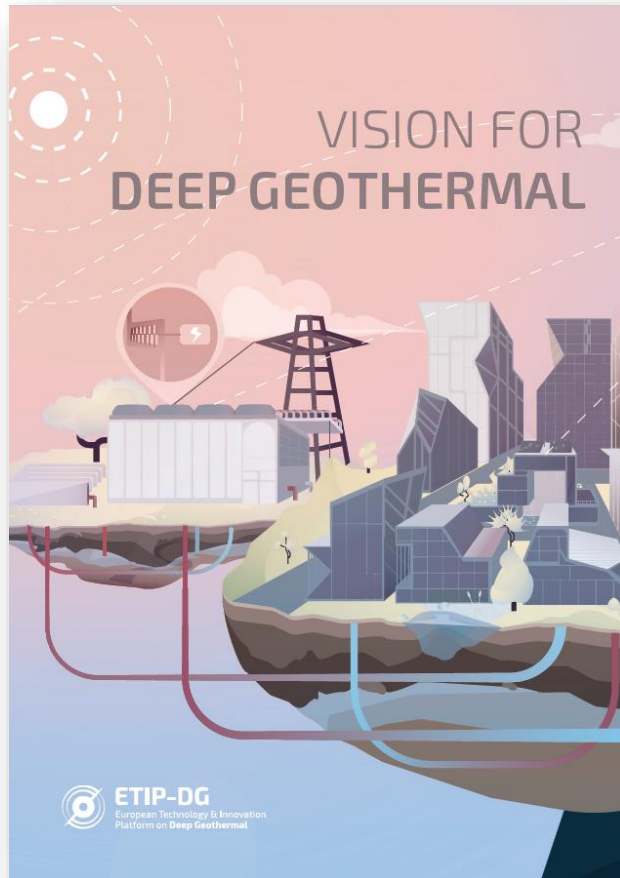
- environmental regulations
- environmental impact, risk and incident
- LCA methodology



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [818242 — GEOENVI]



About the Vision



This VISION looks toward **the future of Deep Geothermal energy development** by 2030, 2040, 2050 and beyond, and highlights the great potential of untapped geothermal resources across Europe. After an **Introduction & Overview** the document briefly describes the **Actual Status of geothermal development** and the VISION's aim for

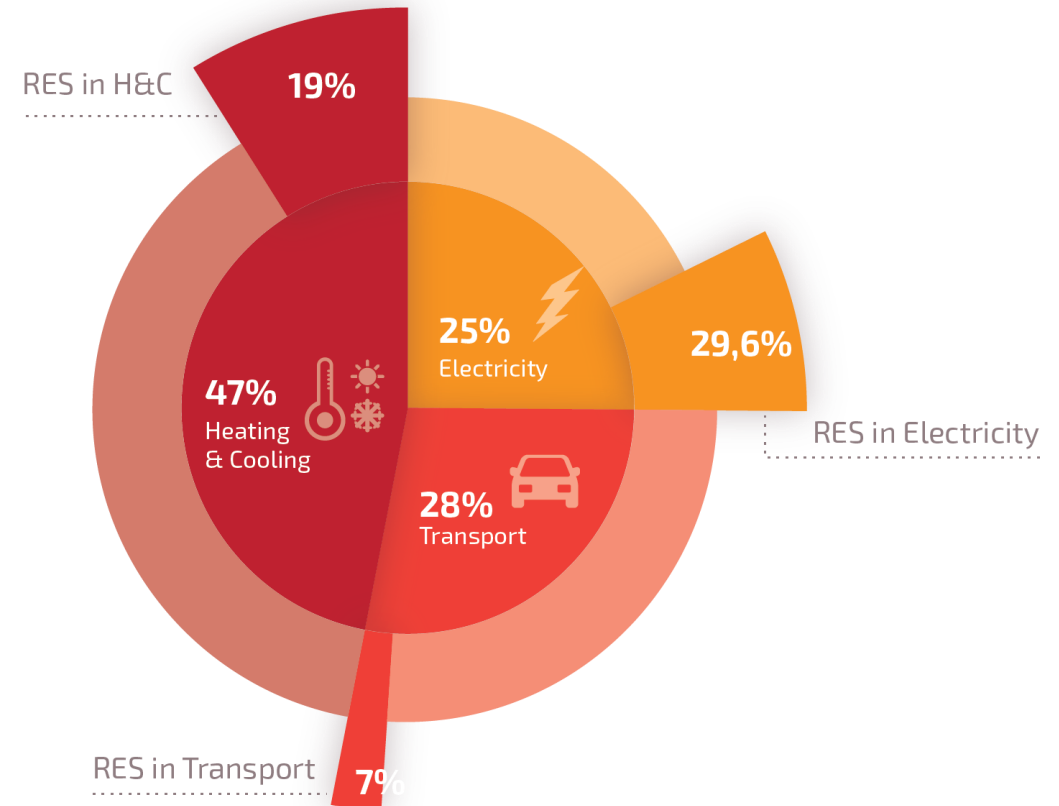
- > **Unlocking geothermal energy**
- > **Increasing the Social welfare in Europe**
- > **Novel technologies for full and responsible deployment of geothermal potential**

Rising to the Vision

Our VISION is to cover

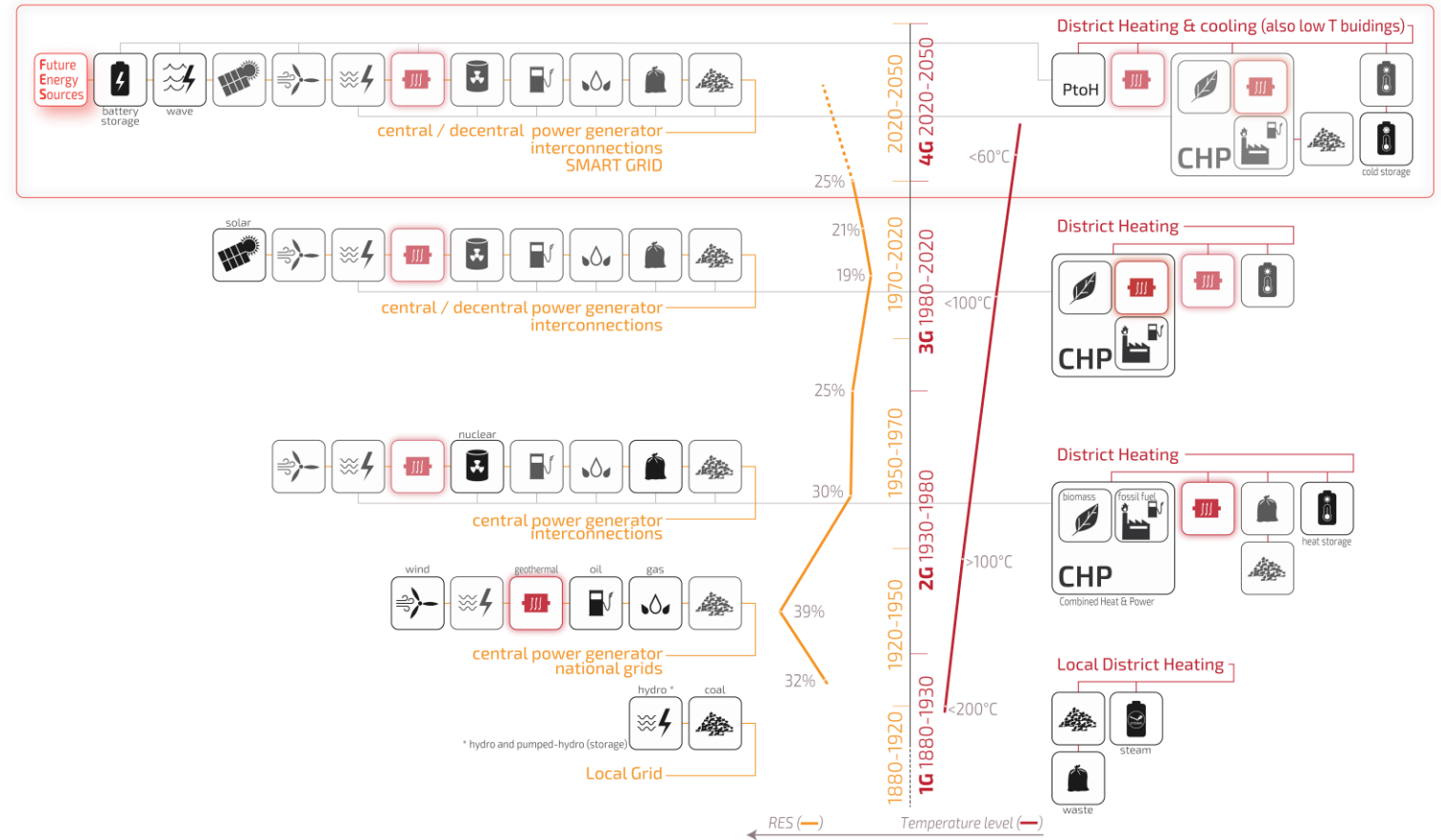
- > A significant part of **domestic heat demand** and
- > a large part of **electrical power demand** in Europe by geothermal energy.

This includes taking the maximum advantage offered by the flexibility of geothermal production, providing large **centralized** as well as domestic and **decentralized** small scale options.



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

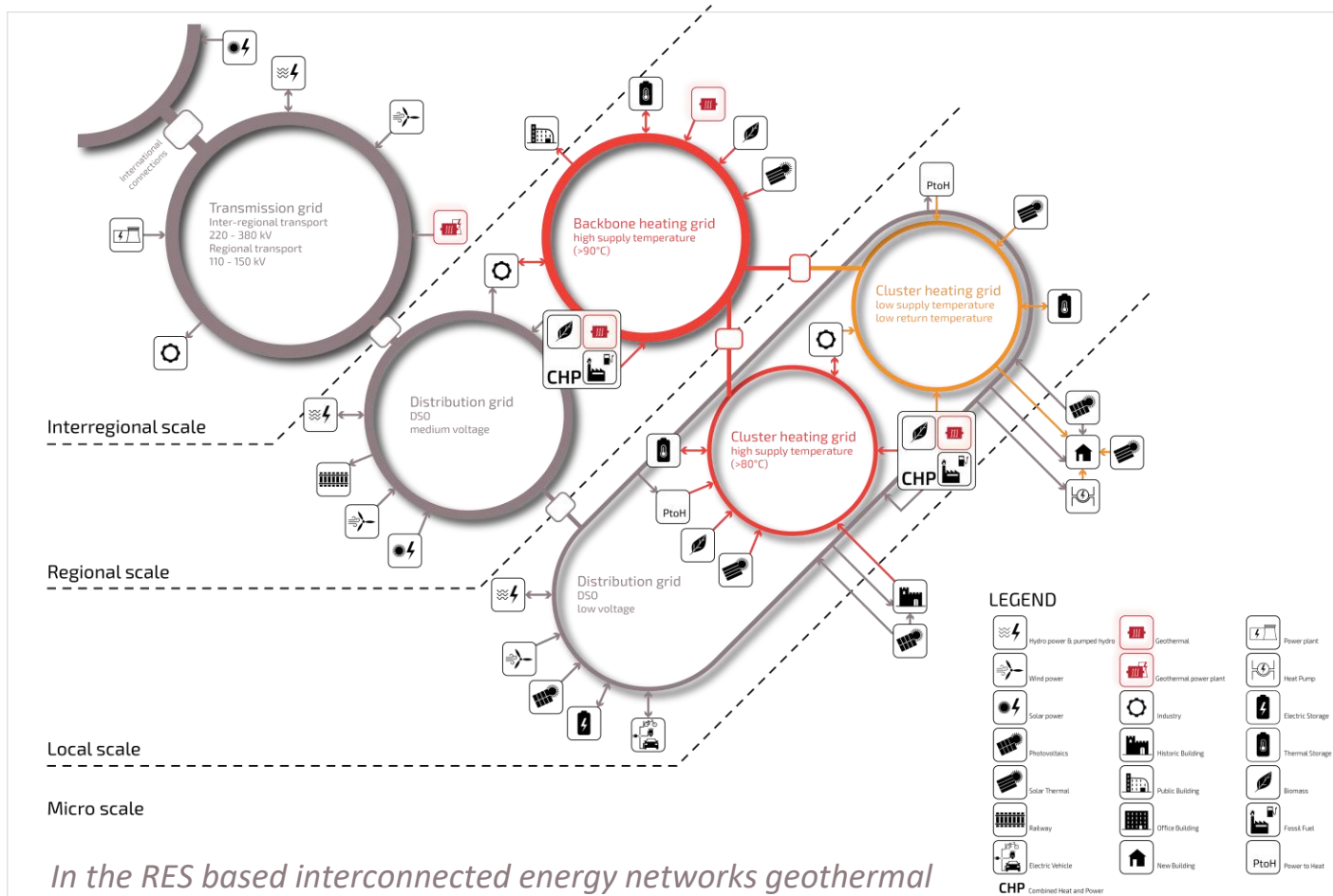
Unlocking Geothermal Energy: Power development



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)

Unlocking Geothermal Energy: Combined production



> Coupling renewable heat and electricity sectors and markets for an optimal use of geothermal energy

> Consumer-producer-prosumer perspectives

> Thermal storage to help balance and to optimize production

> Cascade, hybrid, synergy (e.g. geothermal-algae-biofuels-transport)

In the RES based interconnected energy networks geothermal and underground thermal storage play an important role

**Thank you for
your attention**

