

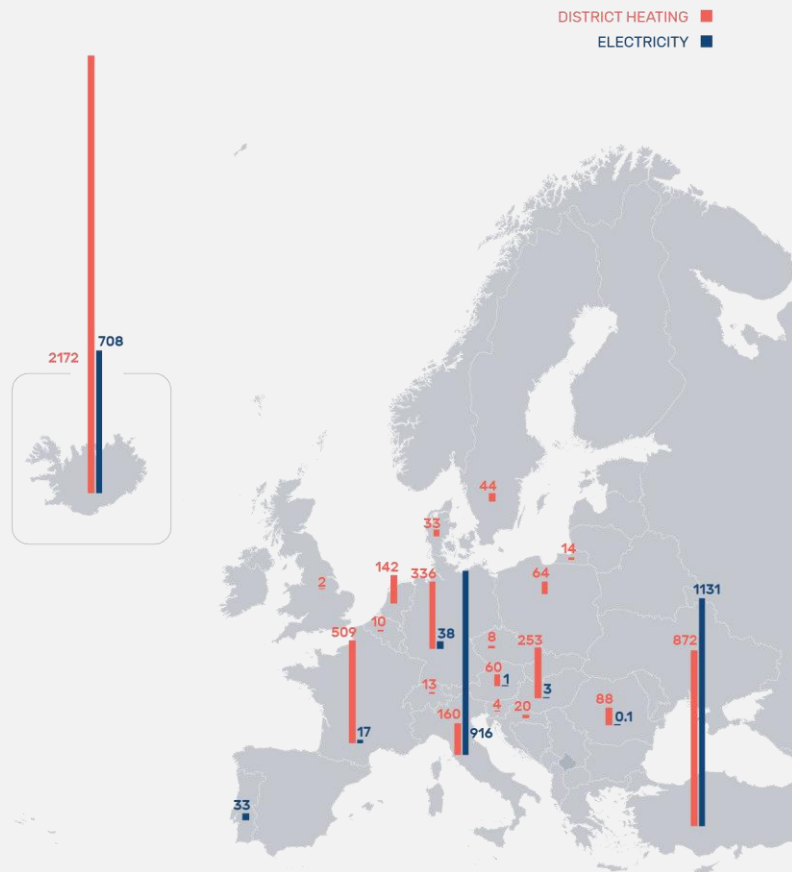
Geothermal energy in Europe

14.11.2018

Overview, regulation,
business models & policy
changes

Deep geothermal in Europe: market overview

Installed capacity for geothermal electricity & district heating (2017, Mwe & MWth)



Geothermal electricity in Europe:

- 2,8 GWe capacity
- 10% average annual growth rate over the last 5 years

Geothermal district heating in Europe:

- 5 GWth capacity
- 600 MWth developed in 2011-2016.

Electricity // Summary of key conclusions

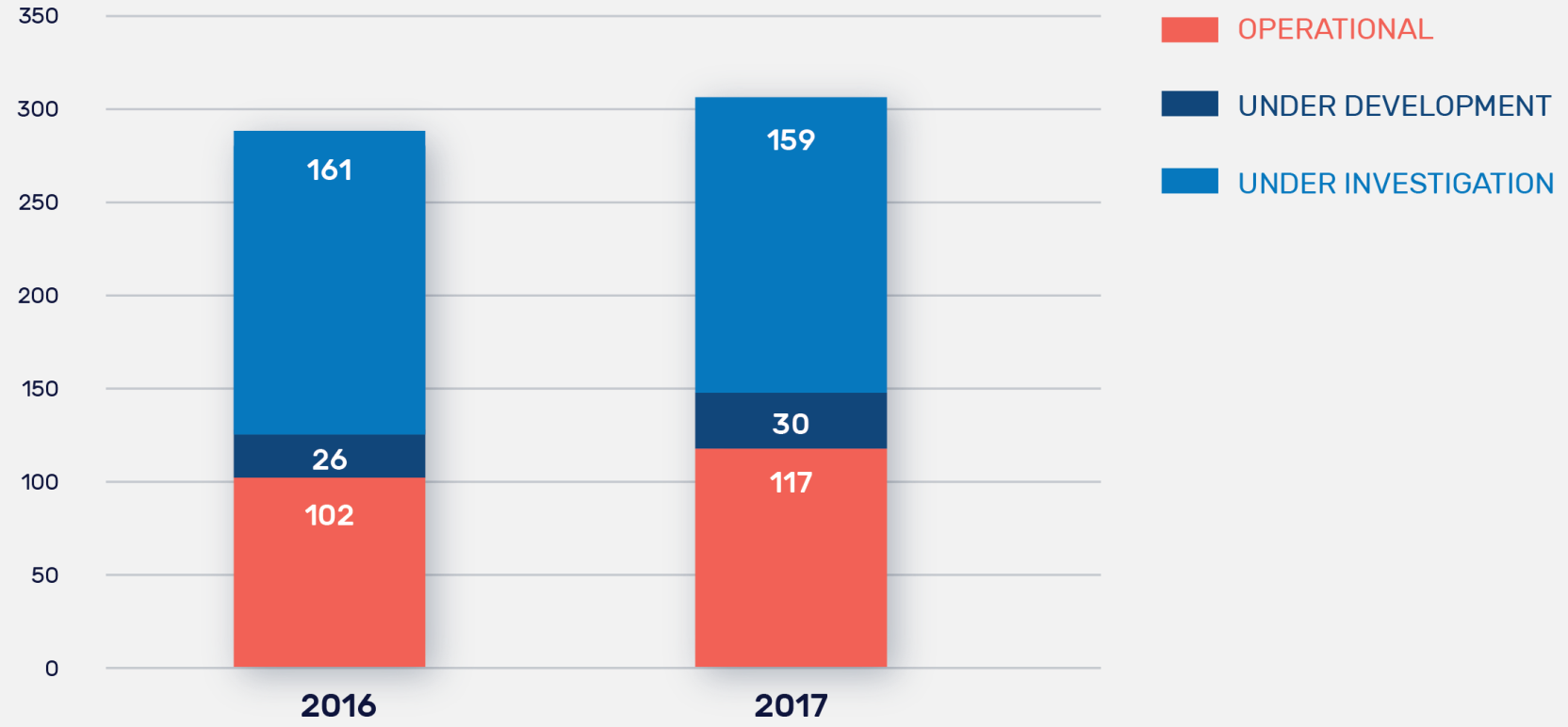
State of Play in 2017

- Total Installed Capacity in Europe: 2847 MWe
- 1106 MW over the last 5 years mostly in TK (average annual growth rate: 10%)
- 2017: 354 MWe added

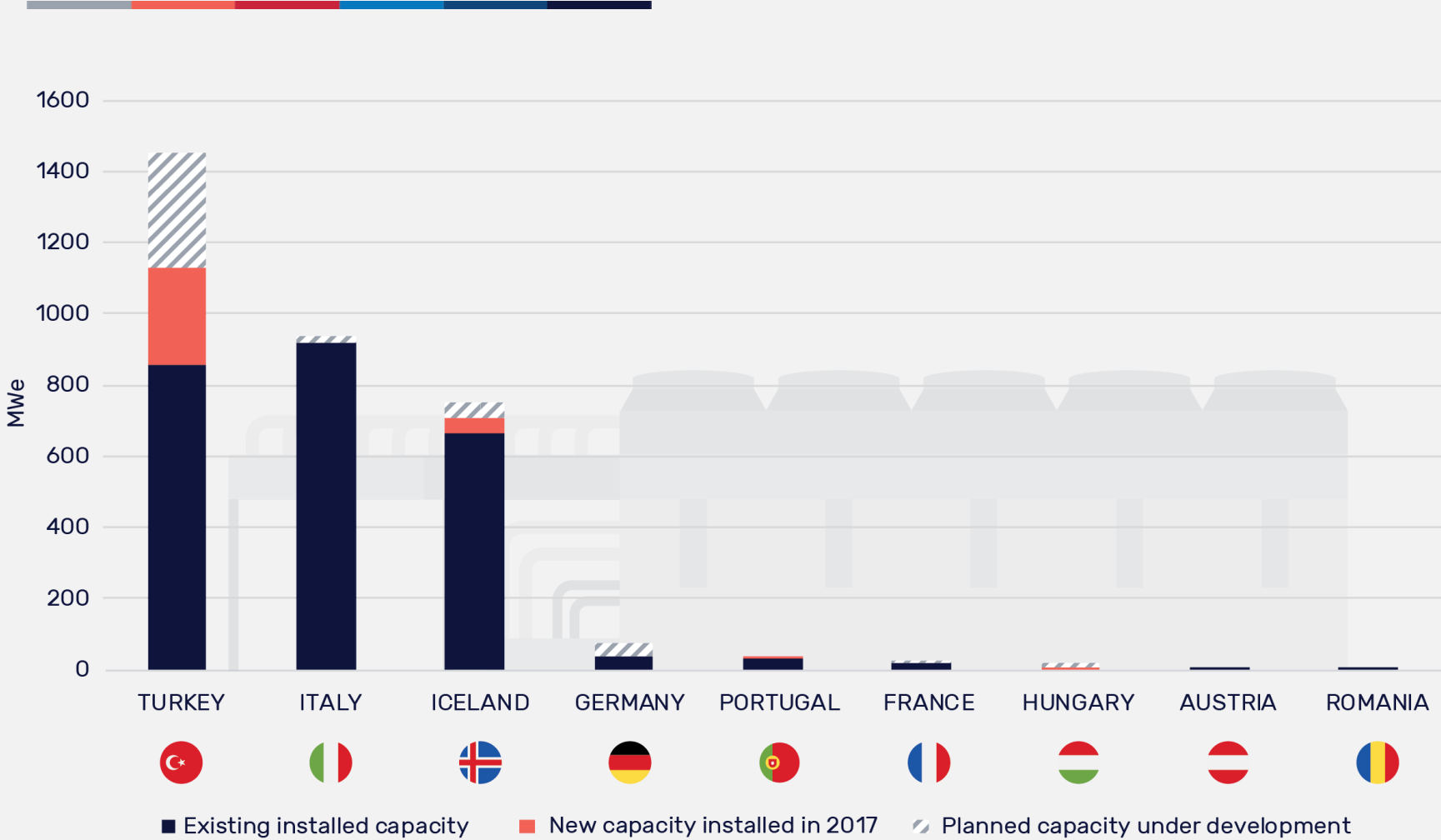
117 Geothermal Power Plants

- 16 new power plants in 2017 (13 in TK, 1 in ICE, 1 in HU, 1 in PT)

117 geothermal power plants in Europe in 2017

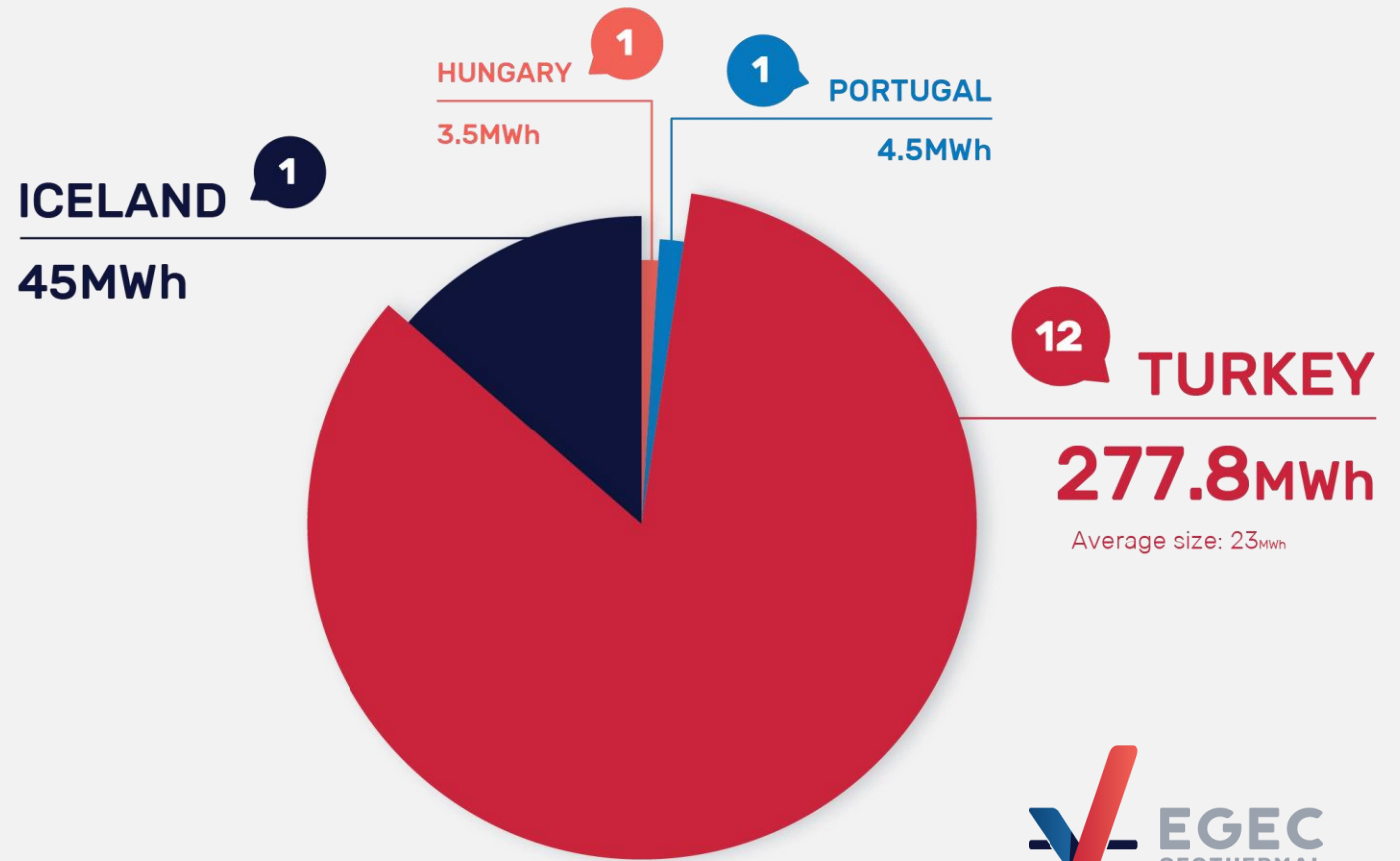


Capacity installed in 2017 by country (in MWe)



New installed capacity in 2017 by country

And number of geothermal power plants



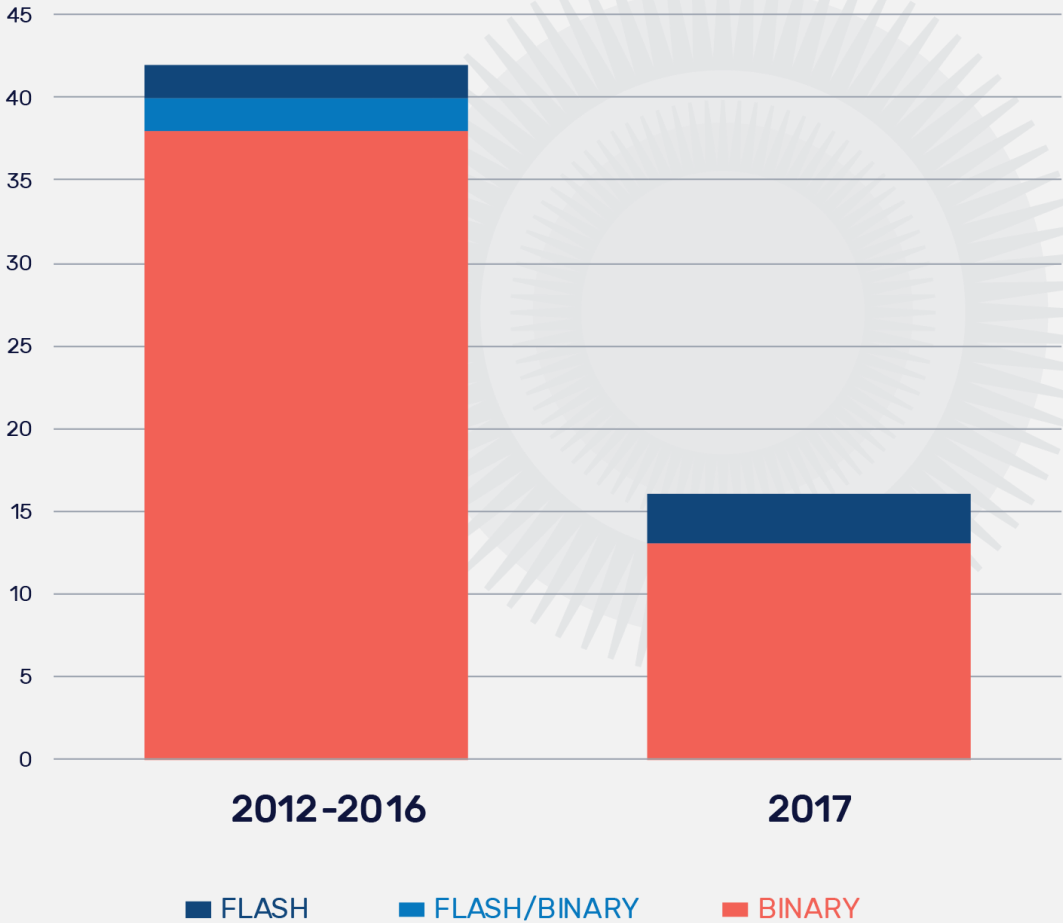
15 New Geothermal power plants in 2017

Country	Location	Turbine	Manufacturer	Capacity Installed (Mwe)
Hungary	Tura, Central Hungary	B-ORC	Kaishan	3
Iceland	Theistareykir	Single Flash	Fuji	45
Portugal	Azores, Terceira Island, Pico Alto	Hydrothermal; B-ORC	Exergy S. p. A.	4,5
Turkey	Afyon	B-ORC	Turboden	3
Turkey	Aydın Germencik	B-ORC	Ormat	27
Turkey	Aydın Kuyucak	B-ORC	Exergy	22
Turkey	Denizli Kızıldere III U1a	Flash	Toshiba	60
Turkey	Denizli Kızıldere III U1b	B-ORC	Ormat	23
Turkey	Denizli Kızıldere III U2a	Flash	Toshiba	52
Turkey	Denizli Kızıldere III U2b	B-ORC	Ormat	15,8
Turkey	Manisa Alasehir	B-ORC	Ormat	10
Turkey	Manisa Alasehir	B-ORC	Ormat	10
Turkey	Manisa Alasehir	B-ORC	Atlas Copco	24
Turkey	Manisa Salihli	B-ORC	Ormat	16
Turkey	Manisa Salihli	B-ORC	Ormat	15



New Geothermal power plants by type of turbine

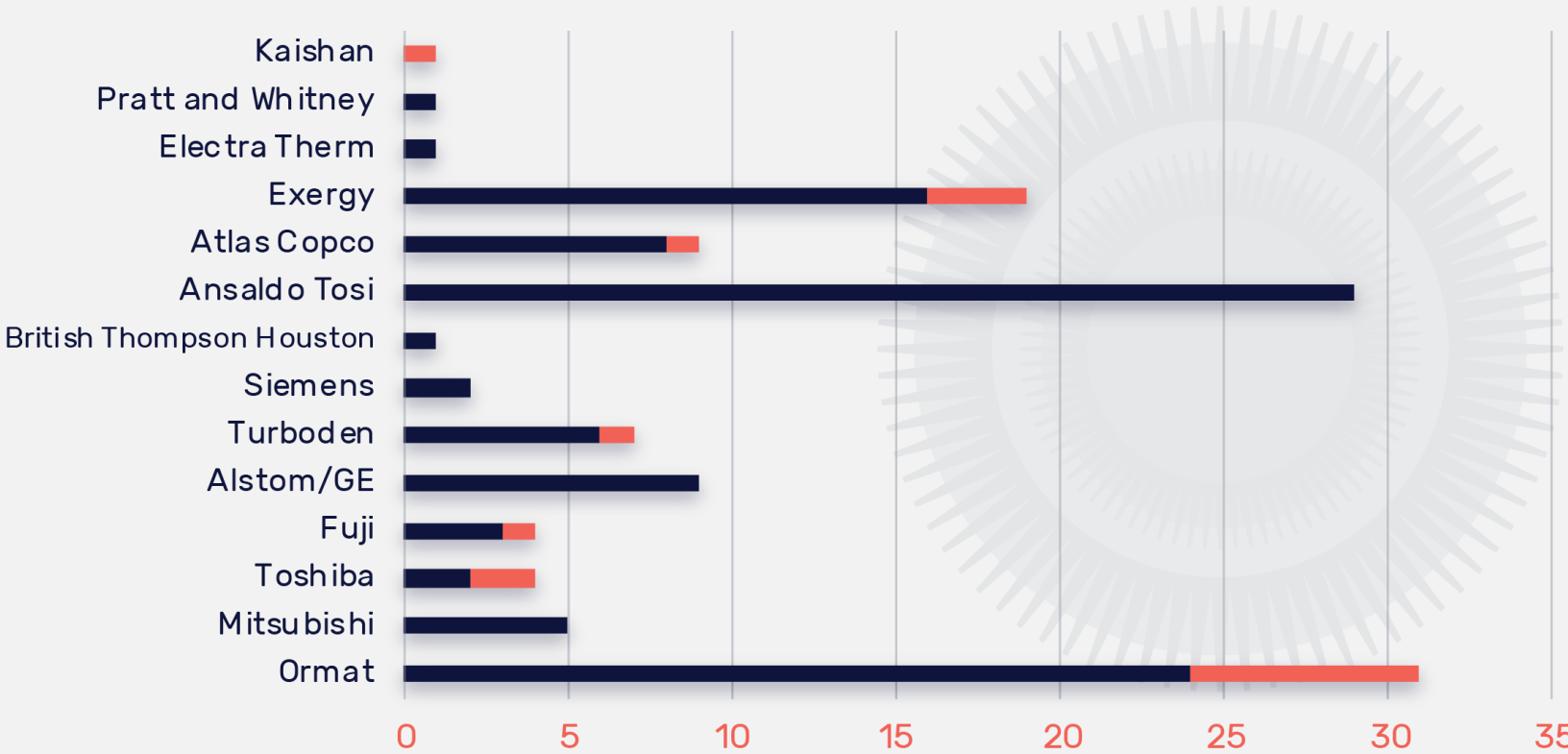
2012-2016 vs 2017



Trends in turbines: Installed turbines per manufacturer



NEW IN 2017



District heating // Summary of key conclusions

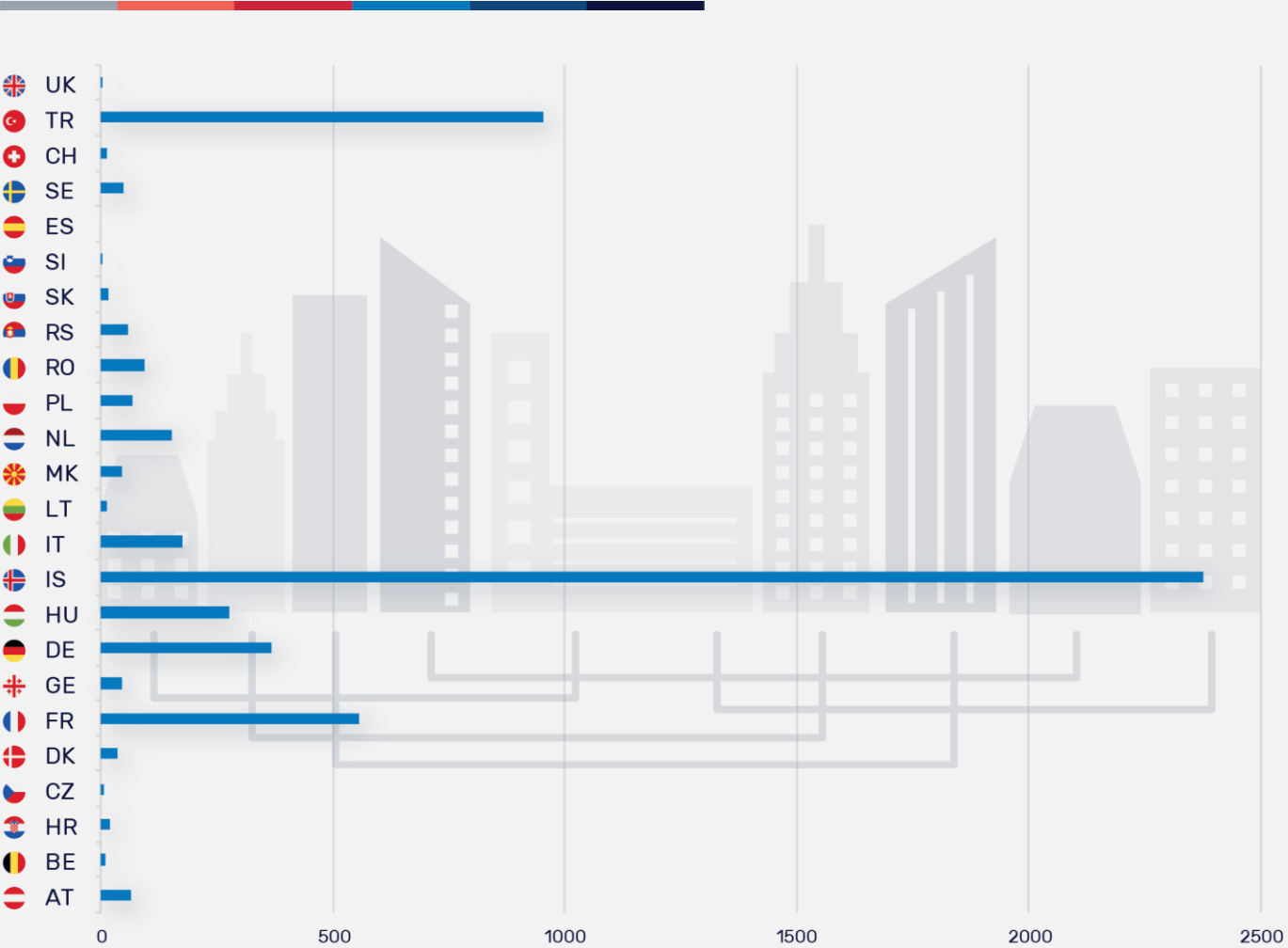
State of Play in 2017

- Total Installed Capacity in Europe: 4,956 MWth
- 10 new or renovated plants over the last year (60 for the 2012-2016 period)

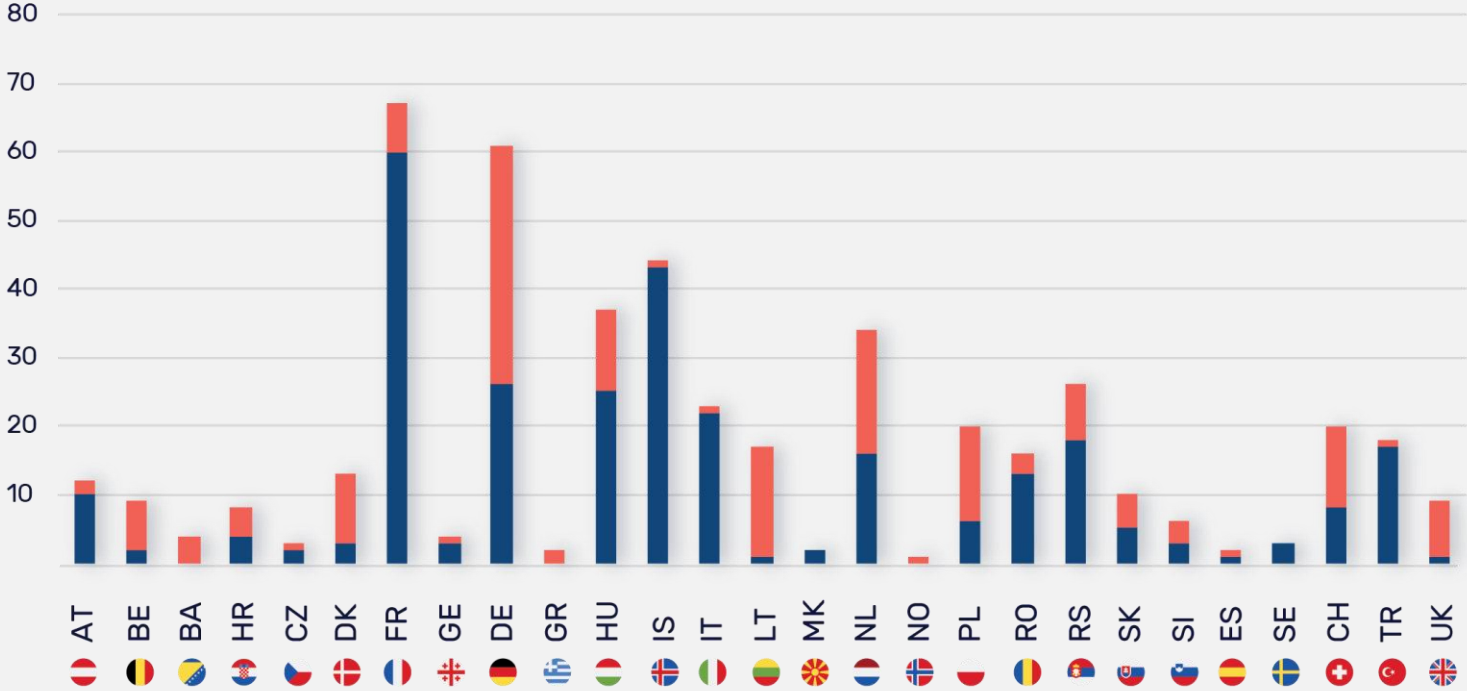
294 Geothermal DH Plants

- 10 new or renovated plants in 2017 (6 in FR, 2 in NL, 1 in IT, 1 in RO)

Installed GeoDH capacity by country in 2017 (MWth)



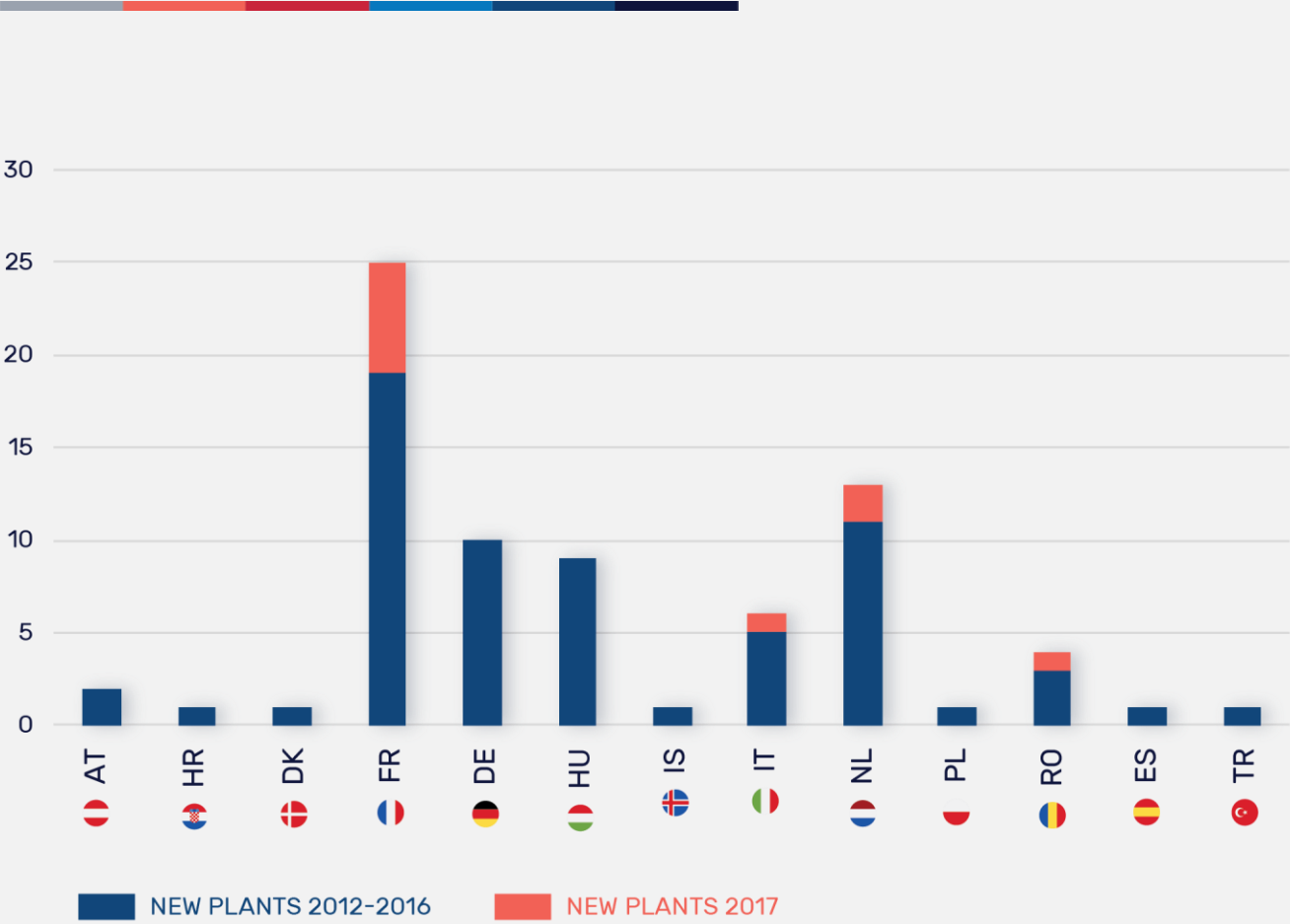
Number of GeoDH plants in operation and under development-investigation per country



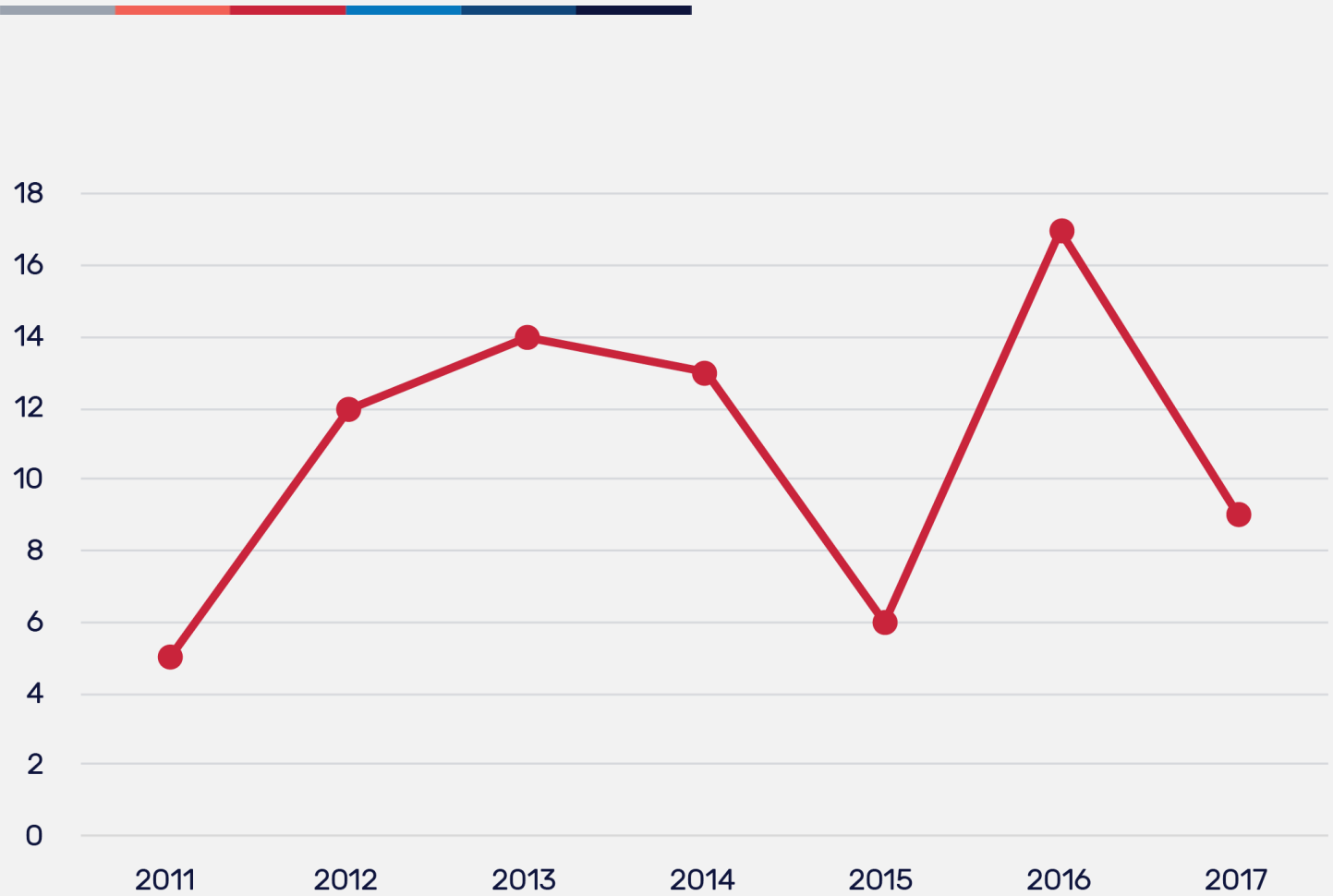
■ PLANTS IN OPERATION IN 2017
■ PLANTS UNDER EXTENSION/DEVELOPMENT/INVESTIGATION



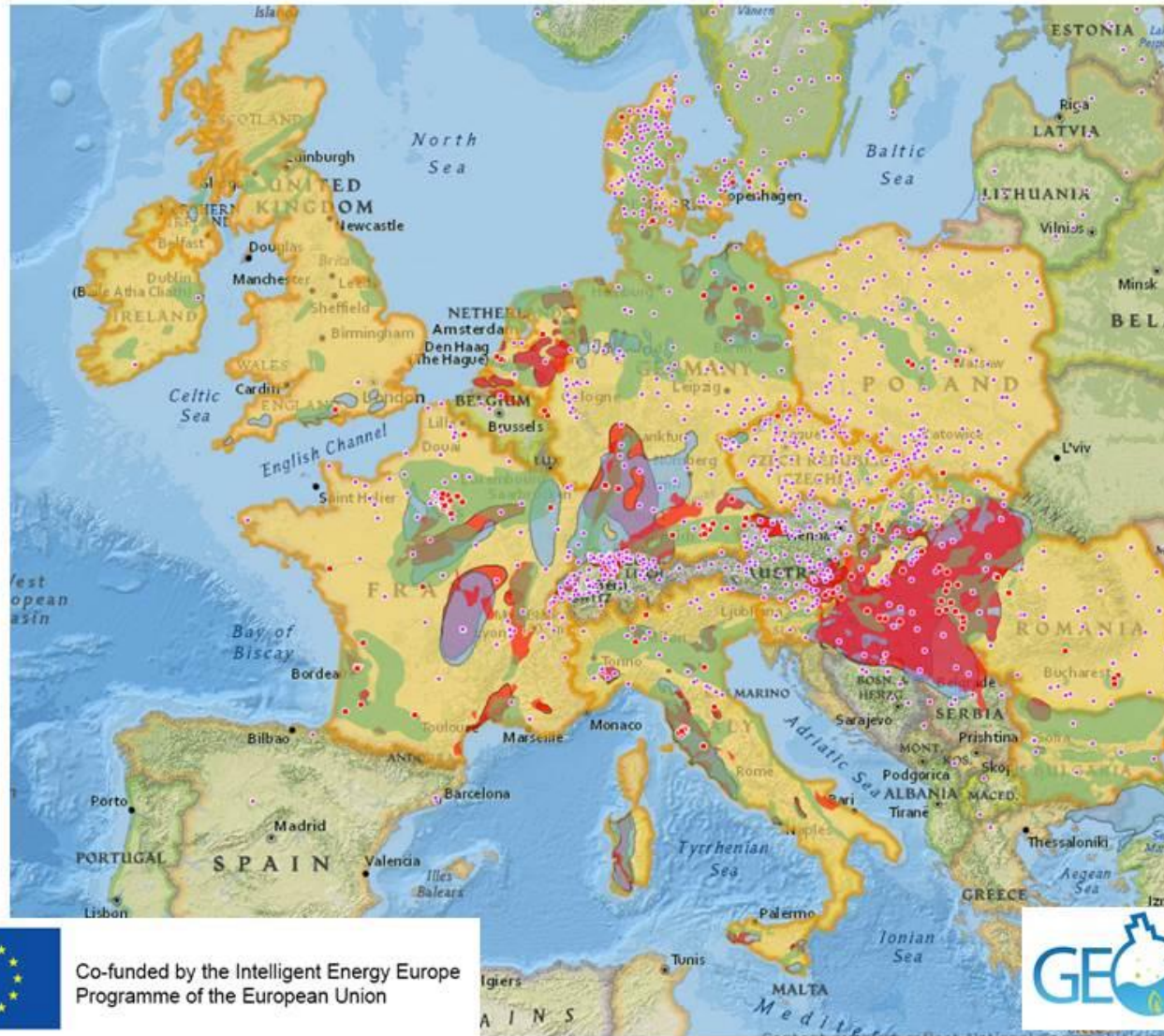
New geoDH plants in 2017 vs 2012-2016



Number of new geoDH plants commissioned by year



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



Co-funded by the Intelligent Energy Europe Programme of the European Union

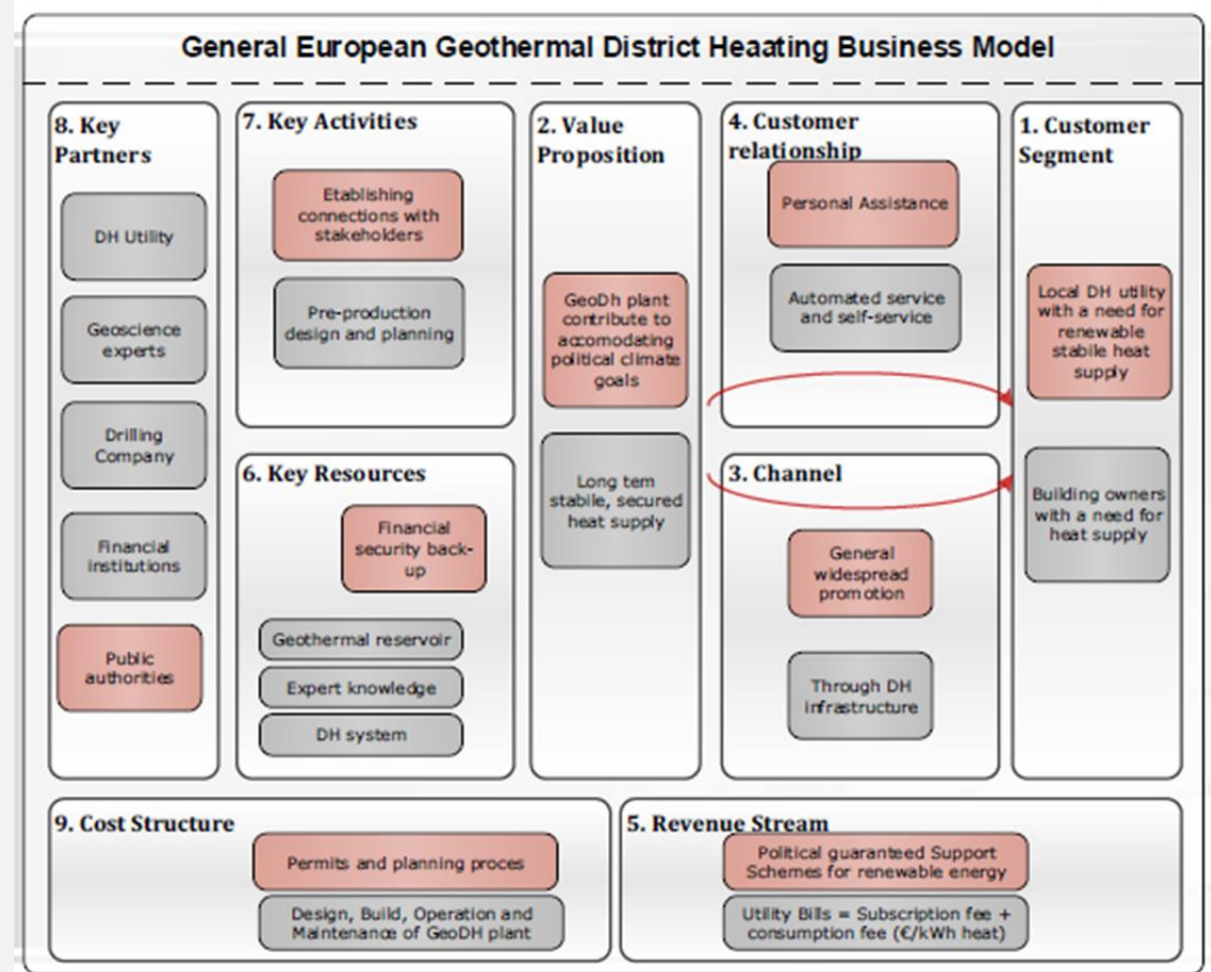


New business models for geothermal energy



Challenges

Demand for Heat supply

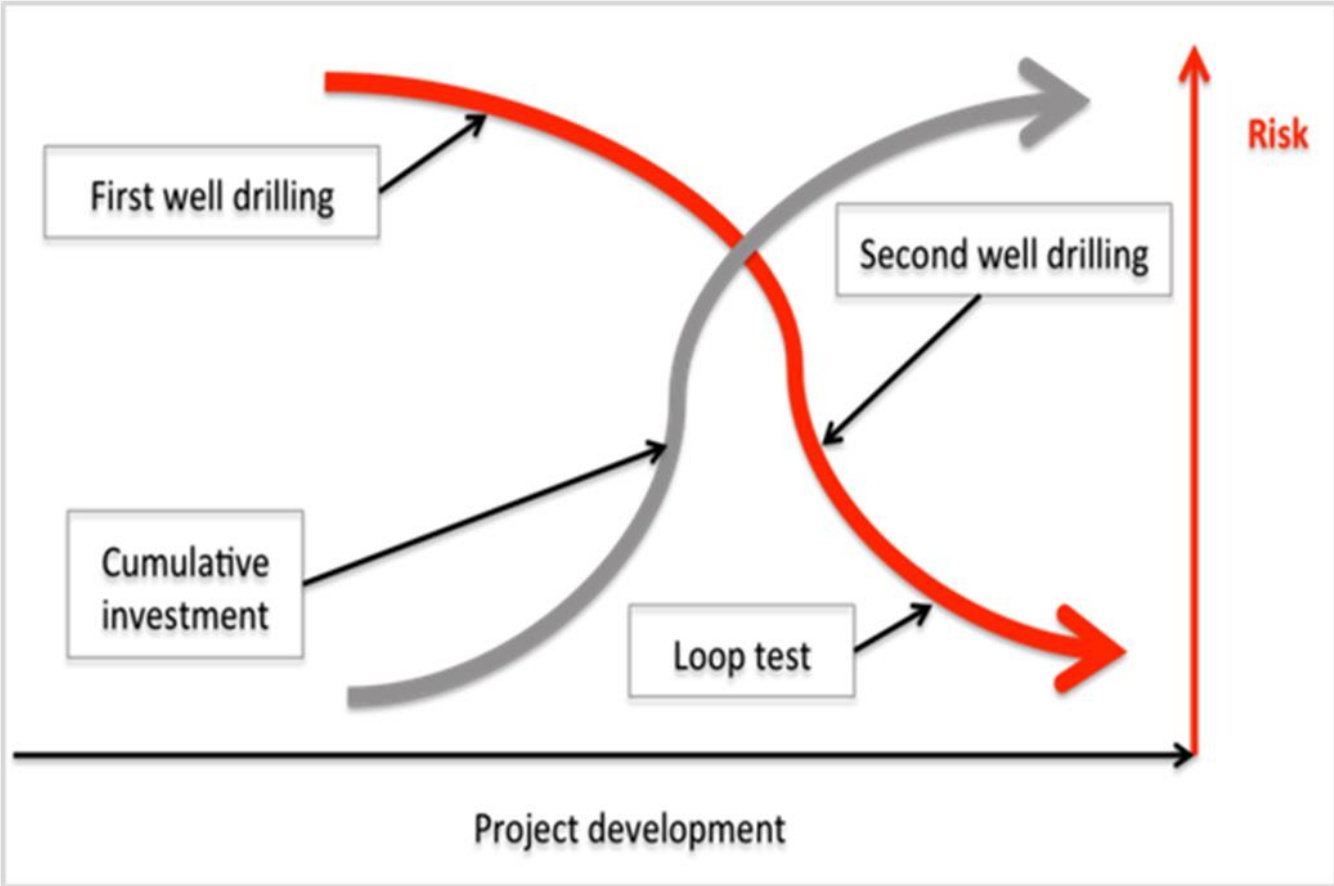


Supplying heat & power to companies

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



Risks in investments

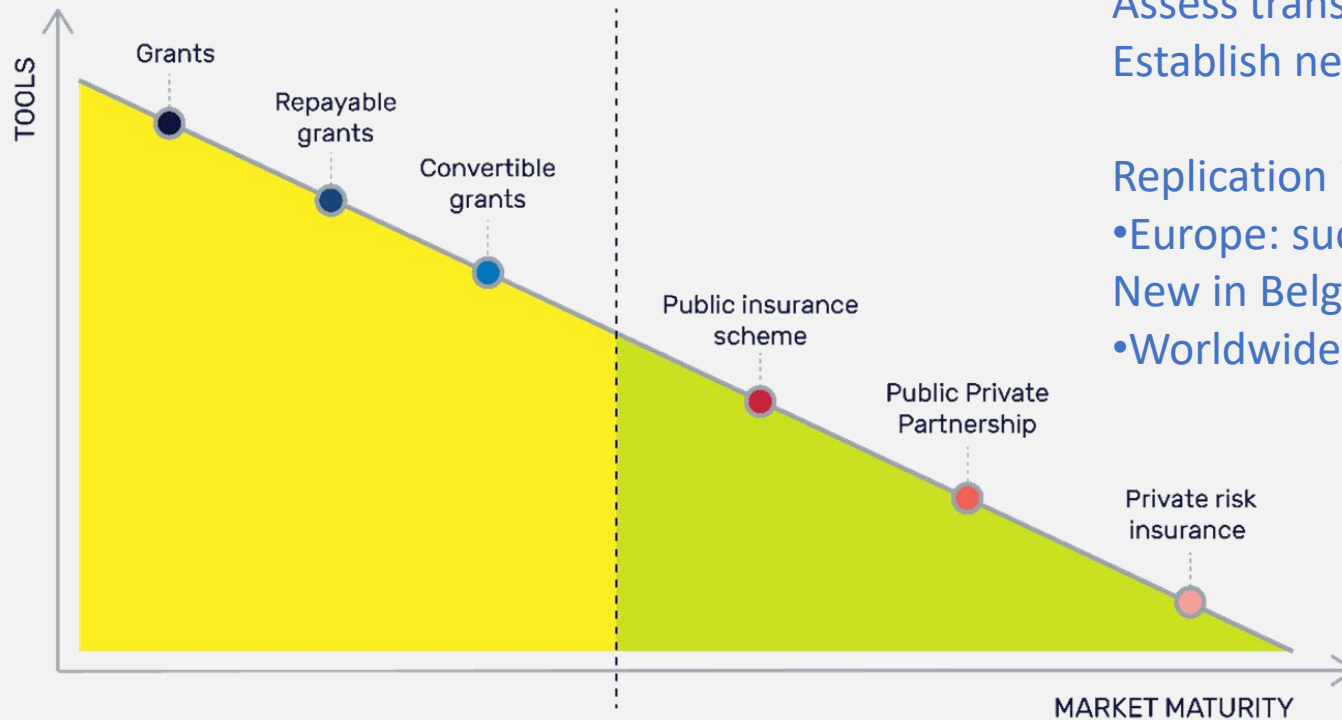


The GEORISK project

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

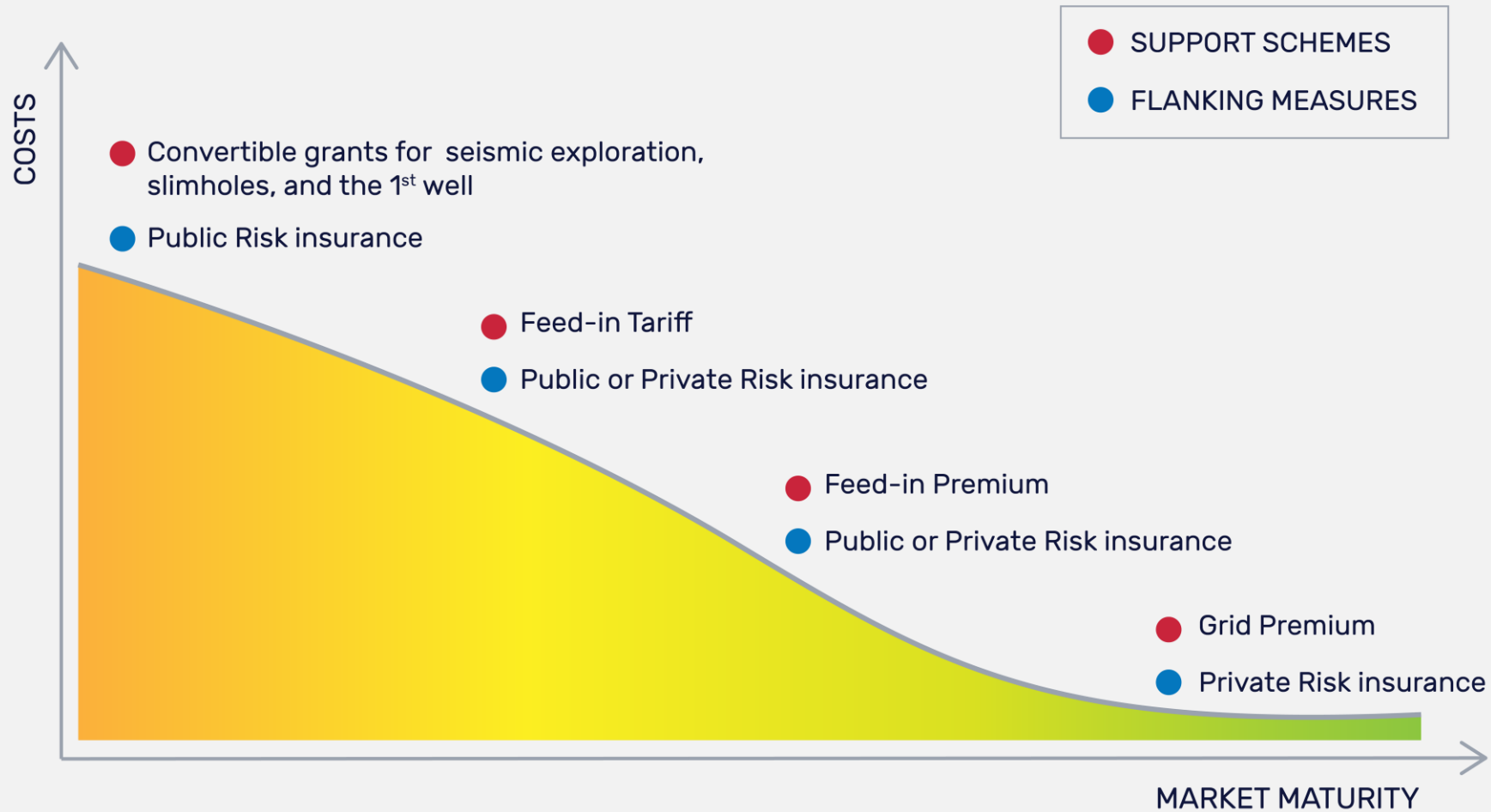


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [818232 — GEORISK]



EGEC recommendations on public financing

Support schemes for Geothermal adapted to technology maturity



The Clean Energy Package



The Clean Energy Package

- European Union legislative acts to fulfil the 2030 targets
 - Renewable Energy Directive, Energy Efficiency Directive, Market Design, Governance, Energy Performance of Buildings Directive
- Currently voted at the European Parliament & the Council
- **Defines the framework for renewable energy for 2020-2030**

Renewable Energy Directive

- **Definition of geothermal energy**
- **Support schemes:** technology neutral/specific tenders, feed-in premiums
- **Simplified authorization procedures** for RES projects
- New provision of “**mainstreaming renewables in heating and cooling**”
- **New article on district heating**

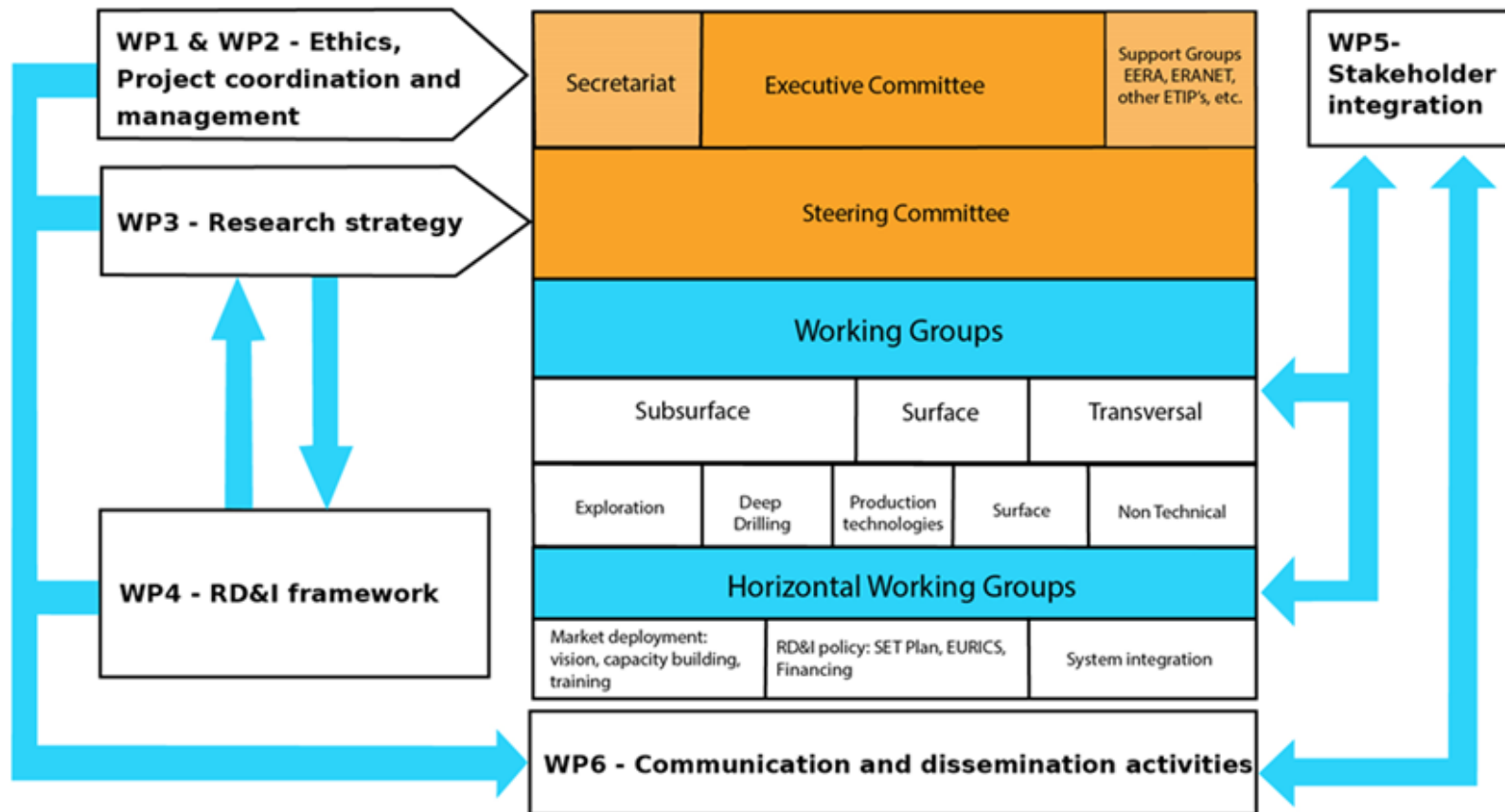
Deploying geothermal with RD&I





ETIP-DG

European Technology & Innovation Platform on **Deep Geothermal**



Participation free of charge.

For more information: visit www.etip-dg.eu



A Vision for Deep Geothermal

Deep geothermal in 2030-2050



ETIP-DG

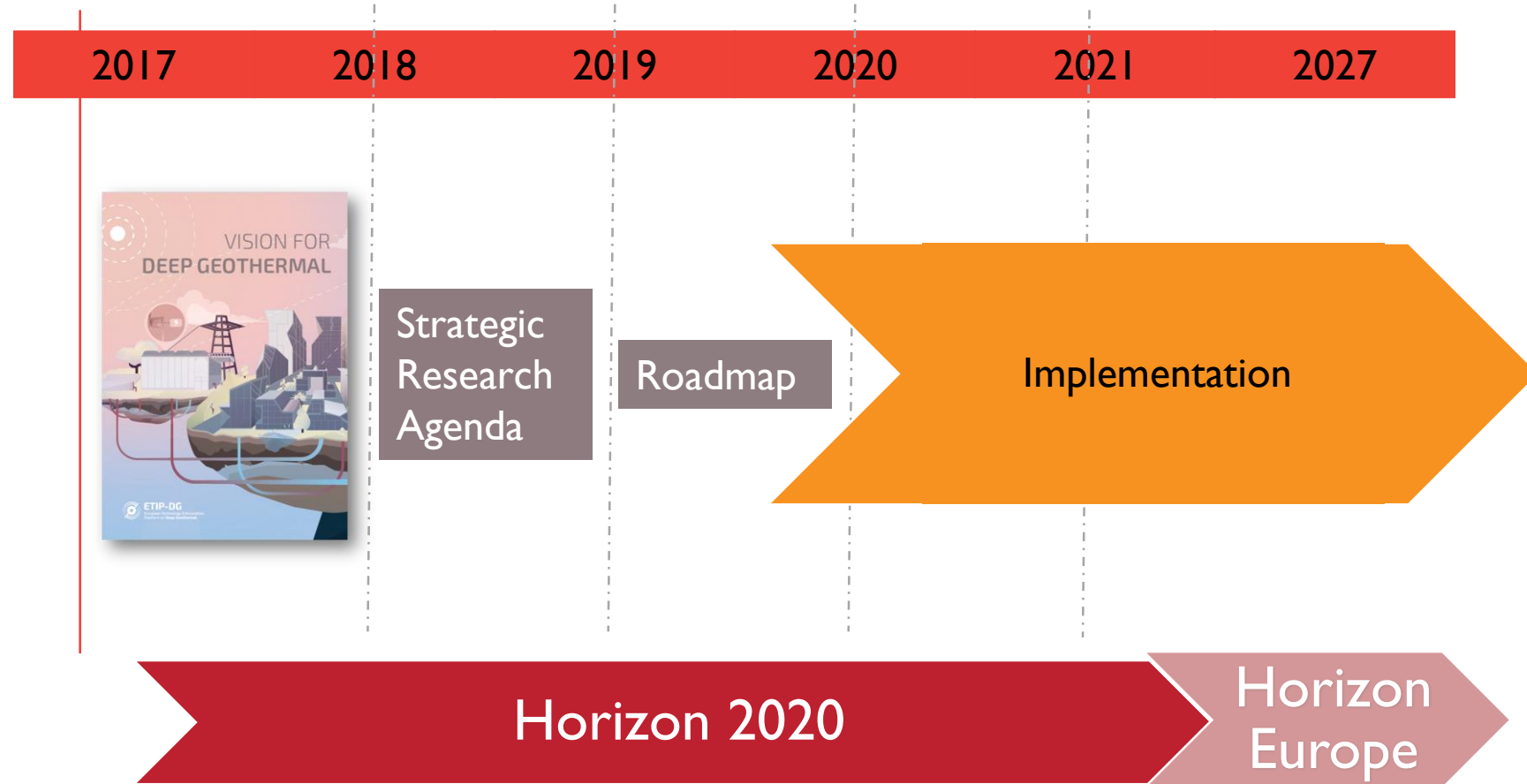
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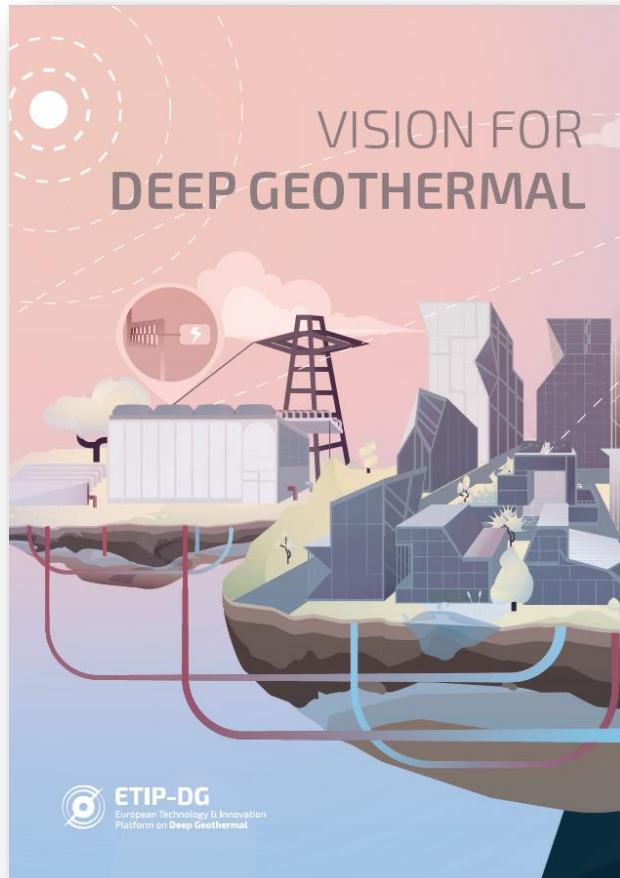


Co-funded by the European Union's Horizon 2020 Research and Innovation Programme [GA. N. 773392]

ETIP activities



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

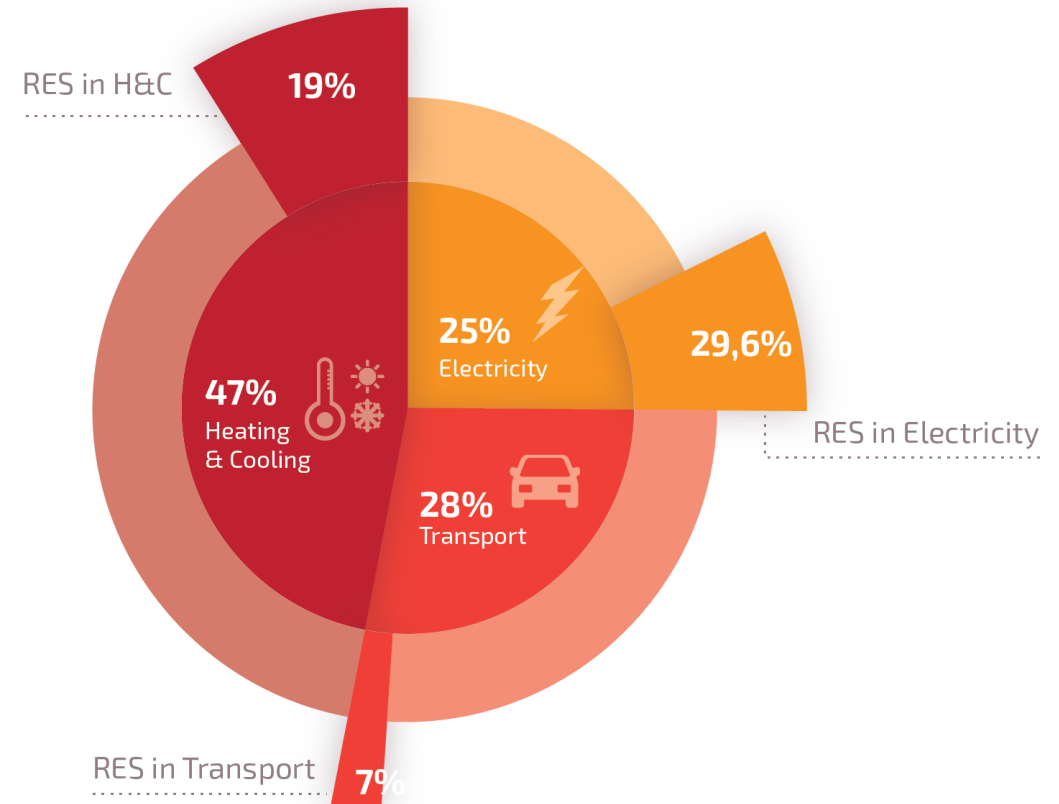
- > **Unlocking geothermal energy**
- > **Increasing the Social welfare in Europe**
- > **Novel technologies for full and responsible deployment of geothermal potential**

Rising to the Vision

Our VISION is to cover

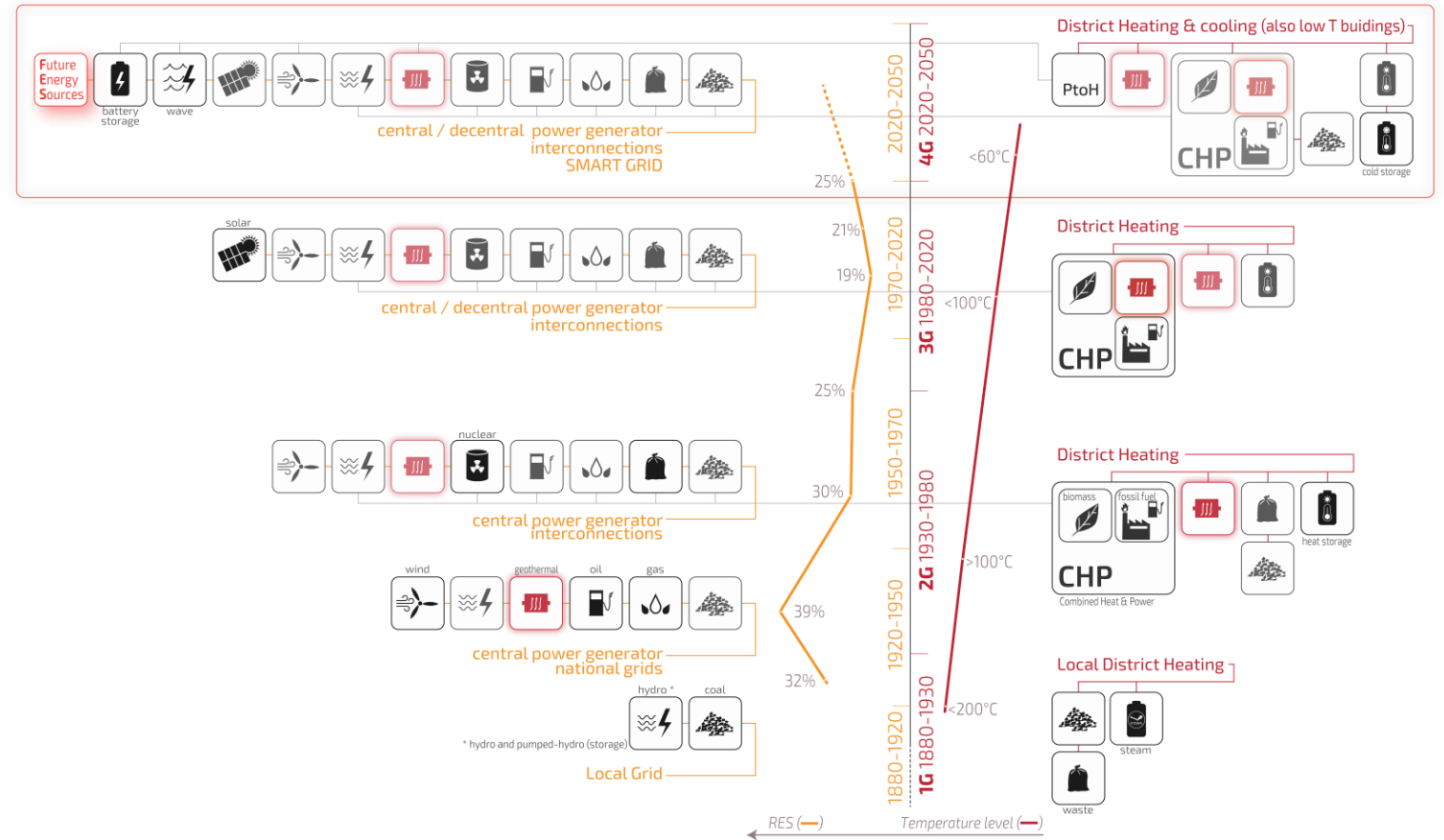
- > A significant part of **domestic heat demand** and
- > a large part of **electrical power demand** in Europe by geothermal energy.

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

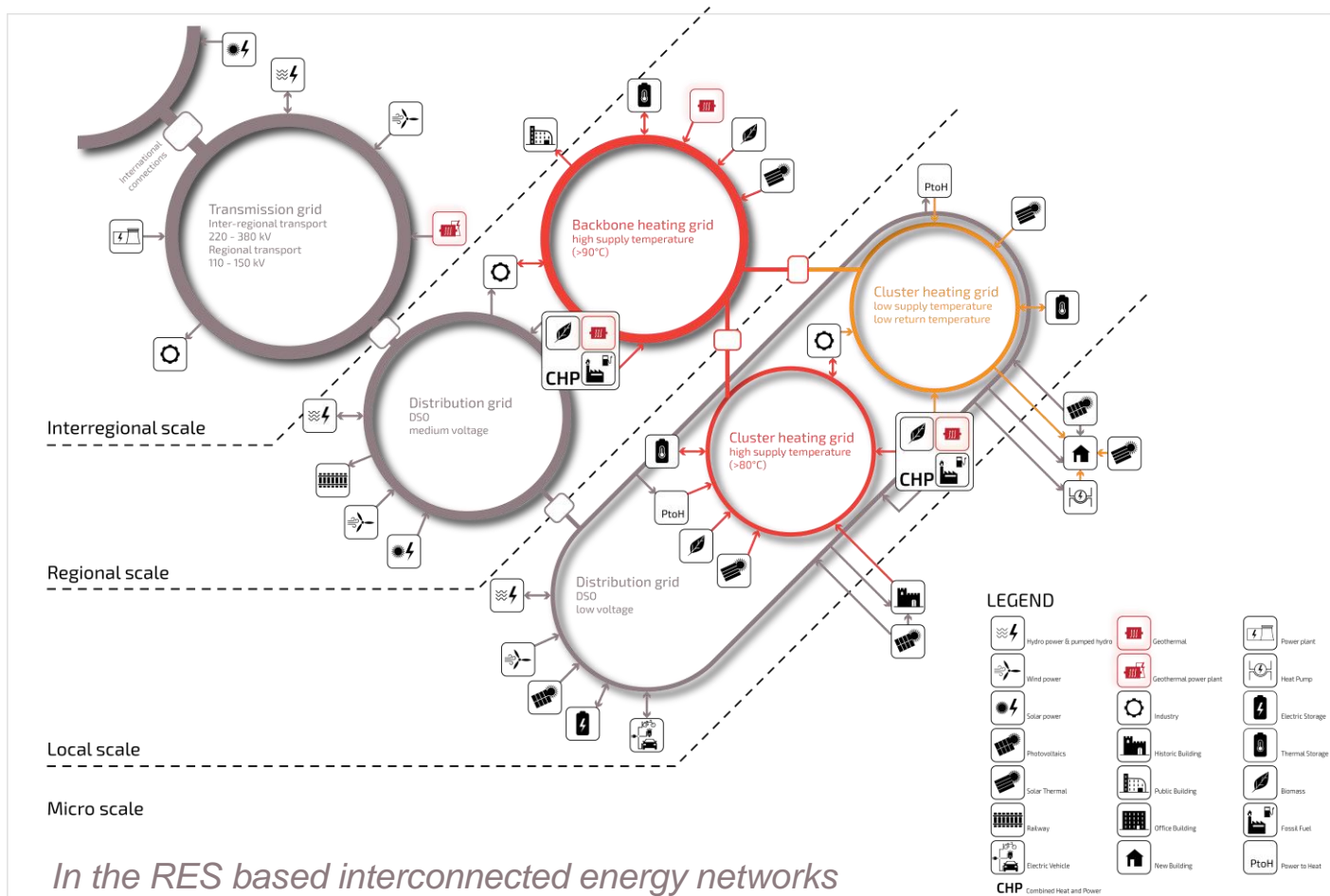
Unlocking Geothermal Energy: Power development



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



The City of the Future

Novel technologies for full and responsible deployment of geothermal potential: towards a SRIA

> Technologies beyond H2020

> While targeting the EU long-term goal of **reducing costs** and **increase performance** of geothermal technologies and installations, RD&I pursue all opportunities for complete deployment of geothermal resources, aiming at various advancements





Main sponsor



EGGC2019

European Geothermal Congress

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**Thank you for
your attention**

