

Geothermal market development in Europe

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Electricity // Summary of key conclusions

State of Play in 2018

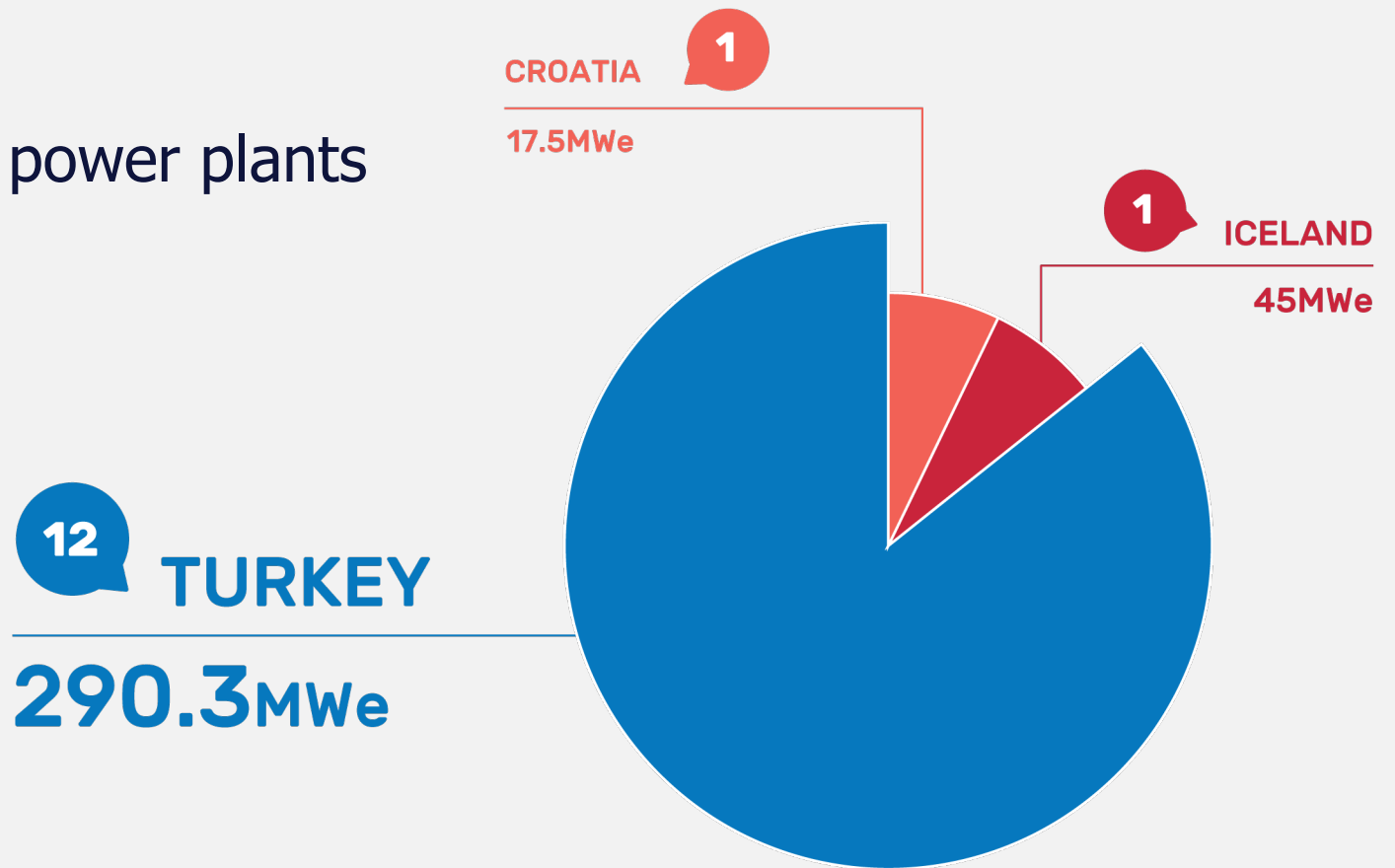
- Europe passes the 3 GWe threshold for installed capacity
- Sustained growth rate of 10%/year
- 2018: 352 MWe added

127 Geothermal Power Plants

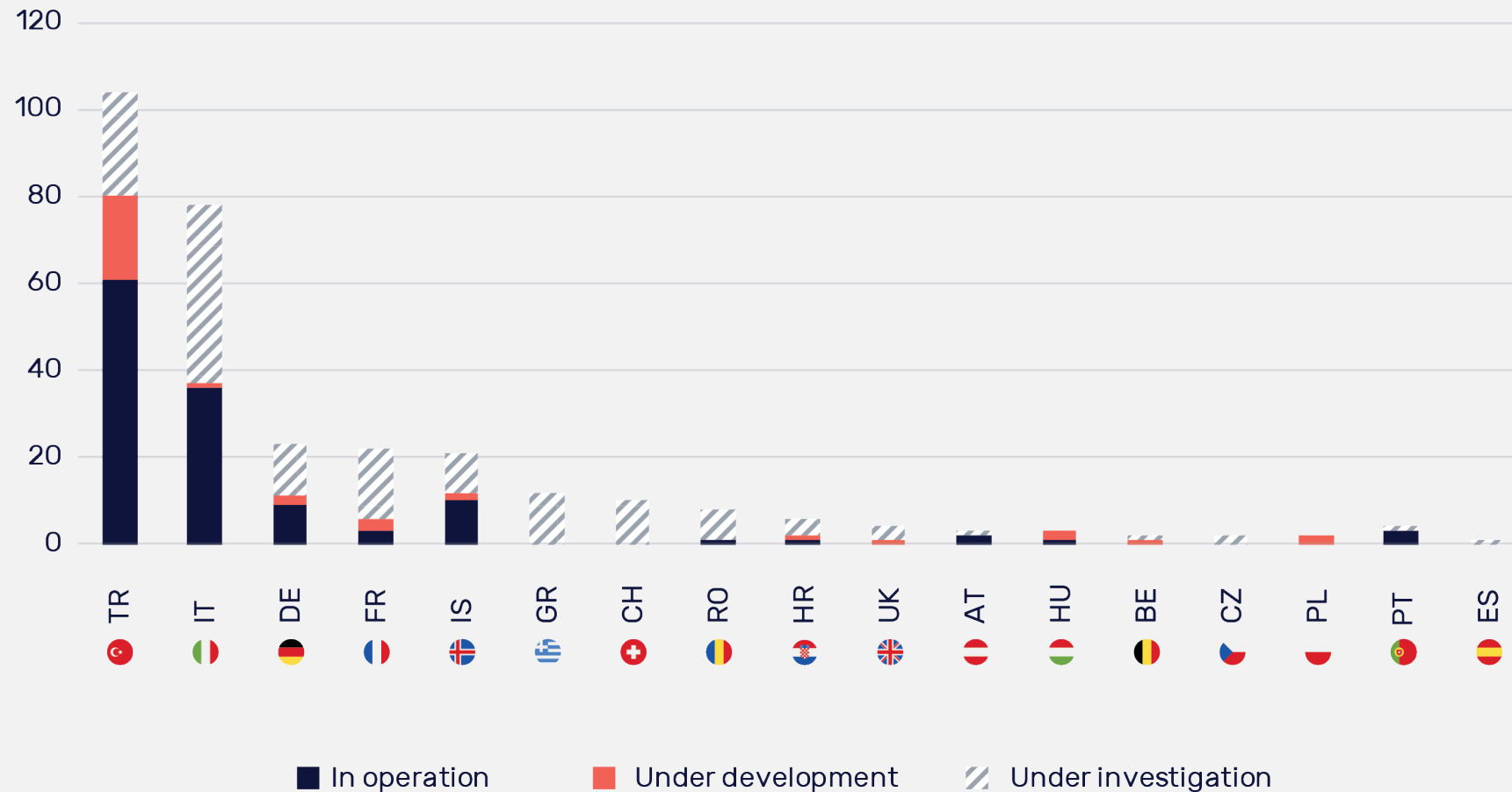
- 13 new power plants in 2018 in Turkey, 1 new in Iceland
- Croatia becomes a geothermal electricity producer

New installed capacity in 2018 by country

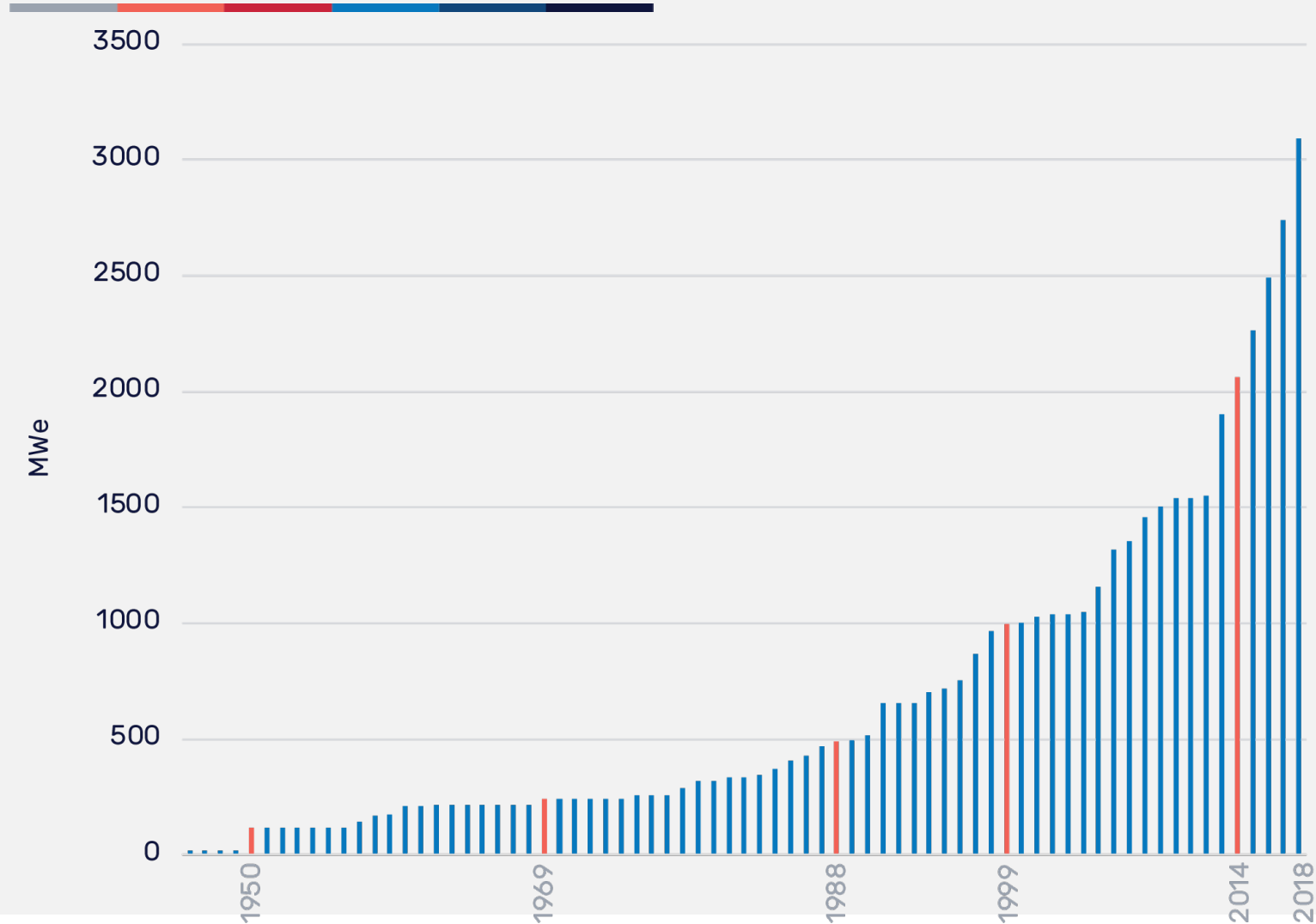
And number of geothermal power plants



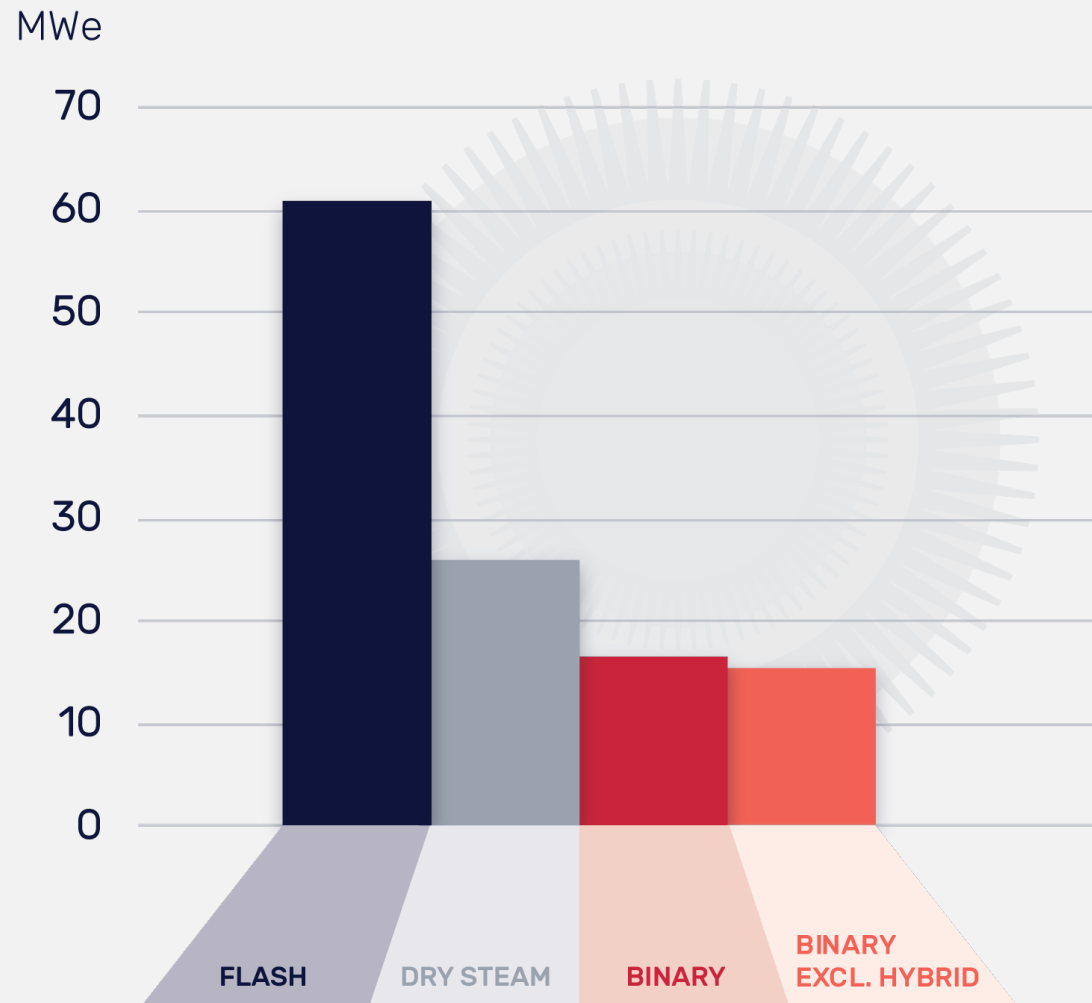
Number of geothermal power plants per country



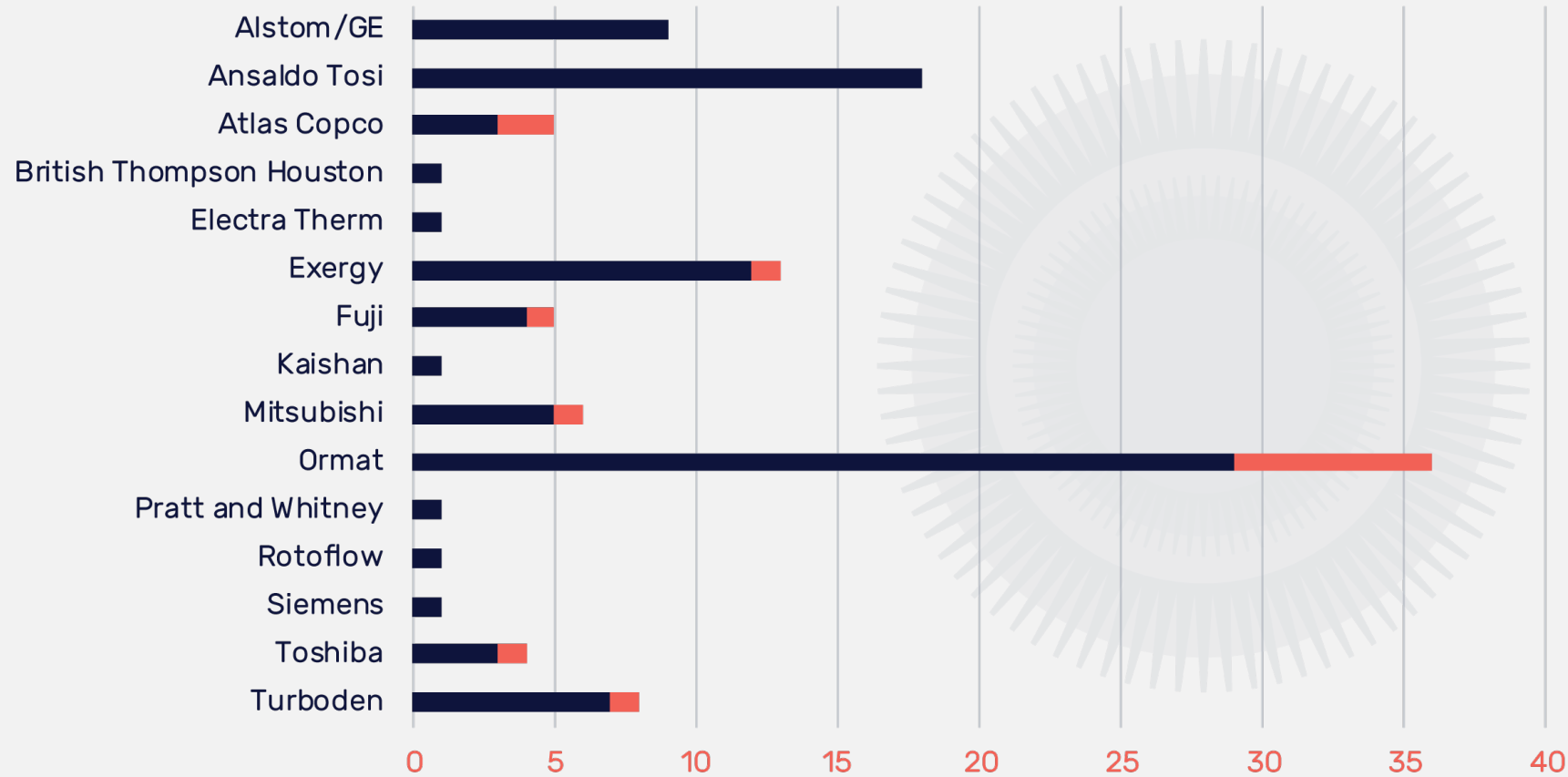
Geothermal electricity capacity in Europe



Average size of geothermal electricity turbines by types of plants



Number of installed turbines by manufacturer



■ NEW IN 2018

District heating // Summary of key conclusions

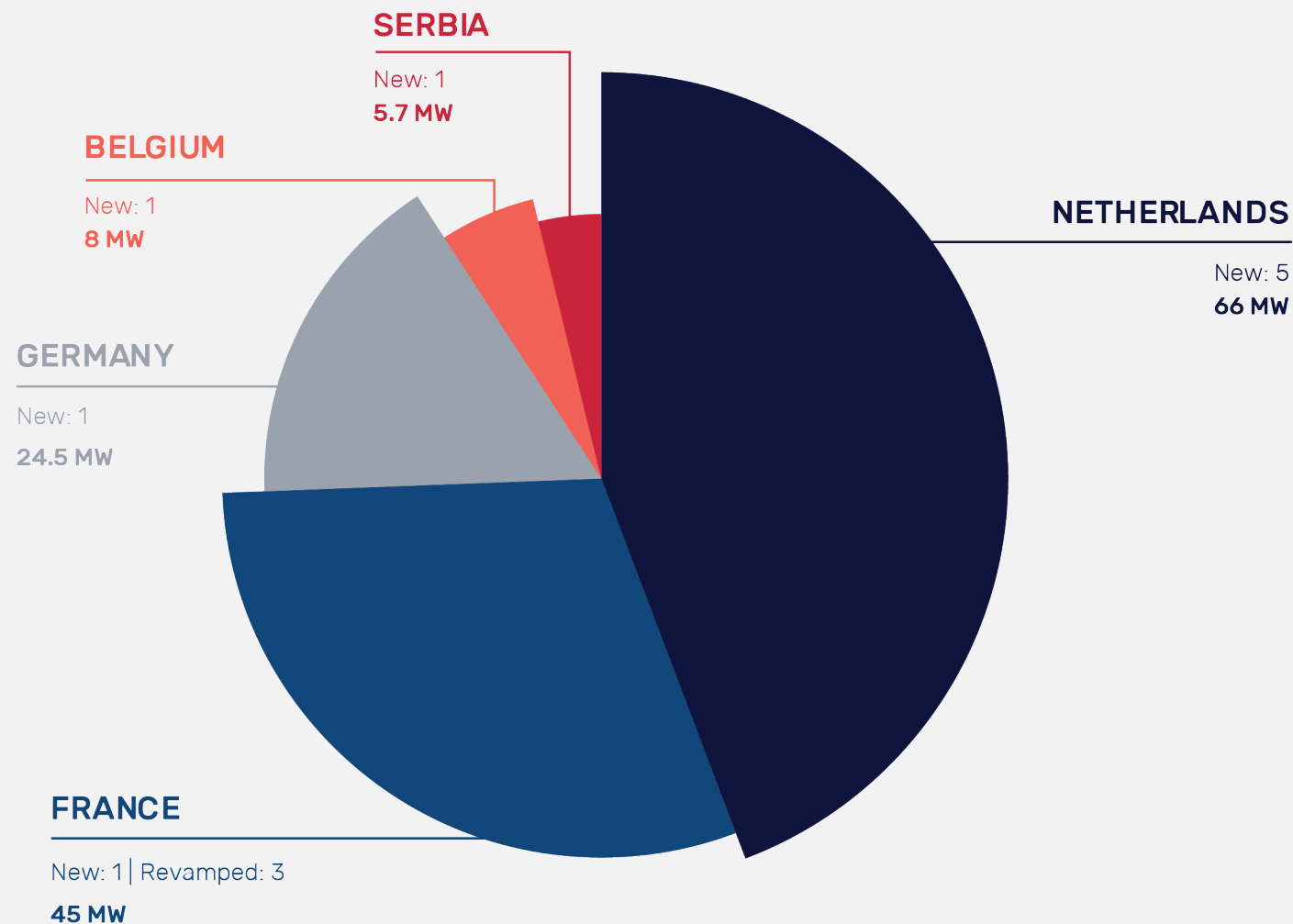
State of Play in 2018

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

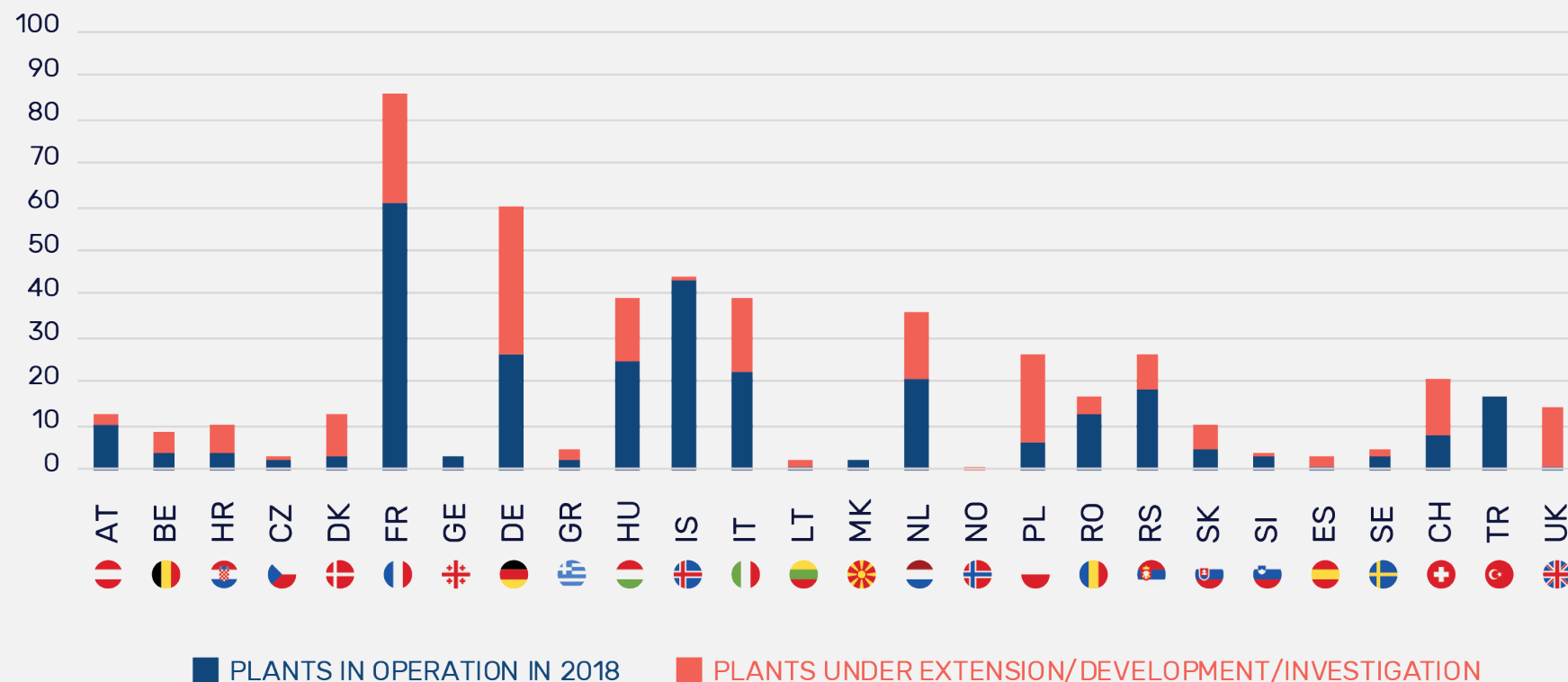
300 Geothermal DH Plants

- 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

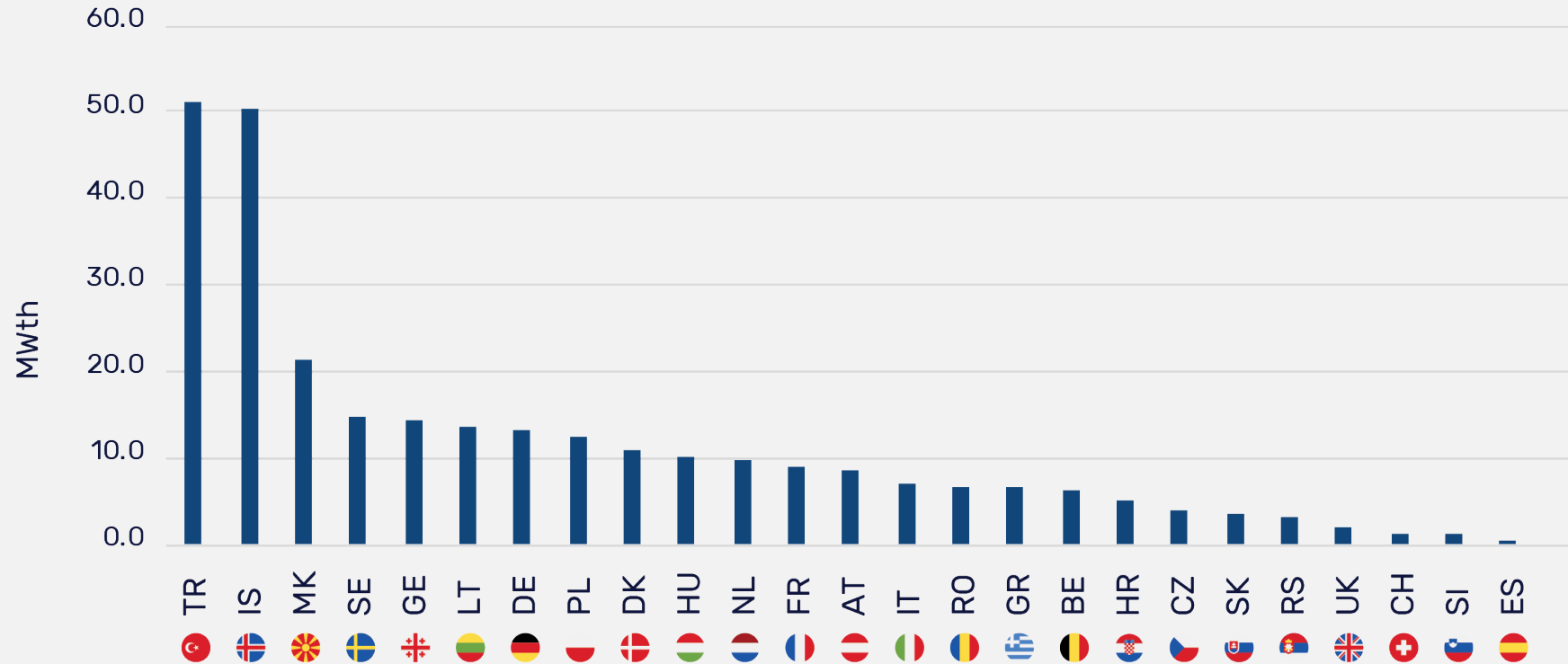
New plants for deep geothermal for heating and cooling in 2018 (capacity and number)



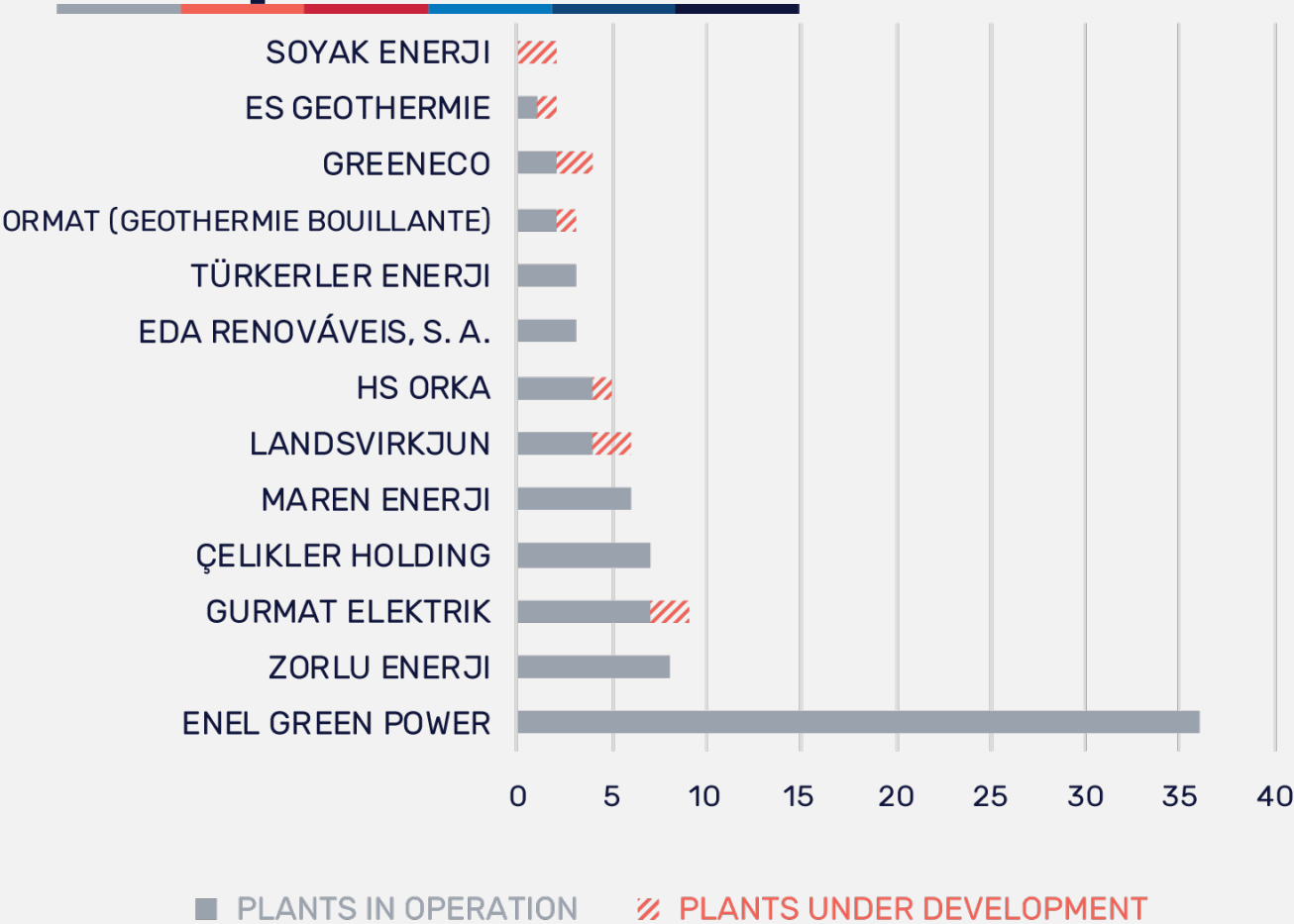
Number of GeoDH plants in operation and under development-investigation per country



Average size of deep geothermal heating and cooling plant per country



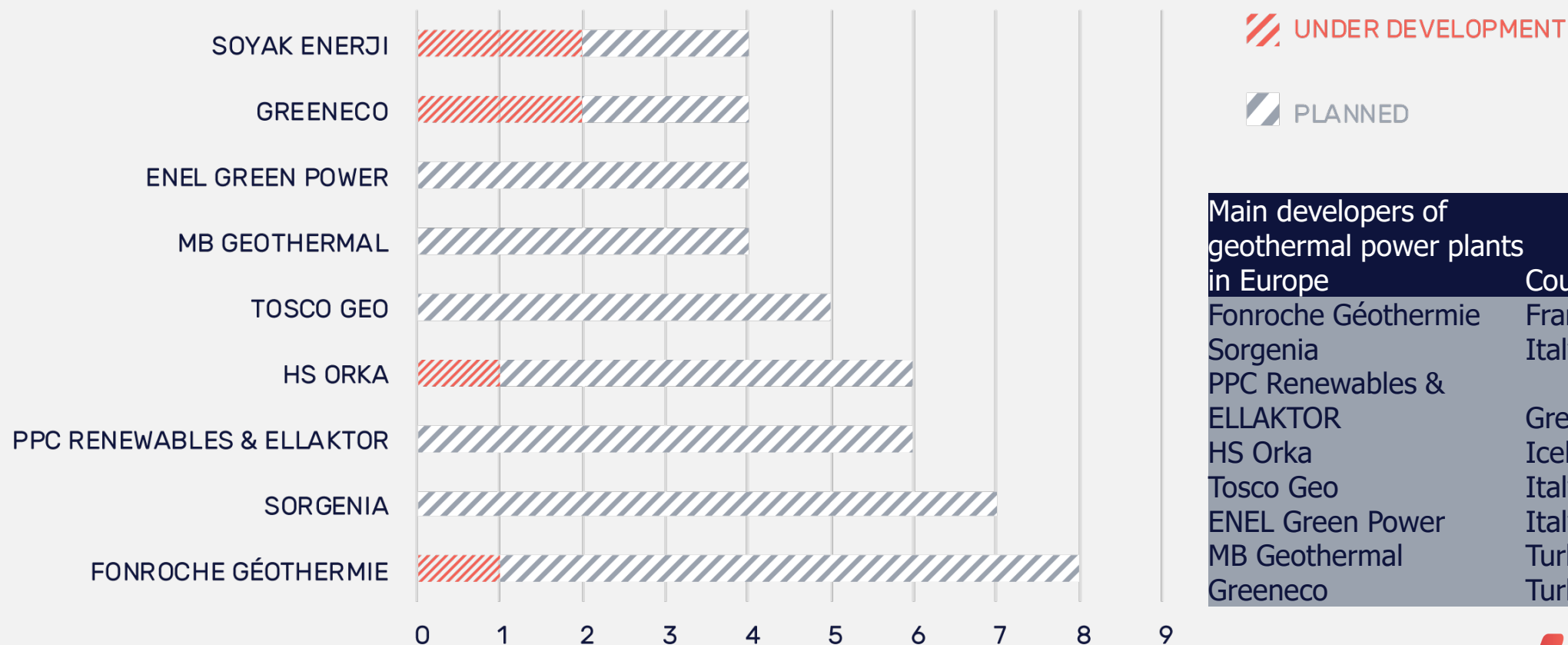
Main operators geothermal power plants in Europe



| 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 |

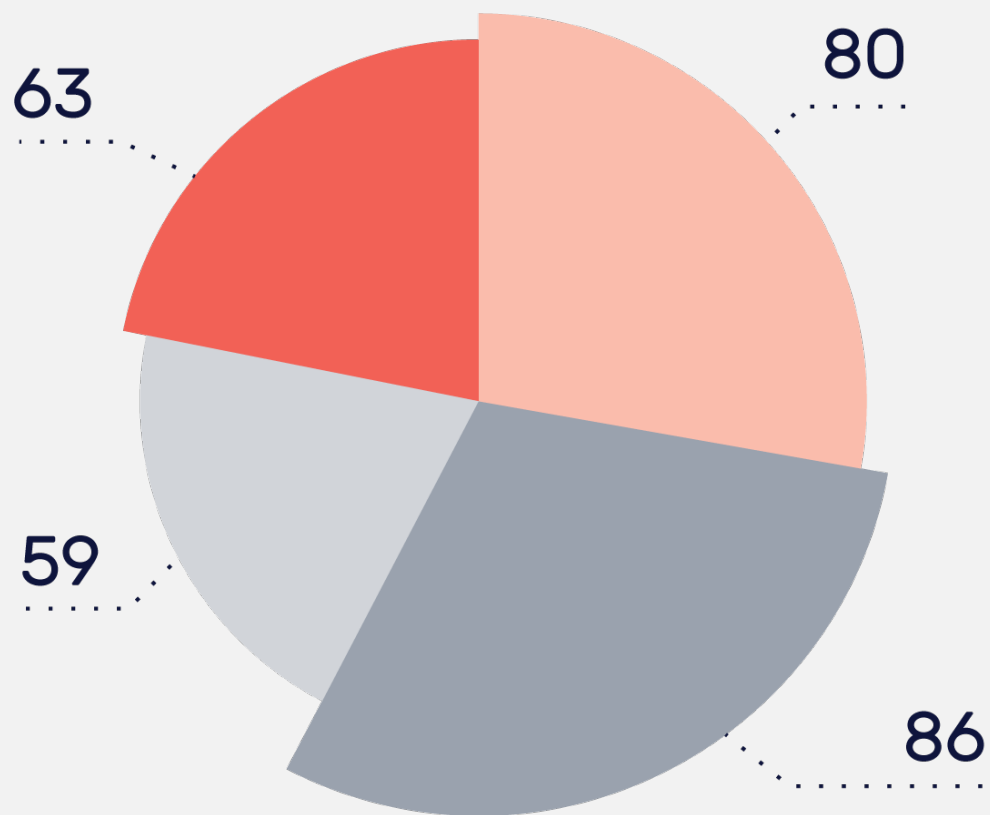


Main Geothermal electricity developers in Europe



| Main developers of geothermal power plants in Europe | |
|--|---------|
| | 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 |

Typology of geothermal heating and cooling projects operators in Europe



Public authority

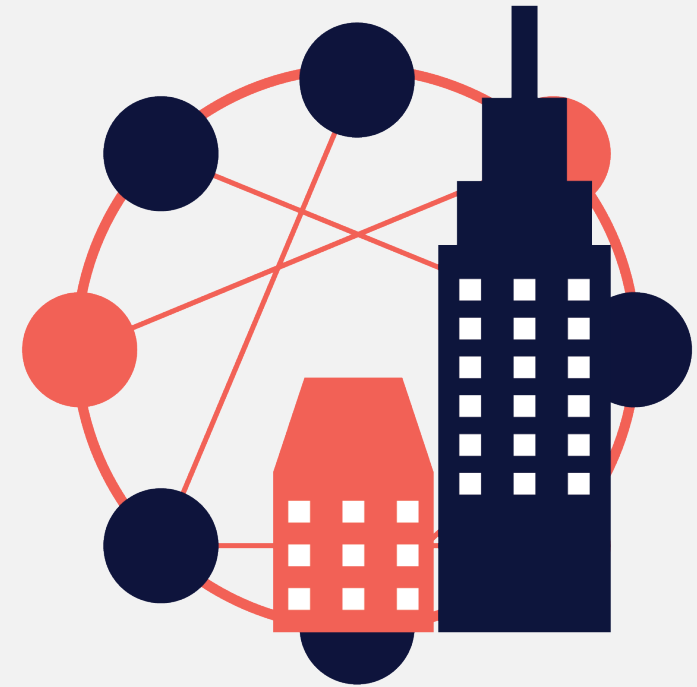
Local energy company

Large private operator

Smaller private operator

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



Corporate PPA

ICELAND

Landsvirkjun signed 35-MW hydro, geothermal PPA with United Silicon

And 58-MW PPA with PCC Bakki Silicon HF for a similar silicon metal plant

USA

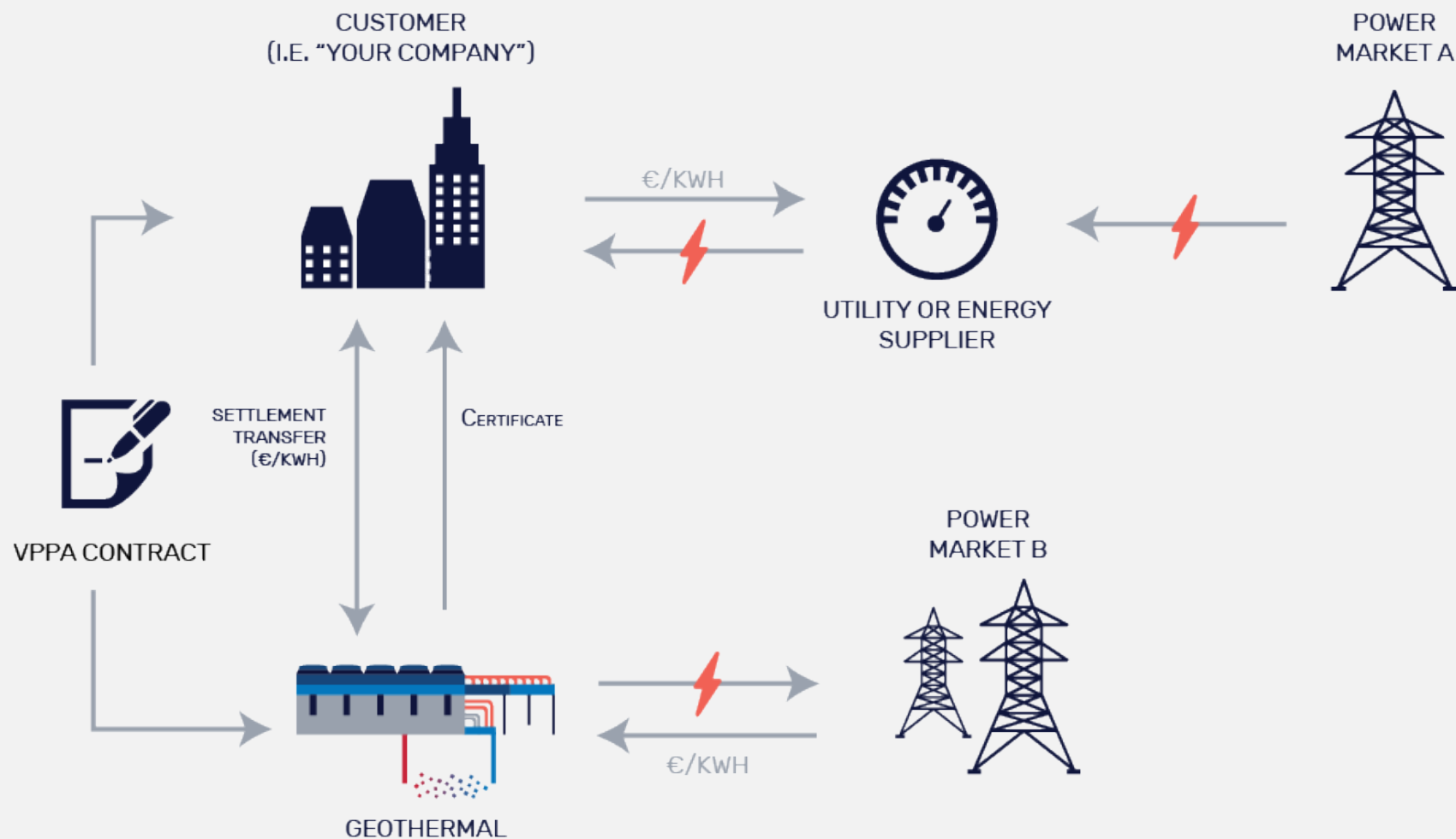
Physical and virtual PPA
Geothermal > Apple

MEXICO

52 MW to Minera Monteverde (metals & mining), Elektra (retail), Axtel (telecom)



Virtual PPA



Thank you for your attention

