

Geothermal energy in Europe

Overview of support schemes & business models

2018

Deep geothermal in Europe: market overview

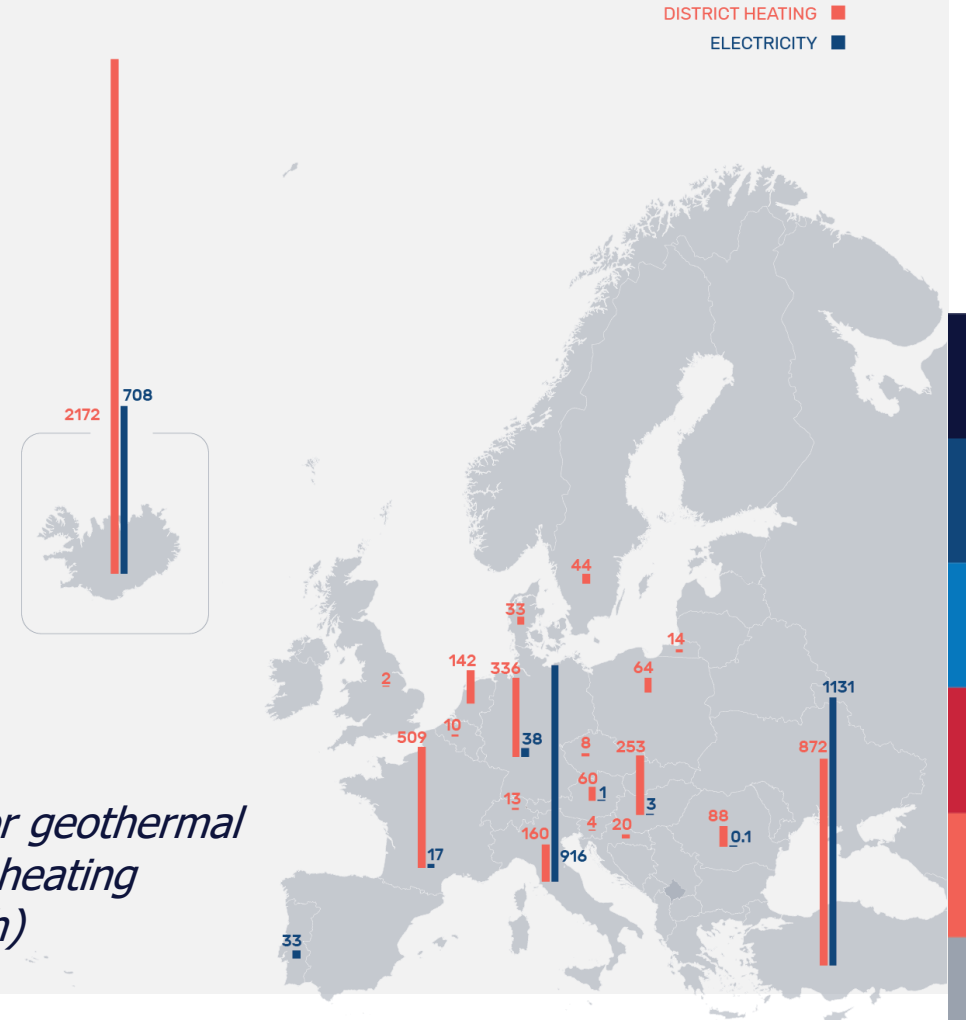
Geothermal electricity in Europe:

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

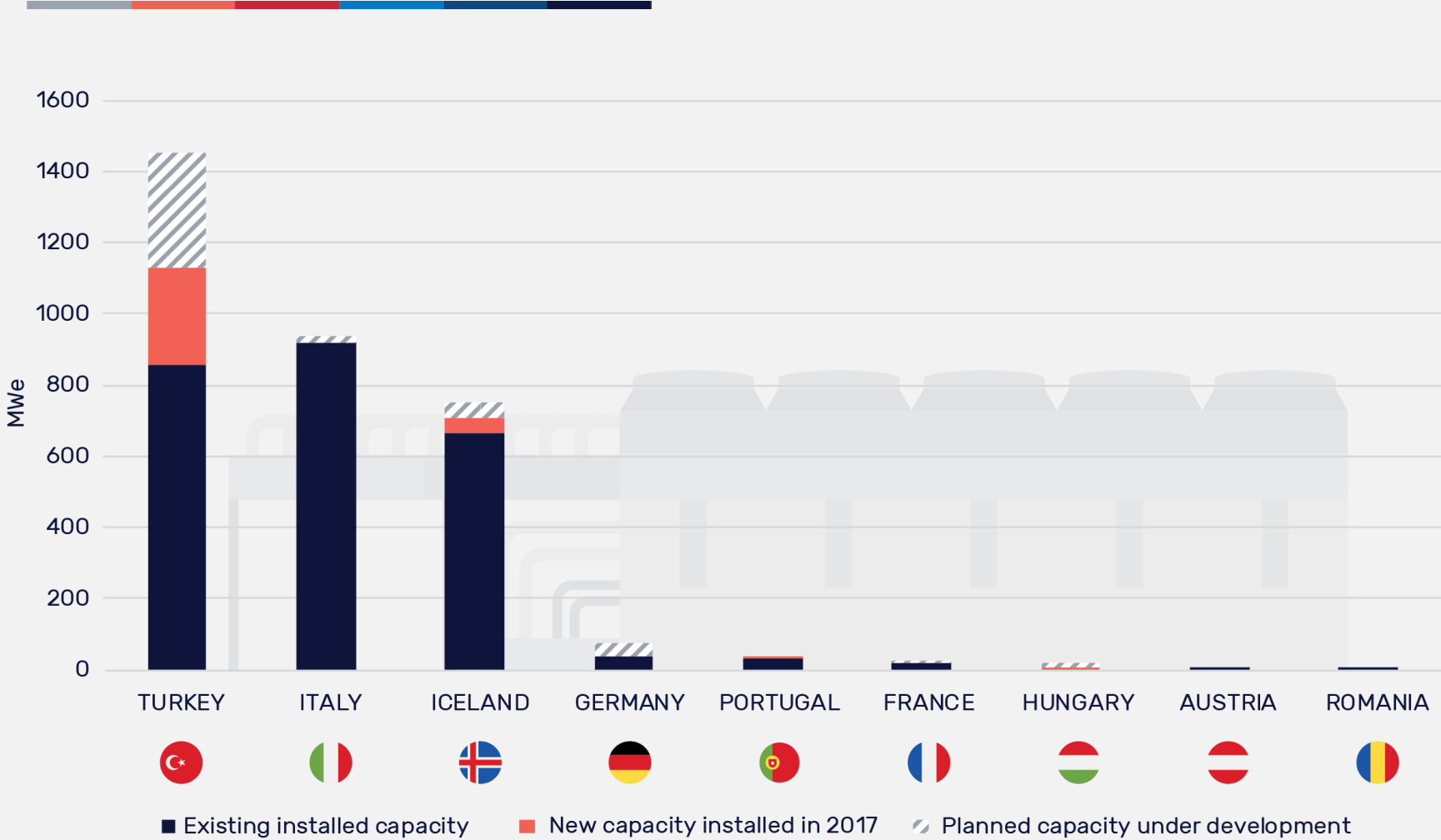
Geothermal district heating in Europe:

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

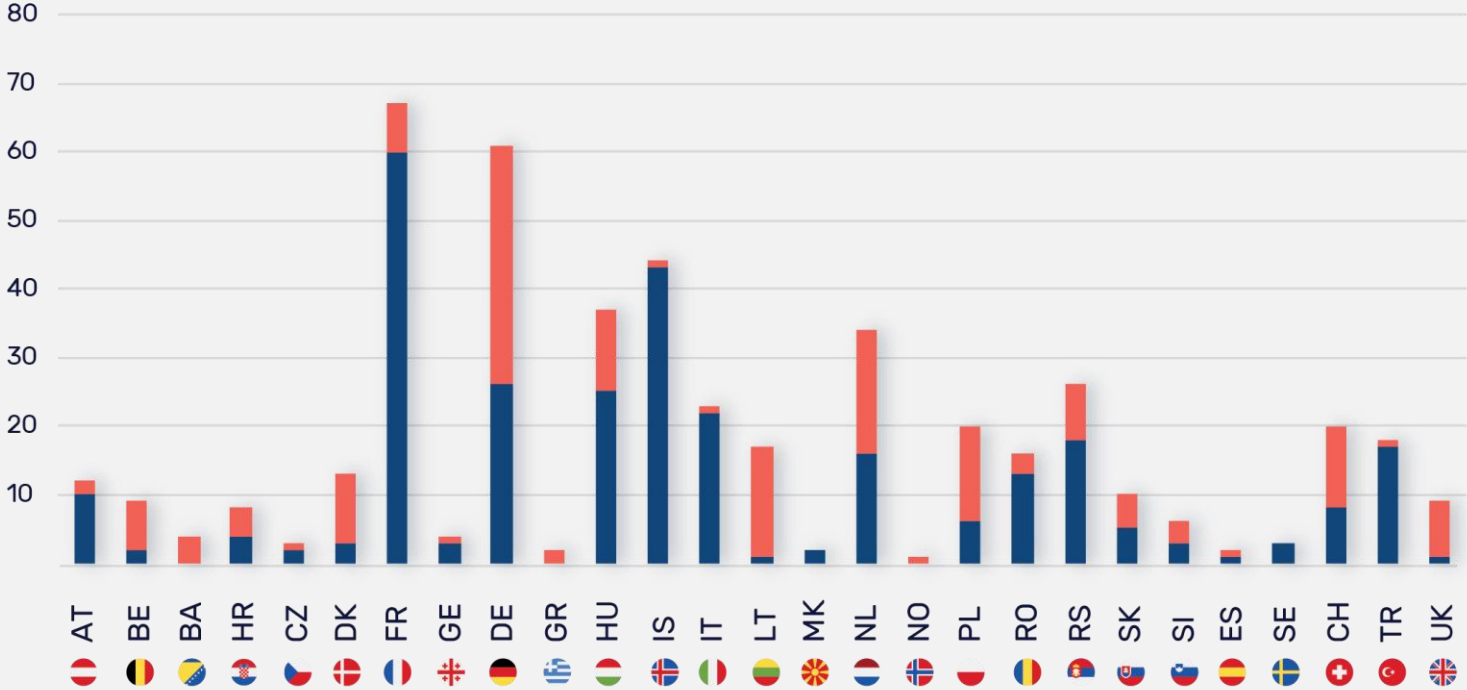
Installed capacity for geothermal electricity & district heating (2017, Mwe & MWth)



Capacity installed in 2017 by country (in MWe)



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



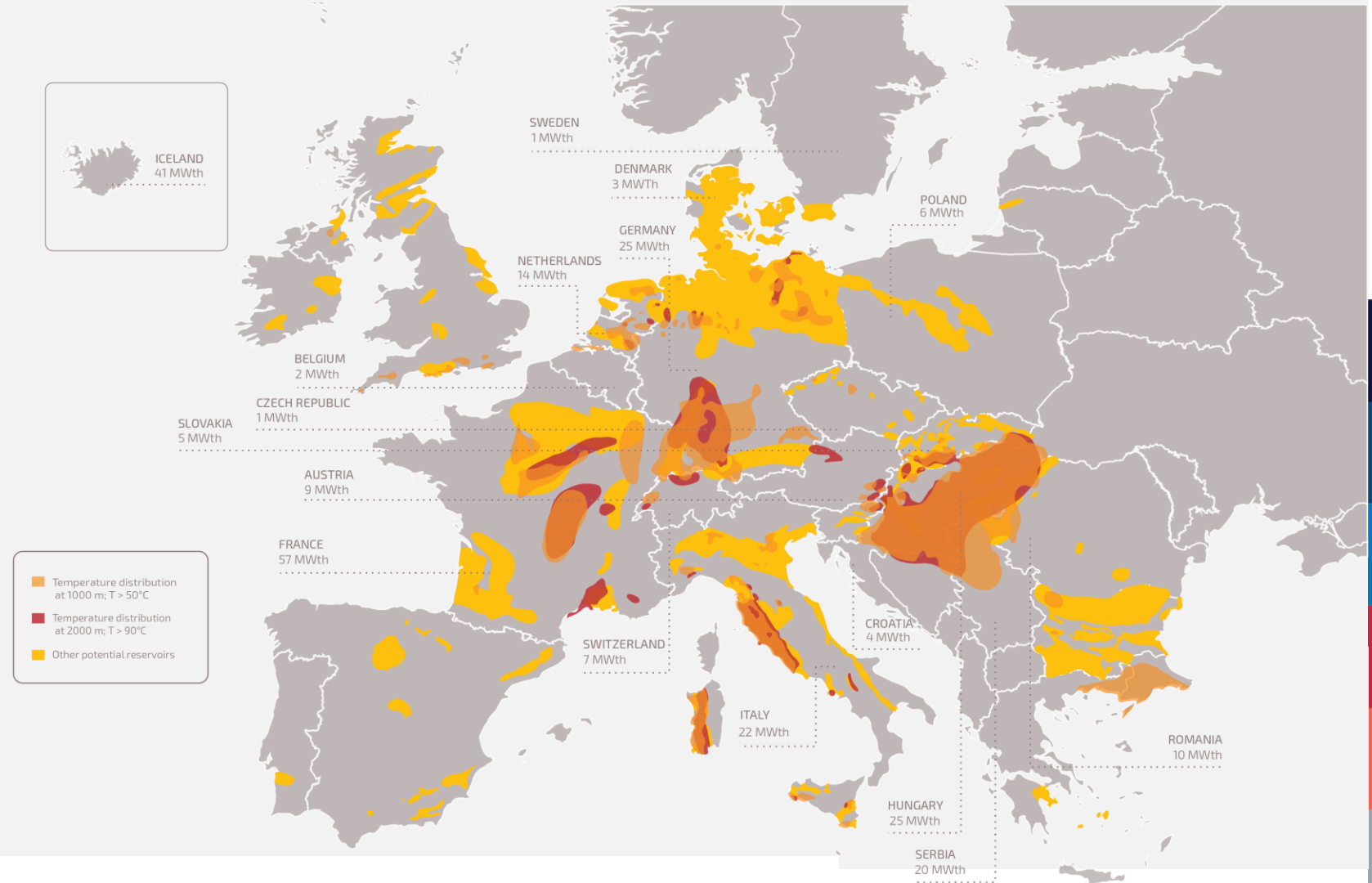
■ PLANTS IN OPERATION IN 2017
■ PLANTS UNDER EXTENSION/DEVELOPMENT/INVESTIGATION



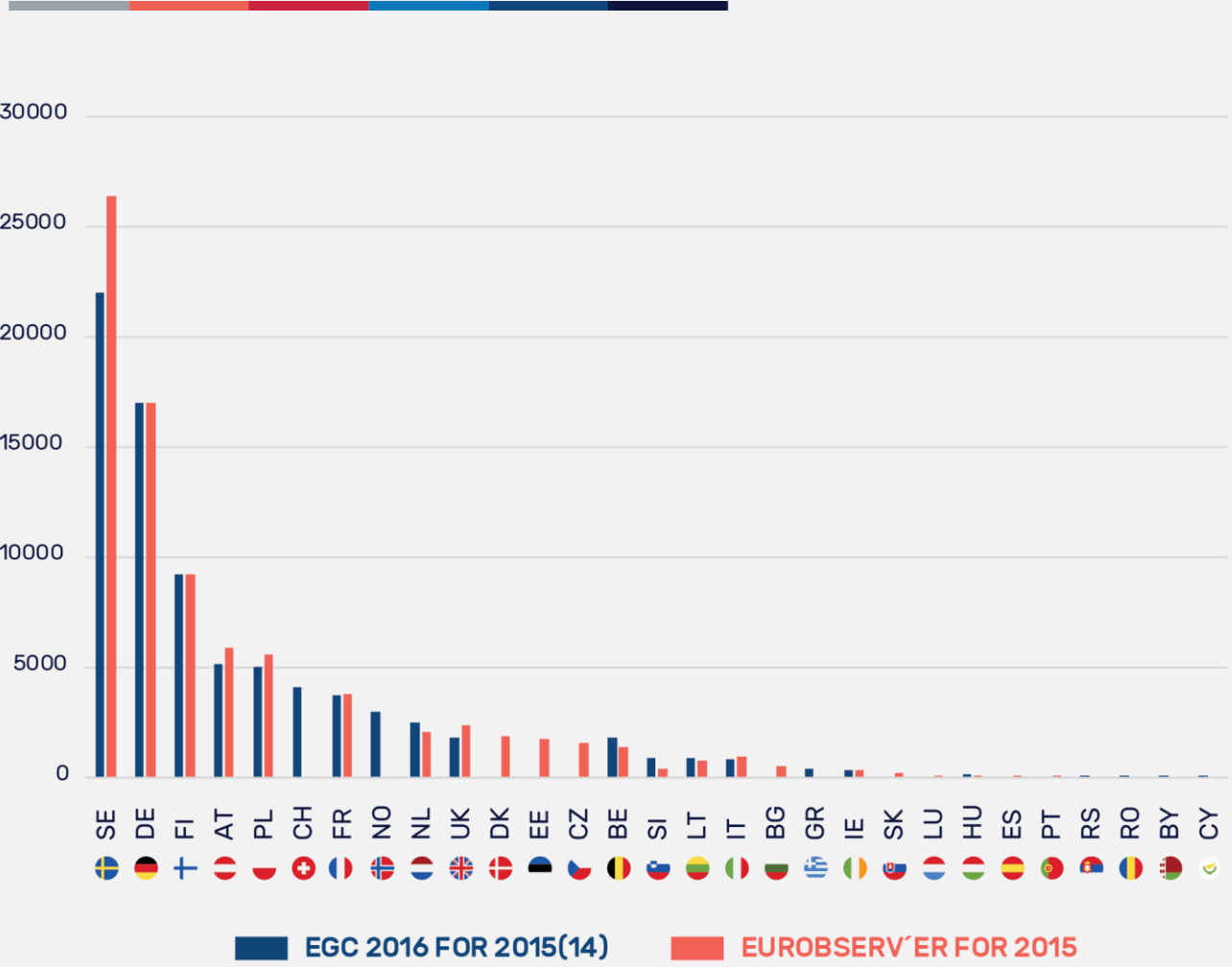
More than 25% of the EU population lives in areas directly suitable for geothermal district heating

Map of areas suitable for geoDH networks and actual geoDH installed capacity.

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



Ground Source Heat Pumps - Number of units installed

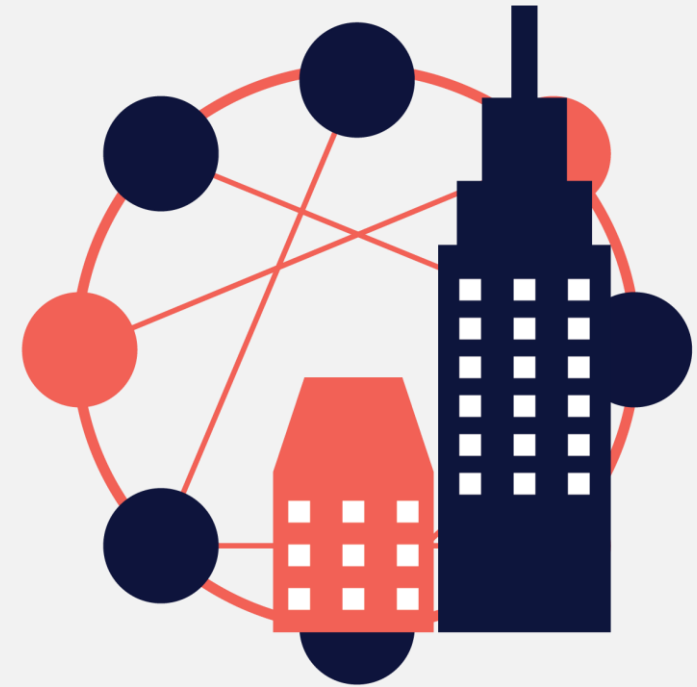


New business models for geothermal energy



Challenge of heat demand: 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 The Netherlands and J&J in Belgium



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

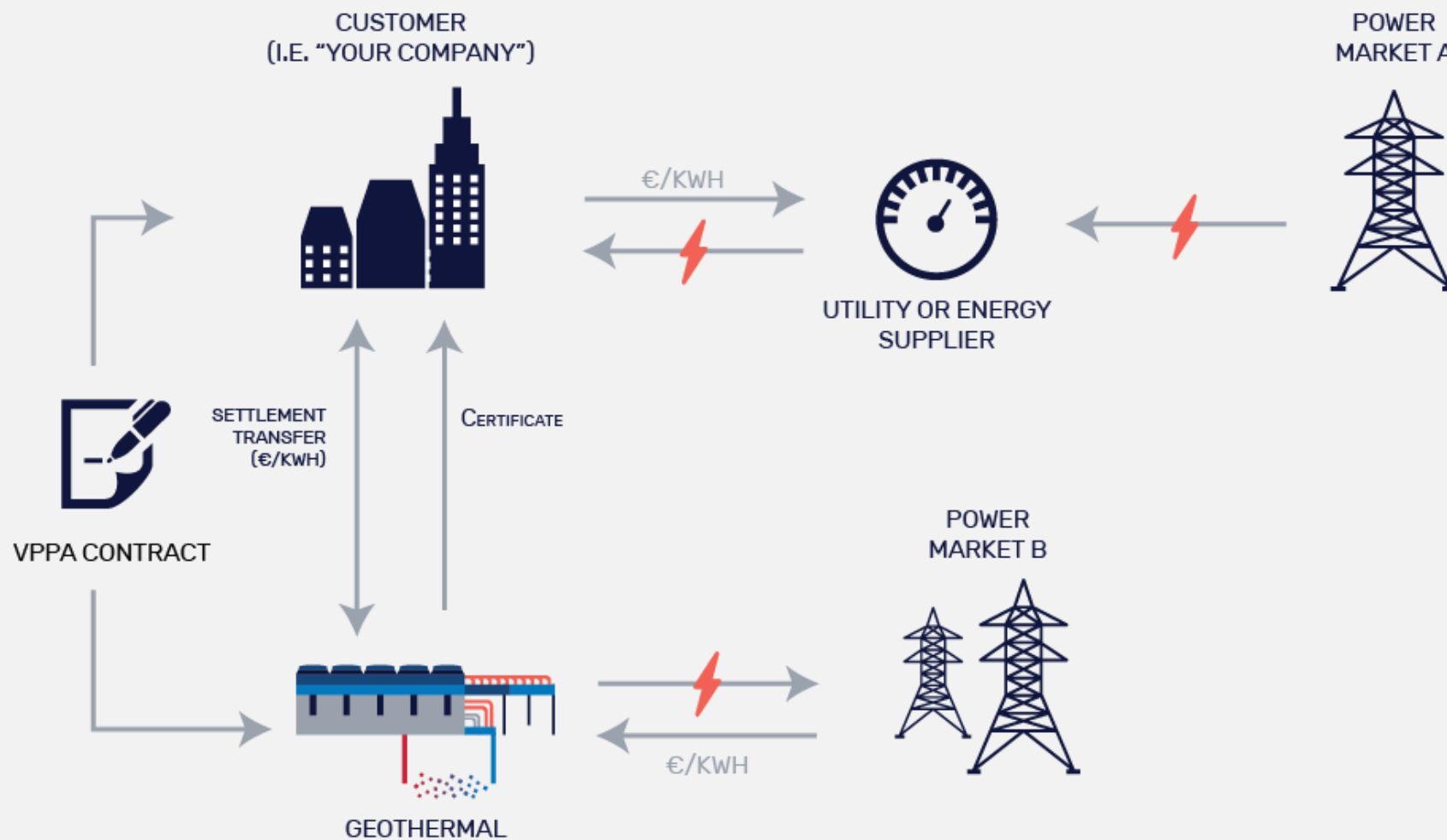
Physical and virtual PPA
Geothermal > Apple

MEXICO

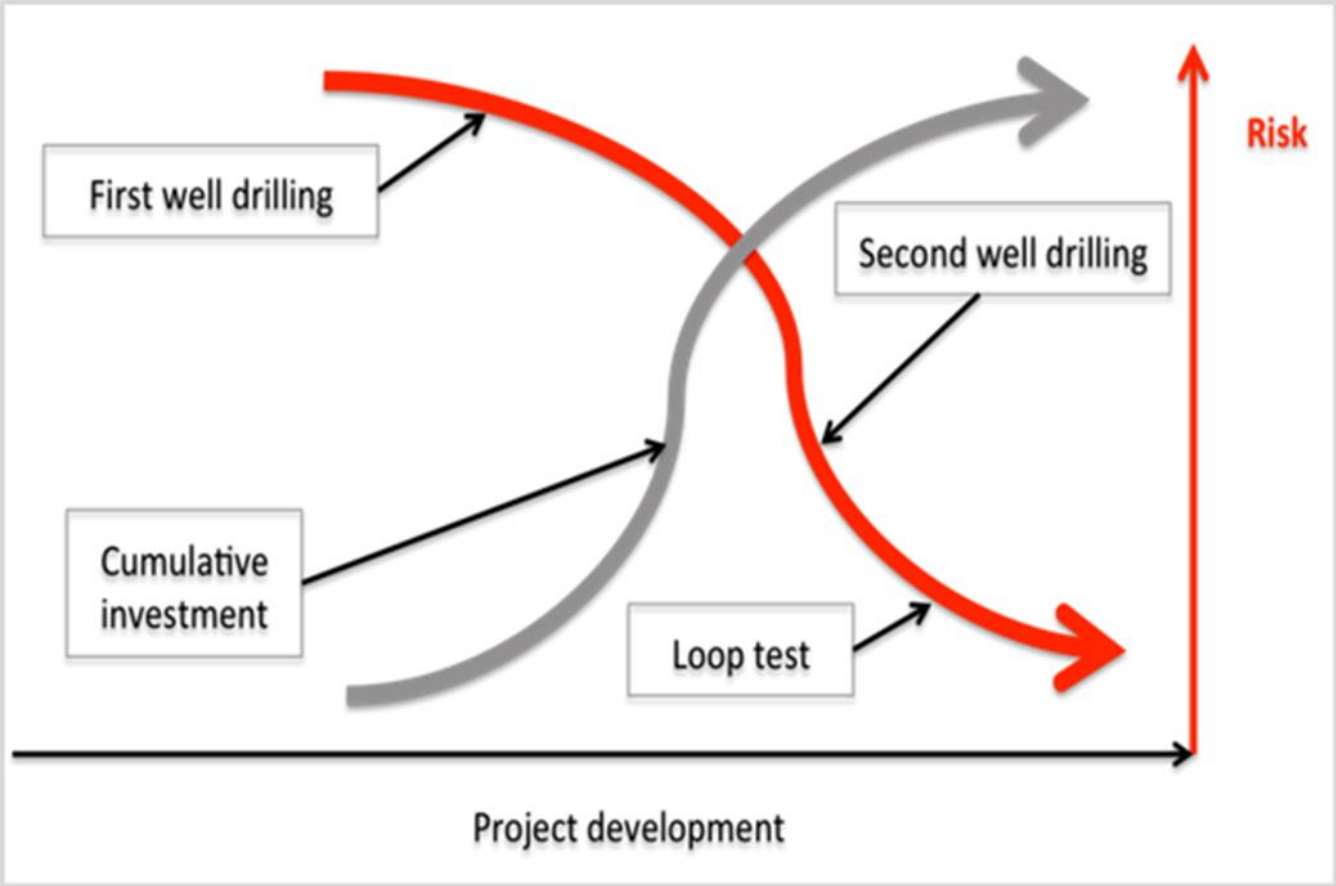
52 MW to Minera Monteverde (metals & mining), Elektra (retail), Axtel (telecom)



Virtual PPA



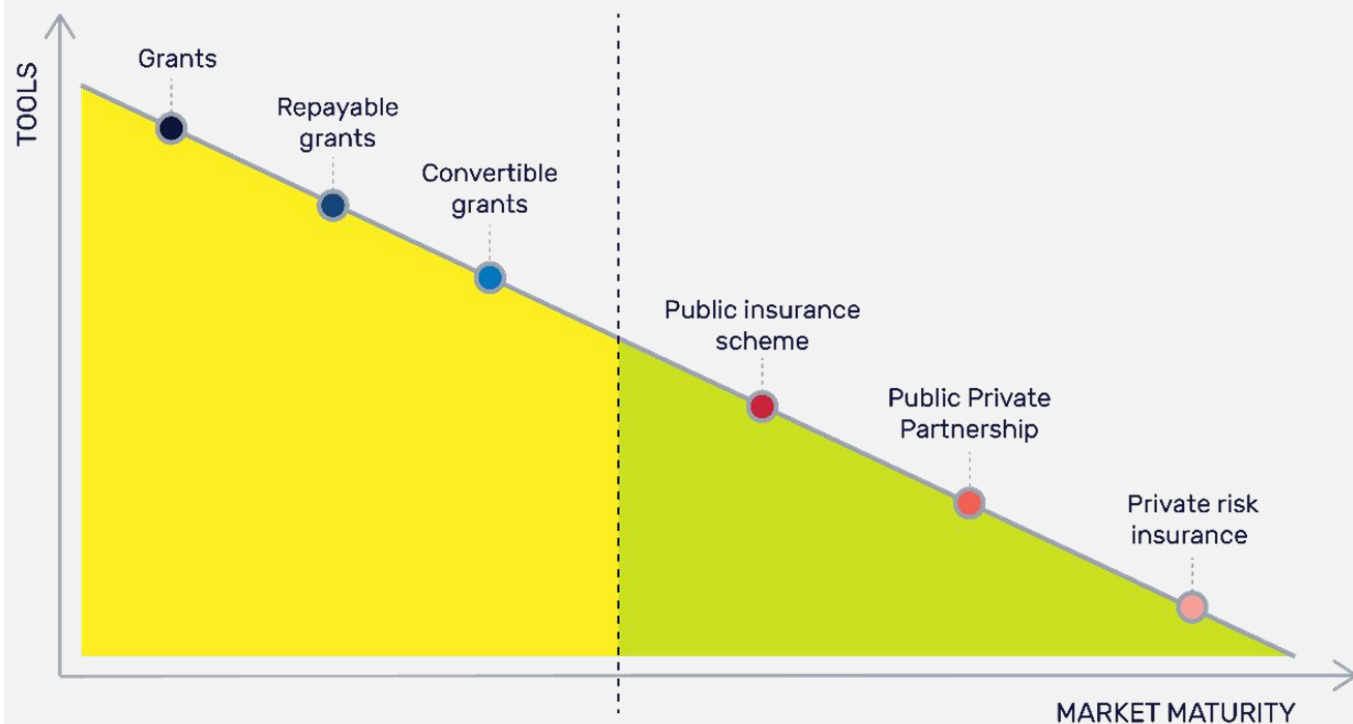
Risks in investments



How to mitigate the risk ?

- **Technology**: Geothermal resource database; Exploration technologies and assessment of geothermal reservoirs;
- **Technical**: New data acquisition with slimeholes, drilling/exploration campaign...
- **Legal**: data sharing (example of Netherlands)
- **Financial**: adapted schemes and tools

The GEORISK project



TARGET COUNTRIES IN EUROPE

- Assess transition in France, Germany, Turkey and Switzerland
- Establish new schemes in Hungary, Poland and Greece

REPLICATION IN

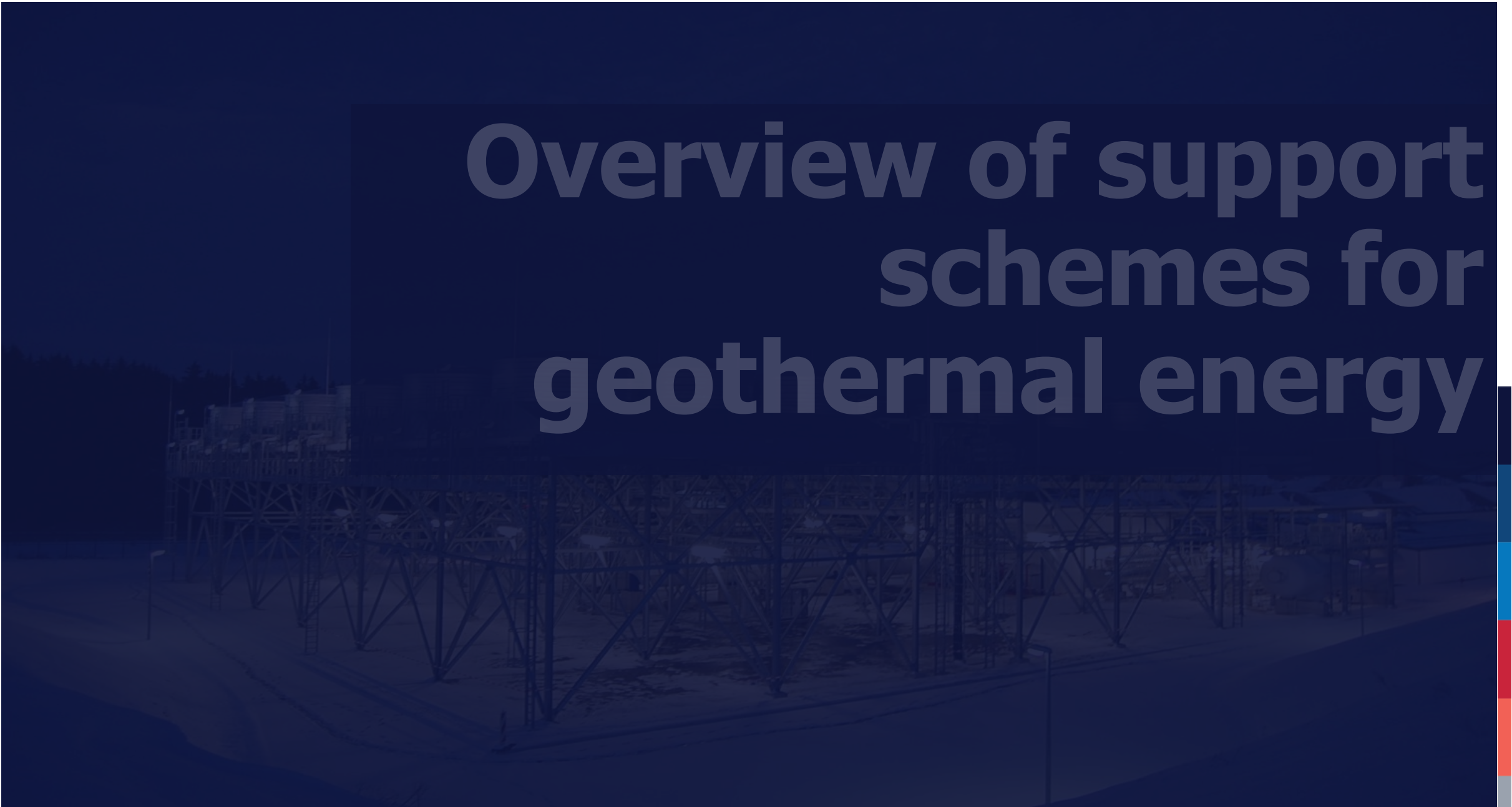
- Europe: such as transition in Denmark, Belgium (Flanders) and the Netherlands + New in Croatia, Spain (Canaries Islands)
- Worldwide: transition in Chile, Kenya & Mexico



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

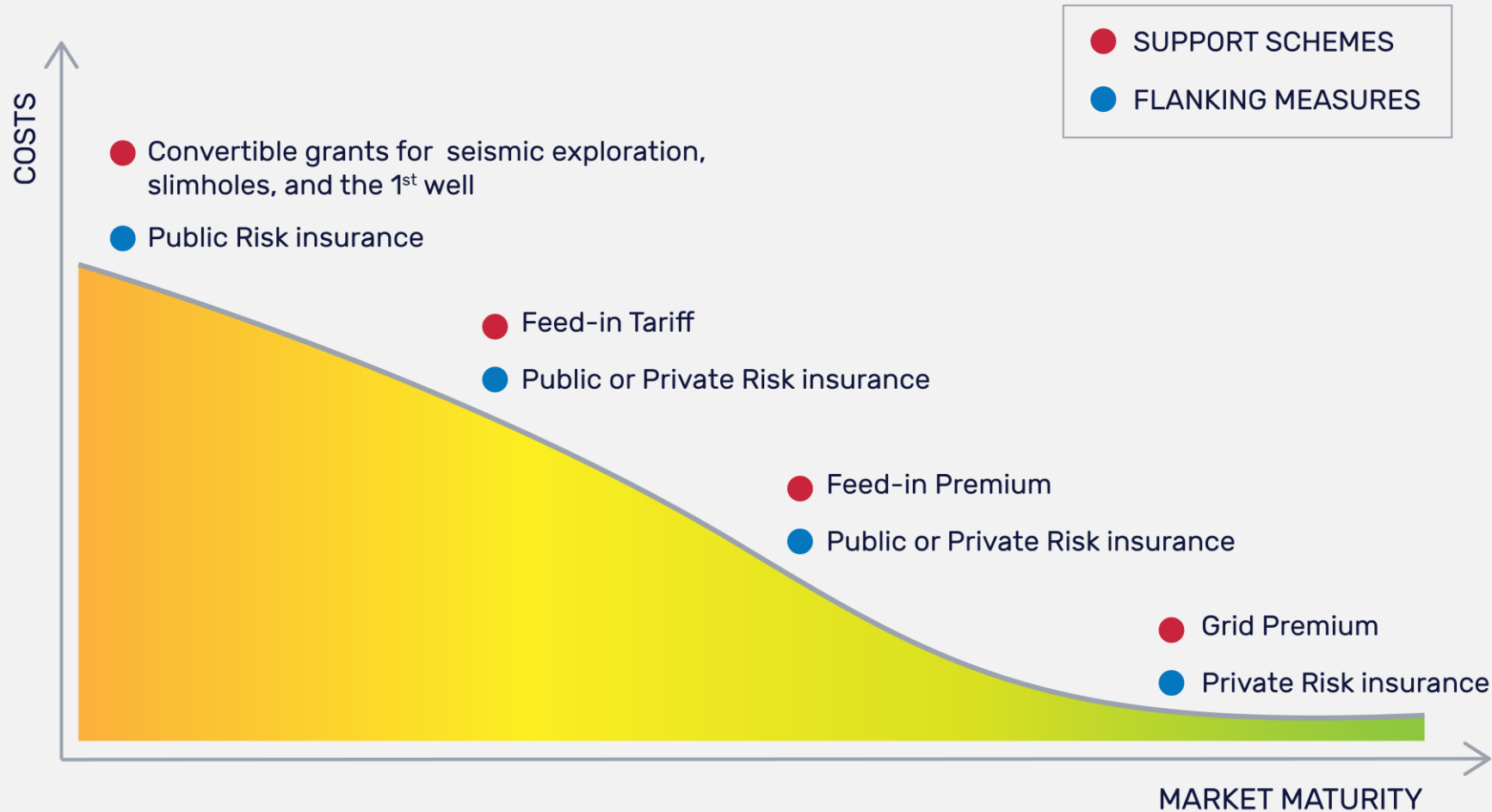


Overview of support schemes for geothermal energy

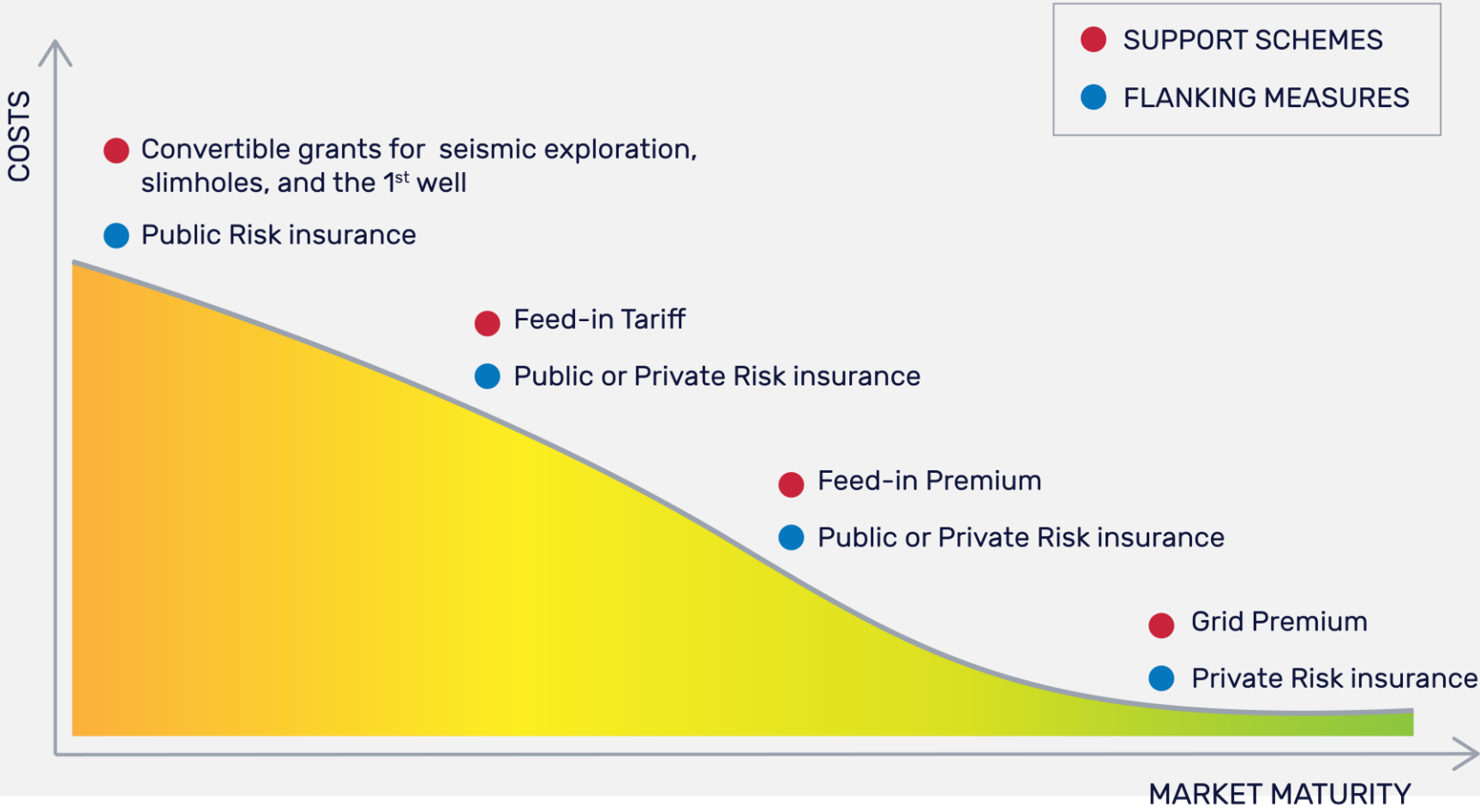


EGEC recommendations on public financing

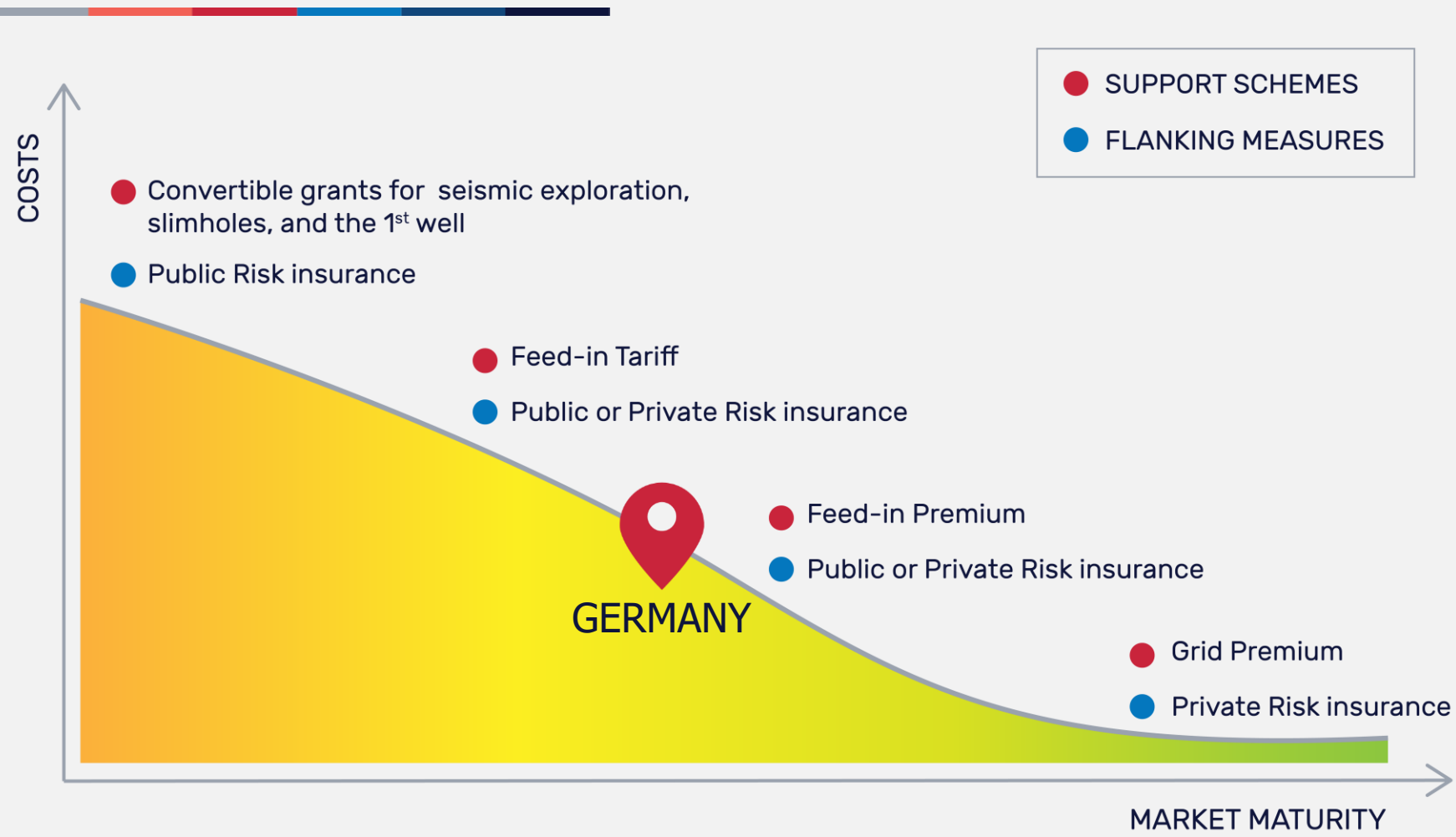
Support schemes for Geothermal adapted to technology maturity



What about Germany? Which support measures ?



Towards a prolongation of the Feed-in premium and the establishment of innovative insurance scheme: repayable loans ?



Feed-in tariff & Premium in Europe

Country	Type	Eligibility period (years)
Austria	Feed in tariff	13
Croatia	Tender, support awarded as FiPremium	N/A
France	Feed-in Premium	20
Germany	Feed-in Premium	20
Greece	Feed in premium	20
Hungary	Tender	20
Italy	Tender	25
	Feed in Tariff/Premium	20-25
Netherlands	Feed in Premium	15
Poland	Feed in Premium	15
Portugal	Feed in Tariff	12
Romania	Investment aid	N/A
Serbia	Feed in Tariff	12
Slovakia	Feed-in Tariff	15
Sweden	Quota system	15
Switzerland	Feed-in Tariff	20
Turkey	Feed-in Tariff / Tenders	10
UK	Feed in Premium	≤15

Feed-in tariff & Premium in Europe

An effective support if ...

- Well designed to be cost efficient
- Adapted degression of tariffs: to allow technology improvements and cost reductions
- Growth corridors instead of caps (risk of stop-and-go in the market)
- Stepped tariff design : premium for demo-innovative plant
- No retroactive cuts in Feed-in Tariff Support

Auctions: geothermal global overview

- **MEXICO**: results of the first 3 calls > CFE for 25 Mwe (3 prices).

Towards a 'base load factor' in the next calls ?

- **INDONESIA**: Highest reference price : \$0.155/ kWh, Energy Ministry ministerial decree no. 17, 2014.

The consortium of PT Hitay Southwestern Energy and PT Dyfco Energy has won the last auction for the Mount Talang Geothermal Working Area with an offer price of electricity of \$0.1275/ kWh.

- **KENYA**: announced move from Feed-in support to auctioning
- **CHILE**: award to ENEL's mix Wind-PV-Geothermal tender of supply of 1.180 TWh per year

Technology neutrality vs specific

**Thank you for
your attention**

