



Geothermal Energy in Europe: Market development, prospective and framework conditions

**Workshop on Geothermal energy:
Status and Future in the Peri-Adriatic Area
*25th August 2014***

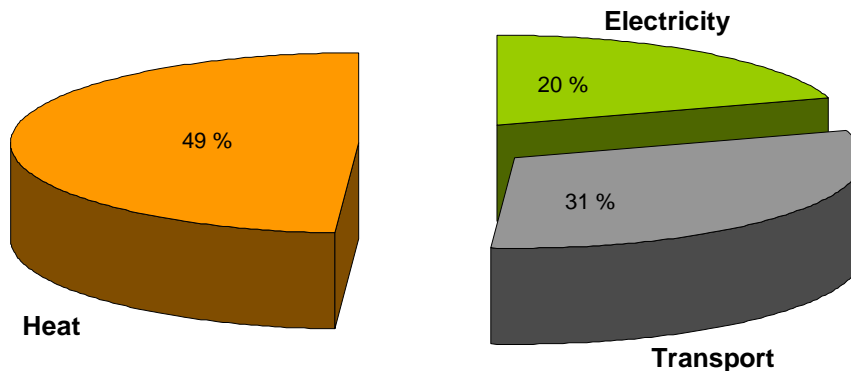
Luca ANGELINO, European Geothermal Energy Council

Content

- **Introduction**
- **Geothermal electricity**
- **Geothermal district heating**
- **Shallow geothermal**
- **Enabling framework: why and what?**



- Share of 49 % of the final energy consumption in EU was in the form of heat, 20% in the form of electricity, and 31% for transport.
- Heat accounted for:
86 % of the final energy consumption in households,
76 % in commerce, services and agriculture, and
55 % in industry

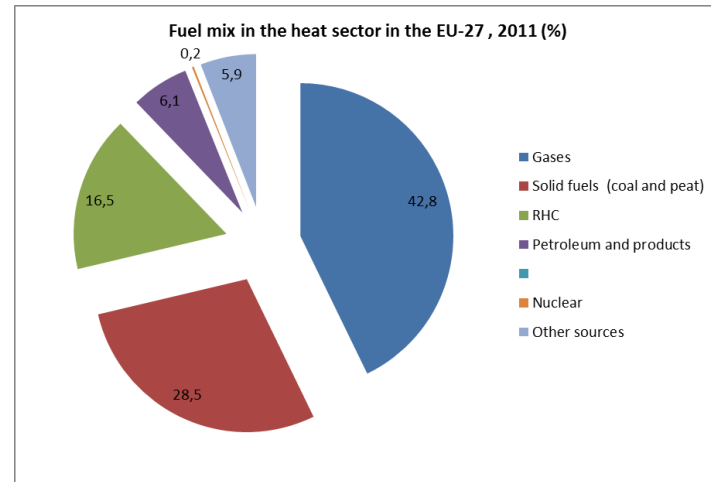


Key message: need a balanced, integrated, and holistic approach to energy policy

Introduction – the heat sector

Warnings:

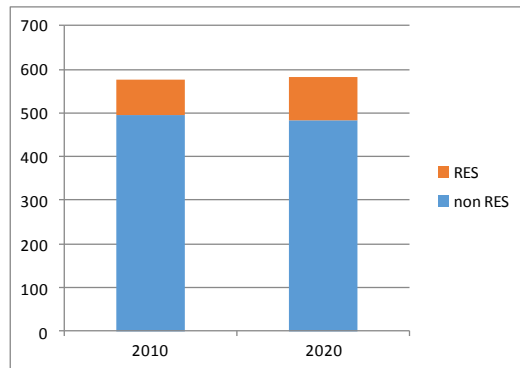
1. Fuel mix heavily dominated by fossil fuels



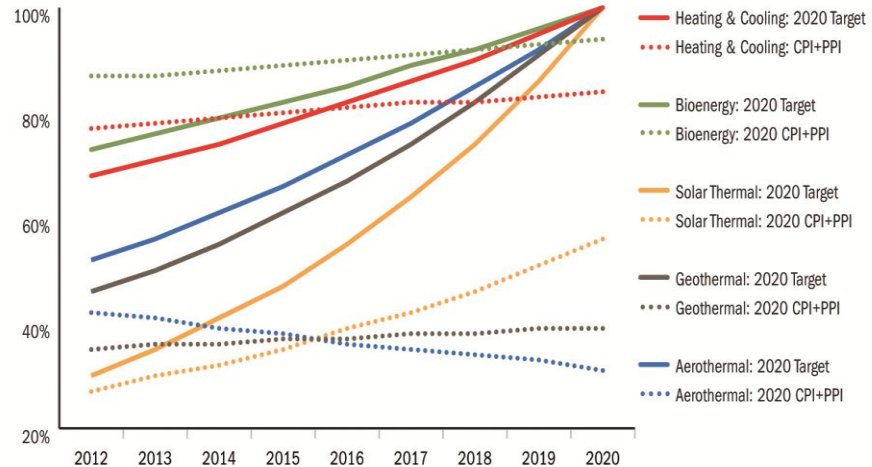
Source: EUROSTAT

2. Not on track to reach the 2020 targets

RES vs Non-RES heat (Mtoe)
– Source NREAPs



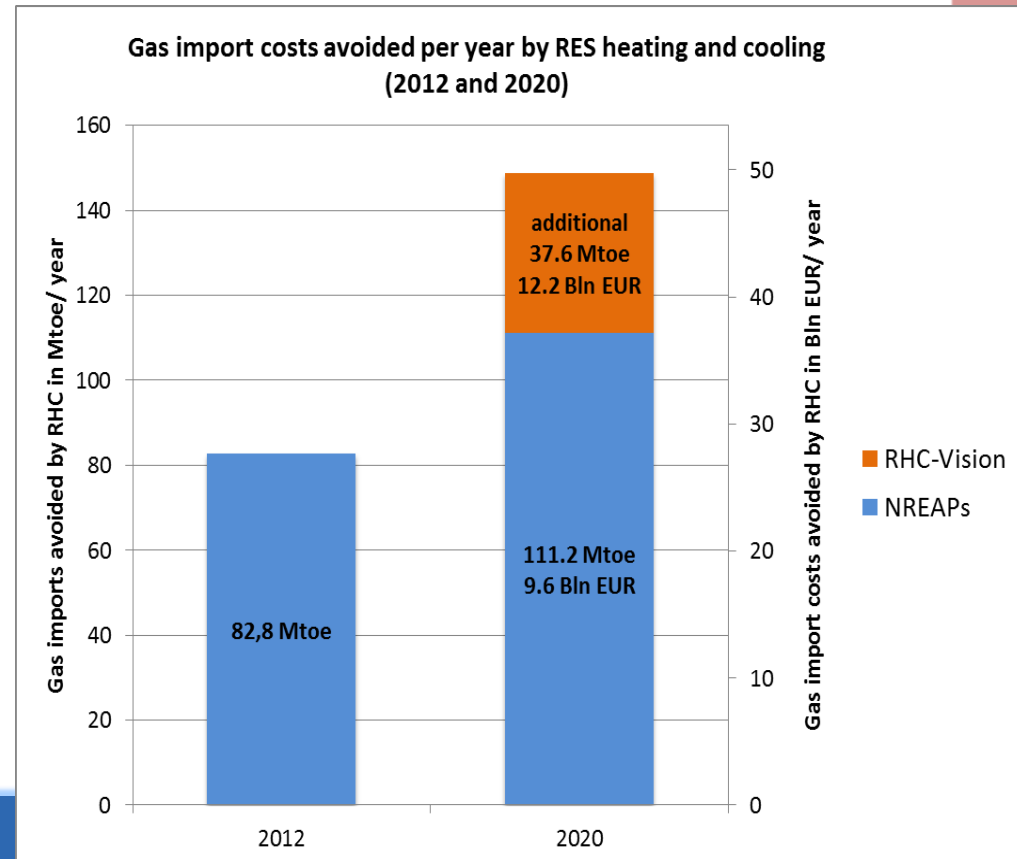
Deviation from 2020 targets



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Introduction – EU fossil import costs and role of RES

- **Natural gas dependency rate:** from 47.1% in 2001 to 65.8% in 2012
- **Use of natural gas in the EU:** ~ 40% buildings; ~ 30% in industrial processes and ~ 25% in power plants
- **EU's fossil fuels imports:** dramatic GDP-leakage - €545 bn (4.2% of EU GDP) on importing fossil fuels in 2012 alone
- **Price of electricity and fossil fuels** up and set to increase further (EC analysis)
- **A solution:** Geothermal and other RES for heating and cooling could save the EU €21.8 bn /y in 2020 compared to 2012
- **GT:** anywhere and available 24 h/d



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Geothermal Electricity in Europe

State of Play in 2013

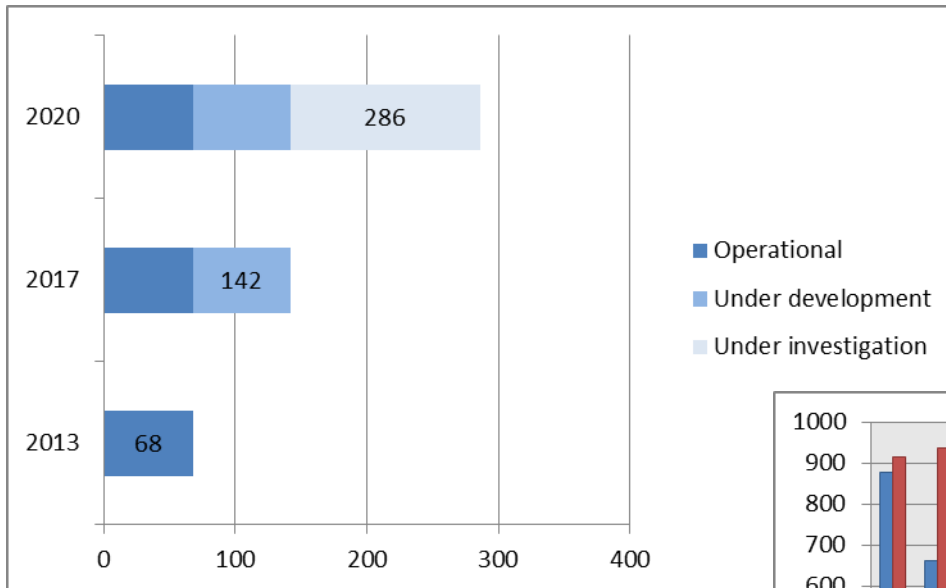
- Total Installed Capacity in Europe: 1.85 GWe
(+145 MWe in 2013)
- Producing 11,7 TWh of Electric Power

68 Geothermal Power Plants

- 8 new power plants in 2013
- EU Installed Capacity of 0.945 GWe

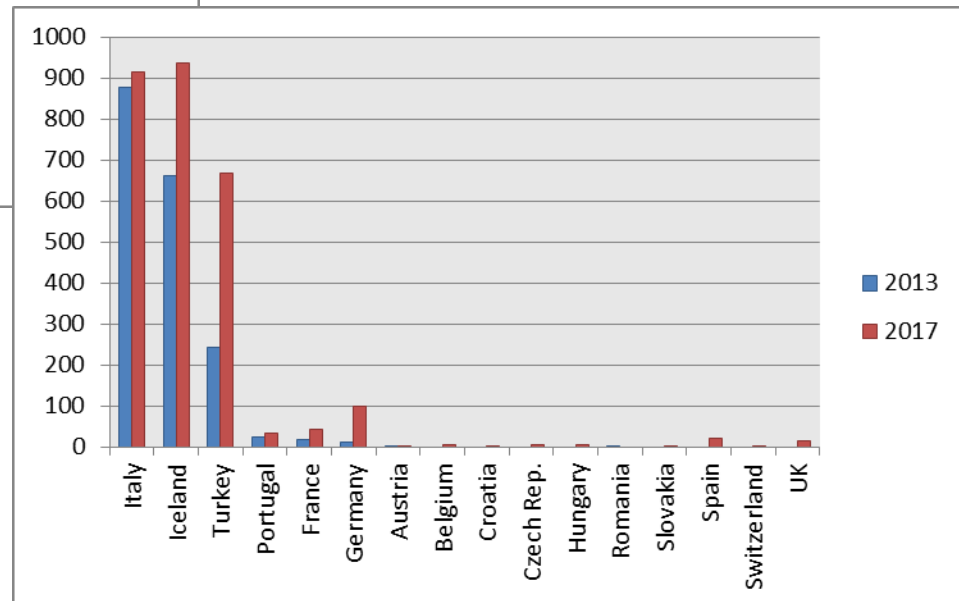
Installed Capacity per Country

Looking to next 5 years...

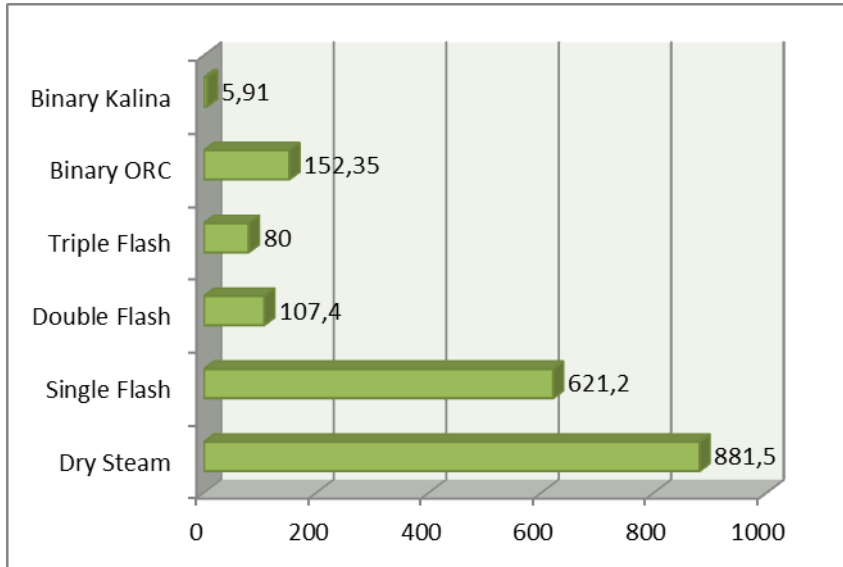


Number of geothermal power plants in Europe

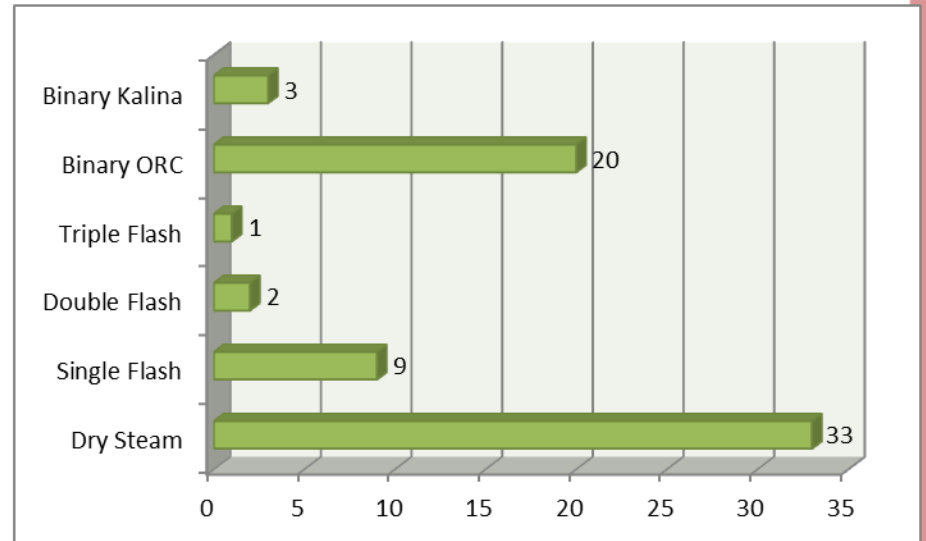
Installed capacity per country (MWe)



Focus on turbines



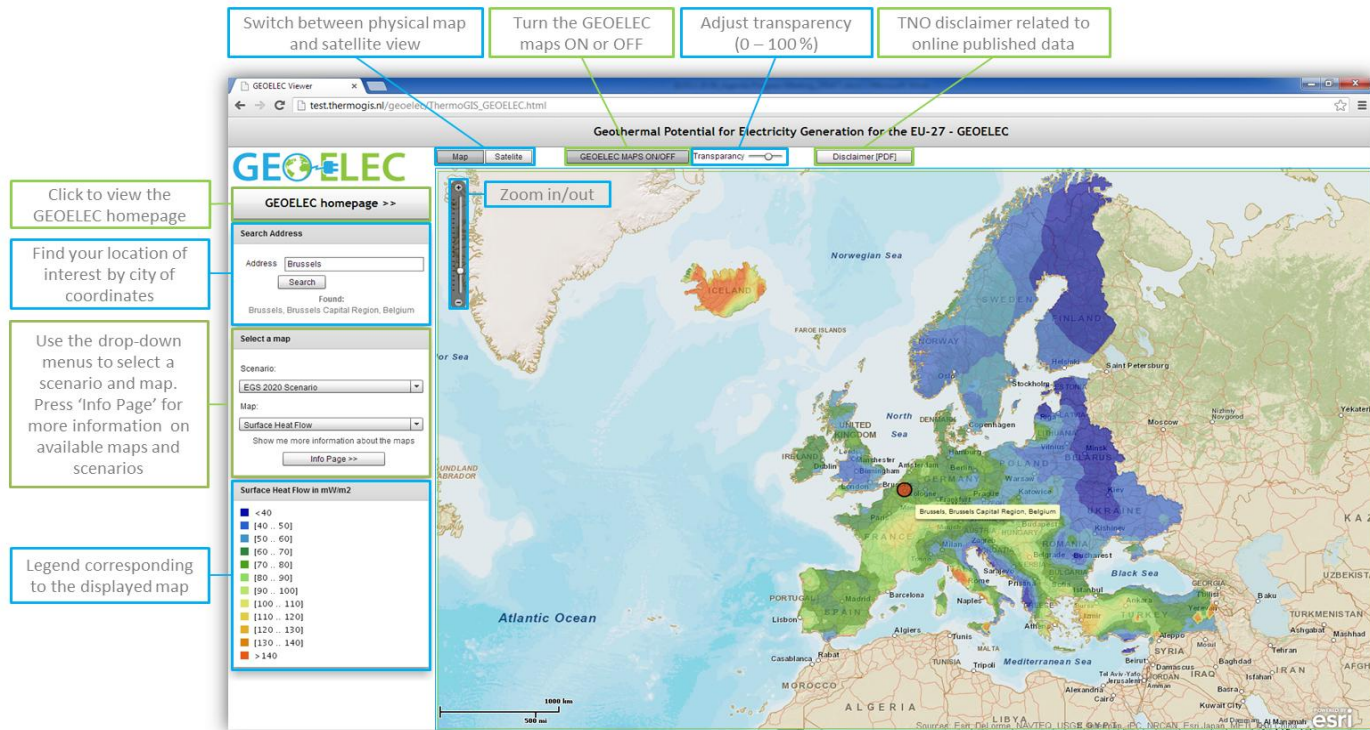
Installed capacity (MWe) per technology



Number of power plants per technology

Geothermal electricity: Prospective and resource assessment

The GEOELEC GIS presents for the first time ever a geothermal resource assessment from 1km to 5km depth



The screenshot shows the GEOELEC GIS interface with several callout boxes explaining its features:

- Switch between physical map and satellite view
- Turn the GEOELEC maps ON or OFF
- Adjust transparency (0 – 100%)
- TNO disclaimer related to online published data
- Click to view the GEOELEC homepage
- Find your location of interest by city or coordinates
- Use the drop-down menus to select a scenario and map. Press 'Info Page' for more information on available maps and scenarios
- Legend corresponding to the displayed map
- Zoom in/out

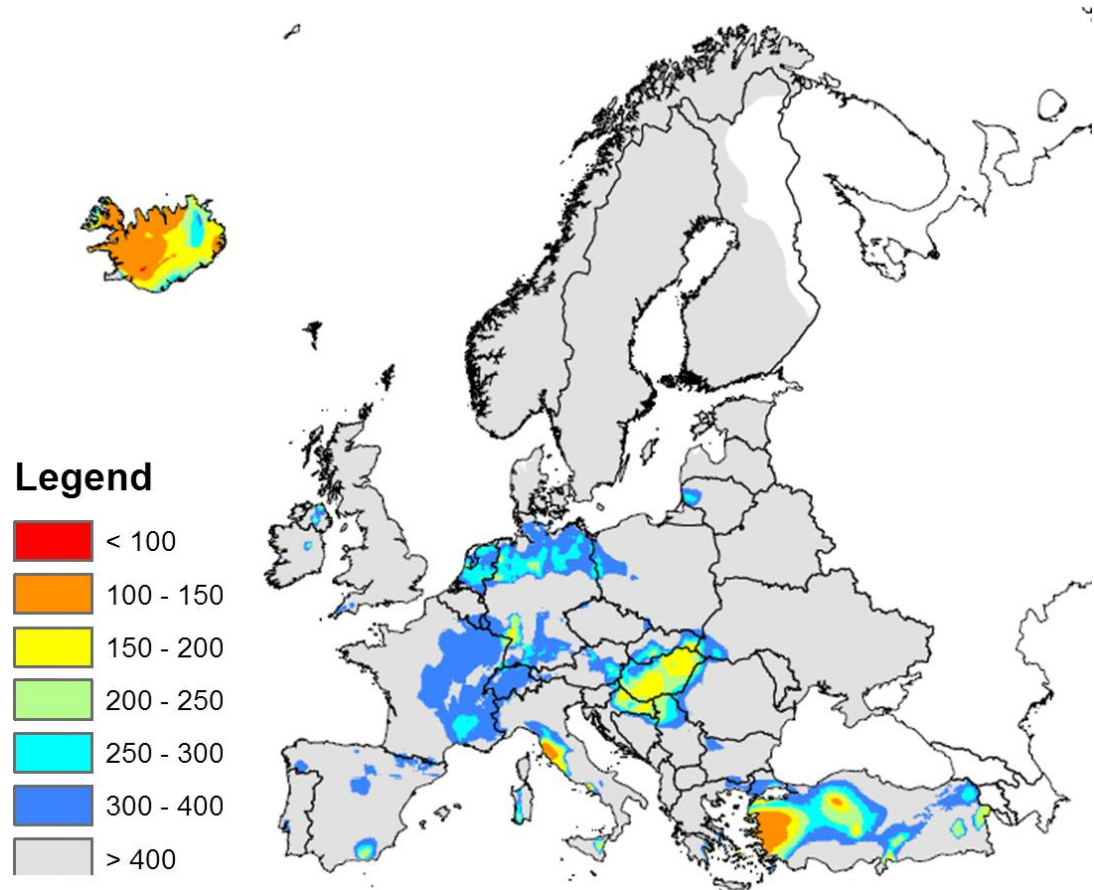
The interface includes a search bar for addresses, a scenario selector (EGS 2020 Scenario), a map selector (Surface Heat Flow), and a legend for Surface Heat Flow in mW/m2. The legend categories are:

Surface Heat Flow in mW/m2
< 40
[40 .. 50]
[50 .. 60]
[60 .. 70]
[70 .. 80]
[80 .. 90]
[90 .. 100]
[100 .. 110]
[110 .. 120]
[120 .. 130]
[130 .. 140]
> 140

Available at: www.geoelec.eu/library

Geothermal electricity: Economic potential in 2020

- The production of geothermal electricity in the EU in 2013 was 6 TWh.
- The NREAPs project a production in the EU-28 of 11 TWh in 2020. EUR/MWh all costs included.

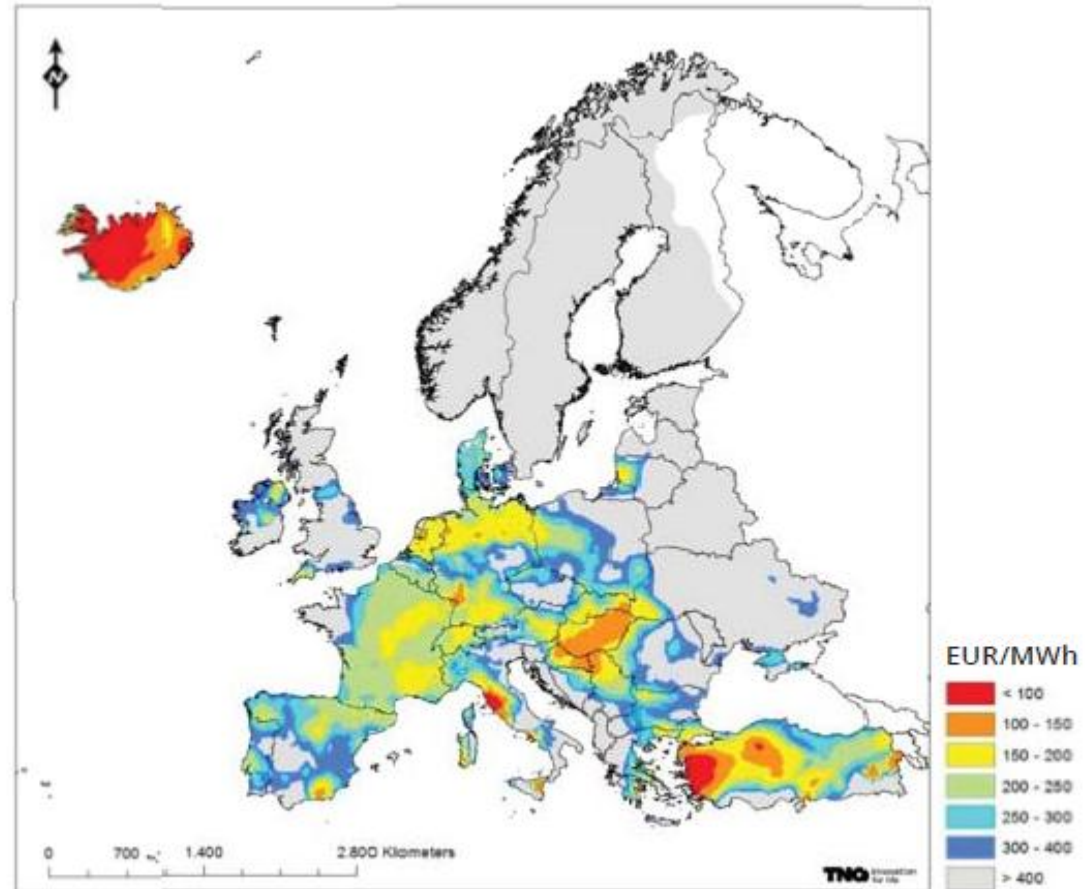


Minimum LCoE in 2020 (in EUR/MWh) Map from Goeolec project

Geothermal electricity: Economic potential in 2030

- According to the GEOELEC resource assessment, in 2030 the economic potential of geothermal power in the EU amounts to 34 TWh.

- Potential by country available in the GEOELEC Potential Study

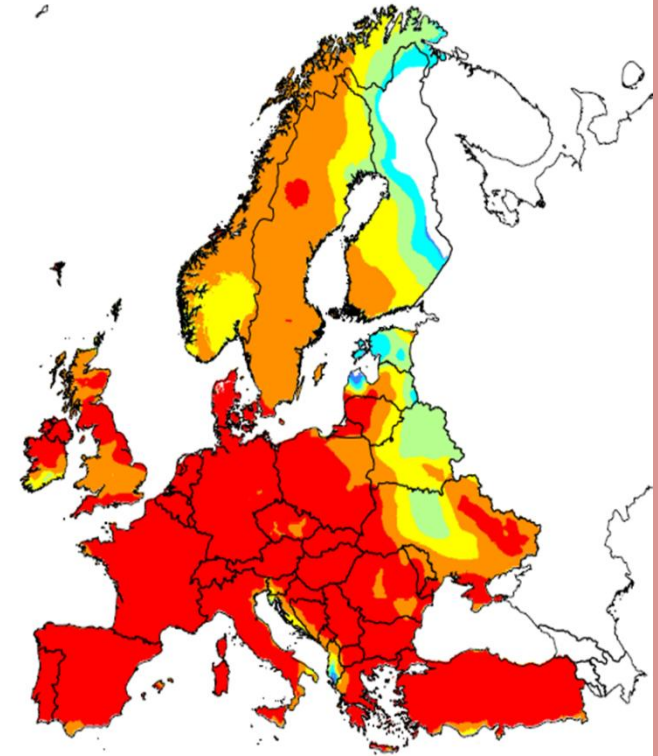


Minimum LCoE in 2030 (in EUR/MWh) Map from Geoelec project

Geothermal electricity: Economic potential in 2050

- Thanks to economies of scale, innovative drilling concepts and substantial cost reduction, the economic potential in the EU grows to approximately 2570 TWh in 2050
- Potentially 50% of the projected electricity produced in the EU)
- More than 4000 TWh including Iceland, Turkey and Switzerland.
- This at ≤ 100 EUR/MWh all costs included.
- Requires large-scale deployment of EGS technologies – today 3 in operation; 11 under development + 2 new NER 300 in HR and FR

Legend



Geothermal power:
economic potential in 2050
(Map from project GEOELEEC)

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Geothermal District Heating

State of Play in 2013

- Total Installed Capacity in Europe: 4.3 GWth (+122 MWth in 2013)
- Producing 12883 GWh of Thermal Power

237 Geothermal DH Plants

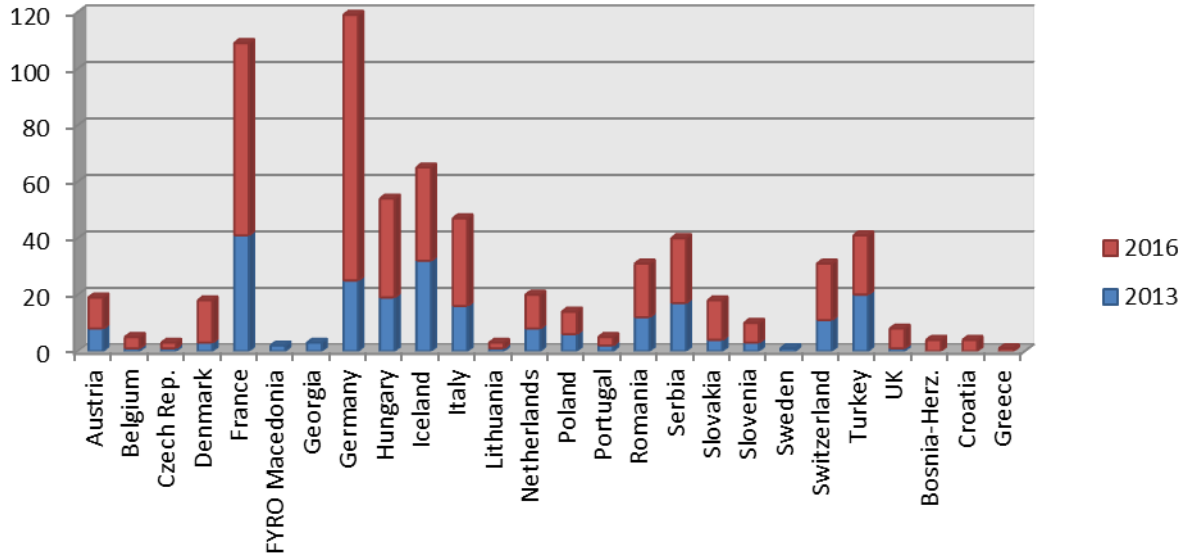
- 11 new GeoDH plants in 2013 + 4 triplet systems
- EU Installed Capacity of 1.1 GWth



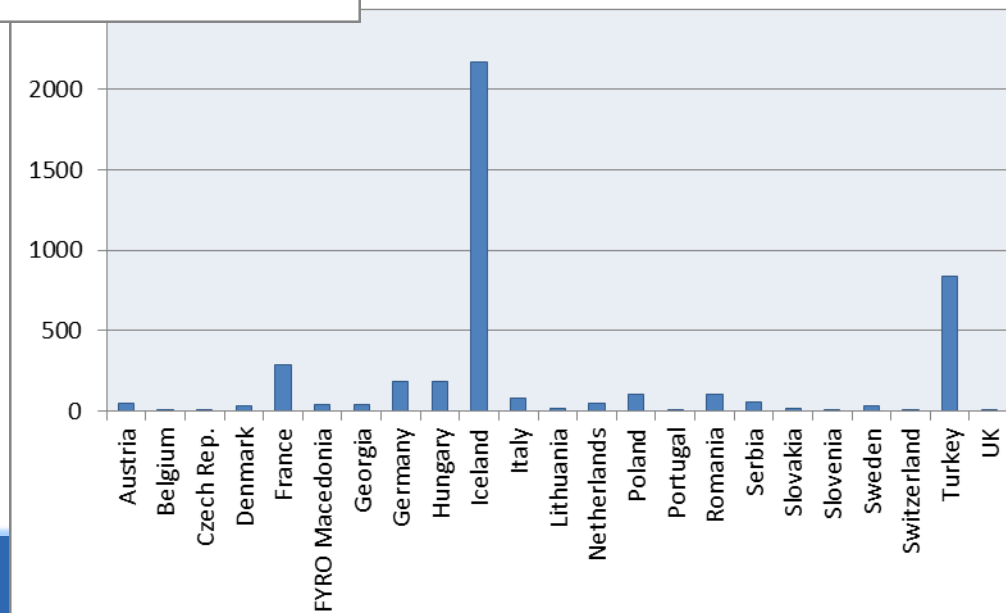
Installed Capacity per Country

Looking to next 4 years...

Number of geoDH systems in Europe



Installed capacity per country (MWth)





European Geothermal District technologies– Technological challenges

- Towards low temperature GeoDH systems with HP
- Increase operational time: from doublet to triplet
- GeoDH from CHP: new opportunities with EGS
- EGS purely for industrial heating: case of ECOGI project
- What about Geothermal District Cooling ?
- Which source combine the GeoDH to ? Biomass, solar etc.
- GeoDH for smart cities= intelligent thermal grid

Geothermal DH: GeoDH Map Viewer

- European scale overview on the deep geothermal potential in 14 countries combined with the existing heat demand in an interactive way
- Shows best potential areas for future geo-DH developments.
- The viewer is available at: www.geodh.eu



Geothermal DH: Potential

- 25% of the EU population located in regions where the temperature at 2000 m deep is higher than 60° C, directly suitable for geothermal H&C.
- Potential in 14 countries available in 09/14
- Viewer and potential available at: www.geodh.eu



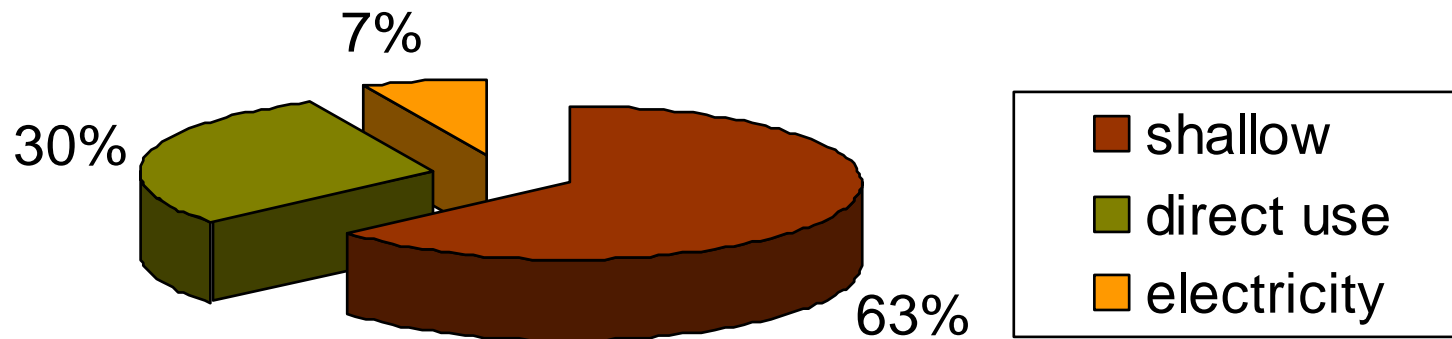
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Shallow geothermal

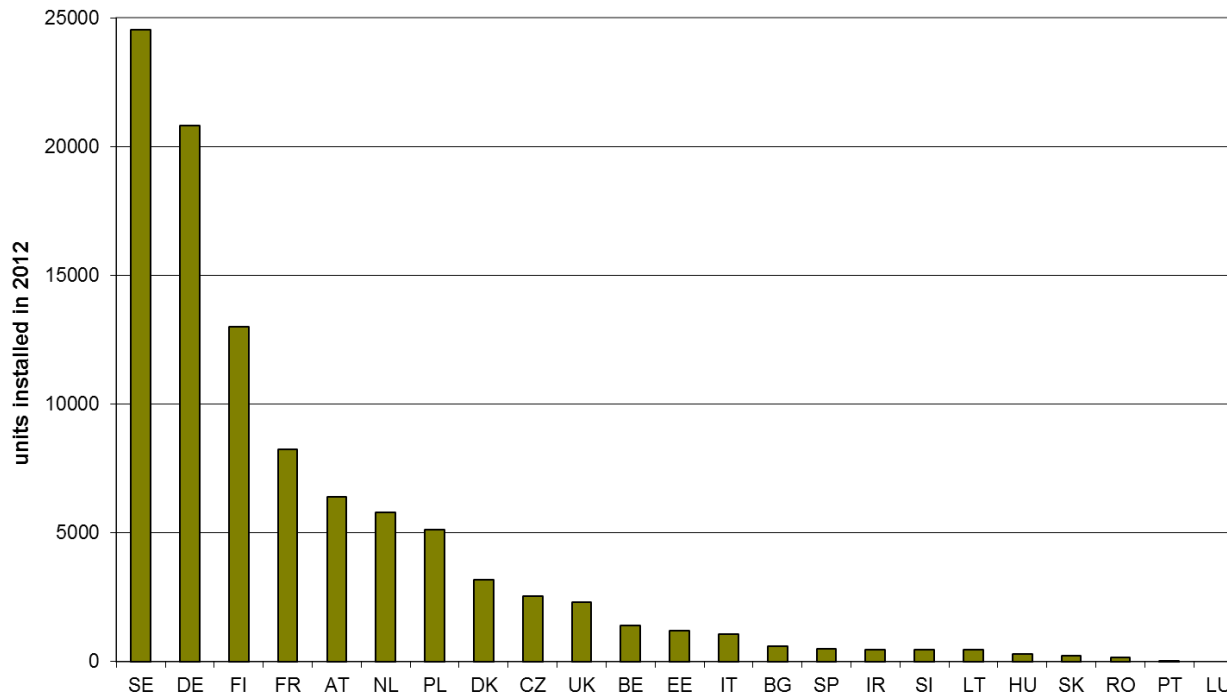
State of Play in 2013

- Shallow geothermal – the largest sector in terms of installed capacity



State of Play in 2013

- Total Installed Capacity in Europe: 17000 MWth
- 1.3 Mio GSHP installed



Number of GSHP units sold in the EU in 2012
(data based on Eurobserv'ER)



Trends in geothermal heat pumps – breakdown by MS

Example: Croatia

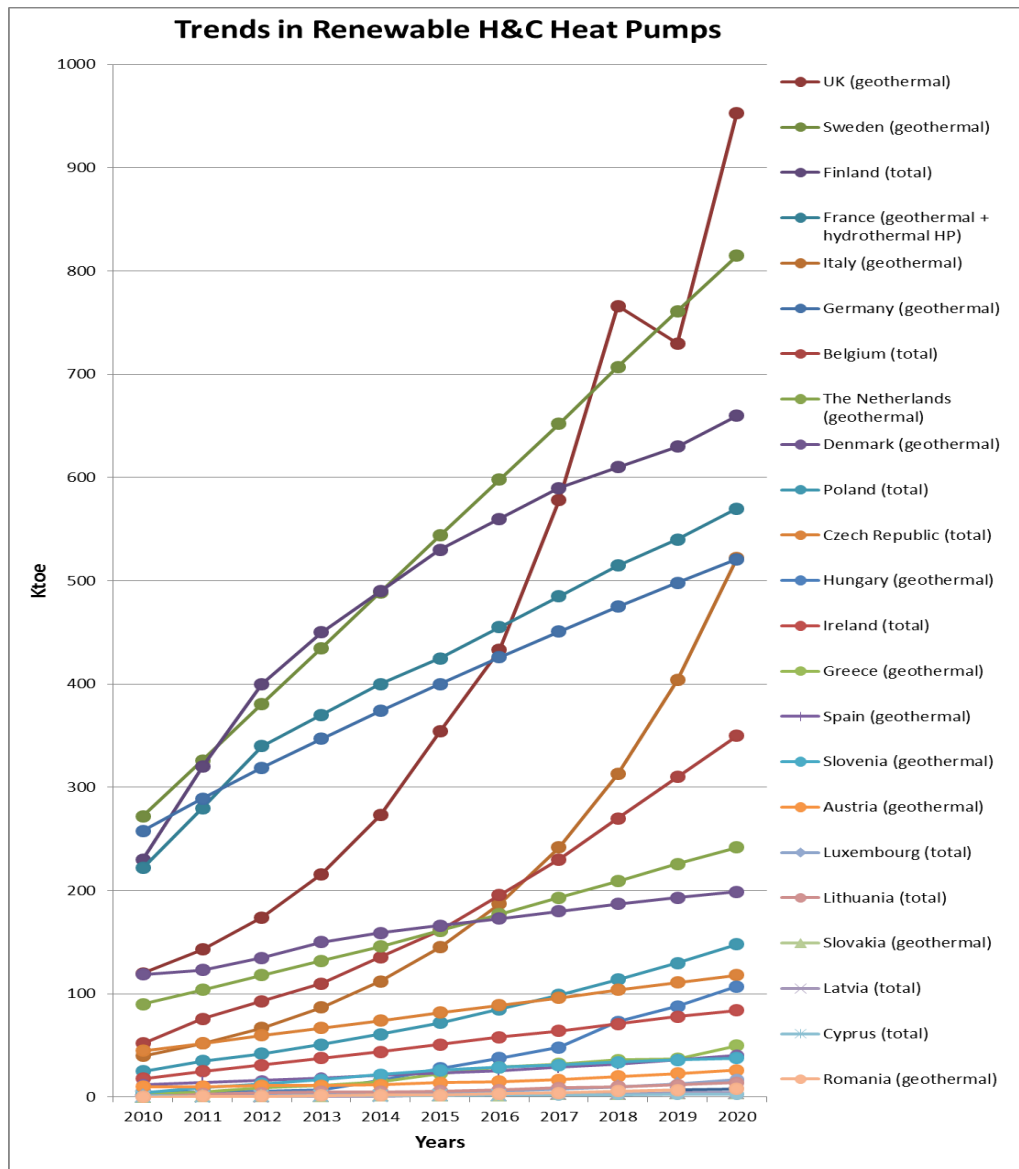
2010: 0

2020: 0

Example: Italy

2010: 40 ktoe

2020: 522 ktoe



Source: European Commission, National Renewable Energy Action Plans



For more information on market development:

The only full and detailed analysis of the geothermal sector in Europe

Free of charge to EGE C members

Available for €250

EGEC
EGEC MARKET REPORT 2013/2014



Third Edition,
December 2013

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Enabling policies: Why?




- **Alleviating EU's energy dependency**
- **Achieving EU and national RES/EE targets**
- **Compensating for persisting market failures**
- **Reducing costs of new technologies**

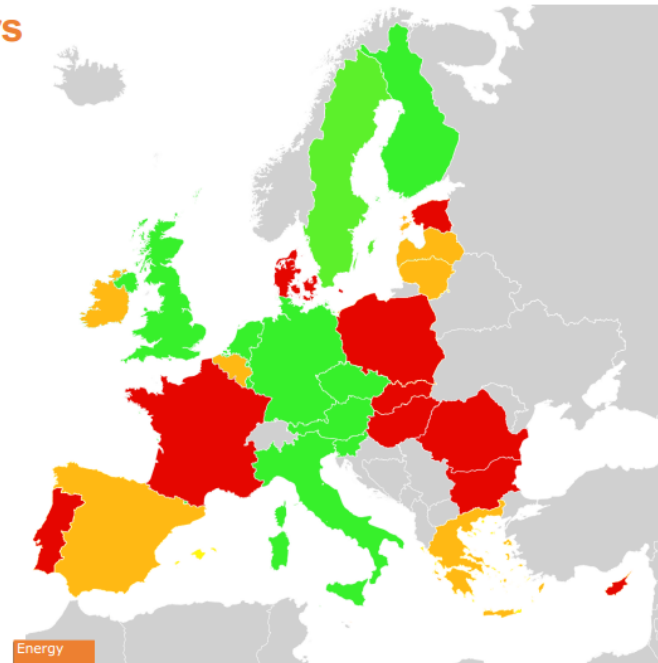
Enabling policies: Why? Compensating for persisting market failures e.g. – regulated prices in the gas sector

Regulated price and social tariffs distort the market (especially for gas in CEEs)



Price regulation fails to activate consumers and suppliers

-  *REGULATED PRICES FOR HOUSEHOLD CONSUMERS AND INDUSTRIAL CONSUMERS, IN GAS AND/OR OF ELECTRICITY*
-  *REGULATED PRICES FOR HOUSEHOLD CONSUMERS*
-  *NO REGULATED PRICES*



Member States currently phasing out price regulations:
 By 2013: Greece, Portugal & Lithuania
 By 2017: Romania



Enabling policies: What?

- a) **Feed in tariffs?** No, phased – out in new EU state aid rules

- a) **Feed-in premiums?** Yes at certain conditions for electricity, more difficult for RES H&C

- a) **Investment aid** – traditional but efficient - including
 - From Structural funds (17bn for RES and EE in 2014-2020)
 - For risk insurance (see GeoDH, GEOELEC projects)

- a) **CO2 tax, phase out fossil fuels subsidies**

- b) **Tax credit/relief?** Sometime inefficient

- c) **Action on existing building stock, implementation existing legislation** (RES, Energy efficiency and Energy Performance of Buildings Directives)

Conclusions

- **Geothermal electricity:** slow but continuous growth;
- **GeoDH market :** booming beyond traditional countries;
- **GSHP market:** largest GT segment, competitive depending on gas, electricity price, regulation, building sector, etc.
- **Geological risk:** first issue to tackle - public aid needed in several cases;
- **Other support schemes:** in evolution (more market approach);
- **Recommandation:** Differentiate support according to market and technology maturity; no stop & go policies, no fossil fuels subsidies.