GeoEner 2017

Madrid 26de Abril de 2017

V CONGRESO de Energía Geotérmica en la EDIFICACIÓN Y LA INDUSTRIA

Geothermal energy in Europe—recent market development and technology trends

Burkhard Sanner

EGEC GEOTHERMAL

www.egec.org

10 aniversario Fundación de la Energía de la Comunidad de Madrid

Comunidad de Madrid

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Índice

Public Perception of Geothermal Energy

We feel:

the heat of the sun

the force of the wind

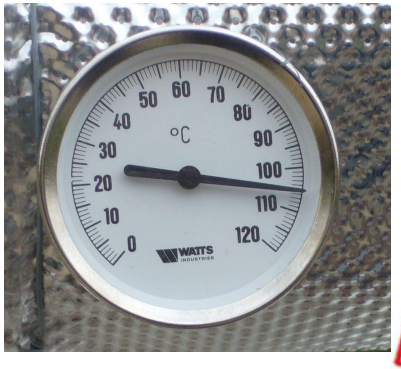
the power of waves

…and the heat of the earth?

Public Perception of Geothermal Energy

Yet the earth can show
it is hot inside!

Geothermal manifestations
in Tuscany, Italy



Thermometer in geothermal circuit of Szentes DH plant, Hungary

Public Perception of Geothermal Energy

When EGEC started work in Brussels, also most politicians perceived geothermal energy as something “far away”, in Iceland, and elsewhere in volcanic areas
– not suitable for use
in most of Europe

Iceland: Krafla geothermal power plant (above) and fumarole (left)

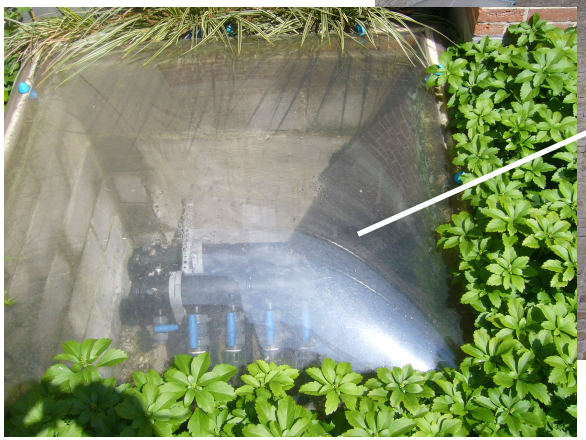
Public Perception of Geothermal Energy

The Renewable Energy House, with 4 borehole heat exchangers, proved that geothermal energy can be harvested very close, in the heart of Brussels

REH inauguration, March 2006

courtyard in 2014

manifold



drilling in 2005

Public Perception of Geothermal Energy

Museum and exhibitions

We need to make geothermal energy visible; numerous excellent examples exist, but more is needed

Exhibition in Nangong geothermal village, Beijing, China (2005)

GSHP demonstration in Museum of Natural Science, St. Gallen, Switzerland (1993)

Public Perception of Geothermal Energy

The EGEC Ferrara Declaration 1999

A Geothermal Europe - The Ferrara Declaration*

In pursuit of a sustainable energy supply, humanity has repeatedly lost its way in dead-end roads, or has perceived interim solutions as final ones. We are surrounded by inexhaustible energy resources that allow us to meet our energy needs and that of future generations without taking uncontrollable risks with the life and well-being of our planet. Now the development of modern technology enables us to make use of these energy sources on a scale that meets the requirements and demands of modern civilisation.

Our task is to make sure, that every European will learn what the words "Geothermal Energy " mean.

We, the Board of Directors and the members of EGEC, and other participants in the seminar, representing the vast majority of companies, organisations and institutions, in fact all of the key players active in geothermal energy development and use in Europe, will do our utmost to advance our goals, will promote geothermal energy use at all levels, and will contribute as our power allows to a successful implementation of a sustainable energy supply.

Our task is to make sure, that every European will learn what the words "Geothermal Energy " mean.

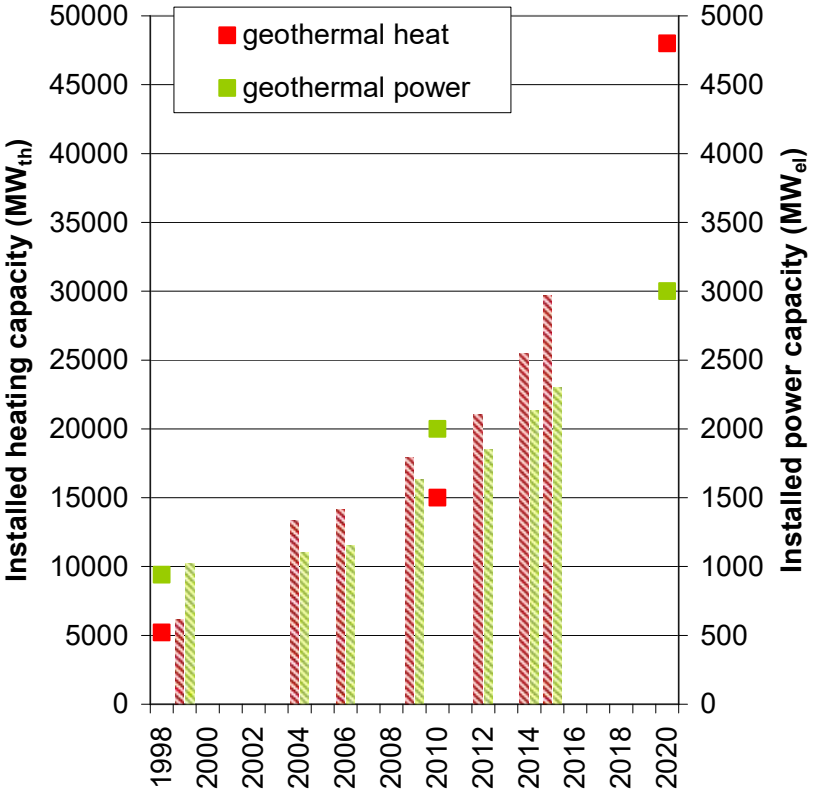
VAINER MERIGHI

E. Boissavy

EGEC Business Seminar 1999

Public Perception of Geothermal Energy

Geothermal Development as forecast in the EGEC Ferrara Declaration 1999



Hashed columns show actual development as to WGC and EGC data; heat includes both deep and shallow

EGEC Business Seminar 1999

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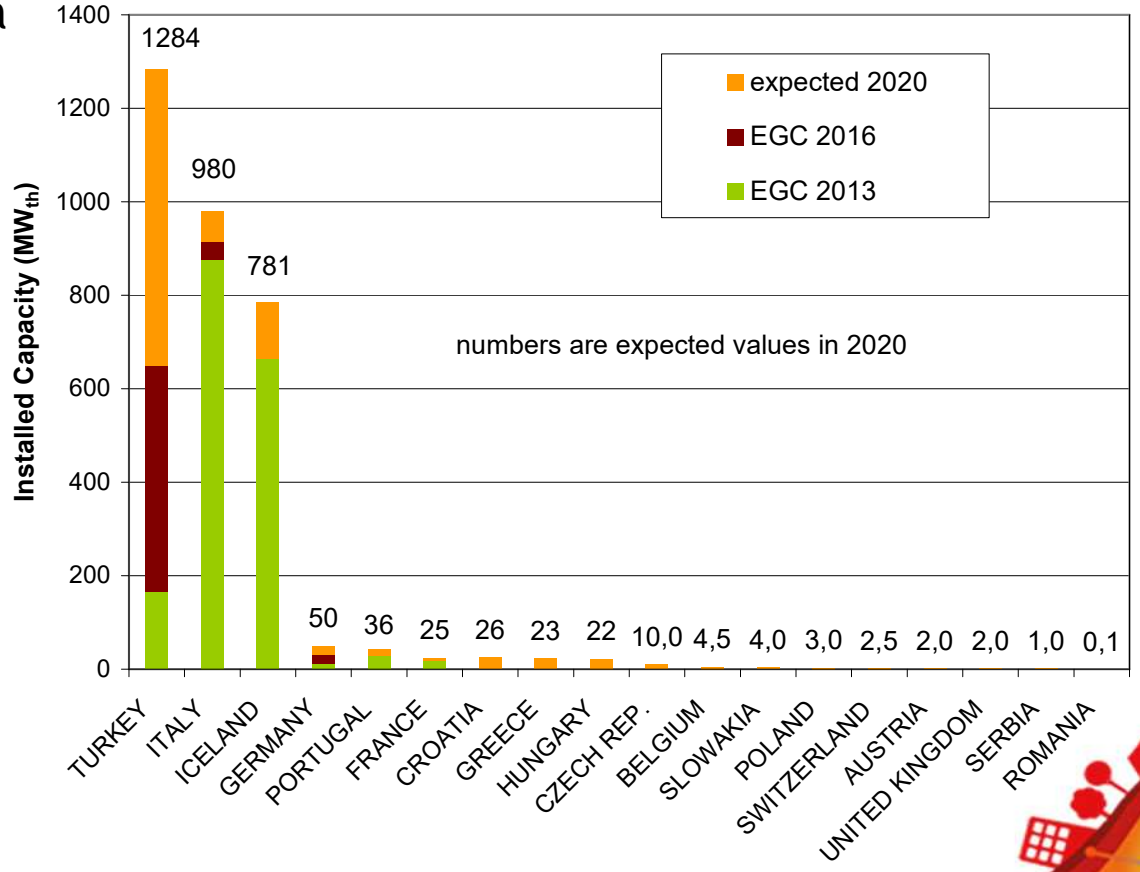
Geothermal Energy for Electric Power

Some impressions of Geothermal Power Plants in Europe

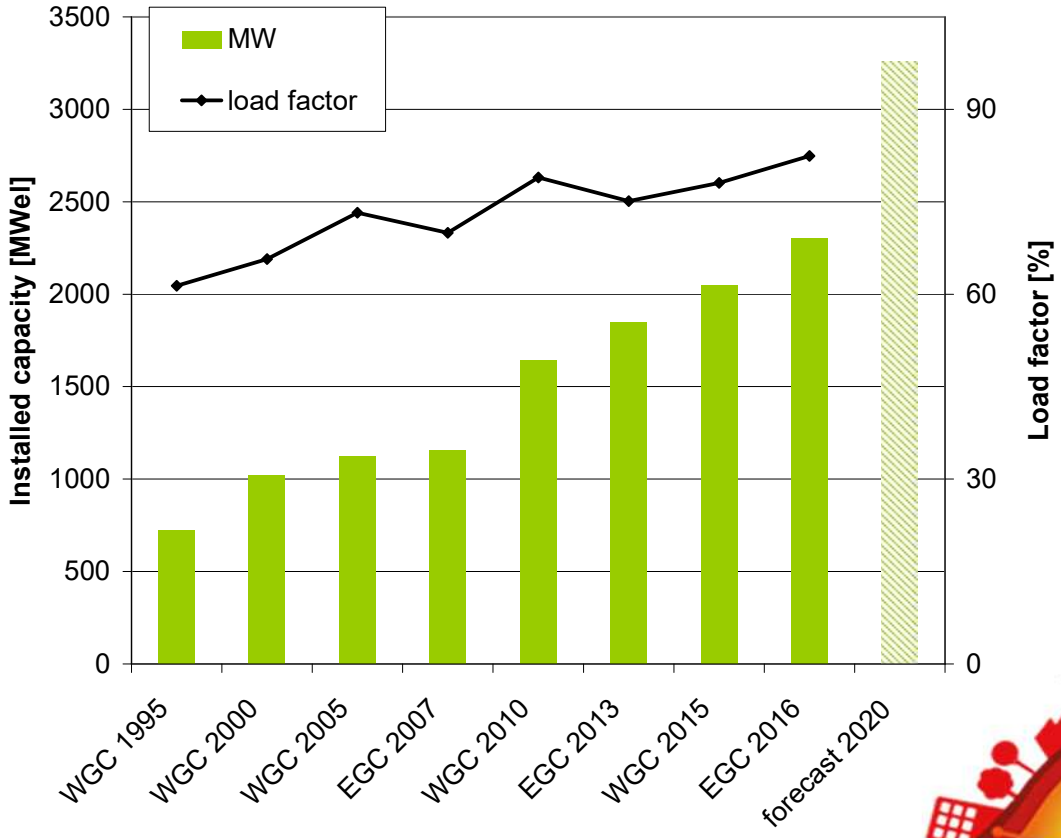
Geothermal Energy for Electric Power

Installed capacity in geothermal electric power in Europe, after data from EGC 2016



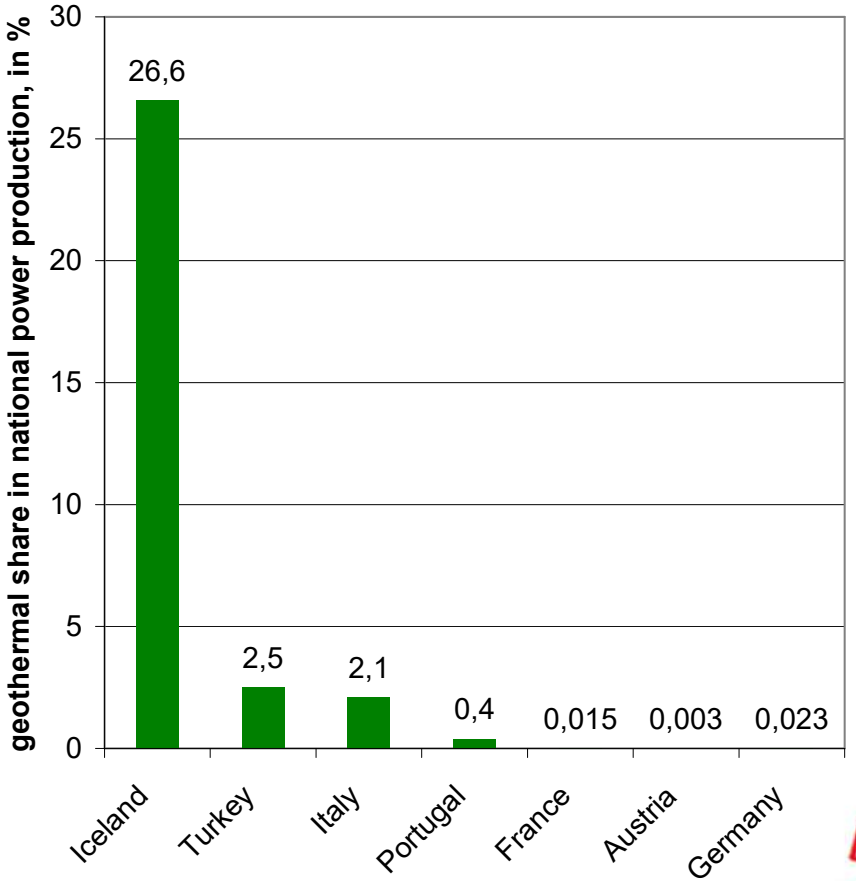
Geothermal Energy for Electric Power

Growth of installed capacity in geothermal electric power in Europe, after data from WGCs/EGCs



Geothermal Energy for Electric Power

Geothermal share in national electric power production in some European countries,
after data from EGC 2016



Geothermal Energy for Electric Power

Preview from EGEC Market Report 2017:

State of Play in 2016

- Total Installed Capacity in Europe: 2542 MW_{el}
- Production in Europe in 2015: 14,6 TWh
- 99 Geothermal Power Plants
- 815 MW over the last 5 years, mostly in TR (growth rate: 47%)
- 13 new power plants in 2016 (12 in TR, 1 in DE)

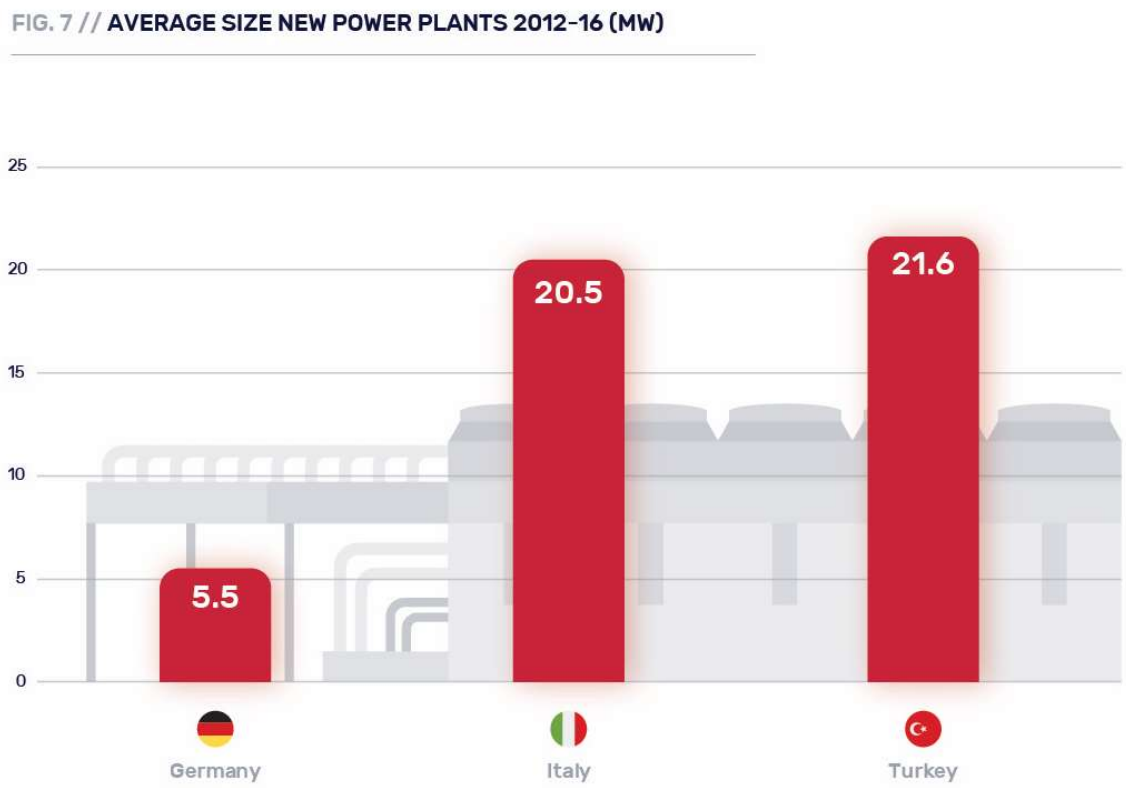
Geothermal Energy for Electric Power

Preview from EGEC Market Report 2017:

FIG.2 // **NUMBER OF GEOTHERMAL POWER PLANTS IN EUROPE**

Geothermal Energy for Electric Power

Preview from EGEC Market Report 2017:



Geothermal Energy for Electric Power

EU-project GeoElec has compiled in 2011-2013 the information on geothermal power potential in Europe, in particular for EGS

GEOELEC

Coordinated by EGEC
Visualisation of the results
by Web-GIS (done by TNO, NL)

Soultz-sous-Forêts

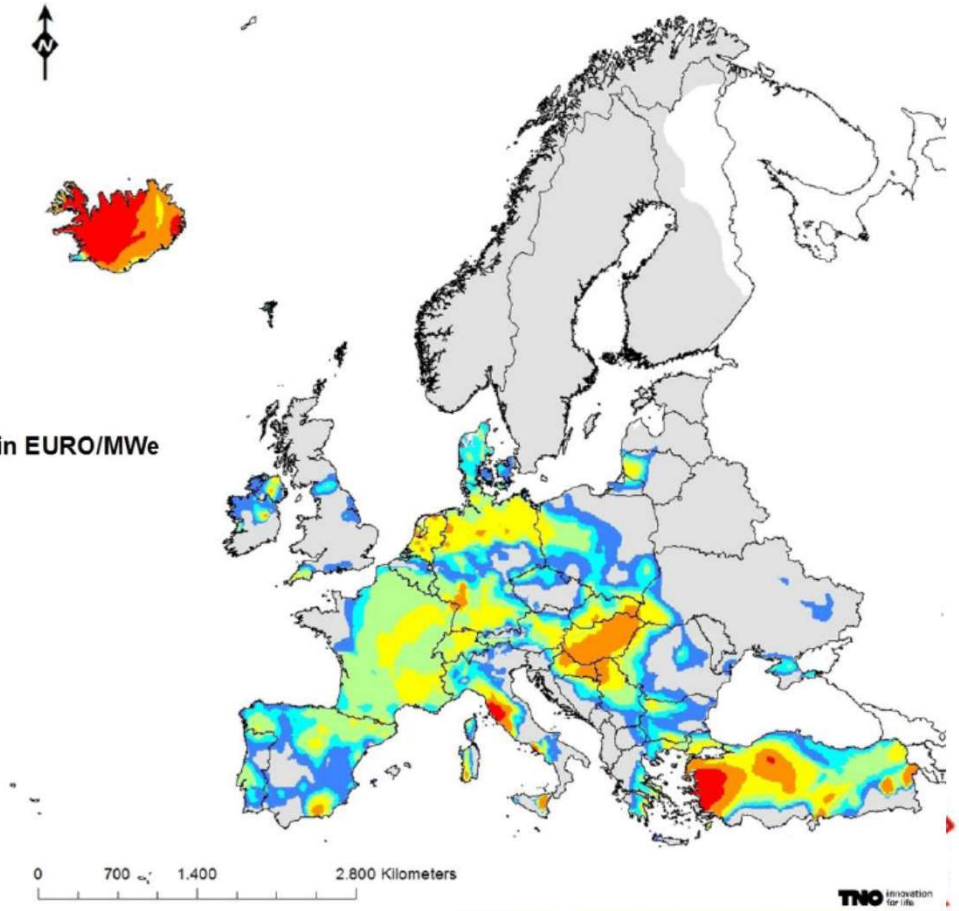
www.geoelec.eu

Geothermal Energy for Electric Power

Geoelec results, as shown in Web-GIS

GEOELEC

Economic potential of geothermal power production in Europe in 2030



Geothermal Power is flexible base-load power!

www.geoelec.eu

Geothermal Energy for Electric Power

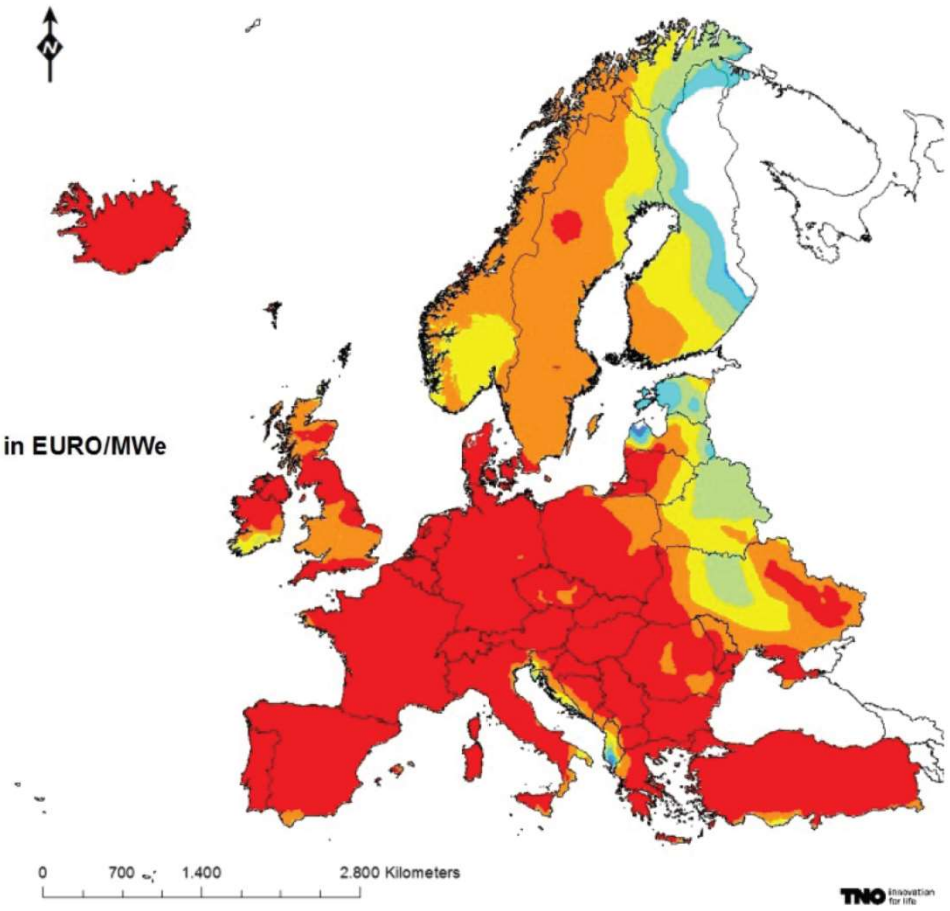
Geoelec results, as shown in Web-GIS

GEOELEC

Economic potential of geothermal power production in Europe in 2050

Geothermal Power is flexible base-load power!

www.geoelec.eu



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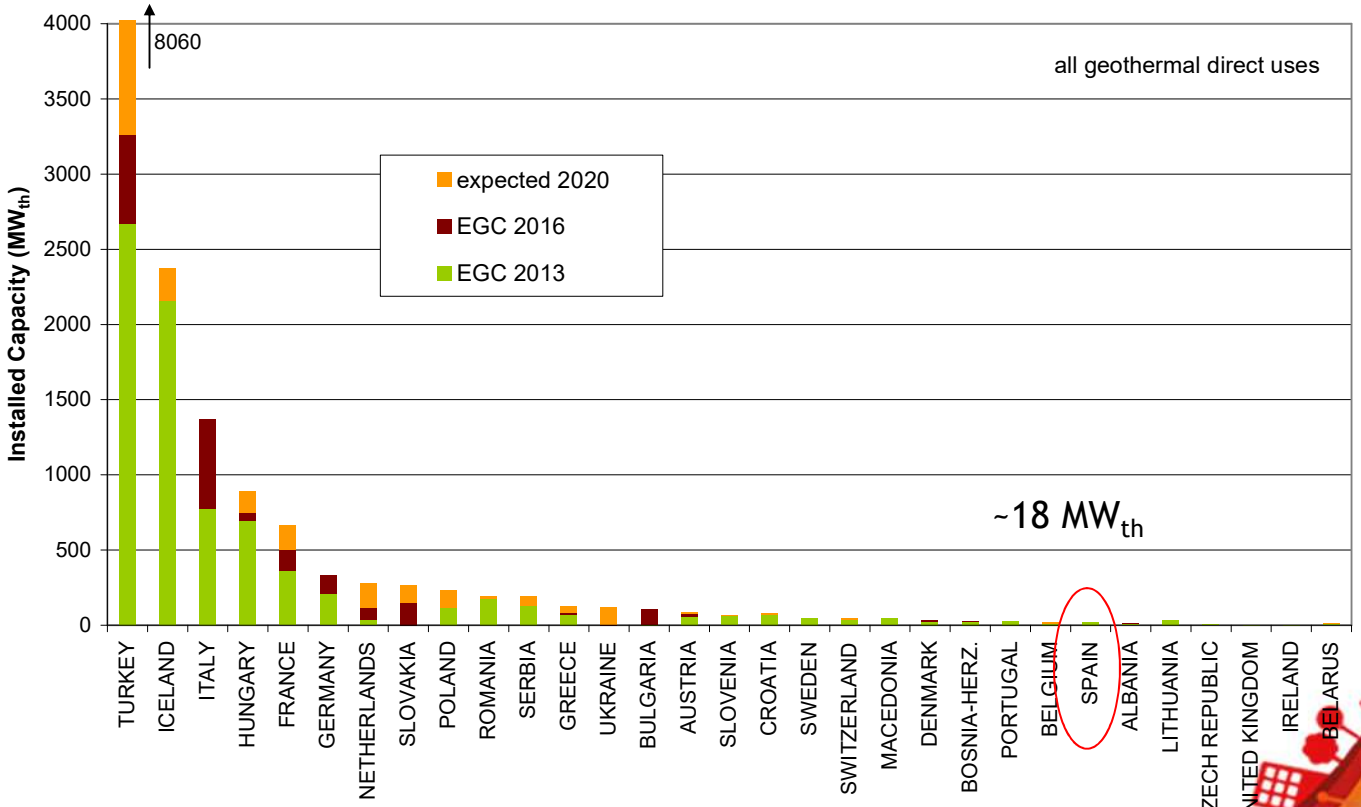
Geothermal Energy for Heating (Direct Use)

Some impressions of Geothermal Heating Plants in Europe

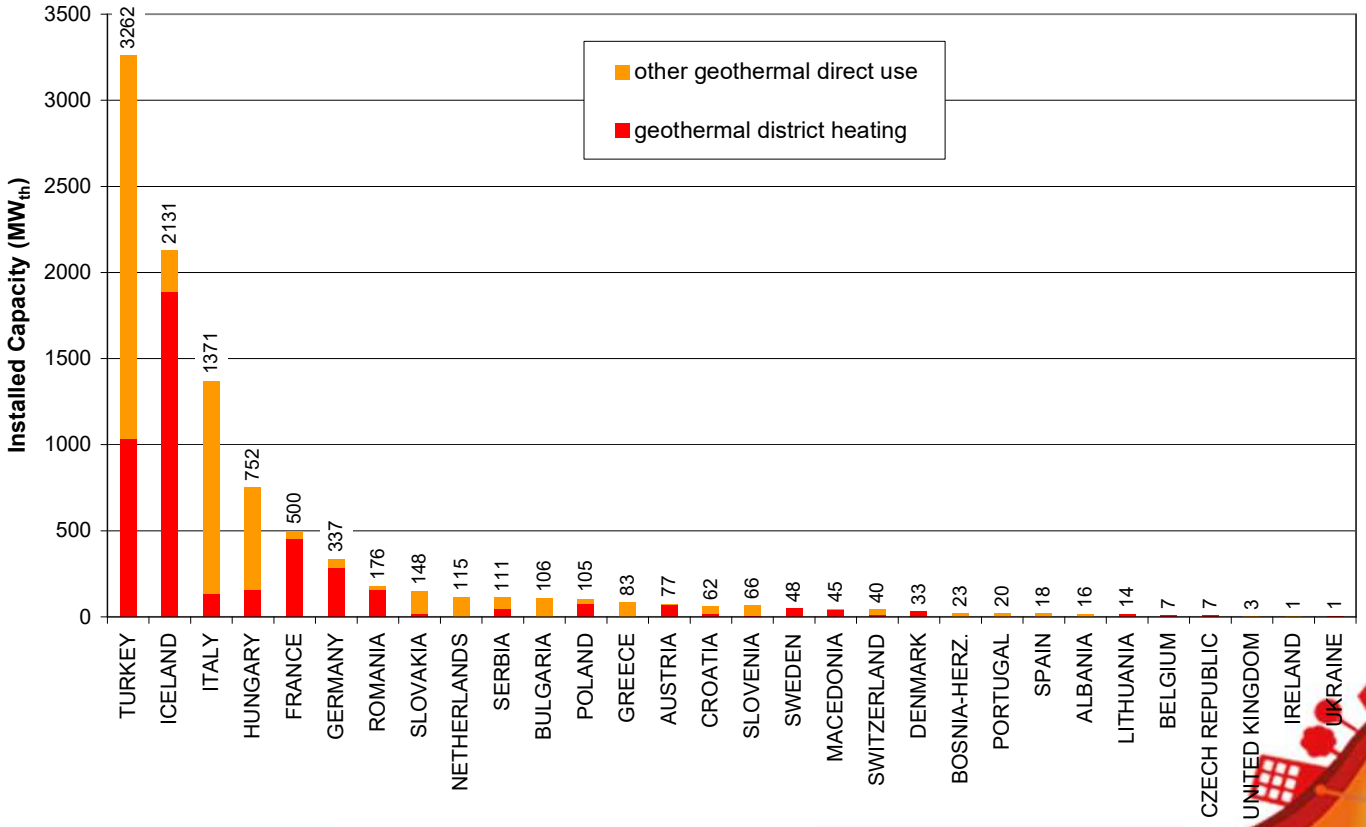
Geothermal Energy for Heating (Direct Use)

Installed capacity in geothermal direct use in Europe, after data from EGC 2016



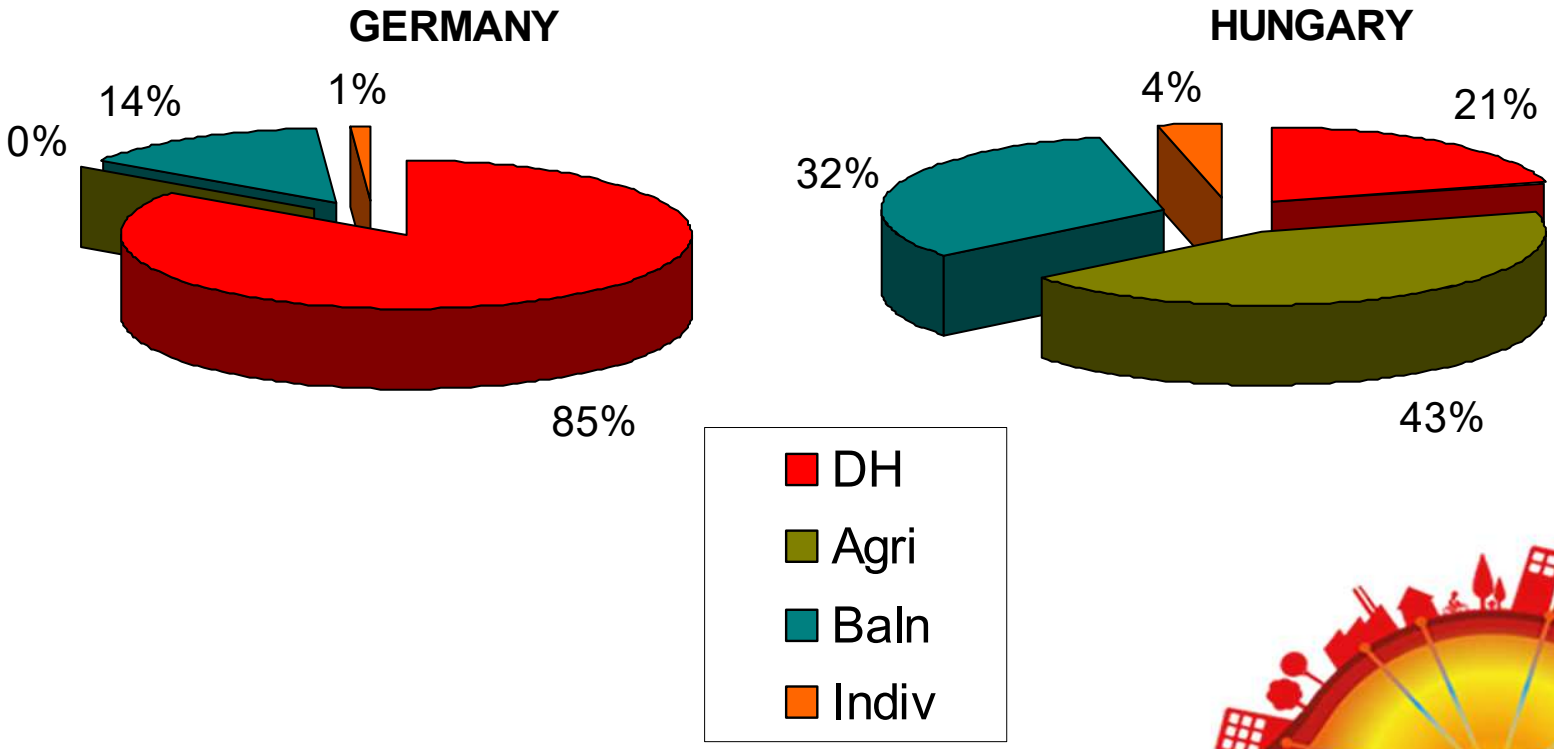
Geothermal Energy for Heating (Direct Use)

Share of geothermal district heating in geothermal direct use in Europe, after data from EGC 2016



Geothermal Energy for Heating (Direct Use)

Comparison of geothermal direct use types in Germany and Hungary, after data from EGC 2016



Geothermal Energy for Heating (Direct Use)

Preview from EGEC Market Report 2016:

State of Play in 2016

- Total Installed Capacity in Europe: 4869 MW_{th}
- 280 Geothermal DH Plants
- 60 new or renovated plants over the last 5 years
- 15 new or renovated plants in 2016
  (9 in FR, 2 in DE, 1 in HU, 1 in NL, 1 in RO)

Geothermal Energy for Heating (Direct Use)

Preview from EGEC Market Report 2016:

FIG. 17 // **AVERAGE SIZE NEW GEODH PLANTS IN SELECT COUNTRIES (MWth)**

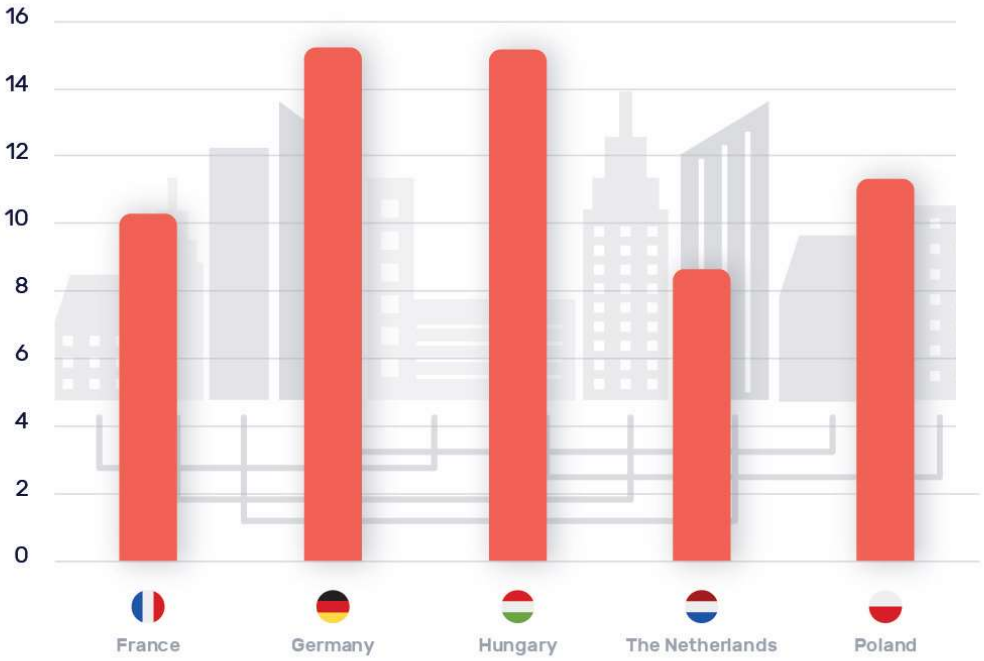
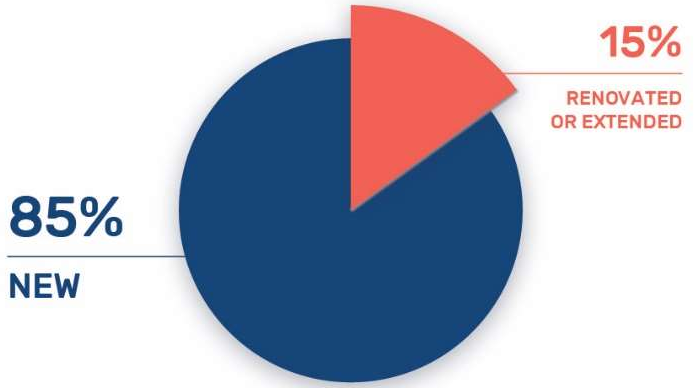


FIG. 18 // **SHARE OF NEW VS RENOVATED GEOTHERMAL DISTRICT HEATING PLANTS IN 2012-16**

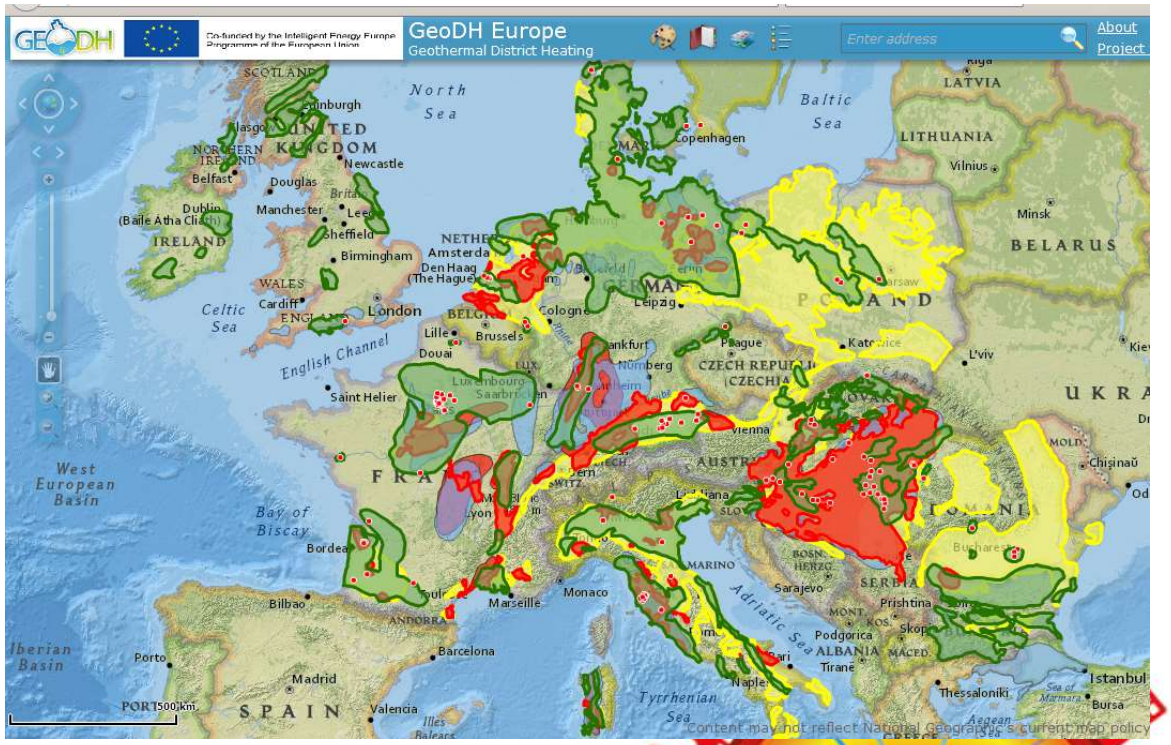


Geothermal Energy for Heating (Direct Use)

EU-project GeoDH has compiled in 2012-2014 the information on geothermal district heating potential in Europe

Coordinated by EGEC
Visualisation of the results by Web-GIS (done by MFGI, HU)

Matching potential and DH demand



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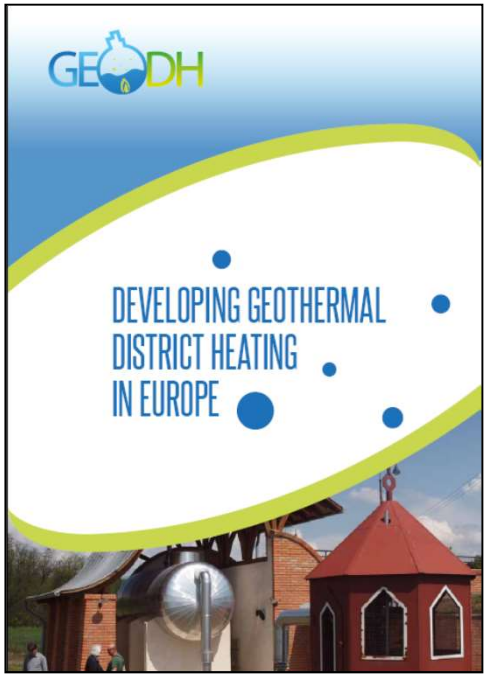
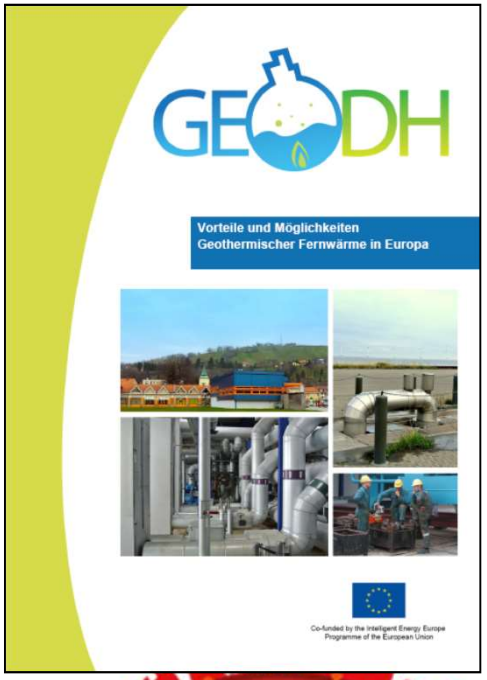
Geothermal Energy for Heating (Direct Use)

EU-project GeoDH has compiled in 2012-2014 the information on geothermal district heating potential in Europe

GEODH

Coordinated by EGEC
Visualisation of the results by Web-GIS (done by MFGI, HU)





Brochure and Final Report for Download at:
www.geodh.eu

Índice

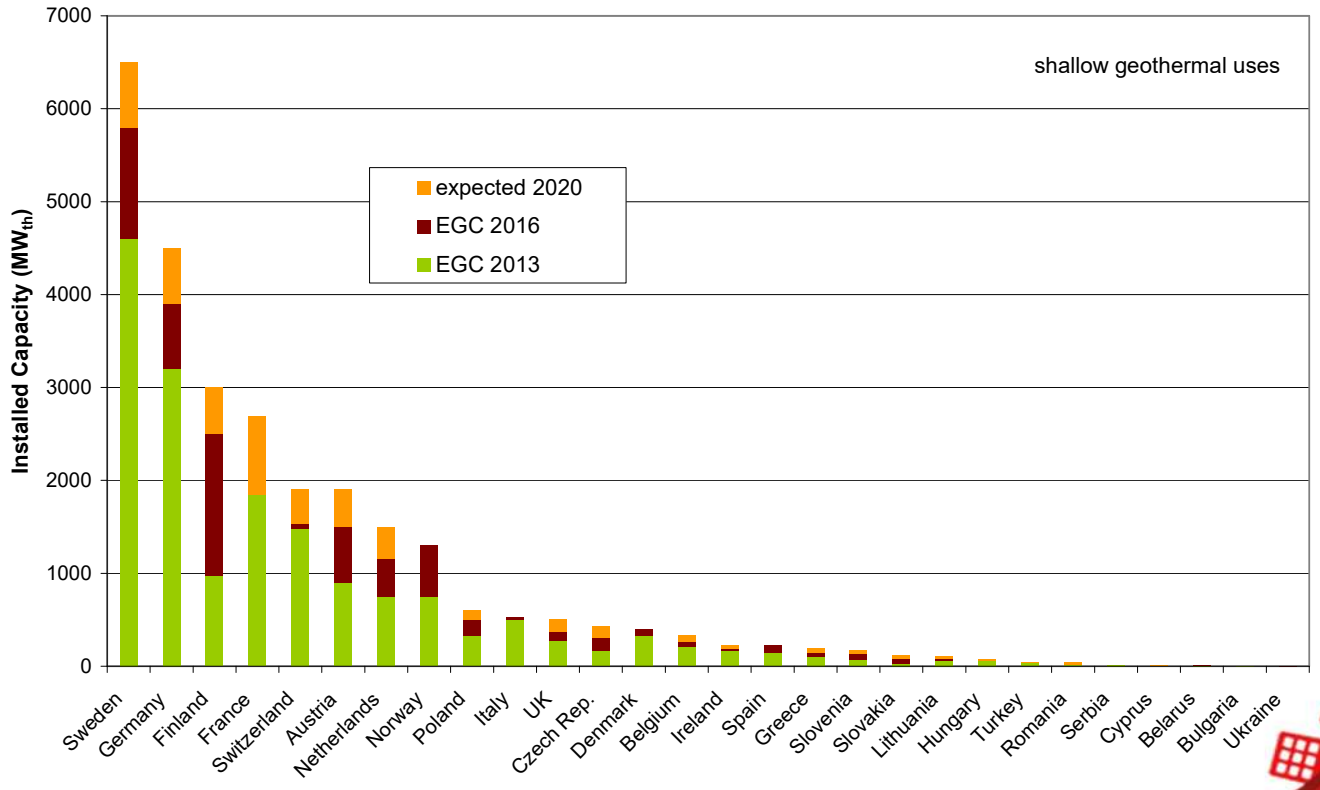
GeoEner 2017
Madrid, 26 de Abril de 2017

Shallow Geothermal Energy for Heating and Cooling

Some impressions of Shallow Geothermal Installations in Europe

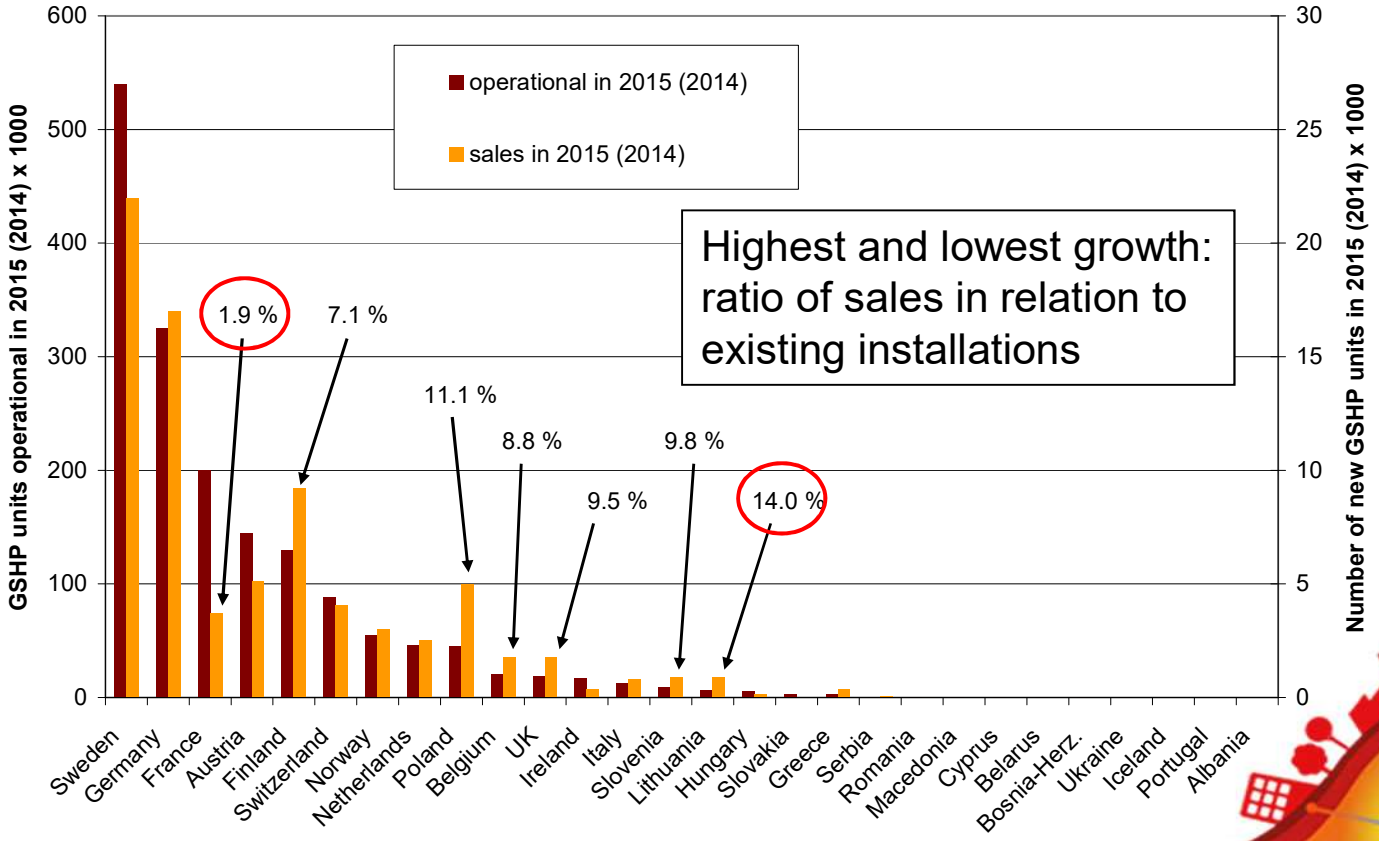
Shallow Geothermal Energy for Heating and Cooling

Installed capacity in shallow geothermal energy in Europe, after data from EGC 2016



Shallow Geothermal Energy for Heating and Cooling

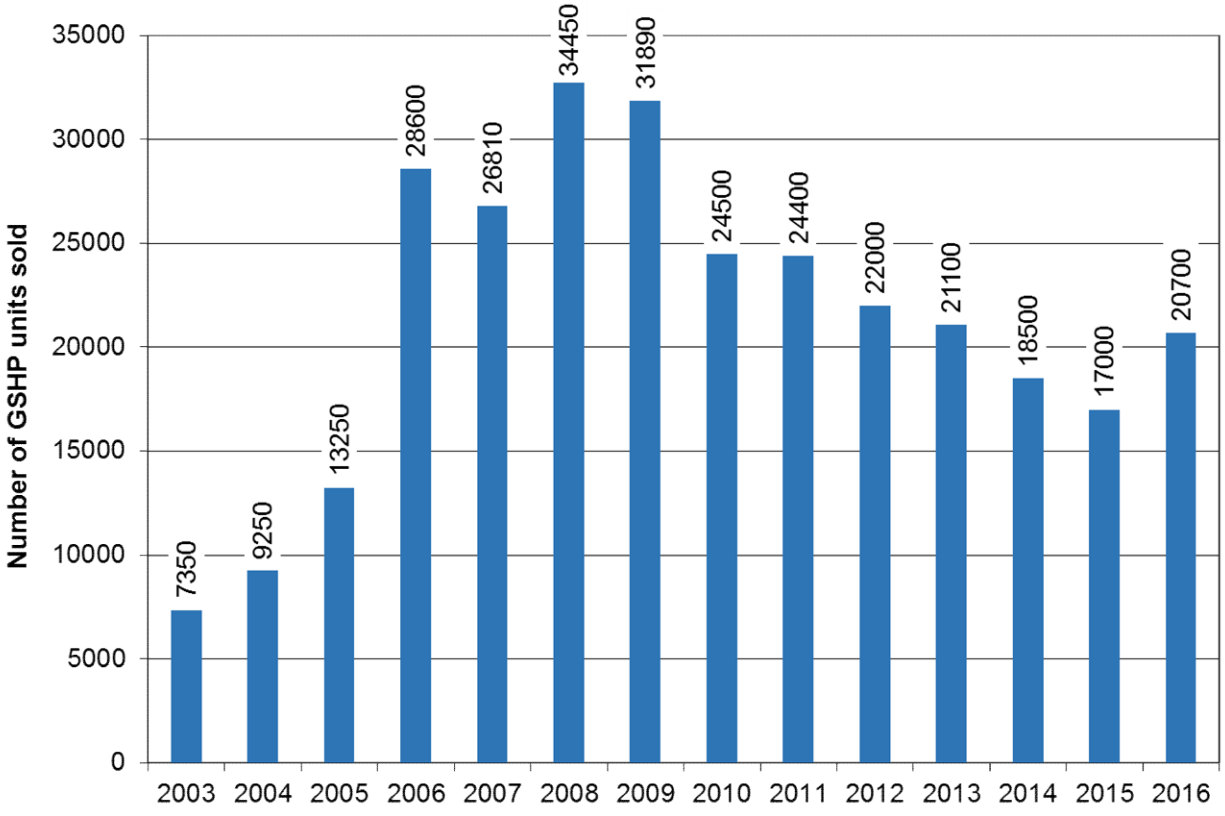
Total number of GSHP and annual sales in shallow geothermal energy in Europe, after data from EGC 2016



Numbers indicate ratio of new plants to existing stock

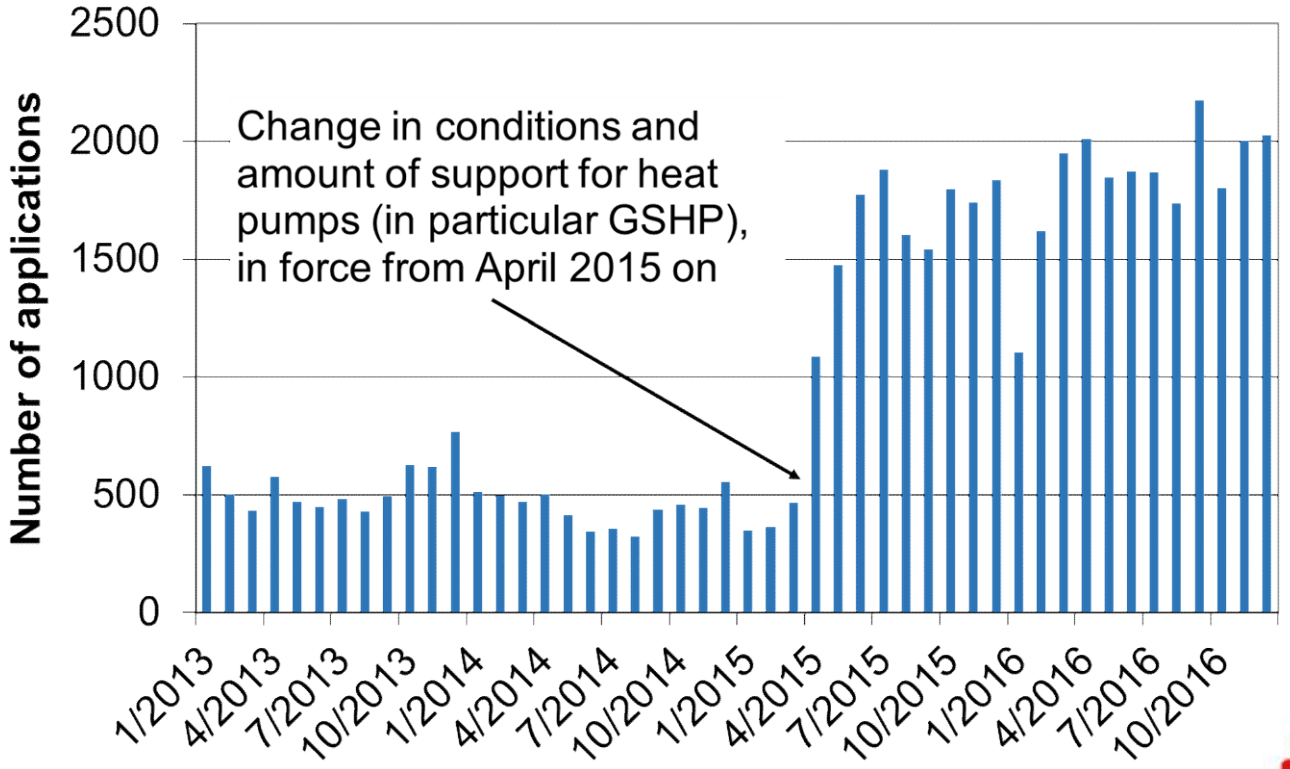
Shallow Geothermal Energy for Heating and Cooling

Development of GSHP annual sales in Germany, after data from BWP
In 2016, a recovery eventually!



Shallow Geothermal Energy for Heating and Cooling

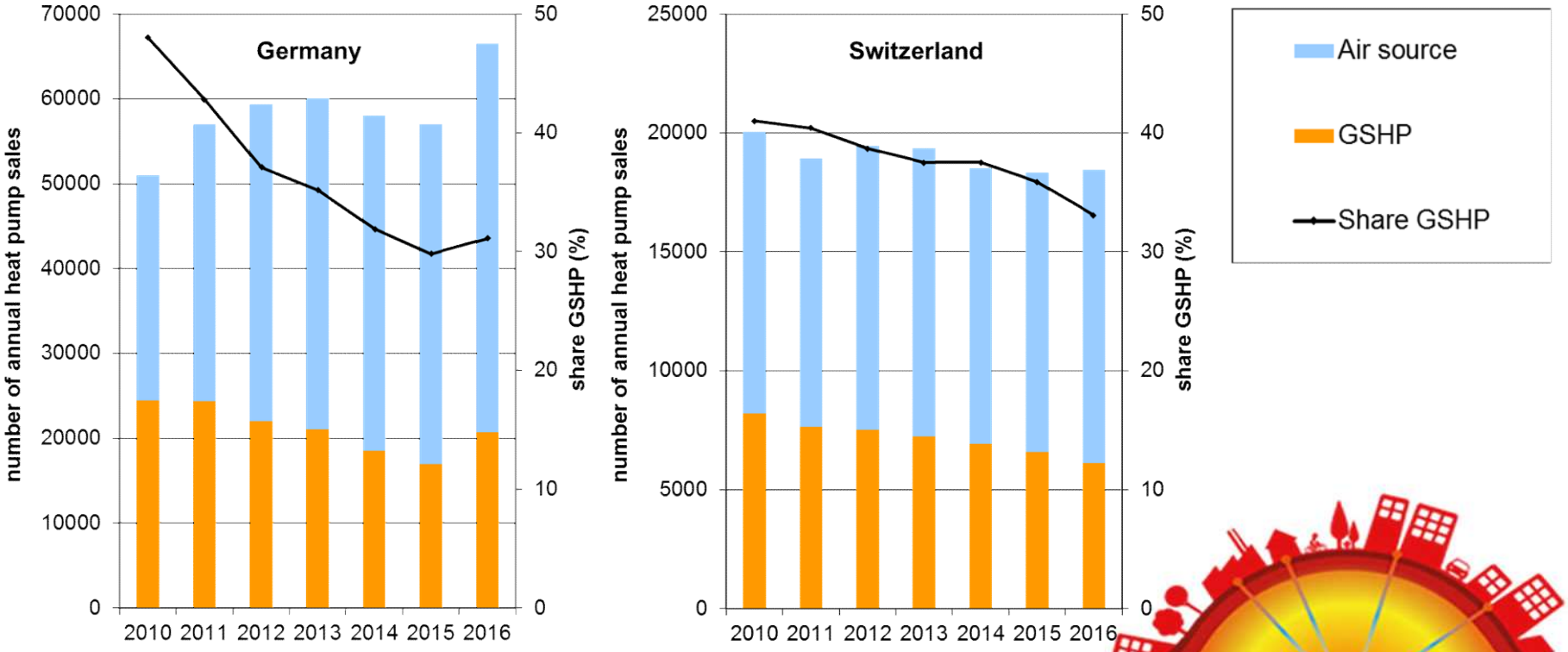
One push for the German market is an improved incentive scheme, MAP



Graph shows heat pumps from all heat sources

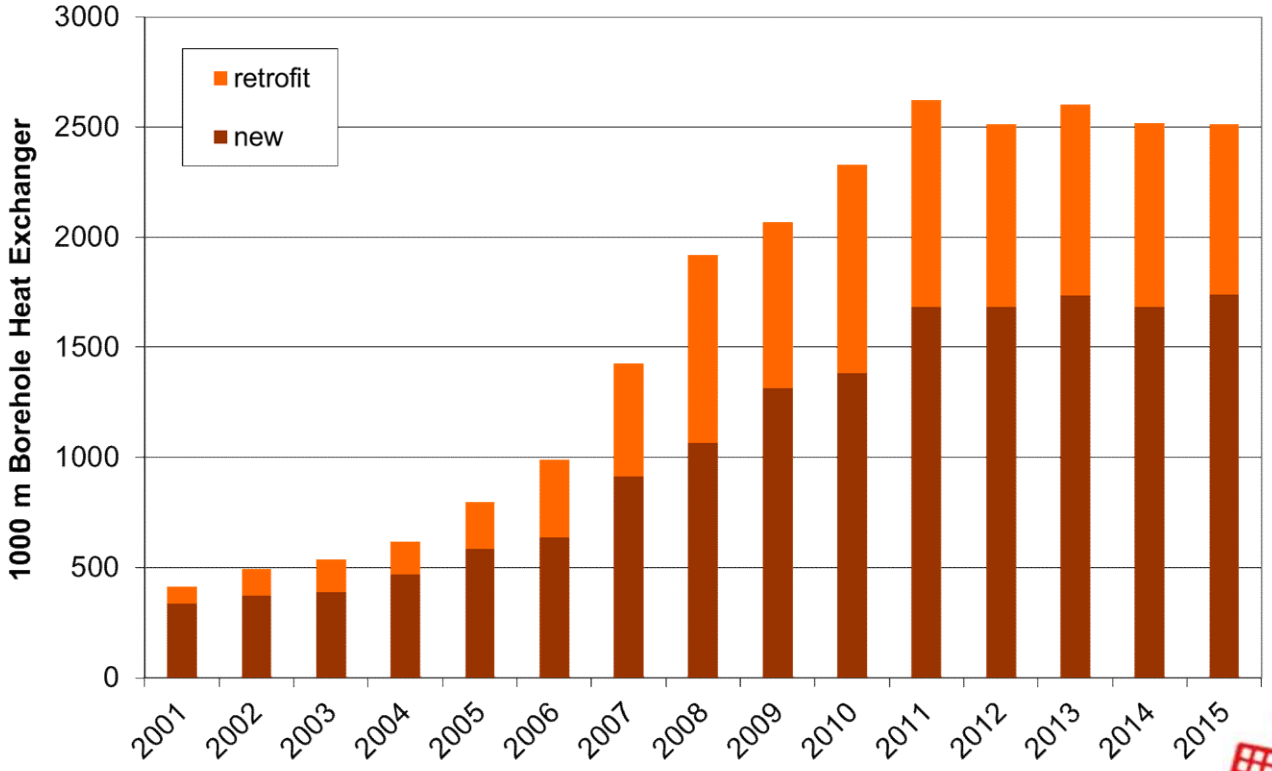
Shallow Geothermal Energy for Heating and Cooling

Share of GSHP in total HP sales in Germany and Switzerland, after data from BWP and FWS



Shallow Geothermal Energy for Heating and Cooling

Development of drilling for Borehole Heat Exchangers in Switzerland, after data from FWS



Shallow Geothermal Energy for Heating and Cooling

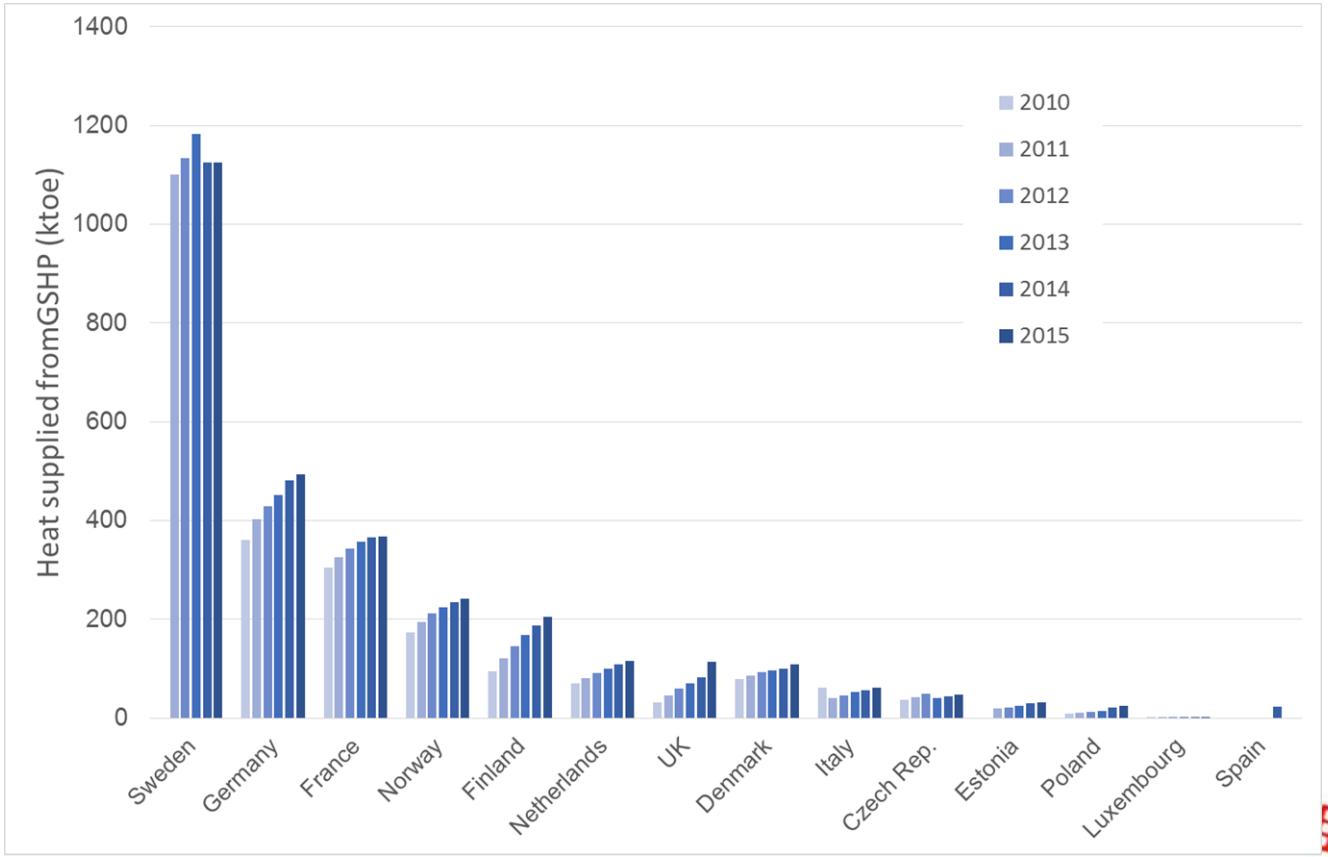
Preview from EGEC Market Report 2016:

State of Play in 2015

- Total Installed Capacity in Europe: ca.22.900 MW_{th}
- about 1.7 million units

Shallow Geothermal Energy for Heating and Cooling

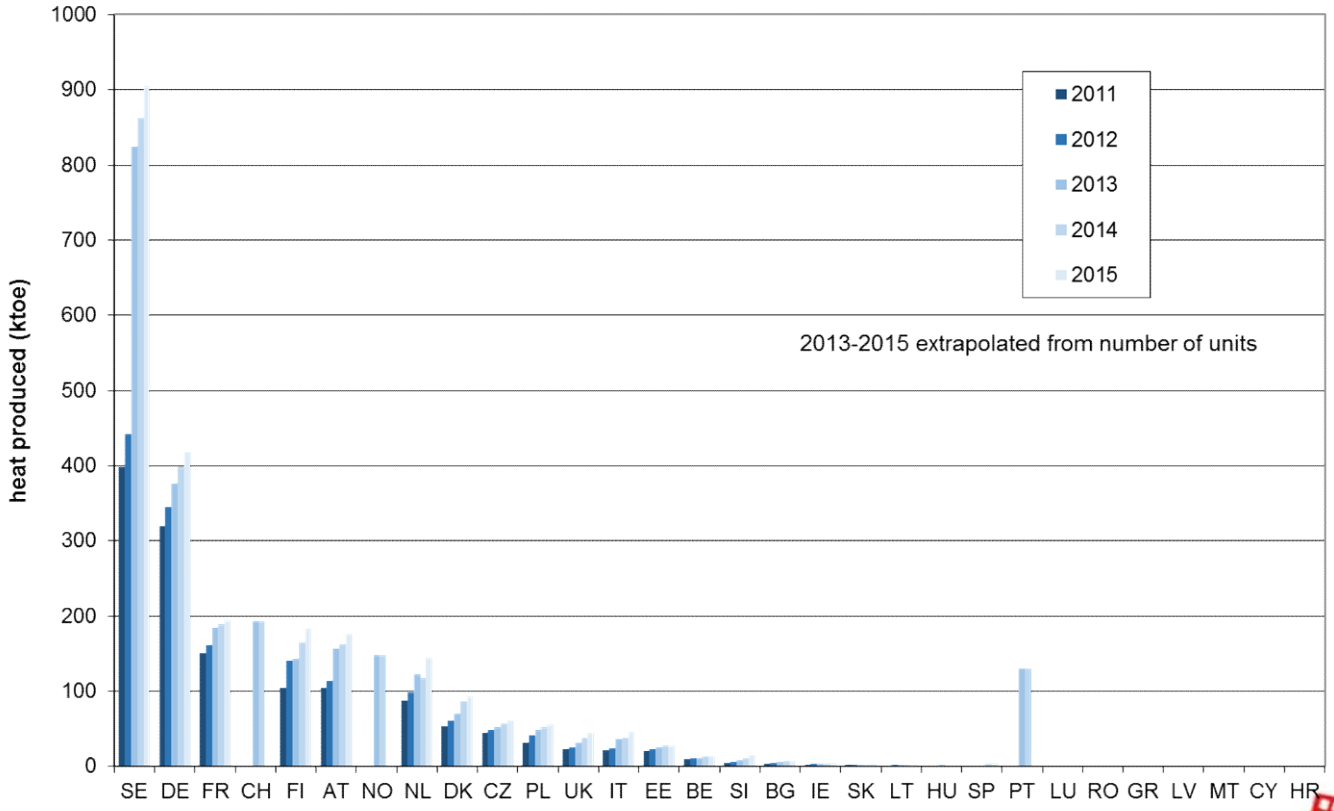
Preview from EGEC Market Report 2016:



Heat supplied from GSHP, after data from Eurostat (SHARES)

Shallow Geothermal Energy for Heating and Cooling

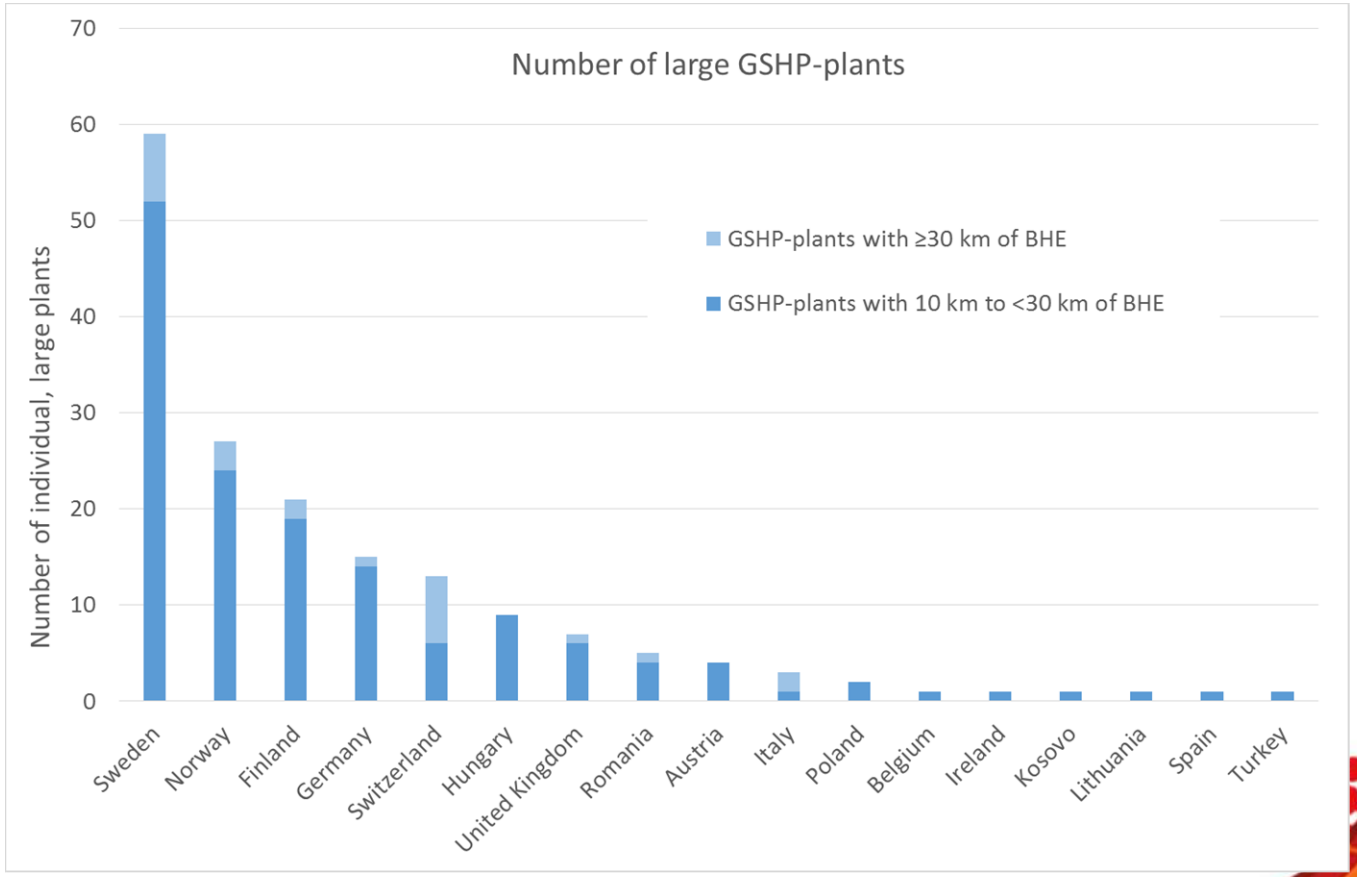
Preview from EGEC Market Report 2016:



Heat supplied from GSHP, after data from EurObservER

Shallow Geothermal Energy for Heating and Cooling

Preview from EGEC Market Report 2016:



A trend can be seen towards large installations, in particular in Switzerland, Germany and the Nordic countries

Shallow Geothermal Energy for Heating and Cooling

Today, the barriers against further market growth of shallow geothermal can be divided into 3 groups:

- Economic shortcomings for heating mode in certain countries (fossil too cheap, electricity too expensive)
- Insufficient awareness with the public (potential consumers), the planners/installers, and the regulatory administration
- Exaggerated licensing requirements, driving cost and uncertainty

Subsidies and grants can only partly offset these barriers.

was tackled e.g. by projects Geotrainet and Regeocities

Shallow Geothermal Energy for Heating and Cooling

Main drivers are more or less the opposite of the barriers:

- Very good economy in countries with high cooling demand (South Europe) or low electricity prices (eg Norway)
- High public awareness and good reputation of the technology, skilled planners/installers (Sweden, Switzerland)
- Good regulatory frameworks and knowledgeable officers

Subsidies and grants can help further under such circumstances (e.g. MAP in Germany, 4500 € for residential BHE installation)

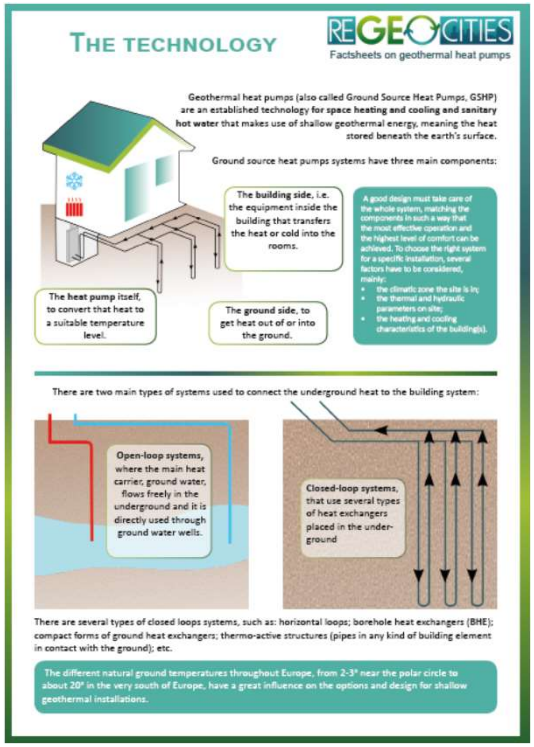
The campaign „The Heat under your Feet“ is intended to create more awareness of shallow geothermal technologies, and the solutions and advantages they can deliver:

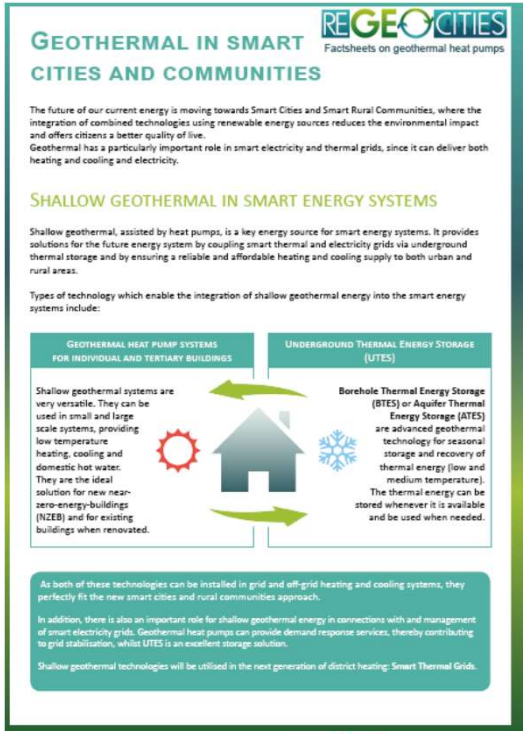
http://www.heatunderyourfeet.eu

Geothermal heat pumps for heating and cooling
The heat under your feet

Shallow Geothermal Energy for Heating and Cooling

http://www.heatunderyourfeet.eu
Factsheets on Shallow Geothermal Energy





REGEOCITIES

http://regeocities.eu/

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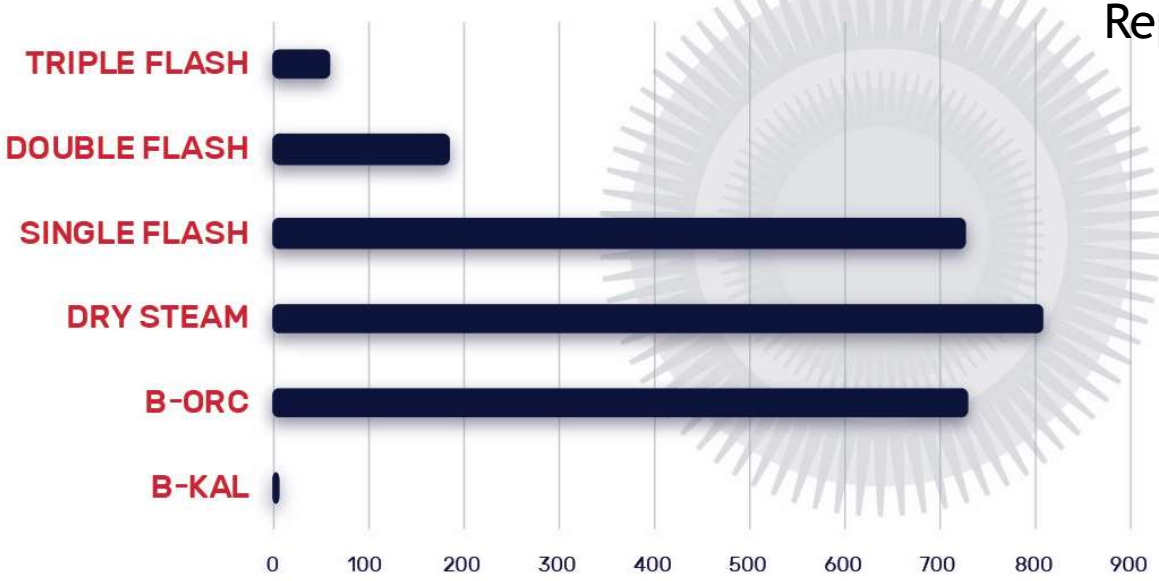
Geothermal Energy for Electric Power

Trends in Turbines

FIG. 8 // **TURBINES – INSTALLED CAPACITY PER TECHNOLOGY (MWe)**

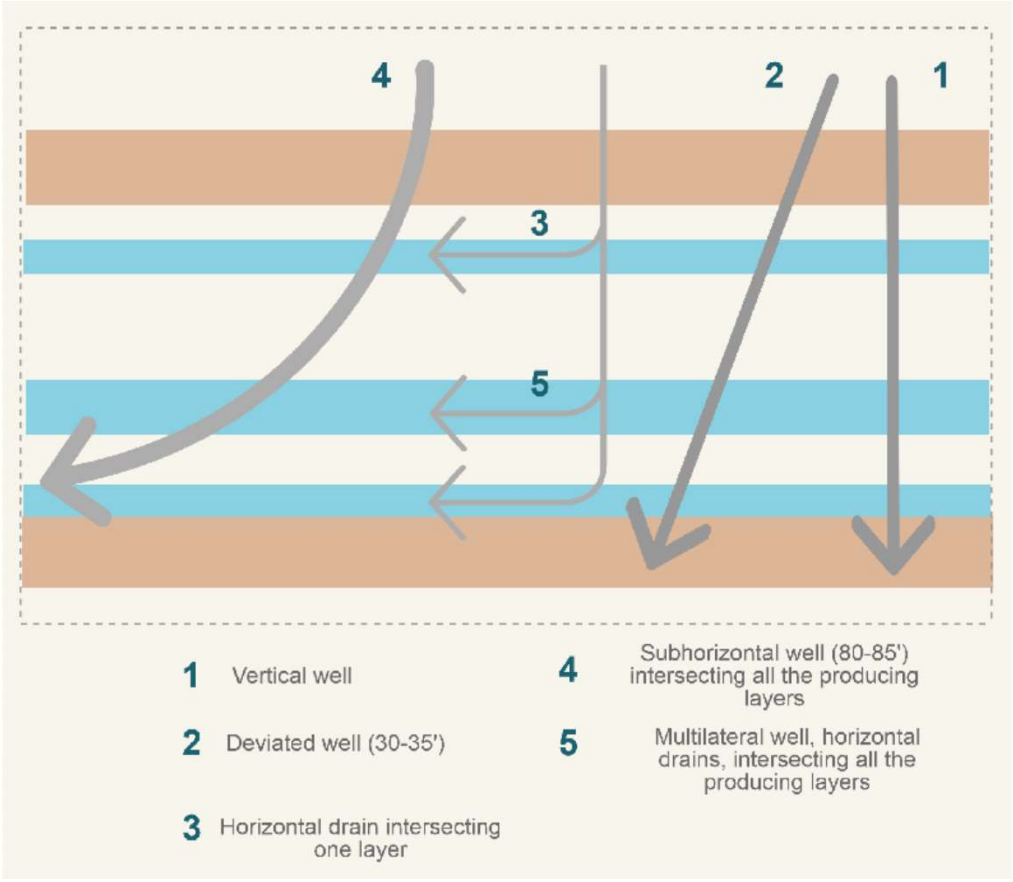


Distribution of Geothermal Power Plant types

(Preview from EGEC Market Report 2016)

Trends and Summary

Trends in Dilling



Innovative Well Designs: Candidate Well Trajectories

(Preview from EGEC Market Report 2016)

Trends and Summary

Trends in Capital Cost

category	sub-category	
Drilling	infrastructure dor drilling site	55%
	electricity	
	1st well	
	2nd well	
	planning &testing	
	reservoir engineering	
Production	Production & Injection pumps (LSP vs ESP)	5%
	heat exchanger	
Power plant (binary)		20%
	turbine and generator	
	plant construction	
	coolers	
Infrastructure		5%
	pipes & valves	
	grid connection	15%
Fees & Contingencies (contractor overhead costs, fees, profit, and construction)		

Typical capital cost break-down for deep geothermal power plant equipment incl. drilling

(Preview from EGEC Market Report 2016)

Trends and Summary

Trends in O&M Cost

O&M = 2% of capital costs

Personnel costs:
remote control, regular routine inspections, start up / shutdown of the plant and during maintenance

Routine maintenance costs:
valves, pumps, the generator, switchgear etc

Consumables:
filters, oil and chemicals

Typical capital cost break-down for deep geothermal power plant Operation and Maintenance

(Preview from EGEC Market Report 2016)

Trends and Summary

Trends in Shallow Geothermal

Still a lot more can be done to make ground source heat pumps better, i.e.:

- more effective,
- more economic,
- easier to install,
- avoiding any risk for ground and groundwater,
- with a broader area of application within the existing building stock, industry, infrastructure etc.

We can capitalise on the intrinsic advantages in efficiency ground coupling offers for heating and cooling, and on the reliability achieved, and go beyond!

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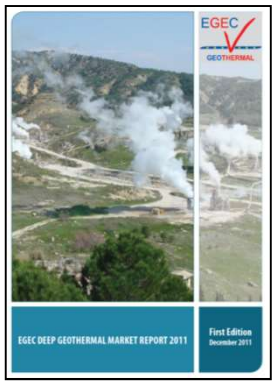
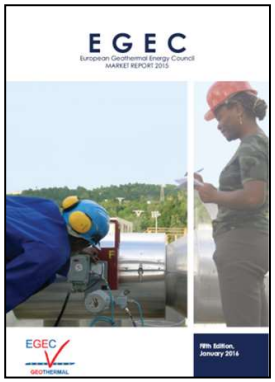
Trends and Summary

EGEC Market Report 2016

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





6th edition Geothermal Market Full Report available to EGEC members in May 2017
Official Launch in Brussels, 10.5.2017
more info: www.egec.org

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