

Nuremberg, 15–16.10.2013

**EUROPEAN**  
**HEAT PUMP** ● **SUMMIT**  
Powered by Chillventa ● **2013**

**Symposium + Expo**

Industrial • Commercial • Residential  
Heating & Cooling • Components & Equipment

Nuremberg, 15 October 2013

# Ground Source Heat Pumps in Europe, Application and Technology – a report from EGC 2013

Dr. Burkhard Sanner

European Geothermal Energy Council, Brussels



## Content

- Market and application
- Technological development

The European Geothermal Energy Congress in June 2013 in Pisa (EGC 2013) brought together ca 500 experts from the geothermal sector. EGC's are only held every 4-6 years (the previous 2007 in Munich area).



Country update reports on the national development in 33 European countries, and 6 dedicated sessions on shallow geothermal technologies (mainly Ground Source Heat Pumps) allowed for an update on the status in Europe.

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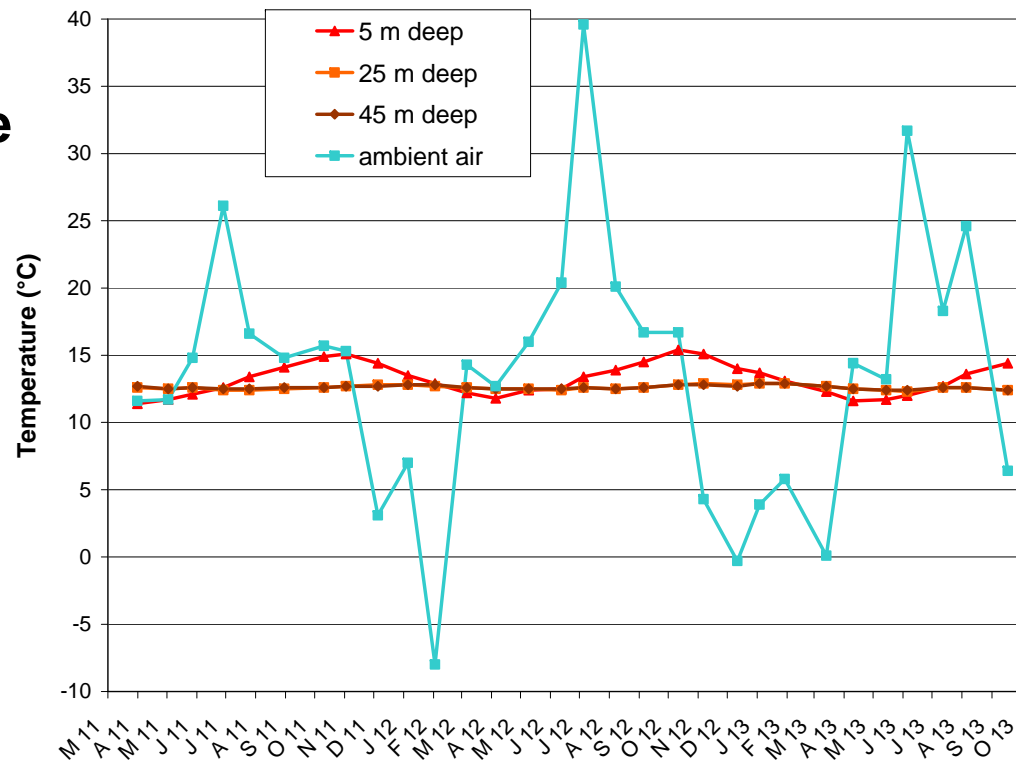


# Content

- Market and application
- Technological development

Why is the underground so interesting as a heat source or sink for heat pumps?

Temperature development in a well in Frankfurt/Main, Germany, 3/2011 – 9/2013 (momentary temperatures, not averages)



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## GSHP Market

The European Geothermal Congress in Pisa in June 2013 (EGC 2013) included a series of country update reports for geothermal energy use.



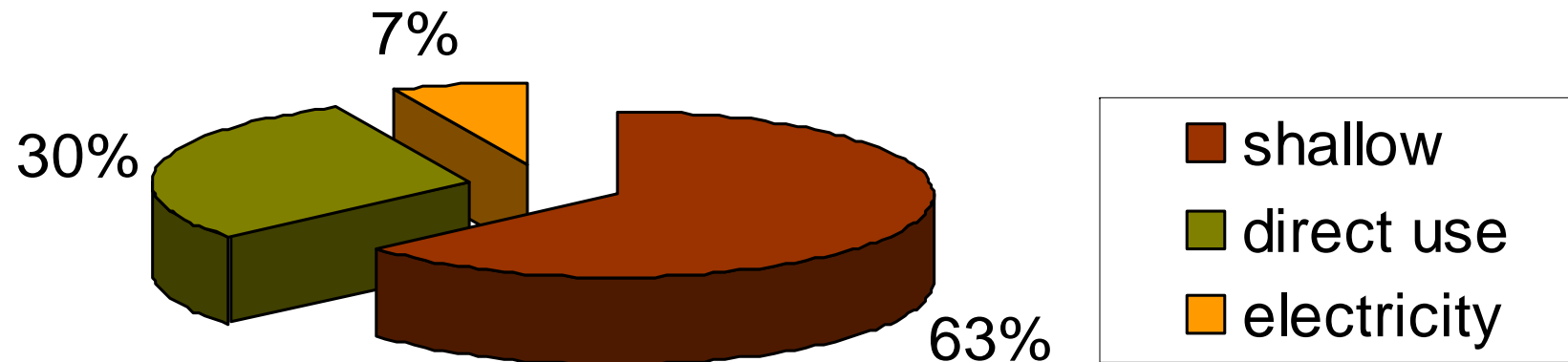
- **33 countries provided update reports, and 29 of them included ground source heat pumps (geothermal heat pumps).**
- **European-wide, the growth rate for GSHP and Underground Thermal Energy Storage is substantial**
- **An installed capacity of at least 17'000 MW<sub>th</sub> was achieved by the end of 2012, distributed over more than 1.3 Mio installations.**
- **While some large markets like Sweden are in a stagnation phase or even shrinking as in Germany, the overall prospects are good, despite the economic crisis in part of Europe**

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## GSHP Market

The shallow geothermal sector, comprising the ground source heat pumps, is the largest in Europe in terms of installed capacity



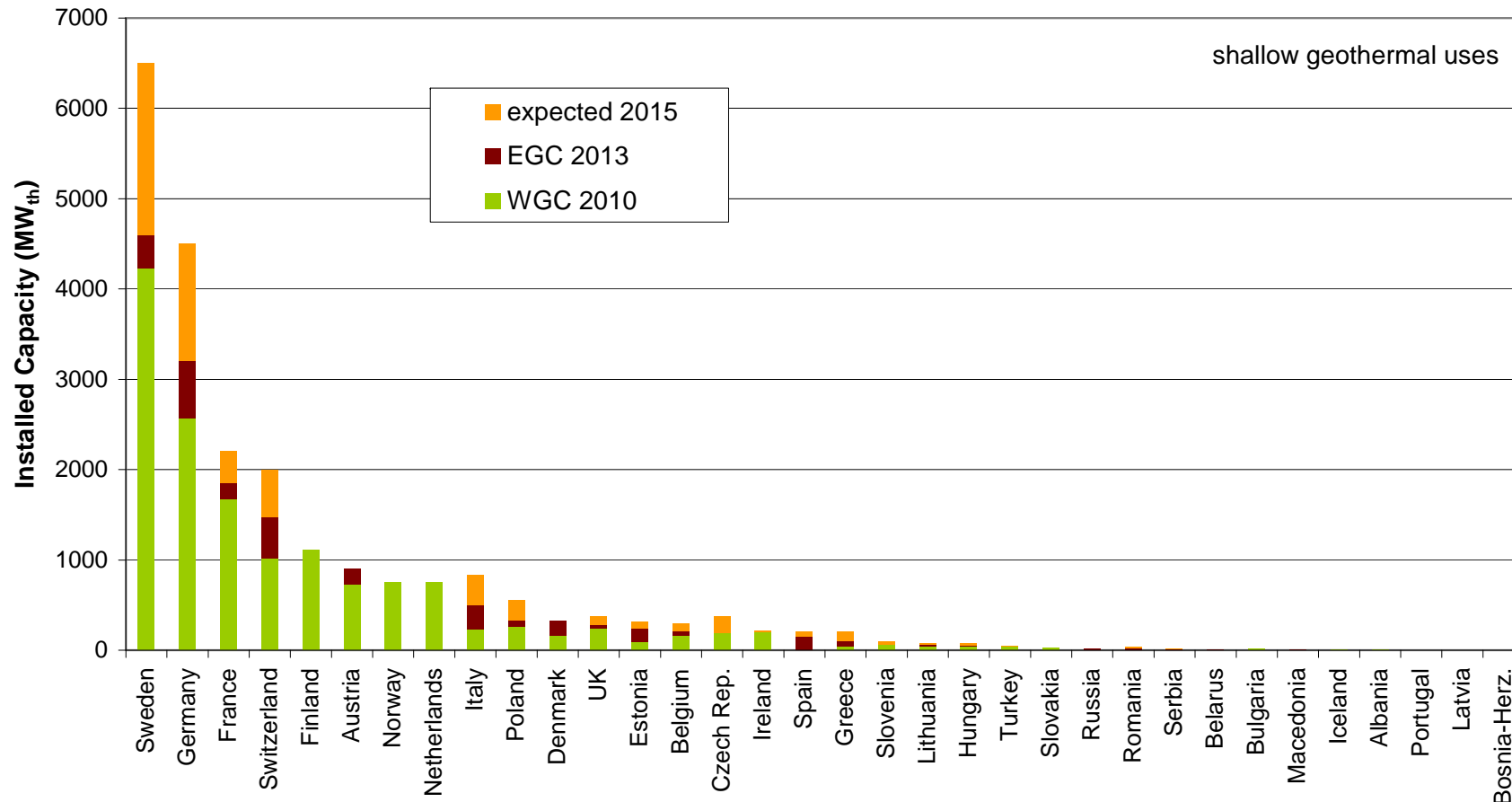
(after data from EGC 2013 country updates)

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# GSHP Market

## Development of shallow geothermal capacity in Europe



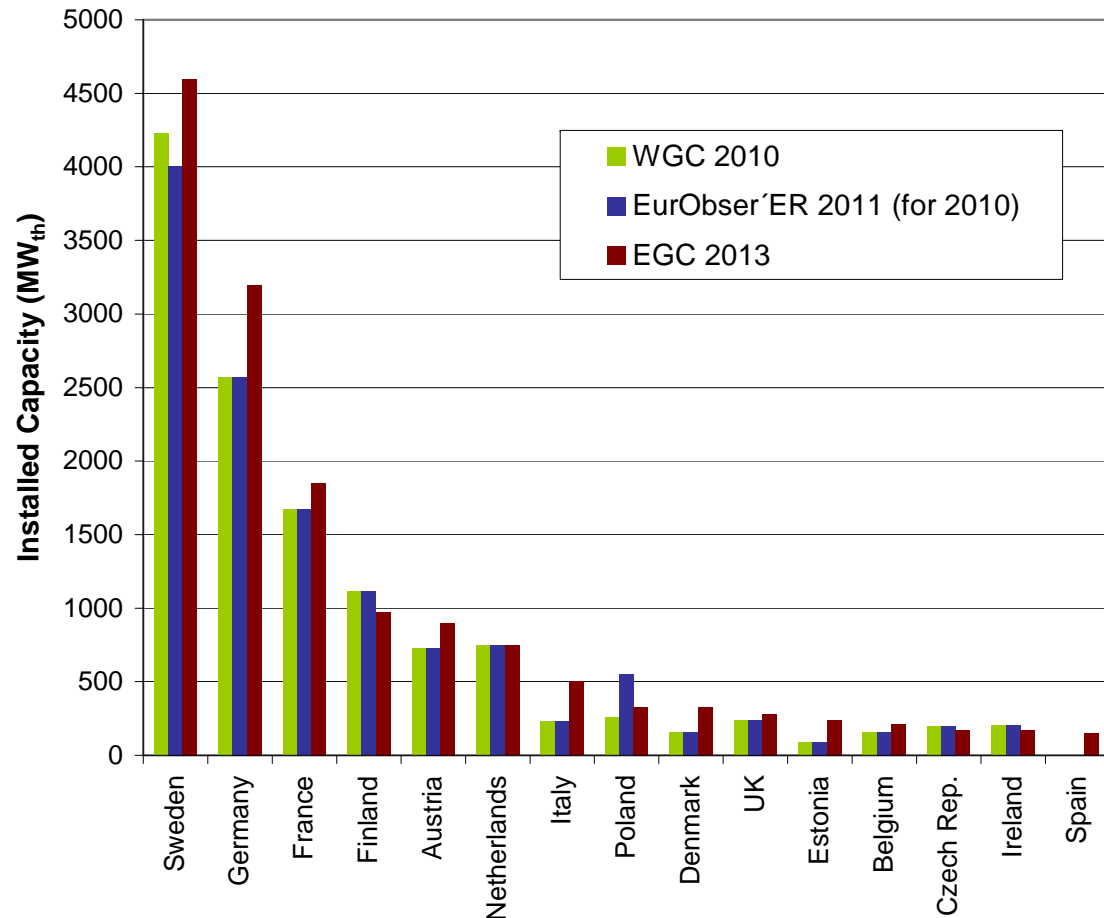
(after data from EGC 2013 country updates)

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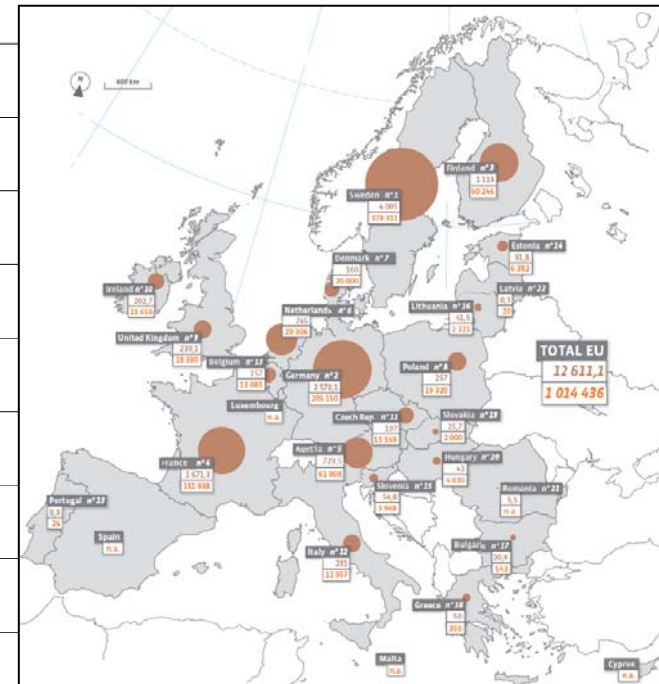


# GSHP Market

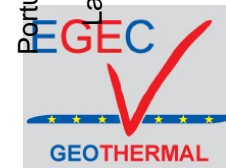
## Comparison of shallow geothermal capacity in Europe (EU-27) after different sources



Map from EurObserv'ER 2011



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## GSHP Market

**GSHP statistics in the past and in the future – example Germany**

**Statistics in the EU are from now on governed by:**

- **Directive 2009/28/EC (Renewable Energy), Annex VII**
- **Details and default values in Decision 2013/114/EU**

**Value for total renewable (geothermal) heat produced in Germany following the rules used by now, as in the German EGC 2013 country update report:**

- **265'000 units (GSHP) installed**
- **2400 MW<sub>th</sub> installed geothermal capacity**
- **4170 GWh/yr of geothermal heat produced**

**Base data from AGEE-Stat, BMU, BWP, GZB;  
detailed sources of data in the report (Ganz et al., 2013)**

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## GSHP Market

GSHP statistics in the past and in the future – example Germany

Statistics in the EU are from now on governed by:

- Directive 2009/28/EC (Renewable Energy), Annex VII
- Details and default values in Decision 2013/114/EU

$$E_{RES} = Q_{usable} * (1 - 1/SPF)$$

$$Q_{usable} = H_{HP} * P_{rated}$$

Calculation using the new EU rules, with the same base data:

Default values for  $H_{HP}$  and SPF are given in 2013/114/EU. For Germany, located in the “average climate” zone,  $H_{HP}$  is considered as 2070 h/year (a rather high value), and SPF for Ground-Water and Water-Water heat pumps as 3.5 (this value is more on the low side for Germany).

$$Q_{usable} = 3200 \text{ MW} * 2070 \text{ h/yr} = 6624 \text{ GWh/yr}$$

$$E_{RES} = 6624 \text{ GWh/yr} * (1 - 1 / 3.5) = 4731 \text{ GWh/yr}$$

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## GSHP Market

GSHP statistics in the past and in the future – example Germany

Statistics in the EU are from now on governed by:

- Directive 2009/28/EC (Renewable Energy), Annex VII
- Details and default values in Decision 2013/114/EU

Value after current methodology:

4170 GWh/yr of geothermal heat produced (= 0,357 Mtoe)

Value after new EU methodology:

4731 GWh/yr of geothermal heat produced (= 0,406 Mtoe)

For the fulfilment of the targets set forth in RES-Directive, an amount of 0,406 Mtoe (**3,7 %** in 2012) is coming from GSHP:

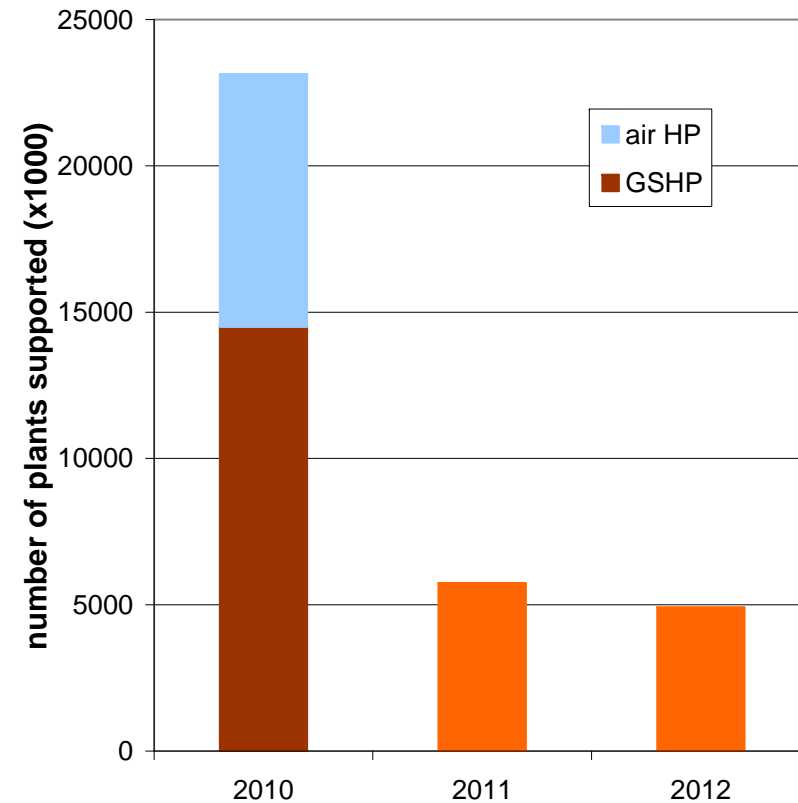
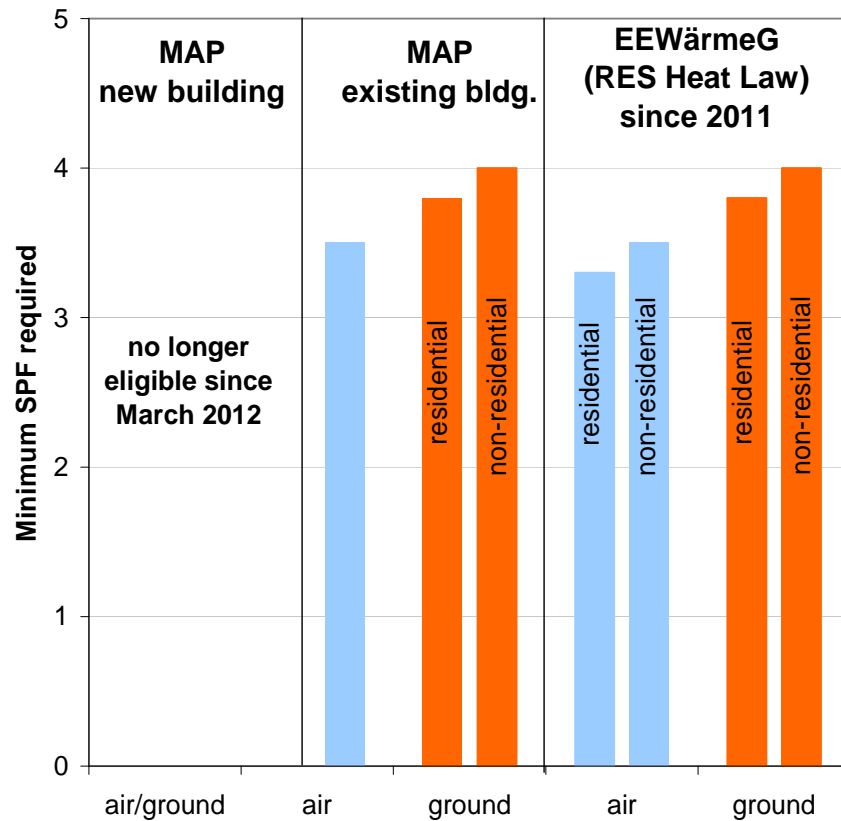
- RES 18 % of final energy consumption by 2020
- NREAP: heat 10,46 Mtoe in 2012 => 14,43 Mtoe in 2020  
(2012: 88,3 % Biomass, 5,1 % Solar Thermal, **2,9 %** GSHP)

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# GSHP Market

## Political support measures for GSHP in Germany



Required minimum SPF for being eligible for support under MAP, or accepted for fulfilling the renewable energy obligation after EEWärmeG

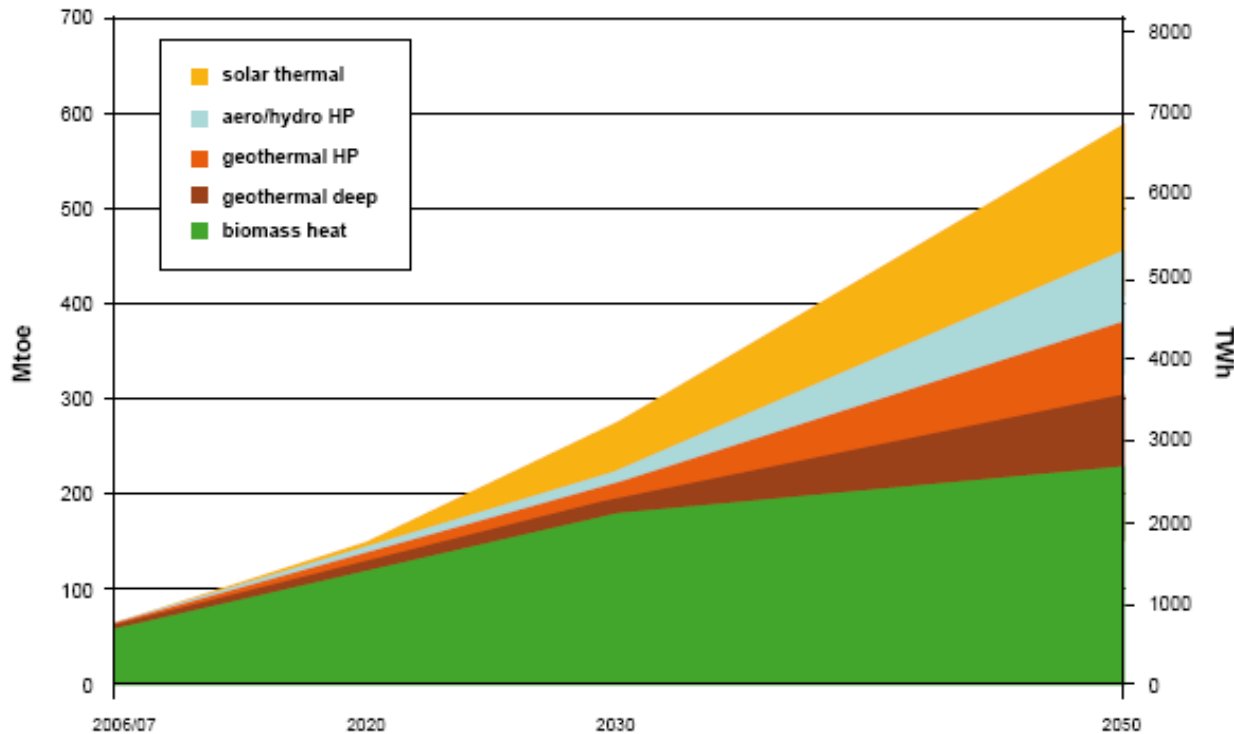
Number of heat pump plants supported within MAP (after data from BAFA)

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# Shallow geothermal energy

Possible development of renewable heating and cooling towards a full coverage of the demand inside the EU in the timeframe up to 2050



**RHC** Renewable Heating & Cooling  
European Technology Platform

[www.rhc-platform.org](http://www.rhc-platform.org)

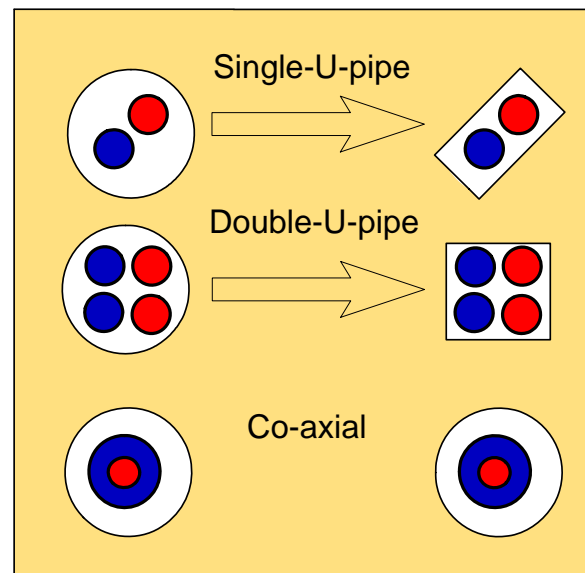


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# Content

- Market and application
- Technological development

Do not attempt the physically impossible:



A technical breakthrough, reaping savings from rectangular drilling ?

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# GSHP – site investigations

## Subsurface investigation for planning: TRT-equipment in various countries

Germany



Finland

Sweden



Greece

Spain

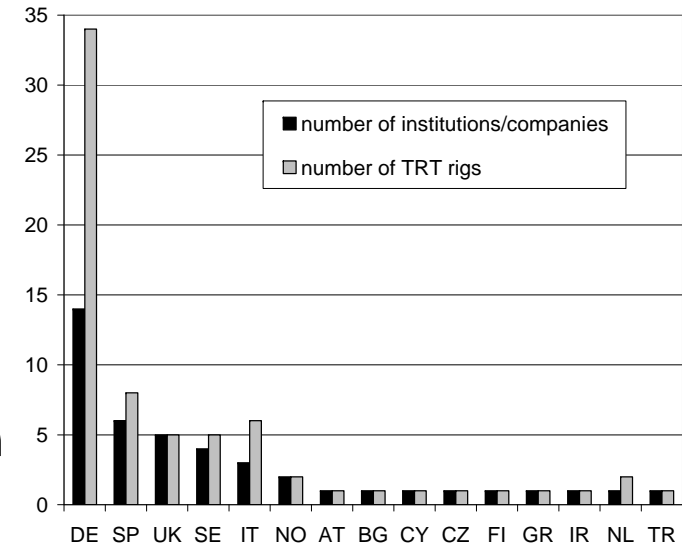


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## GSHP – site investigations

### Subsurface investigation for planning TRT development status

- Practical tool, used widely throughout Europe (right, data from EGC 2013)
- Developments to increase accuracy of measurement
- Advanced evaluation methods based on different mathematical approaches
- Additional information derived from TRT (hydrogeology, grouting, BHE depth, etc.)



A TRT-standard has been drafted by geotechnical experts, currently under voting with CEN/ISO: prEN ISO 17628  
 Technical status ca. 2000, numerous errors; objections filed by EGEC, EHPA, and national associations, companies, etc.

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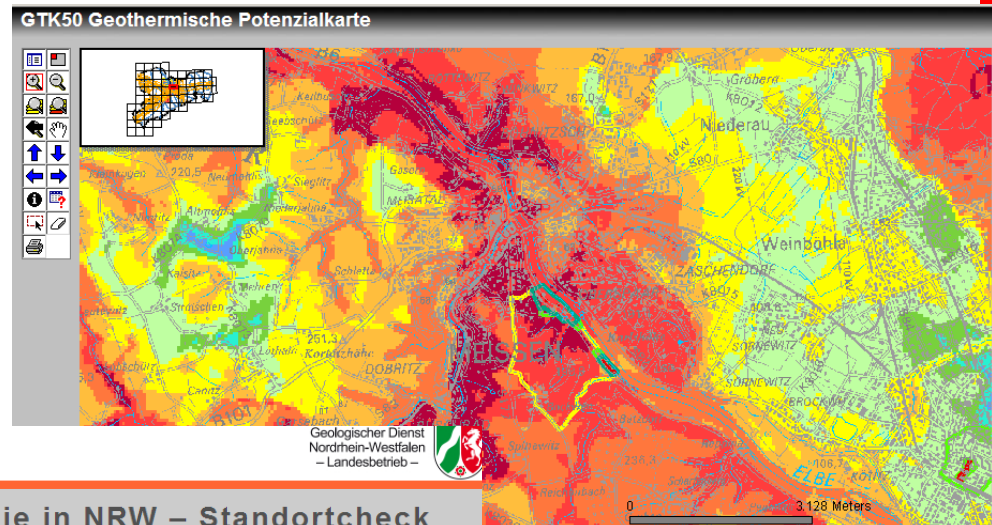




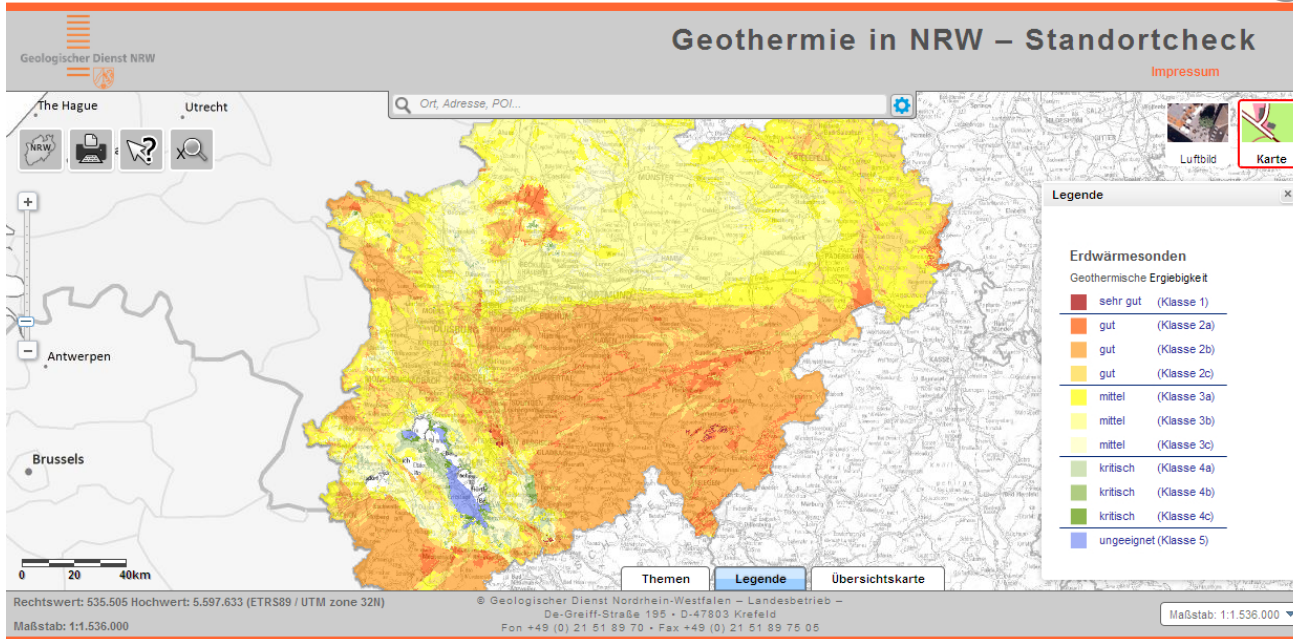
# GSHP – geological data

Subsurface data for planning:  
Info from Geological Surveys

Online GIS system in Sachsen  
(right), and in NRW (below)



In Kooperation mit  
EnergieAgentur.NRW



New online portal  
of GD-NRW,  
online since last  
week!

<http://www.geothermie.nrw.de>

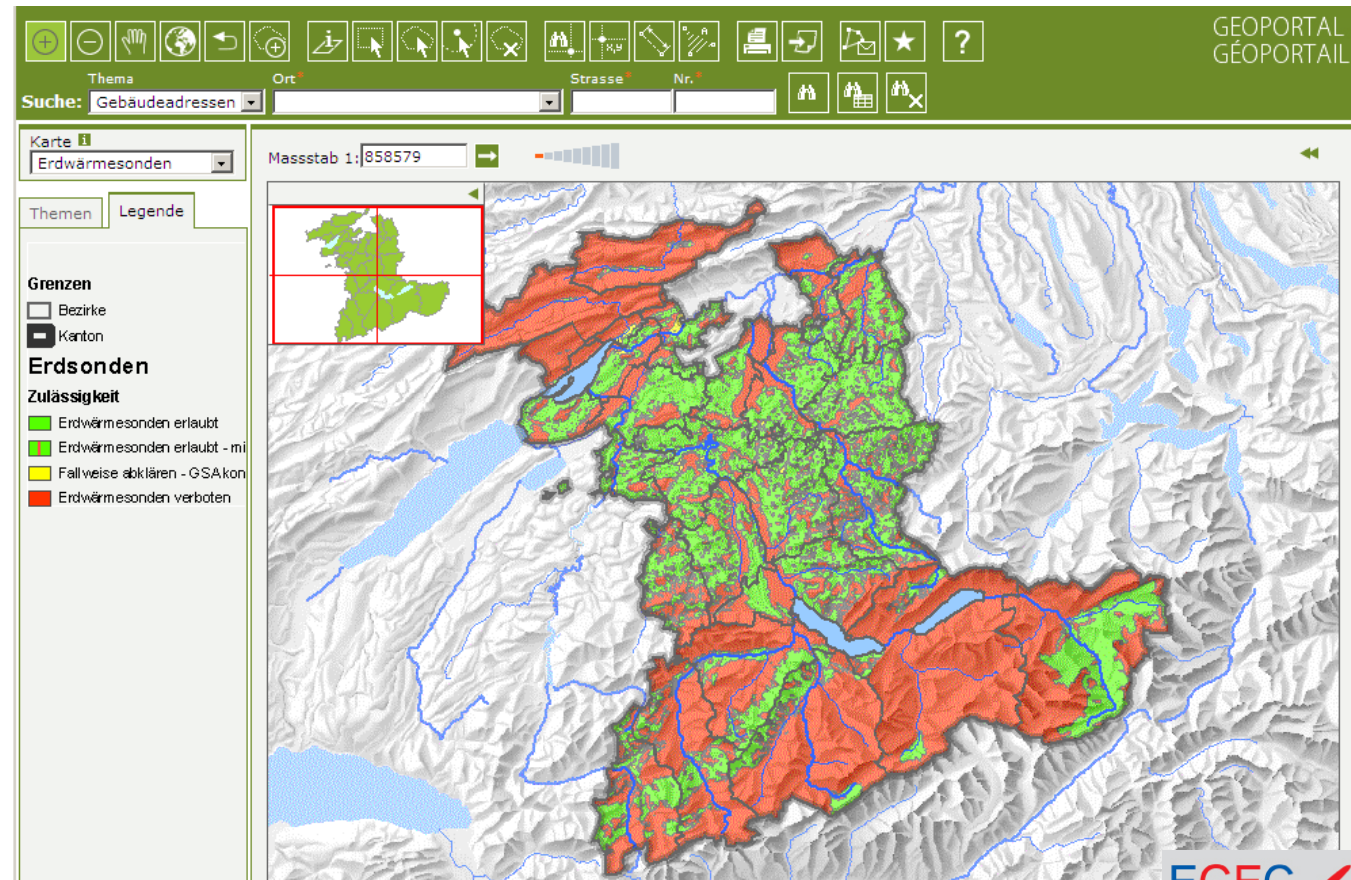
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## GSHP – geological data

Subsurface data for planning:  
Info from Geological Surveys

Areas for BHE  
and for  
groundwater  
heat pumps  
in the Kanton  
Bern,  
Switzerland



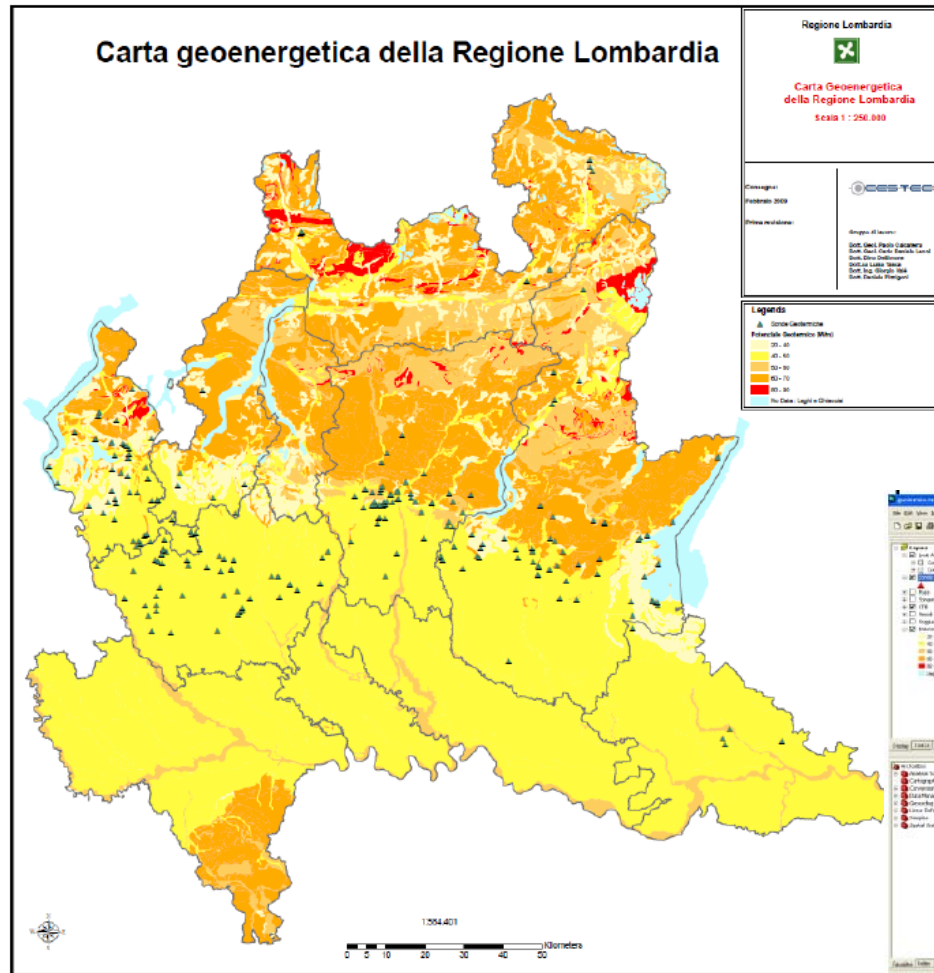
[http://www.bve.be.ch/site/geo/bve\\_geo\\_sta/bve\\_geo\\_karte\\_erdsond.htm](http://www.bve.be.ch/site/geo/bve_geo_sta/bve_geo_karte_erdsond.htm)

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# GSHP – data and registration

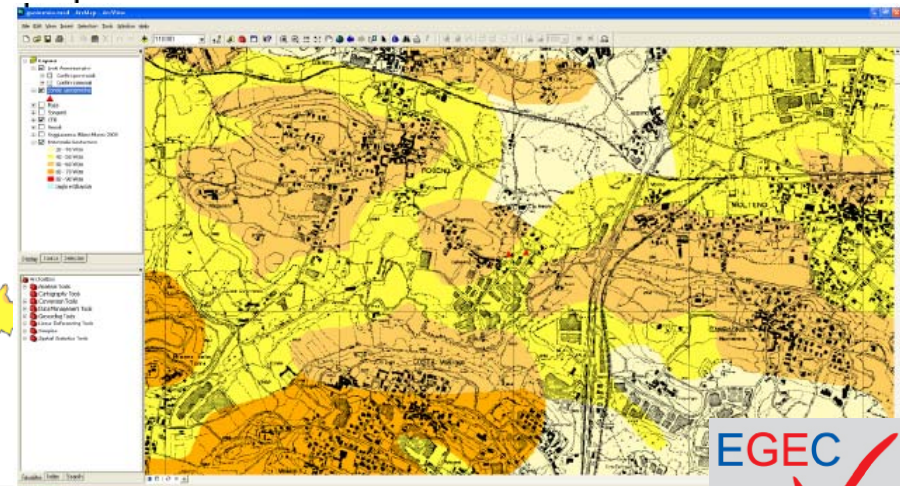
## Subsurface data for planning:



Web-tool for information,  
and for application for  
„sonde geotermiche“  
(borehole heat exchanger)

<http://www.rinnovabililombardia.it/rsg>

Source: Brolis / Finlombarda



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## GSHP – Drilling

### State-of-the-art Drilling:

- Different drilling methods exist to deal with various geological and hydrogeological situations
- For shallow geothermal applications, specialised drill rigs capable of several drilling methods, equipped with BHE installation tools, have been developed
- For protection of the environment and to avoid damages, hydrogeology (in particular artesian waters!) and geology (e.g. swelling evaporites or clay) need to be observed closely
- In shallow geothermal drilling, high standard of quality is possible, and further cost reduction can be expected

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## Project Groundmed



**Ground Source Heat Pumps for Heating and Cooling in Mediterranean Climate - final conference at EGC 2013**



**Advanced ground source heat pumps with improved SPF, optimised systems for cooling mode**

- capacity control,
  - improved temperature approach between BHE and heat pump and between heat pump and indoor system
- energy efficient system components (variable speed pumps, fan-coils, air handling units, thermal storage system)
  - maximising SPF by control algorithms

<http://www.groundmed.eu/>

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# Project Groundmed

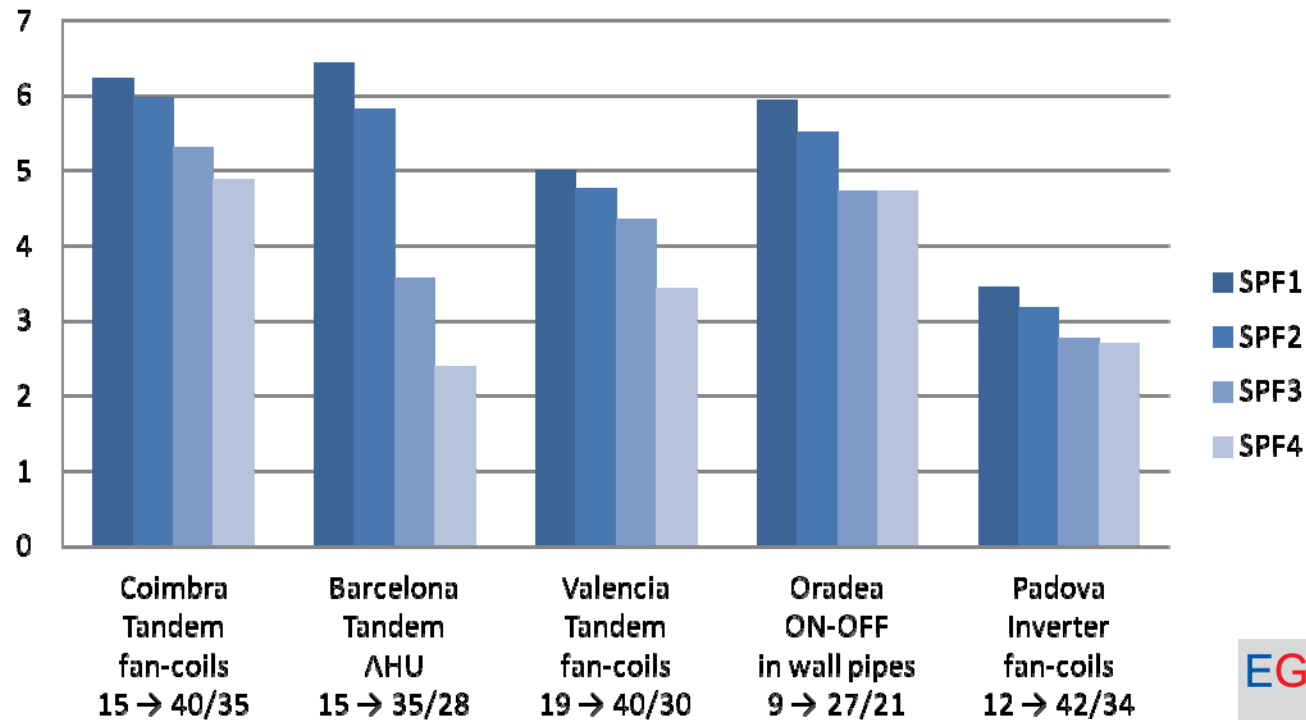


## Ground Source Heat Pumps for Heating and Cooling in Mediterranean Climate - final conference at EGC 2013



Ground-Med monitoring: 1-14 April 2013

### Monitoring Results:



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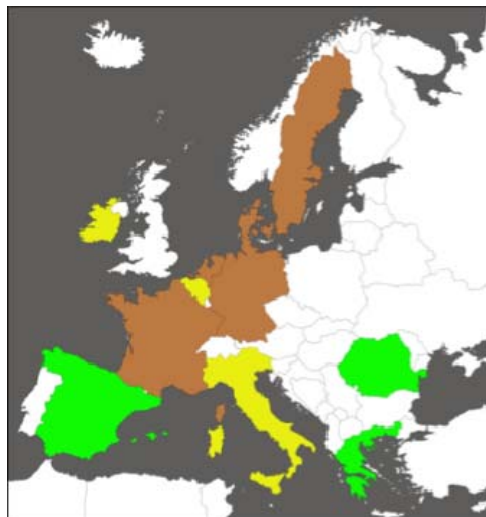
# Project Regeocities



Non-technical issues, in particular to overcome barriers referred to regulation of geothermal resources and administrative procedures.

First results: Overview of shallow geothermal regulations

National reports and European summary



<http://regeocities.eu/>



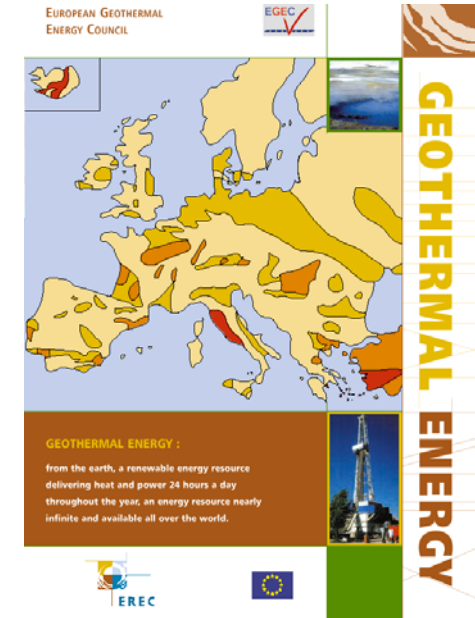
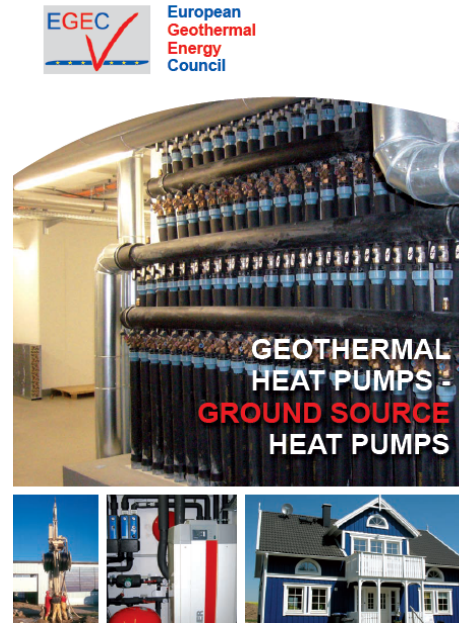
DE, BE, IT, etc.



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*Thank you  
for your  
attention !*



Brochures for download at [www.egec.org](http://www.egec.org)

All papers from EGC 2013 freely  
available on the IGA conference  
database:  
<http://www.geothermal-energy.org/>



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