2020

EGEC GEOTHERMAL MARKET REPORT

Key Findings

EGEC GEOTHERMAL

Tenth Edition
June 2021

ACKNOWLEDGEMENTS

EGEC wishes to sincerely thank all those who submitted data and contributed to the collection of information:

Olof Andersson (Lund University); Teppo Arola (Geological Survey of Finland); Fausto Batini (Magma Energy, Rete Geotermica); Carlos Alberto Bicudo da Ponte (SOGEO); Christian Boissavy (GEODEEP); Micaela Bozzi (Enel Green Power); Dario Bonciani (CosVIG); Maurizio Cei (ENEL Green Power); David Charlet (IDEA, Belgium); Robert Colbach (Services Géologiques du Luxembourg); Petr Dědeček (Institute of Geophysics of the ASCR); André Deinhardt (Bundersverband Geothermie); Gregor Dilger (Bundesverband Geothermie); Ivan Djokic (GECO-inženjering); Robert Gavriliuc (Romanian Geoexchange Society); Matus Gajdos (GA Drilling); Signhild Gehlin (Swedish Geothermal Association); Gregor Goetzl (Geological Survey of Austria); Margarita de Gregorio (APPA, GEOPLAT); Rüdiger Grimm (Geoernergie Konzept); Marek Hajto (AGH University of Science and Technology); Oto Halas (Slovgeotherm); Lars Henrik Nielsen (Geological Survey of Denmark and Greenland, GEUS); Jolanda Kaufhold (Bundersverband Geothermie); Katharina Link (Geothermie Schweiz); Beata Kepinska (Polish Academy of Science); Attila Kujbus (GEOEX); Ben Laenen (VITO); Andrej Lapanje (Geological Survey of Slovenia); Katharina Link (Geothermie Schweiz); Dimitrios Mendrinos (CRES); Sara Montomoli (Enel Green Power); Thor Erik Musæus (Geothermal Energy Nordic AS); Ric Pasquali (Geoserv Solutions); Sibela Oudech (GECO-inženjering); Paloma Perez (APPA, GEOPLAT); Demetris Petrides (Cyprus Ministry of Energy, Commerce and Industry); Armand Pomard (AFPG); Sanja Popovska-Vasilevska (Macedonian Geothermal Association); Dušan Rajver (Geological Survey of Slovenia); Burkhard Sanner; Davide Serra (Enel Green Power); Kathrin Schwarz (Bundersverband Geothermie); Loredana Torsello (CosVIG); Thomas Vangkilde-Pedersen (Geological Survey of Denmark and Greenland, GEUS), Marco Vichi (COSVIG); Sanja Živković (Energetski institut Hrvoje Požar); Miklos Antics (Geoproduction); Pierre Ungemach (Geoproduction).

The sole responsibility for the content of this document, however, lies with the authors.

EDITORS

Thomas Garabetian (EGEC); Philippe Dumas (EGEC); Consuelo Serrano (EGEC); Valeria Mazzagatti (EGEC); Sanjeev Kumar (EGEC); Reghina Dimitrisina (EGEC); Helena Erbanova (EGEC); Sofia Katechi (EGEC).

DESIGN

Consuelo Serrano (EGEC); Valeria Mazzagatti (EGEC); Sofia Katechi (EGEC).

COPYRIGHTS

2020
EGEC GEOTHERMAL MARKET REPORT
Key Findings

Tenth Edition
June 2021

EDITORIAL

MIKLOS ANTICS, EGEC President

Like many industries in Europe, the geothermal industry suffered the consequences of the COVID 19 pandemic in 2020. **Positive trends from previous years came to a standstill,** hopefully only momentarily. Several projects got stopped in their tracks, various others faced delays. For many developers, 2020 was a difficult year, as they faced delays in their ongoing projects and greater hesitation from investors and potential customers. So what do we take from 2020? **Everything will change after the pandemic.** COVID 19 changed how we interact globally for years to come, and has forced economies to look for local resources, including energy. We need to use our own natural and in-place energy resources for heating, for food, for transport.

This market report shows that **geothermal district heating and cooling** projects nearly came to a halt, with merely 2 projects coming online, none in the traditionally dynamic markets where many projects have been delayed by the pandemic. **Geothermal heat pump sales** are broadly stable, bringing the total number to 2.1 million systems deployed across Europe. However, sales have decreased significantly in several of Europe's most dynamic markets. The **geothermal electricity sector** is faring much better thanks to Turkey, which is carrying on the build up of its geothermal power capacity, adding 165 MWe of new capacity. But uncertainty is prevailing in other countries.

We have **witnessed a shift in the political framework for heating and cooling in 2020,** where geothermal energy has been put at the center of many strategies for building decarbonisation and competing fossil energy technologies are being pushed out of the market. For the geothermal electricity industry however, despite positive signals are coming out of Turkey with the long-awaited extension of the feed in tariffs, uncertainty remains the key word in many markets where support to geothermal power projects lacks stability.

The past year highlighted the **vulnerability of the geothermal industry to short term disruptions,** but it also put forward the **robustness of the interest in geothermal energy** across Europe. At the European level, the Renewable Energy Directive will be reviewed, putting renewable heating and cooling as a driver of increased decarbonisation targets. Meanwhile, major investment programmes and green recovery funds are being set up by both the EU and national governments. These programmes will look to pursue the energy transition, and geothermal energy can be a core beneficiary. However, our industry will need to remain mobilised at European and national level to advocate for geothermal projects to be properly included in these plans.

Since the first EGEC Market Report back in 2010, the **European geothermal sector grew and transformed:** we have seen **bad policy decisions** stop the rapid growth of geothermal heat pumps in several key markets, but we have also seen **this technology becoming mainstream** over the last decade. We have seen the emergence of **Turkey** as a global geothermal leader, while the promises of EGS in 2010 have not yet quite delivered. Geothermal district heating has spread out, with projects planned or already operating in ever more countries, and continues to rise interest becoming the key to the decarbonization of heating and cooling.

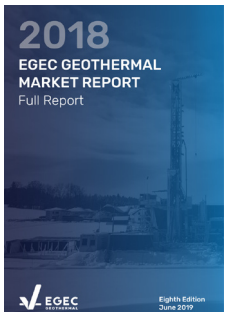
The upcoming **"Fit for 55% package" and the implementation of the various mechanisms** to put the economy back on track after COVID 19 are going to be crucial to bring the geothermal industry to a new dimension. After 10 years of EGEC Market report, we are happy to report that **the sector expanded tremendously:** installed

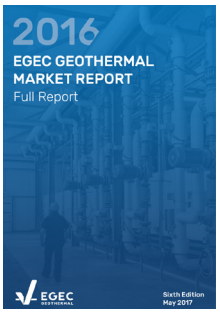
capacity for geothermal power soared from 1.5 GWe to 3.5 GWe thanks to the emergence of Turkey as a reliably dynamic market realizing its potential. The 2 GWth of geothermal district heating and cooling capacity were added, accompanying the emergence of new markets such as the Netherlands. We also doubled the number of geothermal heat pumps, adding 1 million systems, while also installing ever more efficient geothermal heat pumps, of greater capacity, and drilling more efficient and deeper borehole heat exchanger.

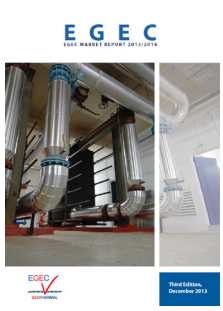
Innovation has been a driving force of the past decade and will continue to be so in the coming one. We are seeing ever more innovation in subsurface systems being translated from the oil and gas industry to the geothermal sector, and innovation specific to the geothermal industry allows to competitively develop a wider range of resources and bring costs down. The Velizy-Villacoublay (West Paris Basin) project deploying **multi-drain reservoir** development technologies is a good example of these practices. But more innovation will be needed, as new needs arise, from geothermal minerals production to mainstreaming geothermal heating and cooling at the scale of cities, and balancing electricity grids thanks to geothermal power plants.

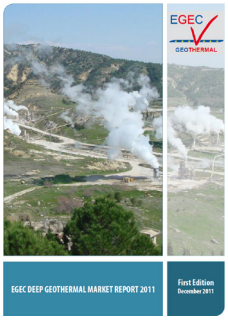
The present Geothermal Decade challenged us with a difficult and complicated start. We are however confident that we have just started the Geothermal Decade, and that rapid growth awaits the geothermal sector.

10 YEARS OF MARKET REPORT









KEY FINDINGS

For the past 10 years, the EGEC Geothermal Market report has been an authoritative publication on the development of the geothermal sector in Europe. Covering all segments of the sector – electricity and heating and cooling supply – the European Geothermal Market Report provides a comprehensive picture of the state of the sector in Europe. The report also looks at key trends in the global geothermal market, including minerals extraction (lithium).

Beyond the statistical reporting, it provides insightful analysis of the market trends, policy framework and technology evolutions that shape the geothermal sector. Every year the report also provides an in-depth review on the state of a specific aspect of geothermal technologies. For the year 2020, the technology focus of the EGEC Geothermal Market Report is about drilling design.

The **full version of the Geothermal Market Report is available for Members only**.

A decade of geothermal energy developments across Europe

2010-2020 was a decade of sustained growth blighted towards the end by the economic impacts of the COVID-19 pandemic. The effects of the pandemic are expected to be short term. The impact of the European Green Deal, combined with the international focus on delivering the 1.5 degree Celsius global emission target, is expected to boost investment in all types of geothermal energy in Europe and globally, making it the geothermal decade.

The past 10 years highlight **how rapidly the geothermal district heating and cooling sector can evolve,** having witnessed the rapid emergence of leading geothermal countries in 2020, such as the Netherlands and Germany. However, the past decade also tells **a story of missed opportunities,** with a few countries not living up to the expectations of 10 years ago.

The **European geothermal heat pump market** continued along the recent stable trends in 2020, despite significant decreases in sales in some national markets (such as Poland) because of the coronavirus pandemic. The geothermal heat pump market remains quite concentrated, as most of the sales take place in some key countries, the Nordic ones above all.

Some European markets serve as a cautionary tale on the impact of policy decisions for the stability of the geothermal heat pump industry. **France** is a notable example, where sales of geothermal heat pumps in 2020 are merely a tenth of those in 2008, when the country was a leading European market. **Decisions to suddenly alter the support framework for this technology**, without consulting the industry led to a dramatic collapse of a rapidly growing and job creating sector.

Aside from Turkey, there were no new additions to the installed capacity of **geothermal electricity** in 2020. However, several projects were close to completion. This slowdown was due to the COVID 19 crisis. Correcting **policy shortcomings, and a disjointed permitting and licensing framework** are the key areas of focus to accelerate future investment.

Geothermal power

Europe had 3.5 GWe of installed geothermal electricity capacity in Europe in 2020. This was distributed over 139 power plants. **Turkey** became the most dynamic geothermal power market in the world for new installed geothermal capacity.

In a major break with previous years, no new country (apart from Turkey) commissioned a geothermal power plant in 2020. This was due to the COVID 19 pandemic as well as the **lack of suitable and robust support frameworks** to accompany the uptake of geothermal electricity.

The coming decades may look quite different, provided the right conditions are set to allow the geothermal electricity industry to consolidate across new markets and further grow in established markets.

Globally, there were little changes in the hierarchy of leading geothermal power producers in 2020, with **USA, Philippines and Indonesia as the three leading countries** in terms of installed capacity. As just mentioned, **Turkey** is however continuing to expand, and the recent extension of the feed in tariffs for geothermal plants will maintain the positive trend of this market.

Geothermal heating and cooling systems

In 2020 there were **350 geothermal district heating systems in operation. A further 232 were in various stages of development.** The **Hellishedi geothermal power plant** completed a 190 MWth major extension in order to link with the district heating network in **Reykjavik, Iceland.**

12 projects are commissioned per year, on average. However, the COVID-19 pandemic delayed projects for much of 2020. We expect a strong rebound in the coming years, especially with the new policy emphasis on renewable heating and cooling in the European Green Deal.

Despite the COVID-19 short term consequences, the European geothermal heating and cooling industry remains on a positive trend. Most European countries are **looking to significantly expand their use of this renewable resource** as they pursue policies to decarbonise heating and cooling.

Throughout Europe, there is a trend towards the deployment of renewable heating and cooling infrastructures driven by local authorities. In **Western Europe**, the focus is notably on the development of new systems to encourage the switch away from the gas networks. In **Eastern Europe**, where antiquated district heating and cooling networks are widespread, there is a focus towards retrofitting infrastructure. There, geothermal energy projects often have to demonstrate their competitiveness against natural gas, as public authorities put a strong emphasis on the fight against energy poverty in their policy strategies.

Geothermal heating and cooling supply to **industry and the tertiary sector** is also expanding. A more comprehensive reporting of these statistical data is expected for next year.

At global level, the use of geothermal heating and cooling is also expected to be an increasingly important driver of new developments, notably in **China, Canada, the USA and Kenya.**

Geothermal Heat Pumps

The European geothermal heat pump market continued along the recent stable trends in 2020, despite significant decreases in sales in some national markets as a consequence of the COVID-19 pandemic.

Sales remained **around 100 thousand units across Europe in 2020. Sweden, Germany and the Netherlands** accounted for over half of these sales. About 2.1 million geothermal heat pump systems were operating in Europe, representing an estimated capacity around 27 GWth, and up to 7 Mtoe of geothermal heating and cooling. The average size of the systems also continued to grow.

Thus far, all European countries with a high geothermal heat pump penetration rate are defined by **Nordic or alpine climates,** reflecting the competitiveness of this technology in colder climates. These countries are also relatively high income, although the emergence of markets such as Estonia, and the rapid growth of geothermal heat pumps in Poland highlight the potential for geothermal heat pumps to be very competitive with the right market and regulatory framework.

Most EU Member States failed to achieve their geothermal heat pump objectives set as part of the 2020 National Renewable Energy Targets within the National Renewable Energy Action Plans. The most ambitious countries are however those most compliant with their targets: Sweden is exceeding its 2020 geothermal heat pump objective by 20% according to the data reported to Eurostat for the year 2019, while Germany in 2019 reached 91% of its 2020 target for geothermal heat pumps.

These results reflect the relevance of geothermal heat pumps, even to **meet large energy needs, and the potential for a rapid scale up** when the right policies are in place – from financial incentives to training of skilled professionals, including a clear permitting framework.

The NATO headquarter is using geothermal energy

FIGURES

FIGURES | GEOTHERMAL POWER

Fig. 1 | Installed capacity for geothermal electricity and district heating by country in 2020 (MW)

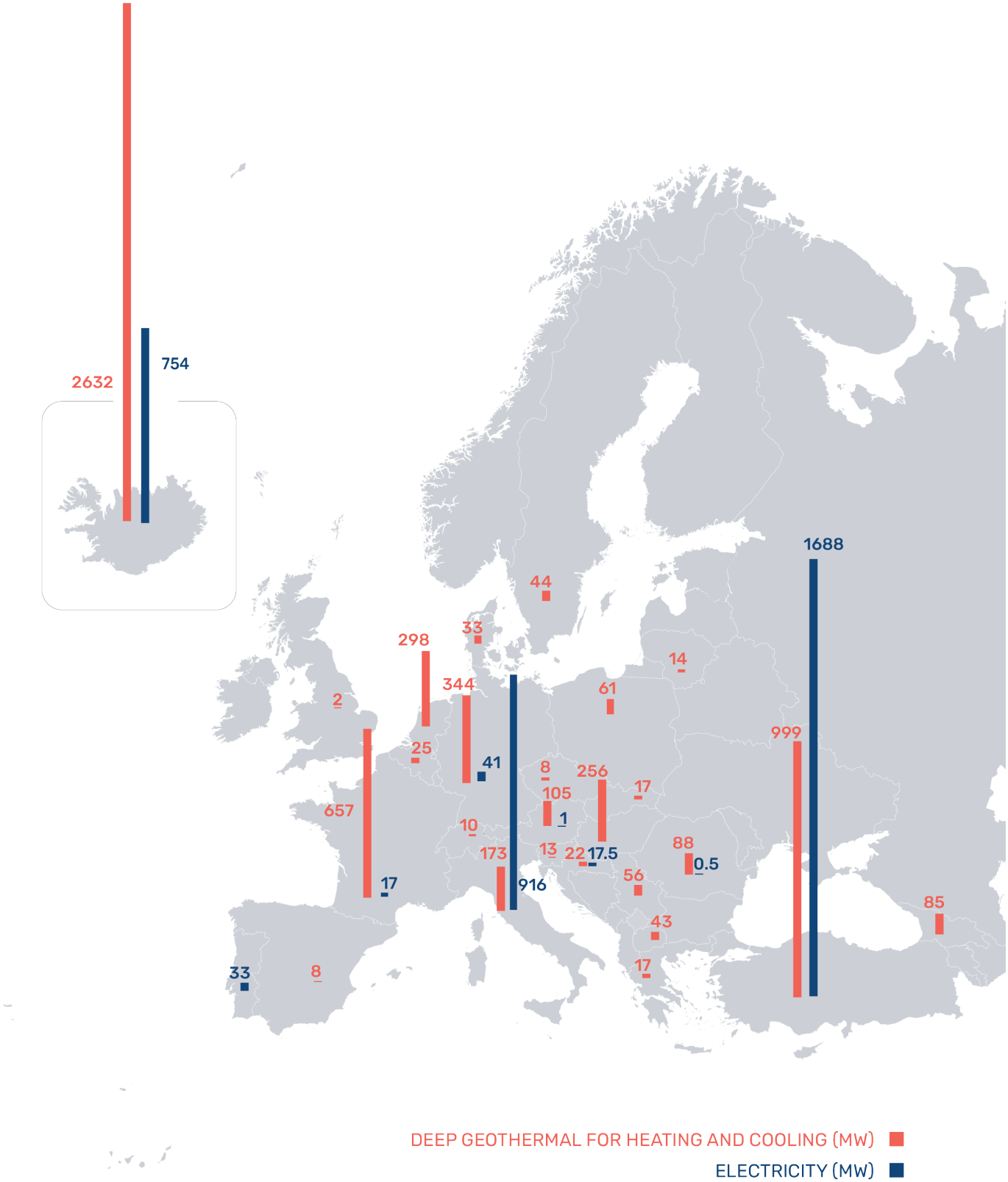


Fig. 2 | Comparing geothermal electricity capacity per country in 2010 and 2020

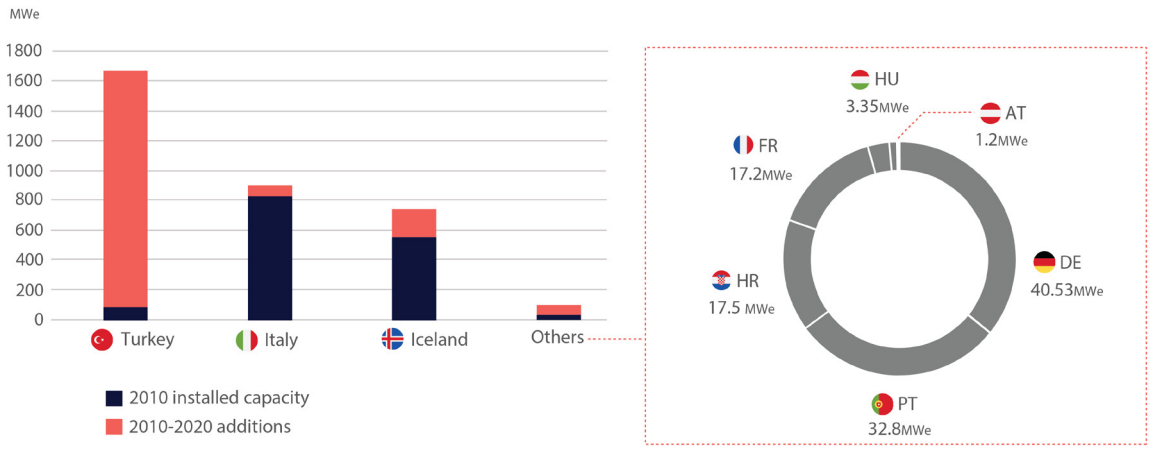


Fig. 3 | Number of plants per country: installed, in development, planned

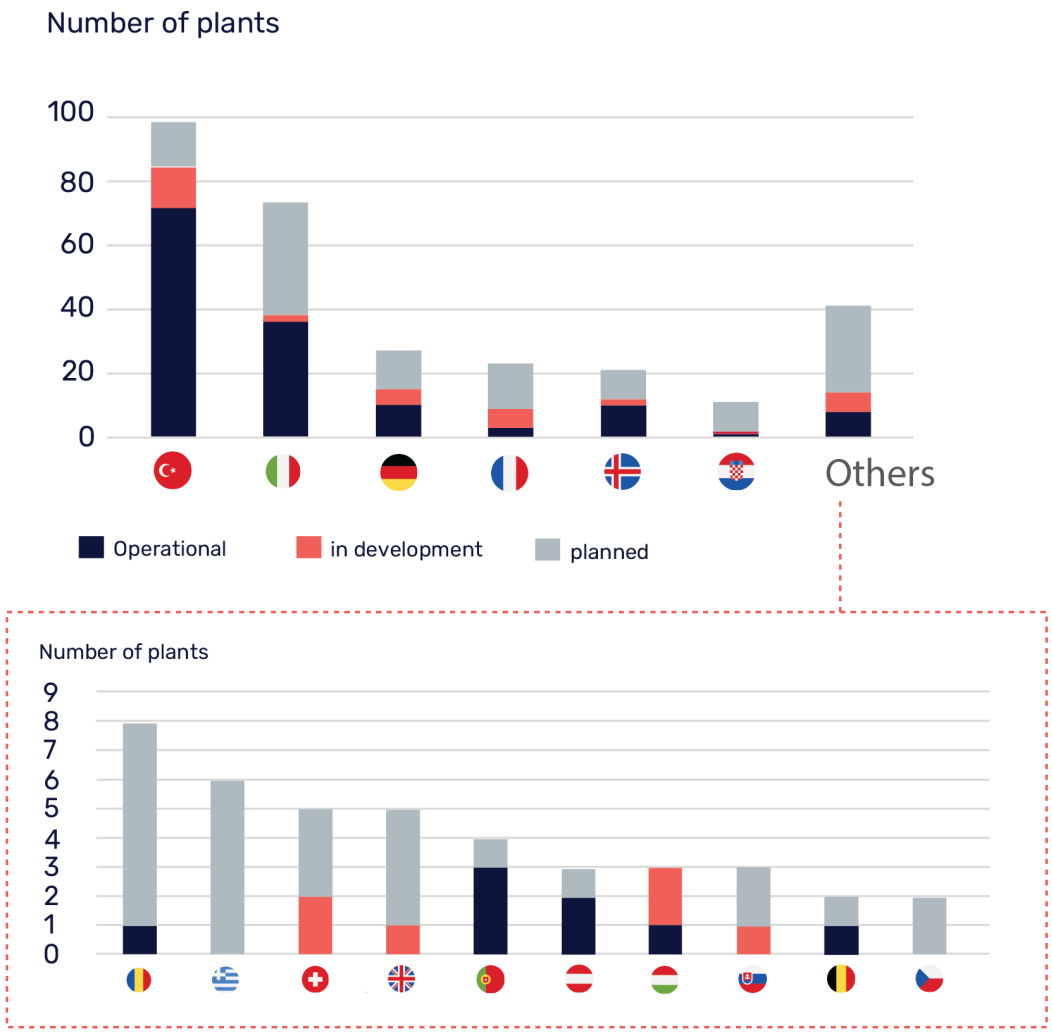


Fig. 4 | Share of different geothermal turbine technologies in Europe

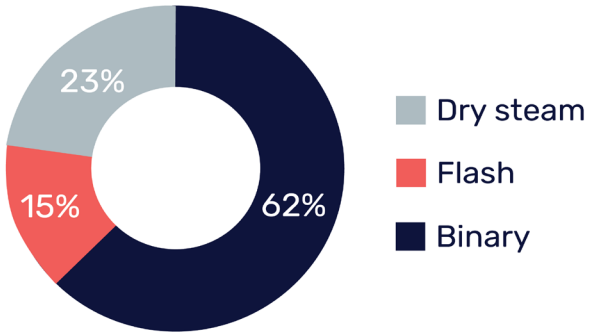
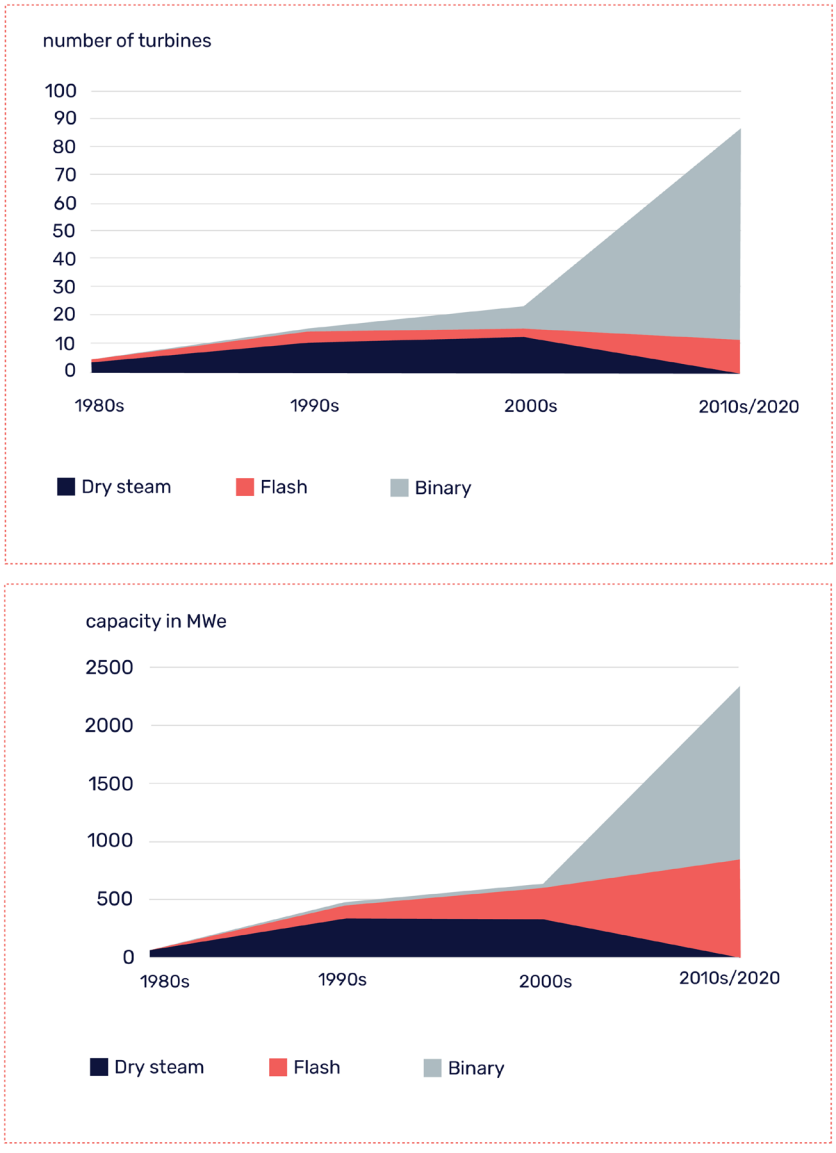


Fig. 5 | The turbine market over the past decades



FIGURES | DISCTRICT HEATING AND COOLING

Fig. 6 | Map of geothermal district heating and cooling in Europe

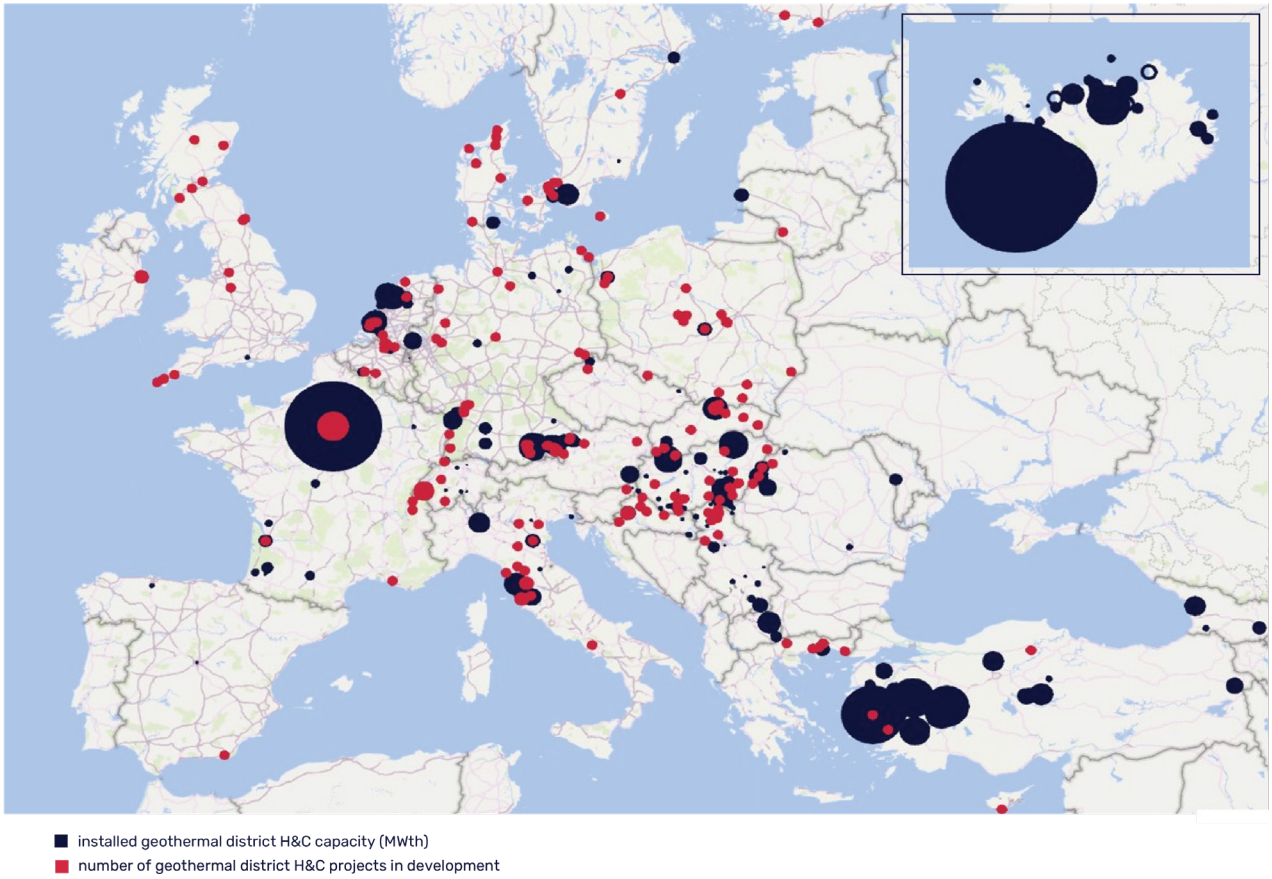


Fig. 7 | Number of geothermal district heating and cooling, operating and in development

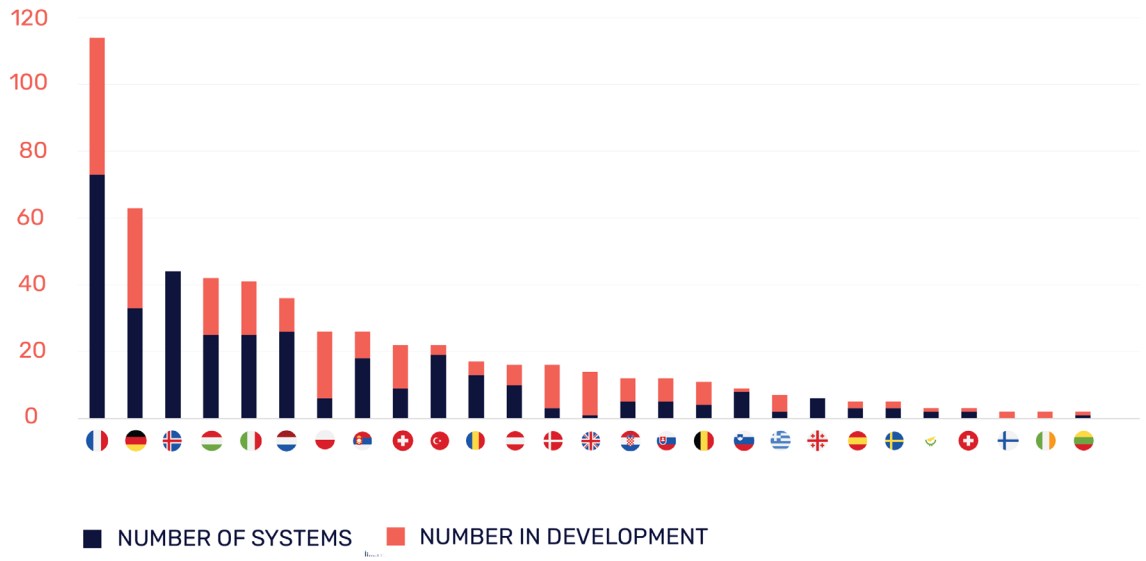
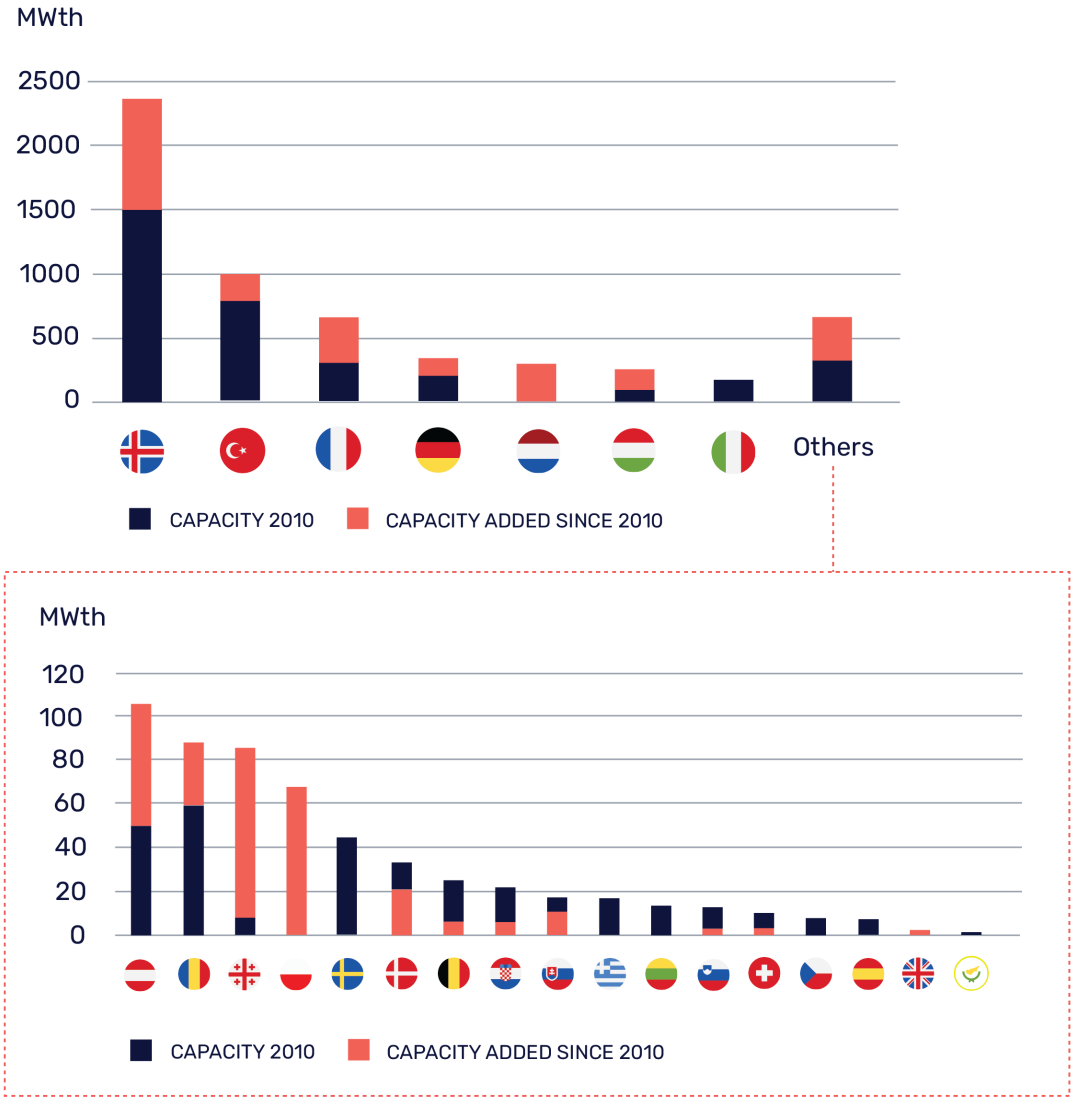


Fig. 8 | Geothermal district heating from 2010 to 2020



FIGURES | GEOTHERMAL HEAT PUMPS

Fig. 9 | Geothermal heat pump installed in Europe

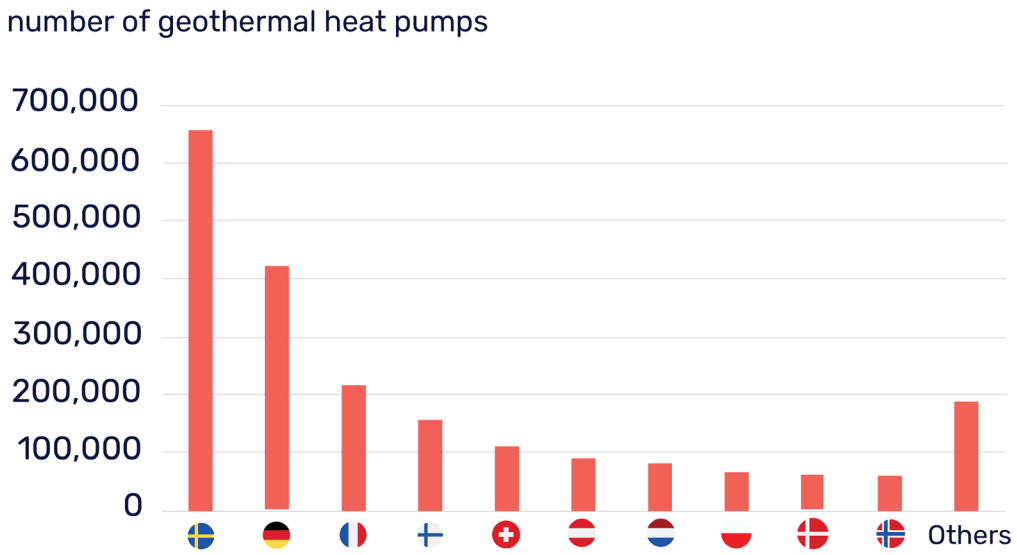
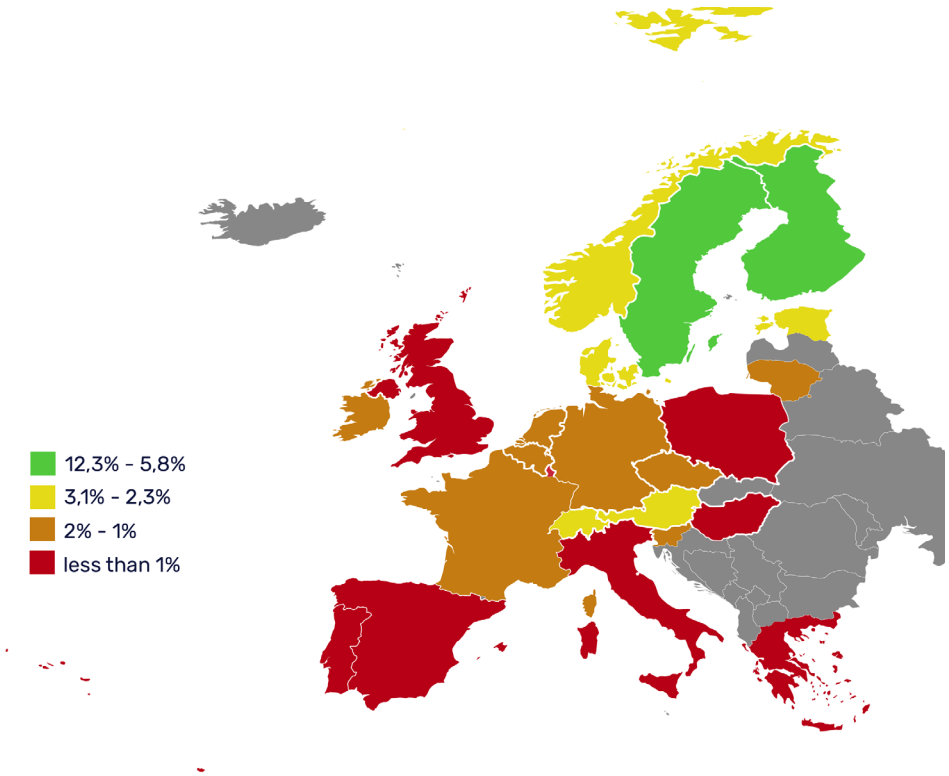


Fig. 10 | Number of geothermal heat pumps systems per 1,000 households



IN THE FULL REPORT

The Ruggero Bertani European Geothermal Innovation Award 2021

The Ruggero Bertani European Geothermal Innovation Award is an initiative of EGEC, the European Geothermal Energy Council, in collaboration with Messe Offenburg, organiser of the GeoTHERM congress. The Award is given to companies which have made an outstanding contribution in the geothermal sector in the form of innovative products, scientific research or project initiatives.

In June 2021 EGEC will announce the final winner among the six endorsed nominations for the Ruggero Bertani European Geothermal Innovation Award 2021.

The six finalists of this year are (in alphabetical order):

- AIMEN Technology Center (Spain). Their innovation is a novel electrochemical-based sensor designed to monitor corrosion in wells and pipes in real-time, without the need of inspection.

- ENGIE Solutions / Antea Group (France). They propose an innovative multi-drain design of a borehole, which allows to cross multiple times a geothermal reservoir, significantly increasing its productivity.

- EuGeli (France). This project, carried out by Eramet, provides lithium extracted from geothermal brines located in the French/German Upper Rhine Graben.

- Hunosa (Spain). Their project turned closed coal mines into a geothermal district heating, using the water of the old coal collieries as a renewable resource.

- MegaWatt Solutions Nordic AB (Sweden). They developed an integrated heat pump solution (the E-Box), which is equipped with a SCADA system featuring numerous control features that monitor the energy performance of the entire system.

- ON Power (Iceland). Their eco-industrial Geothermal Park uses the energy supply in excess from the Hellisheidi geothermal plant for a small-scale hydrogen production unit and a carbon capture plant.

“With those 6 project proposals, the finalists demonstrate originality, innovation, and reliability. The high-quality of the more than 15 applications received makes for a challenging competition, showing that the geothermal sector is brimming with unceasing innovation. This award is a great opportunity to promote ingenious projects, and we are honoured to receive so many good and innovative projects every year”, said Philippe Dumas, EGEC Secretary-General.

The jury for 2021 is composed of Miklos Antics (France, representing EGEC), Inga Berre (Norway, Professor at University of Bergen), Sandra Kircher (Germany, representing Messe Offenburg), Fausto Batini (Italy, Magma Energy, ETIP-DG President), and Javier Urchueguia (Spain, representing RHC-ETIP geothermal panel).

DATA COLLECTION AND METHODOLOGY

The EGEC market report presents the market data along three main areas:

- **Geothermal electricity;**
- **Geothermal district heating and cooling;**
- **Geothermal heat pumps.**

GEOTHERMAL ELECTRICITY

Existing plants

For each power plant connected to the grid, and already in operation contributors submit available information regarding:

- **Locality** (region, province, of municipality),
- **Power plant** name and **type** (hydrothermal or EGS),
- **Year of commissioning** (in case of refurbishment or upgrading, coordinators should report the most recent date)
- **Turbine type** (dry steam, single, double, or triple flash, ORC, Kalina)
- **Turbine manufacturer** (in case of two or more manufacturers please provide all of them)
- **Capacity installed** (in MWe and MWth (in case of CHP)
- **Gross electricity production** in 2019 (in GWh)
- **Operator, service companies, drillers and equipment manufacturers**
- When available, number and depth of wells (in meters)
- When available, temperature and flow rate of the wells

POWER PLANTS UNDER DEVELOPMENT

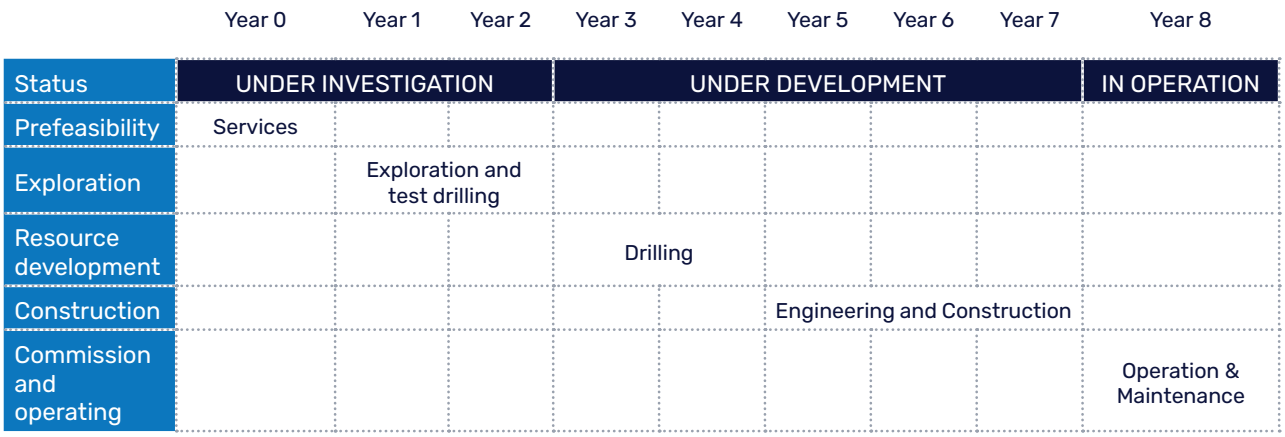
Power plants under development refer to projects for which financing has been announced and/or contracts for drilling services signed (if YES= please specify). For each project contributors submit available information regarding:

- **Locality** (region, province, municipality),
- **Power plant name** and **type** (hydrothermal or EGS),
- **Expected year of commissioning**
- **Expected capacity installed** (in MWe and MWth (in case of CHP))
- **Project developer/consortium** and, if available, **drillers and equipment manufacturers**
- If available planned number and depth of wells

POWER PLANTS UNDER INVESTIGATION

Power plants under investigation refer to projects for which a research permit has been issued but financing has not been announced and/or contracts for drilling services not been signed. For each project contributors submit available information regarding:

- **Locality** (region, province, municipality),
- **Power plant name** and **type** (hydrothermal or EGS),
- **Expected year of commissioning**
- **Expected capacity installed** (in MWe and MWth (in case of CHP)
- **Project developer/Consortium**



GEOTHERMAL DISTRICT HEATING

'Geothermal district heating or district cooling' is defined as the use of one or more geothermal production fields as sources of heat/cold to supply thermal energy through a network to multiple buildings or sites. It includes greenhouses and geothermal heat projects above 500 kWth supported by heat pumps if the heat is distributed via a pipe network to more than one building or site. In this case the capacity of heat pumps should also be released.

Existing plants

For each plant already in operation, contributors submit available information regarding:

- **Locality** (region, province, of municipality),
- **Year of commissioning** (in case of refurbishment or upgrading, coordinators reported the most recent date)
- **Capacity installed** (in MWth)
- **Gross heat production** in 2019 (in GWh)
- **Operator** and, **service companies, drillers and equipment manufacturers**
- When available, the depth of the wells

Planned plants

For each plant under planning contributors submit available information regarding:
• **Locality** (region, province, municipality),
• **Status** (under construction, planned, negotiations)
• **Expected year of commissioning** indicating if the project is an extension/upgrading
• **Expected capacity installed** (in MWth)
• **Project developer/Consortium** and, when possible, **drillers and equipment manufacturers**

Gross heat production: "Gross heat production is the total heat produced by the installation and includes the heat used by the installation's auxiliaries that use a hot fluid and losses in the installation/network heat exchanges. As only heat sold to third parties is reported, gross heat production for autoproducers will be equal to net heat production." (Eurostat, IEA, UNECE & OECD, 2012).

GEOTHERMAL HEAT PUMPS

Geothermal heat pumps, or shallow geothermal systems, refer to the supply of heat and cold to buildings, industrial sites or a district heating, from a geothermal system enabled through a heat pump.

The EGEC Market report is looking to report two categories of market data concerning geothermal heat pumps:

• **Number of unit sold** and **installed stock (aggregated)**
• **Very large systems with a borehole heat exchanger total length greater than 10,000 meters**

Aggregated data on geothermal heat pumps

Contributors are invited to submit latest known data of the number of unit sold and the number of unit installed for geothermal heat pumps during the year 2020. When available the average capacity in kWth of systems sold and/or installed is also welcome.

Very large geothermal heat pump systems

Contributors are invited to submit available information regarding:

• **Locality of the project and the name**

• **Number of boreholes**

• **Average depth of boreholes**

• **Year of commissioning** (in case of refurbishment or upgrading, coordinators should report the most recent date)

Please contact Thomas Garabetian (t.garabetian@egec.org) **for any further clarification.**

The Key Findings of the report have been made publicly available, while the full report, complete with supporting data and tables, is only available to EGEC members.

For more information, visit www.egec.org

LIST OF ABBREVIATIONS

BHE	Borehole heat exchanger
CO2	Carbon dioxide
CHP	Combined heat and power
COP	Coefficient of performance
DH	District Heating
DHC	District Heating and Cooling
EGS	Enhanced Geothermal Systems
EGEC	European Geothermal Energy Council
EPC	Engineering, Procurement, and Construction
EU	European Union
GeoDH	Geothermal District Heating
GW/GWe/GWth/GWh	Gigawatt/Gigawatt electric/Gigawatt thermal/Gigawatt hour
GSHP	Ground Source Heat Pump
HP	Heat pump
ktoe	Kilotonne of oil equivalent
kWh	Kilowatt hour
MW/MWe/MWth/MWh	Megawatt/Megawatt electric/Megawatt thermal/Megawatt hour
NREAP	National Renewable Energy Action Plan
NECP	National Energy and Climate Plan
O&M	Operations and maintenance
ORC	Organic Rankine Cycle
PV	Photovoltaic
RES	Renewable Energy Sources
SPF	Seasonal Performance Factor
TWh	Terawatt hour
UTES	Underground Thermal Energy Storage
MW/MWe/MWth/MWh	Megawatt/Megawatt electric/Megawatt thermal/Megawatt hour
NCG	Non-condensable gas
NREAP	National Renewable Energy Action Plan
O&M	Operations and maintenance
ORC	Organic Rankine Cycle
PV	Photovoltaic
RES	Renewable Energy Sources
SPF	Seasonal Performance Factor
TWh	Terawatt hour
UTES	Underground Thermal Energy Storage

ABOUT EGEC, THE EUROPEAN GEOTHERMAL ENERGY COUNCIL

REPRESENTING THE EUROPEAN GEOTHERMAL INDUSTRY

EGEC, the European Geothermal Energy Council, is a non-profit international organisation founded in 1998 to promote the European geothermal industry and enable its development both in Europe and worldwide, by shaping policy, improving business condition, and driving more research and development.

Based in Brussels, we work with our members on policy, market intelligence, and communication for both deep and shallow geothermal, providing a link between the industry and European institutions. More than 120 members from 28 countries, including developers, equipment manufacturers, electricity providers, national associations, consultants, research centres, geological surveys, and public authorities, make EGEC a unique network, uniting and representing the entire geothermal sector.

THE EGEC GEOTHERMAL MARKET REPORT

Every year, the EGEC Geothermal Market Report analyses market trends and developments in the geothermal sector in Europe.

Since its first edition in December 2011, it has come to be seen as the authoritative overview of the entire geothermal sector in Europe. The report is compiled each year using data from various statistical analyses, local experts, utilities, energy agencies, and national associations. It includes details of all major projects in operation, under development, and under investigation, as well as an analysis of market development, the regulatory and public policy environment, financial tools and incentives, the market forecast, and key players. Every edition also offers an in-depth review of different geothermal technologies.

The Key Findings of the report are made publicly available, while the full report, complete with supporting data and tables, is only available to EGEC members. For more information, visit www.egec.org

EGEC
GEOTHERMAL

EGEC GEOTHERMAL

The voice of geothermal in Europe

European Geothermal Energy Council
Place du Champ de Mars 2, 1050 Brussels, Belgium
+32 2 31 84 065 / com@egec.org
www.egec.org