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GEOTHERMICA Initiative & CETPartnership TRI4
Workshop in Dublin 10/10/2023

Overview of Low-medium Temperature Geothermal in Europe

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About EGEC - Our mission

REPRESENTING THE EUROPEAN GEOTHERMAL INDUSTRY

Status: Non-profit international organisation

Established: 1998

Aim: The promotion of the European geothermal industry to enable its development both in Europe and worldwide

Location: Brussels, Belgium

Positioning in national/ EU/ international context: 180+ members, Representing 550+ entities from 30 different European countries

Creating robust policy frameworks and financial instruments which allow the geothermal industry to grow

Increasing access to public funding and collaboration for research and development

Developing the geothermal industry in Europe and globally.

Click here for info on becoming member

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Technological trends overview

State of the art of the use of geothermal heating and cooling solutions in Europe, with a focus on district HC and low-medium temperature geothermal solutions

1

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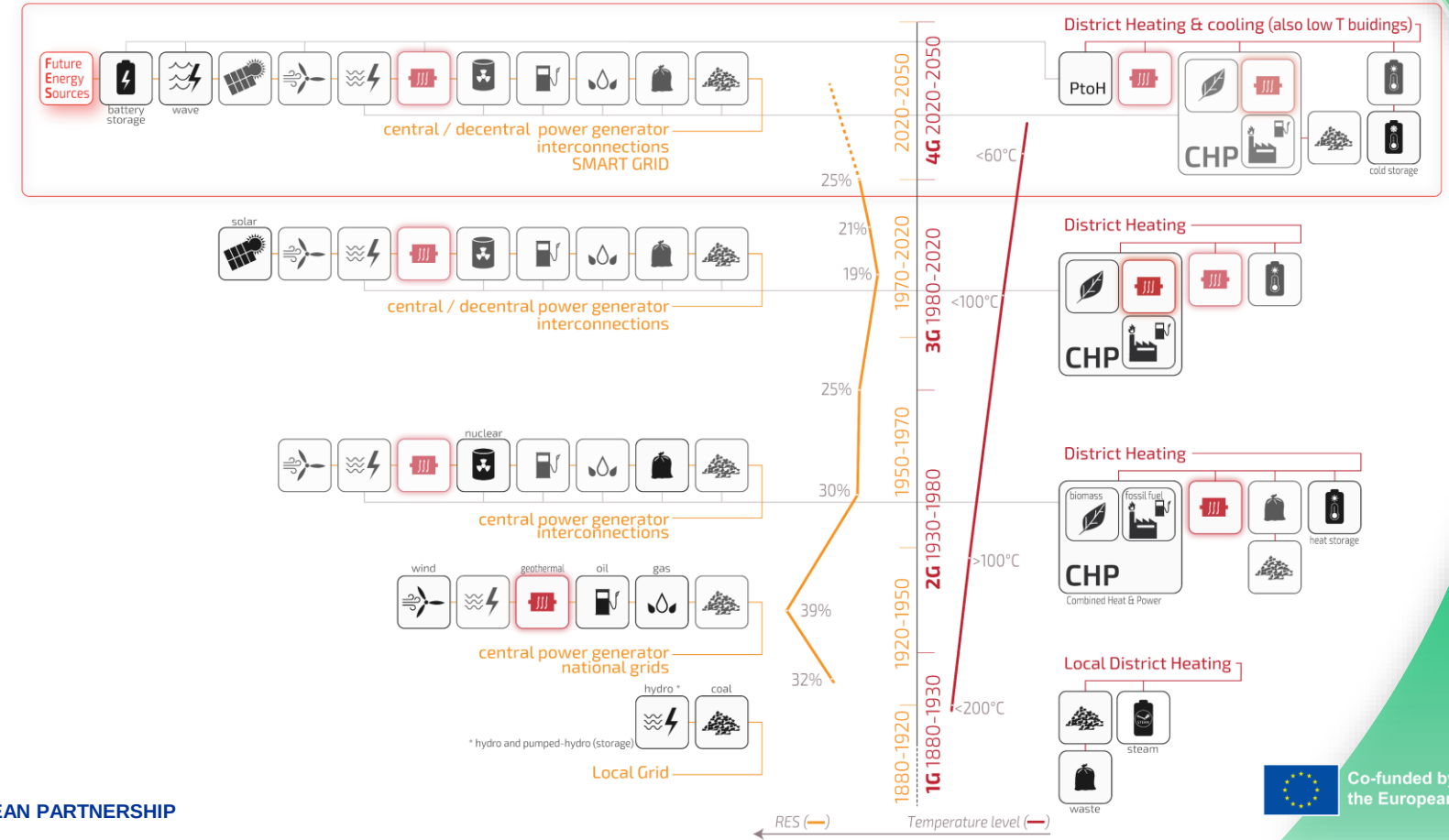
Towards the 5th generation of DH with geothermal



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Larger geothermal HP systems

Small scale geothermal HP units (15-25 kWth) for Heating, cooling and Domestic Hot Water

Medium scale units (25-100 kWth) for Heating and/or cooling and/or sanitary hot water for collective buildings

Large scale systems (100 kWth – 5 MWth, up to 20 MWth) District heating and industrial process heat

ELI-NP centre in Magurele (near Bucharest):
Capacity of 5.4 MWth, for a total air-conditioned area of 27000 m².

The ground source heat exchanger consists of **1,080 boreholes** at 125 m depth, the whole borehole length is 135,000 m.

The largest system in Europe.

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Geothermal District Heating Heat Pumps

New generation of DH systems

MijnWater IN Heerlen, Netherlands

12,000 buildings have gas replaced by a geothermal DH with large heat pumps in Vélizy-Villacoublay, Paris, France.

the European Union

Geothermal free cooling systems

Geothermal cooling in data centres:

the example of Euronext Data Centre in Bergamo

Geothermal Cooling to mitigate urban heat island effect:

Olympic villages – Paris 2024

District Cooling in Munich:

Communal cooling network in the Sendling district to reduce the electricity consumption linked to cooling by 70% across its 22 km grid.

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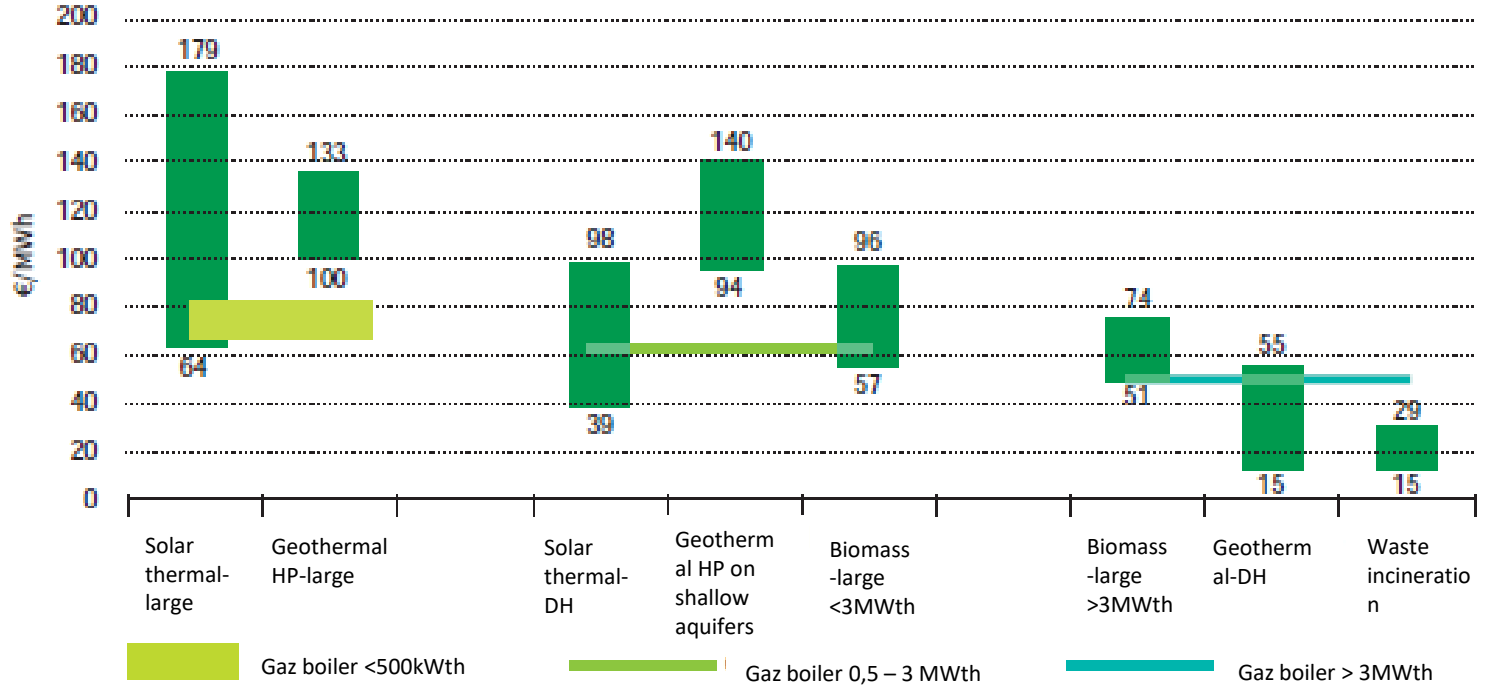
Already competitive

LCoE of heating in large buildings, comparison with gaz boilers (France, 2019)



Source: ADEME

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Market development overview

State of the art of the of the use geothermal heating and cooling solutions in Europe, with a focus on district HC and low-medium temperature geothermal solutions

2

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Heating and cooling major growth sector

- The **conflict in Ukraine** provoked a rapid policy response focused on decoupling energy imports into heating and cooling so more focus on geothermal HP and DHC (EU consumption of natural gas has dropped by 19.3% between August 2022 and January 2023).
- National and supranational **policy is driving change**. For example, Ireland, Germany and Poland launched national roadmaps to aid the rapid growth of geothermal in their countries.
- Main **demand** for geo HP comes from residential (in developing markets) and commercial/public buildings sector (more mature markets).
- Some relative **newcomers** for geothermal DHC systems, such as Ireland, which has three projects in its pipeline.
- GHP and GeoDHC pipeline grown and is **expected to continue exponential growth** as heating and cooling gain greater political attention.

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District heating and cooling market share

- **5,608.31 MWth geothermal DHC** coming from 395 systems across all Europe in 2022 (261 in EU countries).
- The **14 new geothermal systems** in 2022 added 105.23 MWth of capacity. 12 of these new systems were commissioned in the EU.
- France remains the largest geothermal district heating country in the European Union and second to Iceland across Europe.

- ❑ France leads also in terms of projects commissioned, with a total of 5 - adding an additional of 48.7 MWth to existing capacity.
- ❑ Two geothermal systems were commissioned in Finland adding a combined 1,3 MWth capacity.
- ❑ Single systems were also installed in Hungary, Italy, Poland, Serbia, Spain and Switzerland.

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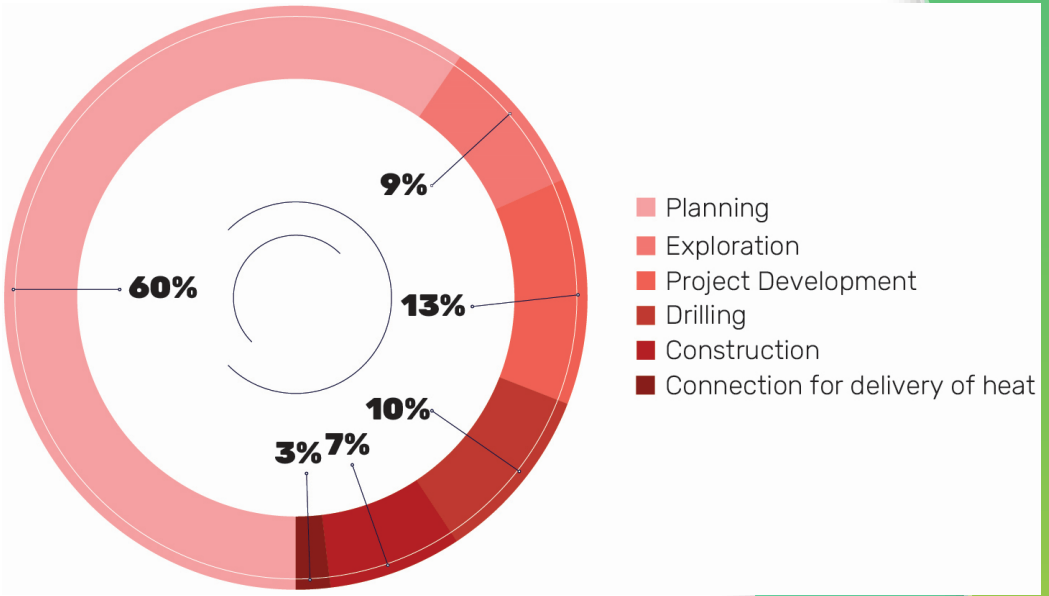
Geothermal DHC project pipeline

- **316 new projects** under active investigation, which add over 744 MW to the operational 5,608 MW capacity.
- **Germany has the largest pipeline** with 102 projects and is followed by France with 24, the Netherlands with 22, Italy and Poland with 21 respectively.
- **Geothermal and agrifood**: new project in Almeria (Spain) to connect local greenhouses and agrifood production sites.



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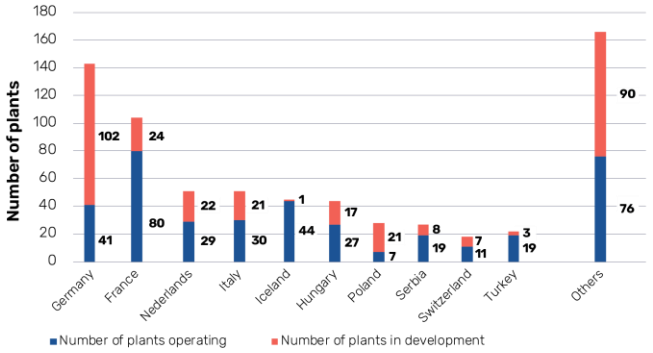
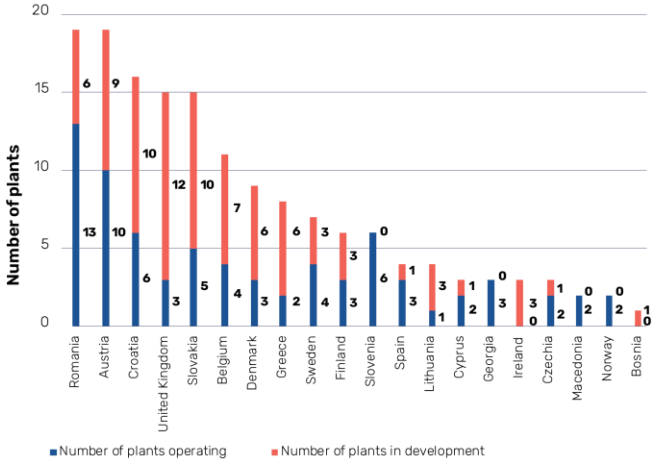
Market development





- 17 geothermal heating systems are expected to be commissioned in 2023. Four are in Serbia; three in Finland; two in the Netherlands and one in Austria, Cyprus, Estonia, Hungary, Italy, Portugal, Slovakia and Spain.
- More than **300 are being developed** or are under investigation.
- These are **typically doublets**, but some projects will drill **multiple wells** as is the case in Denmark. Others will seek **extension** of existing capacity with triplets.

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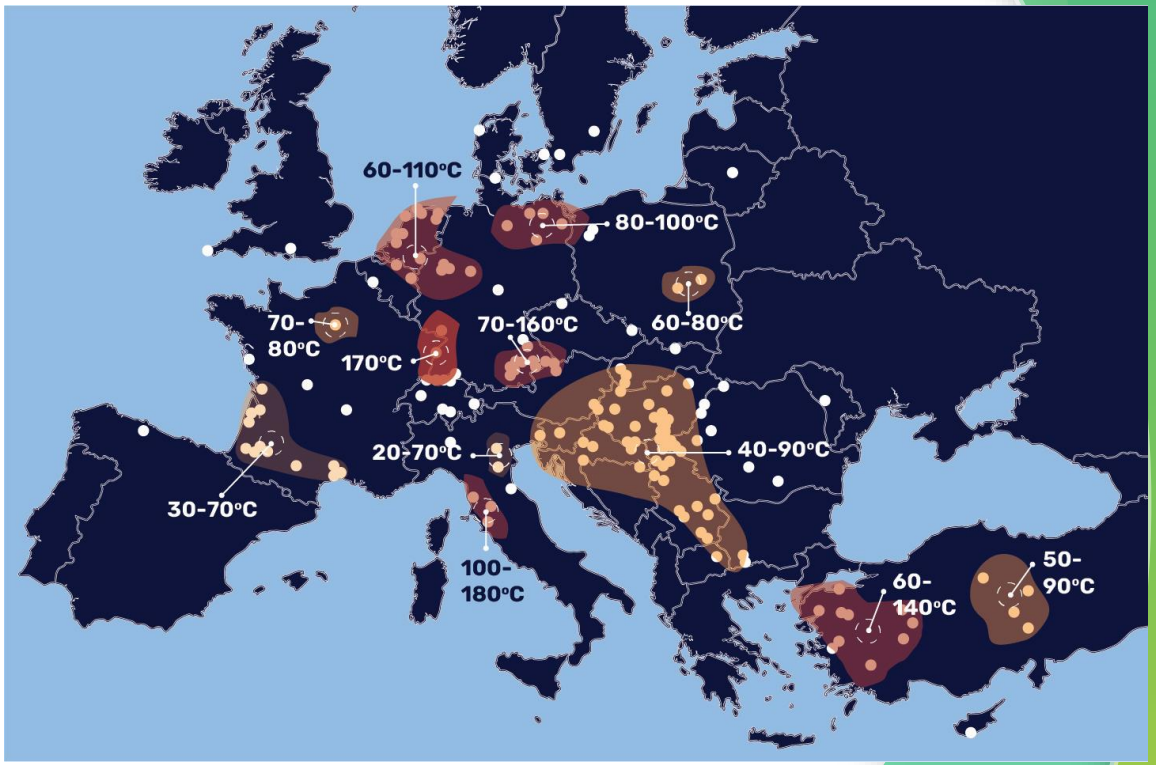
Resource and flow rates

- Most projects centre on reservoirs with temperatures in the 60-80°C range in the EU.
- One of the key trend is the use of large Heat Pumps.
- Greater effort needed for resource mapping.



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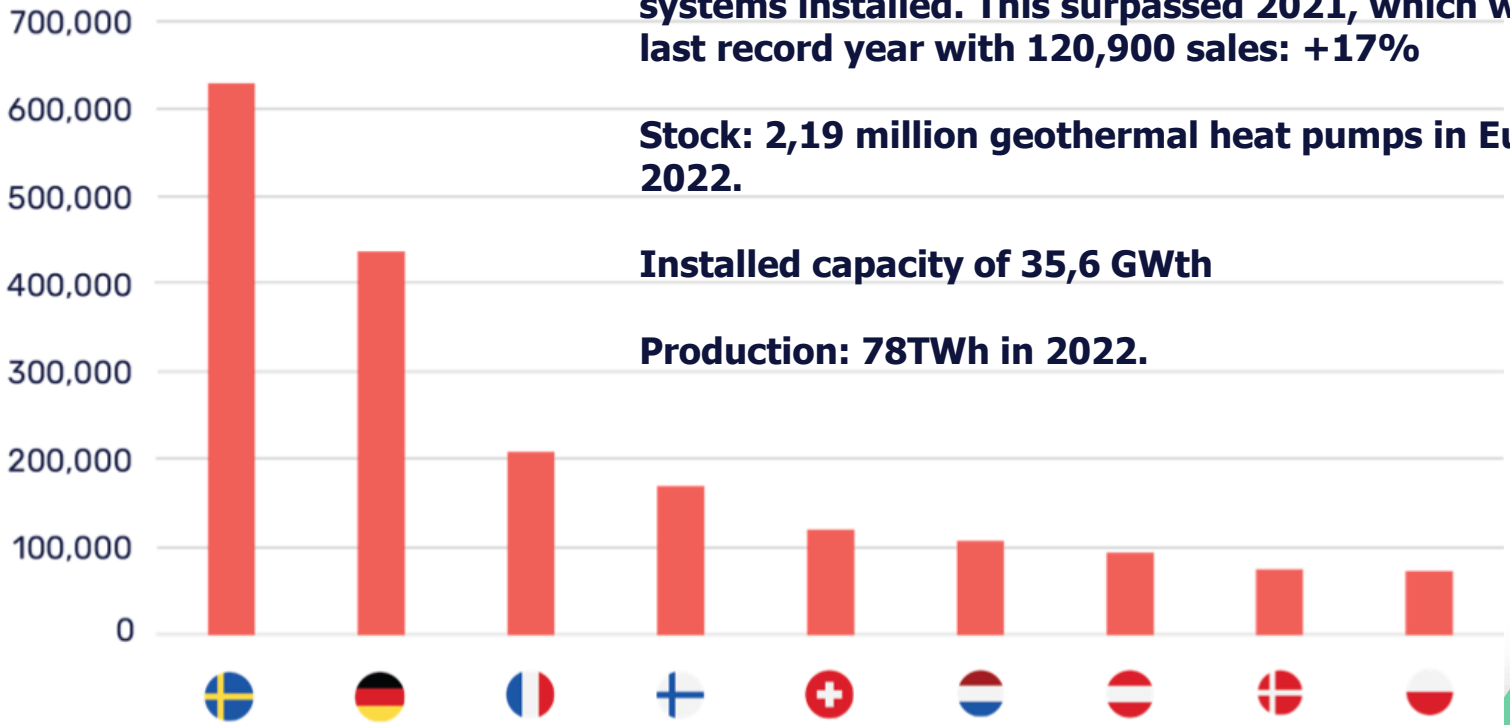
Number of Geothermal HP systems installed in Europe



Record sales in 2022: +141,300 geothermal heat pump systems installed. This surpassed 2021, which was the last record year with 120,900 sales: +17%

Stock: 2,19 million geothermal heat pumps in Europe in 2022.

Installed capacity of 35,6 GWth

Production: 78TWh in 2022.

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Towards large geoHP systems

The total stock of geothermal heat pumps in 2022 was 2,196,709 systems of which:

- 2,196,100 systems with a capacity **of 15 kWth;**
- 600 units of large fields of boreholes with a **capacity greater than 50 kWth** and
- 200 large **open-loop** systems with a **capacity greater 100 kWth**.

Total European Installed capacity is:

- 33 GWth of 15 kWth units
- 2,6 GWth of large BHE units (> 50 kWth)

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2022 Geothermal Market Report

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Cet Partnership

EU policy overview

New key EU legislation which can boost the development of low-medium temperature geothermal in Europe

3

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Key new measures for geothermal

- **Binding targets** for security of investments;
- Robust, efficient and transparent licensing and **permitting rules**;
- **Mandates on local authorities** to produce heat transition plans based on local renewable resources and **binding commitments on Member States** to increase the share of renewables in national heating and cooling final energy consumption;
- National **financial risk mitigation** frameworks and **Heat purchase Agreement** for renewable heating;

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Key measures: RES and HC targets

- **EU RES overall binding target (Art. 3 Renewable Energy Directive)**

  The overall renewable target for 2030 was increased from 32% to a binding 42.5% and an indicative 45%. There is also an additional 5% target of innovative renewable energy technology.

- **Heating & cooling from renewable sources - binding target (Art. 23 RES Directive)**

  The Commission proposed a binding 1.1 percentage point annual increase of RES H&C on Member States. The final outcome is that **this target is split in two – 0.8% increase to 2026, 1.1% for the period 2026-2030.** **The binding nature of the target was the critical aspect to secure**.

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Key measures: RES H&C planning

- **Local authority mandate on RES H&C planning (Art. 25 Energy Efficiency Directive)**

  Urban areas with a population of 45 000 inhabitants will be required to plan renewable heating and cooling networks. **This is a key market driver for geothermal, especially for heat networks**.

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Key measures: Simplify Permitting

- **“renewable go-to areas“** (Art. 15b and following RED):

  - ✓ Each EU Country will map the areas necessary for national contributions towards the 2030 renewable energy target within 18 months after the entry into force of this directive.

  - ✓ MS will adopt a plan or plans designating 'renewables go-to areas' within 27 months.

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Key measures: Simplify Permitting

1) Renewable Go to areas:

- ✓ Permit-granting processes should not take longer than one year for renewables projects, and two years for offshore renewables projects (with exceptions).
- ✓ Shorter deadline of 6 months for areas already designated as suitable for an accelerated renewables deployment.
- ✓ For the **repowering of plants** and for new installations with an electrical capacity of less than 150 kW, co-located energy storage facilities as well as their grid connection, the processes should be limited to **six months, and one year if they concern offshore** wind energy projects (with exceptions).

2) Outside go to areas:

- ✓ For **areas outside go-to areas** the permit-granting processes should not exceed two years, and three years for offshore renewables projects (with exceptions).
- ✓ The time during which the plants, their grid connections and the related necessary grid infrastructure are being built or repowered should not be counted within these deadlines.

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REPowerEU: Fast permitting

Council regulation with emergency measures (valid for 18 months, since December 2022):

- **Renewable energy plants would be presumed to be of overriding public interest**

  This would allow new permitting procedures to benefit with immediate effect from a simplified assessment for specific derogations foreseen in EU environmental legislation.

- **Heat pumps permit-granting procedure**

  The permit-granting process for the installation of heat pumps below 50MW shall not exceed one month, **in case of ground-source heat pumps three months** (+ simplified procedure for grid connection of smaller heat pumps). Member States agreed to give the **possibility to apply the faster permitting rules for ongoing permit requests**.

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Net-Zero Industry Act (NZIA)

Strategic net-zero technologies are selected based on the three following criteria:

1) technology readiness level
2) contribution to decarbonisation and competitiveness
3) resilience of the energy system

The list includes the following technologies:

- Solar photovoltaic and solar thermal technologies
- Onshore and offshore renewable technologies
- Battery/storage technologies
- Heat pumps and geothermal energy technologies
- Electrolysers and fuel cells
- Sustainable Biogas/Biomethane technologies
- Carbon Capture and Storage (CCS) technologies
- Grid technologies

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Net-Zero Industry Act (NZIA)

Seven “pillars” for strengthening the competitiveness of Europe’s net-zero technology manufacturing ecosystem.

1. **Enabling conditions for net-zero technology manufacturing** (faster permits, only one authority as reference, procedures for projects to apply and be recognised as net-zero strategic project by Member States)
2. **CO2 injection capacity** (storage)
3. **Access to markets** (facilitating access to markets in public procurement procedures and auctions, as well as schemes aimed at supporting private demand by consumers)
4. **Enhancing skills for quality job creation in net-zero technologies** (European skills Academies)
5. **Innovation** (regulatory sandboxes to test innovative net-zero technologies in a controlled environment for a limited amount of time)
6. **Governance** (Net-Zero Europe Platform, allowing the Commission to coordinate the above actions jointly with Member States)
7. **Monitoring**

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Strategic Technologies for Europe Plan (STEP)

An initiative to support financially NZIA.

STEP seeks to reinforce, leverage and steer EU funds – existing and new – to investments in deep and digital, clean and bio technologies in the EU, and in people who can implement those technologies into the economy.

STEP also introduces the Sovereignty seal – the EU quality label for sovereignty projects.

Information about existing funding opportunities for STEP investments and relevant contact details of national authorities, on a dedicated Sovereignty portal.

Target investment areas

Contributing EU programmes

Sovereignty seal

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New solutions

Examples of use of low-medium temperature geothermal solutions in Europe

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Olympic village in Paris

- The Olympic Village will be home to over 14,000 athletes during the Games. **68% of the energy will come from geothermal.**
- In total, the geothermal plant will produce **4 MW of heating and 2 MW of cooling.**

Outline of the Athletes' Village, Groupement CDC. Source: leParisien

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Key figures new Paris Olympic Village	
Depth of drilling	~ 60 - 80 m
Boreholes	11 boreholes: three will draw water from the Lutetian limestone, and eight others will be responsible for reinjecting it at sufficient distances not to modify the temperature of the water.
Geothermal power	4 MW of heating and 2 MW of cooling
Temperature of the water drawn	~ 14 degrees
Units covered	Olympic Village: 52 hectares or the equivalent of 70 football pitches, which will be home to over 14,000 athletes during the Games.
Total amount of investments	€27 million
Public contribution	Nearly €6 million will be funded by the Ile-de-France Region, ADEME, the French Agency for Ecological Transition and SOLIDEO, the company building the Olympic facilities.
CO2 emissions avoided	4,500 tonnes of CO2 per year.

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Renewable cooling in the new Euronext data centre in Bergamo

The cooling system uses ground water extracted from redundant wells and sent to redundant heat exchangers. The piping system serving each data room is made with 4 lines with a quarter of the total Computer Room Air Handler (CRAH) connected to each line.

There are two completely independent primary cooling circuits:

- Main primary circuit: normally used in production mode, this uses ground water and water/water heat exchangers (each data hall can use chilled water from at least 4 different heat exchangers).
- Emergency primary circuit: this uses conventional air/water chillers.

Source: 01net.

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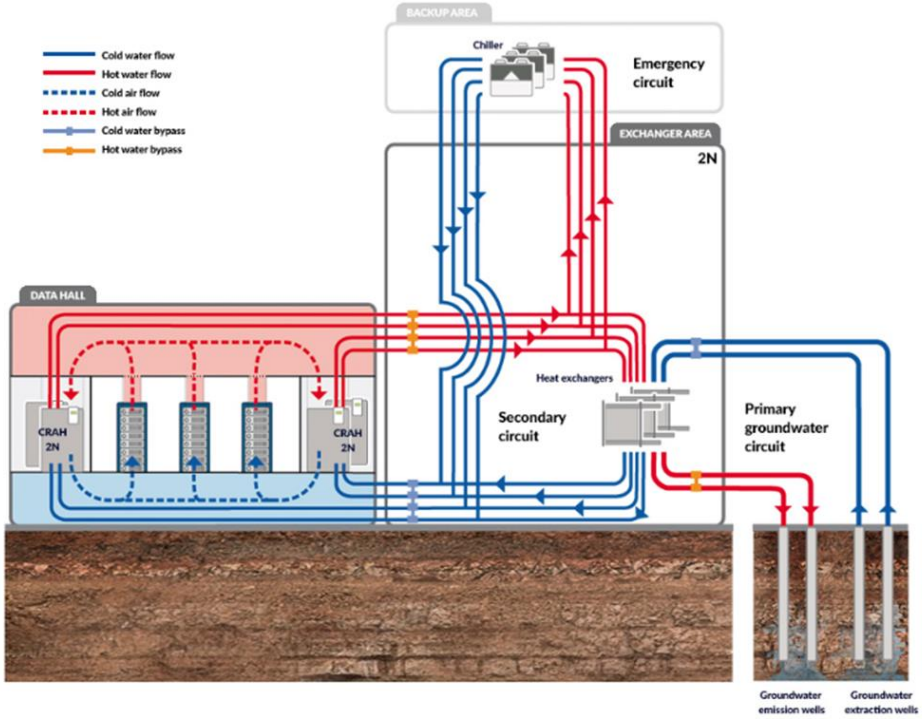
DATA CENTER COOLING THANKS TO GROUND WATER SYSTEM

Using groundwater as the main cooling energy source enables us to reduce energy waste. The main advantage is having a constant temperature of the water which, at groundwater level, remains at around 9°C all year round. On completion of the cooling process and with no chemical alteration, the water is returned to the ground, thus excluding any environmental impact. The completely redundant system can be assisted or replaced by the air/water chillers in the emergency circuit, capable of ensuring the same cooling power as the primary system.



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Geothermal Heat Pump Days 2023

SAVE THE DATE!

16 -17 NOVEMBER 2023 | BERLIN, GERMANY

25 YEARS EGEC GEOTHERMAL

Bundesverband Geothermie

geoENERGIE konzept
Eine Gesellschaft von ENGIE

RHC Renewable Heating & Cooling
ETIP - European Technology and Innovation Platform

COOLING DOWN

GeoBOOST

GEO4CIVHIC