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Geological Survey
Suirbhéireacht Gheolaíochta
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National Geothermal Energy Summit 2023

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Session 2: District Heating and Geothermal Energy

Chair: Dr Niamh O'Sullivan, SEAI



District Heating and Geothermal Energy

Geothermal Summit – October 2023

Dr. Niamh O'Sullivan

94%

24%

Last

Renewable energy used for heating and cooling

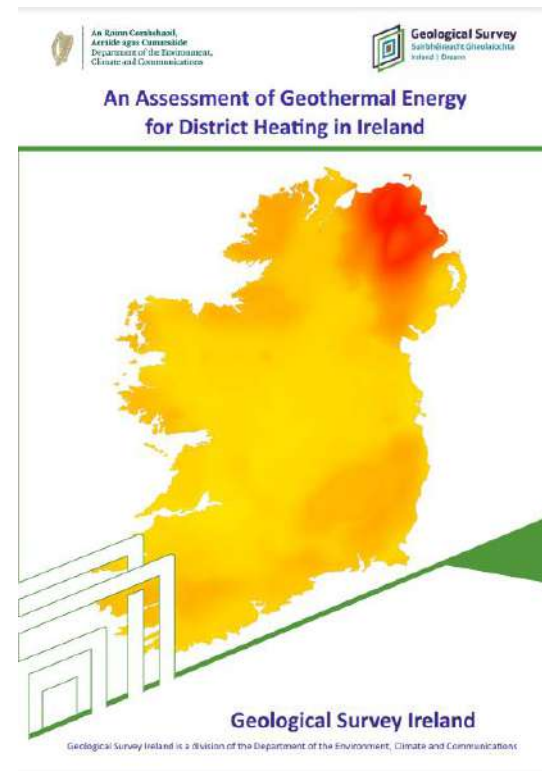
(% of gross final energy consumption for heating and cooling, 2020)



#EUIndustryDays

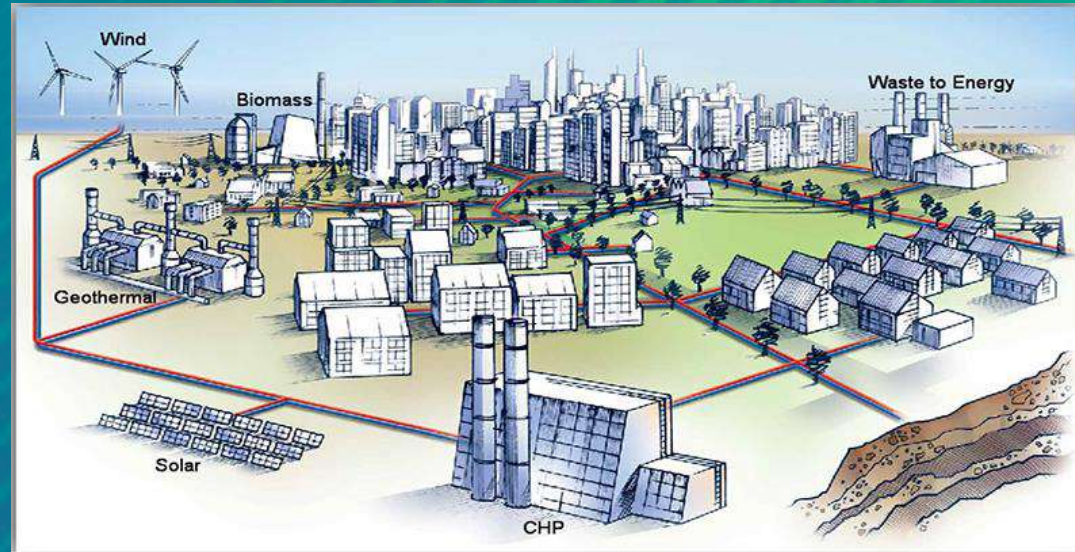
ec.europa.eu/eurostat

SEAI National Heat Study

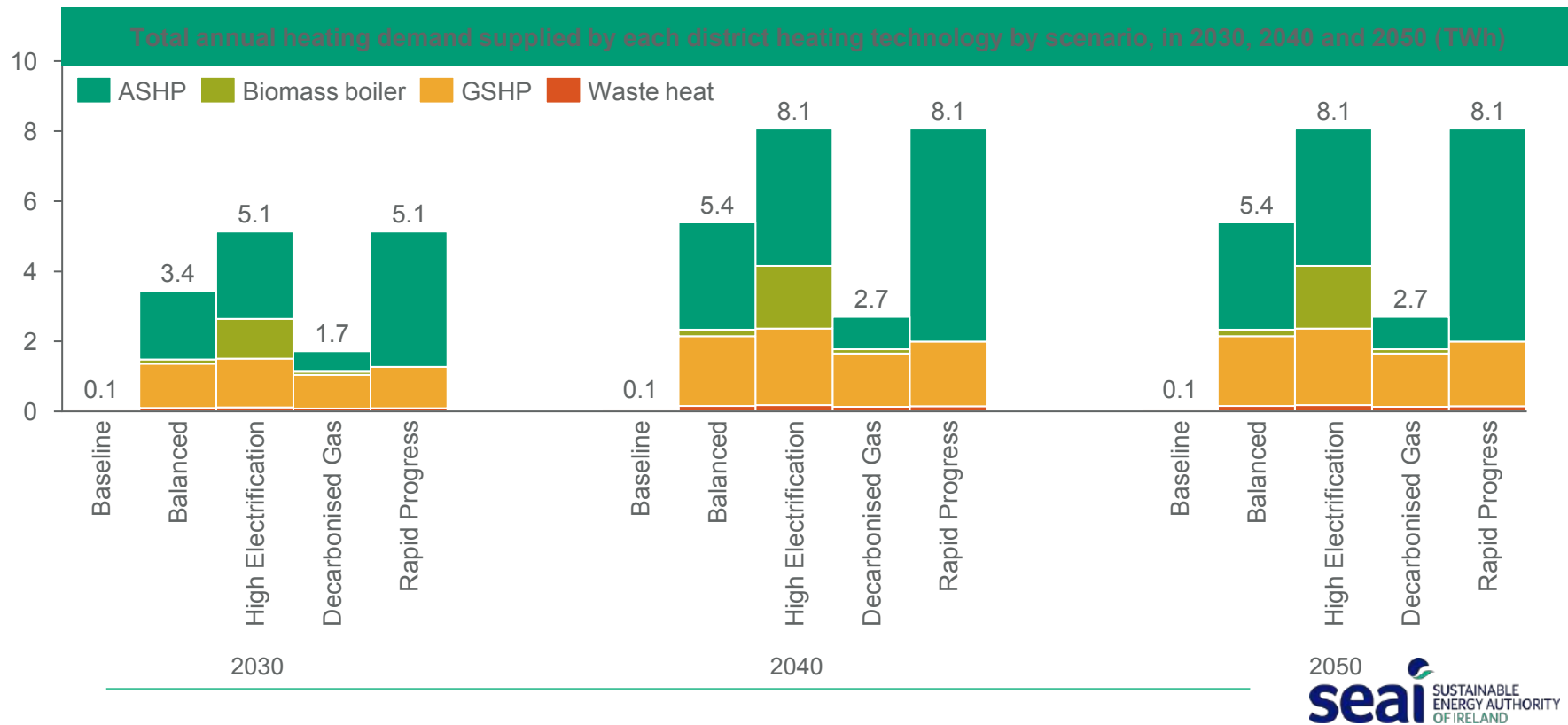


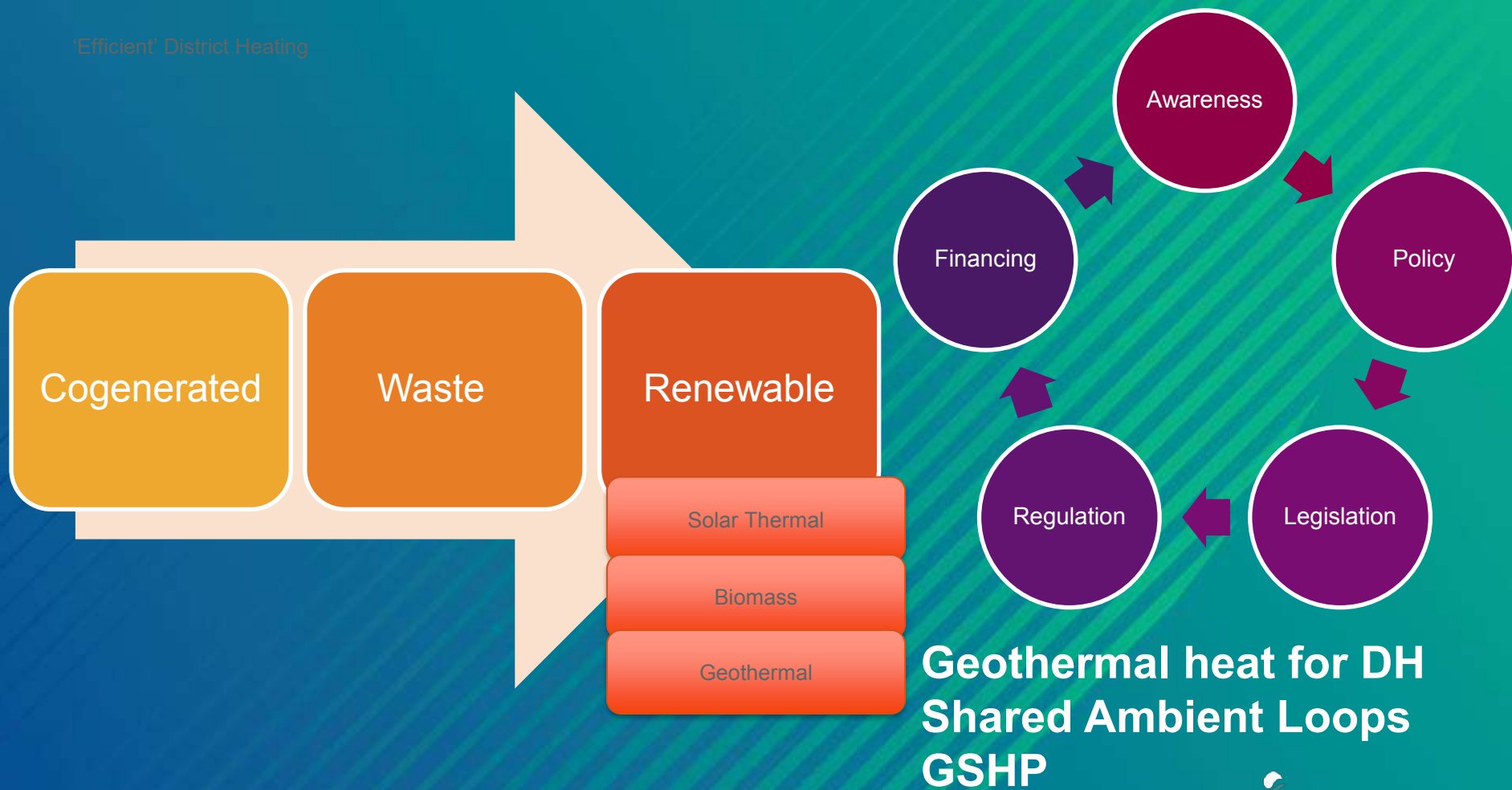


- District heating is a technology that offers additional potential.
- It is **proven and available** now. It could provide as much as around **50% of building heating** demand in Ireland.



Heat pumps supply 12-20% of heating demand in 2030, 33-38% in 2050.
Heat pumps have a prominent role, including those using geothermal resource.
More potential for deep geothermal and waste heat possible.





Geothermal market and policy trends – a European perspective

Emil Martini – Policy Associate at EGE

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

Click [here](#) for info on becoming member



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.



Market development overview

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

1

Heating and cooling major growth sector

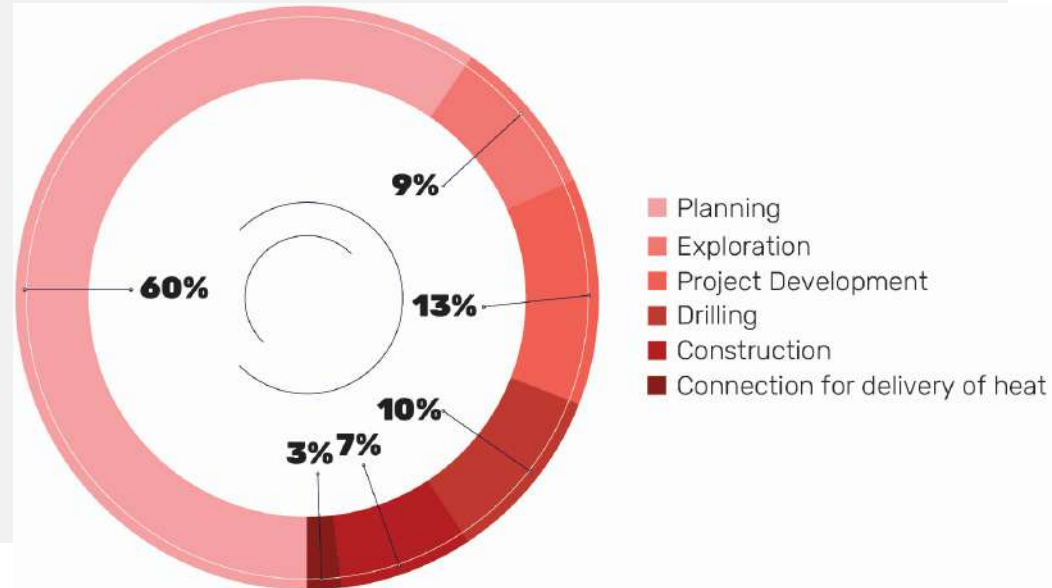
- The **conflict in Ukraine** provoked a rapid policy response focused on decoupling energy imports into heating and cooling so more focus on geothermal HP and DHC (EU consumption of natural gas has dropped by 19.3% between August 2022 and January 2023).
- National and supranational **policy is driving 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.

District heating and cooling market share

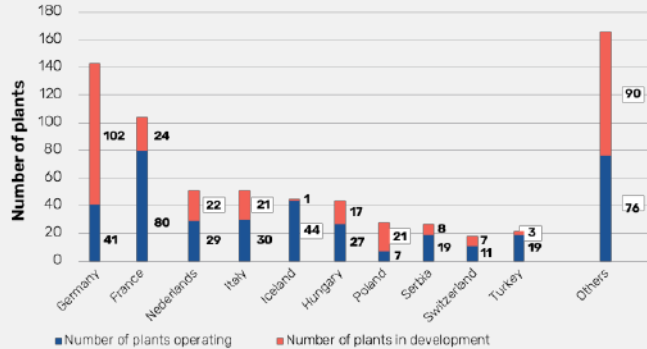
- **5,608.31 MWth geothermal DHC** coming from 395 systems across all Europe in 2022 (261 in EU countries).
 - The **14 new geothermal systems** in 2022 added 105.23 MWth of capacity. 12 of these new systems were commissioned in the EU.
 - France remains the largest geothermal district heating country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

Geothermal DHC project pipeline

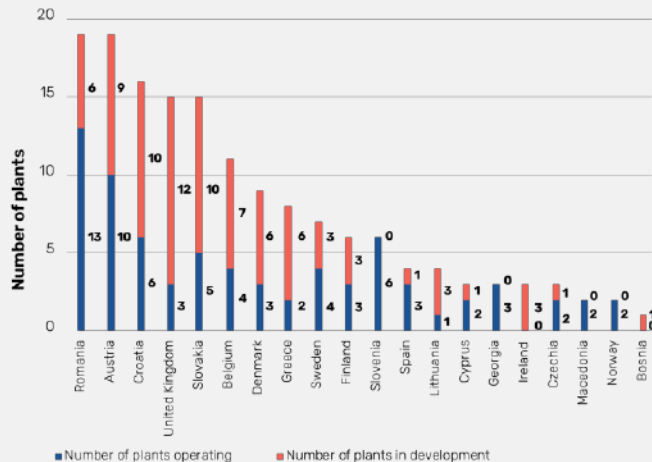
- **316 new projects** under active investigation, which add over 744 MW to the operational 5,608 MW capacity.
- **Germany has the largest pipeline** with 102 projects and is followed by France with 24, the Netherlands with 22, Italy and Poland with 21 respectively.
- **Geothermal and agrifood:** new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



Market development



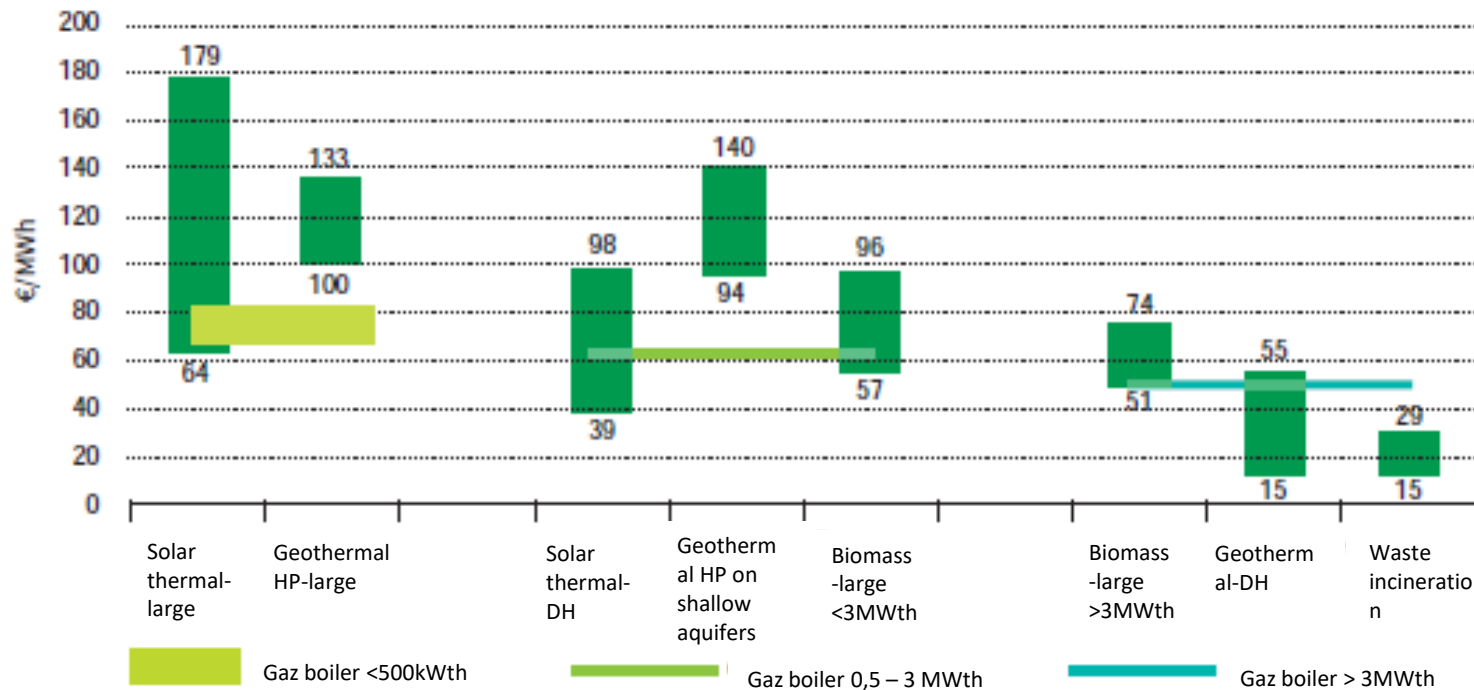
- 17 geothermal heating systems are expected to be commissioned in 2023. Four are in Serbia; three in Finland; two in the Netherlands and one in Austria, Cyprus, Estonia, Hungary, Italy, Portugal, Slovakia and Spain.



- 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.

Already competitive

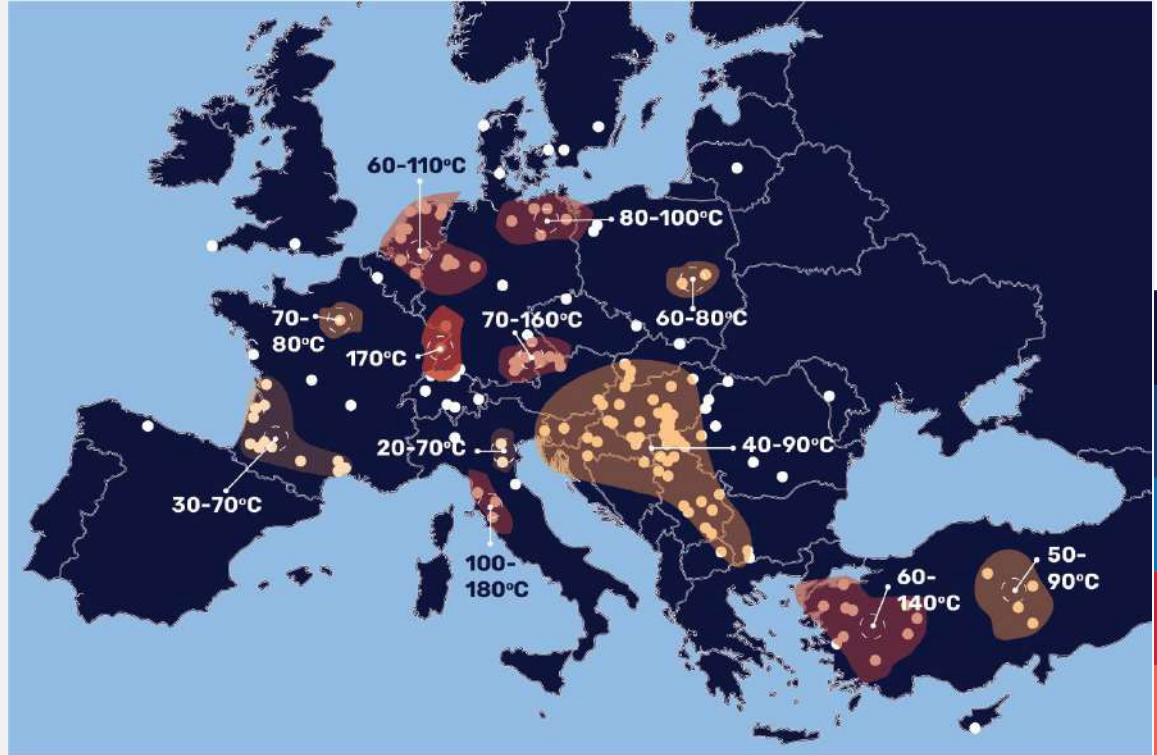
LCoE of heating in large buildings, comparison with gas boilers (France, 2019)



Source:
ADEME

Resource and flow rates

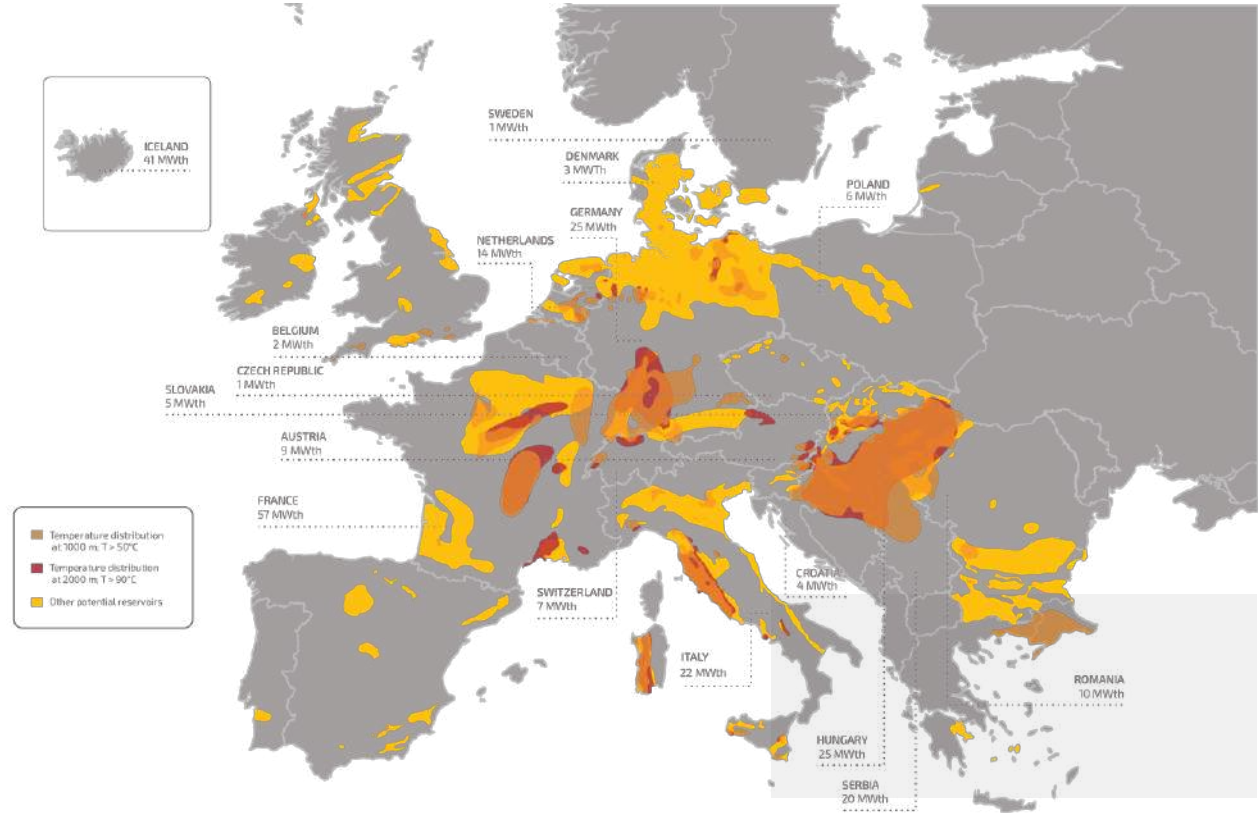
- Most projects centre on reservoirs with temperatures in the 60-80°C range in the EU.
- One of the key trend is the use of large Heat Pumps.
- Greater effort needed for resource mapping.



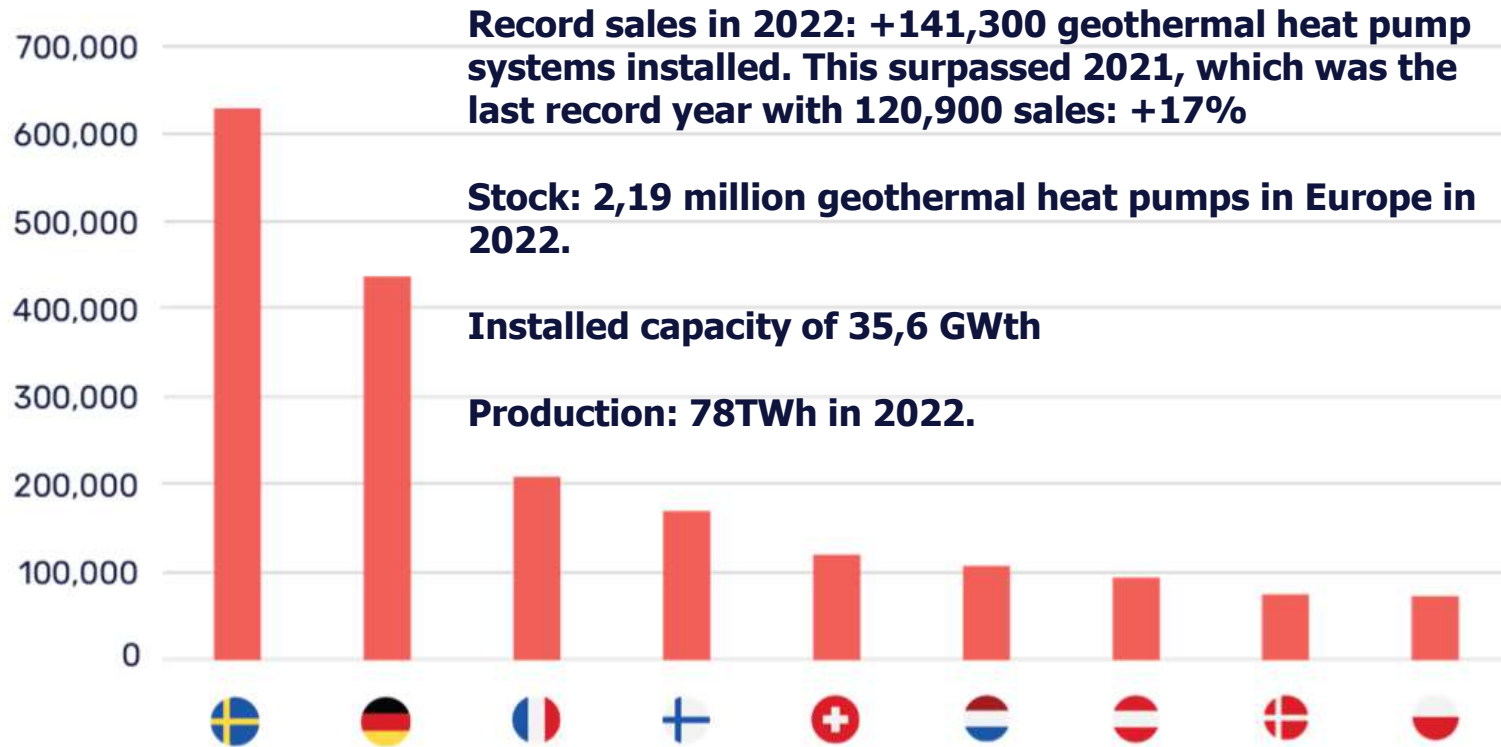
More than 25% of the EU population lives in areas directly suitable for geothermal district heating

Map of areas suitable for geoDH networks and actual geoDH installed capacity according to available geological data

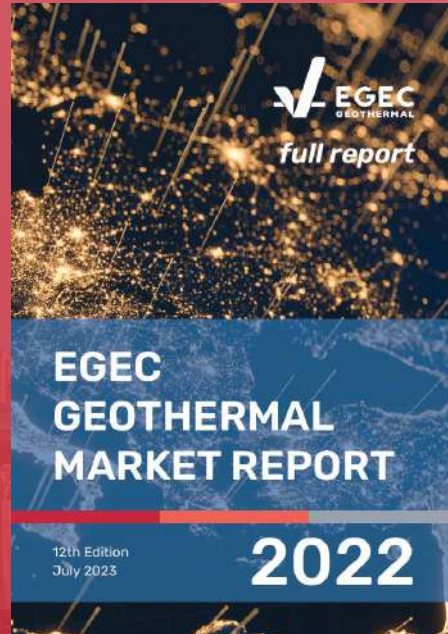
Source: ETIP-DG, adapted from GEODH and EGEN market report



Number of Geothermal HP systems installed in Europe



2022 Geothermal Market Report

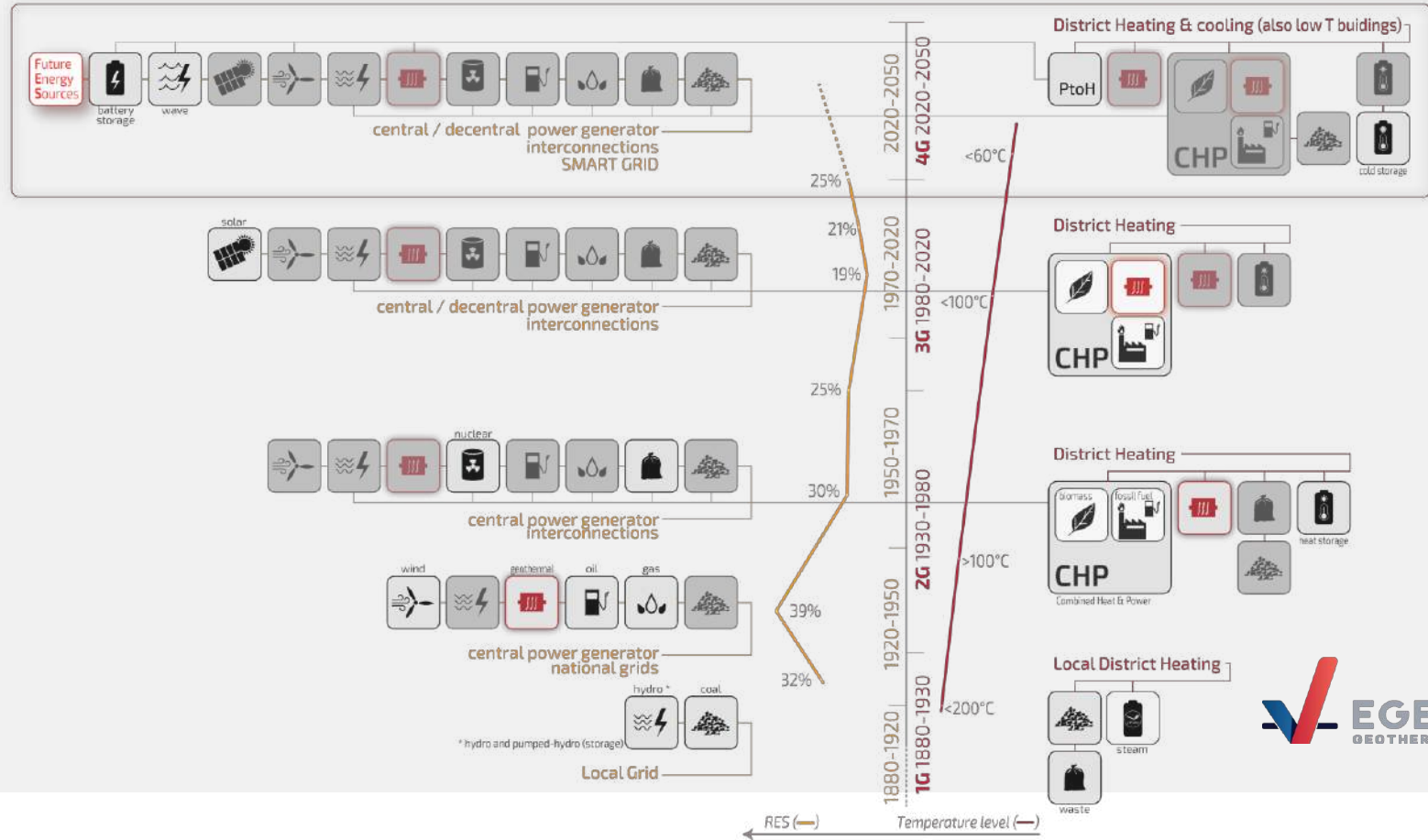


Technological trends overview

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

2

Towards the 5th generation of DH with geothermal



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](https://www.leparisien.fr)

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 <u>covered</u>	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 <u>avoided</u>	4,500 tonnes of CO2 per year.

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:

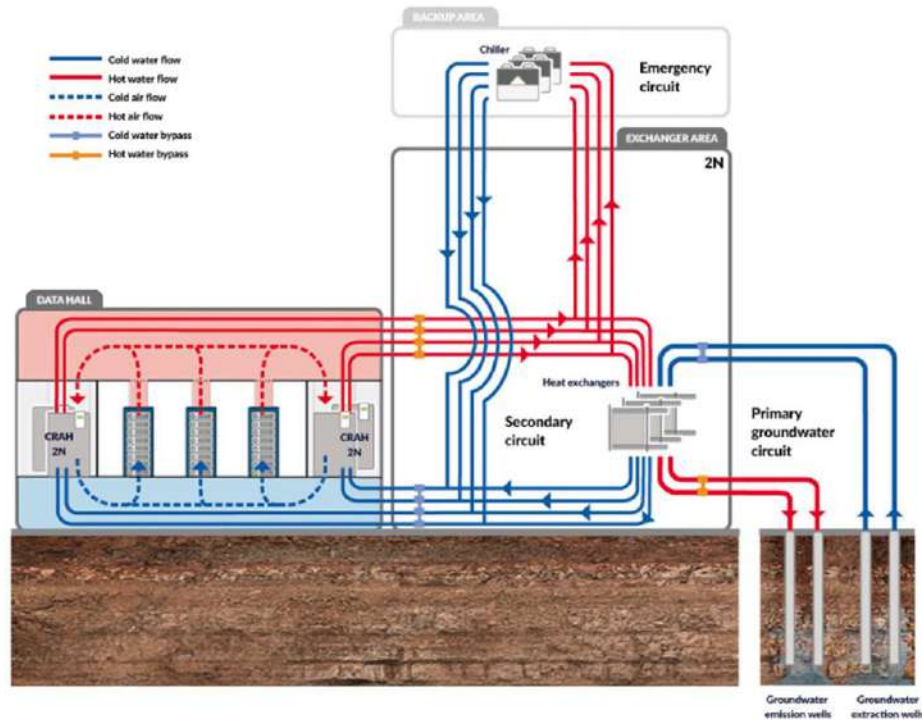
- Main primary circuit: normally used in production mode, this uses ground water and water/water heat exchangers (each data hall can use chilled water from at least 4 different heat exchangers).
- Emergency primary circuit: this uses conventional air/water chillers.



Source: [01net.](https://www.01net.it)

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.



EU policy overview

New key EU legislation which can boost
the development of geothermal district
HC

3

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;

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.**

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.

Simplify permitting: implement key provisions

A) Replicate best practices: a geothermal traffic light system

e.g. from Germany.

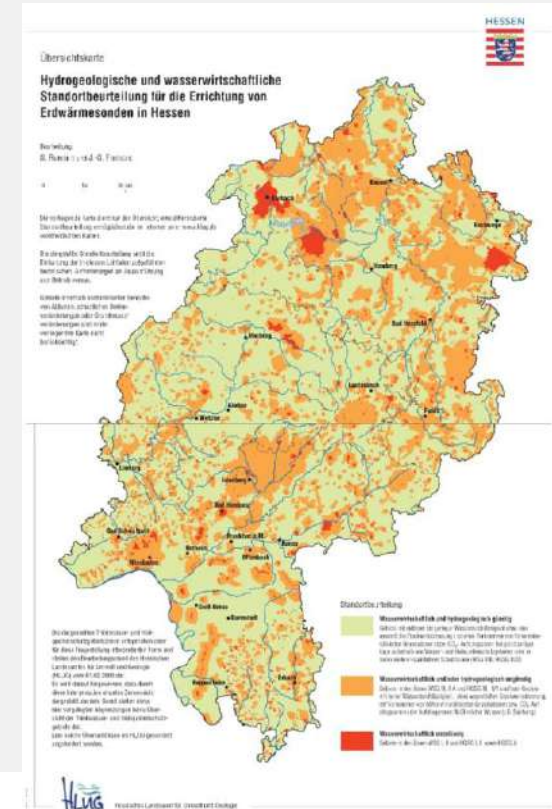
B) Refer to new national legislations:

e.g. France: Article L. 122-1 of the French Construction and Housing Code: To promote renewable energy in buildings a technical and economic feasibility study is required for new build and refurbishments which must include an assessment of geothermal energy.

The Netherlands fossil boiler plan mandates that from 2026 all new heating systems will be hybrid heat pumps. Exceptions to this will be densely populated areas where there will be an option to join a renewable heating network.

Traffic light systems for Hessen (Germany):

- **Green:** just notification
- **Orange:** autorisation within max 3 months
- **Red:** further authorisation



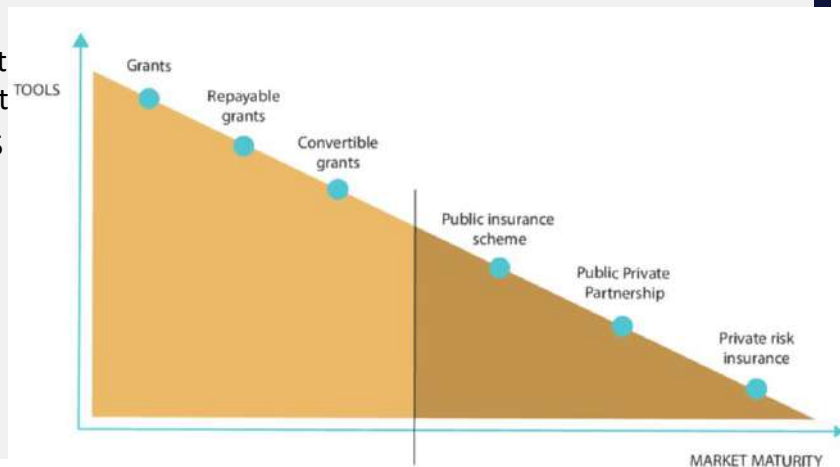
Creation of risk mitigation frameworks for renewable heat and cooling projects

Article 23 of the RES Directive presents this measure to achieve the average annual increase in RHC (Member States shall endeavour to implement at least two of the measures referred in this article):

De-risking instruments can take many forms, depending on the overall maturity of the market. They provide geothermal energy developers with a mean to reduce and manage their exposure to project risk. It is very relevant for small developers and vital for cities developing heat & power projects.

1) Establish a national scheme: e.g.

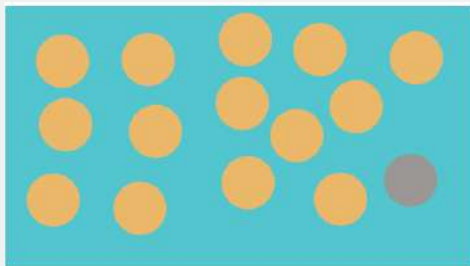
- **France** has operated a fund since the 1980s, de-risking 60+ projects with 80% coverage. Important leverage effect and 20y sustainability.
- **The Netherlands** government provides a guarantee scheme (RNES Aardwarmte). It requires a premium payment equal to 7%.
- **Hungary** operates a scheme based on grants to grow the national geothermal market.



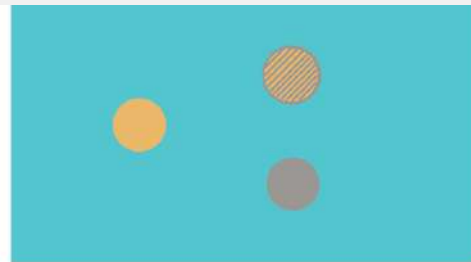
Creation of risk mitigation frameworks for renewable heat and cooling projects

2) Towards a pan European risk mitigation instrument:

- Risk mitigation schemes can be set up at a regional scale, but it is more efficient to pool the risk of more projects. When possible, it is relevant to mutualise the risk over an entire reservoir, as Hungary is promoting in the Pannonian Basin, or even to establish a financing of geothermal de-risking at the European Union level. This allows to reduce the costs for policy makers and developers.
- In France for instance, the geothermal risk mitigation scheme unlocked 42 euros of private geothermal investment for each public euro invested into setting up the scheme.



Representation of a mature market with 1 failed project



Representation of an emerging one with 1 failed project and one partial failure.

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

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**

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

Own Initiative Report (INI) on geothermal

- The European Parliament's ITRE committee agreed to prepare an Own Initiative Report (INI) on geothermal on 12 July.
- An INI is a non-binding statement of the European Parliament's views on a specific subject. Sometimes these are done to pre-empt the direction of an upcoming proposal from the European Commission on the same subject or to lobby for certain aspects to be included within upcoming proposals.
- The INI could help us set up the new Parliament and Commission agendas on geothermal.
- Mr Zdzisław Krasnodębski MEP is the Rapporteur.

Own Initiative Report (INI) on geothermal

Scope and aim of the report as agreed by the coordinators:

Geothermal energy is a clean, cost-effective and weather-independent source of heat and electricity that can play a critical role in the clean energy transition and contribute to the stabilisation of electricity grids. The acceleration of its deployment will be driven by advancements in geothermal technologies, cross-industry collaborations and investments. The report aims to look at the challenges and opportunities related to the development of geothermal energy and its integration within energy systems, as well as to provide policy options to guide policy makers, including the Commission and Member States, potential investors and other stakeholders.



Geothermal Heat Pump Days 2023



SAVE THE DATE!



16 -17 NOVEMBER 2023 | BERLIN, GERMANY



Overview of Heat Networks and Geothermal Policy

11 October 2023

Sharon Clements: Head of Geothermal and Heat Networks Policy





Heat Networks Policy and Regulation

Existing regulations:

- Heat Network (Metering & Billing) Regs 2014 (implementing EU Directive) – UK wide
 - Office for Product Safety and Standards (OPSS) regulatory role
 - Intention to drive energy efficiency and reduce carbon emissions.
 - Obligations on heat suppliers (to notify OPSS before beginning operation and every 4 years)
- Amendments in 2020 introduced building classes defining buildings that should have meters installed.
 - meters must continuously and accurately record customer consumption of heating, cooling or hot water
 - meter readings must be used to bill customers

Building Classes

Viable: Meters must be installed

- Buildings newly connected to communal heating on or after 1 September 2022
- Buildings newly connected to district heating on or after 27 November 2020
- A building that has had significant technical renovation after 27 November 2020

Open: Meters must be installed if cost effectiveness assessment is positive

- A building not in the Exempt or Viable classes.

Exempt: Meters do not have to be installed

- A building used wholly or partly as supported housing, alms house accommodation, or purpose-built student accommodation
- A building where the heat is distributed by means other than hot water and cooled using a transfer liquid other than water
- Building where more than 10% of private dwellings with leasehold provisions which would prevent billing based on consumption

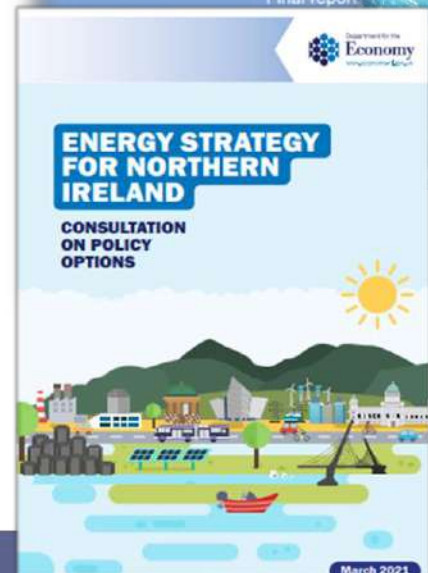
Heat Networks Policy and Regulation



Department for the
Economy
www.economy-ni.gov.uk

Drivers for change

- 2015 - Climate Change Committee (CCC) estimated that around 18% of UK heat, (up from 2%) will need to come from heat networks by 2050
- 2018 (July) – Competition and Markets Authority (CMA) recommends heat network regulation
- 2021 (Nov) – GSNI publish Geothermal Potential for NI
- 2021 (Dec) - Energy Strategy:
 - “To develop opportunities for heat networks we will assess potential solutions to decarbonise existing heat networks.”
 - “We will take forward heat network trials and demonstrators, using a range of energy sources including geothermal energy and, where feasible, waste heat.”
- 2022 (Jan - Feb) – NI ‘Building a Market Framework’ consultation



Future Policy and Regulation

Westminster **Energy Bill**:

- Heat networks will need **Utility Regulator** authorisation
- **Consumer Council** consumer advocate role.

Authorisation conditions will likely include:

- Provision for fair pricing;
- Transparent information for consumers;
- Protection of vulnerable customers;
- Minimum quality of service.



Future Regulation will also introduce.....

- **Minimum technical standards**, and ensure they are met across a network's **design, operation and maintenance** lifecycle.
- Heat network developers will have **powers equivalent to other utilities such as gas and electricity**, including to excavate roadways and maintain infrastructure.
- **Support the decarbonisation** of the sector and energy efficiency improvements by promoting technical standards and introducing (potentially) carbon emissions limits on heat networks.
- **Step in arrangements** and **special administration regime**

Longer term - Heat Network Zoning

- Identification of **viable** areas for heat networks – waste heat, geothermal etc
- Further engagement required on the **who and how**
- **Opportunity** to use range of low carbon heat sources to put us on track for Carbon Budgets and Net Zero.



GEOHERMAL POLICY: GEOENERGY NI

Developing Policy, Demonstrating Potential, Unlocking Geothermal Investment



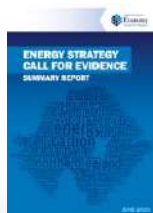
Department for the
Economy
www.economy.ni.gov.uk

GEOENERGY NI
UNEARTHING THE HEAT BENEATH OUR FEET

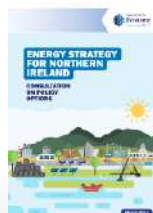


Developing the evidence base

Our Policy Journey



CALL FOR EVIDENCE
Apr 2020



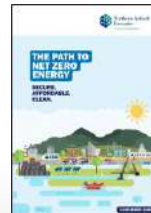
ENERGY POLICY
OPTIONS
June 2021



GEOTHERMAL
ADVISORY CTTEE
JUN 2021



GSNI Report on
Geothermal Potential in
NI November 2021



ENERGY STRATEGY
Dec 2021



ENERGY ACTION PLAN
Jan 2022



QUB Research
June 2022



Arup research
December 2022

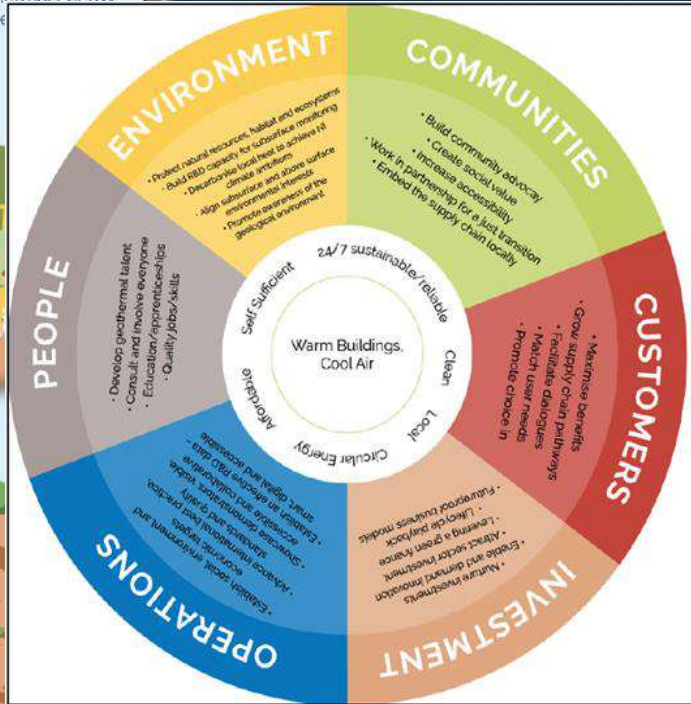


CONTRACT KICK-OFF
MTG
Feb 2023



Our Geothermal Vision

QUB SOCIAL SCIENCE RESEARCH



Communities

To deliver geothermal energy to all communities.

People

To build talent to drive geothermal excellence, capacity development and policy engagement.

Customers

To grow and facilitate geothermal customers in a sustainable way.

Environment

To protect and preserve the environment for all communities.

Operations

To build administrative, operational, and policy support.

Investment

To nurture, shield and protect sector investment funding.

