



**'Heating up the Market'**  
21 - 22 February 2024, Virtual Event

**GEO**THERMAL  
2024

# **EXPANSION OF GEOTHERMAL ENERGY IN EUROPE: SPAIN CASE**

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## Geothermal Energy

Geothermal energy is heat energy stored beneath the Earth's surface. As over 99% of our planet is hotter than 100 °C, geothermal energy represents huge resource of continuous, reliable, carbon-free energy. This internal heat comes from the steady decay of radioactive isotopes in the Earth's core as well as left over heat from the Earth's formation 4.5 billion years ago. Geothermal energy can be harnessed directly for heating and cooling purposes or it can be used to generate clean electricity using steam and turbines. Through geological engineering, surveying and data analysis geoscientists play essential roles in developing and implementing geothermal technologies across the globe.



The Geological Society supports the UN Sustainable Development Goals

### Shallow geothermal

1 Solar radiation heats up the ground to a depth of 10-15m. At this depth ground temperatures remain stable throughout the year (~9-13 °C in the UK), this is warmer than winter surface temperatures and cooler than summer temperatures.

2 Pumping water from a few metres below the surface and using a ground source heat pump can heat or cool buildings depending on the time of year.

### Deep geothermal

1 To harness the energy from heat sources deeper in the Earth, cooled water is pumped down into heated rocks where it is converted into steam. This hot steam rises and can be used directly to spin turbines and generate clean electricity.

2 Deep geothermal energy has traditionally been used in regions located near active plate boundaries such as Iceland, USA, Italy and Costa Rica. However new technologies are allowing deep geothermal energy to be harnessed from lower temperatures in non-volcanic regions e.g. from the granite rocks underlying Cornwall in the UK.

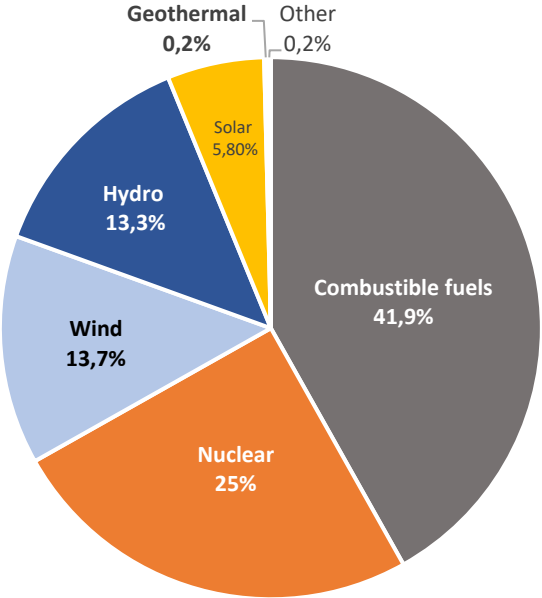
### Mine geothermal

Underground water can accumulate in old, disused mine shafts. The water is tepid (12-20 °C), heated from the high temperatures radiating from the Earth's core. Heat pumps can be used to harness this energy and provide low-carbon heating.

*To achieve climate goals and facilitate a sustainable energy transition, the subsurface and geothermal energy technologies are key*

## 40% of EU's electricity from fossil fuels

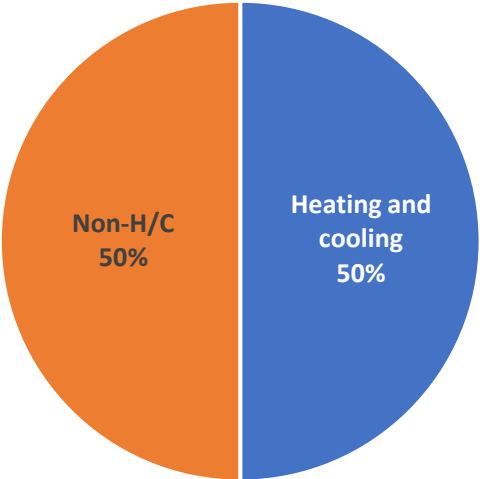
Net electricity generation, EU 2021  
(% based on GWh)



Source: Eurostat, 2022

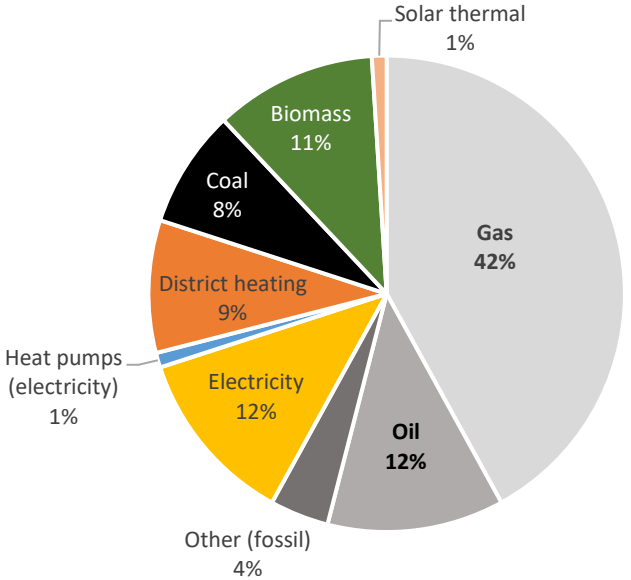
## 70% of EU's heating & cooling from fossil fuels

Heating & cooling represent ~50% of EU's total final energy consumption

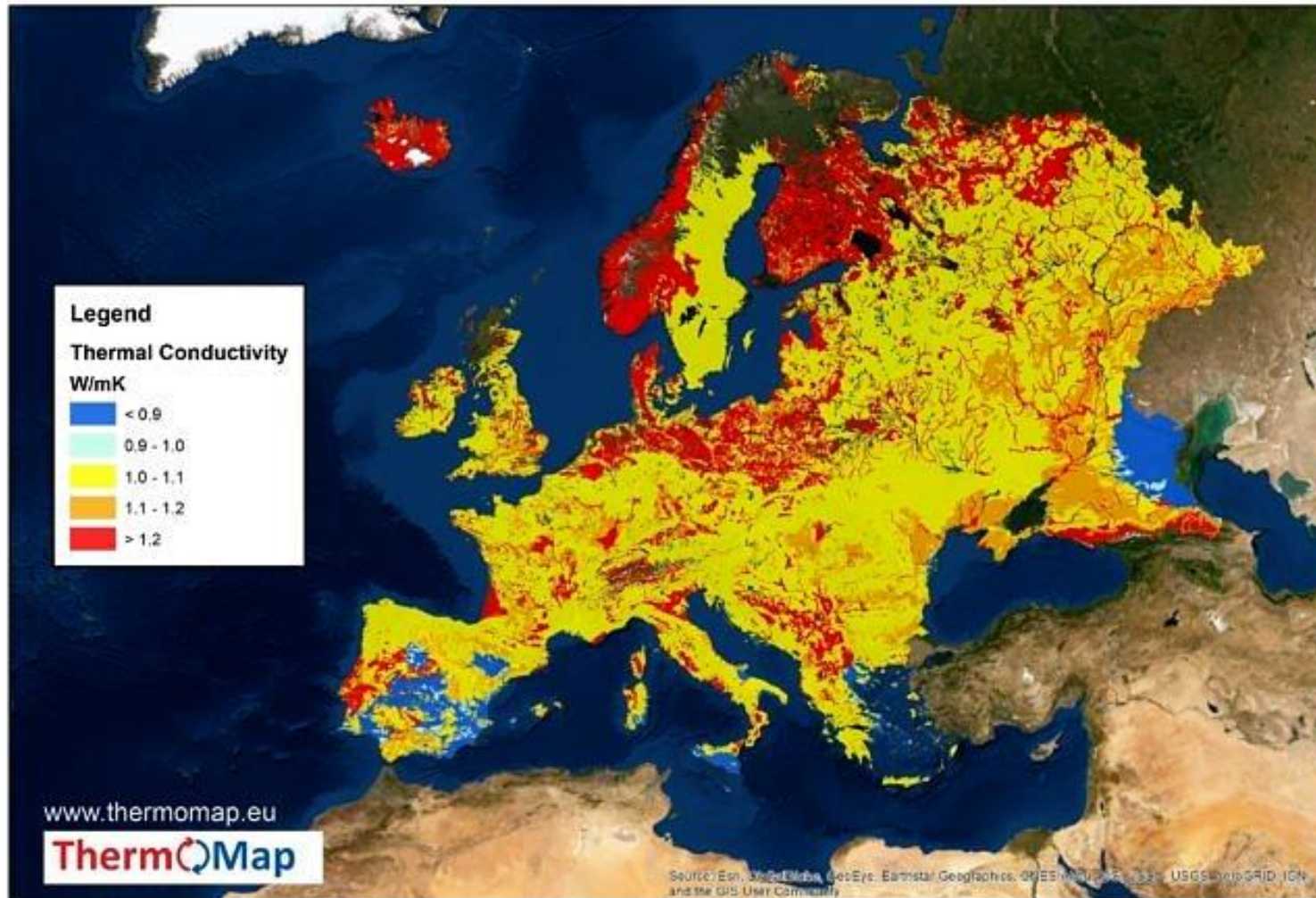


Source: Heat Roadmap Europe 2050 (2017)

About 70% of thermal energy required for heating & cooling is coming from fossil fuels (mostly gas)



Source: Eurostat (2021)



Source: Thermomap EU, 2020

Geothermal represented 0.5 % of the global renewable electricity market in 2022, generating 0.2 % of electricity in the EU.

Geothermal energy has a high potential to supply the EU's district heating and cooling sector, while emerging technologies for higher temperatures and efficiency and for recovery of critical materials from geothermal brines offer promising opportunities.

## EU commitment to SDGs implementation

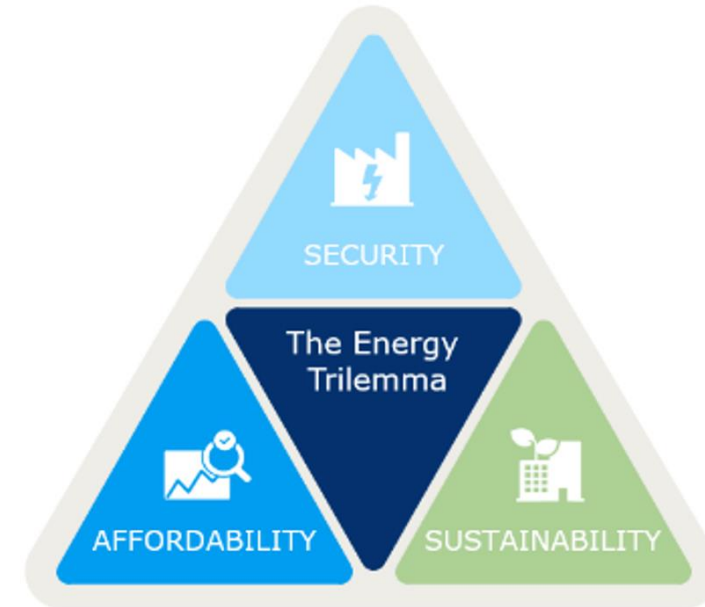


Source: [https://international-partnerships.ec.europa.eu/policies/sustainable-development-goals\\_en](https://international-partnerships.ec.europa.eu/policies/sustainable-development-goals_en)



### Security

- Domestic supply
- Matching supply and demand



### Affordability

- Grid services and balancing
- Efficiency renewables
- Baseload heat

### Sustainability

- GHG emissions
- Low/zero carbon technologies

National policies and regulations are key to the successful development of geothermal projects, and these strongly vary around the world.



- Policy support EU support for the geothermal sector is rooted in the **European Green Deal**.
- The latest revision of the Renewable Energy Directive increased the overall target for the share of renewable energy sources (RES) by 2030 and set a binding target for an annual percentage point increase in the RES share for heating and cooling.
- The revision also ensures simpler permitting for small and large heat pumps.
- The revised **Energy Efficiency Directive** includes an amended definition of an efficient heating and cooling system aiming to boost RES.
- Geothermal energy also features in the Commission proposal for a **Net Zero Industry Act**, as one of eight strategic technologies.
- Lithium that could be extracted from geothermal brine is covered in the proposed critical raw materials act.
- The announced heat pump action plan envisages at least 10 million additional heat pumps by 2027 and 30million by 2030. The plan would encourage use of small and large geothermal heat pumps in buildings, heating and cooling systems, and in industry.

## The European Green Deal

### The EU will:



Become  
climate-neutral  
by 2050



Protect human life,  
animals and plants,  
by cutting pollution



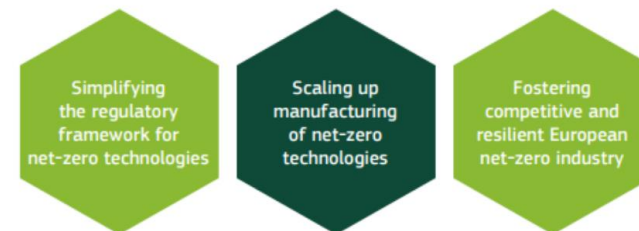
Help companies  
become world leaders  
in clean products and  
technologies



Help ensure a  
just and inclusive  
transition

[https://ec.europa.eu/commission/presscorner/detail/en/fs\\_19\\_6714](https://ec.europa.eu/commission/presscorner/detail/en/fs_19_6714)

## The Net-Zero Industry Act:



[https://ec.europa.eu/commission/presscorner/detail/en/FS\\_23\\_1667](https://ec.europa.eu/commission/presscorner/detail/en/FS_23_1667)

# Major victory for Geothermal Energy in the EU

In January 2024, the European Parliament's Plenary voted on a resolution to support a European geothermal energy strategy (531 votes in favour, 2 against and 20 abstentions). ***Adopted a Report on geothermal energy that recognises the huge potential of geothermal energy and sets the stage for a greener and more sustainable future.***

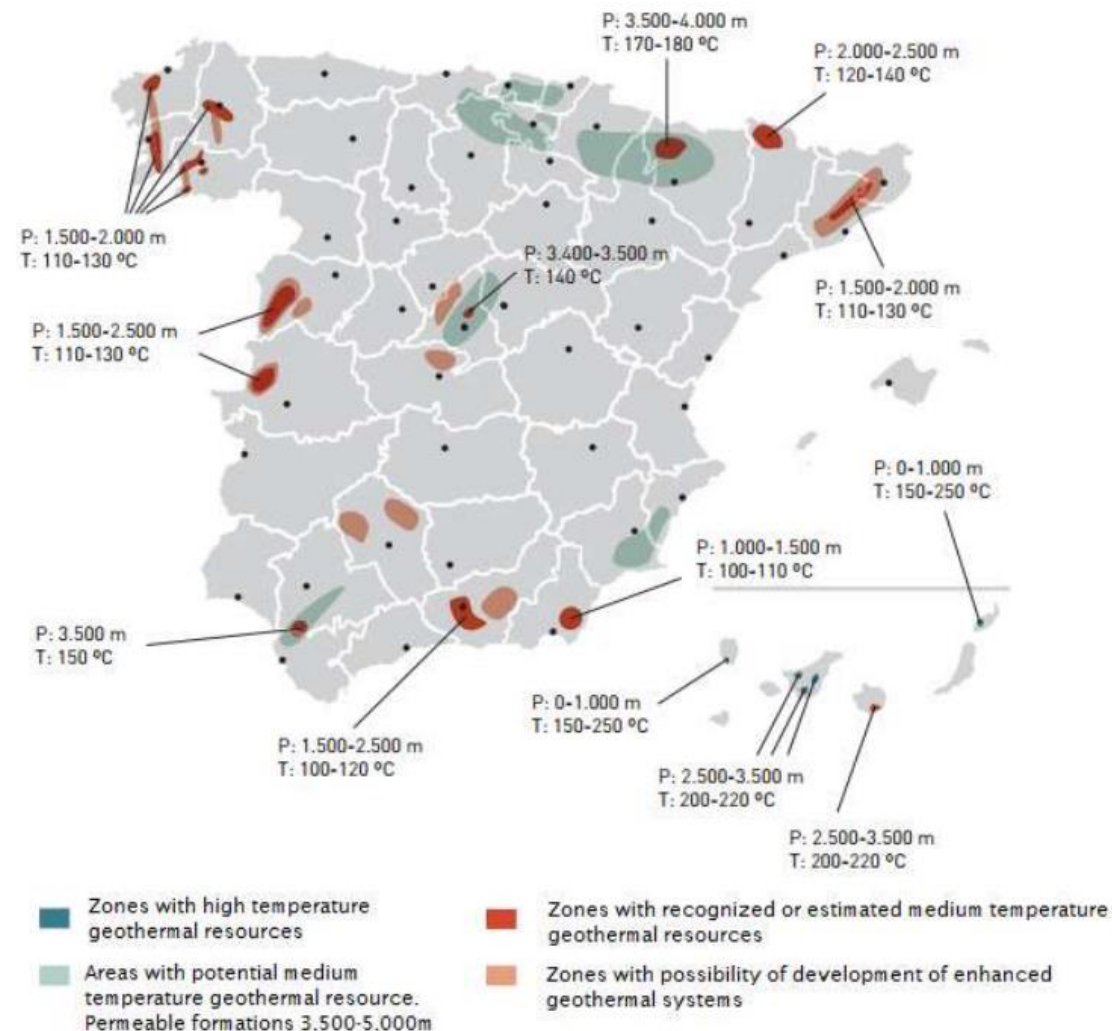
- Governments are urged to invest in geothermal resource mapping and drilling.
- The European Geological Data Infrastructure (EGDI) takes centre stage, providing access to pan-European and national geological datasets.
- Geothermal energy is seen as a game-changer for the decarbonisation of district heating systems.
- The EU needs to streamline the permitting process for geothermal projects to make them more attractive to investors.
- This recognition by the EU Parliament highlights the crucial role of a sustainable Geological service for Europe.

## European Parliament Endorses Call For EU Geothermal Strategy





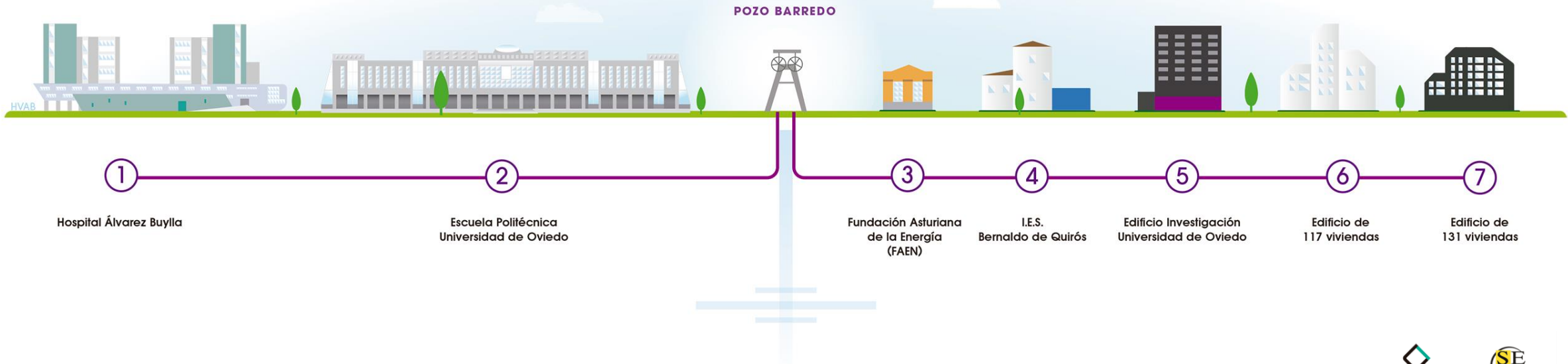
- **High Geothermal potential in Spain:** for high and medium enthalpy resources
- **Canary Islands**, due to their volcanic geology, is the area with **most promising potential**
- **Cantabrian, Pre-Pyrenean, Guadalquivir and Betic Ranges** basins host deep permeable formations that contain fluids whose temperature exceeds 100°C
- Other promising areas such as North of Madrid Basin, **Jaca-Serrablo** and **La Selva-Vallès** (Cataluña) have been identified and evaluated (IGME and O&G explo.)
- **Identified potential areas clearly biased by** the lack (or presence) of deep **well data** (underestimated potential?)



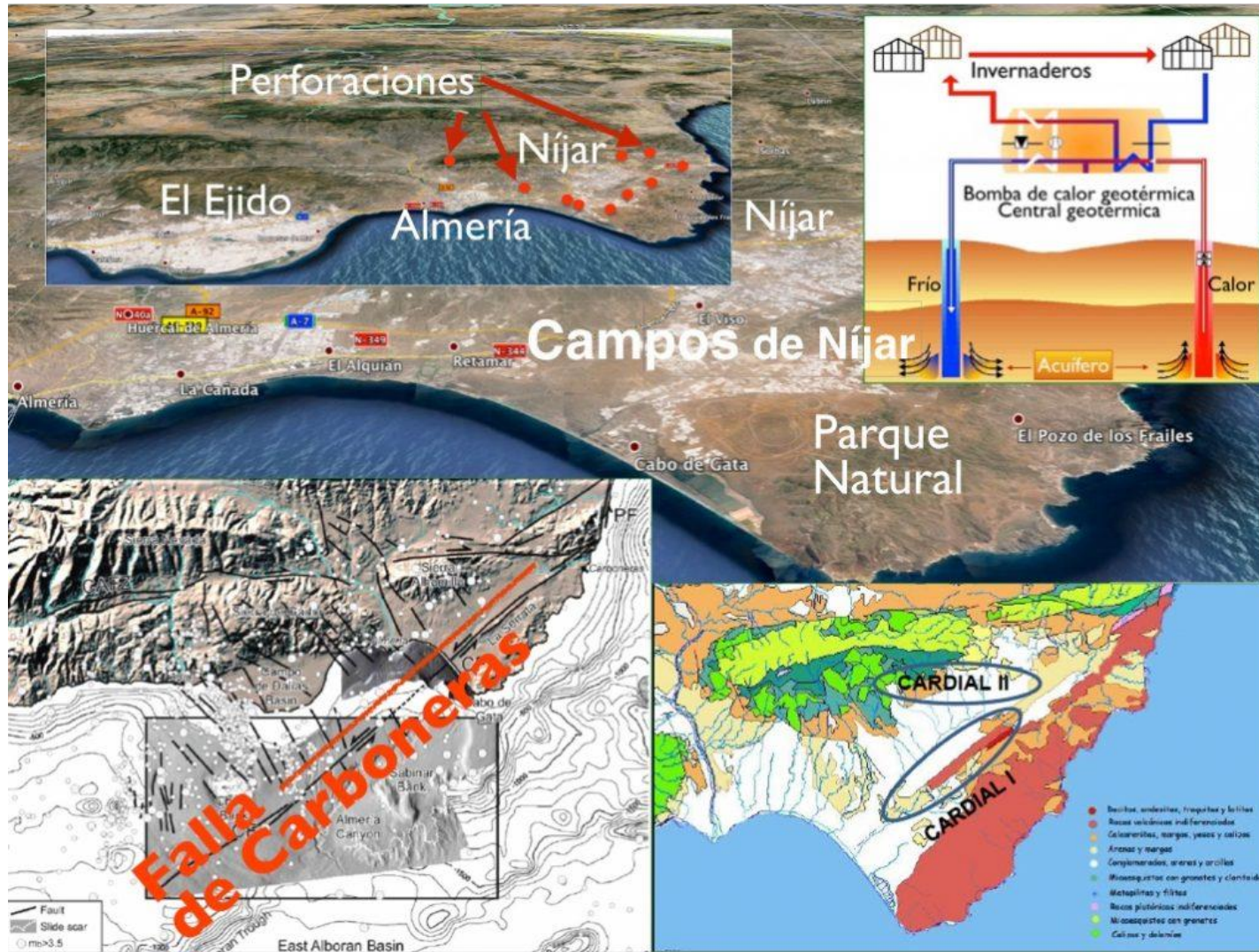
## Turning coal mines in the region of Asturias in Spain to sources of geothermal heating and cooling

New facilities at abandoned coal mines in the region of Asturias in Northwestern Spain are to bring geothermal heating and cooling to a hospital and research building of a university.

### MIERES DISTRICT HEATING



# Geothermal projects in Spain: CARDIAL, Almeria




The project is headed by the Almeria-based company Cardial, belonging to the Cyopsa Group, with headquarters in the Almería Technological Science Park (PITA) and with facilities located in the Níjar field, where it drills to access the areas of high temperatures that are located at high depths.


The project contemplates reaching depths of more than two thousand meters to take advantage of that heat to heat the interior of the greenhouses.

# Geothermal projects in Spain: CROWD THERMAL, Madrid

**District heating in Szeged**



📍 Szeged, Hungary



**COUNTRY BACKGROUND**  
There are currently 23 geothermal plants across the country with an installed capacity of 223.36 MW. These include thermal water town heating, district heating and a binary power plant. Despite having the largest potential for geothermal energy in central and eastern Europe, most of the district heating in Hungary is currently fuelled by fossil gas, with geothermal providing only 4%.


**STATUS OF THE CASE**  
Ongoing: Construction phase

**EXPLOITATION TECHNOLOGY**  
Deep geothermal system (500-5000m)


**USES**  
Heating and domestic hot water

**FUNDING**  
Private and public

**EAI310 and Arroyo Bodonal**



📍 Madrid, Spain



**COUNTRY BACKGROUND**  
Spain has great potential for geothermal resources. Shallow geothermal continues experiencing a steady growth, as it becomes more popular and increasingly applied in building refurbishment and new construction buildings. However, geothermal power plants have not been developed in Spain.


**STATUS OF THE CASES**  
Completed

**EXPLOITATION TECHNOLOGY**  
Shallow geothermal system (<500m)


**USES**  
Heating, cooling and domestic hot water

**FUNDING**  
Private (cooperatives)

**Húsavík Community Greenhouse**



📍 Húsavík, Iceland



**COUNTRY BACKGROUND**  
Iceland is a pioneer in the use of geothermal energy. With a total installed geothermal power generation capacity of 755 MW, the country is among the top 10 countries for geothermal electricity generation. In terms of direct use, Iceland is a role model for district heating (90% of households are heated by geothermal energy) and other direct applications such as bathing and swimming, greenhouses and farming.

**STATUS OF THE CASE**  
Ongoing: planning phase

**EXPLOITATION TECHNOLOGY**  
Shallow geothermal system (<500m)

**USES**  
Food production and processing

**FUNDING**  
Public and private (crowdfunding)

The CROWD THERMAL Spanish Case Study focuses on two housing cooperatives utilizing shallow geothermal energy for **heating, cooling and domestic hot water: EAI 310 and Arroyo Bodonal.**



# Geothermal projects in Spain: Transport hub, Madrid

Sustainable cooling is being supplied to the Moncloa Transport Hub in Madrid, Spain using both geothermal and solar energy as part of the GEOBATT project that is developed by SACYR.

Is demonstration project and the first to combine hybrid geothermal heat pumps, redox flow batteries, and photovoltaic solar panels to provide air conditioning at the Moncloa Transport Hub



Perforación de los sondes geotérmicos en uno de los túneles del Intercambiador de Moncloa.

Imagen: Ministerio de Ciencia e Innovación / Sacyr

Imagen: Ministerio de Ciencia e Innovación / Sacyr



# New investments

## Fundings for geothermal Energy in Spain

EUR 120 million funding from the Ministerio para la Transición ecológica y el Reto Demográfico, multiple studies will be conducted in the Canary Islands and other regions.

- ✓ Gran Canaria: Island Energy Council (CIE) proposes a EUR 31 million project for geothermal exploration and drilling in Valsequillo, Ingenio, Agüimes, and Telde due to their high potential for geothermal development.
- ✓ Tenerife: a private-public partnership between the Technological Institute of Renewable Energy (ITER) and Disa Renovables plan a geothermal exploration campaign in 2024.
- ✓ Repsol will conduct geothermal studies in La Palma and Madrid



LARAZON 3

Medio ambiente

### La geotermia profunda se abre paso en España

Se conceden por primera vez ayudas para explorar esta fuente de energía renovable que ya se usa ampliamente en países como Islandia

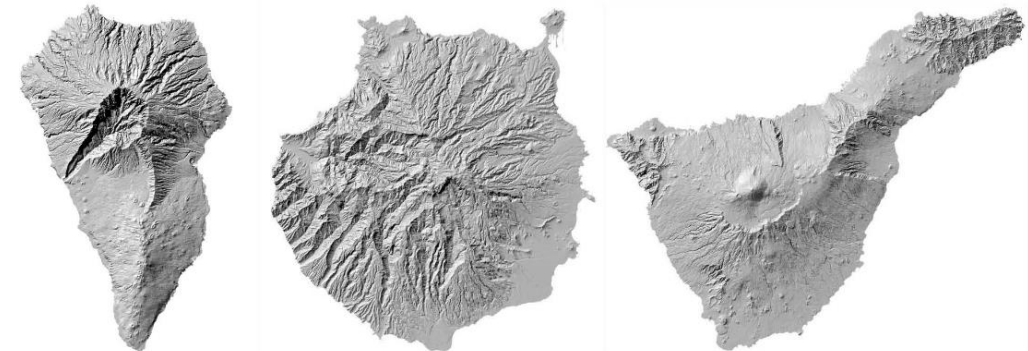


- Geological, geophysical and hydrogeological studies to characterize the subsurface and to assess the site suitability for the use of deep geothermal energy.
- Technical studies to assess the feasibility and design of the geothermal power plant, including the type of the drilling, the fluid and of the heat exchanger.
- Economic and financial studies to assess the costs and benefits of the project, including the assessment of risk and financing options.
- Environmental and safety studies to assess the effects of the project on the environment and public health, and to define measures to avoid and mitigate these effects.

THE COUNCILS OF GRAN CANARIA, LA PALMA, AND TENERIFE PROMOTE THE DEVELOPMENT OF GEOTHERMAL ENERGY ON THEIR ISLANDS



**Avanzando por el desarrollo de la geotermia en Gran Canaria, La Palma y Tenerife: una apuesta que contribuye a la sostenibilidad**



Source: [https://www.iter.es/the-councils-of-gran-canaria-la-palma-and-tenerife-promote-the-development-of-geothermal-energy-on-their-islands/?lang=en#lightbox\[gallery32487\]/2](https://www.iter.es/the-councils-of-gran-canaria-la-palma-and-tenerife-promote-the-development-of-geothermal-energy-on-their-islands/?lang=en#lightbox[gallery32487]/2)

- Geothermal energy has been identified as one of the strategic energy sectors
  
- In Spain there is great potential for geothermal resources that, through adequate support and development of the sector:
  - ✓ increase the use of geothermal energy in the country and attract national and foreign investment to develop this renewable energy
  - ✓ can bring to the country closer to the levels of use of other European countries
  
- Needs political and adequate support instruments to continue promote and impulse geothermal energy