

# Advancing Geothermal Energy in Europe

## The strategic role of a Geological Service for Europe

**EuroGeoSurveys is a non-profit organisation representing the European national geological survey organisations, composing a 10,000+ workforce collaborating through scientific expert groups, task forces, and EU-funded projects. Together, we are laying the foundation for a permanent Geological Service for Europe to provide pan-European public geological data delivery and strong geoscientific expertise to support science-based policy and actions that can accelerate the large-scale deployment of geothermal energy and contribute to a sustainable energy future for Europe.**



### Key messages

- The EU's forthcoming **Geothermal Energy Action Plan** highlights the role of European geoscientific expertise in providing digital and available geological data, models and interactive tools to speed up permitting, reduce risks, and evaluate potential for accelerated deployment and sustainable management of geothermal resources.
- The Geological Survey Organisations (GSOs), under the umbrella of EuroGeoSurveys, develop the foundations for cutting-edge geoscience data and expert advisory services through a future **Geological Service for Europe**, a vital platform to provide the scientific tools, data, and policy support needed to integrate geothermal energy into Europe's broader clean energy strategy. EuroGeoSurveys is committed to take the coordination role of the "Data availability" task in the Geothermal Action Plan.
- **Structural funding from the EU and Member States** is needed to secure continued access to state-of-the-art geoscientific data and expertise that will support national and European policy measures and boost investments in geothermal technologies; establish a level playing field for geothermal development across Europe; unlock geothermal potential beyond traditional hydrothermal regions; and secure a foundation of expertise for all stakeholders.

**Geothermal energy is a crucial pillar in Europe's transition to clean, stable, and locally sourced energy. It can contribute to the baseload demand and provides reliable supply for heat and power generation, and industrial applications. It also offers a cost-effective way to store thermal energy underground and can supply critical raw materials, such as lithium, which is essential for batteries (Figure 1).**

However, despite its vast potential, geothermal remains under-utilised. Several factors have stalled large-scale deployment:

- Cheap gas, which makes geothermal less competitive
- High upfront investment costs and exploration risks
- Complex and lengthy licensing procedures

The entire geothermal value-chain is complex. It involves:

- Assessing the geothermal resource: finding out where and how much heat there is
- Developing the resource: drilling and subsurface engineering
- Using the energy and integration into existing power grids or heating systems
- Managing it sustainably

Each of these steps comes with its own technical and financial hurdles. Many of these challenges can only be overcome with solid geological data and expert knowledge.

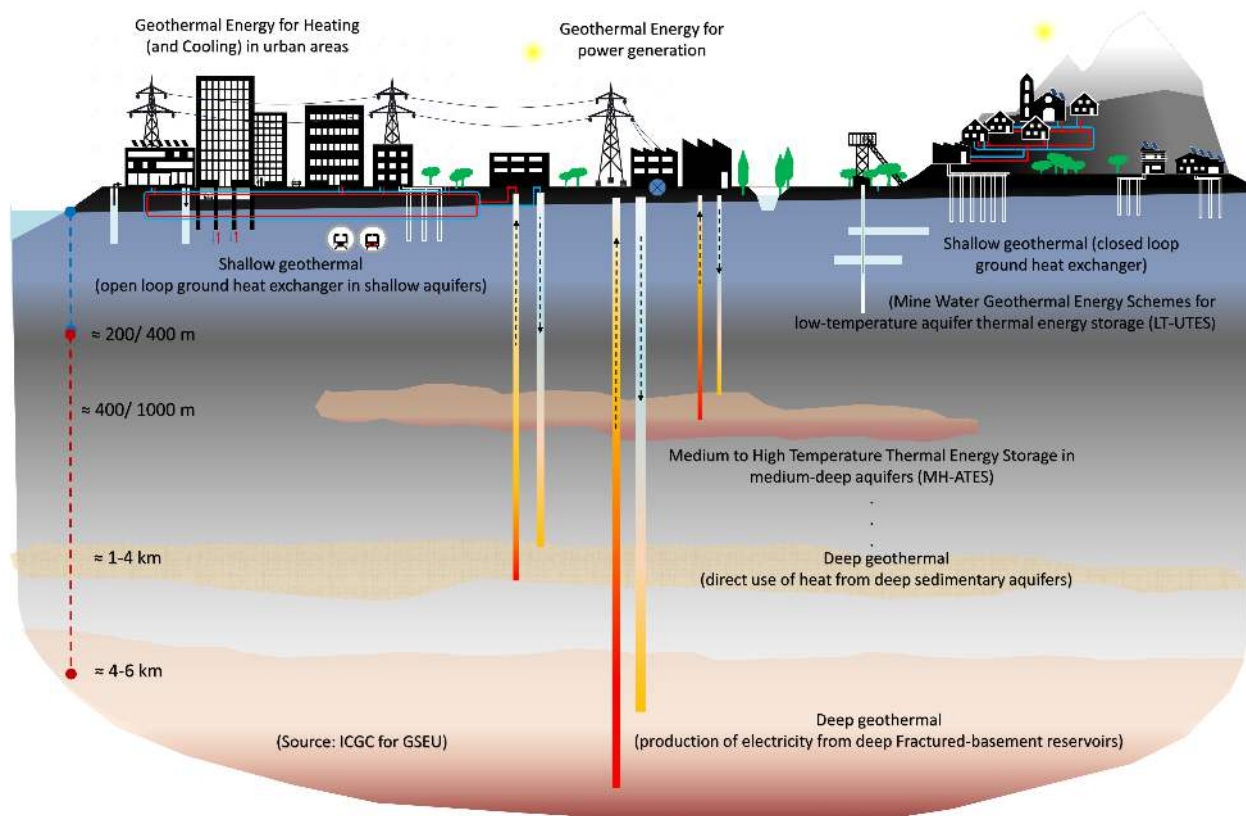


Figure 1: Geothermal Energy and the subsurface storage for heat & cold. GSEU Project: Meet the GSEU Webinar – Mapping and Managing Sustainable GeoEnergy Capacities in Europe, December 11, 2023.

## The European subsurface is a geothermal powerhouse

Europe holds vast and significantly untapped geothermal potential, particularly for heating and cooling, industrial applications, and power generation. This is thanks to Europe's rich geological diversity. According to the European Geothermal Energy Council (EGEC), by 2040 geothermal energy could deliver up to 75% of the EU heating and cooling needs in residential, public and commercial buildings, 65% in the agri-food sector, and 15% of the EU's electricity production.<sup>1</sup>

There are untapped opportunities and technologies available for utilising geothermal energy for heating and cooling in the domestic sector, decarbonising industrial heat, including food processing, chemical production, and other energy-intensive industries, and power generation. Geothermal reservoirs can also co-produce critical raw materials, such as lithium, contributing to Europe's battery production supply chain.

Recent EU strategies and policy documents clearly acknowledge geothermal energy as crucial for Europe's transition to clean energy, e.g.:

- The revised Renewable Energy Directive<sup>2</sup>
- The Net-Zero Industry Act<sup>3</sup>
- The REPowerEU Plan<sup>4</sup>

Beyond the overall goals of decarbonisation set by the SET-plan and the Green Deal, the European Parliament also issued its report on geothermal energy in January 2024 (2023/2111(INI))<sup>5</sup>. This was followed by the Council Conclusions on the promotion of geothermal energy in December 2024. Both documents strongly encourage geothermal development in Europe.

Among their priorities, these documents highlight:

The importance of making organised geological data publicly accessible with a view to creating an EU-wide atlas of geothermal potential.

The vital role of geoscientific knowledge in establishing risk mitigation schemes related to the uncertain subsurface conditions. This will help secure necessary funding for geothermal projects, especially during the costly exploration phase.

<sup>1</sup> [European Geothermal Energy Council \(2024\) Geothermal Now: Priorities for the EU's 2024-2029 Mandate Manifesto](#)

<sup>2</sup> [Renewable Energy Directive \(EU\) 2023/2413](#).

<sup>3</sup> [Regulation \(EU\) 2024/1735; Net-Zero Industry Act \(NZIA\)](#)

<sup>4</sup> [COM/2022/230 final. RePowerEU Plan](#)

<sup>5</sup> [European Parliament resolution of 18 January 2024 on geothermal energy \(2023/2111\(INI\)\)](#)

Moreover, Article 19 of the Critical Raw Materials Act requires national exploration campaigns for minerals found in geothermal areas, including reprocessing existing data.

Strong political coordination and targeted support are urgently needed and cross-border, regional, and pan-European scientific collaboration is essential to build a shared, high-quality geological data, information and geothermal resource knowledge base.

This collaboration can deliver:

'Traffic light' maps to help speed up decision-making related to applications for geothermal permits, in line with the Renewable Energy Directive.

Tailored maps for deep geothermal energy, useful for both direct heating and power generation. These maps can efficiently guide data acquisition through targeted exploration campaigns, minimising risk and identifying 'renewable go-to areas'.<sup>6</sup>

A harmonised approach to subsurface data and infrastructure planning is critical. This will dramatically increase geothermal use, allowing for better and faster decisions, efficient planning, and ultimately help Europe achieve its goals for energy security and climate neutrality.

## The strategic value of a Geological Service for Europe and contribution to Europe's Geothermal Action Plan

The use of Europe's subsurface is shifting from traditional extractive activities of fossil fuels to renewable technologies like clean and sustainable geothermal energy. To make this shift successful, we need to thoroughly understand what's beneath our feet. This means having accurate digital geological data and a deep understanding of the subsurface to properly evaluate the technical and economic potential of geothermal resources. As we connect the underground with our energy systems and urban development, advanced geological knowledge becomes even more vital. It helps us manage risks and protect the environment. Simply put, access to the best subsurface data and geoscience experts is crucial. This will help us deploy geothermal energy more widely, secure Europe's strategic autonomy, and drive competitiveness.<sup>7</sup>

Europe's geoscientific experts, working through the **Geological Service for Europe**, can provide harmonised geological data and knowledge of Europe's geothermal potential. This is a key element of the **Geothermal Action Plan** (Figure 2 and 3).

<sup>6</sup> COM/2022/230 (n 4)

<sup>7</sup> EuroGeoSurveys (2025) *SRIA 2025-2034: Building a Sustainable Geological Service for Europe*.

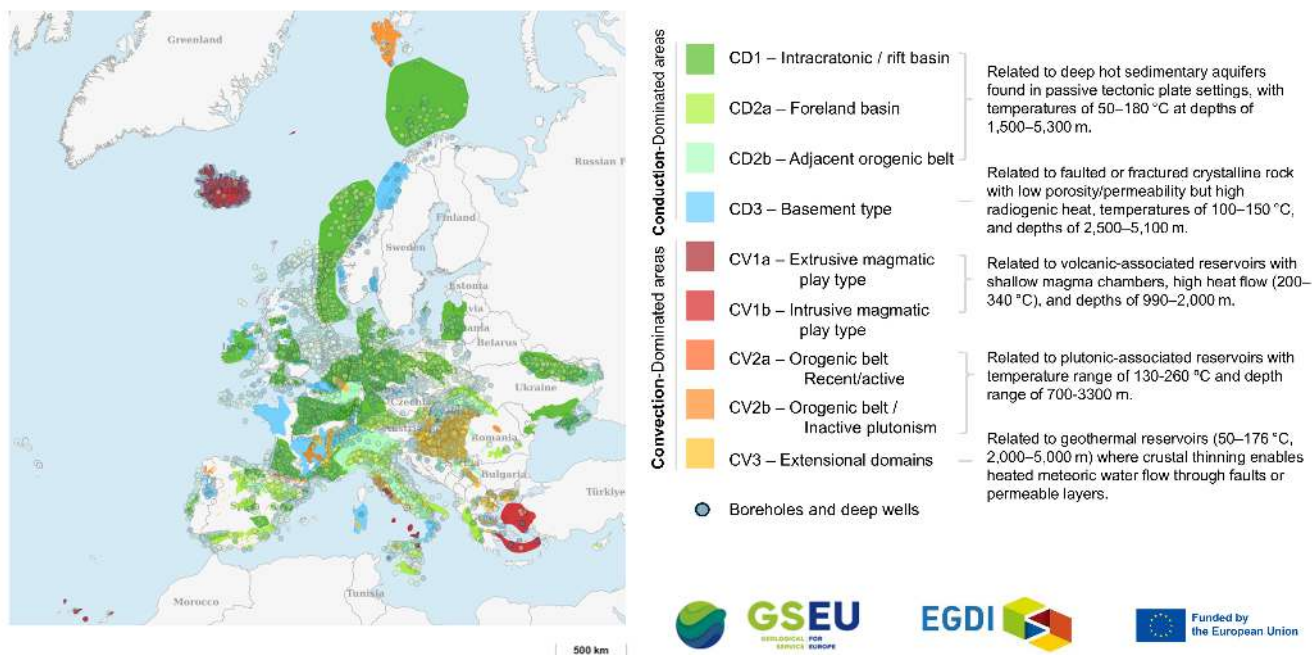


Figure 2: Map of favourable areas at the EU-scale for Deep Geothermal prospecting ('Geothermal Play Types'). Version 1.0 beta, April 1st, 2025, GSEU project.

For over a decade, the GeoEnergy Expert Group of EuroGeoSurveys has been working to provide FAIR (Findable, Accessible, Interoperable, Reusable), harmonised data and geoscientific expertise. Their goal is to support prediction and sustainable use of geo-energy resources and storage capacities, including geothermal energy. This work addresses synergies and bottlenecks, including geological hazards and environmental impacts. It also improves decision-making by developing tools for planning subsurface use and it fosters dialogue with stakeholders, civil society, and the public.

Building on this solid foundation of expertise, through its ongoing [GSEU project](#) EuroGeoSurveys continues to lead the integration and harmonisation of Europe's geothermal subsurface data. By combining subsurface predictive models with innovative methods including AI-based tools and geological assessments through the [European Geological Data Infrastructure \(EGDI\)](#), EuroGeoSurveys is creating a uniquely clear and thorough picture of Europe's geothermal potential.

This data-driven approach is essential to **attract investors, support policymakers, and reduce project risks**. It also forms the bedrock for establishing a **Geothermal Alliance across Europe**.

Even though geothermal energy offers clear benefits and Europe has vast resources, its development has been slow. To unlock geothermal energy's full potential, we urgently need to address these challenges. This requires coordinated EU policies, funding incentives, and public engagement, all strongly supported by geoscientific expertise.

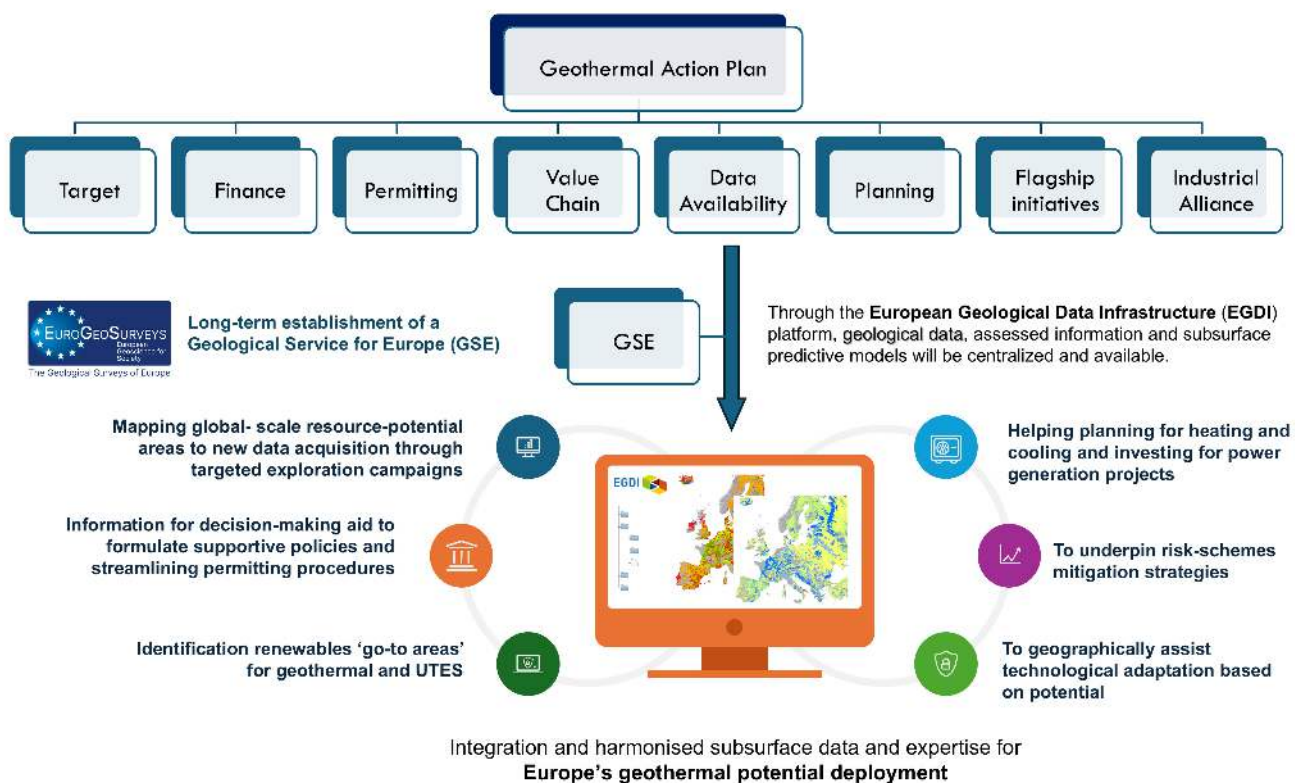


Figure 3: The Geological Service for Europe vision for contributing to the necessary future Geothermal Action Plan for Europe as a permanent service by providing harmonised geological data.

## Call for Action

- 1. Ensure structural support** for EuroGeoSurveys' Strategic Research and Innovation Agenda (SRIA 2025-2034). This is crucial for establishing a permanent Geological Service for Europe to guarantee continuous development and integration of vital geological data and services.
- 2. Promote a harmonised approach** to subsurface data, resource assessment and infrastructure planning. This is essential for scaling up geothermal deployment and reducing fragmentation across Europe.
- 3. Accelerate reforms to geothermal permitting** using EuroGeoSurveys' geoscientific expertise to provide tailored information and advice to governments. This will help streamline and simplify regulatory procedures without risking evaluation performance.
- 4. Strengthen financing mechanisms** for geothermal projects, by development of a European Geological Risk Mitigation Fund. This fund would be built on the systematically assessed and enhanced knowledge of the subsurface provided by the Geological Service for Europe, as well as classification standards to increase investor confidence.
- 5. Fund the acquisition of new subsurface data** through public exploration campaigns, especially in areas with less data coverage. This will ensure an even and reliable knowledge of the subsurface over Europe, minimising exploration risks
- 6. Expand international cooperation and skills development** to ensure Europe remains at the forefront of geothermal innovation and deployment.

Current challenges	Solutions by Geological Service for Europe
<p><b>Regulatory barriers:</b> EU geothermal projects face inconsistent, lengthy permitting. Clearer subsurface management is needed to balance geothermal use with other priorities like CO<sub>2</sub> storage.</p>	<p>National geological surveys and EuroGeoSurveys advise mining authorities and help harmonise EU regulations, supporting permitting. Geothermal maps on EGDI (from GSEU) can identify "acceleration areas" to fast-track applications.</p>
<p><b>Public perception and awareness:</b> Concerns about induced seismicity and other environmental impacts can lead to public opposition for geothermal projects.</p>	<p>Our network's reach and communication expertise can deliver clear, evidence-based information, helping the public understand and accept geothermal projects.</p>
<p><b>Limited financial mechanisms:</b> Lack of dedicated financial tools (risk-mitigation funds, tax incentives, low-interest loans) reduce investor confidence in geothermal projects.</p>	<p>Continued access to high-quality geoscientific data from GSEU and EGDI will improve underground resource assessments, reducing uncertainty and de-risking geothermal projects.</p>
<p><b>Resource accessibility:</b> Not all regions have easily exploitable conventional hydrothermal resources, necessitating the use of unconventional geothermal and other renewables.</p>	<p>With extensive knowledge in renewable integration, including hybrid geothermal-solar-wind-storage systems, EuroGeoSurveys experts are key. Their cross-European knowledge-sharing accelerates deployment, innovation, and cross-thematic cooperation.</p>
<p><b>Technical challenges:</b> Technical challenges like drilling difficulties, corrosion, scaling, and technological limitations must be overcome for innovative geothermal utilisation and advancement.</p>	<p>To ensure successful EU-funded research and innovation in next-gen geothermal technologies (modeling, demonstrating, and testing), EuroGeoSurveys will work closely with organisations like the European Energy Research Alliance, the European Geothermal Energy Council, commercial companies, and universities.</p>
<p><b>Lack of easy access to subsurface data:</b> The geothermal industry and experts need easy, fair access to digital subsurface geological data to assess geothermal potential and reduce geological uncertainty for exploration.</p>	<p>EGDI is a centralised platform for harmonised pan-European and national subsurface data from public and private sources. Expanding existing geological survey databases, coupled with data reporting obligations and reduced data confidentiality times, will further accelerate geothermal energy adoption.</p>
<p><b>International cooperation:</b> To grow the European geothermal sector, partners need to share best practices, technological expertise, and research and innovation outcomes.</p>	<p>EuroGeoSurveys collaboration will foster cross-border cooperation in geothermal projects and research. The GeoEnergy expert group's extensive knowledge and international collaborations will help Europe become a world leader in geothermal energy.</p>