

EU Action Plan on Geothermal Energy: An opportunity to champion innovative clean energy generation pathways

Clean Air Task Force (CATF) welcomes [the European Commission's commitment](#) to put forth an EU Action Plan on Geothermal Energy, as also urged by [the European Parliament](#) and [the Council](#). This is a pivotal opportunity to advance promising next-generation geothermal pathways that can revolutionise the EU's energy system and help meet the bloc's climate, competitiveness, and security objectives.

What are next-generation geothermal energy technologies?

Next-generation geothermal technologies push beyond traditional geothermal plants by unlocking heat from deeper and hotter parts of the earth's crust. Unlike traditional geothermal, these approaches do not depend on shallow, naturally occurring pockets of hot water, and can therefore be applied in many regions across Europe. [Next-generation geothermal approaches include](#) Engineered Geothermal Systems (EGS), closed-loop systems (also called Advanced Geothermal Systems (AGS)), and deep drilling innovations.

Superhot rock systems (a subset of EGS and AGS) aim to access even deeper and hotter conditions than existing EGS and AGS projects (or traditional geothermal plants), i.e. above 374°C. Such systems dramatically expand the potential for heat and electricity generation – potentially producing up to ten times the amount of energy as a lower temperature geothermal well, due to a much greater amount of heat carried by the superhot fluid generated in the process and its enhanced ability to penetrate rock. The energy density and energy per well of this renewable energy source are key reasons why it can be cost-competitive with other energy sources.

The depth at which we find rock hotter than 374°C varies – in some parts of the earth's crust the heat is shallow (2-5 km) and elsewhere it is deeper (10-20 km). Superhot rock energy can be demonstrated with today's technology where heat is relatively shallow (4-7 km). Several projects funded by the EU Horizon 2020 programme ([DEEPEGS](#), [DESCRAMBLE](#), [GEMex](#)) have already reached superhot conditions, demonstrating global leadership in testing technologies at high temperature and pressure. Accessing superhot rock everywhere will require technological advancements in drilling technologies and heat reservoir development. Maturing tools and methods to operate in extreme heat and pressure conditions would mean that we could access heat resources everywhere¹.

Why does the EU need next-generation geothermal pathways?

With strategy and robust funding, next-generation geothermal technologies could provide ample clean firm power and heat, importantly contributing to the EU's climate, economic, and energy security objectives. They could unlock a locally sourced, low-carbon, renewable, and firm energy source for Member States with fewer other options and so help the EU transition away from being dependent on foreign fossil fuels. Generating both electricity and heat, geothermal energy could also contribute to producing significant amounts of clean hydrogen that several sectors will need to decarbonise. Next-generation geothermal systems also have minimal land use and above-ground structure requirements, which is particularly relevant in the context of limited land availability in Europe.

1 For more information, visit www.cleanairtaskforce.org/learn/superhot-rock-geothermal-eu/

Several other world regions have recognised the potential of geothermal innovation and are actively pursuing its development. The United States has launched [EGS pilot projects](#) and [superhot rock research initiatives](#). Iceland, New Zealand, Japan, China, Canada, and Turkey [are actively investing in next-generation geothermal technologies](#), including advanced drilling, reservoir engineering, and high-temperature demonstrations. **The EU must urgently step up with a visionary geothermal strategy and implementation, if it is to build on its strong geothermal innovation legacy and secure technology leadership in a new era of clean energy generation.**

How can the EU Action Plan on Geothermal Energy advance next-generation geothermal pathways?

To unlock the potential of superhot rock energy and other next-generation geothermal pathways, we need a bold Research & Development agenda that will enable technological advancements and pilot demonstrations. Therefore, the EU must:

- **Ensure the development and adequate funding of several next-generation geothermal field testing, pilot, and demonstration projects** across Member States by 2030, meeting a defined target number of projects. This will build experience, generate data, and position the EU as a leader in geothermal innovation. These projects should validate drilling, reservoir creation, and high-temperature materials, extending the depth, longevity, and particularly temperature limits of geothermal systems.
- **Complement demonstrations with targeted R&D for high-temperature geothermal innovation** — Expand grants, both at EU and Member State level, for research into advanced drilling technologies, subsurface characterisation, EGS and closed-loop methods, well construction and materials (cement, casing, alloys), and geochemistry that can increase the temperature conditions at which next-generation geothermal systems can operate. EU-funded projects [IMAGE](#), [COMPASS](#), and [DEEPEN](#) have made notable advancement in researching key technologies for high-temperature next-generation geothermal, but need to be followed up by further research efforts.
- **Establish financial risk-sharing mechanisms for next-generation geothermal projects** – This could include a dedicated EU risk-sharing facility with grant-and-loan blending for early projects and an insurance or a guarantee scheme, led by the European Investment Bank (EIB), for drilling and well performance risk. These mechanisms should be designed to crowd in private capital, reduce the cost of capital, and enable commercial financing of next-generation geothermal projects by the early 2030s.
- **Develop a standardised permitting process template** that Member States can adopt to shorten timelines and reduce project risk, building on effective national models such as [Germany's Geothermal Acceleration Law](#). The template should include approval guidance for next-generation geothermal projects. As geothermal energy technologies are considered 'net zero technologies' under the Net Zero Industry Act (NZIA), they should be effectively and consistently provided with the relevant enabling conditions, including one-stop shop permitting authorities, streamlined permitting deadlines, and simplified, digital procedures. Next-generation geothermal projects should also be duly considered for the status of 'net zero strategic projects' or, where relevant, 'innovative net-zero technologies' under the NZIA.
- **Create an EU-wide geothermal data repository** — Develop a publicly accessible platform to aggregate, standardise, and share subsurface, drilling, and performance data from both public and private next-generation geothermal projects. Such a repository would help de-risk future projects by improving resource characterisation in new geographies, supporting better siting decisions, and accelerating learning across Member States.

CATF urges the European Commission to take the above recommendations into account when drafting the EU Geothermal Energy Action Plan. **Supporting next-generation geothermal technologies — including EGS, AGS, and these systems in superhot geothermal conditions — will help guarantee clean firm energy domestically while positioning the EU as a leader in global clean technology innovation.**

About Clean Air Task Force

Clean Air Task Force (CATF) is a global non-profit organisation working to safeguard against the worst impacts of climate change by catalysing the rapid development and deployment of low-carbon energy and other climate-protecting technologies. With 25 years of internationally recognised expertise on climate policy and a fierce commitment to exploring all potential solutions, CATF is a pragmatic, non-ideological advocacy group with the bold ideas needed to address climate change. Visit cleanairtaskforce.org and follow [@cleanairCATF](https://twitter.com/cleanairCATF)