

Next-Generation Geothermal

A Blueprint for EU Energy Security and Competitiveness

Executive Summary

Next-Generation Geothermal (NGG) energy presents a system-scale opportunity for the European Union to significantly enhance its energy security, industrial competitiveness and independence from fossil fuels. This renewable, local and stable energy source can provide baseload (24/7) electricity and heating and cooling, unlocking potential across much of the continent. The EU needs to develop a competitive cleantech industrial ecosystem providing technologies and know-how for NGG.

However, despite Europe's pioneering role in the underlying technologies, the EU risks losing its leadership to global competitors like the United States and China due to insufficient political support and critical gaps in financing and risk-sharing. To seize this strategic window, the urgently needed EU Geothermal Action Plan must be robust, comprehensive, and focused on catalyzing investment across the full spectrum of next-generation technologies.

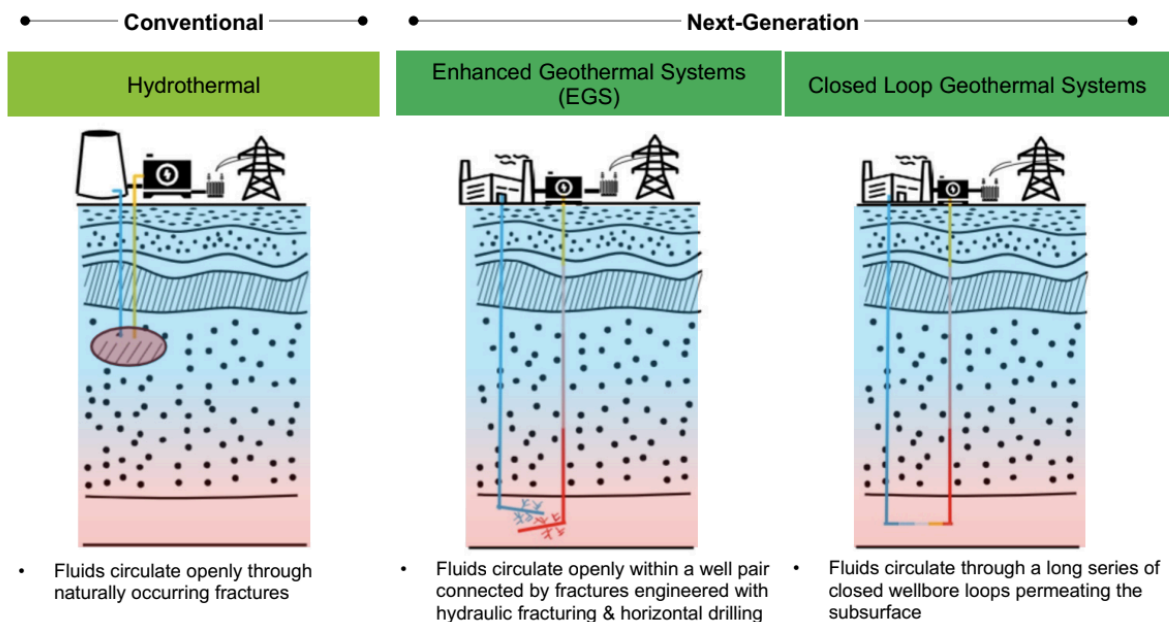
Call for Action: EU Geothermal Action Plan

To secure Europe's role in the geothermal revolution, the EU Geothermal Action Plan must be comprehensive, ambitious and focus on Next-Generation Geothermal. Within it the European Commission needs deliver on following:

1. **Announce a Dedicated EU Geothermal De-risking Facility:** Establish a clear and substantial funding envelope for early-stage exploration and drilling, including First of a Kind (FOAK) projects, potentially through grant-and-loan blending or an insurance/guarantee scheme implemented by the European Investment Bank (EIB). This is necessary to manage the multifaceted risk that is the primary bottleneck.
2. **Set Clear Technological Development Targets for Next-Generation Technologies:** The support should be linked to concrete targets on technology development. These include numerical targets on temperature, depth, or the exploration of enhanced/advanced geothermal techniques to incentivize development and provide an accountability mechanism.
3. **Strengthen the Geothermal Value Chain:** Support the investment in expanding the supply chain for high-temperature tools, materials, drilling services, and the

labor force to maximize value creation in Europe and reduce current gaps that make the Union less autonomous.

4. **Set Up Bankable Long-Term Revenue Frameworks:** Introduce mechanisms such as two-way Contracts for Difference (CfDs) Power Purchase Agreements (PPAs) specifically tailored to NGG. Specific support should go to facilitating risk mitigation in offtake contracts with chemicals and pulp and paper sectors that are particularly suitable as offtake partners for the heat.
5. **Simplify Permitting and Regulation:** Streamline complex permitting and administrative red tape, which can currently slow a project for up to a decade, by considering a dedicated geothermal permitting regime or guidance separating geothermal from minerals extraction. Improve share of and access to (subsurface) data across and within the Member States.
6. **Assemble an EU-level Stakeholder Alliance:** Create a broad alliance spanning industry both NGG technology companies and offtake sectors, public authorities, academia, and civil society to implement the Action Plan and ensure policy is grounded in real-world experience.
7. **Prioritize Environmental and Social Standards:** Ensure the Action Plan promotes the Principles for Responsible Geothermal Development, including early community engagement, fair labor practices, water protection, and establishing induced seismicity mitigation protocol.



Source: US DOE (2024): Pathways to Commercial Liftoff: Next-Generation Geothermal Power

Next-Generation Geothermal Competitive Advantage

Next-Generation Geothermal technologies — such as Enhanced Geothermal Systems (EGS) and Closed-Loop Geothermal Systems (CLGS) — dramatically expand the resource base beyond traditional regions, making geothermal a globally scalable source of baseload renewable electricity.

Benefit	Description
Energy Security & Independence	Provides domestic, renewable, baseload electricity and heat, reducing reliance on volatile fossil fuel imports, the "Achilles heel of Europe's energy system". Geothermal systems are largely underground and distributed, making them resilient to attack
Local and Renewable Electricity at Scale	Estimates by EMBER show potential to deliver approximately 301 TWh of electricity annually in the EU at costs below 100 €/MWh, equivalent to about 42% of 2025 EU coal- and gas-fired generation.
Local and Renewable Heat for Industry and buildings	Provides local, renewable and competitive large-scale sources of energy for heating and cooling. Instrumental in decarbonizing heating/cooling and industrial processes.
Lowering and stabilising energy costs	With advances in drilling technology, the EU could mimic the US target of LCOE for EGS of 45 EUR/MWh by 2035.
Grid Stability and Flexibility	Geothermal operates at a high capacity factor (over 75% globally in 2023) providing baseload electricity. Can also operate flexibly, acting as a "Geothermal Battery" to store surplus wind/solar power as underground heat, supporting the integration of variable renewables.
New Cleantech Industrial Ecosystem supporting traditional industries	Fostering EU scaleups in the NGG segment together with traditional expertise in turbine production for geothermal and drilling skills from oil and gas sectors will lead to development of a new cleantech industrial ecosystem that will provide affordable clean energy.

The Global Race: USA and China Advancing

The EU's early lead in geothermal innovation is shifting as other countries race to turn the progress into leadership and commercial success.

- **United States:** The U.S. is "moving ahead at full speed," deploying significant public funding and supporting first-of-a-kind (FOAK) projects to accelerate next-generation geothermal. The U.S. Department of Energy (DOE) is targeting a Levelized Cost of Electricity (LCOE) of **\$45/MWh by 2035** for EGS. Technology companies like Google and Meta are already deploying geothermal power for their data centers.
- **China:** China is "**massively scaling deployment**," often leveraging European expertise, and together with the U.S. and India, accounts for three-quarters of the global market potential for next-generation geothermal electricity.

Risk of Loss

Without rapid action and stronger policy support, Europe risks continued fossil dependence, loss of industrial leadership, and ceding the learning effects, supply-chain development, and cost reductions to other regions, increasing future costs for European projects .

Next-Generation Geothermal: Industrial and Clean Tech Potential

Next-generation geothermal systems build directly on the EU's existing expertise in drilling, reservoir management, heat-use including central heating systems and engineering in areas like turbine production. The oil and gas industry know-how is central to geothermal's prospects, as up to **80% of a geothermal project's investment** involves capacity and skills common in the oil and gas sector, providing an opportunity for a "clean-transition" workforce.

References

US Department of Energy (2024): Pathways to Commercial Liftoff: Next-Generation Geothermal Power

Ember (2026): Hot stuff: geothermal energy in Europe

IEA (2024): The Future of Geothermal Energy