

16 October 2020
Matchmaking session on EU funding opportunities

**ETIPs' input to the Horizon Europe
Work Programme 2021 - 2022**

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ETIP-DG

European Technology & Innovation
Platform on **Deep Geothermal**



Co-funded by the European Union's Horizon 2020 Research and Innovation Programme [GA. N. 773392]

Agenda

- The role of the European Technology and Innovation Platforms (ETIPs): Deep Geothermal and Renewable Heating and Cooling
- R&I priorities elaborated by ETIP DG
- R&I priorities elaborated by ETIP RHC

ETIP-DG Structure

STRUCTURE

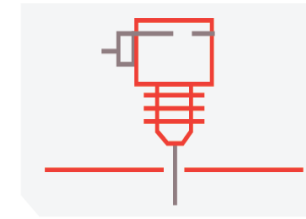


It brings together representatives from industry, academia, research centres, and sectoral associations, covering the entire deep geothermal energy exploration, production, and utilization value chain.

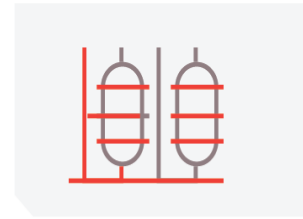
WORKING GROUP



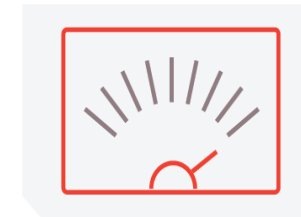
Exploration



Deep Drilling



Production technologies

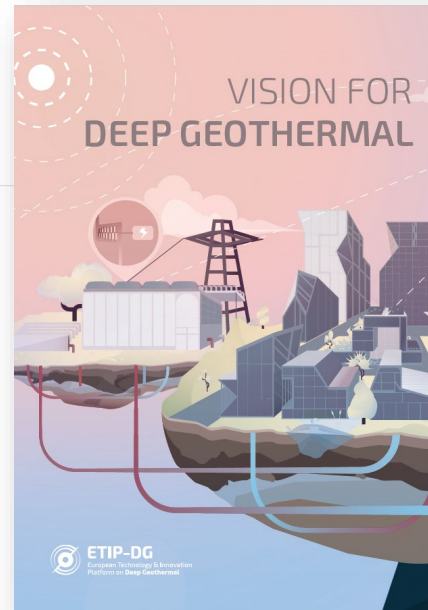


Surface systems



Non-Technical

Primary objectives of ETIP-DG



HORIZON EUROPE Programme

Pillar 1 Excellent Science

European Research Council

Marie Skłodowska-Curie
Actions

Research Infrastructures

Pillar 2 Global Challenges and European Industrial Competitiveness

- Clusters
- Health
 - Culture, Creativity and Inclusive Society
 - Civil Security for Society
 - Digital, Industry and Space
 - Climate, Energy and Mobility
 - Food, Bioeconomy, Natural Resources, Agriculture and Environment

Joint Research Centre

Pillar 3 Innovative Europe

European Innovation Council

European innovation
ecosystems

European Institute of
Innovation
and Technology

Widening Participation and Strengthening the European Research Area

Widening participation and spreading excellence

Reforming and Enhancing the European R&I system

HORIZON EUROPE Programme

Lessons Learned from Horizon 2020 Interim Evaluation



Support breakthrough innovation



Create more impact through mission-orientation and citizens' involvement



Strengthen international cooperation



Reinforce openness



Rationalise the funding landscape



Encourage participation



Key Novelties in Horizon Europe

European Innovation Council

R&I Missions

Extended association possibilities

Open science policy

New approach to Partnerships

Spreading Excellence

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic	Description
1	Efficient resource development
2	Closed loop, combined power, heating & cooling plants and integration in circular economy
3	Assessing deep geothermal resource potential
4	Enhancing flexibility and availability of geothermal plants, its energy use and system integration
5	Developing hybrid plants
6	New electronics and sensor systems to monitor and operate intelligent geothermal wells
7	Exploiting mineral production from geothermal sources
8	High temperature (>50°C) thermal energy storage, towards smart thermal grids
9	Improvement of processes, materials and equipment life time to reduce the impact of scaling and corrosion
10	Cutting edge geothermal resources with enhanced exploration and innovative development methods
11	Improving social welfare

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic 1 Efficient resource development

Scope: Increase the ability to optimally design and operate the whole geothermal system (reservoir, well field, powerplant) and heat and power distribution network, and improve the efficiency of geothermal power and CHP plants (TRL 5 to 9 until 2030).

Topic 2 Closed loop, combined power, H&C plants and integration in circular economy

Scope: Develop reliable, safe and cost-efficient technologies to improve the environmental performance of geothermal power and CHP systems over their entire lifecycle. This can be achieved via technologies which implement the total reinjection of the geothermal fluid including NCGs into the original reservoir and/or by developing technologies for the abatement of NCGs and/or capture for their sustainable use (TRL 4 to 9 until 2026)

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic 3 Assessing deep geothermal resource potential

Scope: Produce a comprehensive mapping and reporting of geothermal resources for different applications in Europe in 2025 (to be continuously updated)
Enhanced exploration methods: both for shallow (< 2km) and deep resources in different geological setting (magmatic/basement&sedimentary), and in urban areas, where conventional exploration is challenging due to logistic reasons.

Topic 4 Enhancing flexibility and availability of geothermal plants, its energy use and system integration

Scope: Demonstrate the technical and economic feasibility of responding to the grid operator's requests at any time is the primary objective. In the case of geothermal plants this includes the ability to increase or decrease output and ramp up and down.
Flexible power plants responding in less than 20 seconds (for power) / up to 2 hours (for heat) and optimisation in two to four existing plants.
(from TRL 5-6 to 8, 2020-2023 period) Fr

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic 5 Developing hybrid plants

Scope: to couple geothermal with other RES for power&heat generation and with storage facilities, notably by integrating thermoelectric energy storage with district heating networks and dedicated equipment (e.g. heat pumps, ORC turbo- expanders, and heat exchanger networks with hot and cold reservoirs able to cover variable demand for heat, cold and electricity). Development of hybrid plant equipment (combining geothermal with waste heat, biomass, etc; from TRL 5 to 7-8, 2023-2026)

Topic 6 New electronics and sensor systems to monitor and operate intelligent geothermal wells

Scope: Development of electronics and sensors to be used in high-temperature geothermal wells during drilling operations. This will lead to better control of the drilling process, reducing the risk of wellbore instability and lost-in-hole incidents. From TRL 5 to 7-8, 2025)

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic 7 Exploiting mineral production from geothermal sources

Scope: develop novel and potentially disruptive technological solutions that can help satisfy European needs for energy and strategic metals as well as other economical non-metallic materials in a single interlinked process. Technologies for metal extraction: (from TRL 4-5 in 2020-2023 period to 7-8 in 2023-2026 period)

Topic 8 High temperature ($>50^{\circ}\text{C}$) thermal energy storage, towards smart thermal grids

of underground thermal energy storage to cope with daily, weekly and seasonal variations in heat demand and handle available heat from the large number of industrial processes with excessive heat. Advanced technologies and components (from TRL 5 to 7-8) in 2020-2023 period. Optimisation of two to three new demonstration plants (from TRL 6 to 7-8 in 2023-2026 period)

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic 9
Improvement of processes, materials and equipment life time to reduce the impact of scaling and corrosion

Scope: to prolong the lifetime of geothermal wells, piping and equipment by making the materials used more resistant to the detrimental effects of temperature, fluid chemistry and flow.
Development of environmentally benign measures (TRL 6 – 8 by 2023, TRL 9 by 2026).
Development of materials for submersible pumps and tubing (TRL 5 – 7 by 2023, TRL 8 – 9 by 2026).
Development of eco-friendly drilling fluids stable under high-temperature and high-pressure (TRL 4 – 5 by 2023, TRL 6 – 7 by 2026, TRL 8 – 9 by 2030).

Topic 10
Cutting edge geothermal resources with enhanced exploration and innovative development methods

Scope: Develop advanced methods and technologies for cost-effective exploration and exploitation of Enhanced Geothermal Systems (EGS), super-hot and deep resources, offshore systems abandoned mines and exhausted water, and oil and gas wells. From TRL 3 to TRL 6 in 2025- 2030 period.

ETIP-DG PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic 11 Improving social welfare

In order to move from R&I to deployment, a series of non-technical barriers for deep geothermal must be removed. 9 key topics have been identified:

- a) Setting the right Policies
- b) Engaging with the public and other stakeholders
- c) Reinforcing competitiveness
- d) Establishing Financial Risk Management schemes
- e) Geothermal deployment support schemes
- f) Establishing a legal and regulatory framework
- g) Embedding geothermal energy into the circular economy
- h) Harmonised protocols for defining the environmental and health impacts of geothermal energy and mitigation planning
- i) Human deployment

About RHC ETIP



Latest publications:



RHC ETIP PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Topic	Description
1	Cost efficient closed loop technology solutions with enhanced material and ground coupling solutions
2	Cost efficient closed loop technology solutions: new generation robotized drilling and closed loop installation solutions
3	New generation of Underground thermal storage systems (UTES): subsurface system development and planning
4	High-temperature UTES systems: integration with DH systems, building and industrial environments
5	Geothermal Resource Management in Cities and for Industry: detailed integration of geothermal energy in the Local Energy Transition urban planning concepts
6	Geothermal Resource Management in Cities: best practices and European templates for integration of Geothermal into the long-term Climate Action plans of Cities and Communities
7	Smart sector integration with geothermal
8	Innovative Geothermal System for the Renovation Waves
9	Improved and eco-friendly geothermal for circular economy
10	Geothermal Green Bonds
11	Improving the regulatory, training & building integration landscape for Shallow Geothermal

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Cost efficient closed loop technology solutions with enhanced material and ground coupling solutions

Scope: Development of cost-efficient solutions to increase the conductivity and thermal capacity of the underground in the vicinity of borehole heat exchangers with environmentally acceptable and stable solutions (TRL 4-5 to TRL 8-9 (to be presented in years 2021-2022))

Cost efficient closed loop technology solutions: new generation robotized drilling and closed loop installation solutions

Scope: Develop fully robotized/automatized drilling solutions for shallow and deeper borehole applications. New drilling equipment should also reduce emission in urban areas with hybrid or full electric drill rigs. (TRL 4 to 9 until 2026)

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New generation of Underground thermal storage systems (UTES): subsurface system development and planning

Scope: to develop technologies for successful application of storage and recovery of heat in aquifers, for large scale seasonal buffering of heat as well as advanced concepts to store H&C based on the use of Borehole Thermal Storage. The scope is to go beyond the 40°C storage temperature limit, facing the complications, which arise with density and water quality issues in these higher temperature conditions (TRL 4 to 9 until 2022)

High-temperature UTES systems: integration with DH systems, building and industrial environments

Scope: to further develop and demonstrate technologies for successful application of storage and recovery of heat in aquifers, for large scale seasonal buffering of heat as well as other applications for heating and cooling storage in mixed climate scenarios. The focus here is on demonstration taking into account the DH network and surface system, control, water management and quality issues as well as the connection to the GSHP or heat exchange systems interfacing with the demand. (TRL 6 to 9 until 2022)

RHC ETIP PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Geothermal Resource Management in Cities and for Industry: detailed integration of geothermal energy in the Local Energy Transition urban planning concepts

Scope: Identify design methods and organizational concepts that result in the most effective and sustainable use of subsurface space by geothermal H&C systems and UTES systems in dense urban areas (TRL 6 to 9 (by 2022))

Geothermal Resource Management in Cities: best practices and European templates for integration of Geothermal into the long-term Climate Action plans of Cities and Communities

Scope to provide:

- planning tool for optimisation of the use of shallow geothermal energy
- tools for an accurate assessment of GHG Emissions reductions in comparison with alternative fossil based technologies for H&C
- Identify best practices strategies for subsurface land-use plans in European cities. (From TRL 6 to TRL 9)

RHC ETIP PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Smart sector integration with geothermal

Topics included, but not limited:

- modelling on decarbonisation of the heat sector, buildings and industry;
- integrate deep geothermal heat to agri-food production and industrial process;
- optimise the production of geothermal energy together with minerals extraction etc.

Innovative Geothermal System for the Renovation Waves

Topics included, but not limited:

- optimizing the performance of geothermal systems by the integration of subsurface models into building energy models;
- creating synergies between different subsurface users responding to dynamic demand patterns of the built environment;
- combined (hybrid) models for all available renewable energies including geothermal systems.

RHC ETIP PRIORITIES FOR HORIZON EUROPE WP 2021-2023

Improved and eco-friendly geothermal for circular economy

Topics included, but not limited:

- Developing new business models
- Performing R&I to develop new technologies for waste and water management
- Develop innovative greener geothermal products, components and systems, transitioning to the use of sustainable materials

Geothermal Green Bonds

Scope: produce guidelines for producing innovative geothermal green bonds that would be applicable for EU projects and neighbouring countries. Increase in the total number of geothermal green bond projects.

Improving the regulatory, training & building integration landscape for Shallow Geothermal

The objective of the topic is to align geothermal technology and drilling innovations (closed loop & hybrid collectors, new material and compounds, new drilling and installation methodologies) with environmental legislation and drilling regulations by demonstrating applicability across different legislative frameworks.