



SHAPING EUROPE'S ENERGY FUTURE  
#EUSEW19

**Geothermal Energy: Meeting Financial and Technical Challenges**

Bruxelles, 19 June 2019

# Deep Geothermal Technology Roadmap

*Fausto Batini*  
Chairman



**ETIP-DG**

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

[www.etip-dg.eu](http://www.etip-dg.eu)



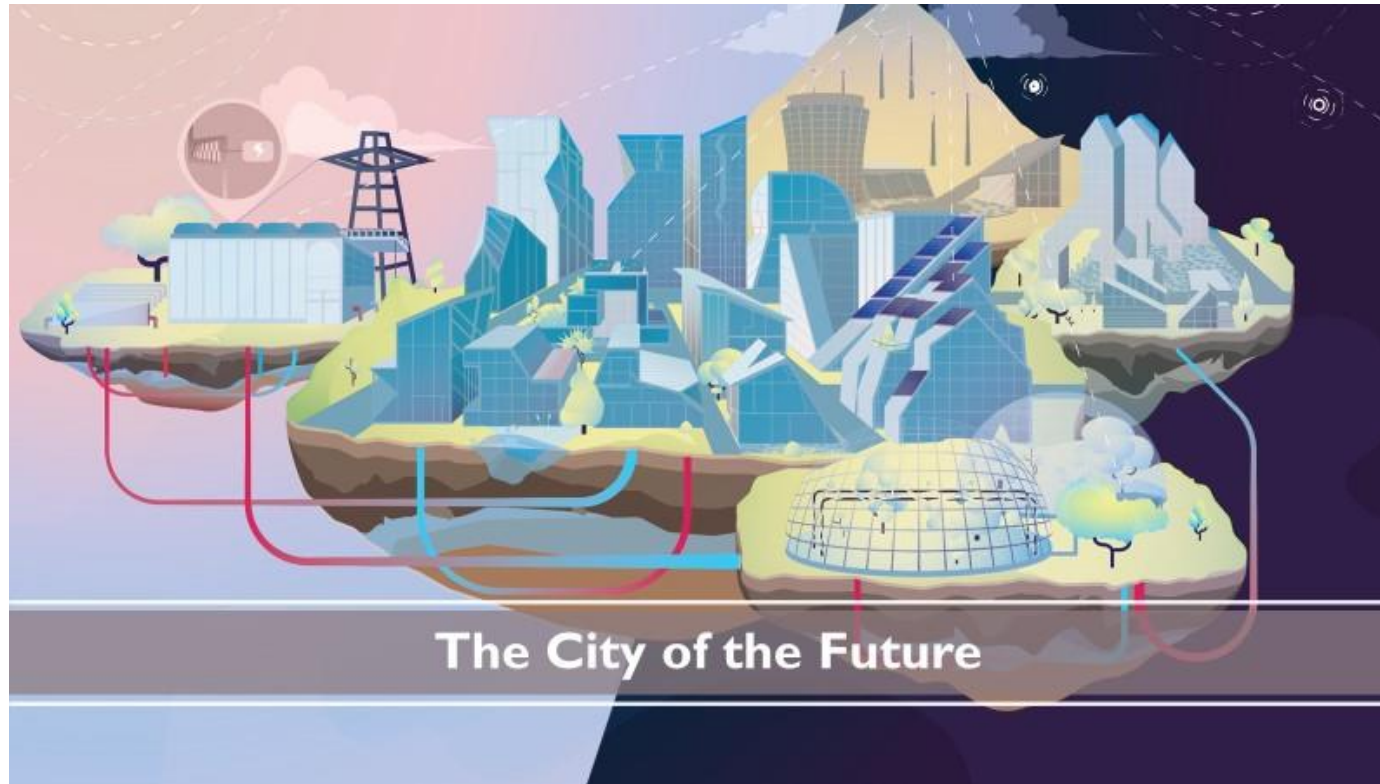
Co-funded by the European Union's Horizon 2020 Research and Innovation Programme [GA. N. 773392]

# ETIP\_DG: European Technology & Innovation Platform on Deep Geothermal

- The **European Technology & Innovation Platform on Deep Geothermal (ETIP-DG)** is an open stakeholder group, endorsed by the European Commission under the Strategic Energy Technology Plan (SET-Plan)
- The overarching objective is to enable deep geothermal technology to proliferate and reach its full potential everywhere in Europe, achieving the overall cost reduction, including social, environmental, and technological costs.
- The Platform was launched in March 2016 during a Geothermal Forum of stakeholders, including large companies, SMEs, academia and research institutions.
- Terms of Reference (ToR) to establish the governance and procedures of the ETIP-DG were adopted in June 2016. The European Commission, DG RTD, officially recognized it as an ETIP in July 2016.
- The European Technology and Innovation Platforms (ETIPs) have been recognised by the European Commission as a tool to strengthen cooperation with Stakeholders under the Strategic Energy Technology Plan (SET-Plan), as part of the H2020 programme.
- The ETIP-GT will liaise with the European Technology and Innovation **Platform on Renewable Heating and Cooling (RHC-Platform)**, officially launched in 2010.

# ETIP\_DG : THE VISION

Promotion of the research and innovation in the Deep Geothermal sector to contribute to the **City of the Future**, where a combination of renewable energy sources are integrated into the system



**Domestic heat and electrical power demand** in Europe can be significantly **covered by geothermal energy** taking the advantage by the flexibility of production.

# ETIP-DG : THE MISSION

Implementation of the Strategic Research Agenda (SRA) to enable the geothermal technologies to :

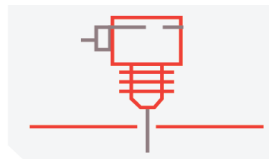
- **unlock new geothermal resources** as an affordable, sustainable and secure energy source in large areas of European countries
- **achieve a significant reduction of the development and O&M costs** of the geothermal projects by improving the performance of technologies and developing new concepts and processes for energy conversion
- **increase the social acceptance** of the geothermal energy, improving the quality of life of the local Community
- **strengthen the European geothermal leadership** in the industry sector continuing to export know-how and technologies worldwide.

# ETIP-DG: THE ORGANIZATION

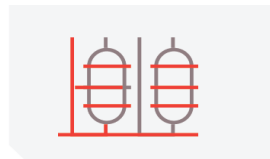
## STRUCTURE



Exploration



Deep Drilling



Production technologies



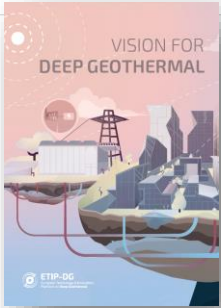
Surface systems



Non-Technical

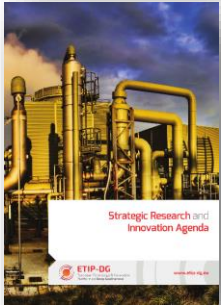
ETIP\_DG brings together representatives of industry, academia, research centres, and sectoral associations, covering the entire deep geothermal energy sector value chain.

# ETIP\_DG – MAIN ACHIEVEMENTS



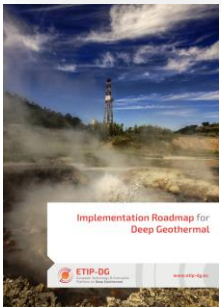
- VISION FOR DEEP GEOTHERMAL (January 2019 - March 2019)

- ✓ Open consultation process with the Stakeholders
- ✓ Publication



- STRATEGIC RESEARCH AGENDA (March 2019 - April 2019)

- ✓ Data collection and discussion about RD&I priorities with TWG.
- ✓ Drafting with the contribution of ETIP\_DG WG
- ✓ Publication



- ROAD MAP (May-June 2019).

- ✓ SC prepare a list of topics to be included in the Roadmap.
- ✓ Questionnaire for definition of the priorities
- ✓ validation during the ETIP\_DG Annual Conference

- Publication

# ETIP\_DG: THE ROAD MAP

This Implementation Roadmap on Deep Geothermal identifies a path forward, developing highly-performant, cost-effective, and sustainable deep geothermal technologies that can expand the production of electricity, heating and cooling while reinforcing EU industrial capacity and leadership in the sector.

R&I priorities, targets and KPIs were defined for unlocking geothermal energy and improving social welfare:

## Technical priorities

1. Prediction and assessment of geothermal resources
2. Efficient Resource access and development
3. Deployment of Heat and Electricity generation and system integration

## Non technical priorities

1. From R&I to deployment and market uptake
2. Knowledge sharing

**Next generation technologies** (addressing long-term concepts and applications today at TRL 1-2 to progress to TRL 3-4 by 2030).

# ETIP\_DG ROAD MAP : TECHNICAL PRIORITIES

## Prediction and assessment of geothermal resources

PA-1: Assessing Deep Geothermal resource potential

PA-2: Improved exploration prior to, during and after drilling

PA-3: Exploration workflows and catalogues

PA-4: Cutting edge geothermal resources

## Efficient resource access and development

PD-1: Total reinjection and greener power plants

PD-2: Reduce the impact of scaling & corrosion and improve equipment lifetime

PD-3: Efficient resource development

PD-4: Effective and rapid penetration rate technology to access the resource

PD-5: New electronics to monitor and operate geothermal well

## Deploy Heat and electricity generation and system integration

PS-1: Developments in turbines

PS-2: Flexible production of heat and power and integration for smart grids

PS-3: High-Temperature Thermal Energy Storage (HT-TES)

PS-4: Developing hybrid plants and Exploiting mineral production



# ETIP\_DG ROAD MAP : NEXT GENERATION TECHNOLOGIES

- The next generation of technologies shall bring the geothermal energy beyond of the state of art through :
  - advanced energy conversion processes and innovative systems,
  - Innovative concepts for energy uses
  - new approaches for more effective commercialisation,
  - higher environmental performance reducing impact and lowering greenhouse gases emissions
- This groundwork shall address long-term applications and stimulate breakthrough possibilities with concept today at TRL 1-2 to progress to TRL 3-4 by 2030.

# ETIP\_DG ROAD MAP : NON TECHNICAL PRIORITIES

- **Shift from R&I to deployment:**
  - Proposition of regulatory, financial, political and social solutions to boost ing the deployment of innovation in the sector,
  - Rise the market uptake all over Europe, creating jobs
  - Reinforcing technological leadership to cultivate significant export opportunities.
- **Knowledge sharing:**
  - Establishing an open-access policy to geothermal information (including standard exchange formats) to ensure easy access to data and information,
  - Launch a pan-European hub of scientific excellence and research infrastructures.

# ETIP\_DG ROAD MAP : IMPLEMENTATION PLAN AND BUDGET

PRIORITIES	2020-2023	2023-2026	2026-2030	Budget (estimated)
<b>Prediction and assessment of geothermal resources</b>				
PA-1: Assessing Deep Geothermal resource potential	■			€ 400.000.000
PA-2: Improved exploration prior to, during and after drilling	■			€ 50.000.000
PA-3: Exploration workflows and catalogues		■		€ 50.000.000
PA-4: Cutting edge geothermal resources		■	■	€ 50.000.000
<b>Efficient resource access and development</b>				
PD-1: Total reinjection and greener power plants	■			€ 125.000.000
PD-2 Reduce the impact of scaling & corrosion and improve equipment and component lifetime	■	■		€ 75.000.000
PD-3: Efficient resource development	■	■		€ 200.000.000
PD-4: Improved rate of penetration technology to access the resource	■	■		€ 140.000.000
PD-5: New electronics to monitor and operate geothermal well		■	■	€ 60.000.000
<b>Deploy Heat and electricity generation and system integration</b>				
PS-1: Developments in turbines	■			€ 100.000.000,00
PS-2: Flexible production of heat and power and integration for smart grids	■	■		€ 140.000.000,00
PS-3: High-Temperature Underground Thermal Energy Storage		■		€ 70.000.000,00
PS-4: Developing hybrid plants and Exploiting mineral production from geothermal sources		■	■	€ 180.000.000,00
Next generation of technologies	■	■	■	€ 120.000.000,00
<b>Non technical priorities</b>				
From R&I to deployment	■	■	■	€ 40.000.000
Knowledge Sharing	■	■	■	€ 40.000.000
			<b>TOTAL BUDGET</b>	<b>€ 1.840.000.000</b>

# IMPLEMENTATION OF THE ROAD MAP – MAIN CHALLENGES

- The **competitiveness of the geothermal energy** in Europe in 2030 is definitely linked to the ability of the whole geothermal sector to successfully implement this road map, according to the targets set by SET-Plan Declaration:
  - **15 €ct/kWh for electricity and 6 €ct/kWh for heat by 2023**
  - **10 €ct/kWh for electricity and 5 €ct/kWh for heat by 2026.**

These cost targets hold for all types of deep geothermal projects, including EGS and very high geothermal systems (> 350°C).
- However **some barriers** (i.e. regulatory, financial, ...) to develop geothermal power projects in Europe still persist and need to be overcome through the public support at the beginning of geothermal development. The setting of a favorable frame is also required to ensure security for investment in deep geothermal.
- Three **key success factors** are essential in the different stages of basic research, development, demonstration, deployment, and commercial market uptake.
  - **Visionary approach to innovation**
  - **Coordinated actions and synergy among the different actors**
  - **Financial support through public funding and economic incentive**

**THANKS  
FOR YOUR  
ATTENTION**



The sole responsibility of this publication lies with the author. The European Union is not responsible for any use that may be made of the information contained therein. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [773392 — DG ETIP]