

# The R&I frontiers as envisaged by the European Technology & Innovation Platform on Deep Geothermal

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**ETIP-DG**

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

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



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# ETIP-DG European Technology&Innovation Platform on Deep Geothermal

The development of low carbon technologies is a key part of the EU strategy.

Geothermal energy, and its generation of electricity, heating and cooling, can contribute to the local, regional and global energy transition toward reliable, clean and affordable energy sources.

To speed up the development and deployment of low-carbon technologies, including geothermal energy, and to strengthen the cooperation with Stakeholders under the Strategic Energy Technology Plan (SET-Plan), the European Commission has introduced Technology and Innovation Platforms (ETIPs).

# ETIP-DG European Technology&Innovation Platform on Deep Geothermal

ETIPs are crucial to the SET Plan because:

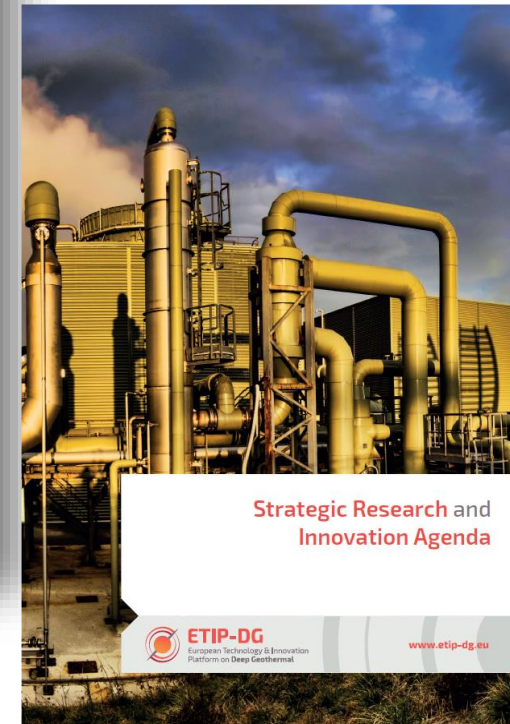
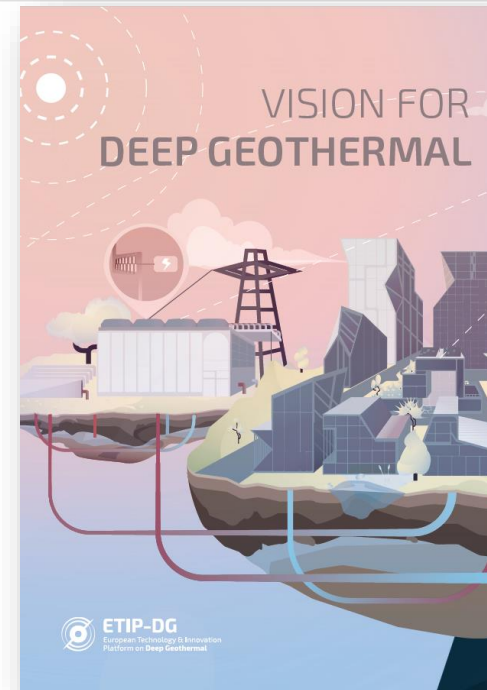
- They support the identification of
  - Additional R&I activities needed to reach the targets (Max. 10 per Implementation Plan)
  - Ongoing R&I activities (When clearly contributing to the targets, ongoing activities (national / EU / industry) need to be identified)
  - Non-technological barriers and enablers
  - Monitoring mechanisms
- Cover the whole innovation chain
- Mobilise the relevant stakeholders

# ETIP-DG objectives as contribution to RI&D

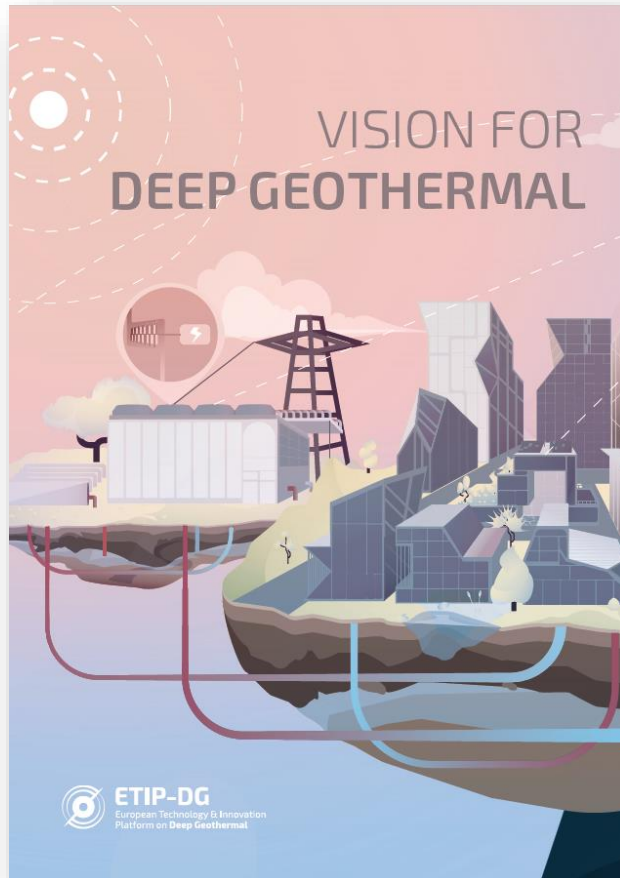
Develop and implement research pathways towards successful deployment of geothermal technologies

- Set the main targets in the **Vision for Deep Geothermal**
- Define R&D topics in the **Strategic Research and Innovation Agenda (SRIA)**
- Plan implementation of priorities in the **Technology Roadmap**, drawing support from a range of financial sources (not only Horizon Europe)

# Primary objectives of ETIP-DG



# About the Vision



This VISION looks toward **the future of Deep Geothermal energy development** by 2030, 2040, 2050 and beyond, and highlights the great potential of untapped geothermal resources across Europe. After an **Introduction & Overview** the document briefly describes the **Actual Status of geothermal development** and the VISION's aim for

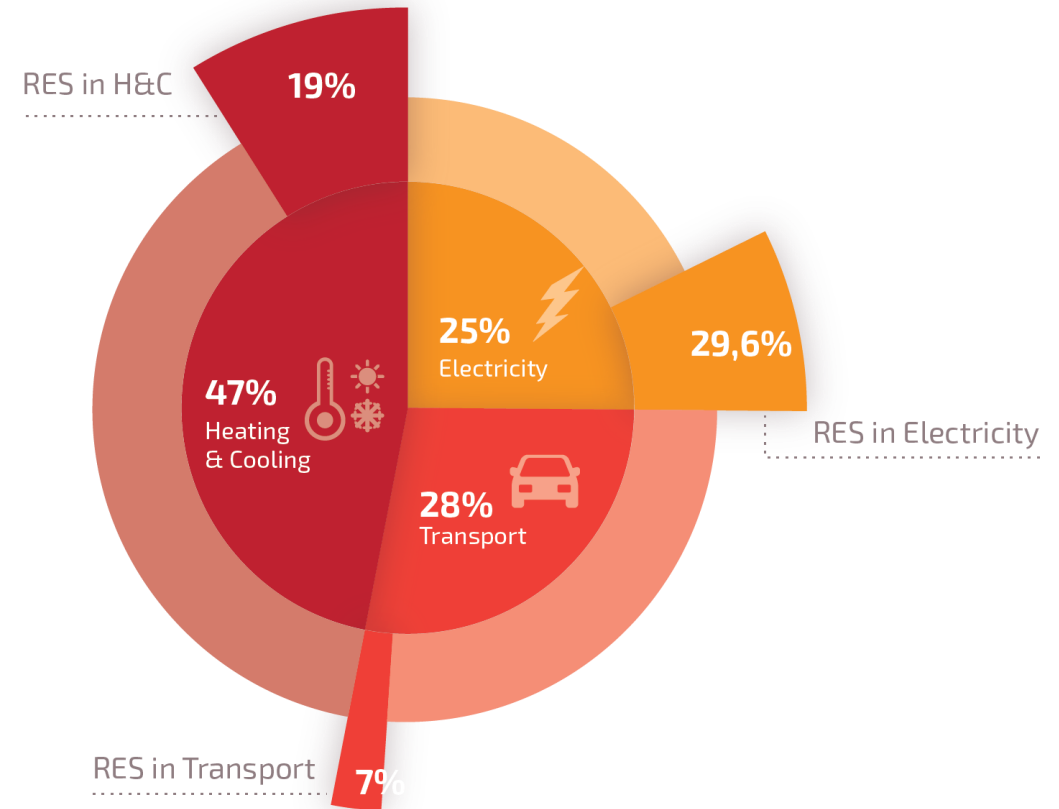
- > **Unlocking geothermal energy**
- > **Increasing the Social welfare in Europe**
- > **Novel technologies for full and responsible deployment of geothermal potential**

# Rising to the Vision

Our VISION is to cover

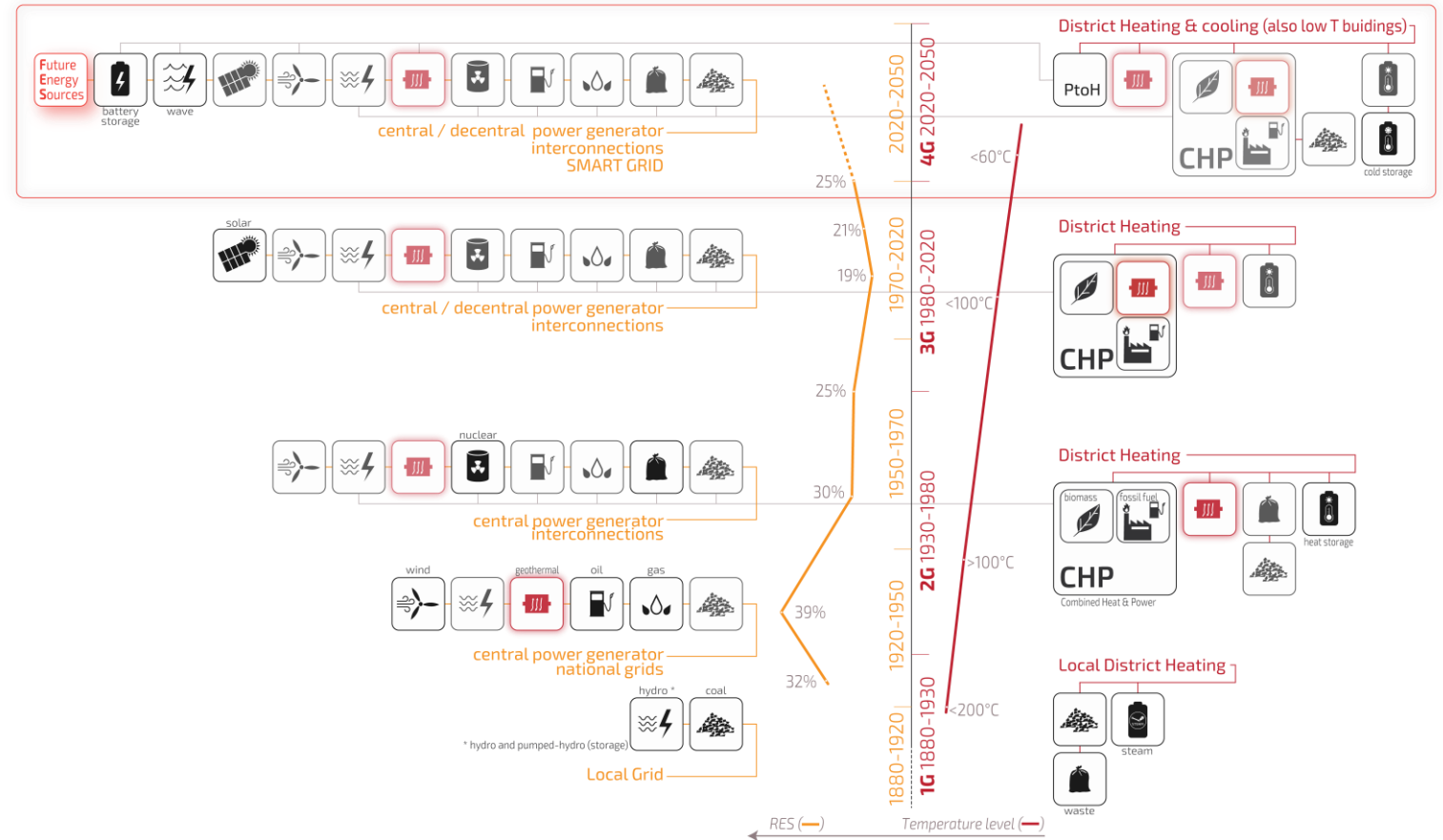
- > A significant part of **domestic heat demand** and
- > a large part of **electrical power demand** in Europe by geothermal energy.

This includes taking the maximum advantage offered by the flexibility of geothermal production, providing large **centralized** as well as domestic and **decentralized** small scale options.



# Unlocking Geothermal Energy: Heat development

- > Operative temperatures of the DHC network can be reduced
- > By demand site management or by thermal energy storage it will be possible to balance heat demand and supply in a DH network.
- > Cascade applications
- > CHP



Evolution of power generation and district heating



# Unlocking Geothermal Energy: Power development

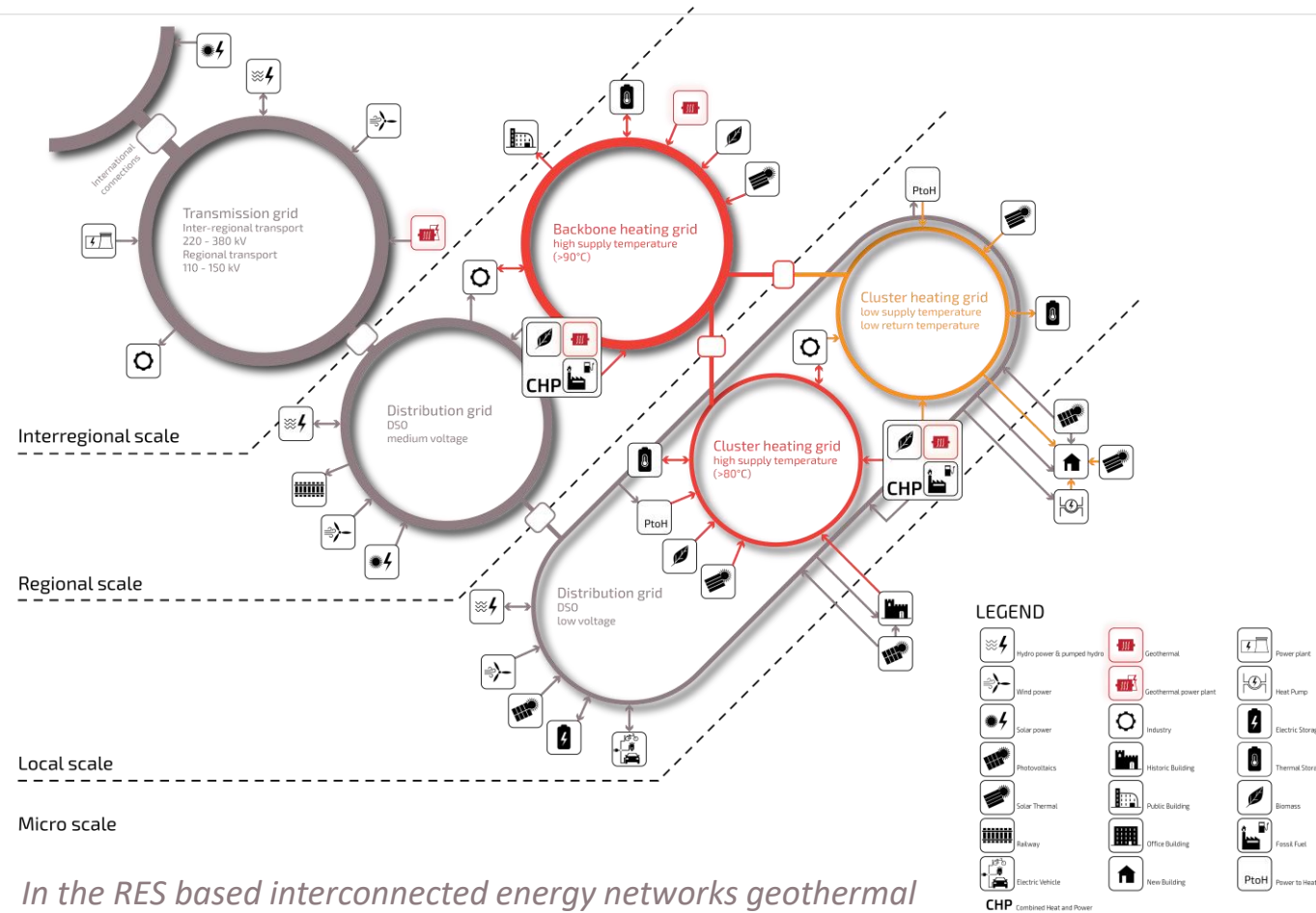


*Combined biomass and geothermal plant in Cornia, Italy*

- > Improved efficiency, optimization of material, processes, cycle design
- > Hybrid, proper combination
- > Cutting edge technologies for any kind of resource (super-hot, off-shore, geopressurized) and any place (from remote islands to urban areas)

# Unlocking Geothermal Energy: Combined production

- > Coupling renewable heat and electricity sectors and markets for an optimal use of geothermal energy
- > Consumer-producer-prosumer perspectives
- > Thermal storage to help balance and to optimize production
- > Cascade, hybrid, synergy (e.g. geothermal-algae-biofuels-transport)



*In the RES based interconnected energy networks geothermal and underground thermal storage play an important role*



# The City of the Future



# Increasing social welfare in Europe

- > Achieve lower **environmental footprint**
- > Create **wealth**
- > Strengthen **dissemination, education and outreach**
- > Guarantee **protection and empowerment** of customers



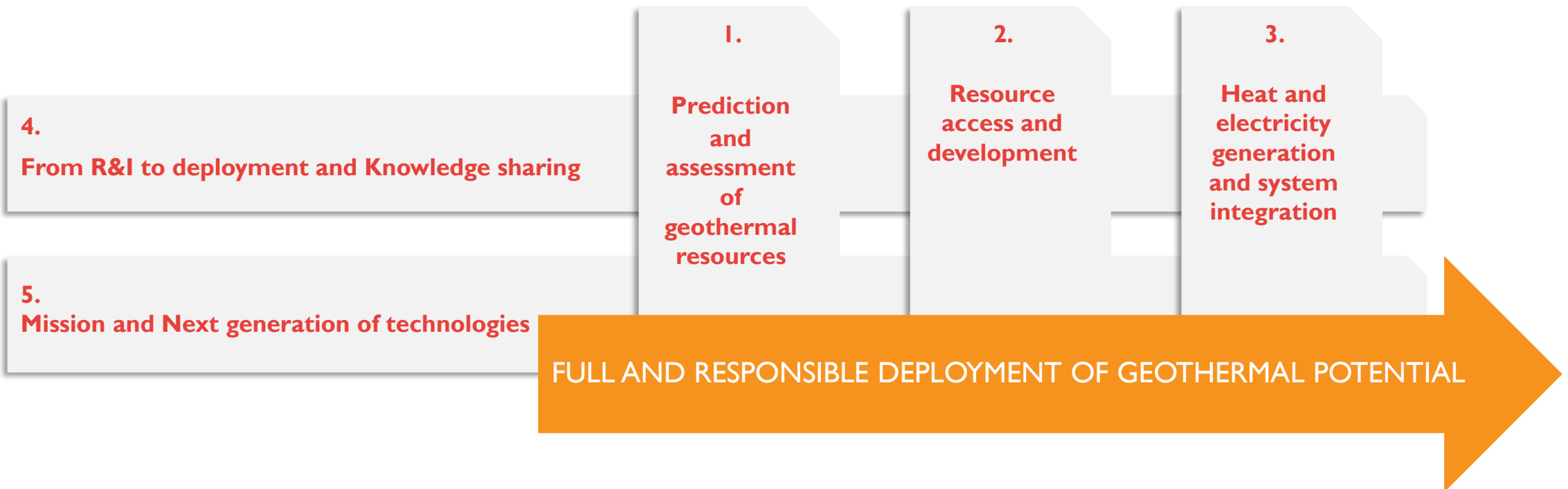
## Role of geological science in the energy transition

- It is immense in the geothermal sector, since it provides the where and why of geothermal resources, and the how for a sustainable management
- Geological science provide data in every phase of a geothermal project: exploration and investigation, well design and drilling, monitoring of subsurface changes due to production and injection for sustainable management, monitor and mitigation of environmental impacts and risks
- It is not straightforward: various challenges
  - The technical challenge is to create the systems and technologies that will streamline and optimise a sophisticated and complex workflow.
  - The logistical and organisational challenge is to create the units and the processes within the geothermal community.

# Novel technologies for full and responsible deployment of geothermal potential

> Technologies beyond H2020

> While targeting the EU long-term goal of **reducing costs** and **increase performance** of geothermal technologies and installations, RD&I pursue all opportunities for complete deployment of geothermal resources, aiming at various advancements





**A. Prediction and assessment of  
geothermal resources**

**B. Resource Access and  
Development**

**C. Heat and electricity generation  
and system integration**

**D. From R&I to Deployment**

**E. Knowledge Sharing**



# Prediction and assessment of geothermal resources

## Targets

- Improve accuracy and reliability and reduce the cost of survey-based and down-hole exploration technologies
- Improve analytical models and energy production forecasting and increase imaging capacity while characterising underground geological, physical and chemical properties throughout the life of geothermal projects
- Minimise the uncertainty associated with geothermal energy by increasing the probability of discovering productive (i.e. fluid-filled) fractures and faults to be used as drilling targets
- Improve resource and uncertainty reporting protocols, contributing to transparent and harmonised methods and instruments for technical and financial risk management, increased transparency for stakeholders, better assessment of energy stocks across Europe, and direct comparisons with other RES projects
- Investigate and characterise unconventional geothermal resources



# Resource access and development: topics

- Advancement towards robot drilling technologies
- Rapid penetration rate technologies
- Green drilling fluids
- Reliable materials for casing and cementing
- Monitoring and logging while drilling (incl. 'looking ahead' of the bit)
- High-temperature electronics for geothermal wells
- Effective and safe technologies for enhancing energy extraction
- Total reinjection and greener power plants
- Reducing corrosion and scaling and optimising equipment and component lifetime
- Efficient resource development
- Enhanced production pumps

# Heat and electricity generation and system int.: topics

- Advanced binary plants
- Innovative design and integration of binary cycle technology into new and existing flash plants
- High-temperature binary power plants
- Power cycles and mitigation for super high-temperature resources, high-enthalpy steam direct expansion
- Flexible production of heat and power
- High-Temperature Thermal Energy Storage (HT-TES)
- Developing hybrid plants
- Exploiting mineral production from geothermal sources
- Generating at different voltages for smart grids

# From R&I to Deployment: topics

- Set the right policies
- Public and other stakeholders' engagement
- Reinforce competitiveness
- Establish Financial Risk Management schemes
- Support schemes to deploy geothermal
- Establish legal and regulatory framework
- Embedding geothermal energy in the circular economy
- Harmonised protocols for defining environmental and health impacts of geothermal energy and mitigation planning
- Human deployment

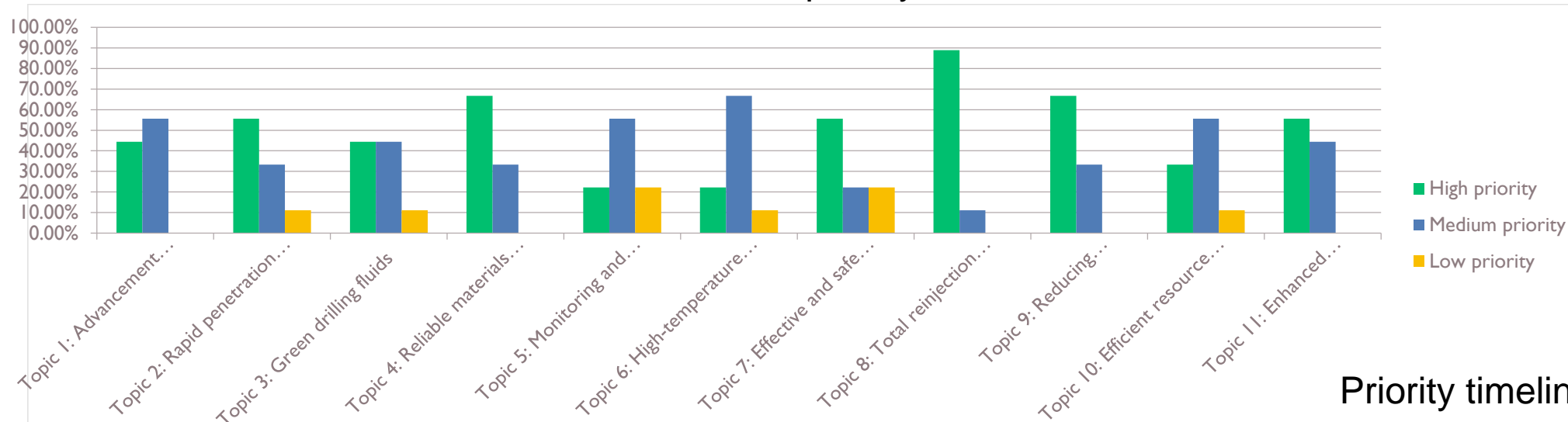
# Knowledge sharing: topics

- Sharing underground data - unlocking existing subsurface information
- Organising and sharing geothermal information
- Shared research infrastructures

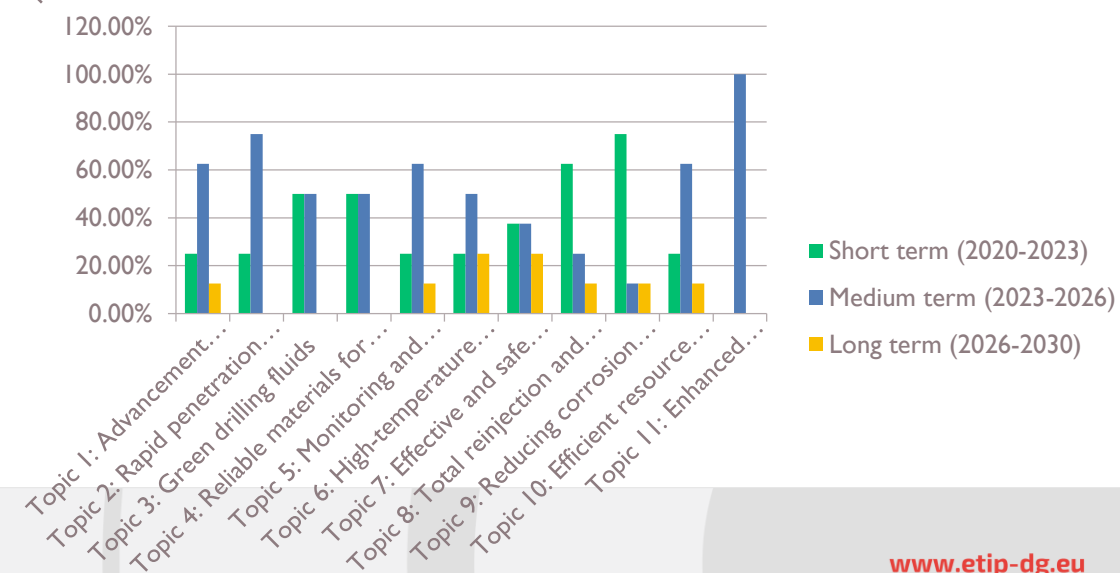
Toward the Roadmap

# Priorities for RESOURCE ACCESS AND DEVELOPMENT

## Level of priority



## Priority timeline



*Thank you  
for your k*

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The screenshot displays the ETIP-DG website interface. At the top left is the ETIP-DG logo with the text "European Technology & Innovation Platform on Deep Geothermal". To the right is a navigation bar with links: ABOUT, LIBRARY, MEETINGS & EVENTS, NEWS, GEOTHERMAL SEARCH ENGINE, and GET INVOLVED. Below the navigation bar is a large banner image showing a network of lines. On the right side of the banner is a "FILTER DOCUMENTS BY" dropdown menu currently set to "All Dates". Below the banner are two news articles. The first article, dated 18 April 2019, is titled "STRATEGIC RESEARCH AND INNOVATION AGENDA FOR DEEP GEOTHERMAL" and features a thumbnail image of industrial equipment. The second article, dated 15 April 2019, is titled "THE ENERGY FUTURE WE IMAGINE IS SOLIDLY GROUNDED ON GEOTHERMAL ENERGY" and features a thumbnail image of a city skyline with green energy symbols. Both articles have a three-dot menu icon at the bottom right.



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