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

Terms of Reference

Table of Contents

1. The EU energy and climate policy agenda

The European Commission launched its "**Framework strategy for a resilient Energy Union** with a forward-looking climate change policy" in early 2015. The strategy is being built around five pillars which are the following:

a) Energy security, solidarity, and trust;

b) A fully integrated European energy market;

c) Energy efficiency contributing to moderation of demand;

d) Decarbonising the economy;

e) Research, innovation and competitiveness.

The first **State of the Energy Union** statement was released in November 2015. It reiterates the Commission's commitment to a decarbonised energy system and sets milestones for the future of the Energy Union. Renewable energy (for electricity, heating & cooling, and transport) is a transversal element of the Energy Union. In particular, the role of renewables in energy security and energy efficiency is critical to reach a sustainable, competitive and secure energy system in Europe.

Research, development, and innovation will be much needed to develop renewable technologies, accompanied by market uptake measures. The objective is to develop competitive sources of energy for consumers and industry. The Horizon 2020 and national R&D national programmes will be crucial to reach this goal.

For the Energy Union, more regional cooperation between Member States and other levels of governance is being promoted. Each EU Member State should report its contribution to the implementation of the **Set-Plan Integrated Roadmap** in its new national climate and energy plan.

Deep geothermal energy is considered a key Renewable Energy Source (RES) to implement the EU 2020-2050 Strategy (section 1.1), and is recognised as a promising technology with large innovation potential in the European Commission's SET-Plan and its Integrated Roadmap (section 1.2). This warrants the need for the creation of an ETIP on Deep Geothermal (ETIP-DG) with a program to scale-up the power output as deep geothermal is one of the few renewables that can provide base load power for both electricity and heat.

1.1 The EU climate and energy Strategy for 2020, 2030 and 2050

By 2020, the EU aims to reduce its greenhouse gas emissions by at least 20%, increase the share of renewable energy to at least 20% of consumption, and achieve energy savings of 20% or more compared to the levels in 1990.

EU countries have agreed on a new 2030 Framework for Climate and Energy, including EU-wide targets and policy objectives for the period between 2020 and 2030. These targets

aim to help the EU achieve a more competitive, secure and sustainable energy system and to meet its long-term 2050 greenhouse gas reductions target. Targets for 2030 are:

- a 40% cut in greenhouse gas emissions compared to 1990 levels
- at least a 27% share of renewable energy consumption
- at least 27% energy savings compared with the business-as-usual scenario

The EU has set itself a long-term goal of reducing greenhouse gas emissions by 80-95% when compared to 1990 levels by 2050. The Energy Roadmap 2050 explores the transition of the energy system in ways that would be compatible with this greenhouse gas reduction target while also increasing competitiveness and security of supply. To achieve these goals, significant investments need to be made in new low-carbon technologies, renewable energy, energy efficiency and grid infrastructure. Because investments are made for a period of 20 to 60 years, policies that promote a stable business climate which encourages low-carbon investments must begin to be made today.

Geothermal potential and perspectives

As assessed in the GeoElec and GeoDH projects, potential for deep geothermal is huge. The GeoElec European maps shows the geological potential (heat in place) and the.technical potential for electricity generation, while the GeoDH map (http://geodh.eu/geodh-map/) underlines how new GeoDH systems can be built in many regions of Europe at competitive costs.

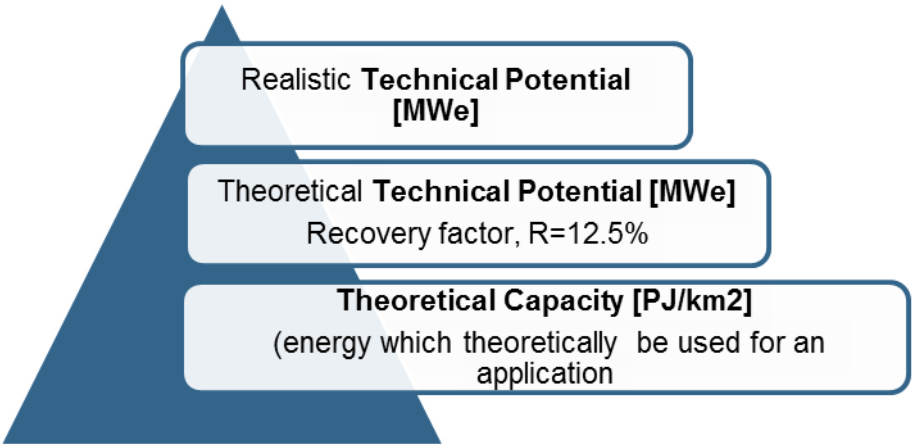


Figure 1 Resource assessment methodology for geothermal power (Source: http://www.geoelec.eu/)

In the GeoElec assessment, the geological potential (heat in place) is translated to an economical potential, using a Levelised Cost of Energy (LCoE) value of less than 150 €/MWh for the 2030 scenario and less than 100 €/MWh for the 2050 scenario:

- **The production of geothermal electricity in the EU in 2013 was 6 TWh**
- **The NREAPs forecast a production in the EU-28 of ca. 11 TWh in 2020**
- **The total European geothermal electricity potential in 2030 is 174 TWh**
- **The economic potential grows to more than 4000 TWh in 2050**

Role of ETIP-DG in the EU climate and energy Strategy for 2020, 2030 and 2050

ETIP-DG has a key role to play in supporting the EU 2020/2030/2050 renewable energy and climate objectives. European Technology and Innovation Platforms have indeed been

recognised as essential instruments for energy security, the political and operational implementation of the EU policy objectives. ETIP-DG can contribute to both the environmental and economic objectives of the Strategy: it would support the development of new renewable power sources while promoting a promising industrial sector in Europe and worldwide. The knowhow gained can be relayed to countries with high density of population, such as India & China, to help them address the climate change issue.

Key EU legislation for geothermal energy

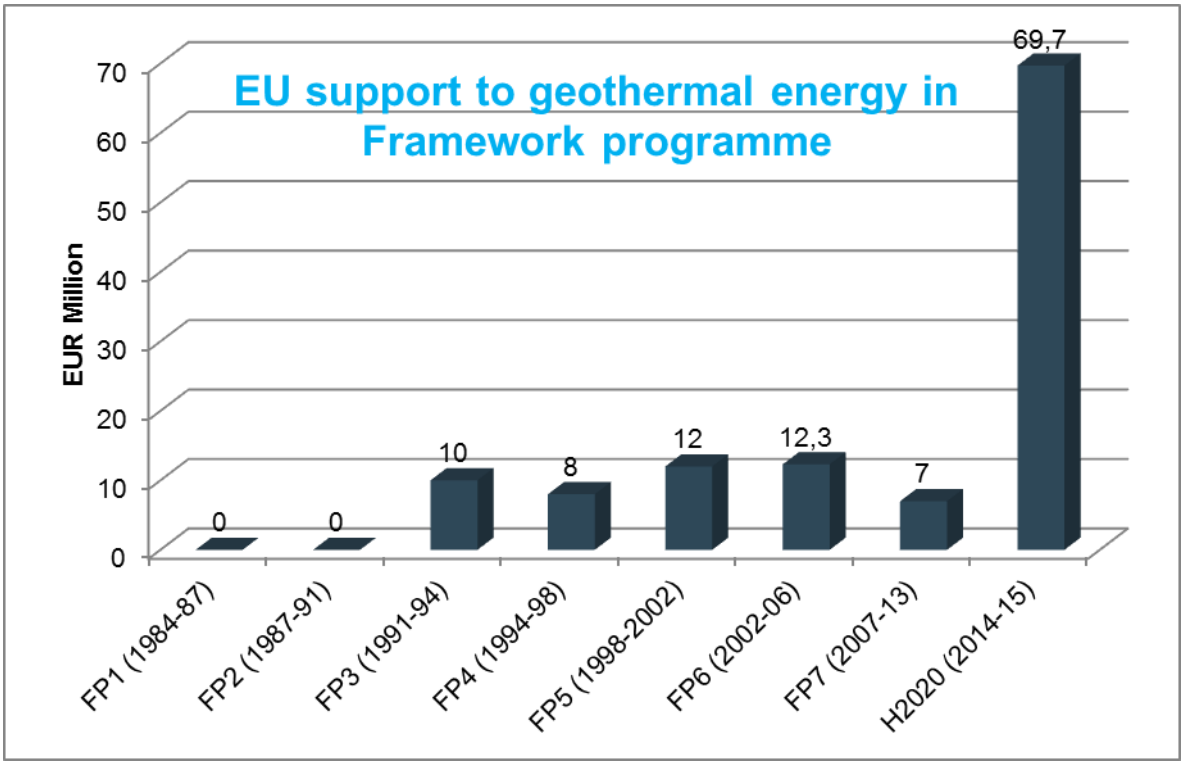
- Directive 2009/28/EC on the promotion of the use of energy from **renewable sources**
- Directive 2012/27/EU on **energy efficiency**
- Directive 2000/60/EC establishing a framework for Community action in the field of **water policy**
- Directive 2006/118/EC on the **protection of groundwater** against pollution and deterioration
- Directive 2009/72/EC concerning common rules for the internal market in **electricity**

1.2. The European Commission's SET Plan and its Integrated Roadmap

The **European Strategic Energy Technology Plan (SET-Plan)** was set up to develop low-carbon technologies and make them economically viable. It aims to accelerate the uptake of new technologies such as next-generation of renewables by reducing their costs and increasing efficiency.

All technologies pass through the same stages of the innovation cycle: from basic research through development, demonstration, deployment, and commercial market uptake. During these phases public funding for the continuing industry-led research, development and deployment is needed in order to bring down costs.

Together with national programmes, since the 1990s the EU has contributed to R&I in geothermal by financing resource assessments, including two geothermal atlases, and a number of demonstration projects, the most famous of which is the flagship and multinational EGS project in Soultz-Sous-Forêts situated along the French-German border. Figure 2 below illustrates the historic allocation of EU funding for R&I to geothermal until 2012, while a number of new projects have been initiated under the current Framework Programme **Horizon 2020** running from 2014 through 2020: €24.1 million in 2014 and €45.6 million in 2015.



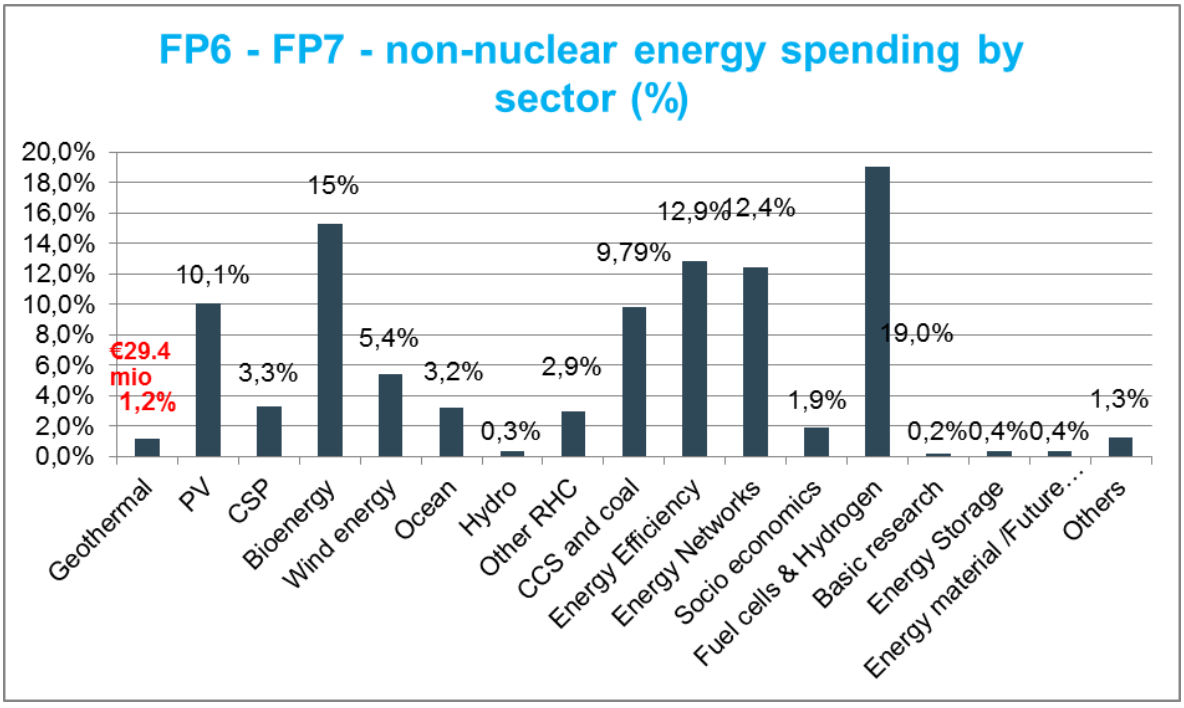


Figure 2 Historic EU R&I support for Geothermal Energy (Source: European Commission)

Another R&I programme at EU level is the **NER300** programme. Three geothermal projects have been awarding funding from this programme, one each in Hungary, France, and Croatia. For the period beyond 2020, a similar programme will be developed, hopefully building on the experience of the NER300, with the name **Innovation Fund**.

In terms of governance, research efforts to accelerate the development and deployment of cost-effective low carbon technologies have been organised under the Strategic Energy Technology (SET) Plan. Established in 2008, it was based on a three pillars implementation structure: a **Steering Group, European Industrial Initiatives (EIIs),** and the **European**

Energy Research Alliance (EERA). It is supported by an information system **(SETIS).** Geothermal was included in the first SET- Plan through the **EERA Joint Programme on geothermal energy (EERA-JPGE)** and the geothermal panel of the **European Technology Platform (ETP) on Renewable Heating and Cooling**, whose aim is to develop strategic research priorities and implementation roadmaps for the sector. Moreover, EGEC created a private TP on geothermal power **(TP-Geoelec)** during the period 2009-2012; this was merged with the geothermal panel of the RHC-Platform.

The Energy Union strategy, with its objectives to 'make the EU the world number one in renewable energies', by leading on the next generation of renewable technologies (amongst other methods), has recognised the need for increased focus on geothermal technology and a dedicated ETIP on deep geothermal energy.

The Energy Union is a very powerful concept as it brings together all the different streams of the EU energy and climate policy. Implementing the Energy Union implies, amongst other things, the full integration of its five dimensions.

In this regard, the fifth dimension "Research, Innovation and Competitiveness" is key to ensure energy security, energy efficiency and the decarbonisation of the EU economy. It should contribute to making Europe the world number one in renewable energies and develop the next generation of renewable technologies for a competitive Europe.

This fifth dimension should be based on the Integrated Roadmap of the SET Plan, which sets out the Research and Innovation (R&I) needs of the entire energy system. The Integrated Roadmap must also be the basis of the energy R&I policy for the horizon 2020.

Renewables for heating and cooling and flexible renewable electricity generation are important components of the future energy system and will contribute to achieving the objectives of the Energy Union.

2. Objectives of ETIP on Deep Geothermal

European Technology and Innovation Platforms (ETIPs) have been recently recognised by the EC as a tool to strengthen cooperation with Stakeholders under the Strategic Energy Technology Plan (SET-Plan), as part of the H2020 programme. Existing European Industrial Initiatives don't include geothermal energy, although the EC has recognised the pressing need for measures, such as an ETIP, to support the deployment of the next generation of geothermal power and heat plants.

The geothermal sector is therefore creating an ETIP on deep geothermal, and is asking for its official recognition and support from the European authorities.

The overarching objective of the new ETIP-DG would be to accelerate the development and deployment of deep geothermal technology, in particular Enhanced Geothermal Systems (EGS), for producing power and/or heat, to move from the current European R&D and pilot-sites to a proliferation of sites in other European countries and different geological situations. The primary objective is overall cost reduction while increasing public awareness and social consent.

The ETIP-DG will be an open stakeholder group, including representatives from industry, academia, research centres, and sectorial associations. It will cover the entire deep geothermal energy exploration, production and utilisation value chain.

To reach the objectives above, additional effort is needed, particularly in the following areas:

- **Market uptake of already competitive geothermal technologies**: Geothermal systems are already competitive in some markets in Europe. There is the need to remove barriers for a market uptake in these areas.

- **Innovation for allowing the fuel switch in cogeneration and for industrial process**: The industry and the CHP sectors must switch to renewables; some innovations are needed for this transition: low temperature (cogeneration) systems, energy efficient devices, micro-CHP etc.

- **Demonstration of flexible RES power plants**: To increase the flexibility of the power system, flexible generation is essential and must be developed with renewable sources. Some renewables, including geothermal plants, usually run as base load, but new technology, such as binary turbines, allow them to be flexible in their production. More demonstration plants must be installed in different market contexts.

- **Research and Development of the next generation of RES technologies such as EGS, Hybrid plants and Unconventional Resources**: Breakthrough renewable technologies could be transformative in the process of decarbonising the energy system. Enhanced Geothermal Systems (EGS) is a technology which has already been demonstrated but an Action Plan must be launched to increase its contribution to the electricity mix. Moreover, research to boost the hybridisation of geothermal energy plus other renewables (biomass, solar thermodynamic and photovoltaic, etc.) as well as the development of unconventional resources (supercritical, magmatic, geopressurised, off-shore, etc.) will enlarge the range of application of geothermal in Europe, extending both geographically and economically.

- **Research and Development on Cogeneration**: One of the main issues with hydrothermal systems is that they are predominantly located in sparsely populated areas and therefore geothermal energy's full potential of CHP is not exploited. Additionally, the minimisation of heat loss during the power conversion cycle and the optimisation of heat discharge by cooling tower should be addressed.

- **Towards a smart, integrated energy system**: The future energy system should make a strong link between its three sectors: electricity, heating and cooling, and transport. Smart energy grids will play an important role in future smart cities and communities by ensuring a reliable and affordable energy supply to various customers with renewable energy carriers like geothermal energy.

- **Improve market conditions (non-technical issues)**: legal & policy, regulations, financing & risk management, capacity building, public engagement and social aspects etc.

- **Strengthening international cooperation**: EU has a large intellectual resource but it is ineffective because it is dispersed. One important objective of the ETIP is to create a common, unified movement which progresses in the same direction. This will help to solve critical problems, allowing both geothermal to develop and climate change to be addressed. Having close communication between all relevant partners and sharing resources (equipment and human) can cost effectively increase the speed of geothermal development.

The ETIP will develop a coherent and updated **Vision** for deep geothermal for power and/or heat, as well as a **Strategic Research Agenda** and a **Technology Roadmap.** It also assesses the overall finance available to carry out this work, from public and private sources.

RD&I activities will cover the development of all deep geothermal technologies, according to their **Technology Readiness level (TRL)** ranging from 1 (Basic principles observed) to 9 (Actual system proven in operational environment).

Technology readiness levels:

TRL 0:	Idea. Unproven concept, no testing has been performed.
TRL 1:	Basic research. Principles postulated and observed but no experimental proof available.
TRL 2:	Technology formulation. Concept and application have been formulated.
TRL 3:	Applied research. First laboratory tests completed; proof of concept.
TRL 4:	Small scale prototype built in a laboratory environment ("ugly" prototype).
TRL 5:	Large scale prototype tested in intended environment.
TRL 6:	Prototype system tested in intended environment close to expected performance.
TRL 7:	Demonstration system operating in operational environment at pre-commercial scale.
TRL 8:	First of a kind commercial system. Manufacturing issues solved.
TRL 9:	Full commercial application, technology available for consumers.

The Platform will pursue the following primary objectives:

- Mobilise all actors sharing a long-term **European Common Vision** for deep geothermal.
- Develop the **European Strategic Research Agenda** for deep geothermal for the next decade(s) and give recommendations for its implementation through the **Technology Roadmap**
- Provide a major contribution to the European industry and research to maintain and consolidate its leading position in energy technologies for geothermal.

Link with the ETIP on renewable heating and cooling and the TP Geoelec

In 2009, a **TP Geoelec** was established, a large part of which was later integrated into the geothermal panel of the RHC-Platform. The remaining dormant TP Geoelec will be integrated in the ETIP on deep geothermal.

The **European Technology and Innovation Platform on Renewable Heating & Cooling (RHC-Platform)** brings together stakeholders from the biomass, geothermal and solar thermal sector- including the related industries such as **District Heating and Cooling**, **Thermal Energy Storage**, **Hybrid Systems** and **Heat Pumps** - to define a common strategy for increasing the use of renewable energy technologies for heating and cooling.

The geothermal panel of the RHC-Platform was launched in 2009. It is today composed of around 300 geothermal experts from the industry and the research sector involved in both shallow and deep geothermal technologies and including non-technical aspects (economy, policies, and education). The secretariat of the panel is managed by the European Geothermal Energy Council.

The RHC-Platform and ETIP-Deep Geothermal will integrate a part of their activities.

3. Organisation and operations

Proposed initial structure

The following figure illustrates a draft proposal of the Working Groups (WG) that ETIP-DG is planning to establish. **A formal decision on the total number of WG, their scope of their work and organisation will be made at the first Steering Committee meeting.**

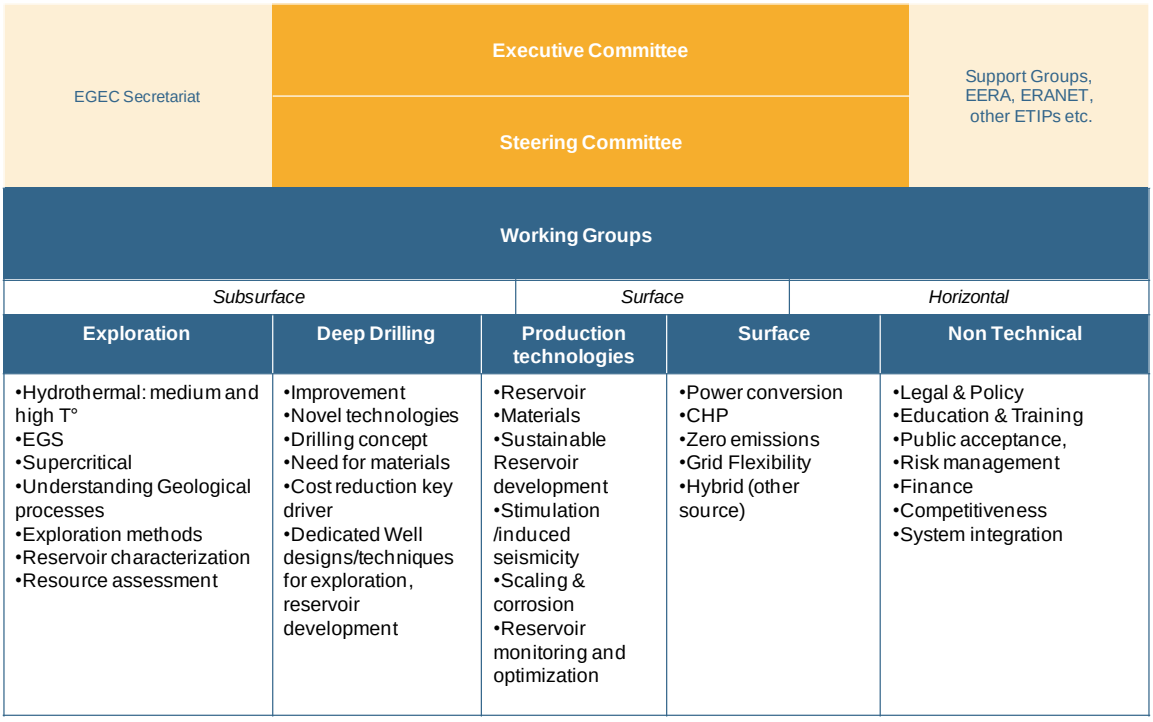


Figure 3 Proposed ETIP structure with indication of possible initial working groups

3.1. Structure

The Management structure of the ETIP-DG is the following:

ETIP Steering Committee

The SC is the highest decision-making body of the ETIP-DG and is responsible for providing guidance to the activities of the Platform. Working Groups on research and policy topics contribute to the achievement of the ETIP's objectives.

ETIP Secretariat

The ETIP Secretariat is managed by The European Geothermal Energy Council (EGEC) and it is responsible for the standard business activities of the ETIP. It provides logistical and organisational support to the Technology Platform and its WGs.

Working groups

The ETIP works with several working groups (WGs) which include all deep geothermal technologies. Acting under the guidance of the Steering Committee, each WG is responsible for collecting and developing stakeholders' inputs from the respective sectors.

The ETIP-DG aims to include stakeholders representing all deep geothermal technologies for energy from industry, research, and the public sector from all over Europe.

The ETIP-DG will liaise with the European Technology and Innovation **Platform on Renewable Heating and Cooling (RHC-Platform)**, officially launched in 2009. The Platform is now recognised by the European Commission as one of the **European Technology and Innovation Platforms (ETIP)** and it is included in the publicly available list of recognised ETIPs on the European Commission ETIP website.

The **RHC-Platform** and **ETIP-Deep Geothermal** will form joint working groups if necessary.

Terms of reference:

The terms of reference were discussed during the preparatory meeting and then adopted by the provisional SC. They apply for the first meeting of the ETIP-DG.

The terms of reference can be amended by the SC at any time; the modified terms of reference should be approved by the ETIP-DG members.

3.2. Steering Committee (SC)

Consistent with the structure, objectives and mission of the European Technology and Innovation Platform on Deep Geothermal, a steering committee, established in 2016, acts as the top-level decision-making body of the ETIP-DG.

The primary aim of the SC is to provide guidance concerning the activities of the ETIP Secretariat and Working Groups, ensuring that the ETIP-DG's other bodies and working groups effectively pursue the ultimate mission of the ETIP-DG: defining the overall **Common Vision**; developing up the **Strategic Research Agenda (SRA)**; and establishing

and implementing a **Roadmap** for the large scale development and deployment of geothermal electrical and/or thermal power plants.

3.2.1. Description and role

The SC of the Platform shall have the following powers and duties:

I. To set the periodic objectives for the ETIP-DG and monitor its implementation;
II. To ensure consistency among the activities of the ETIP-DG and in particular among its working groups;
III. To define, propose and implement any actions required for the achievement of the mission of the ETIP;
IV. To produce any contribution that may be required of the ETIP-DG SC;
V. Through the President or the Vice-Presidents, to represent the ETIP-DG before third parties and external stakeholders.

3.2.2. Composition

Members of the SC are representatives of European companies, research centres or any other legal entities of public or private status, which satisfy all the following conditions:

I. being Members of the ETIP-DG;
II. being willing to be Member of one of the Working Groups;
III. being able and willing to provide an effective contribution to the achievement of the objectives of the ETIP-DG.

One aim is to ensure a good mix of representatives within the SC from different parts of the geothermal sector and of European countries.

The SC of the ETIP is composed of twelve elected Members as well as four nominated representatives: one from **EERA-JPGE**, one from **Geothermal ERA-NET**, one from **IEA-GIA** and one from **EGEC**.

The SC is presided over by a President and by two Vice-Presidents, entitled to represent the entire ETIP vis-à-vis external entities and at all official events.

3.2.3. General Rules

a) Mandate

The duration of all mandates is three years as of the date of appointment. Membership of the SC will automatically end in the event of:

I. Expiration of mandate as SC Member;
II. Expiration of mandate as Member of ETIP-DG;
III. Withdrawal of mandate by the SC (quorum: ¾ of SC Members having right to vote);
IV. Resignation.

The outgoing Members of the SC may be re-appointed.

b) Election:

The SC elected and appointed members are the President, two Vice-Presidents, and thirteen representatives.

Elections of the twelve elected SC members take place by secret ballot following a call for candidates.

All members of the platform are informed of elections and can declare their candidature through a letter addressed to the secretariat. Candidates are elected by the members of the ETIP-DG present at the meeting in which the election is held. In case of absence, a member is allowed to be represented at the meeting by a proxy who must also be a member of the ETIP-DG. III. On the day of the elections, the Secretariat will announce the names of the candidates. After a short explanation of the voting rules, the secret ballot will take place. The candidates obtaining the highest number of votes are elected. In case of a tie, the outgoing President has the faculty to cast one vote, having regard to the competences of the candidates, to their experience, and to the opinion of the Secretariat of the ETIP-DG

The election of the WG Chairs is held just after the selection of the SC members.

The President and the two Vice-Presidents of the ETIP-DG are elected by the SC members at the first meeting of each new term of the SC. In case there is more than one candidate, the election by secret ballot will take place under supervision of the Secretariat and any observers appointed by the Secretariat. The Secretariat of the Platform is responsible for organising and running the elections of the SC's President and Vice-presidents.

The election of the President and Vice-Presidents is ruled by the following procedure:

I. At least 14 days prior to the expiration of the mandate, the Secretariat launches a "call for expression of interest".
II. In order to be eligible, a candidate must be a SC Member. The outgoing President and Vice-Presidents may stand for re-election but cannot hold the position for more than three consecutive terms.
III. Candidatures should be received by the Secretariat at latest one week before the election takes place.
IV. On the day of the elections, the Secretariat will announce the names of the candidates for the position of President and Vice-President. All candidates will be given the opportunity to introduce themselves to the SC Members. After a short explanation of the voting rules, the secret ballot will take place.
V. Each SC Member has the faculty to cast one vote for President and two Vice-Presidents. The candidates obtaining the highest number of votes are elected "President and Vice-President of the SC". In case of a tie, the Coordinator of the Platform's Secretariat has the faculty to cast one vote, having regard to the competences of the candidates, to their experience, and to the opinion of the Secretariat of the ETIP-DG.

c) Quorum and Vote

The SC of the ETIP-DG may validly deliberate provided half of its Members are present. It takes decisions on the basis of a simple majority of votes. Each Member shall have one vote. In case of a tie, the vote of the President or their substitute is prevailing.

d) Proxy

In case of absence, a Member is allowed to be represented at the SC meeting by a proxy who must be a SC Member as well. A Member can represent only one other member. The

notification of a proxy vote can by means of a letter or by email must be received by the Secretariat at least one day in advance of the SC meeting.

Exceptionally, provided that the Secretariat is notified at least one week in advance, a SC Member can be replaced by a colleague from the same organisation or by another Member of the WG's to which he/she belongs to, provided this is not against the specific rules of the WG of reference.

e) Notice

At least two times per year, all Members of the SC are summoned to attend a physical meeting, which usually takes place in Brussels (Belgium).

The SC shall meet on notice of the Secretariat of the Platform acting on behalf of the President, or upon request of at least the half of its Members. The notice must be sent to the SC Members at least one month in advance. The notice shall at least state the main subject of the meeting as well as the venue and the date.

3.3 Executive Committee (ExCo)

The Executive Committee is composed of a President, two Vice-Presidents and the Secretariat of the Platform. The ExCo works with the support of the Secretariat in the overall planning, coordination and management of Platform's activities. The ExCo can also take ad-hoc decisions concerning the daily management of the Platform, but cannot modify the structure of ETIP-DG or approve any of its major deliverables (these are prerogatives of the SC).

The Secretariat helps the President and vice-Presidents when required or upon request in representing the views of the Platform towards external (e.g. European Commission).

3.4 Secretariat

The Secretariat is hosted by the European Geothermal Energy Council.

It is represented by its Secretary General, who is an observer at the Steering Committee and at the Executive Committee.

The Secretariat provides logistical and organisational support to the Technology Platform and its WGs, and, where appropriate, provides intellectual input to their discussions.

The Secretariat is in charge of the organisation and the management of the ETIP-DG website, where general information, public documents and a private section for members and restricted documents will be provided.

3.5 ETIP Deep Geothermal Working Groups (WGs)

3.5.1 Role

The role of the ETIP-DG is to develop and implement research pathways towards successful deployment of the technologies as well as the constant review of the Strategic Research Agenda /Technology Roadmap. WGs are established to define R&D priorities.

WG numbers and themes are decided during the first meeting of the ETIP-DG. Additional WG themes or adjustment can be proposed at any time by members. The Steering Committee amends if necessary and approves these WGs.

3.5.2 Principles

Each member of the Platform selects its experts to be member of one or more WGs. Participation in Working Group is free and open to all active in the deep Geothermal Energy field or related activities.

Each WG selects one chair and one vice-chairs, by vote if requested. These Chairmen and Vice-Chairmen are reporting the WGs activities at the SC, and they can be invited at SC meetings as observers.

WGs meetings take place at least twice a year, but additional virtual meetings or conference calls should take place on a quarterly basis.

To ensure transparency, all documents of the ETIP-DG will be published on a website, which will also serve to inform the stakeholders about current and next activities. Minutes of the WG meetings will also be available online.

3.6 ETIP Deep Geothermal members

Members of the ETIP are entities, not persons. They are European companies, research centres or any other legal entities of public or private status. No membership fees are requested and the access to become membership of the ETIP-DG is not restricted to anybody.

Being member of the ETIP-DG means being member of one or more of the Working Groups. Members can involve one or several experts of their institutions in the different working groups.

Any member of the ETIP can ask the SC to create a new Working Group.