

# Support tools to ensure private stakeholders' engagement

Overview of available public and private R&I funding in Europe

Deliverable number: (D4.2) January 2021  
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ISBN n°: 978-9979-68-535-7

**Deep GEOTHERMAL IWG**  
SUPPORT UNIT



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# 1. Introduction

The SET Plan represents the key EU energy research and innovation initiative that serves the Energy Union goals and delivers the innovations necessary for the EU to become the first climate neutral continent by 2050. It contains a dedicated vision for each technology area and sets ambitious targets to be reached in the next decade(s) in order to place Europe at the forefront of the next generation of low-carbon energy technologies. For each of these technology areas, Implementation Plans have been developed that facilitate the meeting of these targets.

Within the above-mentioned SET Plan, the EU has set an ambitious set of RD&I priorities for geothermal. In order to achieve these, a specific geothermal Implementation Plan (IP) was developed and is currently under execution. This Implementation Plan has been revised and is currently up for endorsement of the SET Plan Steering Group.<sup>1</sup> It identifies 10 areas of priorities for RD&I actions within the deep geothermal sector:

- Geothermal heat in urban areas;
- Integration of geothermal heat and power in the energy system and grid flexibility
- Improvement of overall geothermal energy conversion performance for electricity generation, heating and cooling
- Full reinjection electric and heating and cooling plants integrated in the circular economy
- Sustainable and efficient production technologies
- Development of geothermal resources in a wider range of geological settings
- Advanced drilling/well completion techniques
- Innovative exploration techniques for resource assessment and drilling target definition
- Involving the public in sustainable geothermal development
- Risk mitigation (Financial/Project)

These various priorities cover a broad range of topics for the deep geothermal sector and involve all segments of the deep geothermal value chain. Across the different parts of the geothermal value chain, different types of actors contribute their own expertise and resources to advancing the priorities for RD&I in the deep geothermal sector.

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<sup>1</sup> Updated Implementation Plan: version 2020, [https://66b35e71-78c0-4abe-8c9c-c69611e77267.filesusr.com/ugd/d2a943\\_c7a00a8e13ee43878af0ad1ee6547482.pdf](https://66b35e71-78c0-4abe-8c9c-c69611e77267.filesusr.com/ugd/d2a943_c7a00a8e13ee43878af0ad1ee6547482.pdf)

All technologies pass through the same stages of the innovation cycle: from basic research through to development, demonstration, deployment, and commercial market uptake. During these phases public and private funding for continuing industry-led research, development, and deployment is needed. It is crucial to invest in new renewable technologies and to improve existing ones through RD&I.

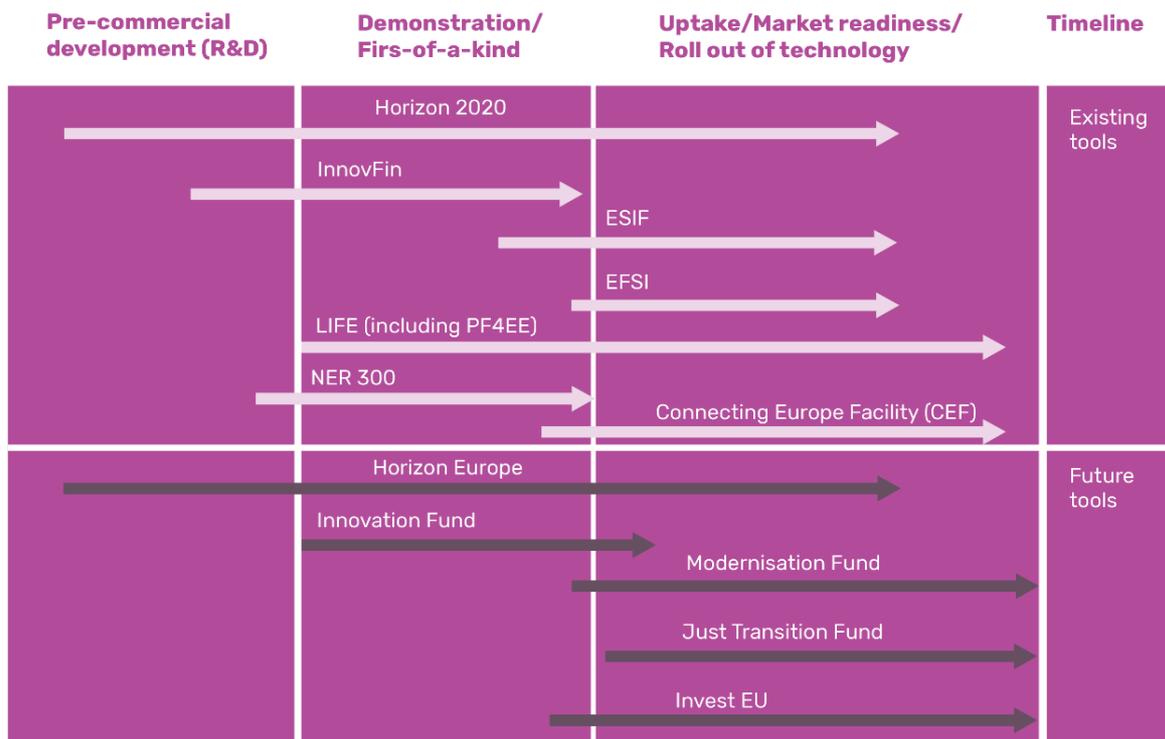
Many actors of the geothermal sectors are involved in regional, national and European publicly funded research projects, such as for example the Horizon 2020 programme (in 2021 it will become Horizon Europe), that financially supports projects that implement the SET Plan priorities. This report contains a series of examples in this sense – EU public financial instruments and an overview of private investments that already are financing or have the potential to support geothermal energy projects.

The aim of this report is to outline some of the key EU and National public financing instruments, as well a private ones, that will be served as a support tool to ensure private stakeholders' engagement. Until the end of the project, the mapping of financial schemes will continue and these results will be reported in factsheets.

## 2. Mapping of European public R&I funding

### 1. OVERVIEW OF EU FUNDING OPPORTUNITIES

#### EU PROGRAMMES FOR LOW-CARBON INNOVATION

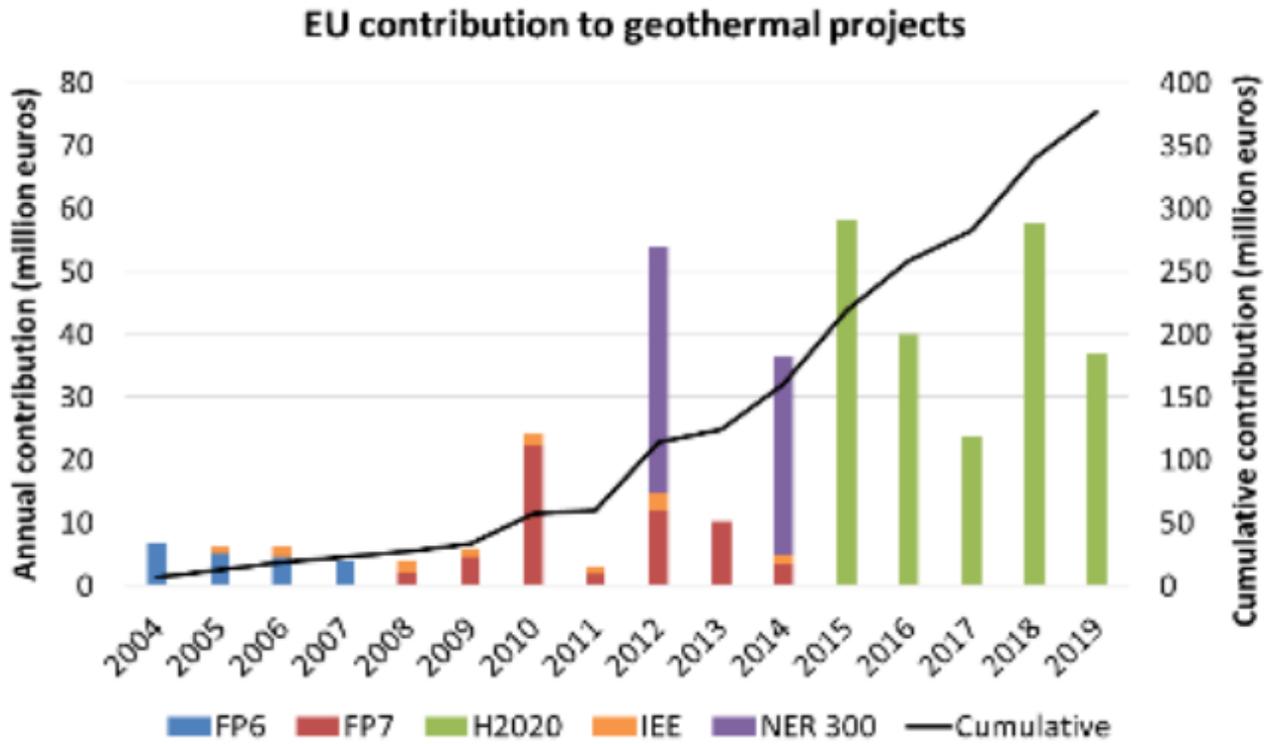


(Figure 1: Overview of EU's upcoming funding opportunities for deep geothermal, source: EGEC)

### 2. EU CONTRIBUTION TO CO-FUNDED GEOTHERMAL ENERGY PROJECTS

The *Commission's staff working document on Clean Energy Transition – Technologies and Innovations* shows the annual and cumulative EU contribution to co-funded projects focused on geothermal started between 2004 and 2019. The analysis below (Figure 2) includes the EU Framework Programmes FP6, FP7 and H2020, as well as the Intelligent Energy Europe (IEE) and NER 300 projects. **The total amount of funds granted by the EU to geothermal energy in the considered period is EUR 377 million, shared among 100 projects.** It can

be noticed that more R&I funding has been allocated during H2020 (EUR 216 million, 49 projects) than in any other previous funding programme, although with a marked variability across the years.<sup>2</sup>



(Figure 2: EU contribution to co-funded projects since 2004: yearly detail and cumulative data)

<sup>2</sup> Commission's staff working document on Clean Energy Transition – Technologies and Innovations, pag.7, <https://ec.europa.eu/transparency/regdoc/rep/10102/2020/EN/SWD-2020-953-F1-EN-MAIN-PART-4.PDF>

### 3. HORIZON EUROPE PROGRAMME

Horizon Europe will be the EU's next Framework Programme for Research and Innovation that will replace Horizon 2020. It will run from 2021 to 2027 with a proposed budget of €100 billion by the European Commission. The final amount will be decided once the EU's next long-term budget will be approved (by the end of 2020).

Set to launch in 2021, Horizon Europe will build on the achievements and success of Horizon 2020, bridging the past and the future of research and innovation in Europe. In keeping with the design of its predecessor, Horizon Europe programme is divided into three main pillars:

- Excellent Science;
- Global Challenges;
- European Industrial Competitiveness.

While Horizon 2020 was structured around seven main Societal Challenges, Horizon Europe identifies five overarching Global Challenges for action:

1. Health
2. Inclusive and Secure Society
3. Digital and Industry
4. **Climate, Energy, and Mobility**
5. Food and Natural Resources.

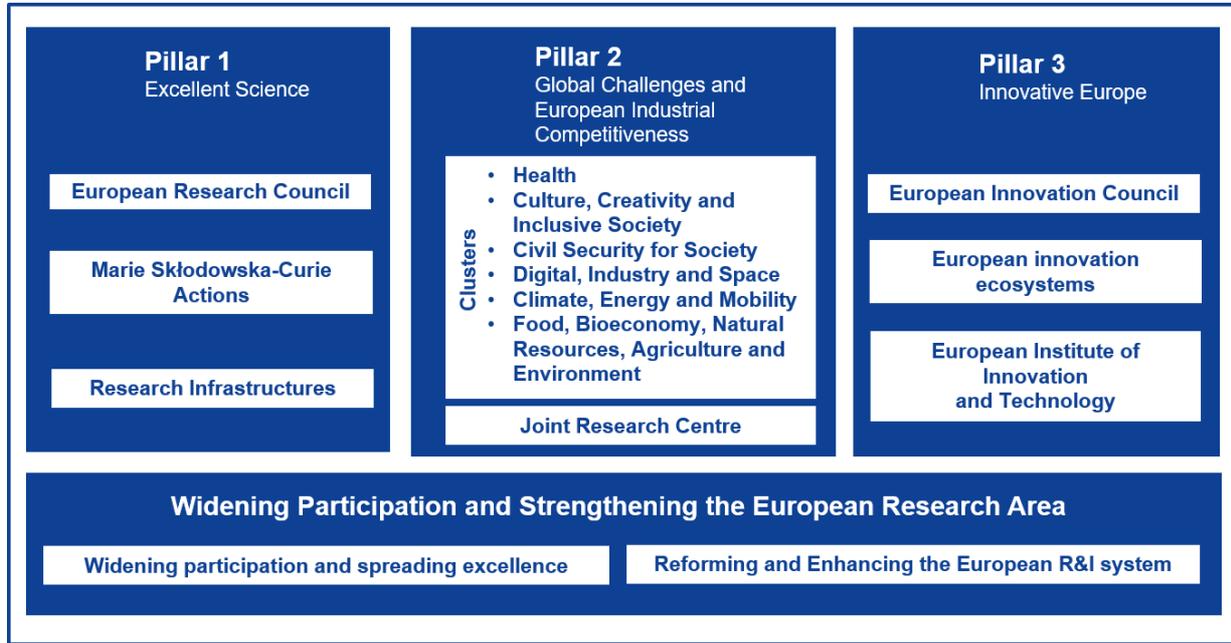
At the same time, Horizon Europe will continue to drive Europe's scientific excellence through the European Research Council (ERC) and the Marie Skłodowska-Curie fellowships and exchanges and draw on the scientific advice, technical support and dedicated research of the Joint Research Centre (JRC). It will also add a new level of ambition and boost the scientific, economic and societal impact of EU funding. The programme will also introduce several new main features:

- A European Innovation Council (EIC) to help the EU become a frontrunner in market-creating innovation;
- New EU-wide research and innovation missions focusing on societal challenges and industrial competitiveness;
- Maximising the innovation potential across the EU;
- The principle of 'open science' that will require open access to publications and data;
- A new generation of European Partnerships and increased collaboration with other EU programmes.

The 2021-2027 programme will also have five mission areas: adaptation to climate change including societal transformation, cancer, **climate-neutral and smart cities**, healthy oceans, seas, coastal and inland waters, soil health and food. Each mission will have a dedicated mission board and assembly.

Horizon Europe also aims at creating a new generation of European Partnerships and increasing their effectiveness and impact, by regrouping the current landscape into three

new types of partnerships (co-funded, coprogrammed, institutionalised) and rationalising the overall number of initiatives. The Clean Energy Transition Partnership will be crucial for supporting innovation within the renewable energy industry.



(Figure 2: *preliminary structure of Horizon Europe*)

### Geothermal energy projects

Horizon 2020 supports 24 geothermal energy projects, corresponding to the financial contribution of a total of €173 million: 12 are Research and Innovation Action (RIA) focused, 9 of them are focused on the Innovation and Action (IA) and 3 projects are fitted under Coordination and Support Action (CSA). Out of 24 projects, 17 are ongoing (of which 3 new ones), and 7 are finished.

Geothermal energy projects are also be eligible to call for projects that are not directly related to the energy field. For example, the “Leadership in enabling and industrial technologies” WP or in the “nanotechnology” one. The current Horizon 2020 awards support in the form of grants through competitive bids for tenders for each project.

## 4. INNOVATION FUND (NER300)

The Innovation Fund just like its predecessor, NER300, is one of the world's largest funding programmes for demonstration of innovative low-carbon technologies and a key funding instrument for delivering the EU's economy-wide commitments under the Paris Agreement. It also supports the European Commission's strategic vision of a climate neutral Europe by 2050. The Innovation Fund will focus on:

- Innovative low-carbon technologies and processes in energy intensive industries, including products substituting carbon intensive ones;
- Carbon capture and utilisation (CCU);
- Construction and operation of carbon capture and storage (CCS);
- Innovative renewable energy generation;
- Energy storage.

The budget of the Fund will be combined with the revenues from the EU Emissions Trading System (EU ETS) – from the auctioning of 450 million allowances from 2020 to 2030, and any unspent funds from the NER300 programme. The total budget may amount to about €10 billion, **depending on the carbon price.**

The Innovation Fund will address several **objectives**:

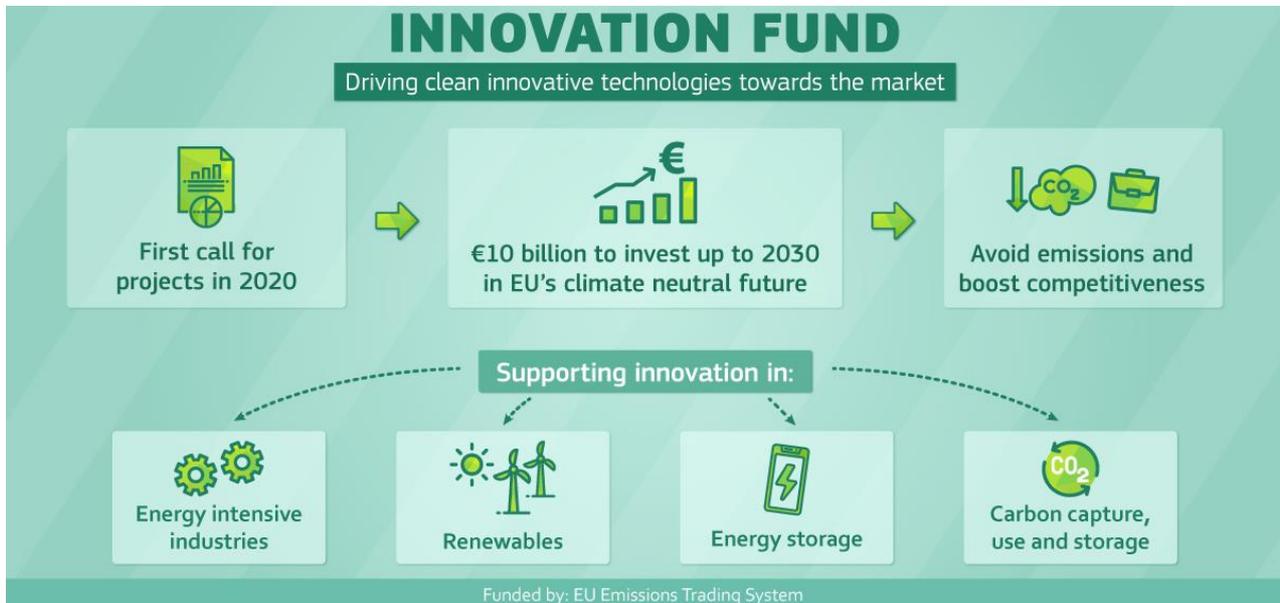
- help create the right financial incentives for projects to invest now in the next generation of technologies needed for the EU's low-carbon transition;
- boost growth and competitiveness by empowering EU companies with a first-mover advantage to become global technology leaders;
- support innovative low-carbon technologies in all Member States in taking off and reaching the market.

The Innovation Fund has taken into account the main lessons learned from its predecessor, the NER300 programme. As a result, the following **aspects have been improved**:

- It is open to projects from energy intensive industries;
- It improves the risk-sharing for projects, which means that its grants cover up to 60% of the additional capital and operational costs of innovation;
- It provides support in more flexible way, following the cash-flow needs of the project through pre-defined milestones;
- It has a simpler selection process and stronger synergies with other EU funding programmes.

It will focus on highly innovative technologies and big flagship projects with European value added that can bring on significant emission reductions. It is about sharing the risk with project promoters to help with the demonstration of first-of-a-kind highly innovative projects. It aims to finance a varied project pipeline achieving an optimal balance of a wide range of innovative technologies in all eligible sectors (energy intensive industries, renewable energy, energy storage, CCS and CCU) and Member States. At the same time, the projects need to be sufficiently mature in terms of planning, business model and financial and legal structure. The Fund will also support cross-cutting projects on innovative low-carbon

solutions that lead to emission reductions in multiple sectors, for example through industrial symbiosis or business model innovation. It is also open to small-scale projects with total capital costs under €7.5 million which can benefit from simplified application and selection procedures.



(Figure 3: [Presenting the Innovation Fund](#))

The European Commission has launched **its first call** of the Innovation Fund on the 7th of July 2020. This call is open for Large Scale Projects, with a first-stage deadline of 29 October 2020. In the first stage, proposals will be assessed on their greenhouse gas emission avoidance, the degree of innovation, and project maturity. In the second phase, scalability and cost efficiency will also be assessed. Seventy projects from the first stage process will be selected to advance to the second stage, which will have a deadline of 23 June 2021. Up to forty of the project proposals that do not make it to the second phase may be considered for Project Development Assistance from the European Investment Bank. Moreover, applications for small scale projects (below 7.5 million EUR) will be launched in December 2020.

More details regarding the application process will be published on the [EC Funding and Tenders portal](#)

### **Geothermal energy projects**

Geothermal projects have benefited from the NER300, and technologies such as EGS are well suited to be eligible under the Innovation fund. Some challenges may however arrive depending on how innovation is defined. The geothermal energy projects in the scope of the Innovation Fund were:

Project name	Location	Funding	Description
<b>Geothermae</b>	Prelog, Medjimurje, Croatia	EUR 14.7 million	Geothermal CHP Project with 18.6 MWe + 75 MWth
			The geothermal power plant pumps geothermal brine from 1850-2300 m deep wells. It takes full profit of the energy content of the geothermal brine, consisting of the heat of the water and the combustion of the aquifer gases such as methane dissolved in the same water using an Organic Rankine Cycle (ORC) turbine.
<b>South Hungarian EGS Demonstration</b>	Battonya, Hungary	EUR 39.3 million	EGS project, for a geothermal power plant with an ORC turbine with a planned capacity of 8.9 MWe
<b>Geostras</b>	Vendenheim, Alsace, France	EUR 16.8 million	GEOSTRAS will develop a deep underground exchanger in Alsace with low natural permeability. A geothermal plant will be built to jointly produce electricity, heat and/or cold with the following characteristics: <ul style="list-style-type: none"> <li>• 241 000 MWh for electric production;</li> <li>• 810 000 MWh for thermal production.</li> </ul>

The funding of the above-mentioned projects is illustrating clearly the priorities of the programme for geothermal energy: contributing to increasing the market maturity of innovative geothermal technologies (typically EGS) and to increase the market uptake of geothermal energy in new markets, by financing innovative project at scale. Considering the ARENA Commercial Readiness Indicator, the NER300 acts to bring technologies from the CRI2 (Commercial trial, small scale) to CRI3 or CRI4 (Commercial scale up).

This provides perspective as to the type of projects that may benefit from support from the Innovation Fund in the coming decade.

### **Challenges of the Innovation Fund: Financial allocation<sup>3</sup>**

A major challenge of the Innovation Fund stems from the way funding will be allocated to selected projects. Indeed, as the Innovation fund has a generalist purpose (it is not designed with a specific energy technology in mind), funding allocation mechanisms may not be aligned with the requirements of geothermal energy projects.

For geothermal energy projects in the NER300 a crucial challenge is indeed related to the allocation of funding in the form of grants repayable in case the projects do not perform as initially promised. Considering the economics of geothermal energy projects, highlighted notably in the scope of the GEORISK project, such funding allocation is particularly

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<sup>3</sup> EGEN, Innovation Fund Factsheet, [https://www.egec.org/wp-content/uploads/position\\_papers/The-Innovation-Fund-factsheet.pdf](https://www.egec.org/wp-content/uploads/position_papers/The-Innovation-Fund-factsheet.pdf)

unsuitable to geothermal project development, as it does not contribute to mitigating the financial risk linked to the innovative nature of the project and the higher geological risk in undeveloped areas. As the Innovation Fund will propose a greater array of mechanisms to allocate funding to innovative renewable energy projects supported, there is an opportunity for geothermal energy projects to receive this financial support. It will also prove to be beneficial in accelerating the progression of technologies toward market maturity.

The allocation of financial means within the Innovation Fund will be executed in a technology neutral manner, by considering the contribution of a project (and the potential adoption at scale of the innovative technology demonstrated) in terms of carbon emissions reductions. Further benefits (for example like the grid services) may be considered but will not be the primary decision factor in allocating the support.

The fund allocation mechanism may allow up to 40% of the awarded grant to be conditioned to the accomplishment of project milestones (in the case of a geothermal project for instance the completion of the first well) and not only on GHG emission reduction performance.

The support allocated to the Innovation Fund is the following:

$$\text{Grant} = 50-75\%(\text{Cost}_{[\text{Innovative Project}]} - (\text{Cost}_{[\text{Coventional project}]} + \text{Operational Cash Flow}))$$

Projects supported under the Innovation Fund must take place in countries that are part of the EU ETS. All innovative geothermal technologies are eligible in principle for receiving the funding that is outlined in the Innovation Fund, without any restriction on scale.

#### Takeaways:

- Key prospect for commercial scale projects of innovative geothermal energy technologies;
- Primarily for deep geothermal projects until now, but large scale shallow geothermal projects may benefit (e.g. UTES);
- Development of new market area for deep geothermal energy;
- Possibility for grants to be partly validated by milestones, not only performance, which can mitigate the risk inherent in innovative geothermal projects.

## 5. MODERNISATION FUND

The revision for the fourth phase of the EU ETS Directive 2018/410, covering the period 2021 - 2030, introduced a number of important changes concerning the 'funding mechanisms' in the EU system. Among these changes, a new funding mechanism was put in place: the Modernisation Fund.

The Modernisation Fund is a totally new funding instrument that is meant to support investments proposed by the eligible EU Member States, 'including the financing of small-scale investment projects, **to modernise energy systems and improve energy efficiency**'. It will operate under the responsibility of the beneficiary Member State. As for now, the **ten beneficiary member states** are the following: Bulgaria, Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania and Slovakia.<sup>4</sup>

The Modernisation Fund will be made up of two percent of the total quantity of allowances available during Phase 4, which shall be monetised between 2021 and 2030. The European Investment Bank (EIB) will supervise the funding allocation mechanism and selection process. In order to use the Modernisation Fund for financing investments, the Member State has to propose investments to the EIB first and to the 'investment committee'. This investment committee consists of 15 members: the ten beneficiary Member States, the European Commission, the EIB and three representatives of other Member States. It will be chaired by the representative of the European Commission.

### Priority investments

At least 70 % of Modernisation Fund will be allocated to the three main areas:

1. Modernisation of energy systems: renewables, networks (including district heating pipelines), interconnectors, energy storage;
2. Improvements in energy efficiency: energy generation (except solid fossil fuels), transport, buildings, agriculture and waste;
3. Just transition in carbon-dependent regions: re-deployment/up-skilling of workers, education and job-seeking, support to startups.

### Geothermal energy projects

Considering the range of objectives of the Modernisation Fund, there is a great potential for financing the geothermal projects. The industry can specifically benefit from the deployment of geothermal energy solutions to reduce their CO<sub>2</sub> emissions. One example in this sense would be the use of geothermal heat pumps that would be crucial in achieving the maximum limitation of carbon emissions.

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<sup>4</sup> European Commission - DG Clima, Innovation and Modernisation Fund presentation, 12 September 2018, [https://www.ictsd.org/sites/default/files/event/180912\\_if\\_and\\_mf\\_2.pdf](https://www.ictsd.org/sites/default/files/event/180912_if_and_mf_2.pdf)

## 4. LIFE PROGRAMME

The LIFE programme is the only EU fund entirely dedicated to environmental and climate objectives that was created in 1992. The current programme covers the period 2014 to 2020 and has a budget of €3.5 billion.

It supports rather small-scale projects aiming to share best practices, test small-scale technologies, and speed up the implementation of relevant EU legislation and policy. Nonetheless, it also acts as a catalyst for investment, notably through integrated projects, and facilitates the implementation of large-scale actions.

The European Commission proposed on 1 June 2018 a regulation establishing a new LIFE programme for the period 2021-2027. The aim is to design an improved and more effective programme in order:

- to contribute to the shift towards a clean, circular, energy-efficient, low-carbon and climate-resilient economy, including through the transition to clean energy;
- to protect and improve the quality of the environment;
- to halt and reverse biodiversity loss, thereby contributing to sustainable development.<sup>5</sup>

In this respect the Commission proposes €5.45 billion EUR to be earmarked to the new programme which would contain two main portfolios - Environment and Climate Action, covering four sub-programmes:

- Nature and Biodiversity;
- Circular Economy and Quality of Life;
- Climate Change Mitigation and Adaptation;
- **Clean Energy Transition.**

Regarding the transition to circular economy, LIFE funding would target projects related to best technologies, practices and solutions developed at local, regional or national level. This also includes integrated approaches for implementing waste management and prevention plans and addressing marine litter.

A new component of the LIFE programme for the next 2021 – 2027 period has been introduced which is related to **the energy sector, namely the Clean Energy Transition**. To support the shift towards a clean energy, especially in regions that lag behind and have difficulty to absorb funding from the European structural and investment funds, the new

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<sup>5</sup> <https://www.europarl.europa.eu/legislative-train/theme-new-boost-for-jobs-growth-and-investment/file-mff-life-programme-2021-2027/09-2019>

programme would encourage investment and activities focusing in particular on energy efficiency and small-scale renewables. The proposal also aims to simplify the LIFE management and to ensure a broader geographical access to the fund.

### **Geothermal energy projects**

The new “Clean energy Transition” sub-programme of the upcoming LIFE 2021 – 2027 opens up a new funding opportunity for geothermal. As geothermal energy is one of the main components for a successful clean energy transition process, there is potential for financing in this specific area.

In relation to the implementation area of the LIFE Programme, it has confirmed its effectiveness and added value. However, there is room for improvements, especially in relation to its role for the implementation of EU key policy priorities, coherence with other EU funds and strategic management of the proposals.

## 5. CONNECTING EUROPE FACILITY (CEF)

The Connecting Europe Facility (CEF) is one of the key EU funding instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at European level. It fill the missing links in Europe's energy, transport and digital backbone and supports the development of high performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy and digital services.

The CEF benefits people across all Member States, as it makes travel easier and more sustainable, it enhances Europe's energy security while enabling wider use of renewables, and it facilitates cross-border interaction between public administrations, businesses and citizens.

In addition to financial grants, the CEF offers financial support to projects through innovative financial instruments such as guarantees and project bonds. These instruments create significant leverage in their use of EU budget and act as a catalyst to attract further funding from the private sector and other public sector actors.

The Innovation and Networks Executive Agency (INEA) implements most of the CEF programme budget. In the next long-term EU budget 2021-2027, the European Commission has proposed to renew the Connecting Europe Facility, allocating €42.3 billion to support investments in European infrastructure networks, including €8.7 billion for energy.

The CEF is divided into three sectors: CEF Energy, CEF Telecom, CEF Transport.

## **CEF Energy**

The EU's energy infrastructure is aging and, in its current state, not suited to match future demand for energy, to ensure security of supply or to support large-scale deployment of energy from renewable sources. The upgrading of existing, and development of new energy transmission infrastructures of European importance will require investments of about €140 billion in electricity and at least €70 billion in gas.

Despite the regulatory measures and policies that are currently put in place to facilitate such investments, under current market and regulatory conditions some energy projects are not commercially viable and would normally not make it into investment programmes of infrastructure developers.

CEF is engineered to address both groups of factors behind the investment gap in the energy sector. Financial instruments, by bringing in new classes of investors and mitigating certain risks, will help project promoters to access the necessary financing for their projects. Grants to contribute to the construction costs will be applied to fill in the gaps in commercial viability of the projects that are particularly relevant for Europe.

A total budget of €5.35 billion is made available for energy projects for the 2014-2020 period, of which €4.6 in the form of grants managed by INEA.

In the energy sector, the CEF shall support projects of common interest that pursue one or more of the following objectives<sup>6</sup>:

- increasing competitiveness by promoting the further integration of the internal energy market and the interoperability of electricity and gas networks across borders.
- enhancing the Union's security of energy supply.
- contributing to sustainable development and protection of the environment, inter alia by the integration of energy from renewable sources into the transmission network, and by the development of smart energy networks and carbon dioxide networks.

## **Geothermal energy projects**

The CEF is looking for proposals that offer solutions to end energy isolation, integrate energy from renewable sources and develop smart energy networks. The geothermal energy perfectly fits the scope, as it provides reliable electricity and heating and cooling solutions at competitive prices. Geothermal energy plants can already market both electricity and heating and cooling sales, as well as provide value to the grid through their dispatchable and flexible generation profile.

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<sup>6</sup> [https://www.euro-access.eu/calls/2019\\_cef\\_energy\\_call](https://www.euro-access.eu/calls/2019_cef_energy_call)

## 6. THE EUROPEAN INVESTMENT BANK

The European Investment Bank (EIB) is the main financial body of the European Union. It is defined as a public bank, owned by the Member States, and it invests in long-term projects by providing loans.

The EIB is notably active in support renewable energy projects and has established a clear set of Energy Lending Criteria to that end. These criteria are used by the bank to define whether it provides support to projects in the framework of EU facilities it may manage, such as the EFSI.

The European Fund for Strategic Investment is the initiative of the European Commission that aims to raise the level of investments in the EU. The objective is to unlock EUR 315 billion of new investments in riskier projects (according to the additionality principle). The scheme is based on risk guarantee, meaning that it would take “first loss” in case the project underperformed. This lowers their financial risk, which means lower financing costs for the projects.

As of 2017, the EFSI has supported projects for EUR 30.6 billion (or a total investment of EUR 163.9 billion), 22% of which in renewable energy or energy efficiency projects.

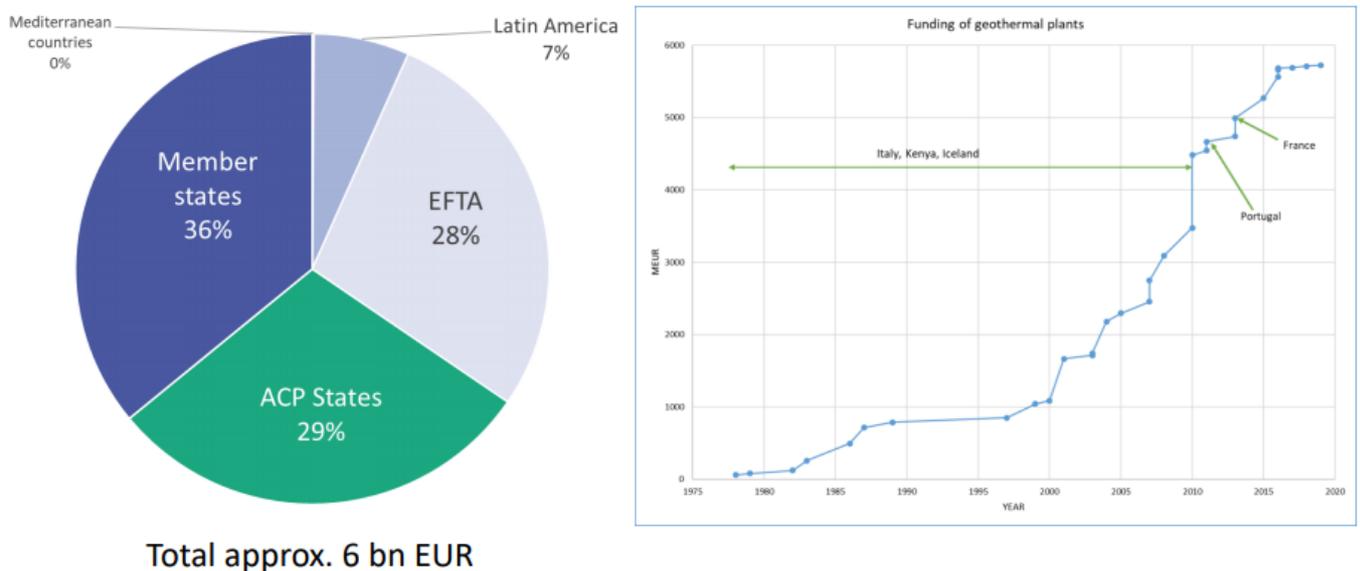
The EFSI is the most prominent example of the increasing financialization of EU public funding, which uses financial instruments to increase the amount of private capital leveraged from the same amount of public money. The European Investment Bank is at the core of this shift in EU fund allocation, managing most of these financial instruments in virtue of the financial expertise it possesses.

### **Geothermal energy projects**

Geothermal energy is among the energy sources targeted by the Bank for its renewable energy investments, notably for the heating and cooling sector. Geothermal projects may be eligible in one or several funding streams of the bank. Large projects may benefit from direct EIB loans. Smaller projects may be eligible to a financial instrument, such as those listed in the FI-Compass platform.

### **Examples of geothermal projects financed:**

1. Deep-seated geothermal energy that contribute to the EU economic policy objectives
2. Smaller projects served through project aggregation through an intermediary. Distinction is made between (i) mature and (ii) Research, Development and Innovation project. Currently the EIB does not fund projects in early stages, but only projects which have proven their economic viability, i.e. exploitation phase.



(Figure 4: EIB funding of geothermal projects, source: [EIB's presentation at the Georisk/Convenant of Mayours Seminar organised on the 13th of December 2019](#))

### **ELENA - Technical assistance facility (European Local Energy Assistance)**

Many EU towns and regions lack the necessary technical expertise and organisational capacity to implement large energy efficiency and renewable energy projects. The ELENA-EIB ("European Local Energy Assistance") provides local authorities with support in designing and setting up the financing scheme of these projects.

ELENA can only provide support to local public authorities (from regions to local energy agencies, including cities or consortium of several cities).

Between the inception of the facility and 2016, over EUR 82 million have been awarded as technical assistance grants, for a total of planned investment amounting to EUR 5 billion.

### **What is funded?**

ELENA covers up to 90% of the technical support cost needed to prepare, implement and finance the investment programme. This could include feasibility and market studies, programme structuring, energy audits and tendering procedure preparation. With solid business and technical plans in place, it is also expected to help attracting funding from private banks and other sources, including the EIB.

Sectors covered by ELENA are the following:

- Public and private buildings, including social housing and street and traffic lighting, to support increased energy efficiency – e.g. refurbishment of buildings aimed at significantly decreasing energy consumption (both heat and electricity). thermal insulation, efficient air conditioning and ventilation or efficient lighting;
- Integration of renewable energy sources (RES) into the built environment – e.g. solar photovoltaic (PV), solar thermal collectors and biomass; Investments into renovating, extending or building new district heating/cooling networks, based on high efficient

combined heat and power (CHP) or renewable energy sources, as well as decentralised CHP systems (building or neighbourhood level).

- Urban transport to support increased energy efficiency and integration of renewable energy sources.
- Local infrastructure including smart grids and information & communication technology infrastructure, for energy efficiency, energy efficient urban equipment, inter-modal transport facilities and refuelling infrastructure for alternative fuel vehicles.

### **EIB lending policy**

The EIB's lending policy obeys policy-led guidelines, notably regarding investment in climate action. Lending represents 90% of the financial commitment of the Bank, which uses several channels to provide financing:

- **Project loans:** these are the main vehicle for EIB financing. It is a direct lending to an actor (company, public authority, etc.) for large single projects. The Bank typically provides loans for a minimum of EUR 25 million, which usually cover no more than 50% of the total investment cost of the project. They are generally awarded in sectors of key importance with impacts on the economy, notably infrastructure investments (transports, energy, water...);
- **Intermediate loans:** this type of loans is made through a local bank to which the EIB issues a loan to finance smaller scale projects on which the local financial institution can more easily gather information and propose adapted vehicles. They notably allow the EIB to reach SMEs, midcaps or local authorities.
- **Venture capital:** through the European Investment Fund, the EIB intervenes on the venture capital market to provide financing to start ups, high tech businesses and other innovative SMEs.
- **Equity:** the Bank also intervenes through equity, notably taking parts in funds promoting EU policy priorities – on infrastructure & environment or on carbon for instance.

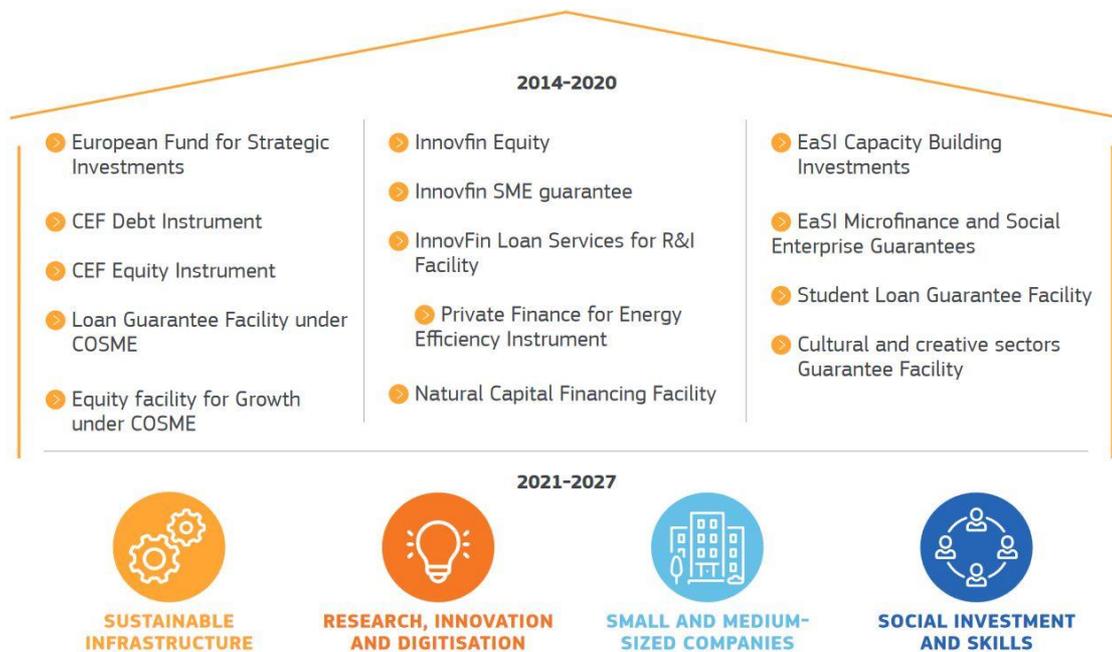
The EIB lending policy forces the Bank to account for issues such as the climate impact of its investment portfolio.

An important step forward was made in November 2019, when the EIB reached an agreement that it would stop providing funding to fossil fuel projects from 2022 onwards. This development is a crucial step towards the redirection of financing to the energy transition. As the largest public development bank, the EIB has an outsized impact on the allocation of financing to the energy sector, and as such it represents a model to follow for other financial institutions. The EIB has been a pioneer in setting criteria that discriminate against financing coal projects, a position adopted now by many major financial institutions. The updated Energy Lending Policy constitute a template for other public and private financial institutions to also ban lending to fossil fuel projects.

## 7. INVESTEU

The InvestEU Programme will be based on the successful model of the Investment Plan for Europe, the Juncker Plan. It will bring together the European Fund for Strategic Investments and 13 EU financial instruments currently available. Triggering at least €650 billion in additional investment, the Programme aims to give an additional boost to investment, innovation and job creation in Europe. It will consist of:

- **The InvestEU Fund** that will mobilise public and private investment using an EU budget guarantee;
- **The InvestEU Advisory Hub** that will provide technical advice on investment projects needing financing;
- **The InvestEU Portal:** an easily accessible database that matches projects with potential investors worldwide.



(Figure 5: [Structure of InvestEU programme](#))

A crucial part of the new InvestEU programme will be played by the European Fund for Strategic Investments (EFSI). It aims at reviving investment in strategic projects around Europe in order to boost the “real economy”, with renewable energy and energy efficiency considered as top priorities. Unlike traditional loans by the EIB, the EFSI aims to take uncertainty out of viable projects, not provide financing directly. Since its launch, the EFSI has approved EUR 30.6 billion for financing projects, which corresponds to a total of EUR 163.9 billion of investment “unlocked” by the Fund. Of the investments approved thus far, 22% have been awarded to energy related projects and 4% to “environment and resource efficiency”. Meanwhile, 31% of investments go to supporting smaller companies.

While EFSI aims at spurring investment in riskier projects, the Fund does not provide loans, nor does it directly bankroll projects. On the basis of EUR 16 billion made available from other EU budget lines and EUR 5 billion from the EIB's budget, EFSI provides "risk guarantee" to projects. This means that a project supported under EFSI will theoretically be able to receive cheaper loans, as the Fund will take first losses if the project underperforms financially.

Thematically, EFSI will notably support strategic infrastructure including digital, transport and energy and the expansion of renewable energy and resource efficiency.

The Fund is managed by a Steering Board, an Investment Committee and a Managing Director. The strategic orientation of the Fund is set by the Steering Board, which includes the choice of the risk profile of projects eligible. The Investment Committee is responsible for approving the support of the EU guarantee for EIB projects supporting important investments in infrastructure and innovation throughout the EU.

The EIB is responsible for operating the Fund, and thus eligible projects should be compliant with its own investment policies and lending criteria.

### **Projects that are supported under the EFSI**

Projects will receive funding from the EFSI if: it will prove to be economically viable with the support of the initiative and will be sufficiently mature to be appraised on a global or local basis of European added value and consistent with EU policy priorities (such as, for example, the 2030 climate and energy package ). A cluster of projects and programmes for energy efficiency and small-scale installations can be financed as well.

EFSI is supposed to finance projects with higher risk-profile. Geothermal projects are fitting well under this scope.

## 8. JUST TRANSITION FUND

The Just Transition Fund is a new funding instrument of the EU that has been announced by the Commission President Ursula von der Leyen as part of the European Green Deal. The Just Transition Fund will be created in order **to support the coal mining regions on their way to become carbon neutral.**

Currently the legislation is under development, expected to come out in January 2020. In 2019 the European Parliament called for an allocation of extra €4.8 billion for the fund under the 2021-2027 MFF, with the aim to support workers and communities in such regions adversely affected by this transition.<sup>7</sup> Analysing beyond its social scope that is seeking for social justice and leaving no one behind in this transition process, the most important debate that is taking place around this new initiative is related to its funding.

### Challenges

The issue of the soon to be established fund is related to the finance and reallocation of resources. It needs to have a comprehensive analysis of what the new fund must bring in, going beyond any simple redistribution of existing EU finances. Moreover, the Just Transition Fund must be viewed as an important part of an overarching and holistic strategy to address climate change and its impact on workers and society. It needs to have a comprehensive strategy and the right implementation tools.

Nonetheless, when distributing the allocation to its Member States and regions that fit that scope of purpose, a rigorous set of condition for a phase-out of coal should be applied.

### Geothermal energy projects

Within the scope of the proposed Just Transition Fund, a number of solutions can be identified in order to tackle the consequences for regional economies and its coal workers. The transition will involve the processes of reskilling and retraining workers and helping them find alternative jobs.

In this context, geothermal energy has a key role to play, as it can provide new jobs as a result of diversification of the local economy and tapping into the potential of the renewable energy sector. Former mine sites can be reconverted to renewable energy generation, including geothermal energy.

More details [here](#)

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<sup>7</sup> [https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/642217/EPRS\\_BRI\(2019\)642217\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/642217/EPRS_BRI(2019)642217_EN.pdf)

## 9. EU'S RESILIENCE AND RECOVERY FACILITY

The Resilience and Recovery Facility (R&RF), launched in July 2020, is designed to inject additional funding into Member States to aid their economic recovery after the COVID-19 pandemic. It supports projects and programmes (sometimes referred to as reforms) which deliver “green and digital transitions,” and contribute to “strengthening the growth potential, resilience and cohesion of the Member State concerned .”

€310 billion grants and €250 billion loans will be made available, in conjunction with other ‘Next Generation EU’ funds, to Member States. The aim is for governments to outline how they will stimulate and reform their economies to deliver (some) tangible outcomes by 2024. The funds are dispersed depending on the applications made from Member States in their national R&R Facility lists.

### **The process**

- Member States will submit Recovery and Resilience plans to the Commission from 2020 to 2022. They have to be submitted by 30 April, each year, to obtain funding in that year.
- Given the urgency of the need for economic stimulation, governments have been asked to prepare draft lists for this September.
- This allows for feedback/negotiation with Member States before finalising funding. Should there be problematic projects submitted, this gives time for them to be raised to the European Council meeting in October.
- Otherwise, the Commission will then adopt a decision (Commission decisions cannot be amended by the Council or Parliament) indicating that they are to be fast-tracked for financing.
- The Commission will publish each Member States R&R plan to allow for oversight from the European Council, Council and European Parliament.
- The plans will have to fit into European Semester as well as National Climate & Energy Plans (NECPS), Just Transition plans and Partnership Agreement plans (related to Cohesion funding).
- The Commission will report annually on the progress of investments against the R&R plans.

### **Projects and programmes/reforms**

- **Projects:** These can be pre-commercial at different TRL levels or specific investments that were held up/stalled because of the pandemic.
- **Programmes/reforms:** This applies to national legislation and enabling frameworks such as subsidies. They should be eligible for EU funding as grants or loans. New investment programmes or reforms to existing programmes can also be suggested to the government.
- **Note –** there is scope for funding source overlap. So projects that could be innovative (and applicable to the EU’s Innovation Fund) are eligible as are programmes/national subsidies

that were reduced/eliminated due to financial constraints which could/should be attributed to the pandemic.

**EU dimension:**

It is important to stress the relevance to the EU's Green Deal priorities. Linking the project or programme to the following will be beneficial:

- o **Renovation Wave** (projects for public buildings, schools, social housing, hospitals, etc): Highlight emissions saved (use lignite coal as the benchmark for emissions saved/avoided - 800kg/per tonne); and assume every euro saved by the consumer delivers an additional €30- €50 economic stimulus in the local economy; health benefits, etc

- o **Renewable energy** – Alongside the renewable energy benefits it is important to highlight CO<sub>2</sub>e savings, Stress the impact on energy important non-renewable energy elements too.

- o **CO<sub>2</sub> emissions to be saved/avoided**. This should be an estimate and round-up to the nearest million tonnes.

- o **Sector integration** – How the project/programme makes the EU's energy system function better is key. For example, highlighting lithium deposits to the EU's industrial strategy on lithium battery security of supply and the impact on the electrification of mobility. Geothermal to decarbonise industrial emissions is also useful.

- o **Just transition**: If there is an opportunity to upskill workers to enter the geothermal industry or support carbon-intensive regions transition to sustainability – for example by using mines to provide geothermal heat grids, etc – these should be referenced in your proposals.

- o **Industrial strategy elements**: If a connection can be made to cost and emission reductions for manufacturing industry this is very helpful.

Furthermore, it is useful to connect how the project/programme allows for large-scale investment which benefit local supply chains or leads to the EU gaining international competitive advantage through lithium battery valuechain investments, for example.

- o **A link to the National Energy and Climate Plans (NCEPs)** is important.

More details [here](#)

### 3. Overview of National public R&I funding in DG IWG Member Countries

It is crucial that research resources are also mobilised across Europe. R&D support from Member States and regions must be coordinated at European and national level. Geothermal R&I spending shows major variation among Member States, but there are research priorities that are shared between some technologies within certain groups of countries. Synergies should be exploited in these areas, which is of particular importance for capital-intensive R&I activities.

Funding awarded under national or local programmes is granted in pursuit of numerous policy priorities. These range from environmental protection to civil society development, including research and the protection of cultural heritage. These facilities put a strong emphasis on climate and energy however, focusing on renewable energy, green industry innovation or energy efficiency.

In order to put the Implementation Plan into action, Member States and Regions must progressively increase national R&D funding for geothermal.

#### 1. ERANET

A new financing tool created recently is GEOTHERMICA – ERA NET Co-fund. This is currently supporting eight transnational projects on geothermal energy. The total investment in the projects is close to € 50 million. About half is funded by GEOTHERMICA and the other half comes from project partners.

This is the first series of GEOTHERMICA-funded projects, bringing innovative geothermal (primarily deep geothermal, though some projects also deal with shallow geothermal) energy solutions closer to commercial deployment. A second call was launched in May 2019. The available budget for the Second Call is close to €20 million in total. Moreover, the GEOTHERMICA Consortium will be broadening for the Second Call, with Norway and USA joining, giving GEOTHERMICA now the weight to influence and accelerate the development of geothermal energy globally, enlarging export opportunities for European entities.

#### 2. SMART SPECIALISATION PLATFORM – REGIONAL

The Smart Specialization Platform on geothermal energy “S3 Partnership Geothermal Energy 2.0” launched in 2019 will increase the interregional cooperation along shared priorities related to geothermal energy.

This Regional Partnership aims at helping local policy makers to better use the related European Structural Investment Funds (ESIF) and other public/private investments smartly, in order to harness their place-based competitive advantages on the most appropriate way.

EU structural and investment Funds dedicated to regional policies of interest for the geothermal sector are the following: the Cohesion Fund, the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the European Agricultural Fund for Rural Development (EAFRD).

Funding can be obtained by responding to competitive calls for tender or proposals.

### 3. ICELAND

Iceland is a pioneer in the use of geothermal energy for space heating. Generating electricity with geothermal energy has increased significantly in recent years. Geothermal power facilities currently generate 25% of the country's total electricity production<sup>8</sup>.

The ownership of resources inside the ground is attached to a private land, while on public land resources inside the ground are the property of the State of Iceland, unless others can prove their right of ownership. Even though the ownership of resources is based on the ownership of land, research and utilisation is subject to licensing according to the *Act on Survey and Utilisation of Ground Resources, No. 57/1998* and the *Electricity Act, No. 65/2003*. Survey, utilisation and other development pursuant to these Acts are also subject to the *Nature Conservation Act, Planning and Building Act and other acts* relating to the survey and utilisation of land and land benefits<sup>9</sup>.

Iceland offers grants for the exploitation of energy resources and for special projects in the field of economical energy use.

The state-owned National Energy Fund grants subsidies for measures that aim to reduce the use of fossil fuels. Among other aims, it supports the exploitation of domestic energy sources instead of fossil fuels (art. 8 Act No. 87/2003). The National Energy Fund offers grants to promote the exploitation of domestic energy sources, among others renewable energy sources, but especially geothermal energy (art. 8, Act No. 87/2003). Grants shall not exceed 50% of the estimated costs of a given project<sup>10</sup>. Three major amendments have recently been made to the legal energy framework in Iceland:

- The ownership of resources can no longer be sold by the state or municipalities although utilisation rights can be leased to a developer for up to 65 years with a possibility of extension. Royalties for the utilization are determined by the Prime Minister.
- Producers of electricity compete in an open market in Iceland. Therefore CHP power plants are obliged to keep separate accounts for heat and power production to prevent cross subsidisation of electricity.

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<sup>8</sup> Iceland National Energy Authority, Geothermal, <https://nea.is/geothermal/>

<sup>9</sup> *Idem*.

<sup>10</sup> RES Legal, Iceland, <http://www.res-legal.eu/search-by-country/iceland/single/s/res-e/t/promotion/aid/subsidy-national-energy-fund/lastp/369/>

- The National Energy Authority can grant licenses on behalf of the Minister of Industry, Energy and Tourism, effective as of 1 August 2008.
- Orkustofnun grants licenses, that before were granted by the Minister, based on the Acts on natural resources, hydrocarbon and electricity.

#### 4. BELGIUM

Belgium can be classified as an emerging market for deep geothermal energy. In recent years, a new dynamic has set the basis for an accelerated deployment of deep geothermal projects. The commissioning of the first deep geothermal projects in Flanders in 2018 is quite a milestone in that regard. Moreover, the country already has a dynamic market for shallow geothermal, which is growing fairly rapidly as 2017 sales represent 17% of the total installed stock and have grown by over 20% from the previous year.<sup>11</sup>

In Belgium, energy is a matter of regional competence. However, there is one fiscal measure on the federal level that promotes the use of heat production from renewable energy source, namely the *tax deduction on investment costs for companies*.

In the Brussels-Capital region, the generation of heat from renewable energy sources is promoted through *energy subsidies* as well as through *investment assistance for companies*:

- *Subsidy Primes énergie 2018*: Within the bounds of its available budget, the Brussels-Capital region provides energy subsidies for residential, industrial as well as service sector buildings located in the Brussels region.
- *Subsidy Aide à l'investissement*: Within the bounds of its available budget, the Brussels-Capital provides investment assistance for companies which develop environmental projects, including investments in renewable energy systems.

In Flanders region, for renewable heating and cooling from renewable energy resources, the Flemish support scheme provides a *quota system*. Grid operators and municipalities are responsible for setting up premium schemes.

- *Premium*: Grid operators and municipalities are responsible for setting up premium schemes to support heating and cooling from renewable energy. Therefore, the amount of premium attributed and eligible technologies differs among municipalities.
- *Quota system*: In Flanders, CHP producers are eligible for CHP certificates. The amount of CHP certificates granted for 1000 kWh of primary energy saved in a qualitative CHP-facility compared to a situation in which the same quantity of electricity or heat were produced separately is multiplied with the respective technology-specific banding factor (Art. 7.1.2. §2 Energy Decree).

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<sup>11</sup> EGEC, Country Fiche Belgium, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-BE.pdf>

In the Walloon region, the generation of heat through renewable energy plants is promoted through a system of *energy subsidies*, the granting of a zero-percent loan as well as through investment incentives for companies<sup>12</sup>.

- *Subsidy (Primes énergie)*: Several energy subsidies are provided by the Walloon Region for the generation of heat from biomass, shallow geothermal energy and solar thermal energy plants.

- *Subsidy (Aide à l'investissement)*: Within the bounds of its available budget, the Walloon Region provides investment assistance for companies that initiate projects aimed at developing the sustainable use of energy, including investments in renewable energy plants.

- *Subsidy (UREBA)*: Within the bounds of its available budget, the Walloon region provides UREBA subsidies, which aim to support public bodies in their initiatives to reduce the energy consumption of their buildings. Projects using renewable energy sources are subsidised.

- *Loan (Ecopack)*: Households willing to improve the energy performance of their houses may benefit from a zero-per cent interest loan for the realisation of several refurbishment works. Certain renewable energy technologies are eligible for the loan.

## 5. GERMANY

Lately Germany started to look more actively into geothermal, as a potential renewable energy source that would contribute to the country's strategy to replace fossil fuels with renewables.

Within the legislative energy framework, Germany has launched its national strategy for the energy transition, the so-called *Energiewende*, in 2010 that aims to decarbonise German's economy. The strategy is incorporated within the *Renewable Energy Sources Act (EEG)* that underlines that by 2025, 40% to 45% of Germany's energy has to come from renewable energy sources, 55-65% in 2035, aiming for the final 80% at least by 2050.

Regarding research and innovation, *the 7th Energy Research Programme of the Federal Government*, entitled "Innovation for the Energy Transition"<sup>13</sup>, is the main instrument setting out guidelines for energy research funding. Managed by the German Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Food and Agriculture (BMEL), the programme provides specific R&D funding for the development of geothermal heat and power.

In particular, it focuses on:

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<sup>12</sup> RES Legal, Belgium, <http://www.res-legal.eu/search-by-country/belgium/summary/c/belgium/s/res-hc/sum/108/lpid/107/>

<sup>13</sup> 7th Energy Research Programme of the Federal Government, <https://www.bmwi.de/Redaktion/EN/Artikel/Energy/research-for-an-ecological-reliable-and-affordable-power-supply.html>

- Demonstration projects with an objective of replicability;
- Reduction of costs for geothermal technology developments, improvement of security and best practices;
- Heating and cooling storage underground;
- Mapping of resources and explorations;
- Research on the material use of extracted geothermal liquids;
- Modelling and simulation of geothermal systems to increase forecasting reliability and minimise financial risk.

In 2017 the Federal Ministry for Economic Affairs and Energy provided approximately 16.49 million euros in funding in the field of geothermal energy. In addition to the Federal programmes, the German Lander also provided funding for research in geothermal energy for 4.7 million euros in 2016, mostly in Lower Saxony (2.2 million euros) and Bavaria (1.5 million euros). Furthermore, the Renewable Energies Programme of the German development bank KfW provides a repayment bonus and support for drilling costs for heat and power plants using geothermal energy<sup>14</sup>.

## 6. THE NETHERLANDS

The Netherlands is currently one of the most dynamic markets for geothermal energy in Europe. Starting from only a couple MWth of capacity 10 years ago, the country now is in the top 5 EU countries in terms of installed geothermal district heating capacity.

*The Energy Agreement for Sustainable Growth* (2013) and the *Energy Agenda* (2016) set out the main targets for the Netherlands renewable energy strategy up to 2050. It aims for a 14% sustainable energy by 2020, that should be increased to 16% by 2023. The Dutch government intends to reach almost 100% sustainable energy by 2050 with CO2 emissions, 80% to 95% lower than in 1990<sup>15</sup>.

Geothermal is presented as a key resource to the achievement of these ambitious goals, especially in the heating sector where the Netherlands plan to further promote the development of ultra-deep geothermal heating (including in industrial processes) and the better use of residue streams. According to the Energy Agenda, most of the buildings will be heated by geothermal energy and electricity in 2050.

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<sup>14</sup> EGEC, Country Fiche Germany, [https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-DE-final\\_.pdf](https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-DE-final_.pdf)

<sup>15</sup> EGEC, Country Fiche Netherlands, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-NL-Final.pdf>

## Support schemes

In terms of financing and support schemes, the Dutch Government provide businesses with a risk management fund to cover the risks of drilling for geothermal heat. Summary of support schemes<sup>16</sup>:

- *Premium tariff*: the Netherlands have introduced a premium tariff (bonuses on top of the wholesale price) to promote the generation of heat from renewable sources;
- *Tax regulation mechanisms*: enterprises are eligible for a tax credit (EIA) for investments in specific types of renewable heating systems;
- *Loans*: investors in RES H&C projects (excluding biomass and biogas) are eligible for a reduction of the interest rate on the basis of a Green project declaration.

Furthermore, Companies can use the *Energy Investment Allowance (EIA)* to invest in energy-efficient technology and durable energy under favourable fiscal conditions

## 7. PORTUGAL

Portugal is among the largest geothermal electricity users in the European Union that has three operational projects in the Azores Islands representing 33 MWe. On the mainland however, Portugal is not making use of its deep geothermal resources.

Deep geothermal developments in Portugal are primarily enabled by the Azores energy company [EDA Renovaveis](#).

In terms of the legislative framework for energy, *the National Energy Efficiency Action Plan (NEEAP) 2013-2016 and the National Renewable Energy Action Plan (NREAP) 2013-2020* are the basis of Portugal's renewable energy policies, setting an overall target of 34,5% of energy generated from RES in gross final energy consumption by 2020, with around 60% of the RES generated electricity. Under the NREAP, geothermal electricity is considered an important element for Portugal's energy transition and future developments are expected particularly for deep geothermal installations.

## Support schemes

Existing geothermal installations (i.e. plants up to 3 MW) can apply for a feed in tariff, while currently there is no direct support scheme for RES in the heating sector.

*The Fund to Support Innovation (Fundo de Apoio à inovação - FAI)*, is the main funding instrument for research and projects of innovation and technological development in the field of renewable energy.<sup>17</sup>

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<sup>16</sup> RES Legal, Promotion in the Netherlands, <http://www.res-legal.eu/search-by-country/netherlands/tools-list/c/netherlands/s/res-hc/t/promotion/sum/172/lpid/171/>

<sup>17</sup> EGECC Country Fiche Portugal, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-PT.pdf>

Concerning GSHP's the potential is huge and is starting to be exploited. There are a few installations registered until 2014, but the registration data of the installations are scarce and do not represent the totality of what is installed in Portugal. However this tends to change due to the preparation of new legislation for regulating shallow geothermal operations. In fact, a new legislation draft on GSHP's was already prepared by the Directorate General for Energy and Geology (DGEG) – the Portuguese authority for those geological resources – that will contribute not only to ameliorate the quality of the operations, but also to allow future statistical data to be more realistic. In addition, in 2018 it was released a call for geothermal projects, sponsored by the FAI – “Fundo de Apoio à Inovação”, to promote the use of geothermal resources in Portugal, namely the low enthalpy resources associated with Thermal Baths/Spas facilities. For the time being, two district heating networks for hotels and public buildings were retained for funding: (i) S. Pedro do Sul (67°C, 17 L/s) with a proposed 5 km network, and (ii) Chaves (74°C, 15 L/s) with 3 km extension; field work will be performed in 2019/2020.<sup>18</sup>

## 8. ITALY

Italy is and remains a global leader of the modern geothermal industry. The Italian geothermal energy industry is at the forefront of research and innovation. Geothermal energy in Italy is mostly used to generate electricity and the central location for it is in the Tuscany region. Most of its geothermal heating and cooling capacity comes from the production of combined heat and power.

In terms of the legislative framework for the energy sector, Italy's strategy for the energy transition were clearly set out in *the National Energy Strategy (SEN)*<sup>19</sup>, approved in 2017, and in the proposed *National Energy and Climate Plan (NECP)*. The Plan set an ambitious target of increasing the share of renewable energy to at least 32% of EU energy use by 2030<sup>20</sup>, by implementing new technology-neutral incentives, progressively moving towards market parity for renewables after 2020, and doubling the R&I investments in the sector.

### Support schemes

Italy's funding for energy R&D is covered within the scope of the National Research Strategy 2015-2020 which sets the priorities for the country's applied research. Energy is one of the

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<sup>18</sup> EGC 2019, Geothermal Energy Use, Country Update for Portugal, <http://europeangeothermalcongress.eu/wp-content/uploads/2019/07/CUR-22-Portugal.pdf>

<sup>19</sup> Italy's National Energy Strategy, [https://www.mise.gov.it/images/stories/documenti/BROCHURE\\_ENG\\_SEN.PDF](https://www.mise.gov.it/images/stories/documenti/BROCHURE_ENG_SEN.PDF)

<sup>20</sup> European Commission, Italy: Summary of the Commission assessment of the draft National Energy and Climate Plan 2021-2030, [https://ec.europa.eu/energy/sites/ener/files/documents/necp\\_factsheet\\_it\\_final.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/necp_factsheet_it_final.pdf)

12 selected specialised areas of intervention, in accordance with the National Smart Specialisation Strategy (S3).

Funding is provided by the Ministry of University and Research through its main operating funds:

- *Fund for Basic Research*
- *Fund for Industrial Research*

Additional supporting schemes for renewable R&D, including geothermal, are:

- *The Fund for Interventions and Measures for Technological and Industrial Development*, managed by CSEA, which is aimed at supporting interventions and measures for technological and industrial development in the field of renewable sources and energy efficiency.
- *The Fund for the Development of Intangible Capital*, managed by the MEF, in agreement with the MiSE and the MiUR, that can also be used to finance technological research by companies, in collaboration with research institutions;
- *The Tax Credit Measure of the National Industry 4.0 Plan*, aimed at stimulating private R&D expenditure to innovate processes and products. It consists of a tax credit of 50% on incremental expenses in Research and Development, recognized up to an annual maximum of €20 million/year.<sup>21</sup>

## 9. SWITZERLAND

Switzerland also belongs to the countries that possess an enormous potential for geothermal energy development, and very recently the Swiss government started to implement a new policy direction for renewables until 2050.

Switzerland developed an *Energy Strategy 2050*<sup>22</sup>, that entered into force on 1 January 2018. It targets reducing energy consumption, improving efficiency, and enhancing the utilisation of renewable energies. Several new measures and incentives have been devised to support the development of geothermal energy<sup>23</sup>:

— The geothermal guarantee scheme for geothermal power projects has been overhauled: today's risk coverage has been raised from 50% to 60%, and the eligible costs have been extended to include prospecting expenses. Under current legislation, the scheme runs until 31.12.2030;

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<sup>21</sup> EGEC, Country Fiche Italy, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-IT.pdf>

<sup>22</sup> Swiss Federal Office of Energy, <https://www.bfe.admin.ch/bfe/en/home/policy/energy-strategy-2050.html>

<sup>23</sup> Katharina Link, Gunter Siddiqi, Nicole Lupi, *Geothermal Energy Use, Country Update for Switzerland*, <http://europeangeothermalcongress.eu/wp-content/uploads/2019/07/CUR-29-Switzerland.pdf>

- Direct financial support (investment aid) of up to 60% of the cost for prospecting and exploration of geothermal power projects. At most CHF 50 million per year flow into the fund. Under current legislation, the scheme runs until 31.12.2030;
- Direct financial support (investment aid) for prospecting and the subsurface exploration and development for direct use geothermal energy projects. At most 60% of the eligible cost will be subsidized. The scheme is funded via Switzerland's levy on fossil fuels used for stationary heat supply; at most CHF 30 million per year flows into this fund. Under current legislation, the scheme runs until 31.12.2025.

Another important measure is to publicly make available subsurface data obtained from subsidized projects (seismic data, logs etc.). This process is handled by the *Swiss Geological Survey of the Swiss Federal Office of Topography swisstopo*.

The Energy Strategy 2050 also includes an “action plan for coordinated energy research”. It is also worth mentioning that a number of Switzerland's cantons have developed targets for geothermal heat, which are expected to have an effect on the development of national policies. Financial support for geothermal research and innovation has grown considerably in the last 5 years from about *CHF 5 million to CHF 15-20 million per year*.

## 10. SPAIN

Spain is a southern European country, therefore defined by a heating and cooling sector. Cooling plays a more important role than in most other European markets. For this reason, shallow geothermal systems, which are a proven solution for renewable heating and cooling needs, are quite relevant for the Spanish market. However, Spain also has significant deep geothermal resources, for heating and to some extent for electricity, allowing for deployment of these technologies in the coming decade.

*The National Renewable Energy Action Plan 2011-2020 (NREAP) and the Renewable Energy Plan 2011 – 2020 (REP)* form the legislative basis of Spain's renewable energy policies until 2020. The aim is to achieve 20.8% of share of energy generated from renewable sources in gross final energy consumption. The PER has a specific focus on geothermal, estimating a gross potential of 3,000 MWe to be harnessed through conventional or enhanced geothermal systems for the generation of electricity. And a target of at least 50 MWe generated in 2020. In addition, the plan estimates that geothermal energy potential for thermal uses could exceed 50,000 MWt, with production mostly driven by the use of heat pumps<sup>24</sup>.

As for now, Spain has no specific support schemes for geothermal electricity or geothermal heat.

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<sup>24</sup> EGEC, Country Fiche Spain, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-ES.pdf>

## 11. FRANCE

The French geothermal district heating industry is well established. In terms of shallow geothermal systems, the French market is on a negative trend as a result of a shift in the support framework. In general, the market for heating systems in France remains dominated by fossil fuels, in particular fossil gas or oil boilers. The structure of incentives tends to also disproportionately benefit air-based heat-pumps. For deep geothermal, the French market is notably carried by the large French energy groups and their subsidiaries, but several smaller companies and SMEs are also key in geothermal development. In addition, the role of specific financial institutions, most notably the “*Caisse des Dépôts et Consignations*”, should be underlined as it has been instrumental in allowing some recent developments in innovative technologies<sup>25</sup>.

*The Energy Transition for Green Growth Act*, provides the main legal framework of France renewable energy policy, setting objective of 23% RES by 2020 and 32% by 2030. In 2030 renewable energy sources should account for 40% of total electricity generation and 38% of final heat consumption<sup>26</sup>.

*SAF Environnement Fund* is a guarantee fund for geothermal district heating covers geological risk and protects operators against the risk faced during the exploration and exploitation phases of geothermal projects.

### Support schemes

France has put several instruments in place to forward geothermal energy utilisation for electricity as well as for heating and R&D.

Regarding Innovation and R&D, *the Investments for the Future programme*<sup>27</sup> is the main financial instrument for the geothermal sector, increasing the potential of exploitable geothermal resources for heat and electricity. The implementation of the Investments for the Future program is steered by the General Investment Commission (CGI). It is supported by several operators, including ADEME, which is responsible for innovation for energy and ecological transition.

To support and manage the special nature of these projects, ADEME offers project owners two types of financing:

- Support via State aid which is subject to European competition regulations. This is organised through calls for projects.

Two tools for investing own funds as an "informed investor":

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<sup>25</sup> EGEC, Country Fiche France, [https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-FR\\_2\\_Final.pdf](https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-FR_2_Final.pdf)

<sup>26</sup> LOI n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte (1), <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031044385&dateTexte=&categorieLien=id>

<sup>27</sup> French Environment & Energy Management Agency, <https://www.ademe.fr/en/investments-for-the-future>

- for SMEs: the Ecotechnologies fund;
- for intermediate-sized enterprises (ISE) and large enterprises: ADEME's direct investment in entrepreneurial companies.

These investments are made as a long-term informed investor. A non-French company can benefit from these investment mechanisms to receive financing for their innovative projects provided the demonstrators or protection will be located in the country and benefit the French economy and job market.<sup>28</sup>

There is also the so-called *Programme des Investissements d'Avenir 3 (PIA3)*, that is organised regularly, once a year for the period of 2019-2021.

## 12. TURKEY

Turkey is located on an active tectonic zone. Its geological and geographical location is rich in terms of geothermal energy resources – it has approximately 1.000 geothermal springs that located all over the country that have various of temperatures.

The geothermal capacity of Turkey is very high: 78% of these geothermal fields are situated in Western Anatolia, 9% in Central Anatolia, 7% in the Marmara Region, 5% in Eastern Anatolia and 1% in the other regions. 90% of geothermal resources are low and medium enthalpy geothermal areas which are suitable for direct applications (heating, thermal tourism, industrial usage, etc.), while 10% are suitable for indirect applications (generation of electricity). Geothermal sources have widespread uses in Turkey<sup>29</sup>. Today geothermal energy is used for electricity production, heating (greenhouse and residences), thermal and health tourism, industrial usages, fish farming, for drying purposes and etc. The installed capacity of geothermal energy as of year 2018 was 14.9 GWe.

The exploration of geothermal energy in Turkey falls under the *Geothermal Resources and Natural Mineralized Waters Law*. Since 2008, this piece of legislation has helped private sector to start investing in geothermal projects. In conjunction with this development, the country's total geothermal heat capacity (visible amount of heat) reached to 35.500 MWt.<sup>30</sup> Nowadays, recording visible growth in geothermal power capacity thanks to its market liberalisation and support mechanisms, Turkey has become a global example.

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<sup>28</sup> ADEME, *Investment Mechanisms*, <https://www.ademe.fr/en/investment-mechanisms>

<sup>29</sup> Ministry of Energy and Natural Resources of Turkey, *Geothermal Energy Potential Of Turkey And Research Studies*, <https://www.enerji.gov.tr/en-US/Pages/Geothermal>

<sup>30</sup> Ministry of Energy and Natural Resources of Turkey, *Geothermal Resources and Natural Mineralized Waters Law*, <https://www.enerji.gov.tr/File/?path=ROOT%2f1%2fDocuments%2fSayfalar%2f5686+SAYILI+JEOTERMAL+KAYNAKLAR+VE+DO%c4%9eAL+M%c4%b0NERALL%c4%b0+SULAR+KANUNU.pdf>

## Support schemes

Renewable energy producers in Turkey received TRY 38.04 billion (EUR 5.8 billion) in incentives in 2019 under the *Renewable Energy Support Scheme (YEKDEM)*, according to data provided by Energy Exchange Istanbul (EXIST). Under the YEKDEM program, renewable energy plants get feed-in tariffs. The stimulus is also available for geothermal. The YEKDEM scheme is ending this year and the authorities are working on a new model. Turkey has another incentives mechanism, called *YEKA or Renewable Energy Resource Zones*. It was launched in 2016 and its tenders forms part of Turkey's aim to supply 65% of its energy needs from domestic and renewable sources by 2023.<sup>31</sup>

## 13. SWEDEN

Sweden is the leading market for shallow geothermal in Europe, and the largest user of geothermal in terms of final energy use in Europe. Thanks to a successful regulatory and financial framework, and favourable climate and geological conditions, Sweden is consistently leading the European market in terms of installed stock and sales of shallow geothermal systems. Moreover, Sweden is also investing in geothermal technologies, such as underground thermal energy storage (UTES), to deal with seasonal demand peak in heating and cooling.

In terms of legislative initiatives, the *Framework Agreement on Energy Policy (Energy Agreement)* provides the main legislative framework for Sweden's renewable energy policies. This legislative framework does not make any specific reference to geothermal energy or to plans for the development of geothermal technology other than heat pumps.

## Support schemes

All renewable energy generation technologies, including geothermal, are eligible for a quota system, which obliges electricity suppliers, certain electricity consumers and energy-intensive companies to annually acquire renewable energy certificates in due proportion to their electricity sales and their consumption by a set date. In addition, electricity produced from geothermal energy in electricity generators with a capacity lower than 50 kW is not taxable and a tax reduction is provided for the excess electricity fed from microproducers of electricity generated from renewable energy sources.

Concerning heating and cooling, the installation or replacement of a heat pump in both apartments and single-family houses is eligible for the tax allowance covering 30% of the labour costs (up to SEK 50 000 per year).<sup>32</sup>

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<sup>31</sup> Balkan Green Energy News, *Renewable energy producers in Turkey get EUR 5.8 billion in incentives in 2019*, <https://balkangreenenergynews.com/renewable-energy-producers-in-turkey-get-eur-5-8-billion-in-incentives-in-2019/>

<sup>32</sup> EGEC, Country Fiche Cyprus, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-SE.pdf>

## 14. IRELAND

The development of the geothermal sector in Ireland is rather slow. Ireland is mostly using shallow geothermal systems for heating and cooling. However, despite the low rate of usage, the shallow geothermal systems are the best answers to decarbonisation in Ireland, especially where the population heavily relies on oil boilers.

In terms of the legislative framework, Ireland energy policy has been mainly defined in 2015 White Paper entitled “*Ireland’s Transition to a Low Carbon Energy Future 2015-2030*” (DCENR, 2015). The paper sets the framework for the government’s renewable energy policy 2015-2030. According to the white paper, Ireland aims to establish a new regulatory framework to facilitate the exploration and development of geothermal energy resources in order to bridge the gap to the 2020 renewable heating target. Furthermore, the paper calls for the establishment of a regulatory framework to facilitate the development of geothermal energy resources to 2030<sup>33</sup>.

*The Sustainable Energy Authority of Ireland (SEAI)* is Ireland's national sustainable energy authority that works with householders, businesses, communities and government to create a cleaner energy policy framework and provides financial support for R&I projects. Energy decarbonisation and climate action are more firmly on the agenda than ever before. SEAI now offers research funding of up to €650,000 per project over four years. Demand has increased more than tenfold in the last two years since a review and re-launch of the programme, and an increased number of larger-scale projects than ever before are being funded. SEAI hosts a cross-government consultation prior to the launch of funding calls, so that projects are positioned to have more direct impact on cross-sectoral policy priorities. Strategic research partnerships have been negotiated with several key organisations, including the Geological Survey of Ireland. These new partnerships enable a highly joined up approach to the funding of energy research in Ireland.<sup>34</sup>

## 15. CYPRUS

The use of geothermal energy in Cyprus is limited to the heating and cooling applications mainly for the residential buildings. From 2010 and until 2014, there were two research projects funded by the Research Promotion Foundation of Cyprus. These were focused on mapping of ground temperatures and soil’s properties in specific areas of the island. The results of these projects confirm that there is no direct geothermal potential in Cyprus, apart from the use of ground source heat pump systems. Over last four years (2016-2019) the

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<sup>33</sup> EGEC, Country Fiche Ireland, <https://www.egec.org/wp-content/uploads/2019/11/Country-Fiches-IE.pdf>

<sup>34</sup> Energy Ireland, *Ireland’s energy research revolution*, <https://www.energyireland.ie/irelands-energy-research-revolution/>

legislation in Cyprus in regard to the use of geothermal energy remains the same. Although, there are training courses accompanied with certification schemes for geothermal heat pump installers which exist from 2017, the interest of the employers and employees remains limited. This evidence introduces till now the lack of certified specialists for the installation and maintenance of the ground source heat pump systems.<sup>35</sup>

It is worth noticing that in 2018 a financial supporting scheme for energy interventions in residential buildings was launched by the Ministry of Energy, Commerce and Industry. Under this scheme, a series of intervention measures was eligible for subsidisation and among them the installation of a ground source heat pump system was an option. This scheme was finalised by the middle of the year, due to the absorption of the available fund, but there was no interest about the installation of a shallow geothermal system.<sup>36</sup>

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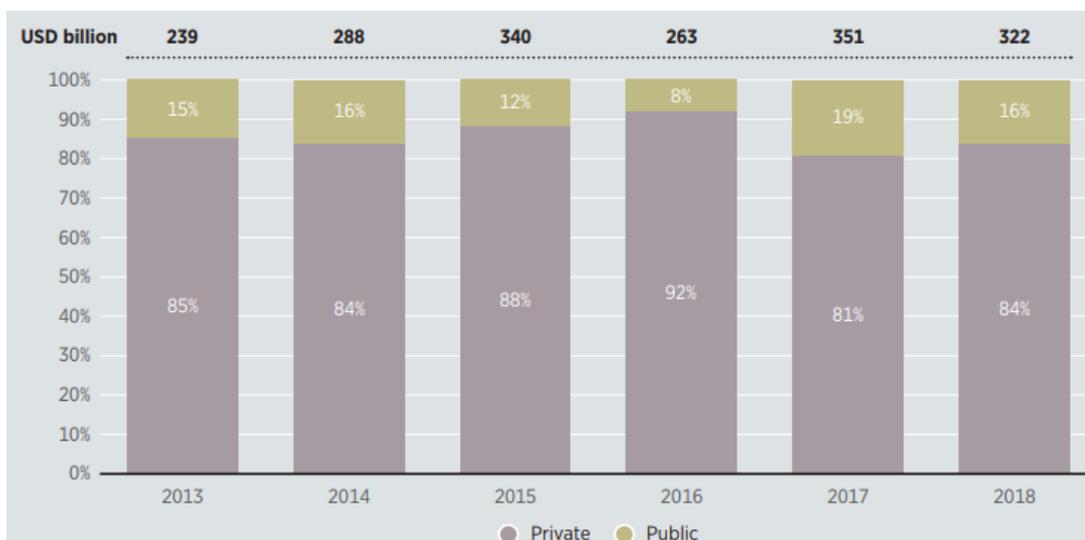
<sup>35</sup> Apostolos Michopoulos, *Geothermal Energy Use, Country Update for Cyprus*, <http://europeangeothermalcongress.eu/wp-content/uploads/2019/07/CUR-07-Cyprus.pdf>

<sup>36</sup> *Idem*

## 4. Overview of private R&I funding at the Global and European levels

### 1. CURRENT STATUS AND REVIEW OF THE LAST DECADE, GLOBAL PRIVATE FUNDING

In terms of private investments, IRENA's report on Global Landscape of Renewable Energy Finance 2020 shows that on the global level **private sources** have continued to be **the dominant source of financing** for renewable energy projects, accounting for **86% of total investments between 2013 and 2018, with an average of USD 257 billion per year.**



(Figure 6. Public and private investment in renewable energy finance 2013-2018, source: [IRENA](#))

Moreover, the analysis conducted by the IEA shows that **companies active in energy technology sectors have increased their total annual energy R&D spending by around 40% over the last decade** (IEA, 2020b), and their total energy R&D spending reached around USD 90 billion in 2019.

For the geothermal sector, a large part of these investments were directed to innovation and the development of demonstration projects: new technologies for geothermal DH, new areas for geothermal power plants, size and efficiency of the plants...

In 2019 however the growth was 3%, lower than the 5% annual growth observed in the two periods 2010-13 and 2015-18, which were preceded by the global financial crisis and divided by the economic impact of the oil price collapse of 2014.

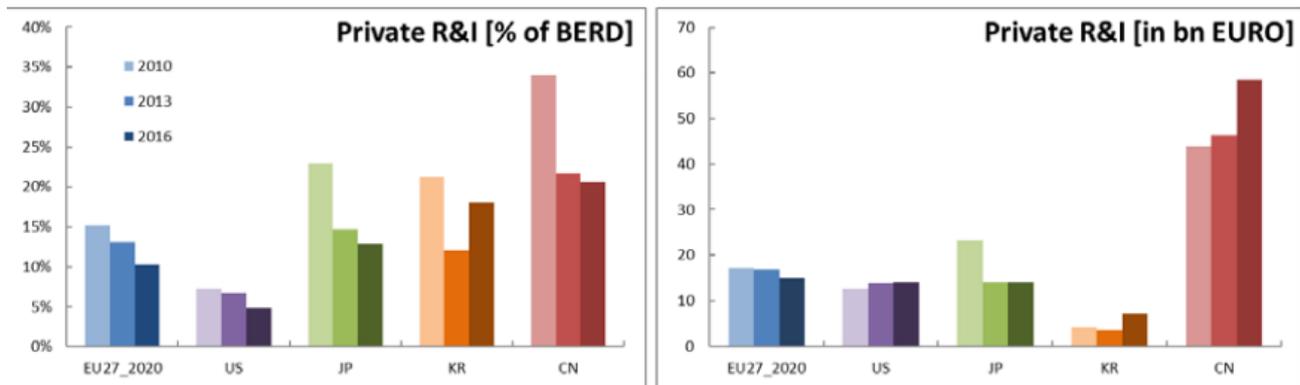
On the positive side, it is worth highlighting that companies active in **renewable energy technologies have increased their R&D spending faster than other energy technology**

**sector companies:** they increased their expenditure on R&D by 74% between 2010 and 2019, adding over USD 2.5 billion to efforts to improve their technologies.<sup>37</sup>

The above-mentioned global trend is also reflected **on the European level: private financing is leading the investments race in R&I.** According to the European Commission's *Report on the progress of clean energy competitiveness*, the EU has invested in recent years an average of **nearly EUR 20 billion a year on clean energy R&I** prioritised by the Energy Union<sup>38</sup>:

- EU funds contribution - 6%
- Public funding from national governments accounts - 17%
- **business contribution estimated - 77%**

(Figure 7: Estimates of private R&I financing of Energy Union R&I priorities)



(source: Report from the Commission to the European Parliament and the Council on progress of clean energy competitiveness, pag. 11)

However, the overall public and private spending trends **on research & innovation (R&I) within the EU** are not encouraging. Member States are spending slightly less on clean energy R&I compared to previous years, while the EU's overall public R&I investment in clean energy technologies as a share of GDP is the lowest among major economies. This mirrors the global trend in private sector: the International Energy Agency observes that public sector spending on low-carbon energy technologies was lower in 2019 than in 2012.<sup>39</sup>

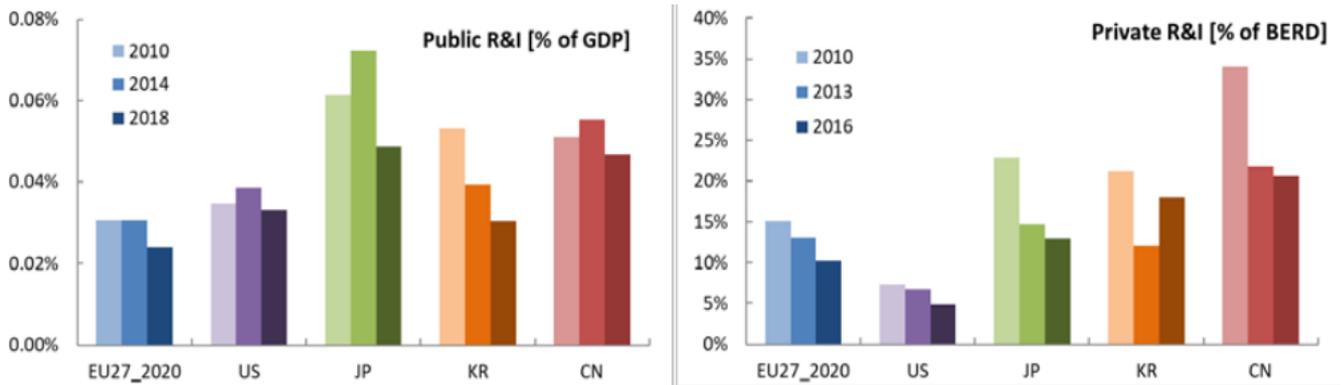
<sup>37</sup> IEA, Energy Technology Perspectives 2020 - Special Report on Clean Energy Innovation, pag 43, [https://emis.vito.be/sites/emis/files/articles/91/2020/Energy\\_Technology\\_Perspectives\\_2020\\_-\\_Special\\_Report\\_on\\_Clean\\_Energy\\_Innovation.pdf](https://emis.vito.be/sites/emis/files/articles/91/2020/Energy_Technology_Perspectives_2020_-_Special_Report_on_Clean_Energy_Innovation.pdf)

<sup>38</sup> Report from the Commission to the European Parliament and the Council on progress of clean energy competitiveness, [https://ec.europa.eu/energy/sites/ener/files/report\\_on\\_clean\\_energy\\_competitiveness\\_com\\_2020\\_953.pdf](https://ec.europa.eu/energy/sites/ener/files/report_on_clean_energy_competitiveness_com_2020_953.pdf)

<sup>39</sup> 2020 report on the State of the Energy Union pursuant to Regulation (EU) 2018/1999 on Governance of the Energy Union and Climate Action, [https://ec.europa.eu/energy/sites/ener/files/report\\_on\\_the\\_state\\_of\\_the\\_energy\\_union\\_com2020950.pdf](https://ec.europa.eu/energy/sites/ener/files/report_on_the_state_of_the_energy_union_com2020950.pdf)

**The estimated private investment in Energy Union R&I priorities** (spanning a number of business sectors) **has been decreasing in recent years**. Moreover, **R&I investment in the activities set out in the European Strategic Energy Technology Plan**, agreed between Member States, industry, the research community and the Commission, **represents only 15% of the estimated needs up to 2030**.

*(Figure 8: Estimated public 52 and private 53 R&I financing in the Energy Union priorities)*



*(source: 2020 report on the State of the Energy Union pursuant to Regulation (EU) 2018/1999 on Governance of the Energy Union and Climate Action, pag. 13)*

## 2. EU PRIVATE SECTOR INVESTING IN R&I FOR GEOTHERMAL

The main actors in private finance for renewable energy investments are:

- **Commercial banks**
- **Institutional investors** (incl. pension funds and insurance companies)
- **Financial market investors** (incl. venture capital/private equity, high net worth individuals, angel investors, etc.)
- **Private companies** (company's own resources)
- **Small end-users, crowdfunding & corporate sourcing** (households, farmers, small cooperatives, etc.)

The deployment of geothermal energy technologies at scale is dependent on the availability of private financing.

### a) Actors

There are several categories of actors that provide private financing to geothermal energy projects, each with its own specific characteristics. However, private investors are looking to balance the risk and profitability of their investments, usually reflected in a metric such as the cost of capital. Different types of investors will have a different tolerance to risk: for instance, a large financial institution with a diversified project portfolio may be more willing to invest in a riskier geothermal project than a small investor that would entirely rely on said project.

Category of private investor	Type of geothermal projects supported	Type of financing provided
Local banks	Geothermal heat pumps (individual, large buildings, business...), district heating...	Loans
Private equity	Geothermal developers, manufacturers, large projects (district heating, electricity)	Equity financing
Pension funds	All	Any, through private financial institutions such as banks or PE
Investment banks	Refinancing, manufacturers, utilities, large scale project financing	Loans, equity, complex financial products
Households	Geothermal heat pumps, district heating	Private investment, heat bills payment

SMEs	Geothermal heat pumps, district heating/heat for processes, small electricity projects	Private investment (equity), corporate PPA
Utilities	All (typically larger projects)	Private investments, project finance (typically structured by involving other investors)
Citizens/energy communities	All, usually projects within the community	Crowdfunding (loans, grant, equity...)

### b) Instruments

Various instruments allow geothermal project developers to gather the necessary capital for their geothermal project. Instruments can be deployed at various scale: there is for instance significant differences in the loan provided to a household for installing a geothermal heat pump in their home by a local bank, and the loan provided by an investment bank to a utility for the financing of several large scale geothermal projects in export markets. The financial instruments usually provided by private financial actors to geothermal projects include:

- **Loans:** the provision of a sum of money that must be paid back to the investors (at an interest). Loans are an attractive option for developers in the current financial conditions of low interest rates. However they require a robust derisking framework and a degree of maturity in the geothermal energy market as investors want to minimise their risks.
- **Equity:** in providing equity, private investors become directly involved in the projects, and do not receive a return if the project is not profitable enough. As a riskier form of financing, it is usually provided either directly by developers, or at later stages of the project where the geothermal risk has been mitigated to a large extent.
- **Corporate PPAs** are an emerging financing instrument for geothermal project developers. By securing the demand for the geothermal energy produced, developers ensures its income, which in turns reduces the financial risk profile of the project. Corporate PPAs are emerging rapidly as the evolution of public operational support framework is exposing developers to more financial risks.

There is no single private financial instrument that is inherently better for geothermal energy technologies. Moreover, beyond direct financing, some financial instruments can be directly relevant to the market uptake of geothermal energy projects. For instance securities backed on the provision of geothermal energy, harmonized within the framework of the EU sustainable finance taxonomy, can allow to direct new financing to the geothermal sector. However, such complex financial products are only emerging in the renewable sectors, and need a harmonized set of standards to prevent greenwashing.

## I. Private Power Producers:

Within the EU private financing landscape, private companies (utility industry) are investing quite liberally in technologies that it hopes will solidify its relevance during the clean energy transition. These prefer to create corporate funds that provide investments for a wide range of renewable energy projects, including geothermal<sup>40</sup>:

- **BP Ventures:** the British petroleum giant has invested more than \$400 million in 40 companies, along with more than 200 co-investors. It has money in Drover (carsharing), Freewire (electric vehicle charging), Fulcrum Bioenergy (creating biogas from household waste), Peloton (autonomous vehicles and truck platooning) and Victor (on-demand jets).
- **Enel Startup:** the Italy-based company manages eight "innovation hubs" worldwide, where it is collaborating on more than 165 projects. It has put resources into companies such as Archon (monitoring drones), Demand Energy (an energy storage company that Enel ended up buying), I-Em (maintenance and management for renewable energy plants) and Ultrasolar (which optimizes solar panel production).
- **Engie New Ventures:** the four-year-old French organization focuses broadly on cleantech. Its investments include Advanced Microgrid, Airware (industrial drone applications), Gogoro (electric scooters and swappable batteries), Heliatek (organic solar film) and Homebiogas (residential biogas technology).
- **Shell GameChanger:** this accelerator program originally was created back in 1996, but the senior management added a cleantech component in collaboration with the National Renewable Energy Laboratory. The initial focus is on energy storage technologies, and it will grant up to \$250,000 in funding.
- **Total Energy Ventures:** According to its informational website, the venture arm of French energy company Total review more than 500 proposals annually.
- **Lead Ventures** is Central and Eastern Europe's industry specialized venture capital and private equity firm. Lead Ventures has EUR 100 m under management invested by MOL and two financial institutions specialized in supporting the start-up ecosystem – the Hungarian Development Bank (MFB) and Eximbank.

They operate independently and ask for support to crowdsourcing platforms, 'crowd' and 'outsourcing', such as Idea Bounty, OpenIdeo, InnoCentive etc.

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<sup>40</sup> 9 corporate venture funds shaping clean energy innovation, <https://www.greenbiz.com/article/9-corporate-venture-funds-shaping-clean-energy-innovation>

## Case study: ENEL call for proposals “Competition: Brinemine – extracting lithium & minerals from geothermal brine”

In December 2019, [Enel](#) has launched a competition valued at \$30,000 seeking novel methods to economically extract lithium and other valuable minerals from brines produced in geothermal power plants. [InnoCentive](#) collaborated with Enel to manage this challenge. Created in 2001 under the auspices of the pharmaceutical firm Eli Lilly, InnoCentive is a private intermediary between companies or organisations to support their R&I deployment. They are specialised in short term (30 to 620 days) competition challenges. InnoCentive typically bring assistance to proposers and solutions providers.

### II. Banks and Investors

Commercial banks, Institutional investors (incl. pension funds and insurance companies) and Financial market investors (incl. venture capital/private equity, high net worth individuals, angel investors, etc.) generally participate in geothermal projects when resources are confirmed. However, some new actors have financially contributed to geothermal R&I projects.

For example, in the Netherlands Rabobank plays an important role in financing Dutch geothermal development. It has so far funded around 90% of Dutch geothermal heating projects, with an exposure of more than EUR 200 million.

In October 2020, a new private funding company for RES was launched - **Downing Renewables & Infrastructure Trust PLC (DORE)**. They are intending to launch an initial public offering (IPO) and seeking to raise up to **GBP 200 million** via a placing, an offer for subscription and an intermediary offer (together, the Issue) to invest in a diversified portfolio of renewable energy generating assets including geothermal along with other infrastructure assets in the **UK, Ireland and Northern Europe**.<sup>41</sup> DORE is expected to qualify for the London Stock Exchange's Green Economy Mark at Admission, which recognises companies that derive 50% or more of their total annual revenues from products and services that contribute to the global green economy.

Another development in terms of private financing in geothermal: Mubadala, the Abu Dhabi-based sovereign investment company, has announced taking a significant stake into Asper Investment Management's (Asper) **Dorothea investment vehicle (Dorothea)**. Dorothea is targeting to deploy more than AED 2.1 billion (**EUR 500 million**) into **building a network of district heating services across the Netherlands**. The company is focused on

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<sup>41</sup> Press Release, New Downing Trust Announces Intention-To-Float, <https://www.downing.co.uk/news/new-downing-trust-announces-intention-to-float>

developing a series of district heating systems across the Netherlands, tapping among others geothermal energy. Khaled Abdulla Al Qubaisi, CEO of Mubadala Aerospace, Renewables and ICT said: “This investment is highly attractive for us, as heating networks not only support the development of sustainable energy infrastructure but are also stable assets which provide predictable cash flows and steady returns. Mubadala and Asper have a successful record of investing in public energy services and as Europe transitions to a zero-carbon future”.<sup>42</sup>

**Deutsche Investitions- und Entwicklungsgesellschaft** – institutional investor and a subsidiary of KfW Group in Germany, provide companies with long-term investment capital in the form of loans or equity. They also advise and help customers to design their investments efficiently. Its investments portfolio includes also projects focused on geothermal.<sup>43</sup>

In the US, venture capital has been the most popular option when providing private investments in clean energy technologies. A recent example has been provided by **Vinod Khosla, Collaborative Fund and The Engine** that provided \$6 million to **Quaise** - a start-up developing millimetres wave drilling capabilities to access deep geothermal energy. Quaise is developing and commercializing a deep drilling method invented at the MIT Plasma Science and Fusion Center — using a gyrotron to generate millimetric electromagnetic waves for drilling at depths beyond what can be accomplished today with conventional drilling. The company is working toward accessing depths of 10 to 20 km, which would dramatically open the opportunity for this clean and power-dense energy source.<sup>44</sup>

Another approach towards the contribution of private finance towards geothermal development can be seen in the case of **Reykjavik Geothermal**, an Iceland based developer company. This company has been backed by the American hedge fund billionaire Paul Tudor Jones II. In 2019 it kicked off a \$4.4 billion project to bring geothermal to Ethiopia. The company started exploration drilling in September 2019 for two 500-megawatt plants in Corbetti and Tulu Moye, south of the capital Addis Ababa. At full-scale, each project would become the largest independent power producer in Africa.<sup>45</sup>

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<sup>42</sup> Abu Dhabi-based sovereign investment fund buys into district heating vehicle in the Netherlands, <https://www.thinkgeoenergy.com/abu-dhabi-based-sovereign-investment-fund-buys-into-district-heating-vehicle-in-the-netherlands/>

<sup>43</sup> DEG, <https://www.deginvest.de/International-financing/DEG/>

<sup>44</sup> Updated: A roundup of venture capital funding in clean energy, <https://pv-magazine-usa.com/2020/06/12/a-roundup-of-venture-capital-funding-in-clean-energy/>

<sup>45</sup> Bloomberg, The \$4.4 Billion Energy Plan for Ethiopia, <https://www.bloomberg.com/news/articles/2019-05-27/tudor-jones-backed-rg-poised-for-4-4-billion-african-power-push>

Moreover, **Breakthrough Energy Ventures, the investment firm financed by billionaires like Jeff Bezos, Bill Gates, and Jack Ma that invests** in companies developing technologies to decarbonise society, is **investing \$12.5 million in a geothermal project development company called Baseload Capital.**

Baseload Capital is a project investment firm that provides capital to develop geothermal energy power plants using technology developed by its Swedish parent company, Climeon.

### Case study: Climeon Heat Power solution

Last year, Baseload Capital Holding AB and the Nordic Environment Finance Corporation, [NEFCO](#), have agreed on a financing programme to accelerate the building and deployment of Heat Power plants on a global scale. Baseload Capital was founded in January 2018 as an investment entity for renewable energy projects by three Swedish venture capital companies and Climeon. Then, Baseload Capital issued USD54 million green bond to finance low temperature geothermal power generation development globally. Finally, Investor-led investment fund Breakthrough Energy Ventures has invested \$12.5 million in Baseload Capital, the private investment company which Climeon owns part of, to speed up the global deployment of low temperature geothermal heat power.

### Case Study: GA Drilling and its disruptive Plasmabit contactless drilling technology

Slovakia-based GA Drilling signed in 2019 a EUR 4.2 million funding agreement with Lead Ventures and a service agreement with MOL Group. Lead Ventures, a Budapest based venture capital firm invested funds provided by MOL Group, and Hungarian Eximbank. In currently opened Series “B” round of financing, GA Drilling has contracted more than 85% of round’s investment volume. The earlier investors of Series “B” round – Berlin Technologie Holding, Slovak Investment Holding and American investor Ted Halstead have been followed by MOL Group, European oil major. MOL signed the Service Agreement, enabling GA Drilling to gain the access to onshore production wells. The direct investment from MOL Group is executed through their investment body Lead Ventures founded in 2018.

### III. Innovative solutions with crowdfunding & corporate sourcing

**Corporate sourcing** of energy is used by corporations or public authorities to secure their supply of renewable energy. More conventionally they have been used – notably in beyond the EU in markets such as the US – by utilities to source power capacity, for instance from renewables. The benefit of corporate sourcing is to provide certainty for both parties: the energy producer has a higher certainty on income with a stable customer at a predetermined price. The consumer benefits from certainty on price in the long term. Corporate sourcing of energy may take various contractual forms. It may correspond to Power Purchasing

Agreements (PPA, where an agreement is made for the long-term sale of energy by two parties), to a joint venture or even to a corporation investing in its own geothermal project. Often associated with renewable electricity, corporate sourcing can also be used for heat supply to industry, agri-food or for space heating.

Corporate sourcing can moreover be a key factor for the development of a geothermal demonstration project, either by providing support in the context of a joint venture for a demonstration project (e.g. the ECOGI project in France about the supply of geothermal heat to a biorefinery for process heat), or by reducing the financial uncertainty for project developers, and hence reducing capital costs.

This business model may involve a direct connection between the plant and the customer as in the case of the heat supply from the Rittershoffen plant. They can also be virtual PPAs where the energy - usually electricity - is fed at one end of the grid and consumed at the other. In the latter case, sound certification of the electricity consumption, for instance with guarantees of origins is necessary to avoid a double counting of the renewable energy produced throughout the energy system.

Geothermal energy, as a flexible baseload source of energy is particularly suitable for the needs of a PPA, as it can respond to variations in demand and is available when needed. For this reason, there are several examples of geothermal PPA across the world and in Europe.

### Case Study: PCC BakkiSilicon in Iceland

In 2014, Landsvirkjun, Iceland's national power company signs power purchasing agreements with the industrial actor PCC BakkiSilicon for 35 MW of hydroelectricity capacity and 58MW of geothermal electricity. The purpose of this agreement was to provide electricity for a plant to produce silicon metals. The value of geothermal power for this type of customer is the guarantee to have a stable electricity source (geothermal plants have capacity factors up to 100%) with stable prices in the long term.

Beyond virtual or physical PPAs, corporate sourcing includes companies developing geothermal projects for their own supply of power and heat. A great example can be found in the Netherlands with the agro-food industry where Dutch greenhouses replace gas by geothermal for heating their facilities. They often invest in the geothermal project development. Another example is in Belgium. Officially launched in December 2019, the drilling campaign for the geothermal heating project by Janssen Pharmaceutica in Beerse is under way. The company plan to heat its campus by geothermal.

Another option for the EU private sector to raise the necessary finances for its projects is **crowdfunding**. A recent example in this sense comes from Germany. Josef Birner from Herrsching, a private geothermal developer from Bavaria aims to mobilize private investors

and collect around EUR 14 million via crowdfunding to realize his geothermal project by providing geothermal electricity and heat) in a second attempt.<sup>46</sup>

Crowdfunding is an emerging resource for geothermal energy projects. Crowdfunding enables project to raise a new form of capital, that comes with strings attached. Typically, geothermal energy projects enter into crowdfunding financing to anchor projects within the community. The crowdfunding, while providing equity, is particularly relied on to foster community engagement. Indeed, the buy-in of the local community allows for a core of supportive citizens to signify their support of the project. By enabling the community to take financial ownership of the project, geothermal developers mitigate the risk of opposition as the involvement through crowdfunding guarantees transparency and accountability.

A key example of a crowdfunding project is the United Downs Deep Geothermal Project in Cornwall/ UK has successfully concluded its GBP 4.4 million fundraising campaign. The funding was thought in the form of bond financing through Abundance, a renewable energy focused crowdfunding platform. To a large extent, this project's crowdfunding is driven by financial motives. Another example is the GéoMarnes Project by Engie in the Paris area, which is primarily driven by the desire to engage the community in the project (the crowdfunding is limited geographically and contributions by individuals are capped to ensure it is not co-opted by large investors).

### 3. BLENDED FINANCE: AN INCREASING TREND FOR PPP

Increasingly, however, more countries have been opening doors to private developers and are following a model where the **public and private sectors share cost and risks when financing geothermal energy projects.**

For example, one of the key-components to Turkey's unparalleled growth in geothermal development has been the de-risking of geothermal fields using public funds. In 2016, the World Bank approved a \$350 million project developed with support of ESMAP which included a \$40 million risk sharing mechanism to cover part of the cost for failed exploration wells in projects that are expected to confirm about 210 MW of geothermal capacity. These projects are expected to mobilize about \$200 million of private capital and incentivize exploration outside the most developed areas.

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<sup>46</sup> Private developer targets crowdfunding for geothermal project in Bavaria, Germany, <https://www.thinkgeoenergy.com/private-developer-targets-crowdfunding-for-geothermal-project-in-bavaria-germany/>

Another example of cost sharing between public and private sectors is **St. Lucia**, where concessional financing will be used to carry out an exploration drilling campaign in an area with high prospects. If the resource is confirmed the government will engage a private company to fully develop the field.<sup>47</sup>

**The Green for Growth Fund (GGF)** - an impact investment fund that mitigates climate change and promotes sustainable economic growth by investing in measures that reduce energy consumption, resource use and CO2 emissions. The fund is a public-private partnership that leverages risk-capital provided by public institutions with additional private capital to substantially increase investment volumes to regions and sectors that do not normally attract such flows. The fund channels this dedicated financing to businesses and households through local financial institutions, and through direct investments to eligible projects and companies. The GGF operates in 19 markets across **Southeast Europe, including Turkey, the European Eastern Neighbourhood Region, and the Middle East and North Africa**. The fund supports projects that use established technologies, including geothermal.

This trend is also seen in Germany, where KfW Development Bank (KfW), the German government's development bank and RMB established **the Facility for Investment in Renewable Small Transactions (FIRST)**. It was set up as a debt funding platform with RMB contributing R1bn and KfW R300m. Initially targeted at the now-stalled small projects independent power producers programme (SPIPP), a department of energy initiative, FIRST has since expanded its mandate to include small renewable energy projects outside the SPIPP programme. FIRST demonstrates how a successful partnership between a commercial bank and a development bank, which have differing mandates and investment hurdles, can deliver a blended funding solution.<sup>48</sup>

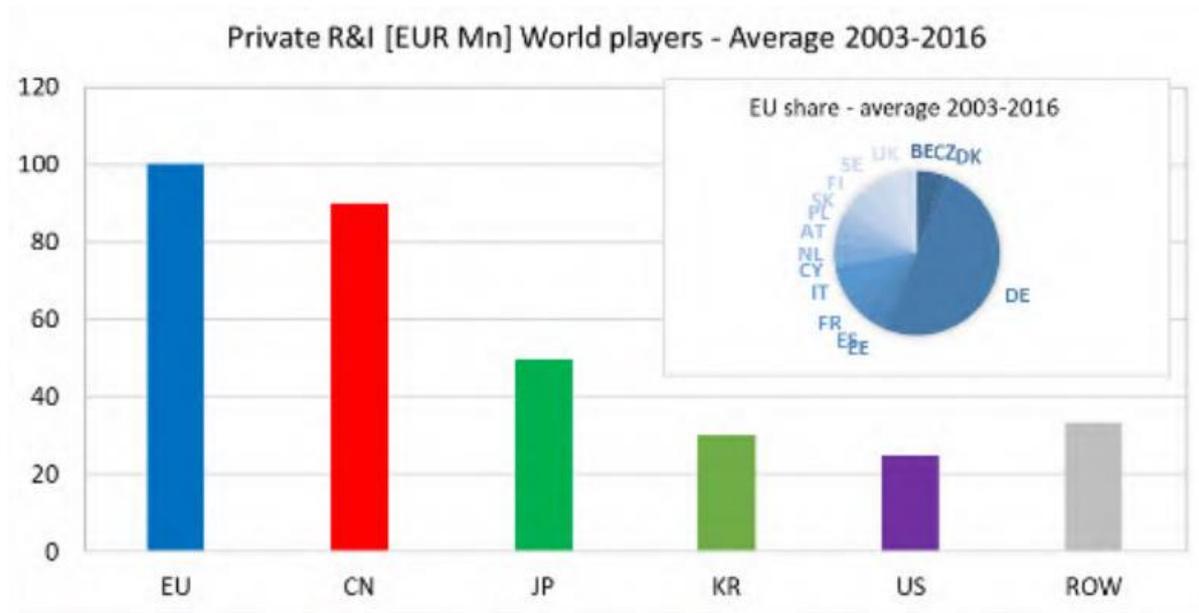
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<sup>47</sup> The World Bank, *Geothermal Energy is on a Hot Path*, <https://www.worldbank.org/en/news/feature/2018/05/03/geothermal-energy-development-investment>

<sup>48</sup> A FIRST FOR THE PRIVATE SECTOR AND RENEWABLES, <https://www.rmb.co.za/news/a-first-for-the-private-sector-and-renewables>

To sum up, in terms of private R&I funding for geothermal, **EU private companies invested quite markedly in R&I for geothermal energy over the last years**, as shown in Figure 9. According to the latest data available, the average yearly investment over the period 2003-2016 was **EUR 100 million**.

In the EU, **Germany had by far the lion's share. France, Italy, Sweden, Finland, and the Czech Republic (as well as UK)** are other remarkable countries.<sup>49</sup>



(Figure 9: *Average private R&I investment in the period 2003-2016*)

However, the **R&I private RES investments landscape post Covid-19** might be affected. The recent health crisis also impacted the landscape of energy investments that shows now very clear that in the overall economy recovery, R&I investments in geothermal and other renewable energy sources will be proved to be more efficient than ever. That is why a continuous dialogue and exchange of views between public and private sectors on how to improve the investments capacity in renewables is crucial.

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<sup>49</sup> COMMISSION STAFF WORKING DOCUMENT Clean Energy Transition – Technologies and Innovations Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on progress of clean energy competitiveness, pag. 9, <https://data.consilium.europa.eu/doc/document/ST-11880-2020-ADD-4/en/pdf>

## 5. Conclusion

The IP will be executed using various resources depending on the nature of the research, innovation priorities and the specific needs of the technologies. Several public and private mechanisms for supporting investments in deep geothermal energy exist at the European and national levels. These mechanisms can address different project stages and can come from different sources (public, private or a blending of both).

The European Union is the major provider of public funding for renewable energy and energy efficiency projects. It proposes mechanisms to allocate funding for every type of projects – from the most innovative to the most proven technologies, from small-scale R&I to large plants. The main information sources that were used in order to update the existing and upcoming EU's funding mechanisms were the European Union's institutions websites. As such, in some cases, the information provided on these sites has been replicated in the publication – the link to the source website being available at the end of the description.

There is a variety of EU public and private/national funds and financial schemes that can be used to achieve the climate neutrality by 2050. An overview of these has been listed in this report, as well as an average of EU public and private R&I spending on geothermal projects.

It is crucial to notice, however that within the context of the COVID19 crisis, the **R&I spending is likely to suffer in the next few years**. In its World Energy Investment 2020 report, the IEA reported that 2020 will see global energy investment slump 20%, which equates to almost \$400bn, compared to the 2% growth that was forecast before the crisis.<sup>50</sup> It also warns that renewables will not be spared.

Considering this, **a continuous discussion with both – private and public sectors – is crucial**. A loss of momentum now would be harmful on the long-term: the past years have seen a number of path-breaking commitments by major industrial players to net-zero goals, which implicitly commit them to the scale-up of technologies in need of demonstration and first-mover investment.

This information shall be used as a support tool in order to engage private stakeholders in the funding discussion of geothermal energy projects. More details on private funding for R&I are regularly updated and provided in the Annual reports on the execution of the Deep Geothermal Implementation Plan by companies (D4.4 and D4.5).

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<sup>50</sup> World Energy Investment 2020, <https://www.iea.org/reports/world-energy-investment-2020>