

Work Package 4: Framework Conditions for RD&I

Deliverable 4.1: Mapping of relevant policy and regulatory issues







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1. Introduction

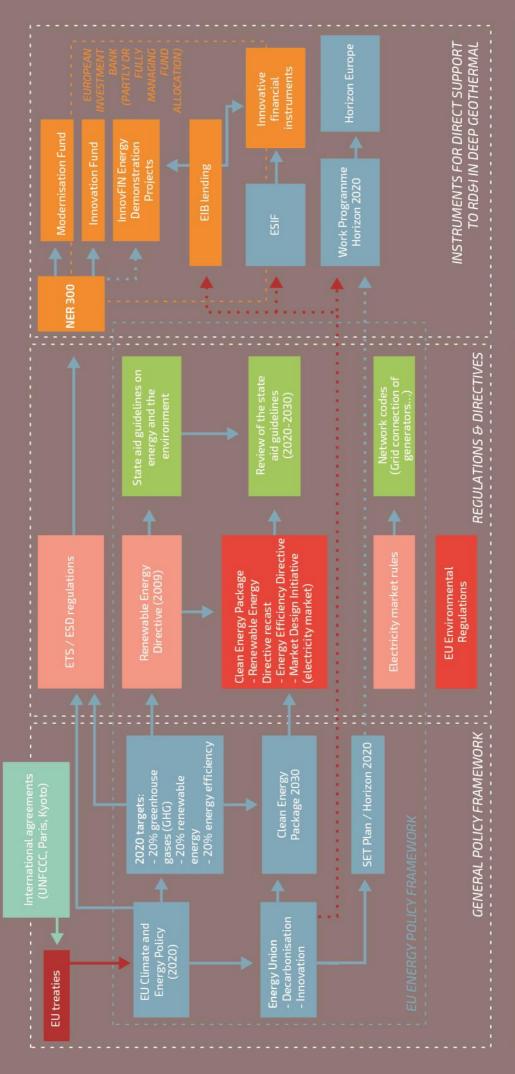
Deep geothermal energy is a heavily regulated sector, and usually requires a specific support framework. This publication proposes an overview and a mapping of the main European policies and regulations applying to deep geothermal energy, and an inventory of the main European funding streams for innovative deep geothermal projects.

When considering the European regulatory and policy framework, the various interlinked regulations and policies create a complex regulatory background. Although this complex regulatory framework may not necessarily result in an overregulation of geothermal projects, and may indeed provide a consistent and robust framework that allows confidence in deep geothermal energy projects, the lack of readability may be a deterrent for the emergence of new geothermal markets.

Geothermal energy is promoted at the European level in the framework of the EU's Climate and Energy objectives, which aim to put the European economy on a pathway compatible with maintaining climate change below 2°C. As a renewable energy source, deep geothermal energy is indeed a solution to meet this objective. However the specific requirements of geothermal – namely drilling, geothermal fluid extraction and possible gas emissions –put deep geothermal projects within the scope of several European environmental legislations. In addition, as geothermal development is still new in many markets, deep geothermal projects usually benefit from European policies to support research, development and innovation.

This publication proposes an overview of the regulatory and policy framework at the European level for geothermal energy, notably considering RD&I and environmental impacts. This overview aims to present the most general regulatory and policy framework – the European one – while acknowledging the role of national and regional authorities in providing additional frameworks that are adapted to local specificities. National and regional framework may indeed vary significantly from the European one, by proposing more robust and more specific policies according to the issues specific to a territory. According to the principle of subsidiarity, the EU proposes regulations that leave large margin for national, regional and local authorities to set more ambitious thresholds or to implement a detailed framework. This publication also explores several case studies of support frameworks for deep geothermal energy at the national level. These case studies notably underline the importance of programming in supporting the emergence of deep geothermal in new market, and of dedicated facilities such as geological risk insurance schemes.

OVERVIEW OF THE **EUROPEAN REGULATORY AND POLICY FRAMEWORK ON CLIMATE AND ENERGY** FOR SUPPORTING DEEP GEOTHERMAL



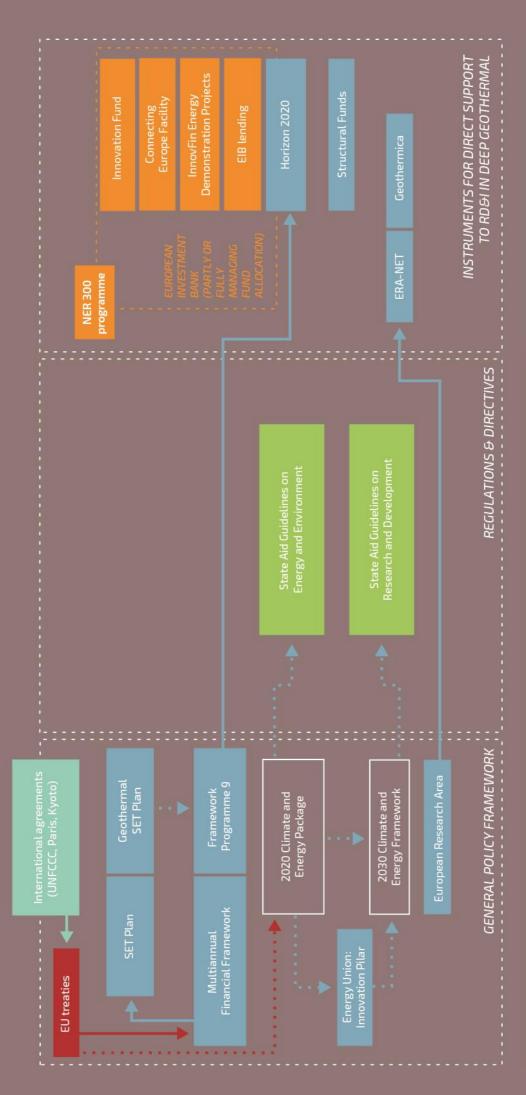
Guidelines: technical interpretation of Directives and Regulations by the EU Commission that shapes Member States application International agreemetns EIB managed financing European Commission as primary actor and enforcer EU Regulations.: binding on Member States, although enforcement comes from the European Commission - - - Partial driver Primary driver **EU Directives EU Laws** LEGEND

LIST OF ABBREVIATIONS

EIB: European Investment Bank
ESD: Effort Sharing Decision
ESIF: European Structural and Investment Fund
ETS: Emission Trading Scheme
SET Plan: Strategic Energy technology Plan
UNFCCC. United Nations Framework Convention on



OVERVIEW OF THE EUROPEAN REGULATORY AND POLICY FRAMEWORK ON RESEARCH, **DEVELOPMENT AND INNOVATION** RELATING TO DEEP GEOTHERMAL PROJECTS





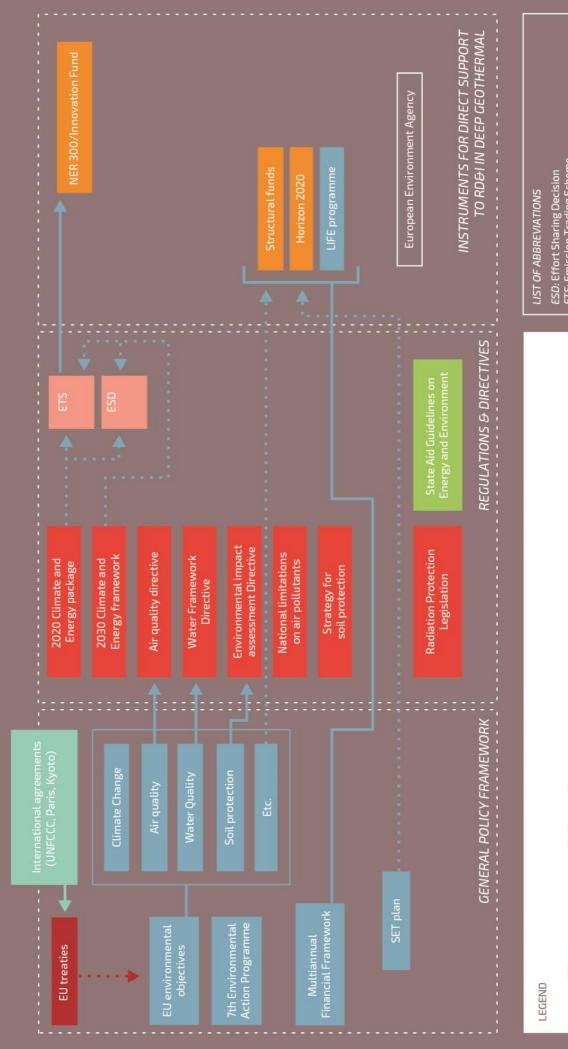
LIST OF ABBREVIATIONS

ETS: Emission Trading Scheme
SET Plan: Strategic Energy technology Plan
UNFCCC: United Nations Framework Convention on ERA: European Research Area Climate Change





OVERVIEW OF THE EUROPEAN REGULATORY AND SUPPORT FRAMEWORK ON ENVIRONMENT RELEVANT TO DEEP GEOTHERMAL PROJECTS



ETS: Emission Trading Scheme SET Plan: Strategic Energy technology Plan UNFCCC: United Nations Framework Convention on Climate Change

Guidelines: technical interpretation of Directives and Regulations by the EU Commission that shapes Member States application

European Commission as primary actor and enforcer

- - - Partial driver

Primary driver

International agreemetns

EU Regulations.. binding on Member States, although enforcement comes from the European Commission

EU Directives EU laws

EIB managed financing







2. Mapping of the policy and regulatory framework for deep geothermal energy

2.1 Index of key European policies and regulations

European Climate and Energy Framework

The European Union plays a key role in the promotion of renewable energy sources such as deep geothermal energy, notably thanks to its climate and energy policy framework. This framework is structured around two axes:

- The climate and energy targets (on renewable energy, energy efficiency and carbon emission reduction) and the related legislative texts, such as the Renewable or the Energy Efficiency Directive;
- The Emission Trading Scheme: the largest existing carbon market, which did not however succeed in providing a relevant price signal to direct industrial investment towards carbon emission reduction.

Both axes contribute to supporting innovation in deep geothermal energy. The ETS, from which the NER300 originates, provided direct support to several EGS projects in the past years.

The Renewable Energy Directive, which is the main piece of EU climate and energy legislation relevant for deep geothermal, introduced key provisions for the development of innovative energy technologies. For geothermal for electricity production, provisions such as priority of dispatch and priority access are instrumental to provide investor certainty at intermediate stages of technology readiness when supporting a demonstration project. The Renewable Directive also structured support schemes for renewable electricity at the European level, which led to the establishment of feed-in tariffs or premium that incentivise investments in new deep geothermal projects. The national binding target for minimum level of renewable energy in 2020 that included the Renewable Directive, as well as the requirement to provide some "National Renewable Energy Action Plans" were also instrumental for the development of deep geothermal by providing trajectories for each renewable source. The need to identify new resources to meet their target also led some Member States to initiate the development of deep geothermal in their territory or to relaunch it after long periods of stalled developments.



Emissions Trading Scheme, Effort Sharing Decision, NER300 and Innovation

The Emission Trading Scheme is the European carbon market for large facilities. The Effort Sharing Decision governs how "non-ETS" emissions reductions should be allocated among EU Member States. Within the Directives setting the ETS and the ESD, facilities to support the development of innovative renewable energy projects have been set up, notably the NER300 (which provided grants to renewable energy and CCS projects). It has proven a major tool for supporting geothermal projects). From 2020 onwards, the NER300 will be replaced by an Innovation Fund and a Modernisation Fund.

The Modernisation Fund is addressed at lower income European Member States for the modernisation of energy or industry facilities. It allocates 2% of the total ETS revenues. The Innovation fund meanwhile is expected to replace the NER 300 facility in using European Trading Scheme revenues to fund innovative energy projects. It should rely more heavily on financial instruments than its predecessor (which awarded all support through grants). Funding would come from the revenues from 400 million carbon allowances in the ETS.

European Structural and Investment Funds (ESIF) – Cohesion policy

The 'Cohesion policy' is behind the hundreds of thousands of projects all over Europe that receive funding from the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund (Cohesion Fund applies to EU Member States which have a GDP lower than 90 % of the EU-27 average – the average is calculated not including Croatia).

Economic and social cohesion – as defined in the 1986 Single European Act – is about 'reducing disparities between the various regions and the backwardness of the least-favoured regions'. The EU's most recent treaty, the Lisbon Treaty, adds another facet to cohesion, referring to 'economic, social and territorial cohesion'.

EU Structural and Investments Funds dedicated to Cohesion policy of interest for the geothermal sector are the following ones:

- The Cohesion Fund
- The European Regional Development Fund (ERDF)
- The European Social Fund (ESF)
- The European Agricultural Fund for Rural Development (EAFRD)

The funds of the Cohesion policy are allocated by seven-year programming periods, which are defined in the European budget. EUR 351.8 billion are set aside for cohesion policy measures in the 28 EU member countries for the 2014-2020 period. This amounts to about one third of the EU budget.



Financial Instruments (FI)

Financial instruments take an increasing importance in the attribution of Cohesion Policy funds, as the European Commission sees them as a solution for a "more efficient" use of the Structural Funds. For the European Institutions, Financial Instruments are a solution to maximise the impact of the Structural Funds by relying on mechanisms other than grants. Typical examples of financial instruments include technical assistance (such as pioneered by ELENA), soft loan schemes or revolving funds. For the 2014/2020 programming period, about EUR 4 billion of the European Structural and Investment Funds are channelled through the so-called Financial Instruments.

The definition of these instruments allows a "bottom-up" deployment, where the Managing Authorities of the ESIF, or the project leaders, can set up a Financial Instrument to fit their purposes. Their establishment does not require a modification of the Operational Programme, which makes it easy for a Managing Authority to repurpose ESIF funds to set up a FI.

Horizon 2020

Horizon 2020 is the main EU Research and Innovation programme with nearly EUR 80 billion of funding available over 7 years (2014 to 2020). It serves the "Innovation Union", a EU initiative that aims at promoting Europe's competitiveness.

Funding opportunities under Horizon 2020 are set out in multiannual work programmes, which cover a large array of issues across different EU priorities, from education to climate action, including the digital economy. The work programmes are prepared by the European Commission within the framework provided by the Horizon 2020 legislation.

European Investment Bank

The EIB is the European Union's bank. It is owned by the Member States and acts according to their policy priorities. The Bank works closely with other EU institutions to implement EU policy. It focuses on specific priorities including climate action and strategic infrastructure.

The EIB can intervene to support project through different channels such as:

- Loans: recipients range from large corporations to municipalities and small and medium-sized enterprises;
- Technical Assistance: which is provided by a team of experts (economists, engineers and sectoral specialists) to complement EIB financing facilities;
- Guarantees;
- Venture Capital: channelled through intermediaries.



The EIB lending policy forces the Bank to account for issues such as the climate impact of its investment portfolio. The Bank's annual climate action target is currently set at 25% of total Bank lending based on a clearly defined set of eligible sectors and projects. Over the last few years, renewable energy and energy efficiency projects constituted approximately one half of the Bank's climate action projects, equivalent to around 40 percent of total climate action lending¹.

3. Case studies of selected European national frameworks

FRANCE

Highlights on the national situation



Overview of the deployment of geothermal energy

In 2017 the total thermal installed capacity in France is estimated to be 509,5 MWth² with 60 plants in operation. The installed geothermal electricity capacity is 17 Mwe.

A leading market in Europe for deep geothermal energy, thanks to significant potential, a long tradition of utilizing this resource and a large established capacity for district heating, France is also at the forefront of innovation for

geothermal energy. It is notably in Alsace, in Soultz en Forêt that the first demonstration EGS power plant was successfully developed. Overseas territories such as Guadeloupe benefit from favourable conditions for geothermal development, which contributes to the energy security of these Islands.

In 2017, France was the theatre of another ground-breaking innovation in deep geothermal: in December, the successful completion and test of a sub-horizontal geothermal well on the Paris suburban Cachan site was announced. It was followed by a second well in March 2018. The well, which will serve as the injection unit of the local Geothermal District Heating doublet, is a world premiere in geothermal well engineering.

¹ European Investment Bank, Energy Lending Criteria, 2013

² EGEC Market Report 2017



Stated objectives: policies and prospects

France's energy objectives are defined by the Multiannual Energy Planning³ (*Programmations Pluriannuelles de l'Energie*). This 5-year plan, currently covering the 2018-2023 period, notably lays out objectives for the development of each energy technology.

For geothermal for electricity, the Programming builds on the establishment of a geological risk insurance scheme, and on support tariffs adopted during the year 2017. For geothermal for heating, the GEODEEP Fund is also put forward, with objectives to extend the use of this resource beyond its "traditional" area around Paris.

On heating and cooling, the use of deep geothermal in France is planned to at least double in the next 5 years (from 200 ktoe in 2018 to 400-550 ktoe in 2023) in the Mainland. For electricity, capacity in the mainland is planned to grow from 8 MW to 53 MW over the programming period.

Programmes on geothermal energy in France

NAME	MANAGED BY	OBJECTIVES	BUDGET
Call for R&D proposals- renewable energies including geothermal	ADEME (French Environment and Energy Management Agency)	Financial support for geothermal R&D projects.	N.A
Investments for the Future programme	ADEME is responsible for innovation for energy and ecological transition; the implementation is steered by the General Investment Commission (CGI)	Specific call for proposal based on two pillars: Axis 1: geothermal development Axis 2: demonstration projects The 2018 calls opened on February and has three closing dates: June 14, 2018, 5 pm, October 25, 2018, September 19, 2019.	Global budget for projects: EUR 3.17 ⁴ Billion
Call for R&D proposals – energetic uses of underground	ANR (National Agency for Research)	Financial support for R&D projects, including geothermal. The 2017 call was launched in September and will close at the end of March 2018.	N.A
Geothermal risk insurance	GEODEEP	Insurance for projects at early stage to mitigate the risk of well failure. Established in 2015.	EUR 50 million

³ Programmations Pluriannuelles de l'Energie, 2018-2023. (2016) https://www.ecologique-solidaire.gouv.fr/sites/default/files/PPE%20int%C3%A9gralit%C3%A9.pdf

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⁴ 2017 figures from ADEME Bilan 2010-2017



In 2010, following the conclusions of a commission on strategic investment priorities and domestic borrowing, the government decided the allocation of EUR 35 billion for the support of investments in several sectors such as higher education and research as well as sustainable development. The "Investments for the Future" programme ("Investissements d'Avenir") was created to promote innovation and creating non-relocatable jobs in these sectors. They are managed by the French Energy Agency ADEME, which is responsible for the implementation of the environmental and energy transition. As such, it publishes calls for expression of interest for companies, and has granted a budget of EUR 3.1 billion in the 2017 to support innovative projects for the developments of smart grid and renewable energies.

France RD&I framework covers a wide range of topics related to geothermal energy development and demonstration projects. The general French regulatory and support framework includes facilities for geothermal risk management and mitigation and support to district heating and electricity projects.

GERMANY

Highlights on the national situation



Overview of the deployment of geothermal energy

There are 33 geothermal plants in operation across Germany in March 2018. Most of these plants exclusively generate heat, with 336 MWth of thermal capacity installed. Nine of the geothermal plants generate electricity. They have a combined installed electrical capacity of 38,19 MWe.

Germany is a key market for the current development of deep geothermal in Europe due

to ambitious objectives set at the local level, for instance by local authorities such as Munich, which aims for a fully renewable based district heating network, to a large extend using geothermal energy.

Stated objectives: policies and prospects

At the national level, the *Energiewende* aims at decarbonizing the economy and has made Germany a world leader in investment in renewables. The general objectives are that by 2025, at least 40 to 45 % of Germany's energy is to be sourced from renewable energy and



aiming at raising this target to at least 80% by 2050. Investments in research and development for geothermal, if they are significant at the European scale, are far from the scale of funding channelled towards bringing other renewable to market.

Germany remains a European leader for innovation, being the site of some of the first EGS projects developed and being among the most advance market in terms of TRL for this technology.

The Renewable Energy Sources Act adopted in 2017 lays out targets for renewable energy deployment of 40-45% in 2025, 55-65% in 2035 and at least 80% by 2050⁵. To meet these objectives, the Act sets values for feed-in-tariffs and premium for geothermal electricity, notably geothermal, which are designed to incentivise investments. It also proposes specific (though limited) tendering provisions for innovative projects.

Programmes on geothermal energy in Germany

NAME	MANAGED BY	OBJECTIVES	BUDGET
6th Energy Research Programme of the Federal Government	Jülich (PtJ)	Research for an environmentally sound, reliable and affordable energy supply and accelerate the adoption of renewable energy. Wide range of activities, from public awareness to funding.	EUR 875.98 million in 2016

In charge of economic, technology, industrial and energy policies, the Federal Ministry of Economics and Technology (BMWi) acts as the coordinating agency in setting the programmatic direction of the energy research policy and the Federal Government's Energy Research Programme. In 2011 the German government launched the 6th Energy Research Programme. Entitled 'Research for environmentally sound, reliable and affordable energy research', it sets out the guiding principles and priorities of the government's support policy in innovative energy technologies. In geothermal research, the BMWi approved funding for 22 projects amounting to EUR 19.55 million in 2016 (2015: 21 projects for around 17.3 million euros). EUR 12.5 million were also allocated to ongoing research projects on deep geothermal.

 $^{^{5}} https://www.bmwi.de/Redaktion/EN/Downloads/renewable-energy-sources-act-2017.pdf?__blob=publicationFile\&v=3$

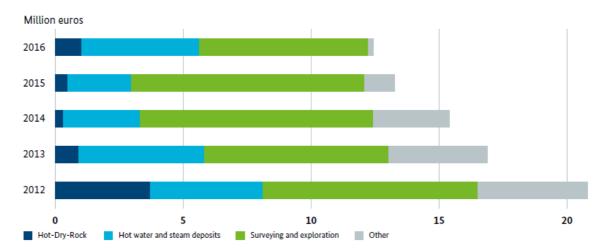


Figure 1: Funding for deep geothermal in Germany (BMWi⁶)

Consultation process for the 7th Energy Research Programme is ongoing⁷. In light of the downward trend in funding for deep geothermal energy research Germany under the 6th Energy Research programme, there is a risk of constraining innovation in Germany for the coming years.

Beyond direct support for innovation under the energy research programme, Germany is also supporting the development of deep geothermal energy projects through a feed in premium of 25.2 €ct/kWh for electricity, and by awarding repayable grants or subsidised loans to deep geothermal heating and cooling projects through the KfW. A quota for minimum levels of renewables in the domestic sector also contributes to supporting innovation in deep geothermal.

Case study: Munich - project "GRAME"

The BMWi funds projects that contribute to the development of geothermal energy. Amongst other projects, the GRAME research project run by Stadtwerke München was started in 2015 and has received funding of around EUR 4.6 million from the BMWi. The aim of GRAME is to provide the entire district heating for Munich from renewable energies by 2040, with the majority being sourced from geothermal energy. Munich has the ideal geological conditions for this purpose.

⁶ BMWi, Report of the Federal Government on Energy Research 2017

⁷ Report of the Federal Government on Energy Research



ITALYHighlights on the national situation



Overview of the deployment of geothermal energy

In 2017 the total thermal installed capacity in Italy is estimated to be 195,9 MWth⁸ with 22 geothermal district heating plants in operation. The installed capacity for electricity is the highest in Europe and the European Union with 915,5 MWe. Italy is a major historical actor in the development of geothermal energy: the first ever geothermal power plant was set up over a century ago in Tuscany. Today the country remains at the forefront of geothermal innovation, exploring cascading uses of heat, hybrid and zero-emission plants.

Stated objectives: policies and prospects

Renewable energy sources represent 17% of Italy's energy demand. The objective to 2030 is 28%, with 55% in the electricity sector and 30% in heating and cooling. Being rich with significant geothermal resources, further deployment of geothermal electricity and heating and cooling is a mean to achieve the objective.

Programmes on geothermal energy in Italy

NAME	MANAGED BY	OBJECTIVES	BUDGET
National Operative Programme – Enterprises and Competitiveness	Ministry of Economic Development	Incentives aimed at reducing energy consumption and climate-changing gas emissions of companies and production areas, including the installation of plants for producing energy from renewable sources for self-consumption, giving priority to high efficiency technologies. The Axis IV, dedicated to Energy Efficiency, supports the transition towards a low carbon economy in all sectors.	EUR 375 million

⁸ EGEC Market Report 2017

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The Italian national programmes for energy are central programmes for increasing renewable energy utilization. The programmes have a broad scope of operation, and geothermal energy is put forward as a key tool for meeting renewable objectives.

The Interregional Operational Programme Renewable Energy and Energy Saving (POI Energy) was financed by the European Regional Development Fund (ERDF), in the 2007-2013 programming period. It produced one geothermal assessment project of four southern Italian regions and 80 funded projects related to geothermal energy. Its success lead to the continuation of the programme to the NOP Enterprises and Competitiveness. During this 2014-2020 programming period, Regions and businesses will still have the opportunity to acquire and enhance the studies, plant proposals and diagnoses carried out by the "POI Energia", in order to exploit the high potential of resources such as geothermal sources, or to enhance the economic benefits deriving from energy savings.

HUNGARY

Highlights on the national situation



Overview of the deployment of geothermal energy

Hungary has a tradition of using geothermal energy, notably in spa resorts. However, the country is also prominent is the use of its geothermal resource through district heating in Europe. There are indeed over 254MWth of geothermal heat capacity in Hungary. The country is also investing in innovation, having inaugurated in 2017 its first geothermal combined heat and power in the Budapest area. Two additional combined geothermal

heat and power plants are being developed, with planned capacities of 18 MWe for electricity and 34 MWth for heat.

Stated objectives: policies and prospects

Hungary's first National Climate Change Strategy (NCCS) for 2008-25 was adopted by the parliament in 2008. It includes a greenhouse gas emissions reduction target of 16% to 25% for 2025 compared to 1990. The NCCS emphasized the government's obligation to create the necessary regulatory framework, to review and adjust subsidy systems and to raise awareness of sustainability in the society. The residential sector was given high priority. In 2011, Hungary issued a National Energy Strategy to 2030, including an objective for 25% renewables (notably geothermal) in heating and cooling, or to increase the use of



geothermal for reducing agriculture's carbon footprint. The strategy estimates that geothermal could cover up to 5% of Hungary's energy needs on the long term.

Programmes on geothermal energy in Hungary

NAME	MANAGED BY	OBJECTIVES	BUDGET
Environment and Energy Efficiency Operative Programme (EEEOP)	National Development Agency and the National Environment and Energy Centre	The Environment and Energy Efficiency Operative Programme is one of the 15 operational progammes of New Hungary Development Plan; in the 5 th priority axis, there is the increased energy efficiency and renewable energy application, specifically geothermal energy utilization.	EUR 3.7 billion (EUR 845 million for energy)

The Environment and Energy Efficiency Operative Programme (KEHOP in Hungarian) is a EU co-funded programme that provides funding for the 2014-2020 period. It benefits from the Cohesion Fund (CF) and Regional Development Fund (ERDF). Energy efficiency improvements, production of heat energy, especially in the building sector, using renewable energy sources including geothermal, support of renewable energy solutions and adaptation to climate change are among the priority areas of the programme.

In the framework of the EEA and Norway grants financial Mechanisms, the EEA FM-PA 6 Renewable energy programme area, there were two calls issued during the first quarter of 2014 and are currently under implementation:

- Increased renewable energy production: Implementation of Geothermal Based District Heating Systems Replacing Existing Fossil Fuel Based District Heating;
- Increased awareness of and education in renewable energy solutions Grant for Supporting Participation in Courses on the Utilization of Renewable Energy Solutions

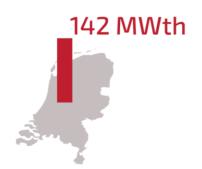
A new call for proposal was issued on January 2018⁹ within the Regional Cooperation Fund for 2014-2020, and renewable energy, notably geothermal, is still among the priority axes. The budget for the Regional Cooperation is EUR 15 million.

⁹ Common Challenges – Shared Solutions – EEA and Norway Grants Fund for Regional Cooperation



THE NETHERLANDS

Highlights on the national situation



Overview of the deployment of geothermal energy

The existing geothermal sector is relatively young and small-scale, but its diversity and complexity will increase in the next five to ten years 10 . For the Netherlands, geothermal energy represents an opportunity for a cost-efficient decarbonisation of heating and cooling. Little emphasis is put on developments for electricity production at this stage. In 2017, the total geothermal district heating installed capacity in the Netherlands was 142 MW_{th} .

Stated objectives: policies and prospects

The government of the Netherlands has announced that it will invest EUR 300 million in a series of measures for reducing CO2 emissions. Projects will involve disconnecting existing residential neighbourhoods from the natural gas grid, using geothermal heat and reducing carbon emissions in agriculture and industry. The government is taking these CO2 reduction measures in anticipation of a new national climate and energy agreement. The government is also setting aside more than EUR 30 million for innovations that will help reduce carbon emissions from glasshouse horticulture.

Geothermal is presented as a key resource in the Dutch Energy Agenda11.

¹⁰ State of the Geothermal Energy Sector, State Supervision of Mines, 2017

https://www.government.nl/binaries/government/documents/reports/2017/03/01/energy-agendatowards-a-low-carbon-energy-supply/Energy+agenda.pdf



Programmes on geothermal energy in the Netherlands

NAME	MANAGED BY	OBJECTIVES	BUDGET
Netherlands Oil and Gas Portal	TNO	Provides detailed information on the subsurface as a public service	N.A
Greenhouse as energy producer (KaE)	Marketing Board Horticulture	Geothermal energy in greenhouse horticulture	N.A
Intensification program energy challenges 2020 (IP2020)	Companies, branch organizations and government (EZK and RVO.nl)	Focus on the realization more applications for renewable energy and more energy savings; to accelerate the application of sustainable renewable energy, "Acceleration tables" have been set up, one of them concerns geothermal energy.	N.A
SDE+ (Stimulering Duurzame Energieproductie)	Netherlands Enterprise Agency	Encourage the production of renewable energy (notably for heat) in the Netherlands. Including geothermal. EUR 3.9 billion committed to geothermal in 2016.	Feed-in- premium subsidy
Risk management fund for geological risk	State	Up to 85% of well cost refunded in case the thermal output is below 90% of estimates. Cost for being covered: 7%.	

Greenhouse as Energy Source stimulates innovations in promising areas, including geothermal. The greenhouse sector has huge ambitions for limiting its CO2 emissions, and is specifically facilitated by the activities of this programme; calls for projects are issued twice a year, the latest call was in autumn 2016.

The SDE+ is an incentive scheme for the production of renewable energy in the Netherlands. The primary target groups for SDE+ are companies, institutions and non-profit organisations. The project must be realised in the Netherlands. The national government is excluded from participation.

There will be two periods for SDE+ subsidy applications in 2018, one in spring and one in autumn. The SDE+ round of applications for spring 2018 runs from 9 am on 13 March to 5 pm on 5 April 2018. The spring budget totals EUR 6 billion. Last year, in the second round for the SDE+, 5,783 applications for renewable energy projects have been received, and total subsidy budget requested amounted to over EUR9.9 billion. For geothermal, 9 projects sought funding with an investment volume of together EUR 883 million (\$1 billion) for a planned installed generation capacity of 264 MW.



POLAND

Highlights on the national situation



Overview of the deployment of geothermal energy

While geothermal energy remains a minor component of Poland's energy mix, with 64 MWth of capacity currently installed for district heating, it does possess valuable resources. Poland also has a long history of using thermal waters for balneotherapy.

Highlighting its emergence as a key market for geothermal developments in Europe, with 14 plants currently in development (compared to 6 existing facilities).

National objectives and policy projects

Poland has not traditionally been a major actor in the geothermal sector. It has long had a strong indigenous energy industry, which remains to this day, with large coal reserves and a significant exploitation of its oil and gas resources. Poland's energy policy is notably characterised by a drive for autonomy and the use of indigenous source.

Another driver for the development of geothermal energy in Poland, is the need for improving air quality in the country, which still relies heavily on coal for heating purposes (which dramatic impact on different types or air emissions).

The highly developed district heating infrastructure, though it remains in need of additional investment, is an opportunity for integrating geothermal heat at a lower cost.

Programmes for geothermal energy in Poland

NAME	MANAGED BY	OBJECTIVES	BUDGET
Public support for geothermal energy generation uses	,	Programme destined to financing the development of geothermal energy by local authorities.	EUR 45 million (exploratory well drilling) EUR 113 million (additional well drilling)



The Ministry of Environment plays a key role for the development of geothermal energy in Poland. Funds for supporting geothermal heat or CHP in Poland are primarily channelled through the Polish National Fund for Environmental Protection¹², which redistributes part of the royalties paid by fossil energy extraction to the Polish government into environmental projects (including renewable energy deployment).

Geothermal energy in Poland can also benefit from the geological survey realised in the second half of the 20th Century for the purpose of oil and gas exploration. This resource is made freely available by the Government.

Moreover, several European funding channels, from the European Union such as the structural funds, or from other programmes such as EEA-Norway grant also contribute to the emergence of deep geothermal uses in Poland. For instance, the EEA facility contributed to financing the development of a plant in Poddembice. Within the GeoHeatPol project it also aimed at collecting best practices for scaling geothermal energy deployment in Poland.

Poland is also looking into the possibility to set up a risk guarantee mechanism for reducing investment costs in geothermal energy projects. The GeoHeatPol project contributed some inputs to these debate, which remains at its early states – much like the development of geothermal in Poland.

BELGIUM - FLANDERS

Highlight on the national situation



Overview of the deployment of geothermal energy

The use of deep geothermal energy in Belgium is limited. Currently, there are three geothermal heating plants in operation in the Walloon part of the country. Together, they supply about 19 GWh/y of thermal energy. In contrast to the limited use, deep wells that have been drilled in the past prove that there is a potential for deep geothermal energy production in the sedimentary basins that border the Brabant Massif ^{13,14}.

The principal geothermal resources are porous chalk deposits for Late-Cretaceous age and

¹² https://www.nfosigw.gov.pl/en/

¹³ E. Petitclerc and Yves Vanbrabant, 2001. Développement de la plate-forme Géothermique de la Wallonie. Rapport Final, DG04, Direction Générale Opérationnelle de l'Aménagement du Territoire du Logement, du Patrimoine et de l'Energie, Département de l'Energie. (https://energie.wallonie.be/fr/lageothermie-profonde.html?IDC=6173)

¹⁴ B. Laenen, S. Sneyers, J. Hendrickx, 2015. Stappenplan voor de ontwikkeling en implementatie van geothermie als duurzame, stabiele en betaalbare bron van warmte en elektriciteit in Vlaanderen. EFRO-project 910: GEOTHERMIE 2020 (https://geothermie.vito.be/nl/projecten/geothermie-2020)



lime- and dolostones of the Lower-Carboniferous in the Campine and Devono-Carboniferous platform carbonates in the sedimentary basins south of the Brabant Massif ^{13,15}. In the last decade, there is a renewed interest in deep geothermal as a local energy source. This has sparked a series of initiatives to further explore the geothermal potential and to develop new geothermal plants. In Flanders, two deep geothermal plants are now under development: one in Mol - Donk and one in Beerse. Furthermore, the feasibility of geothermal energy production is being investigated at 5 other locations in the provinces of Antwerp and Limburg. In the Walloon region, three new projects for geothermal district heating were launched in the Mons area. On February 8, a first new 7 MW geothermal heating plant was inaugurated Ghlin. Other developments are foreseen at the Ambroise Paré hospital and near the new railway station in Mons. In addition, a fourth project for combined power and heat production is under investigation.

National objectives and policy projects

The new developments go along with initiatives of the Flemish and the Walloon governments to facilitate the development of the regional deep geothermal resources. In 2016, the Flemish government amended the Decree on the Deep Subsurface to provide a legal framework for the exploitation of deep geothermal heat. At the end of that year, the Flemish government approved the corresponding implementation decision, allowing interested parties to apply for a geothermal exploration or exploitation permit. In addition, the Flemish government is working to implement an insurance system to cover the geological risks of deep geothermal project and is providing financial support for the development of geothermal heating in the context of the calls on 'green heat', the ecology premium and a scheme for investments in innovative technologies in the agriculture.

The Flemish government adopted deep geothermal as one of the technologies that will allow the region to meet its 2020 renewable energy targets. According to the Energy Plan 2020, the production of heat from renewable sources should rise to 9.197 GWh for the year 2020. Based on the projects that are under development in Mol and Beerse, the production of heat from deep geothermal in 2020 is set at 164 GWh. Further increase in the following years is envisioned in the Flemish heat plan, but no figures are set forward.

On April 21, 2016 the Walloon government approved a guidance note aiming at the implementation of a legal framework for the development of geothermal energy in Wallonia. This framework will take the form of a decree. It will implement specific measures to jointly achieve the following objectives to:

- Protect the resource;
- To develop a renewable energy source through the creation of public heating networks;

¹⁵ S. Loveless, H. Hoes, E. Petitclerc, L. Licour, B. Laenen, 2015. Country update for Belgium, Proceedings of the World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.



 Develop a new industrial activity in Wallonia, via a policy to stimulate industrial investment and encourage economic expansion.

Programmes for geothermal energy in Belgium

NAME	MANAGED BY	OBJECTIVES	BUDGET	
FLEMISH REGION				
Call groene warmte, restwarmte, biomethaan	Vlaams Energie Agentschap (VEA)	Support for investments in the development of green heat, the recovery of residual heat and bio- methane	Call system; the budget per technology category is set prior to each call	
Strategische ecologiesteun (STRES)	Agentschap Innoveren en Ondernemen (VLAIO)	Support for (large) investments in innovative green technologies that cannot be standardized because of their unique company-specific character	20 to 40% of the accepted additional investment depending on the (cost) performance and the type of organisation	
Ecologiepremie (EP- Plus)	Agentschap Innoveren en Ondernemen (VLAIO)	Support for investments for the use of geothermal heat. Only installation with a capacity up 5 MW are eligible. Larger plants can apply for STRES.	15 to 55% of the additional investment costs depending on the technology and the type of organization	
VLIF-steun	Departement Landbouw & Visserij	Support for investments in geothermal energy in agriculture	30% of the investment with a maximum of 1 MEuro	
Waarborgregeling aardwarmte	Departement Omgeving	Insurance system for geological risks		
WALLOON REGION				
Direct support	Département de l'Energie et du Bâtiment durable	Specific support depending on the project	N/A	
FEDER	Département de la Coordination des Fonds structurels	Support for demonstration and development projects in the context of ERDF	Depending on the call, type of project and organisation	

Over the last 3 years, the Flemish government introduced a number of support schemes to facilitate investments in deep geothermal energy. In addition, the Flemish government is finalizing the 'Waarborgregeling voor het opsporen en winnen van aardwarmte in de diepe



ondergrond. Once this regulation is in forces, a financial guarantee will be paid to investors if the realized capacity of a deep geothermal energy project is lower than the expected capacity. The scheme only covers the geological risk associated with thermal output of the system. The risk of, for example, technical complications during drilling, the co-production of oil or gas or the risk of induced seismicity are not insured. To make use of the guarantee scheme, the project must fall within the scope of application and the applicant must pay a premium of 7% of the guaranteed amount.

In the Walloon region, support is being given on a case-to-case basis. In 2011, the Walloon government launched an action plan to develop 3 pilot projects to improve the knowledge on the geothermal potential of the Carboniferous carbonate reservoir in the area between Tournai and Charleroi. Within the context of this action plan, they offered support to projects by IDEA and Earthsolution. Demonstration and investment projects in deep geothermal energy can also file a request for support in one of the calls that are launched in the context of the ERDF (FEDER).





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