

## EU Legal Framework for Geothermal Energy: State of Play and Future Developments

Luca Angelino

<sup>1</sup> European Geothermal Energy Council, Rue d'arlon 63-67 1040 Brussels, Belgium

[l.angelino@egec.org](mailto:l.angelino@egec.org)

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### ABSTRACT

In accordance with its treaties, the European Union (EU) is entitled to legislate on a number of issues, including environmental protection, functioning of the market as well as energy-related matters. Such legislation, and the way it is eventually implemented at national level, impacts the geothermal energy sector under various aspects.

For instance, a directive aiming, say, to price carbon dioxide ("CO<sub>2</sub>" or for ease of style "carbon") emissions in the energy sector or to increase the share of renewable energy may incentivise the use of geothermal energy technologies. Likewise, a regulation whose objective is to preserve the quality of the environment may also have a relevant impact on the procedures required to realise a geothermal plant.

This paper presents an overview of the current legal and policy frameworks in force in the EU with the aim of elucidating about the expected impact for the development of geothermal energy in Europe.

### 1. INTRODUCTION

EU legislation on energy was based for many years on the EU authority in the areas of the internal market and environment under various provisions scattered throughout the EC Treaty. It is with the inclusion of a dedicated chapter in the 2009 Lisbon Treaty that energy has officially become an area of shared competence between the EU institutions and the member states.

As a matter of fact, the energy chapter makes it possible for the EU to develop a more strategic energy policy. Article 194 (1) of the Treaty on the Functioning of the European Union (TFEU) sets out its objectives as follows:

"in the context of the establishment and functioning of the internal market and with regard for the need to preserve and

improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States, to:

- (a) ensure the functioning of the energy market;
- (b) ensure security of energy supply in the Union;
- (c) promote energy efficiency and energy saving and the development of new and renewable forms of energy" (EU, 2012).

For the purpose of this paper, the most important point in this subparagraph is the recognition in Primary law of the promotion of renewable energy and energy efficiency as two of the objectives of the Union. Besides this, Article 194 TFEU further frames the EU actions on energy issues with reference to the establishment and functioning of the internal market, while the requirement "to preserve and improve the environment" makes clear that the existing obligation to integrate environmental considerations (in Article 11 TFEU) explicitly applies to energy legislation and policy.

That is to say that EU decision-makers are entitled to legislate on a number of issues which can have a relevant impact on the geothermal energy sector, regardless of the differences between shallow and deep, heating and cooling, electricity or combined heat and power (CHP). For instance, legislation aiming to increase the share of renewable energy incentivises the use of geothermal energy technologies. On the other hand, measures aiming to preserve the quality of the environment ensure may limit the location, affect the procedures required and ultimately the costs of the realisation of a geothermal system.

Against this background, it should be noted that the EU *acquis* goes beyond EU member states as it applies to the European Economic Area (EU countries plus Iceland, Norway and Lichtenstein) when deemed "of EEA relevance" and can be also adopted by other third countries under the Energy Community Treaty or bilateral agreements.

Furthermore, it is relevant to highlight here that EU legislation is often flexible, broad in scope, and aims to lay down the general objectives in a policy sphere. Hence, in many cases the actual impact will ultimately depend on the way the EU legal framework is eventually transposed and implemented at national level.

As we shall see, while the EU can make use of a variety of formal and quasi-formal legislative instruments, those relevant for geothermal energy are very often “directives”, which by definition “shall be binding, as to the result to be achieved, upon each Member State to which is addressed, but shall leave to the national authorities the choice of form and methods” (Article 288 TFEU).

In other words, member states must adapt the common legal framework they have previously contributed to setting at EU level to the national circumstances and domestic preferences. And it is precisely because of this interdependence between the supranational and the national level, and in most cases between the national and the regional level, that any analysis of the EU legal framework for geothermal cannot be exhaustive and self-standing. Yet, it could provide valuable background information for a better understanding of the legal framework at national and local level.

This paper will in particular reply to the following questions:

- A. Among thousands of pages of EU legislation, what are the rules with a major impact on geothermal energy? And how can they shape the development of the sector?
- B. What EU policies are currently under development and how could they affect the sector up to 2020 and beyond?

## 2. THE EU ENERGY AND CLIMATE POLICY

Geothermal is fully recognised to be a safe, reliable, environmentally benign renewable energy source. For this reason geothermal energy technologies can benefit from any climate mitigation policies. And it is no wonder that the so-called 20-20-20 targets endorsed by EU leaders in March 2007 within the framework of the EU action on climate change are some of the main drivers for the market growth of geothermal technologies.

The 20-20-20 goals, which are headline targets of the European 2020 strategy for growth, are:

1. Reduction of at least 20% in greenhouse gas (GHG) emissions compared to 1990 levels;
2. 20% of the final energy consumption to come from renewable sources;
3. Improvement of energy efficiency by 20% compared to projections made in 2007.

The choice of an integrated approach with three different targets reflects to the need to pursue a variety of objectives on top of sustainability and climate mitigation, namely to ensure security of supply and improve the competitiveness of the EU economy.

Together with EU-wide and national targets - binding for GHG emissions reduction and renewable energy, indicative for energy efficiency - a set of legislation has been adopted with the aim of delivering the expected results by 2020.

Further, these headline targets also imply a greater focus on research and development (R&D) for renewable energy and increase the need to fully internalise the costs of carbon emissions so as to trigger investments in low-carbon technologies. The next sections of this paper look at most of these complementary aspects.

## 3. THE RES DIRECTIVE

Directive 2009/28/EC on the promotion of the use of energy from renewable sources (RES Directive) has been the most significant legislation for geothermal. This directive builds on the 2001 Renewable Electricity Directive, which had set indicative targets for renewable electricity in the EU, but expands its scope to include the heating and cooling and the transport sectors. Amongst other things, the RES Directive sets legally binding targets for member states and puts forward a number of measures aiming to overcome the following crucial barriers preventing renewables from entering the energy market: long and discriminatory administrative procedures, rigid local plans, lack of information, shortage of skilled workers, and unfair regime to access to the grid. A list of the key provisions in the RES Directive is reported in Table 1 below and analysed thereafter.

**Table 1: Key provisions in the Renewable Energy Directive**

Article	Provision
Art. 2 (c)	Definition of Geothermal energy
Art. 3	Mandatory national targets
Art. 4	National renewable energy action plans
Art. 5 (4) and Annex VII complemented by decision (C(2013) 1082	Calculation of renewable energy from heat pumps
Article 13	Administrative procedures, regulations and code
Art. 14	Information and training
Art. 16 (2)	Access to grid

### 3.1 Binding targets and national renewable action plans

In its 2006 Renewable Energy Roadmap the European Commission identified the lack of a coherent and effective policy framework throughout the EU and a stable long-term vision as major factors preventing market uptake of renewable energies (European Commission, 2006).

The RES Directive tackles this issue by setting legally binding targets for each member state (Article 3). In addition, the directive required national governments to submit national renewable energy action plans (NREAPs) in 2010. These plans were intended to provide detailed roadmaps showing how each country expects to reach its legally binding 2020 target for renewable energy, including sectoral targets, and the technology mix they expect to use. Member states report on progress every two years.

The European Geothermal Energy Council (EGEC) undertook an evaluation of the NREAPs in 2011. Figure 1, 2 and 3 at the end of the paper are taken from that assessment and depict the overall projection and significant growth by 2020 for geothermal electricity, heat, and geothermal heat pump technology.

In order to be able to achieve the national targets, Article 3 allows member states to make use of national mechanisms of support for the promotion of energy from renewable sources provided they are compatible with the State aid guidelines for environmental protection. The guidelines are currently under revision and substantial changes may be expected. Furthermore, complementary guidelines from the Commission on how member states should design support schemes for renewable electricity are expected in mid-2013.

### 3.2 Definition and classification of geothermal energy

Different terms were used in national regulatory acts referring to the geothermal sector. Such lack of a clear and widely accepted definition of geothermal energy represented a concrete obstacle to the development of effective rules in this field.

Luckily, the RES Directive eventually solved this problem: it legally recognises the “renewable nature” of geothermal energy and provides a EU-wide and legally binding definition according to which “*geothermal energy*” means *energy stored in the form of heat beneath the surface of solid earth* (Article 2). Any national legislation shall therefore define geothermal according to this provision.

The RES Directive refers to “shallow geothermal” in relation to training and certification. Nevertheless, it does not differentiate further between shallow and deep. The EU-funded project GeoThermal Regulation-Heat (GTR-H) has proposed that a single depth limit

ought to be used to define and differentiate between shallow and deep geothermal resources depending on country specific geological conditions, e.g. deep geothermal resources can be defined as occurring below depths of 200m to 500m (Goodman et al., 2010).

Within such a classification, the legal framework may further provide a definition of Enhanced Geothermal System (EGS). As such, EGS could be defined as “an underground reservoir that has been created or improved artificially”.

### 3.3 Streamlining administrative procedures

Realising a geothermal project requires a variety of different permits. The administrative procedures to obtain these authorisations involve a multitude of central, regional and local authorities. Complex, long, and sometimes unnecessary burdensome procedures can cramp the investment in the geothermal sector. Delays, for example, can provoke uncertainty and lead to higher risks due to which investors require higher returns. Though having several competent administrative bodies to assess an application for geothermal licenses is fair, a one stop-shop process should be the rule for each phase of a project.

In this regard, the RES Directive requires member states to streamline and rationalise the administrative procedures required for awarding permits to renewable energy projects. Article 13 (1) (a) requires member states to define and coordinate the respective responsibilities of national, regional and local administrative bodies for authorisation, certification and licensing procedures, including spatial planning. In addition, timetables for determining planning and building applications should be transparent and comprehensive information and assistance to applicants should be made available at the appropriate administrative level.

Moreover, it is worth highlighting that the RES Directive specifically requires that rules governing authorisation, certification and licencing fully take into account the particularities of individual renewable energy technologies. Further, the directive also encourages, where applicable, the practice of “simple notification” for smaller projects and decentralised devices for energy from renewable sources such as heat pumps.

### 3.4 Local and regional planning

Local infrastructure plays an important role in determining local heating and cooling planning. Local plans for heating and cooling are valid for many years and once implemented it is difficult to alter the infrastructure. This can prevent, for instance, the development of a new geothermal district heating system.

Article 13 (3) requires member states to recommend to all actors, in particular local and regional administrative bodies, to ensure that equipment and systems are installed for the use of electricity, heating and cooling from renewable energy sources, and district heating and cooling when planning, designing, building and renovating residential (or industrial) areas. Besides this, the directive specifies that governments shall encourage local and regional administrative bodies in particular to include heating and cooling from renewable energy sources in the planning of city infrastructure, where appropriate.

Regarding the example of district heating networks above, as they are traditionally owned and operated by municipalities, national governments could make recommendations on how geothermal could replace conventional fuels supplied through district heating networks.

### 3.5 Support schemes and technical specifications

Article 13(2) aims to avoid discrimination against renewable energy equipment and systems that can receive support. According to this subparagraph, member states shall clearly define any technical specifications which must be met by renewable energy equipment and systems, including Geothermal heat pump technology, in order to benefit from support schemes.

The directive asks in addition that these technical specifications be based on existing European standards including eco-labels, energy labels and other technical reference systems established by the European standardisation bodies, with the objective to avoid the granting of a monopoly to specific national testing centres for certification of equipment and systems, member states cannot prescribe where the certification of equipment and systems should take place (Hodson et.al., 2009).

### 3.6 Information and training

Lack of awareness and information as well as shortage of skilled workers are still relevant market failures preventing the further uptake of shallow geothermal technologies. Article 14 of the RES Directive addresses these issues by requiring member states to ensure that information is made available to all relevant actors about support measures, net benefits and costs, as well as guidance and training programmes.

Moreover, certification schemes or equivalent qualification schemes for installers of shallow geothermal systems needed to be available by the end of 2012. Certification awarded in a EU country shall be recognised by any other member state. In this regard, it is worth mentioning that the EU-funded project GEOTRAINET has developed a European-wide educational programme as an important step towards the certification of geothermal installations.

### 3.7 Access to the electricity grid

Traditionally, electricity infrastructure was established to serve the needs of an electricity system with large, centralised production units located close to mines, rivers or main consumption centres. The generation capacity and the network were publicly owned under monopoly conditions. In this system the flow of power is mainly unidirectional, transported from the high-voltage transmission level to the distribution networks.

Geothermal power plants and other small-scale renewables are directly connected to the middle-voltage distribution networks and for this reason they are called distributed generation. In order to integrate larger amounts of distributed renewable electricity generation, the electricity systems are facing technical, economic and regulatory challenges. This challenge is particularly acute for the distribution network.

Whilst it is of the utmost importance for any geothermal electricity project to have access to the grid, the above-mentioned challenges for the electricity systems can be easily turned into obstruction and discrimination towards any new and renewable generation. For this reason there is a need of clear and non-discriminatory rules: the RES Directive addresses these issues in Article 16.

While the Renewable Electricity Directive provided member states with the option to give a priority or guaranteed access to the grid for renewable electricity power plants, Article 16 (2) of the RES Directive makes it mandatory. This provision is complemented by a similar guarantee awarded to high efficiency cogeneration in Directive 2012/27/EU on energy efficiency (EED). Eventually, Article 15 (5) of the EED states that member states may set rankings between and within different types of renewable energy and high efficiency cogeneration. This shall happen without prejudice to Article 16 (2) of the RES Directive. However, it should be noted that some linguistic versions of the directive vary. Indeed, while some versions state that member states “shall in any case ensure that priority access or dispatch for energy from renewable energy sources is not hampered”, others – including the English version - refer to “variable renewable energy sources” only. In this respect, the implementation at national level will better define the concrete implications of this provision and should be closely monitored.

The above provisions in the RES Directive and in the EED constitute specific legislation for the connection and dispatching of electricity generating installations using renewable energy sources. They are complementary to Directive 2009/72 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC which setting the “*lex generalis*” for the electricity sector and thereby applies to geothermal power plants as well.

### 3.8 Calculation of renewable energy from heat pumps

A heat pump is a device allowing the transformation of heat from a lower temperature level to a higher one, by using external energy (e.g. to drive a compressor). The amount of this external energy input, be it electric power or, more rarely gas, has to be kept as low as possible to make the heat pump ecologically and economically desirable.

Against this background, the definition of appropriate methodologies for accounting for the contribution of heat pumps to the renewable energy targets was seen since the beginning as a significant implementation challenge given the diversity of heat pump applications and the current scarcity of statistical data (Hodson et. al.).

Lack of reliable statistics has also sometimes acted as a barrier for the development of the technology, notably as it was difficult to quantify the energy and thereby other impacts of the technology. Setting up a methodology is being a long and complicated process but it should contribute to the removal of this “statistical barrier”.

As explained by recital 31 of the RES Directive “the energy used to drive heat pumps should be deducted from the total usable heat. Only heat pumps with an output that significantly exceeds the primary energy needed to drive it should be taken into account”

Accordingly Article 5(4) provides that “aerothermal, geothermal and hydrothermal heat energy captured by heat pumps shall be taken into account for the purposes of paragraph 1(b) provided that the final energy output significantly exceeds the primary energy input required to drive the heat pumps. The quantity of heat to be considered as energy from renewable sources for the purposes of this Directive shall be calculated in accordance with the methodology laid down in Annex VII”:

$$E_{RES} = Q_{usable} * (1 - 1/SPF)$$

where:

$E_{RES}$  = amount of energy captured by heat pumps to be considered energy from renewable energy sources for the purposes of this Directive;

$Q_{usable}$  = the estimated total usable heat delivered by heat pumps fulfilling the primary energy efficiency criterion, and

$SPF$  = the estimated average seasonal performance factor for those heat pumps

Analysing the details of the above methodology is far from the objectives of this paper. However, it should be mentioned that in line with Annex VII, on 1<sup>st</sup> March 2013 the European Commission adopted a decision (C(2013) 1082 final) establishing how

Member States shall estimate the two parameters “Qusable” and SPF, taking into consideration differences in climatic conditions. The guidelines may be revised and complemented by the Commission by 2016, if statistical, technical or scientific progress necessitates it.

### 4. GEOTHERMAL AND ENERGY EFFICIENCY

With buildings being responsible for nearly 40% of final energy consumption in the European Union (in residential homes, two thirds of this is for space heating) (EC, 2011), a large potential for the use of renewables, cost-effective energy savings and carbon emissions reduction exists and remains untapped in this sector. To this end, a series of regulations have been adopted at EU level with a special focus on new buildings. They can have an impact on the development of geothermal heat pumps but also, in certain cases, of Geothermal district heating. This section will also cover the issue of energy efficiency in energy supply.

#### 4.1 Promotion of renewables in buildings

To begin with the RES Directive, Article 13(4)-(6) puts obligations on member states to introduce, where appropriate, measures in their building regulations and codes so as to use minimum levels of renewable energy in buildings (as of 2015)<sup>1</sup>. This directive also place specific requirements on public buildings to fulfil an exemplary role (since 2012 onwards) and requires member states to promote renewable energy technologies that contribute to a significant reduction of energy consumption, among which heat pumps fulfilling the minimum requirements of eco-labelling for heat pumps.

#### 4.2 Energy performance of buildings

With regards to energy efficiency, shallow geothermal technologies and geothermal district heating can undoubtedly be crucial technologies in meeting minimum requirements for energy performance which member states have to set in compliance with Directive 2010/31/EU on energy performance of buildings (EPBD). This directive, originally approved in 2002 and now replaced with effect from 1<sup>st</sup> February 2012 by a recast directive adopted in May 2010, is the main EU legislative instrument affecting energy use and efficiency in the building sector. The level of these requirements is not prescribed, except for the fact that it has to be cost-optimal, but is established at national level and reviewed every 5 years. What is mandatory is the adoption by member states of a methodology for calculating the energy performance of buildings which needs to take into account certain elements, including the thermal characteristics of a building.

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<sup>1</sup> The so-called “building obligation” is already in place in some countries and is widely recognised to be as an effective support measure to renewable heating and cooling.

The EPBD applies to new as well as existing buildings undergoing major renovation<sup>2</sup>. For new buildings, high-efficiency alternative systems, including geothermal heat pumps and district or block heating or cooling, (particularly where it is based entirely or partially on energy from renewable sources), need to be considered. To this end, their technical, environmental and economic feasibility should be assessed before construction starts. Finally, when new, replaced or upgraded technical building systems, such as heating systems, are installed, they should also comply with the energy performance requirements.

In addition, the EPBD looks to the future and introduces for the first time in EU law the concept of “nearly zero-energy building”, i.e. a building that has a very high energy performance, whose amount of required energy should be covered to a very significant extent from energy from renewable sources produced on-site or nearby. All new buildings owned or occupied by public authorities should become nearly zero-energy after 31<sup>st</sup> December 2018, while this provision is extended to all new private buildings by the year 2020.

#### 4.3 The Energy Efficiency Directive

If the EPBD and the RES Directive contain key measures for the promotion of energy efficiency and for the integration of renewable energy into buildings, they are complemented and enhanced by the EED adopted in 2012.<sup>3</sup> For instance, Article 5 of this directive sets out the obligation, as from 1<sup>st</sup> January 2014, to renovate 3%<sup>4</sup> of the total floor area of heated and/or cooled buildings owned or occupied by central government<sup>5</sup>. This is a step forward from the EPBD, although this target does not cover a large part of the public building stock (for instance public buildings owned by regional and local authorities), and does not address the private sector at all.

Under the EED, however, member states have to set up energy efficiency obligation schemes to achieve new savings each year of 1,5 % of the annual energy sales to final customers. In that regard, it is relevant to report that energy savings achieved with heat pumps can be counted, without any limitation, towards the 1.5% target.

<sup>2</sup> Member states may choose to apply one of the following definitions of ‘major renovation’: (a) the total cost of the renovation relating to the building envelope or the technical building systems is higher than 25 % of the value of the building, excluding the value of the land upon which the building is situated; or (b) more than 25 % of the surface of the building envelope undergoes renovation;

<sup>3</sup> The EED shall be transposed by 5th June 2014 and repeals Directives 2006/32/EC (Energy Services Directive) and 2004/8/EC (Cogeneration Directive).

<sup>4</sup> The directive specifies that the 3 % rate shall be calculated on the total floor area of buildings with a total useful floor area over 500 m<sup>2</sup> and, as of 9 July 2015, over 250 m<sup>2</sup>.

<sup>5</sup> However, it is possible for member states to take alternative cost-efficient measures to achieve an equivalent improvement of the energy performance of the buildings within their central government estate.

The directive also aims to improve efficiency in energy generation. This includes the monitoring of efficiency levels of new energy generation capacities, establishment of national comprehensive assessments of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling as a basis for a sound planning of efficient heating and cooling infrastructures, including recovery of waste heat. Member states should carry out and notify to the Commission this assessment by 31 December 2015 (Article 14 (1)).

Article 14 (3) provides that for the purpose of this assessment member states shall carry out a cost-benefit analysis covering their territory based on climate conditions, economic feasibility and technical suitability in accordance with Part 1 of Annex IX. The cost-benefit analysis shall be capable of facilitating the identification of the most resource- and cost-efficient solutions to meeting heating and cooling needs. That cost-benefit analysis may be part of an environmental assessment under Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive, see chapter 7).

**Table 2: Timeline for the promotion of RES for energy efficiency purposes**

Date	Provision
As of 2014	Member States to renovate each year an average 3% of the public building stock owned by central governments (EED)
As of 2015	Member states to introduce, where appropriate, measures to use minimum levels of RES in buildings (RES Directive)
By 31 <sup>st</sup> December 2015	National assessment of the potential for the application of high-efficient cogeneration and efficient district heating and cooling; followed by adequate measures in case where benefits exceed costs (EED)
31 <sup>st</sup> December 2018	All new buildings owned or occupied by public authorities shall be nearly zero-energy buildings (EPBD)
31 <sup>st</sup> December 2020	All new private buildings shall be nearly zero-energy buildings (EPBD)

Finally, Article 14 (4) provides that when a potential for the application of high-efficiency cogeneration and/or efficient district heating and cooling is identified and the benefits exceed the costs, member



states will have to take adequate measures to accommodate their realisation. In this respect, Geothermal technologies can have an advantage as they fall within the definition of high efficient cogeneration and district heating (articles 1 (34) and 1 (41) respectively).

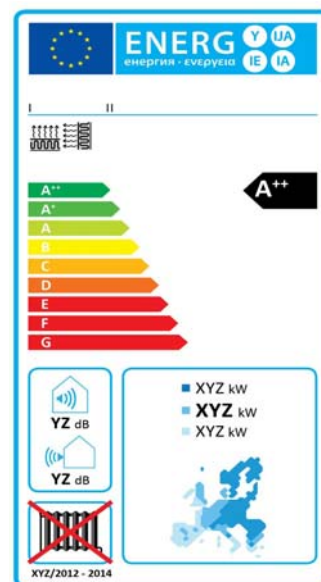
#### 4.4 Ecodesign and energy labelling

Geothermal heat pumps are covered under both Ecodesign and energy labelling legislation, which are two of the most effective policy tools in the area of energy efficiency. Ecodesign aims to improve the energy and environmental performance of products throughout their life cycle, while energy labelling requirements aim to providing citizens with information about the environmental performance of products and thereby incentivise industry towards the development of further improved products and innovations beyond minimum levels.

Recast Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products (Ecodesign Directive) does not set binding requirements on products by itself, but through implementing measures adopted on a case by case basis for each product group (lot): Geothermal heat pumps are covered under ENER Lot1 “Boilers and combi-boilers” and ENER Lot 2 “Water heaters.” A proposal by the Commission with regard to ecodesign requirements for space heaters and combination heaters is in its final stages before final approval and is expected to be published on the Official Journal in July 2013. The new requirements will be repealing the previous ones set out in Commission Decision 2007/742/EC.

Recast Directive 2010/30/EC on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (Energy Labelling Directive) extends the scope of its predecessors to also cover products in the commercial and industrial sectors. The Directive introduces new efficiency classes A+, A++ and A+++ on top of the existing A grade for the most energy-saving household products to reflect technological progress. The directive applies to “energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use”. Energy classes and the specific products that must labelled will be determined by a Commission working group by means of delegated acts.

A Commission proposal, also close to final approval, will be introduces an energy label for brine-to water heat pumps in two phases: the first to be introduced two years after the entry into force will range from A++ to G, while the other ranging from A+++ to D will be introduced in 2019.



**Figure 4: First energy label for brine-to-water heat pumps**

#### 5. PRICING CARBON EMISSIONS

As well as promoting renewables and energy efficiency, integrating the cost of carbon emissions into the price of goods and services is one of the most popular and straightforward methods to combat climate change. As a carbon price means that goods or services embedding a lot of carbon are more costly, in the short-term companies - which strive to maintain their costs as low as possible - should be incentivised to substitute carbon-intensive inputs for less carbon intensive ones. And if there is expectation of a long-term carbon price then companies should be incentivised to invest in low-carbon technologies including geothermal. For the purpose of this paper, therefore, it is important to underline that a long-term and sufficiently high carbon price can incentivise the development of geothermal energy.

Whilst carbon pricing is a good thing, setting it at the right level and establishing what goods should be covered it is all but easy. Carbon tax and emission trading are the two ways to price carbon. We will not go into the details of what would be the most efficient way to price carbon emissions but will say that for a number of reasons a carbon tax is a more direct method than emission trading and that the EU has never managed to set a EU-wide tax on carbon despite the first attempt by the European Commission dates back to 1992 and the latest 2011 proposal is still striving against the unanimity principle ruling fiscal matters within the Council of the EU<sup>6</sup>.

<sup>6</sup> The Commission proposal to amend Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity (COM(2011)) 169/3 has very little chance

Without a carbon tax<sup>7</sup>, the EU has instead ended up with an emission-trading scheme that the Commission has defined as the cornerstone of the EU climate policy. The EU Emission Trading Scheme (ETS) is a cap and trade system aiming to cap the overall level of emissions allowed and, within that limit, allowing participants in the system to buy and sell allowances<sup>8</sup> as required. Companies can also buy limited amounts of international credits from emission-saving projects around the world.

Launched in 2005, the EU ETS is now in its third phase, running from 2013 to 2020. The system today covers carbon emissions from commercial aviation, the electricity sector, heat plants below 20MW and from energy-intensive industry sectors.

The first trading period ran for three years to the end of 2007 and was a “learning by doing” phase to prepare for the crucial second trading period running between 2008 and 2012 and coinciding with the first commitment period of the Kyoto Protocol. In the first and second trading period under the scheme, member states had to draw up national allocation plans (NAPs) which determine their total level of ETS emissions and how many emission allowances each installation in their country receives.

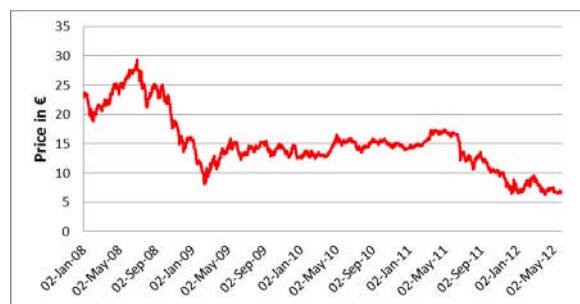
Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community has revised the system for its third phase. Increased efficiency ought to be achieved by means of a longer trading period (8 years instead of 5 years), a robust and annually declining emissions cap (21% reduction in 2020 compared to 2005), and a substantial increase in the amount of auctioning (from less than 4% in phase 2 to more than half in phase 3). Greater harmonisation was also agreed upon many areas, including cap-setting (an EU-wide cap instead of the national caps in phases 1 and 2) and the rules for transitional free allocation.

Despite these efforts the system has never recovered from the initial over-allocation of permits handed out to the major polluters free of charge on the basis of their prior pollution levels. As a matter of fact, the second phase following the initial learning period corresponded with the breakdown of the economic crisis; an economic downturn means a lower level of input which in turn leads to lower emissions. As a result of lower emissions and over-allocation of permits in the market, the price of European Union Allowances (EUAs) has collapsed hitting new record lows as clearly shown in Figure 5 below.

to be approved due to the formal opposition of several member states.

<sup>7</sup> Nevertheless, a national carbon tax is in force in some Nordic countries such as Sweden, Denmark, and Finland.

<sup>8</sup> One allowance gives the holder the right to emit one tonne of carbon.



**Figure 5: Historic EUA price January 2008 – May 2012 Source: Intercontinental Exchange from EC, 2012b**

In a bid to revitalise the ETS in the short-term the European Commission has put forward a proposal – dubbed as “back-loading” – to delay the sale of some 900 million EUAs from 2013-2015, i.e. half of annual carbon emissions under the scheme. However, the plan faced a serious setback on 16<sup>th</sup> April 2013 when the European Parliament refused to approve in plenary a text previously endorsed by a Parliament’s Committee on Environment. In addition to this proposal, the Commission has also launched a debate on structural measures in order to adjust the ETS in the longer-term.

With regards to geothermal, it is possible to draw a conclusion and learn a lesson from this experience. As far as the conclusion is concerned, despite its declared objective to contribute to triggering investments in low-carbon technologies one can observe that the EU ETS has hitherto had nearly no impact on the sector. This is because of its intrinsic characteristics, e.g. price volatility and depression, limited coverage in terms of both GHG (not all GHGs are covered by the ETS) and economic sectors (e.g. currently 50% of energy products are subject to a carbon price under the ETS and, for instance, small scale heat installations are not covered).

Concerning the lesson, contrary to what has been argued, it appears the EU ETS alone - with all its weaknesses –cannot guarantee at all the achievement of the long-term EU decarbonisation objectives. Ergo, in line with the EU energy and climate package a number of complementary policy tools could be needed also beyond 2020.

## 6. ENVIRONMENTAL LEGISLATION

Regulations aiming to preserve and improve the environment can also affect the development of geothermal systems. It is not possible to cover the entire EU environmental *acquis* in this paper: we will just limit to mention the main EU environmental regulations affecting the geothermal sector which are reported in Figure 6. Thanks to this legislation the development of geothermal is ensured to be compatible with other environmental objectives.



### 6.1 Water regulation

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD) requires member states to implement the necessary measures to prevent deterioration of the status of all bodies of surface water and to prevent or limit the input of pollutants in groundwater in order to achieve good quality status by 2015. A key element of the Directive is its river basin approach, following the natural geographical and hydrological unit - instead of according to administrative or political boundaries. For each river basin district - some of which will traverse national frontiers - a "river basin management plan" needs to be established and updated every six years.



**Figure 6: Environmental legislation affecting geothermal**

Regarding groundwater, as it is considered quantitatively much more significant than surface water, and for which pollution prevention and quality monitoring and restoration are more difficult mostly due to its inaccessibility, the WFD takes a precautionary approach and establishes a prohibition on direct discharges to groundwater.

The application of water legislation to geothermal energy depends on whether a system is an open or closed-loop system. For the purpose of this paper, it is relevant to highlight that Article 11 of the WFD gives member states the option to authorise the reinjection into the same aquifer of water used for geothermal purposes provided it does not compromise the environmental objectives of the directive. It is therefore within the competence of the national governments to decide as to whether reinjection of the geothermal fluids is required.

The WFD is complemented by Directive 2006/118/EC on the protection of groundwater against pollution and deterioration (Groundwater Directive). This Directive sets out specific measures to prevent pollution or limit the inputs of pollutants into groundwater, criteria for the assessment of good groundwater chemical status and criteria for the identification and reversal of significant and sustained upward trends and for the definition of starting points for trend reversal.

### 6.2 Environmental assessment

An environmental assessment is a procedure aiming to ensure that the environmental implications of

decisions are taken into account before the decisions are made. Environmental assessments can be undertaken for individual projects on the basis of Directive 2011/92/EU (EIA Directive) or for public plans or programmes on the basis of Directive 2001/42/EC (SEA Directive). The common principle of both Directives is to ensure that plans, programmes and projects likely to have significant effects on the environment are made subject to an environmental assessment prior to their approval or authorisation. The projects and programmes co-financed by the EU, including through Structural Funds have to comply with the EIA and SEA Directives to receive approval for financial assistance.

According to the EIA Directive it is for the national authority to determine whether and which geothermal drilling projects should be subject to an environmental impact assessment. This is done by the "screening procedure", which determines the effects of projects on the basis of thresholds/criteria or a case-by-case examination. In doing so, the national authorities need to take into account the criteria laid down in Annex III. Whilst no major changes are envisaged in relation to geothermal energy, it is nonetheless relevant to mention that the EIA Directive is currently under revision and an updated version should be adopted by the end of 2013.

Finally, a geothermal project shall comply with Directive 92/43 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive). In accordance with Article 6 (3) of the directive, if a proposal is considered to have a significant effect on the conservation objectives of a Community Site an appropriate assessment will be required. In light of the conclusions of the assessment of the implications for the site, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public. Emissions, noise and the impact on water (surface or groundwater alike) are likely to be among the factors to be analysed in the context of a deep geothermal proposal.

### 6.3 F-Gas Regulation

Hydrofluorocarbons are the Fluorinated-gases (F-Gases) used in various sectors and applications, including heat pump equipment. Because they do not damage the atmospheric ozone layer, they are often used as substitutes for ozone-depleting substances. However, F-gases are powerful greenhouse gases, with a global warming effect much greater than CO<sub>2</sub>, and their emissions are rising strongly.

With Regulation 842/2006 on certain F-gases, the EU aims to contain, prevent and thereby reduce emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol. It applies to heat pumps notably to

prevent leakages of these gases, arrange proper recovery and ensure the recycling or destruction of the cooling circuits of heat pump equipment.

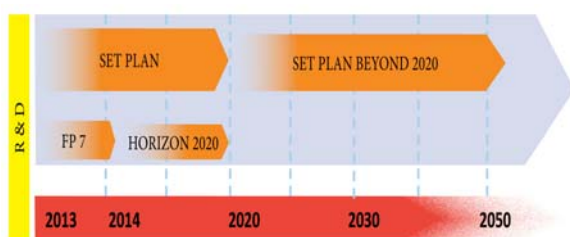
In November 2012, the European Commission adopted a proposal (COM(2012)643) to revise this regulation and set-down rules for F-Gases for 2030 and beyond. Such a proposal is currently under evaluation by European Parliament and the Council and should be adopted in the second half of 2013.

#### 6.4 WEEE Directive

Recast Directive 2012/19/EU on waste electrical and electronic equipment aims to increase the re-use, recycling and recovery of such waste. It applies to heat pumps, which fall within the category “temperature exchange equipment” listed in Annex III.

### 7. RESEARCH AND DEVELOPMENT

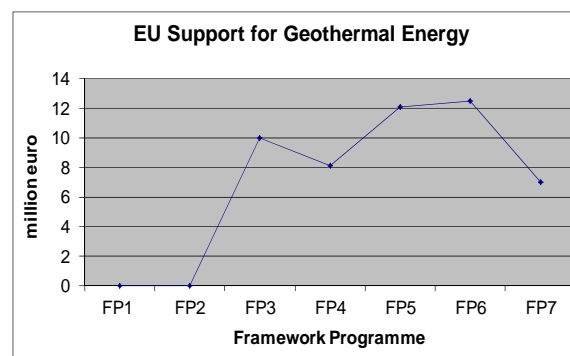
All technologies pass through the same stages of the innovation cycle: from basic research through development, demonstration, deployment, and commercial market uptake. During these phases public funding for the continuing industry-led research, development and deployment is needed in order to bring down costs. Commission’s documents have often pointed out how crucial is to invest in new renewable technologies and to improve existing ones through RD&D. Member states have spent €4.5bn on renewable energy R&D over the last 10 years with the EU spending €1.7bn from the Sixth (FP6) and Seventh Framework Programme (FP7), and the European Energy Research Programme for Recovery (EERP). Figure 7 illustrates the main R&D instruments at EU level.



**Figure 7: Main EU R&D programmes for energy**

#### 7.1 EU R&D funding for geothermal

Figure 8 illustrates the historic allocation of EU R&D funding to geothermal until 2012. In this respect, however, EGE (2013) has argued that “the allocation of EU funding between different technologies across the energy sector has been all but fair”. EU R&D funding allocated to geothermal energy during the FP6 and FP7 until March 2012 amounted to €29.4 million which according to EGE is “negligible if compared to what it was allocated to other technologies” (see Figure 9 at the end of this paper).



**Figure 8: Historic EU R&D support for Geothermal Energy (Source: European Commission)**

According to the same source, more funding should be made available in the next Framework Programme “Horizon 2020” running from 2014 to 2020, in order to achieve the 2020 targets for geothermal as well as to continue technology development of advanced technologies beyond 2020.

#### 7.2 The SET-Plan and its evolution in relation to geothermal energy

The Strategic Energy Technology (SET) Plan has been defined as the technology pillar of the EU energy and climate policies. It is a strategic plan to accelerate the development and deployment of cost-effective low carbon technologies. Established in 2008, it is based on a three pillar implementation structure: a Steering Group, European Industrial Initiatives (EII) and the European Energy Research Alliance (EERA) and is supported by an information system (SETIS).

The SET Plan prioritised those technologies supposedly most relevant to the energy and climate policy objectives for 2020 and for which an EII was set-up: wind, solar, electricity networks, CCS, bioenergy, nuclear, fuel cells and hydrogen, energy efficiency.

In relation to geothermal energy the SET-plan has not evolved substantially since it was launched. Geothermal was included in the Plan through the EERA Joint Programme on geothermal energy (EERA-JPGE) and the geothermal panel of the European Technology Platform (ETP) on Renewable Heating and Cooling. Since then, strategic research priorities for the sector were developed in two distinct documents - *Strategic Research Priorities for Geothermal Technology* (European Technology Platform on Heating and Cooling, 2012) and *Strategic Research Priorities for Geothermal Electricity* (TP Geoelec 2012), whilst work is in progress for the elaboration of an implementation roadmap.

According to EGE (2013), the case for EII on geothermal should be considered as “EGS is at its early deployment stage, [and] is an excellent example

where EU action is legitimate because it generates economies of scale in different regions of the EU.

## 8. WHAT AFTER 2020?

As currently framed, the RES Directive (see section 3) is designed to ensure the achievement of the 2020 renewable energy targets. It foresees a post-2020 roadmap in 2018, but without any concrete action renewable energy (including geothermal) will embark on unknown paths. Industry, the investors and other stakeholders in the energy sector require clarity regarding policy developments after 2020. This is why the European Commission has started preparing for the period beyond 2020.

In 2009 EU Heads of State and Government committed to decarbonising the EU the economy while at the same time ensuring security of supply and preserving industrial competitiveness. This objective implies the reduction of GHG emissions by 80-95% in 2050 compared to 1990 levels.

As regards to the energy sector, this means some 85% CO<sub>2</sub> emission reductions by mid-century. In order to explore five decarbonisation and two current trends pathways, in December 2011 the European Commission published its Energy Roadmap 2050 (EC, 2011b). Regardless of scenario choice, the biggest share of energy supply in 2050 will come from renewable energy. Strong growth in renewables is a so-called 'no regrets' option, together with energy efficiency and smarter infrastructure.

EGEC (2012) has analysed the Roadmap and its Impact assessment of the Energy Roadmap 2050 to illustrate its main implications for the geothermal sector. The development of geothermal energy up to 2050 according to the Roadmap is shown in Figure 10 at the end of the paper.

Following the Roadmap, the debate on a new climate and energy package was officially kick-started in March 2013 with the publication of a Green Paper on "A 2030 framework for climate and energy policies" (EC, 2013b). This policy document has launched a public consultation (open until the 2nd of July 2013) with which the Commission seeks the views of member states and stakeholders on climate and energy policies in a 2030 perspective, including on policy instruments and characteristics of a 2030 target for renewable energy. All responses to this consultation will feed into the Commission's on-going work on the 2030 framework which is expected to be published by the end of 2013 (EC, 2013c). Figure 11 below illustrates how the climate and energy policies are being developed to date with a view to the 2030 and 2050 horizons.



**Figure 11: Development of EU climate and energy policies**

It is very likely that the debate on 2030 will focus on the two main options currently on the table, i.e. the continuation of an integrated approach based on GHG emissions reduction, renewable energy and energy efficiency targets or a GHG-only approach. One thing is certain: if the 20-20-20 targets are major drivers for the growth of geothermal energy today, there is no doubt that the longer-term development of the sector will be heavily affected by shape and substance of the 2030 package.

## CONCLUSIONS

This paper shows that a comprehensive legal framework for geothermal is in force. Geothermal technologies can benefit from this framework, for instance from the Energy and Climate Package, through which the EU has both set ambitious targets for 2020 and put in place specific measures to remove market failures, and tap the enormous potential for renewable energy and energy efficiency.

Within this package, the RES Directive has been the most important piece of legislation for geothermal energy in Europe. It has addresses specific barriers for its market uptake, among which the lack of a coherent definition, the persistence of burdensome administrative procedures and the shortage of skilled and certified workforce.

Moreover, as geothermal technologies for heating and cooling can be more easily integrated in new and refurbished buildings, they can also benefit from regulations pushing up the renovation rate and promoting energy efficiency in buildings (EPBD, EED)<sup>9</sup>. Nevertheless, it is not possible to make a quantitative assessment of such an impact: the roll out of these technologies will largely depend on the case-by-case feasibility assessments.

In this regard, it is appropriate to bear in mind that the EU often adopts flexible legal framework and that it is the way the EU law is ultimately adapted at the

<sup>9</sup> In order to be more precise, it should be further assessed the compatibility between the concept of "nearly zero energy buildings and shallow geothermal systems" which may be difficult particularly for individual buildings.

national and local circumstances that really matters. A clear example of this is given with the first Renewable Energy Progress Report, with which the Commission has issued a warning over the slow implementation of the RES Directive, notably with regard to the streamlining of administrative procedures and access to the grid for renewable electricity (European Commission, 2013b). In the accompanying Staff Working Document, the EU's executive body has also highlighted that due to lack of measures and incentives, the deployment of geothermal is not proceeding according to plan, especially in the heating sector where it is indeed expected to have the greatest shortfall in 2012, i.e. -32.1% (European Commission, 2013c). Here it is also worth noting that the current economic crisis was not indicated as a major cause of such a shortfall.

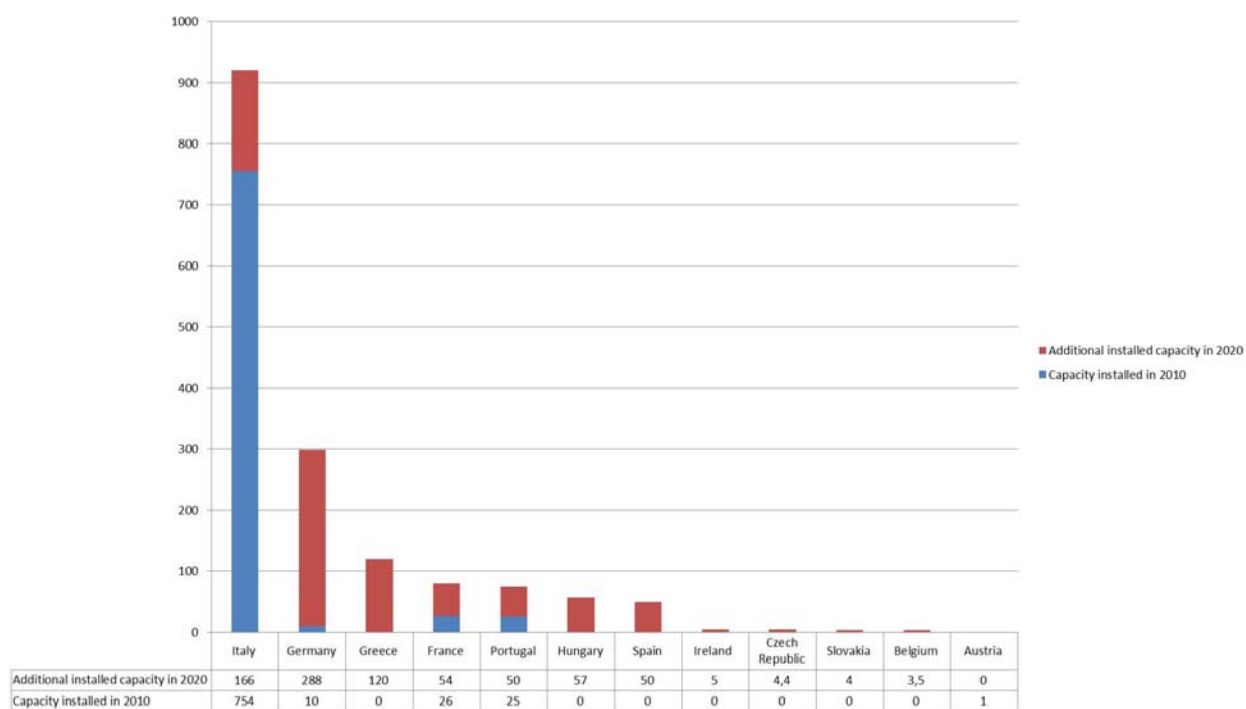
Regrettably, good news is not even coming from the EU ETS and the EU R&D sector, which are expected to be two crucial tools to achieve the 20-20-20 targets. The ETS got bogged down in over allocation of permits and it is not incentivising any change in technology choice. In the short-term the system may at best aim to incentive a partial shift from coal to gas. As regards to EU R&D strategy, looking at the allocation of funding across the energy sector over the last two framework programmes but also at the design of the SET-Plan, one may have the impression that geothermal energy is not put on the same footing as other technologies.

Regardless of deployment levels, it is highly desirable that geothermal technology is sustainable in the long run. This paper shows examples of EU environmental *acquis* ensuring that a geothermal installation is compatible with other EU environmental goals. It concludes that general principles and objectives, e.g. the goal to achieve good quality of waters by 2015 and the possibility for a member state to allow the reinjection of geothermal fluids, are established at EU level. However, it is then within the competence of national authorities to take final decisions, e.g. regarding whether actually authorise reinjection. Besides this, the analysis shows that EU legislation is promptly adapted to follow technology progress or new scientific findings, e.g. regarding F-gases for heat pumps.

Finally, this paper concludes that while the 20-20-20 targets are major drivers for the expected geothermal growth until 2020, the shape and substance of a 2030 framework for climate and energy policies currently being debated at EU and national level, may have a substantial impact on the development of geothermal technologies in the longer-term.

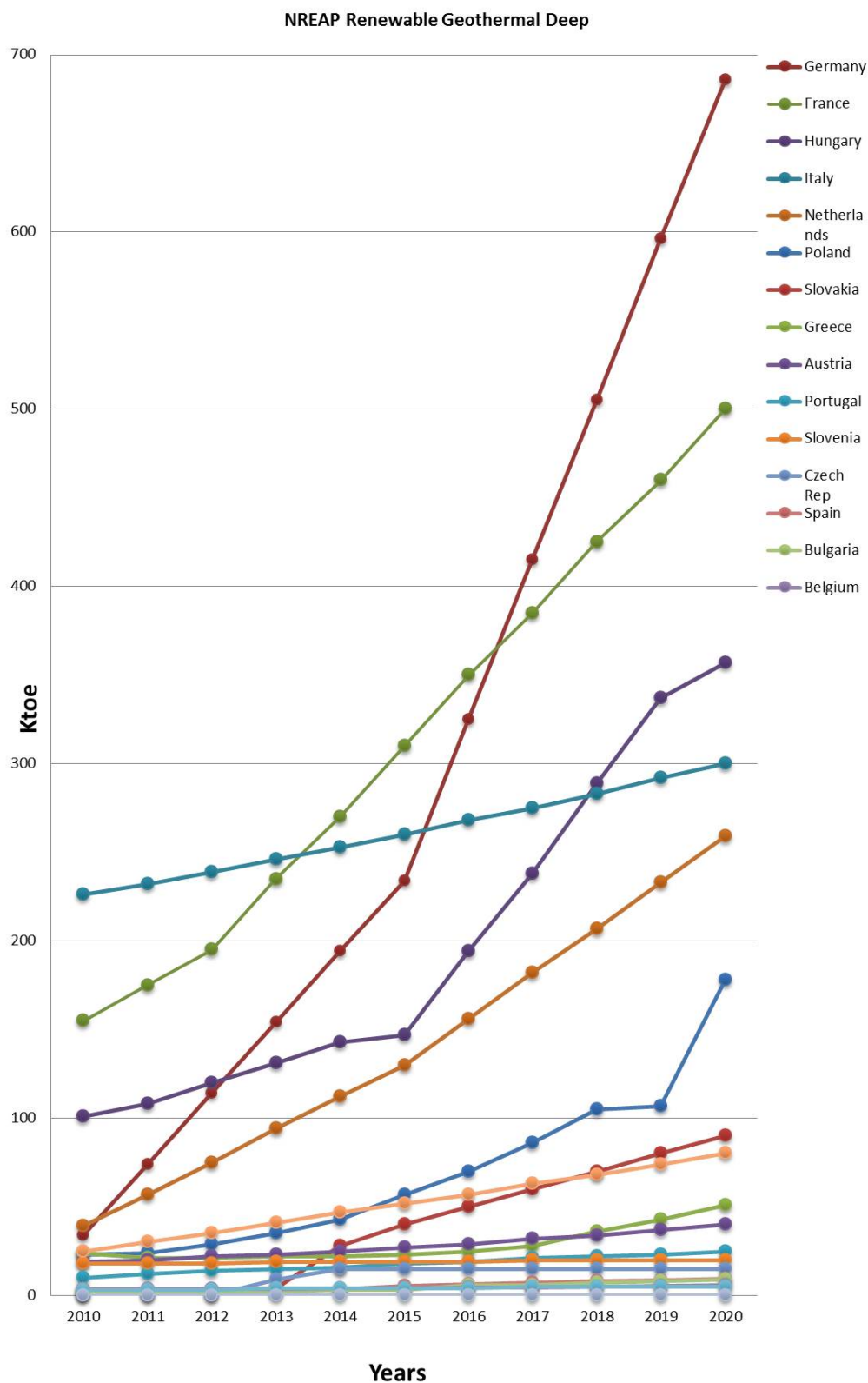
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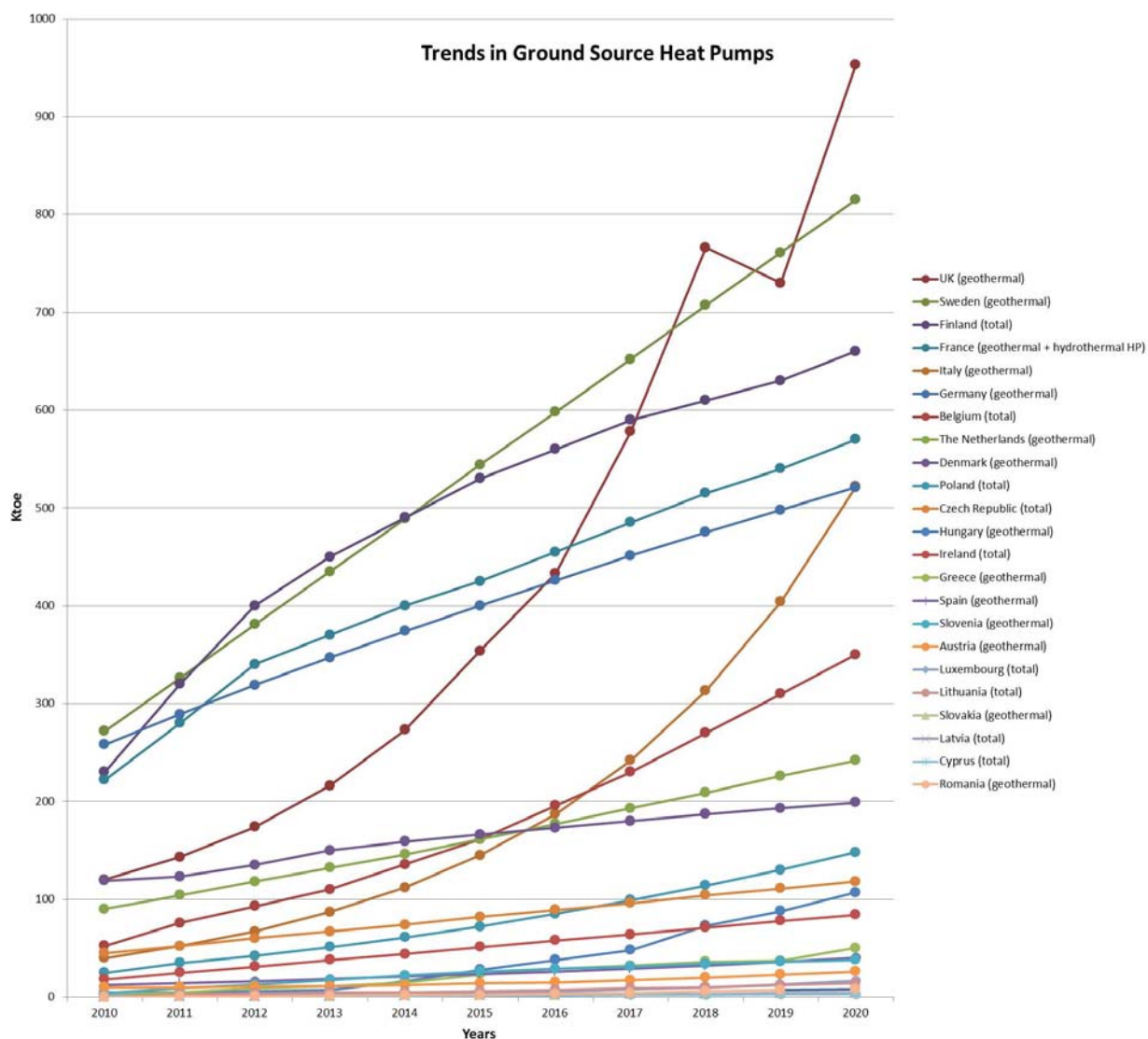


**Figure 12: Trends in geothermal power installed capacity: (MW) Source: EREC Final Evaluation of the National Renewable Energy Action Plans**

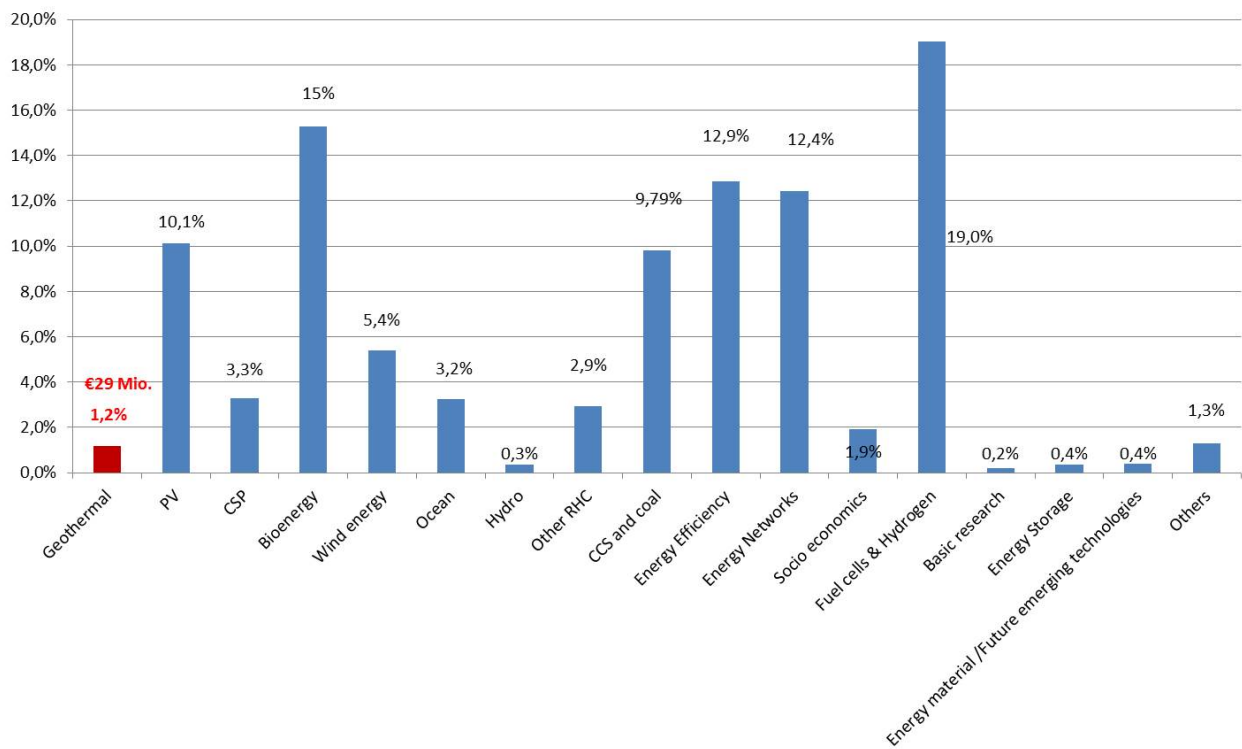




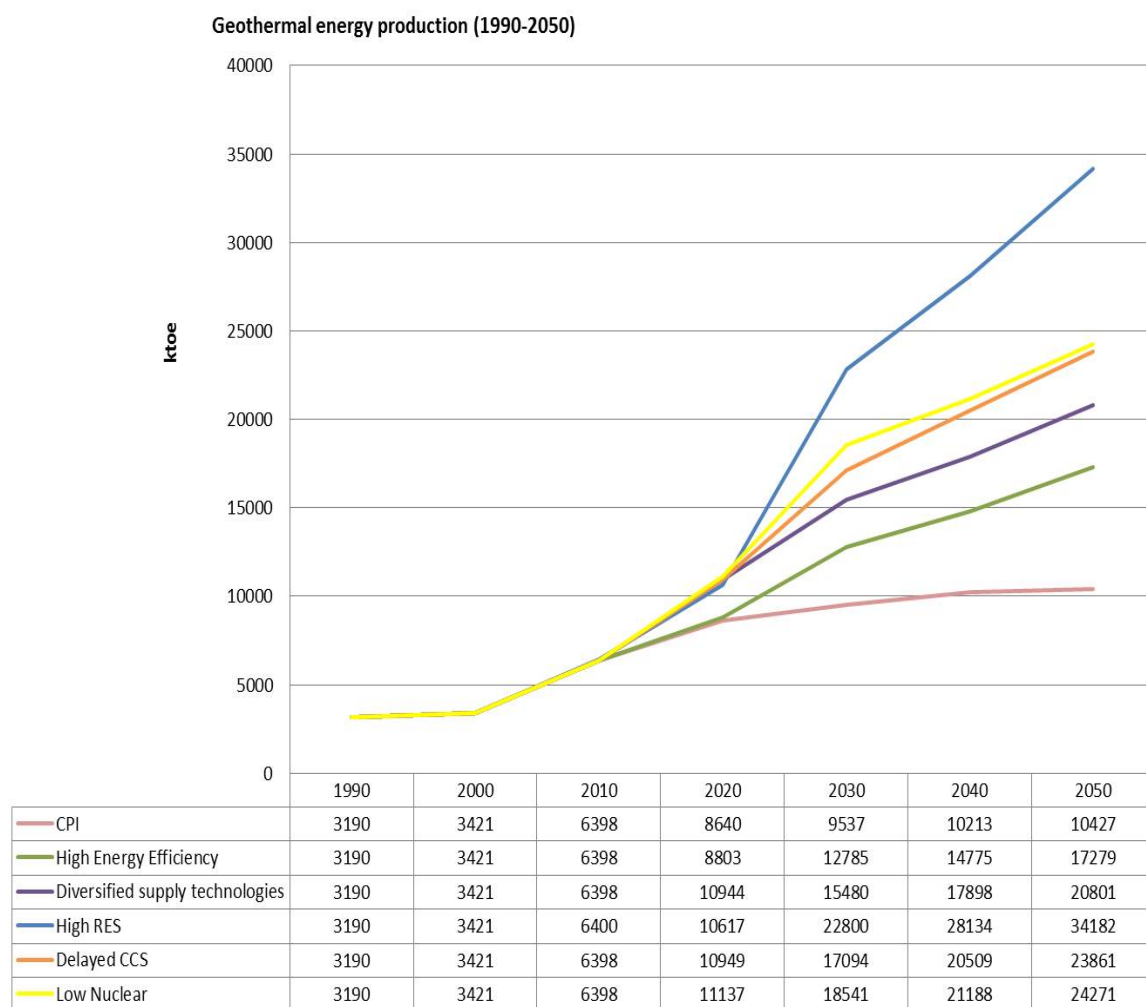
**Figure 13: Trends in deep geothermal heating and cooling: (Ktoe) Source: EREC Final Evaluation of the National Renewable Energy Action Plans**



**Figure 14: Trends in ground source heat pumps: (Ktoe) Source: EGEF Final Evaluation of the National Renewable Energy Action Plans**



**Figure 15: FP6- FP7 Non-nuclear energy spending by sector (%)**



**Figure 10: Geothermal Energy production until 2050 according to the Energy Roadmap 2050. (Source: EGE, 2012)**