EUROPEAN GEOTHERMAL ENERGY COUNCIL

EGEC Final Evaluation

of the

National Renewable Energy Action Plans

NREAPs:
Final evaluation of the geothermal contribution

Brussels, 14th July 2011

This evaluation has been undertaken by EGEC and its members, and aims at presenting the positive aspects contained in the NREAPs in addition to some of the inaccuracies, and most notably to assess the measures as presented.

If it is to be argued that in general the Plans propose more ambitious targets for RES electricity than for RES H&C, this is not true for geothermal. The potential of geothermal power is quasi ignored; however some Member States do support the development of geothermal direct uses and geothermal heat pumps.

One important remark is that geothermal receives much less financial support than all other RES. Flanking measures for developing geothermal energy are not mentioned in many of the NREAPs, especially given that a simplification of the authorisation procedures is not always proposed.

Some countries used the Primes model to generate their scenario. One underlying problem is that it does not take into account technology innovations. Our sector is aware of many developments, notably with EGS, so forecasts ought to be done with other models in order to accurately reflect reality. This has also been a requirement of the RES directive (recital 20):

"To permit the benefits of technological progress and economies of scale to be reaped, the indicative trajectory should take into account the possibility of a more rapid growth in the use of energy from renewable sources in the future. Thus special attention can be given to sectors that suffer disproportionately from the absence of technological progress and economies of scale and therefore remain under-developed, but which, in future, could significantly contribute to reaching the targets for 2020."

EUROPEAN UNION

Geothermal Electricity

The potential of geothermal electricity is an unknown for many of the NREAPs. Such studies should have been undertaken during the last year in order to prepare these Plans, but nothing has been produced in some countries. Therefore these potential studies must be done immediately in these countries.

In consequence, the targets 2020 for geothermal electricity are all conservative. Moreover, the figures on the installed capacity and the production in 2010 are erroneous. Some projects already underway are not taken into account and there are also some errors concerning availability, for example, the fact that a geothermal plant runs ca. 7800 h / year!

Although geothermal is one of the most competitive RES electricity sources with conventional geothermal technologies, and is the most competitive (all geothermal technologies: conventional, low temperature and EGS) if we consider integrating external costs (storage, grid infrastructure etc.); there are few support measures proposed to further develop it.

All NREAPs present their measures for future electric infrastructure, and we may note that they do not mention any special need for geothermal energy.

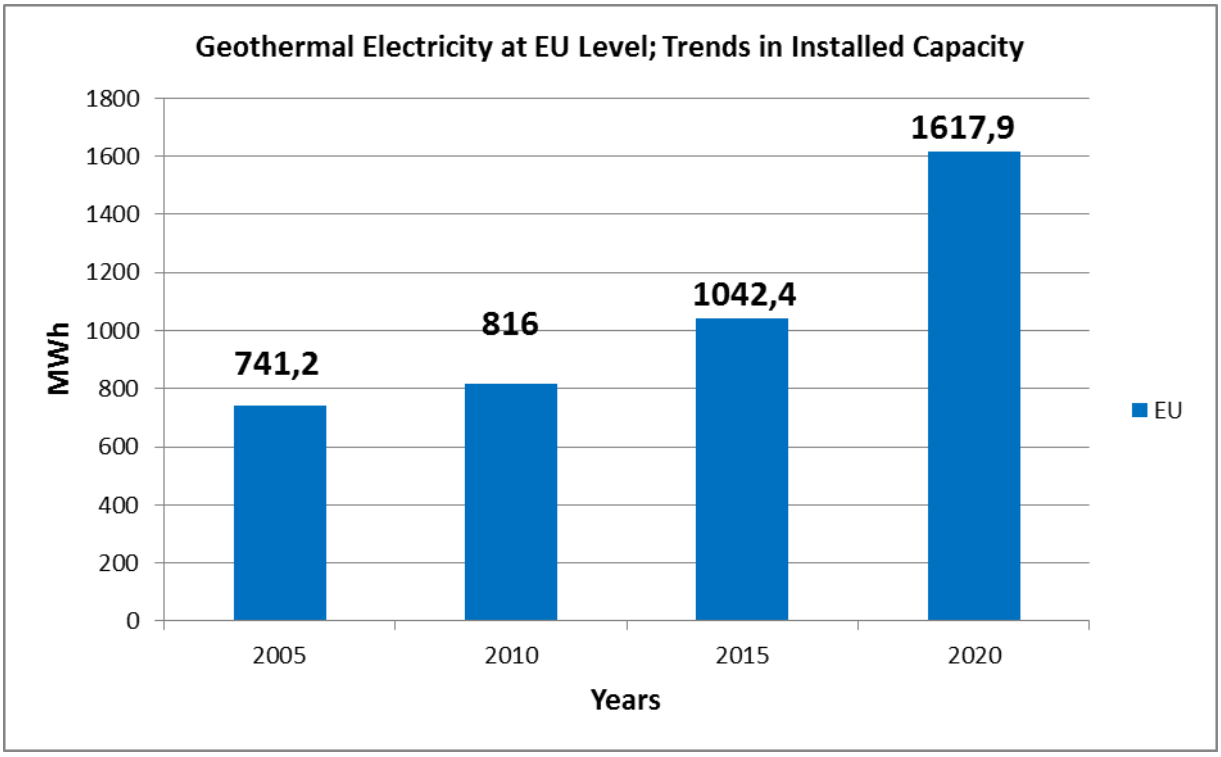
There is a general lack of a regulatory framework on deep geothermal energy, and the lack of political will results in less incentives for geothermal than for other RES. There is also no statement concerning “subsurface land planning” (e.g. conflicts with CCS and nuclear waste disposal sites).

The good news is that countries like Spain, Ireland, and Portugal take into account some EGS plants to be built in the next 10 years. Additionally, geothermal power is recognised as a renewable base load having the best availability among all renewables with ca. 7800 h/year.

To conclude, some Member States identify the issue of risk mitigation as an important barrier and propose to remove it. Our suggestion here is to support the idea of creating a Geothermal Risk Insurance Scheme at the European level, through the new Financial Facility issued from the European Economy Recovery Plan.

You will find below graphs that show the evolution trend forecasted by the NREAPs for the Geothermal Installed Capacity and of the Gross Electricity Production at EU level.

Figure 1. Trends in Geothermal Power Installed Capacity



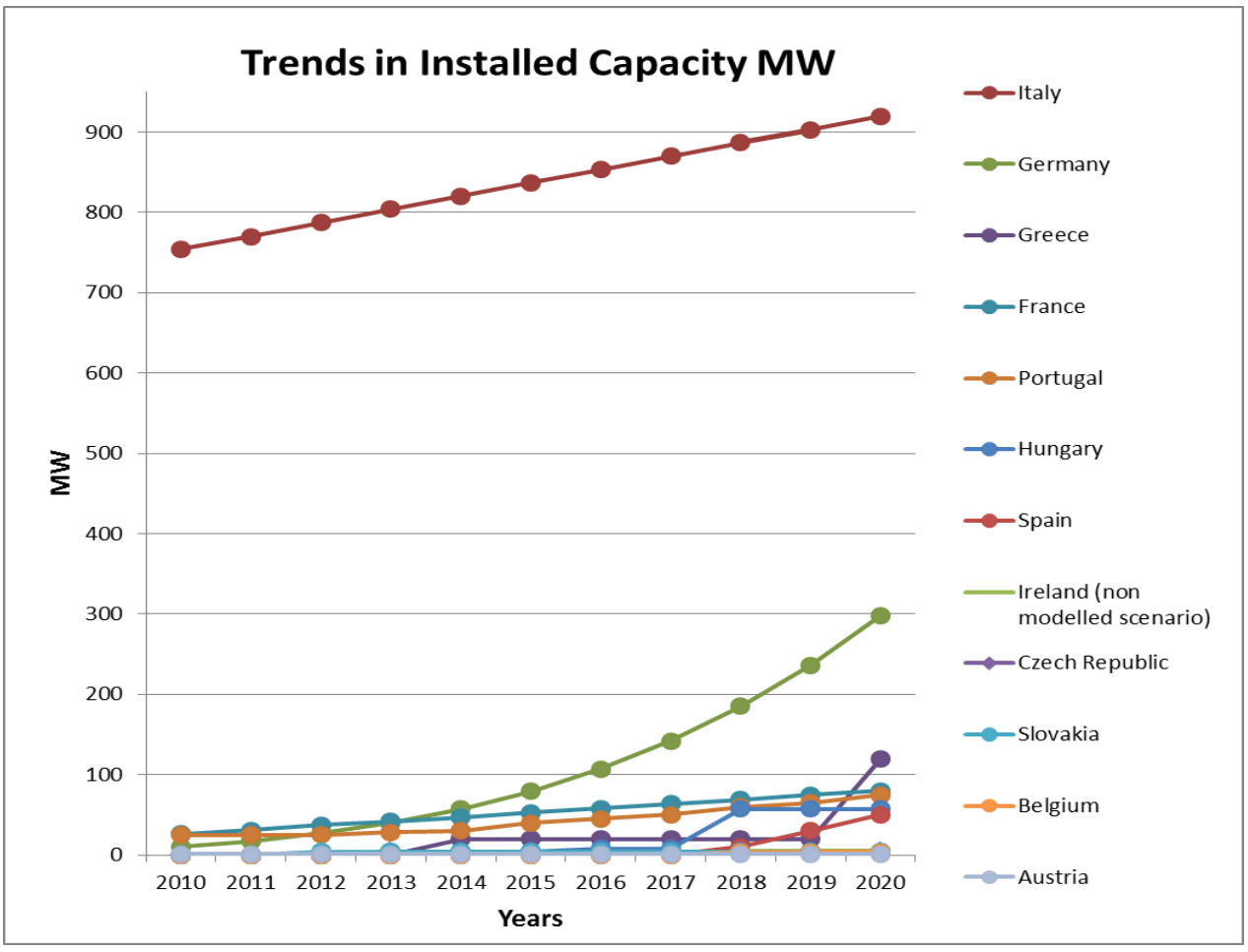
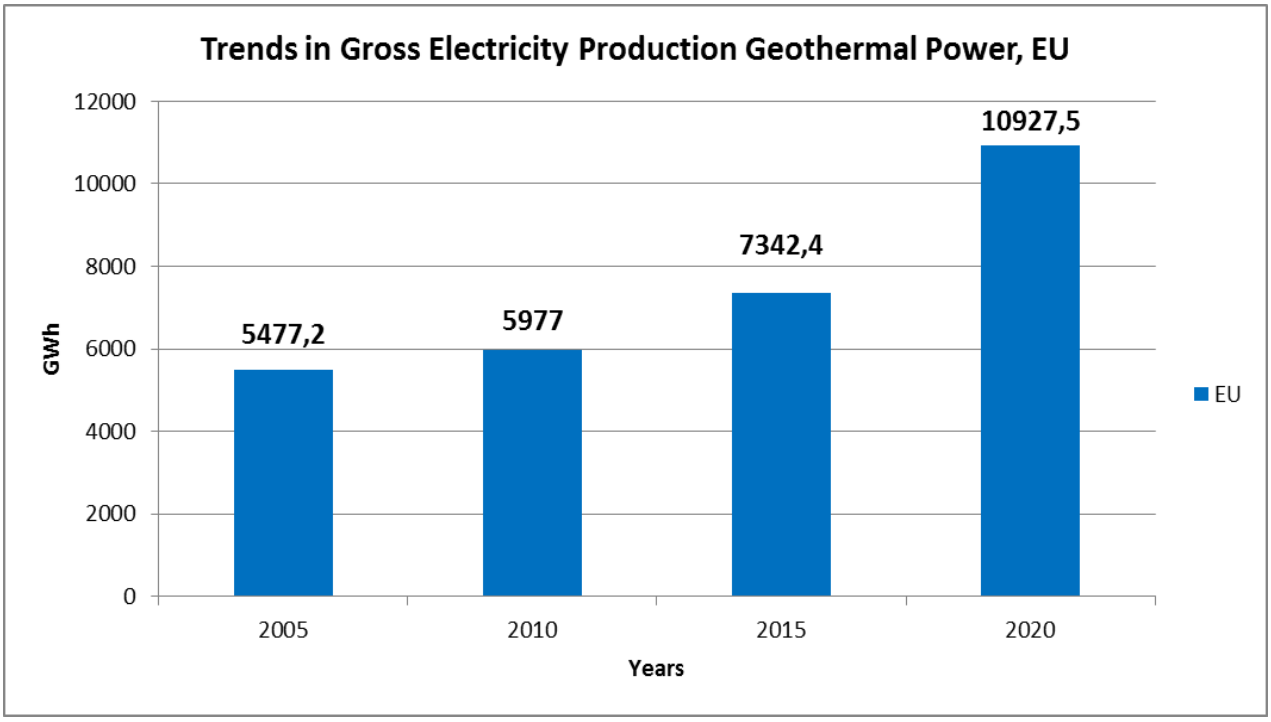


Figure 2. Trends in Gross Electricity Production for Geothermal Power



Geothermal Heating & Cooling

In general, support for the sector of RES heat is profoundly under-developed across the EU, and significant measures need to be taken to fully realise the possible contribution of RES. The European Authorities should adopt a large scale Action Plan to develop RES Heating and cooling in the EU, notably with the exchange of best practices in support schemes.

Direct uses

The deep geothermal potential for heating and cooling is also unknown in some countries. It must be studied, and new figures must be proposed to update the NREAPs.

The collection of statistical data for all direct uses (district heating, balneology, bathing, agro-industrial process, desalination etc.) is incomplete, with the consequence that some figures for 2010 are incorrect.

Regulations and support measures are proposed but in general the targets 2020 are very conservative. Good news emerges from The Netherlands, France and Germany where ambitious development is planned.

New construction, enlargement and refurbishing of district heating infrastructure are of crucial importance for geothermal energy, in particular deep geothermal. It is, however, not underlined enough in the NREAPs.

The cascade uses with district heating are not studied, neither are the Combined Heat & Power EGS plants.

Find below a graph representing the trend forecasted by the NREAPs for Deep Geothermal heating and cooling at EU level.

Figure 4. Trends in Deep Geothermal Heating and Cooling, European Union

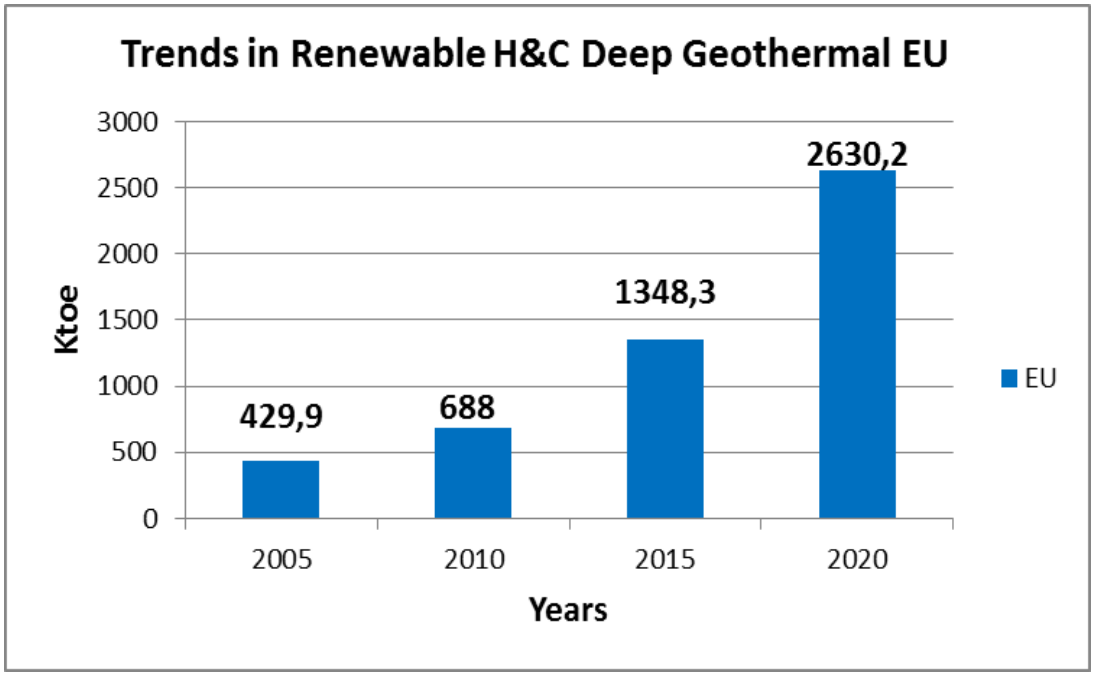
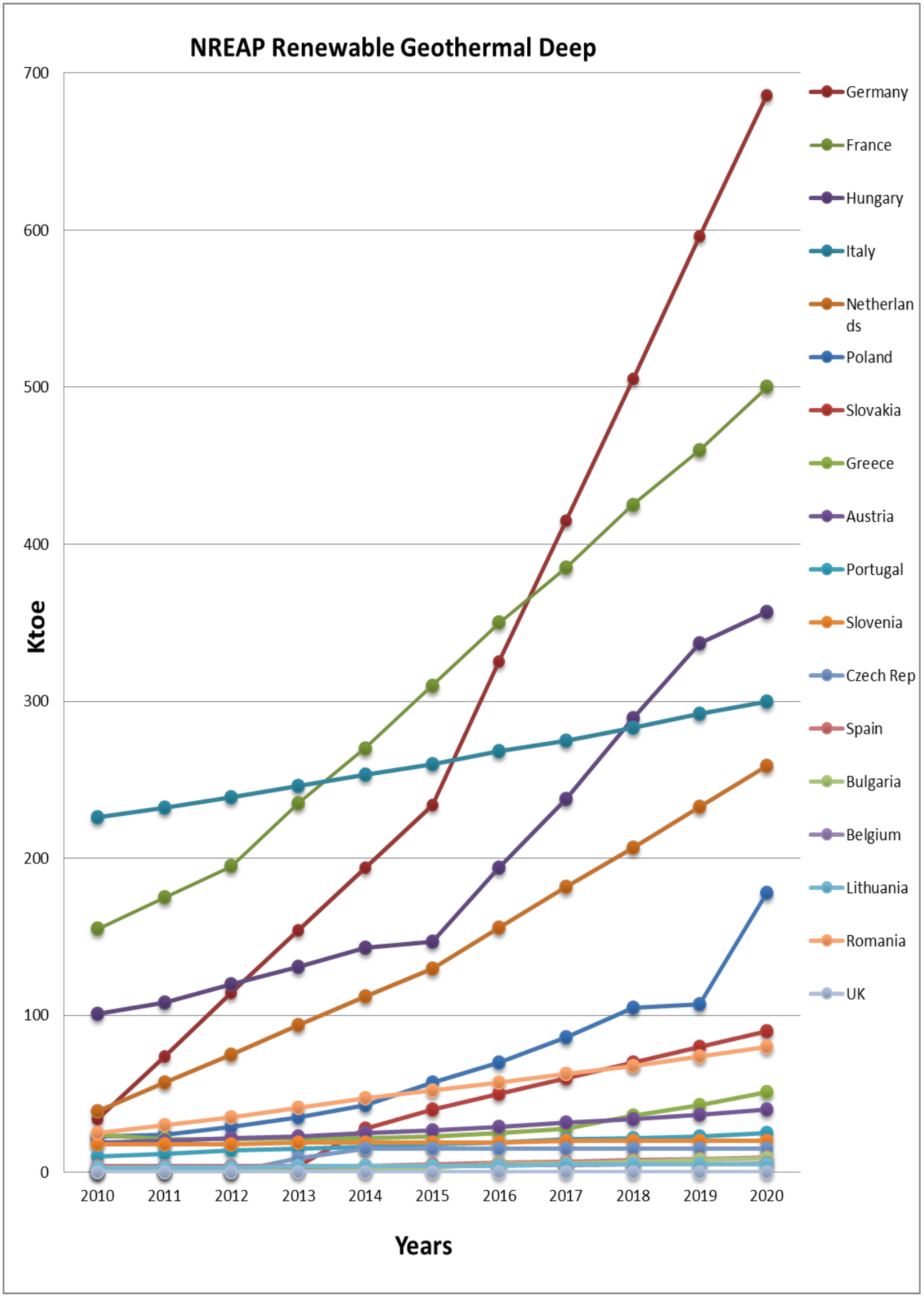


Figure 4. Trends in Deep Geothermal Heating and Cooling



Geothermal Heat Pumps

The statistical data for 2010 contains many errors. The number of installations is unknown for many NREAPs. An increase is foreseen everywhere, but in some countries the growth rate from 2010 to 2020 is unrealistic.

Countries such as UK and Sweden plan an important development, and 3 countries (Bulgaria, Malta and Portugal) foresee no development at all with a 2020 target of 0 ktoe! Some Member States do not follow the EC template as they do not distinguish between the different HP systems. A specific target for geothermal heat pumps must be provided.

Flanking measures must be established such as a regulatory framework, training activities and a certification scheme, actions which few member states propose.

On the following page you will find graphs showing the trends forecasted by NREAPs regarding Geothermal Heat Pumps in Europe.

Figure 5. Trends in Renewable H&C Heat Pumps

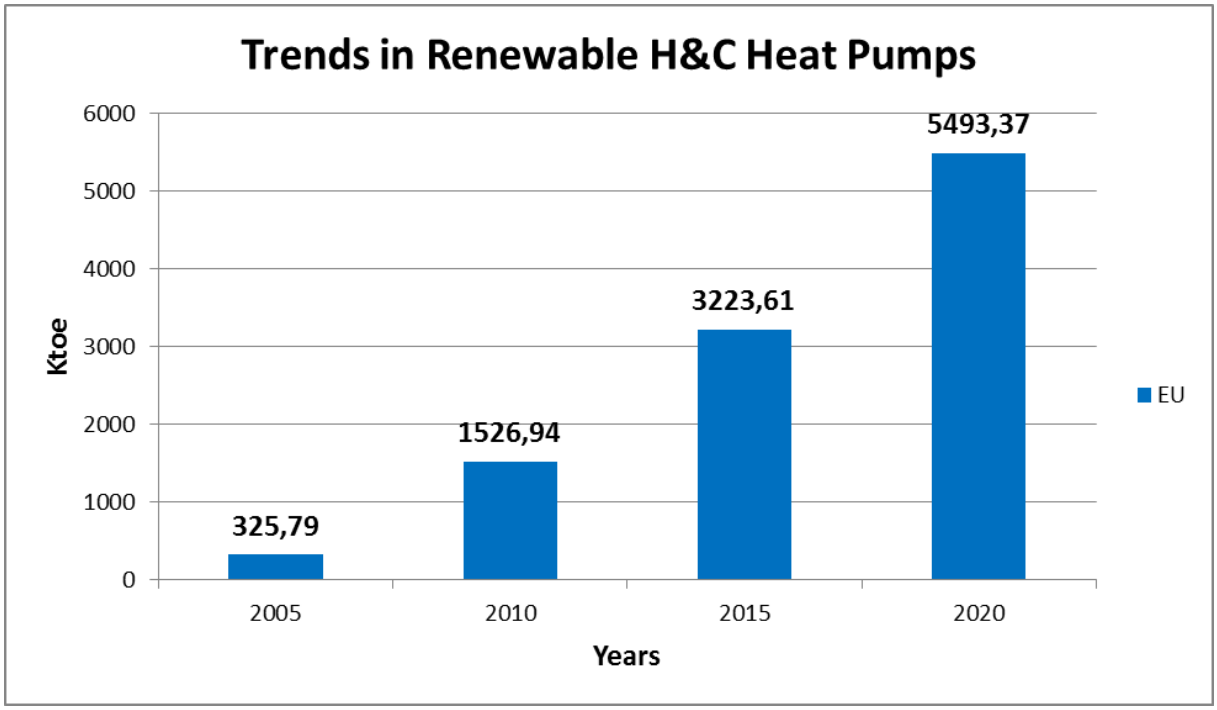
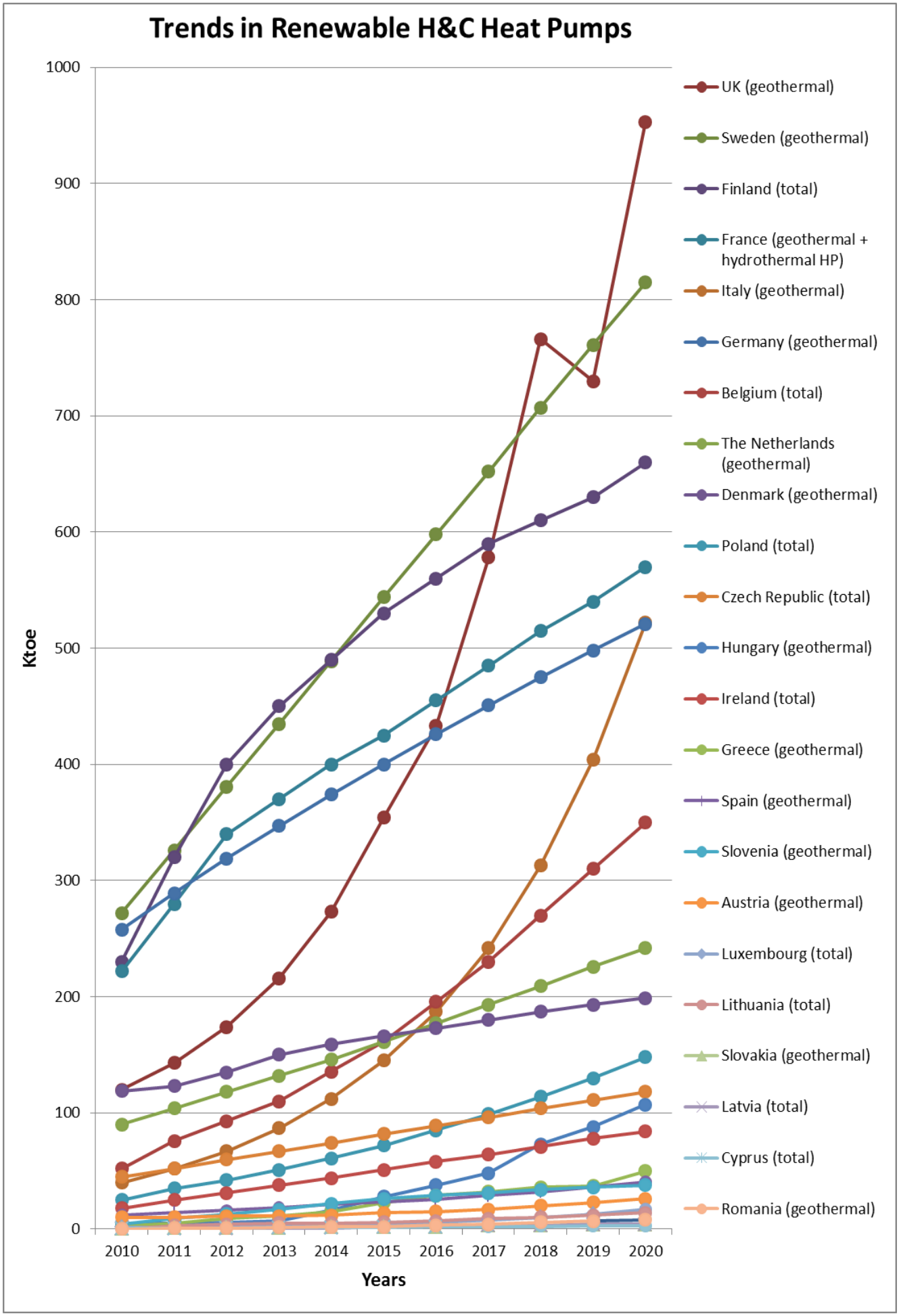


Figure 6. Trends in Geothermal Heat Pumps



AUSTRIA

Austria has already 3 geothermal power plants and notably one ORC plant with low temperature at 80°C the best example in the world for continental conditions.

However, the NREAP does not propose a target for electricity in 2020 and the figures for 2010 are incorrect (1,4 MWe installed and not 1 MWe, and 3,8 GWh and not 2 GWh with Blumau, Altheim, Simbach/braunau plants). The feed-in tariff for geothermal is low and much less than for other RES. They are no measures to develop geothermal electricity unless the potential is important and the Austrian Energy agencies are not promoting this technology.

There are some incentives for deep geothermal (District Heating) and Geothermal Heat Pumps; but no ambitious targets for the future.

For Deep heating & cooling, Austria proposes a steady growth (+2 ktoe/y) from 19 to 40 ktoe. The problem with this is that they are 20,2 ktoe produced in 2010 (845 TJ/y)…and in the near future new deep geothermal projects can be expected in the Vienna Basin and notably a geothermal district heating project in the Upper Austrian Molasse basin is planned for the town Ried im Innkreis, some 30 km east of Geinberg. Production temperatures are expected as high as 105 °C, geothermal power is expected as high as 15 MW.

For geothermal heat pumps, the forecasted growth is to have +1-2 ktoe/y, so around 1000 new installations per year. The proposal is an increase from 10 to 26 ktoe in 10 years.
According to us, there are 50 000 GHP installed in Austria, producing ca. 70 ktoe (2880 TJ) annually.

Moreover it seems there is confusion between geothermal and hydrothermal heat pumps. These ones should concern only systems with surface waters (lakes and rivers) not with underground water (geothermal). Additionally, there is no certification scheme proposed for shallow geothermal installers.

In sum, some measures for developing geothermal heating in Austria are proposed but not the relevant targets. We identify some inadequacies with this situation.

BELGIUM

Belgium does not any geothermal electricity plants installed for the moment, but they plant a first installation in 2018: a power plant with a capacity of 3,5 MWe improving its production from 22,3 GWh in 2018 (6370 h/y) to 29,1 GWh in 2020 (8310 h/y).

A financial support scheme is available for geothermal electricity production with green certificates. It has never been used, and is low; being much lower than those of other RES.
The regulatory framework is not described and it is only in the Brussels region that a simplification of the administrative procedures is planned for the future. No potential study has been produced so the objectives of 2020 are not ambitious.

For deep geothermal h&c, Belgium proposes a growth from 2,8 ktoe in 2010 to 5,7 ktoe in 2020; and is very moderate in comparison with the possibilities in Belgium for geothermal direct uses (spas, greenhouses, fish farming etc.).

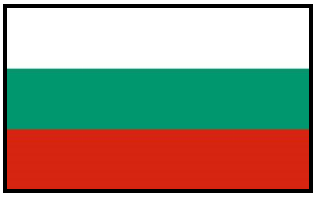
There is one geothermal DH in St Ghislain (Mons) managed by IDEA which recently received, December 2010, a new incentive for developing a second geothermal DH in Mons area (project Geother-wall).

Belgium is currently undertaking a potential study on DH, RES integration in DH with a chapter on geothermal. When the results are published, Belgium would have to reconsider its targets 2020 for deep geothermal h&c.

Financial supports are available for geothermal h&c and specifically, a special instrument has been created on DH. There is also a support for GSHP but Belgium does not plan a simplification of the procedures, or the establishment of a regulatory framework for GSHP. In Belgium, no training courses are organised for GSHP installers and they do not plan to establish a certification scheme for GSHP.

One important problem is that they do not distinguish the different HP (EC requirement in its template). The increase planned for this sector is important: from 7,09 to 350 ktoe between 2010 and 2020. Flanking measures (training and certification for drillers and designers, financial support, regulations etc.) are crucial for reaching this objective.

BULGARIA



Bulgaria does not propose any target for geothermal electricity; however a feed-in tariff exists for geothermal, although the rate is not mentioned in the plan. Huge potential exists for hydrothermal (low temperature) and EGS, but it has not been studied. This analysis must be done presently.

For deep geothermal H&C, the proposal is an increase from 1 to 9 ktoe; and support measures are planned to accompany this development, but there are already 25,88 ktoe produced (1083 TJ/y) from space heating-greenhouses-bathing etc. This statistical data must be revised

No targets are proposed for geothermal HP, but Bulgaria produced already 6,8 ktoe (286,23 TJ/y) from this technology.
Some flanking measures are proposed: implementation of EPBD recast, promotion of the RES h&c technologies, and a certification of ghp installers is planned.

In sum; certain measures for developing geothermal energy in Bulgaria are proposed but not the relevant targets. We identify some inadequacies with this situation.

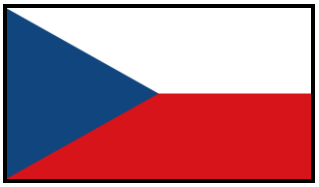
CYPRUS

There are not targets for deep geothermal electricity and h&c. Potential for development exists as Cyprus has several active fault lines along which earthquakes occur.

The incentive scheme seems available for geothermal electricity, cogeneration and district heating but without many of the necessary details clearly defined. The potential and the support measures must be clarified.

Incentives also seem available for geothermal HP, as well a planned certification scheme for ghp installers. Cyprus proposes a target for 2020 but it does not distinguish HP types (aerothermal, geothermal and hydrothermal), although it was required by the EC in its template. The increase from 0,34 ktoe to 2,97 ktoe in 2020 for all HP is very conservative, as it means a total of ca. 1000 ghp installed in 10 years.

CZECH REPUBLIC



The NREAP forecasts the installation of a first geothermal power plant in Czech Republic in the next 10 years. The support scheme proposes a specific tariff for geothermal: 17,7 € ct/kWh and a green bonus of 13,3 € ct/kWh.

The objective is to have only one plant of 4,4 MWe capacity, installed in 2013, producing 9 GWh in 2013 (availability: 2045 h/y), and 18,4 GWh (availability: 4181 h/y) during the following years with the same capacity. Therefore, they plan to have the geothermal installations running partially in 2013 and fully operational from 2014. The availability proposes is low and it does not correspond to reality of a geothermal power plant which is base load.

Moreover, the incentive scheme will stimulate more projects; and if a first one is successful, others will be installed. The Czech Republic has the potential to develop low temperature power and EGS plants. In order to achieve that, other measures should also be adopted; a geothermal regulatory framework, simplified licensing procedures, establishing a risk insurance scheme and promotion of the technology.

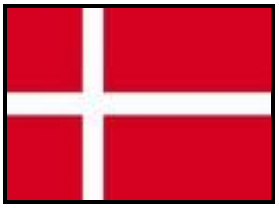
The plan presents some measures which could be used to develop deep geothermal heating and cooling. They declare 0 ktoe produced in 2010, but for many years several installations are running, such as the spas in Karlovy Vary & Marianske Lazne: producing 2,15 ktoe today. The Czech Republic foresees to have 9 ktoe by 2013, and 15 ktoe from 2014 without any further increase.

Also here, if the first installations are deemed successful, more plants will be installed. The geothermal potential is here, important.

For the HP sector, they forecast a linear growth (+ 7ktoe per year) from 45 ktoe in 2010 to 118 ktoe in 2020. There is today 14,000 GHP installed in Czech Republic, producing 28,68 ktoe. The support measures for GHP are not clear and there is not a real certification scheme planned.

Figures in the NREAP have to be updated in order to distinguish between the different HP systems.

DENMARK



A legal framework exists in Denmark for deep geothermal (Legislative Decree No. 889 of 4 July 2007 with subsequent amendments).
In their NREAP, they declare that: " *In Denmark, geothermal energy is used to produce heat that can be used in district heating systems… there are many watery sandstones places in Denmark with water conductive properties of such a nature that geothermal heat is possible…*"

However, the stated target for geothermal electricity by 2020 is 0. A potential for electricity production exists mainly for EGS but Denmark does not provide any measures to develop it.
A first step should be to undertake a study in order to understand this deep geothermal potential.

They declare 0 Mtoe production of heating and cooling from deep geothermal although 2 geothermal DH systems are running in Thisted (7 MWth installed) and in Copenhagen (14 MWth) . A third one is currently drilled in Sonderborg.

The total production in 2010 of deep geothermal h&c is 19,12 ktoe (800 TJ for 44 MWth installed capacity). A collection of recent data must be made to update these figures.

Denmark reports 119 ktoe of geothermal heat pumps in 2010. The objective of 199 ktoe by 2020 is conservative:

Linear growth of 8 ktoe per year (it means ca. 5 000 new GHP installed / year)

- From 2005 to 2010: 67 new ktoe have been produced > ca. 12 ktoe / year
- They plan to have a growth below the scenario business as usual (BAU), although the GHP market is still in development and that they are planning several measures to have more RES-heating in buildings.
- They mention HP installers but not about shallow geothermal installers for GHP.

Remark: in the Annex, it is written: "*It should be noted that geothermal energy is included even though it is actually not renewable and will ultimately become exhausted. However, its potential use is so modest that this will take many hundreds of years and it can thus be considered renewable."*

We ask Denmark to delete this sentence completely, as it is completely incorrect and discriminatory. It does not respect the RES directive and they contradict themselves later stating:

"Inside the core of the earth, radioactive processes still occur that are similar to those in the sun. These processes produce a constant stream of heat from inside the earth which has a temperature of around 5000 °C. This heat streams up to the earth's crust where it can be utilised. There are huge amounts of geothermal energy in the underground everywhere on earth. However, in many places this is difficult to access, so the utilisation of geothermal energy can primarily take place in sub-surface areas with rock types such as sandstone or chalk. These types of rock have a suitable porosity as well as good water conducting ability (permeability), so sub-surface water can flow freely. These sub-surface areas are called geothermic reservoirs."

ESTONIA

The NREAP for Estonia is amazing and rather difficult to evaluate. Indeed they base their RES development only on one technology: wind.

For electricity, the RES increase is based only on wind; hydro and biomass remain equal. All other RES are not to be developed!

For heating and cooling, Estonia plans to decrease the RES part! Biomass will decrease, and solar thermal and geothermal are not developed (neither deep nor shallow geothermal).

Such a document in not an action plan for promoting RES, as required by the RES Directive.

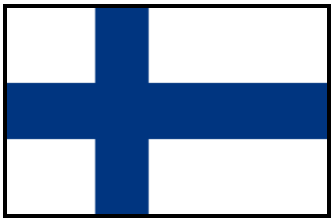
In theory, geothermal is in the Estonian Electricity Market Act so support schemes should be available, but the target 2020 is 0 MWe installed.

Estonia plans also some actions on Buildings, but the RES h&c production will decrease and geothermal targets are 0 ktoe by 2020.

Actions are planned for training and certification of the RES installers, but at a later timeframe.

The potential of all RES technologies (and not only wind) should be studied in depth and measures must be adopted to improve this NREAP in order to allow a real development of RES in Estonia.

FINLAND



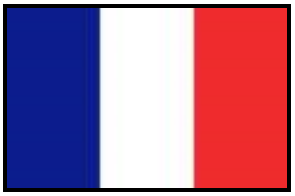
No targets and zero support measures are proposed for geothermal electricity in Finland by 2020. They do not plan any development of deep geothermal for heating and cooling. A study to know its potential should be made urgently, especially on EGS.

For geothermal HP, the support measures are not clear. They declare 230 ktoe produced from HP in 2010, and they aim to reaching 660 ktoe by 2020. They did not distinguish the different types of HP, so we do not now the target for GHP; but this distinction was required by the EC in its template. It is difficult to understand the objectives they have outlined for GHP development.

We estimate to have ca. 50 000 units of GHP installed in Finland today, representing an installed capacity of ca. 1000 MWth and producing around 200 ktoe.
7500 GHP units were sold in 2008. If we use this figure for a scenario BAU, it means for the period 2010-2020:

- 7500 * 10 = 75000 new GHP
- The total installed capacity in 2020 would be = 125 000 units
- It means ca. 470 ktoe from geothermal heat pumps (with an average capacity of 20 kWth)

FRANCE



The NREAP presents many and clear support measures for developing geothermal energy.
A good regulatory framework is in place, a risk insurance fund is established and a new feed-in tariff has been adopted in July 2010 with a special support on EGS (0,2 € ct/kWh + 0,07 € ct/kWh). This is not mentioned in the NREAP, and it must be added.

All necessary conditions are present for increasing the production of geothermal power. So it is rather strange that France proposes a 'reasonable' 2020 target with 80 MWe installed, when the Grenelle de l'environnement proposed 190 MWe just for overseas territories. We could add that France has one EGS plant installed already, but no future projects are foreseen in the Plan.

The total installed capacity in 2010 is 16,5 MWe (and not 26 MWe mentioned in the NREAP) and a good rate of avaibility is achieved, greater than 90%. Production for 2009 and 2008 was below 95 GWh (not 153 GWh as mentioned in the NREAP), due to various maintenance and technical issues.

The exploitation in Guadeloupe (Bouillante power plants) started in 1984, and a second unit has been commissioned in 2004. The total capacity of 15 MW did not increase since 2005. The activity for the third unit of 20 MW is on-going. The EGS project at Soultz-sous-Forêts is now operating a scientific pilot plant module of 1.5 MW.

The French linear trend (+ 5 MWe each year) is not realistic; soon the capacity will increase from 16 MWe to 36 MWe directly.

Finally, we can recommend that France adopts other measures to increase awareness of the public and decision makers of this technology.

For geothermal direct uses, support measures are consistent to allow an important increase from 155 ktoe to 500 ktoe in 2020. However, a simplification of procedures is crucial to reach this target.

For geothermal heat pumps, several measures are adopted for supporting this technology. We can suggest that the certification scheme Qualiforage should be further developed and the administrative procedures for small scale GHP systems must be simplified. The forecasts are to grow from 280 ktoe to 570 ktoe by 2020, with a growth rate of +60 ktoe / year from 2010 to 2012 ; and +30 ktoe/y after that and until 2020.

The current growth rate for 2 years is + 60ktoe/y, with ca. 25 000 new installations annually. We do not believe that this will stop suddenly in 2012, because the market is far for being mature and all the support measures adopted will help the development of the GHP market. We can notice the Grenelle de l'environnement suggested more ambitious targets with 800 ktoe by 2020.

GERMANY

The NREAP foresees a geothermal development but the situation is different according to the technology.

For geothermal electricity, Germany adopted several support measures:

- Feed-in tariff with bonus for EGS and CHP (0,16 +0,04+0,03+0,04 € ct/kWh)
- Risk insurance scheme
- Clear regulatory framework
- Development of EGS and binary plants

The licensing of geothermal plants (water legislation, mining legislation) is listed; however, no further statements are made. The various existing problems e.g. with the delineation according to § 4 BBergG are not mentioned, and no word about streamlined or simplified regulation. There is also no statement concerning “subsurface land planning” (e.g. conflicts with CCS disposal sites).

In light of the recent energy concept of the German Federal government, the paragraphs concerning grid access and RES priority might contain a potential for conflict. In particular, the question of grid capacity is seen primarily from the perspective of short-term high feed-in, mainly from wind. There is a risk that the relatively large capacities of geothermal energy in the base load and medium load sector, which we hope to see towards the end of the period covered by the NREAP, cannot be taken by the grid due to the prolonged operation period of nuclear power plants.

The NREAP foresees an increase, with an exponential growth, from 10 MWe (27 GWh) in 2010 to 298 MWe (1654 GWh) by 2020. Firstly, we can notice the figures for 2010 are not accurate: with 4 CHP plants (Landau, Unteraching, Neustadt-Glewe and Bruchsal) the installed capacity today is 7,14 MWe, but the production is 50,08 GWh!

In electric power generation from geothermal energy, a link is made with the use of waste heat for district heating, which might seem a bottleneck for further development. However, with advancing technology this will not be the case. Also the annual load factor that can be calculated from the 2020 values is only 63 % (5500 h/y), far from the reality of power-oriented geothermal plants that can achieve values in excess of 90 % (8000 h/y)!

The potential in Germany is more important, and reaching 298 MWe will be a first step. In order to achieve that more support measures are needed, and notably a communication plan to increase awareness and public acceptance.

For geothermal direct uses, Germany adopts also interesting support measures. The increase forecasted will lead Germany to be top of European countries for geothermal h&c production.

The scenario is to grow from 34 ktoe to 686 ktoe in 2020. Here too, in order to reach this target a large action plan must be adopted.

A correction must be made for the data from 2010: there are already 57,28 ktoe produced from District Heating and bathing installations.

For geothermal heat pumps, the support measures adopted could allow a large development of the GHP market. Yet some regulations/laws proposed are not support schemes *sensu strictu*, but rather impose obligations.

For the certification of installers, beside the category of installers (plumbers), only electricians and roofers are mentioned. For the shallow geothermal industry, the professions of drillers and pipe layers are as important and need to be taken into consideration.

The NREAP foresees a linear increase of + 30 ktoe/y, from 258 ktoe in 2010 to 521 ktoe in 2020. But there are 178 000 units installed today, with a growth rate of ca. 30 000 new installations / year (+ 60 ktoe/y). Therefore, the growth rate (lower than the current one although the RES Directive has been implemented) and the target 2020 are not realistic, not in relation to the support measures adopted.

One problem to be outlined is that the German NREAP lists existing programs and regulations, without giving a further perspective. In general, the sector of support for RES heat is heavily under-developed in Germany, and significant measures need to be taken to fully realise the possible contribution of RES

GREECE

Greece is one of the few Member States proposing to develop geothermal electricity, and establishing support measures. The potential is huge for high and low enthalpy plants and for EGS.

Their plan is to start with a 20 MWe power plant in 2014 and having 120 MWe installed by 2020. This target is reasonable and much more could be done. The 20 MWe refers to new power plants of the power company (DEH) to be installed in existing geothermal leases, namely in Milos, Nisyros and Lesvos, which can be in operation by 2013-14 if works start immediately. The availability of the geothermal plants proposed is 6100 h/y.

Greece has just adopted a new Feed-in tariff in 2010 with 9,94 € ct/kWh for high temperature and 15 € ct/kWh for low temperature power plants. It should allow a first development but the licensing procedure should be simplified, including geothermal concessions tendering.

For geothermal direct uses, they indicate a production of 24 ktoe, forecasting a small increase to reach 51 ktoe by 2020 and support measures should allow for greater development. Greece has adopted a regulation in 2009, and subsidies are proposed for CHP plants and DH systems.

For geothermal heat pumps, they count 3 ktoe produced in 2010. They plan a growth to 50 ktoe by 2020 which represents 2500 new GHP installed per year.

For 2009, the real figures are:

<u>Direct geothermal heat uses</u>

Installed capacity: 84,6 MWh
Energy use: 16 ktoe

<u>Geothermal Heat Pumps</u>

Installed capacity: 50 MWh
Energy use: 6,4 ktoe

HUNGARY

Hungary is one of the few Member States proposing to develop geothermal electricity, and establishing support measures. The conventional geothermal potential is low (e.g. binary ORC or Kalina) but quite high for future EGS systems. Hungary proposes to have a first geothermal electrical plant in 2013 (4 MWe capacity producing 29 GWh and operating 7250 hours/year), a second one in 2016 (8 MWe for 57 GWh, operating 7125 h/y) and 57 MWe from 2018 (210 GWh, operating only 3684 h/y).

Hungary has a legal framework for deep geothermal with support measures:

- Mining Act, Water management Act, Electricity Act and the Act for environmental protection
- Renewable energy and a geothermal legislation are under preparation (notably for new geothermal energy concessions)
- Green Bank supported by the National Government
- Declared feed-in tariff and regulated takeover price of the produced electricity from renewable energy. The price is subsidised and fixed. There are three price levels; the weighted average is ~ HUF28/kWh, ~ 10 eurocents.
- Hungarian State support from EU sources – EEOP (KEOP) Environmental and Energy Operative Program

One flanking measure should now also concern geothermal risk insurance.

The country has high potential for low- and medium enthalpy geothermal, suitable for direct uses. For Deep heating & cooling systems, Hungary proposes a growth from 101 ktoe in 2010 to 357 ktoe by 2020.

The objective is to develop all geothermal applications: for balneology, agriculture, bathing, district heating (new and retrofitting) etc. EGEC estimates there is already 9200 TJ/y produced in 2010 (220 ktoe).

Hungary aims at developing RES integration into buildings, notably with geothermal HP. For geothermal heat pumps, the proposal is an increase from 5 ktoe to 107 ktoe in 10 years. According to us, in 2010 there are 4000 GHP installed in Hungary, already producing 12,5 ktoe.

The certification of all RES installers is planned in the future and training activities will be proposed notably through regional actions. A simplification of the procedures should be envisaged.

The Hungarian NREAP suggest an interesting development for geothermal, but the potential is much higher. Firstly, the Statistics about geothermal must be verified and therefore targets could be recalculated.

IRELAND

Ireland focuses mainly on RES-electricity, they just forecast a small increase of res-h&c.

The NREAP proposes a target for geothermal electricity only in the non-modelled scenario (where Ireland reaches its RES target before 2020 and export RES production). Here, the proposal is to have 5 MWe installed from 2018 to produce 35 GWh (availability: 7 000 h/y). There is a feed-in tariff but no for geothermal power!

A geothermal legislation is under preparation and soon a new bill will be published. It should clarify the situation, especially for deep geothermal by simplifying the licensing procedure, by establishing support measures and presenting a development roadmap.

Ireland does not put any figures on deep geothermal heating and cooling, and does not propose any support measures. However, in 2010 there is 0,5 ktoe of direct uses (air conditioning-cooling: 6622 MWth and bathing: 1452 MWth) and a potential for further development exists.

For geothermal heat pumps, the figures concern the HP sector without distinguishing geothermal, aerothermal and hydrothermal. It is required by the EC template in order to allow the drafting of specific support measures, the proposal of a certification scheme for drillers etc.

For the HP sector, they forecast a steady growth (+ 7ktoe per year) from 18 ktoe in 2010 to 84 ktoe in 2020. There is today 9500 GHP installed in Ireland, producing 17,78 ktoe. The current growth rate is 1600 new units per year: + 3,5 ktoe/y

The support measures for GHP are not clear. They describe the training activities in Ireland about geothermal, and they indicate a liaison is established with the Geotrainet project on establishing a 'European Training Framework for GHP installers and designers'. However, there is no real certification scheme planned.

ITALY

Italy has the most important potential for deep geothermal, and a long tradition with the first power plant in 1904 and direct uses of the geothermal resource since Romans. It is rather strange the NREAP does not propose to develop more this technology and it focuses on other RES technologies and on import RES from non-EU countries.

It ought to be questioned here, what is the less expensive solution?

The establishment of green certificates for geothermal power allows the installation of new plants, and the special tariff of 20 € ct/kWh for small plants (<1MWe) should help the installation of micro-generation plants

Yet two current barriers are not solved by the NREAP:

- the licensing procedure should be simplified and delays for authorisation reduced
- public acceptance in Monte Amiata region. Various communication actions should be determined.

The NREAP scenario is to have a linear increase of +16 MWe each year. This does not match with geothermal plans which are bigger and require more than 1 year to be installed. It seems the Primes model has been used, but this is not relevant for geothermal, especially in Italy.

Moreover the figures for 2010 are incorrect. With the 2 new units in 2009, the total installed capacity is today 842,5 MWe and not 754 MWe (Enel official data on the net geothermal electricity on grid are: 671MW (2008), 695MW (2009), 695 MW (2010).

The production in 2010 is 6575,4 MWh (for 810,5 MWe operating) and not 5632 MWh. We can add that two additional 20 MW units (Nuova Radicondoli Unit 2 and Chiusdino 1) have been planned in Travale- Radicondoli area and their commissioning is foreseen in 2010-2011. The PIER in Tuscany plans 200 MWe installed within the next 10 years; and more projects are planned in other Italian regions.

The 2020 target of 920 MWe is really an underestimation. The data in the NREAP must be updated to reflect geothermal power.

We can underline the availability of 7500 h/y and the global costs for geothermal electricity production in Tuscany of 7€ ct/kWh.

Italy proposes support measures for deep geothermal heating and cooling and for geothermal heat pumps. A certification of GHP installers is planned in liaison with the Qualicert project.

It seems there is confusion between the 2 geothermal categories for heating and cooling in ‘Table 11’, for some geothermal installations with large heat pumps.

The first one concerns ‘Geothermal (excluding low temperature geothermal heat in heat pump applications), so the direct uses and deep geothermal applications with heat pumps. The second one is about shallow geothermal (geothermal heat pumps).

For the direct uses, the plan forecasts a linear increase of +7 ktoe/y, from 226 ktoe in 2010 to 300 ktoe in 2020. The potential is much more important, and this target is very conservative.

For geothermal HP, the NREAP proposes an exponential growth from 40 ktoe to 522 ktoe. It is really promising and we suggest more support measures and the adoption of an action plan to promote this technology if Italy wishes to reach this target.

By developing its deep geothermal potential, Italy could avoid the importation of RES and could prevent a significant amount of expenditure.

LATVIA

Latvia proposes no targets for geothermal electricity. A potential for deep geothermal exists in Latvia and is briefly described in the NREAP, but there are zero support measures for geothermal electricity available.

The city of Riga is proposing to implement an EGS pilot project with electrical capacity of 3–4 MWe and heat capacity of 30–40 MWth in Riga (Riga City Sustainable Energy Action Plan for 2010-2020, approved by Riga City Council on 6 July 2010. Decision No.1644).

Thus the potential exists and it has been identified by the city of Riga. It seems they were not contacted by the Ministry. A liaison should be established urgently (as required by article 5.4 of the Commission decision of 30.6.2009 establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC).

For deep geothermal heating and cooling, Latvia also does not foresee any development and they write that current production is equal to 0 ktoe. This is incorrect.

Firstly, the total installed capacity of deep geothermal in Latvia is 1,31 MWth and 29,59 TJ/y from 2 balneology facilities in Jurmala and Lieapaja, a fish farm at Dobele, some individual space heating (8,9 TJ) and district heating systems (0,17 MWth and 4,75 TJ). Secondly, the potential for deep geothermal is important. It is briefly described in the NREAP. Between 1992 and 1994 the Government of Denmark financed a study of the geothermal potential in Lithuania and Latvia called *Baltic Geothermal Energy Project*.

To develop this technology, support measures are needed but nothing is proposed in the NREAP.

For geothermal heat pumps, there is no specific target. Latvia does not follow the EC template and just proposes a target for all HP.

They state there is 0 ktoe in 2010 but it is not true. More than 20 GHP units have already been installed, producing 2,22 TJ in 2010. The linear growth rate proposed is to reach 4 ktoe by 2020, which means around 2000 HP units in 10 years.

The support measures for GHP are not detailed and Latvia mentions the preparation of a procedure for the certification of GHP installers, but without giving further clarification.

LITHUANIA

The NREAP indicates a wish to promote electricity and heating production from geothermal energy utilising the potential of West Lithuania. Notably, the Lithuanian State Geology Survey prepared a plan for 2011–2015 in order to determine the possibilities of using renewable and non-traditional resources of the earth's interior. It is part of the National strategy 2010-2015 presented in the NREA, however not many details are given on it.

However, Lithuania does not provide any 2020 target for geothermal power production, and while there is a feed-in tariff scheme for RES, there is no rate for geothermal. The potential exists but it has not been studied.

For deep geothermal heating and cooling, the 2010 figure is right: the Klaipeda District Heating (13,6 MWth in operation) produced 2,5 ktoe (105,8 TJ/y). The objective of 5 ktoe is so very conservative. There is a huge potential for deep geothermal and Lithuania proposes support measures for geothermal heat. Therefore, this target must be reviewed.

For geothermal heat pumps, there is no specific target. Lithuania does not follow the EC template and just proposes a target for all HP.

They state there is 0 ktoe in 2010 but it is not true. 3000 GHP units have already been installed between 2005 & 2009, producing 7,3 ktoe in 2010 (305,7 TJ).
The linear growth rate proposed is to have 1-2 ktoe more each year to reach 14 ktoe by 2020. It means the current growth rate of 600 units/y will continue normally as if the RES Directive does not bring more support. Figures in the NREAP must be updated.

The support measures for GHP are not detailed and Lithuania mentions the preparation of a procedure for the certification of GHP installers but without giving more details.

LUXEMBOURG

There is nothing about deep geothermal for electricity or heating/cooling production. Luxembourg does not know its potential. They don't have any targets on geothermal electricity for 2020 and they do not propose any measures for geothermal electricity development in Luxembourg.
A study to know its potential should be made urgently, especially on EGS.

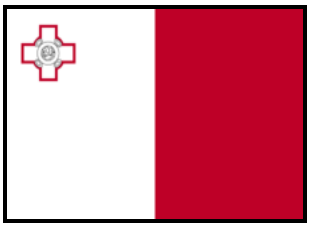
The only measures on geothermal energy concern geothermal Heat Pumps. An incentive scheme (regulation 2009) exists for supporting GHP with quality requirements.
It seems there is confusion in the tables (pages 29 and 70) on heat pump requirements for Geothermal HP and Air HP.

Luxembourg mentioned "a *possible obligation to use renewable energies in buildings is to be revised*." Training activities are to be developed but no references to geothermal are made. Moreover there is no certification scheme for GHP installers and the establishment of such a scheme is not presented.

For geothermal heat pumps, there is no specific target. Luxembourg does not follow the EC template and just proposes a target for all HP. They state there is 1,4 ktoe in 2010 and an exponential growth rate is proposed to reach 16,9 ktoe from HP by 2020.

Figures in the NREAP have to be updated to distinguish the different HP systems.

MALTA



Malta forecasts for 2020:

- 0 GWh of geothermal electricity
- 0 ktoe of deep geothermal h&c
- 0 ktoe of GHP

However, the deep geothermal potential is not presented or analysed. It seems it has not been studied, although Malta had one year to prepare its NREAP.

For GHP, it is rather strange they do not plan any targets but they write these applications will become more common so training on GHP will be proposed in the future!
Nothing is planned about certification of GHP installers.

Finally, they state:

Schemes promoting energy efficient heat pumps for air-conditioning had been implemented way back in 2008. Such equipment can contribute to the heat generation as a renewable resource, however the Directive identifies only heating mode as relevant resource as a contribution to the targets. The major load in Malta as a Mediterranean country is in cooling.

This is an inaccurate interpretation of the Directive. Both the RES Directive and the EC Template speak about heating and cooling.

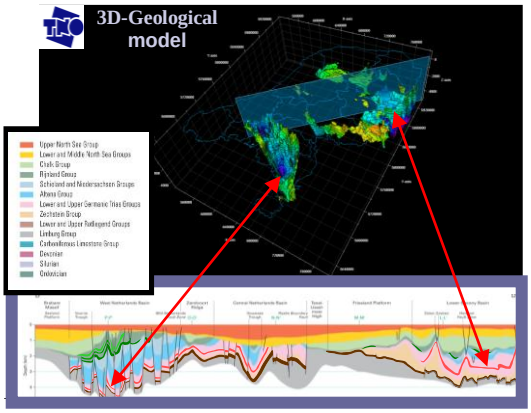
All of this data must be reviewed.

THE NETHERLANDS

The Netherlands does not foresee any electricity production from geothermal energy. Yet the potential exists and it has been identified by TNO and several other organisations. Geothermal electricity may qualify in coming years for a more general support measure (SDE+) focused on green electricity, renewable transport fuels and – after 2012 – renewable Heating & Cooling. The SDE+ concept was announced at the end of 2010, and the details will be elaborated in 2011. It is however, assumed that the SDE+ effects on Heating & Cooling will be substantially larger than the effects on geothermal electricity.

A liaison should be established urgently with TNO and relevant organisations (as required by article 5.4 of the Commission decision of 30.6.2009 establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC).

Netherlands – TNO-DINO



Deep Geothermal Energy (Direct Use applications) is expected to contribute 0.26 Mtoe (11 PJ) in 2020. This is 7 times the 2010 contribution, for which 0.04 Mtoe (1.6 PJ) is expected.

The trend proposed is to have 20 ktoe/year until 2015, and 25 ktoe/y between 2015 and 2020. It was exactly the target proposed by EGEC. Dutch authorities have already given 85 license applications for deep drilling. However, the figures on installed capacity for 2010 are not exact.

In the Netherlands, there are already 5,83 MWth and 89,7 TJ/y for district heating and 10,13 MWth and 189,9 TJ/y for greenhouse heating, representing a total of 6,8 ktoe. The major part of deep geothermal applications will be in Greenhouses and District Heating - which will require new infrastructures. The NREAP does not provide detailed information about this.

A legal framework for regulating deep geothermal (Mining Act) is in place and a review for improvement and fine tuning for geothermal is on-going.

The major part of deep geothermal applications will be in District Heating which will require new infrastructures. The NREAP does not provide detailed information about this.

A Risk mitigation scheme has been established but its implementation was problematic, and it should be re-launched soon.

Coming from 90 ktoe in 2010, they declare that geothermal heat pumps should deliver 242 ktoe by 2020 with a linear growth of ca. 15 ktoe/y (8000 units/y).

In 2010, the estimated capacity and use of GHP is 175 MWth and 1012, 6 TJ/year for the smaller units and 1219, 3 MWth and 9407 TJ/y for the larger units; for a total of 1394, 3 MWth and 10419,8 TJ/y or ca. 250 ktoe.

For shallow geothermal the permitting authority is granted to the (12) Provinces in the Netherlands. One disadvantage is that each Province may, and in practice does, apply its own special requirements, depending on the local geohydrological situation. This complicates the procedure.

All statistical data for geothermal h&c (deep and GHP) in the Netherlands should be clarified and the 2020 targets and support measures adapted accordingly.

A positive point is that they are preparing an Action Plan on certification of RES installers and notably GHP ones.

POLAND

Poland does not plan for any development of geothermal electricity by 2020 and financial supports for this technology are rather low. An important deep geothermal potential exists in Poland and more investigations should be done to see how to exploit it, notably with low temperature power plants.

However, Poland is working on a new regulatory framework for geothermal. The draft of the new Geological and Mining Law is now under discussion by the Sejm and the proposed rules should come into force in 2011.

Proposals are to simplify procedures for deep geothermal (electricity and h&c) projects and they include:

- Investment procedures
- Nomination of specific bodies
- Reduce timing
- Introduction of exemptions
- etc.

There are many DH systems in Poland, but few with RES (5 geothermal heating plants in operation). This potential is currently being examined by the State. It proposes several supports for geothermal DH: 'operation program on infrastructure and environment', special program for deep geothermal h&c (until 2013).

An important development of deep geothermal h&c is expected, with a growth from 23 ktoe in 2010 to 178 in 2020, and especially between 2019 and 2020 (+71 ktoe in 1 year). New DH infrastructures are needed to facilitate this increase.

The NREAP also mentioned a plan to develop geothermal into public buildings. Support schemes seem available for geothermal HP. The legal frame for a certification of the installers and notably the drillers exists and a new regulation will be adopted to detail about the scheme.

Poland plans an increase of HP from 25 ktoe in 2010 to 148 ktoe in 2020 (without distinguishing HP systems). We estimate that more than the half will be geothermal systems, as already the geothermal HP production in Poland is around 1044 TJ/year.

The New RES law to be adopted in 2011 should consider also a development of geothermal electricity, and it should provide more details about geothermal HP.

PORTUGAL

In this NREAP, there are no support measures for helping the development of geothermal energy, yet Portugal adopts a positive attitude for geothermal power. A potential study is currently undertaken including EGS and should be released next year. The conclusions of this report should be taken into account in order to update this NREAP.

It is interesting to note that a 2020 target is proposed for geothermal electricity. The increase foreseen is from 25 MWe (producing 163 GWh, availability: 6520 h/y) today to 75 MWe in 2020 (producing 488 GWh, availability: 6500 h/y). The projects allowing for this growth have been already identified (new 50 MWe in Açores are planned) and several EGS projects are examined (ca. 12 MWe).

Although no measures are adopted on deep geothermal h&c, an increase is planned from 10 ktoe to 25 ktoe by 2020. Indeed there is the potential for more district heating, bathing, and heating from cogeneration EGS plants.

Geothermal heat pumps are not recognised as renewable by Portugal. They do not respect the RES Directive. Moreover there is a wrong interpretation of the annex VII.

This annex VII concerns the accounting of RES from HP, not the criteria to consider the HP a RES or not. It is true the accounting methodology will come later and by 2013 (Q usable for counting RES in statistics). But for defining HP as RES, the formula to be used, is stated by annex VII: SPF > 1,15 * 1/n
With SPF = given by HP rating, and estimated eg. VDI 4650 in Germany or similar EN standards.
With n = average European power production efficiency (given by Eurostat: 34,8 %)

In consequence; neither support measures (including a certification scheme), nor a 2020 target are planned. Also, we know of several GHP are already installed in Portugal. Therefore, they must completely review this part of their NREAP.

ROMANIA

The NREAP does not propose a geothermal development and the target for geothermal electricity is 0. However, the national legal frame on RES considers geothermal energy and specific measures are established to support this technology: 3 green certificates for 1 MWh produced by geothermal electricity (ca. 16,5 € ct/kWh).

A regulatory framework for geothermal energy is in place but the procedures for licensing must be simplified. As detailed in the evaluation (paragraph 5), there is a huge potential for low temperature power plants and EGS.

The Plan mentions the EGEC vision document on geothermal electricity and it does not follow the conclusion of the European Geothermal Industry Federation. Indeed, it is suggested there to develop first power plants during the next 10 years and have a large deployment after 2020.

A first step should be to undertake a study to understand this deep geothermal potential for electricity production, and later to update the NREAP with targets for geothermal. As there are inaccuracies between the support measures and the targets, new figures must be provided.

Romania has more than 100 deep wells for geothermal energy. The potential for heating and cooling is huge. Some measures are proposed for further development of deep geothermal. The incentive is 1 green certificate / 1 MWh of geothermal h&c. Projects are identified and a cooperation with Denmark is mentioned for a DH project.

The total production in 2010 is 29,52 ktoe (1235 TJ/y) from district heating, bathing, process heating, heating of greenhouses etc. The NREAP mentions 25 ktoe.
The table 11 of the EC template for NREAP has just been provided by Romania. The target is to reach 80 ktoe by 2020 for deep geothermal heating & cooling, so to multiply by 2,5 the current production which is low.

In addition, for geothermal heat pumps, the NREAP says there are no installations in 2010 but that is incorrect: an estimated 5.5 MWth are installed already and producing 29.70 TJ/yr (0.7 ktoe). And, the 2020 target of 8 ktoe means only 4000 installations in 10 years, which is rather conservative.
This technology is mentioned with the other RES h&c sources in the national legal frame. However, the specific support measures are not detailed for GHP and it is written the support is under certain conditions, also not specified. The GHP are excluded from Romanian incentives programs, like the structural funds. This must change immediately.

Romania must provide more information about its support measures to see their consistency, and they must respect the RES Directive. Geothermal heat pumps are renewable and they must be included in the NREAP and the other policy on RES (structural funds etc.).

A certification of the installers is mentioned but without many details on its establishment.

SLOVAKIA

Slovakia plans to have its first geothermal power plant within the next 10 years. The NREAP foresees the installation of a 4 MWe plant in 2012 but no more projects after that. The production from 2012 will be 28 GWh (availability = 7 000 h/y) and increasing to 29 GWh in 2019 and 30 GWh in 2020, with the same capacity of 4 MWe (availability improved to 7250 h/y and to 7500 h/y).

This forecast is rather peculiar because if the first plant is successful, many more projects will be developed. The potential for geothermal power in Slovakia is large, with low temperature power plants and EGS. Some projects have already been initiated: Geoterm, a JV of local players and the Ministry of the Economy expect a plant of 8-9MW, for a cost of EUR30 million, to be installed in the eastern part of the country: the Košice basin.

There are no specific support measures for geothermal (some incentives mentioned in the plan are not detailed), or any indication about the deep geothermal regulations and the simplification of procedures.

Slovakia is ambitious for developing geothermal direct uses: increase by 300% the production from 3 ktoe in 2010 to 90 ktoe by 2020, with a growth from 2013 of +10 ktoe each year.

It is difficult to evaluate this growth rate because the support measures on geothermal h&c are not described. Flanking measures should also be adopted: renovate and build new district heating, develop cascade uses, simplify procedures, promote the technology etc.
Moreover, it seems there is a big problem with the statistical data for 2010. We have a figure of 73 ktoe produced in 2010 for Slovakia! Geothermal water is utilised for direct use in:

- Agriculture = 461,1 TJ/y
- Individual space heating (19 installations) = 381,1 TJ/y
- District heating (2 installations) = 232 TJ/y
- Fish farming = 271 TJ/y
- Recreational purposes (59 locations) = 1708,5 TJ/y

For geothermal HP, they say there are no installations in 2010 but that is incorrect: 16 GHP units are installed already (1,624 MWth capacity and 13,49 TJ/y or 0,32 ktoe produced) . And, the 2020 target of 4 ktoe means only 2000 installations in 10 years, which is rather conservative.

Slovakia adopted some support for heat pumps but there are no details about incentives for geothermal HP. A certification of the installers is foreseen, with collaboration with the projects Qualicert and EUCert.hp.

Finally, it is interesting to note that in Slovakia, the highest potentials on renewable energy production have been biomass with 46.7 %, geothermal energy with 17.5 % and solar energy with 14.5 % (Decree of the Slovak Government No. 282/2003), yet it is not reflected in the NREAP.

SLOVENIA

The NREAP provides substantial information about measures for developing geothermal energy in Slovenia. It is indeed true there is a huge potential. For example, the guaranteed purchase prices for geothermal electricity is 15,25 €cent/kWh. However, no geothermal power plants are installed and the plan does not forecast any production: 0 MWe and 0 GWh by 2020!

It means that other support measures are needed, such as increased awareness amongst decision-makers and the public, or establishing risk insurance. A detailed study of potential will help to fix appropriate targets.

There are several support measures for geothermal heating and cooling; Slovenia aims at promoting systems of district heating using geothermal energy (a tender is currently being drafted).

A support scheme for generating heat from RES for heating is also proposed with an introduction of a system of feed-in incentives to hook up/produce heat from RES. It is to be completed by a proposal for an obligatory share of RES in district heating systems and the establishment of a spatial planning of DH and CHP geothermal plants.

A new version of the Mining Act should allow a clarification of the regulations about deep and shallow geothermal. Slovenia indicates that between 2010 and 2020, 10 million Euros should be invested for building new geothermal district heating (GDH) systems. Yet Slovenia proposes just a small increase from 18 ktoe in 2010 to 20 ktoe in 2020, so 2 ktoe more in 10 years!

This is not aligning with the support measures proposed. The capital costs for a GDH are ca. 1 Mio € / MWth. So 10 new MWth should be installed in Slovenia according to the NREAP.
It represents 45 GWh (a GDH typically runs 4500 h /y) so 4 ktoe.
Moreover, there is already 18,45 ktoe (772 TJ/y) produced and the district heating in Benedikt will start operating soon (14,4 TJ/y so 0,34 ktoe).

Therefore this target must be updated.

For Geothermal heat pumps, support measures are proposed for the RES integration into the buildings but without specific measures for GHP. A certification scheme for GHP installers is planned from 2012.

Slovenia forecasts a regular increase (+ 3 ktoe / year) from 4 ktoe in 2010 to 38 ktoe in 2010, but there are already 3451 GHP installed producing 9 ktoe (379 TJ/y).

To reach the NREAP target on GHP it is crucial to remove one barrier in particular; in Slovenia, the electricity tariff for heat pumps is higher. It hampers the GHP development and it does not respect the RES Directive.

SPAIN

The first objective is to make an evaluation of the deep geothermal potential for electricity production. This study has to be made now and the conclusions should serve to update this NREAP.

It is mentioned that an electricity production from geothermal could be done with:

- Conventional technologies in the Canaries
- Low temperature power plants and EGS in other regions

It is interesting to see they plan a development of low temperature binary and EGS plants; but no support measures are planned for the moment. Moreover, the plan identifies one important barrier, the geological risk. Here, a proposal is to look at best practices from France and Germany and to support the creation of a European Geothermal Risk Insurance Scheme.

The 2020 target to have 50 MWe installed is rather conservative when considering the exploration that is on-going in the Canaries for geothermal power plants. Also, the calculation of the production in GWh is incorrect: 300 GWh. It means they consider an availability of 6000 h /y when it's typically 7800-8000 h/y for a geothermal power plant.

For deep geothermal heating and cooling, they plan only some geothermal District Heating systems. The production should increase from 3,8 ktoe in 2010 to 9,5 ktoe by 2020. Yet they are already 5,285 ktoe produced in 2010:

- 76,21 TJ from space heating
- 92,42 TJ from heating of greenhouses
- 52,5 TJ for bating

All these figures must be updated, and the final target should be adapted accordingly including heating production from cogeneration EGS plants.

For geothermal heat pumps, the current growth rate is 30% in Spain and it represents ca.2000 new installations per year. This figure is modest because the market is still at a juvenile stage. Spain plans to have only a 15% growth from 2010 to 2015.

It is not possible considering:

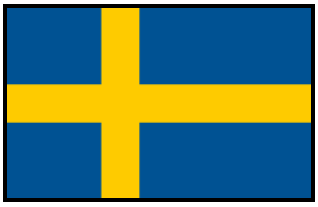
- The market just starts with few thousands GHP installed
- The RES directive will bring new support measures notably on promotion
- Spain has launched a new incentive scheme Geocasa: 3 Mio € for GHP development

Additionally, they plan to have a mature market in 2015, so after that the growth will be only 12%. Here too it is impossible:

- In 2015, if 23 ktoe are produced it is only ca. 20,000 installations!
- A mature market like in Sweden today is around 20,000 new installations per year not in total!

In sum, the trajectory and the final target of 40,5 ktoe by 2020 are not realistic.

SWEDEN



Sweden does not have any targets on geothermal electricity for 2020 and they do not propose any measures for geothermal electricity development in Sweden. A study to know its potential should be undertaken with the utmost urgency, especially on EGS.

They also do not plan any development of deep geothermal for heating and cooling. However, a geothermal district heating is running in Lund (Nimrod District) for 25 years! In 2010, we already have ca. 2,15 ktoe.

On geothermal heat pumps, the Swedish market is already mature. A certification scheme exists for HP installers and it is described in the NREAP. But for shallow geothermal installers, the Swedish plan does not present the existing certification scheme for drillers. Something must be proposed and it is required by the article 14 of the RES Directive.

They plan a linear increase for the next 10 years of around 50 ktoe each year, from 272 ktoe to 815 ktoe in 2020. It represents ca. 25 000 new units per year, which is the current trend.

In 2010, the total production of GHP for heating and cooling is estimated at 1 097 ktoe:

- 828 TJ/y of individual space heating
- 504 TJ/y of UTES
- 43969 TJ/y of other GHP
- 612 TJ/y of UTES-cooling

These statistical data from 2010 has to be clarified in order to propose accurate targets for 2020.

UNITED KINGDOM

There are no targets for electricity production from geothermal and it seems they do not recognise the potential. However, 2 EGS projects are on-going, so the UK must have objectives for 2020 and establish the support measures to reach them, as they already exist in the other RES sectors.

For deep geothermal, there is no target for heating and cooling production and the same remarks apply.

The UK does not propose measures on geothermal direct uses and does not indicate any data on 2010 production and the target 2020. Yet deep geothermal is already producing in the UK:
. A geothermal district heating system in Southampton started operation in 1987. It has been expanded to 2,7 MWth producing 1,73 ktoe.
. A spa in Bath: 0,379 ktoe
. Some heating systems for greenhouses: 0,189 ktoe

The main development in the future will be through the combined heat & power installations of the EGS power plants. The UK has so to adopt the 2020 objectives and flanking measures to accompany this development.

The 2020 objectives for the geothermal heat pumps market are really interesting. They plan an exponential growth, culminating in the last year with around 100,000 new installations per year.

To reach this objective, the support scheme presented (Renewable Heat Obligation) must be implemented as soon as possible. Some flanking measures are also necessary, such as training and certification of installers, simplification of the procedures etc.

Two important remarks about the figures in Table 11 (p. 155):

- The data about GHP production in 2010 is incorrect, there is already 180 ktoe
- The figure for 2019 is 730 ktoe, but you have 766 ktoe in 2018, it is likely they have probably been switched.