

K4RES-H

KEY ISSUE 3 : REGULATIONS FOR GEOTHERMAL ENERGY

Executive summary	2
Introduction	5
Overview on the different regulations	7
Case studies :	
• Germany	8
• France	11
• Ireland	15
• Hungary	17
• Poland	20
Overview of the European schemes	24
Conclusions	31
Reference to more detailed sources of information	36

Acknowledgement:

Larger sections of the text for the country information on France, Hungary and Romania, as well as the complete text for Switzerland and most of the conclusions have been taken from the very helpful compilation in Rybach (2003). EGEC wishes to thank Prof. L. Rybach for the permission to use this part of his work for the current study.

EXECUTIVE SUMMARY

Geothermal energy is a specific natural resource:

- i. it is on the border-zone of managing mineral commodities, groundwater reserves and other energy sources by being bound to geological formations and to thermal waters;
- ii. it is heat of radioactive decay and other geological processes therefore it is a conditionally renewable flow-type resource;
- iii. the property rights over geothermal energy are owned by the State in most EU countries, but typically landowners can exploit shallow subsurface resources for their own use;
- iv. the utilisation of geothermal energy is still at its juvenile stage on the European scale; certain technologies have already fully developed markets in some countries, like shallow geothermal heat pumps in Sweden, Austria and Germany, or high-enthalpy geothermal power plants in Italy..

Geothermally relevant legislation is reviewed for selected countries. The compilation for Germany, France, Hungary, Poland, and Ireland reveals that the legal bases show great differences. Governmental policies to support geothermal development are focusing so far on power generation only. Serious efforts are needed to harmonize legislation and to simplify procedures as well as to establish and implement strong policies to boost geothermal heating and cooling.

The legislative and regulatory framework for geothermal energy is very diverse within the EU member states (and candidates), and in some cases is a real barrier to geothermal energy use. For the geothermal sectors already established firmly on the market (mainly shallow geothermal), it also can act against the free competition and trade of goods and services. Some actions recently have been started to look more closely into the existing situation, and to develop suggestions how to overcome the obvious problems.

Any regulatory framework for geothermal energy has to serve the following main purposes:

- Securing environmentally friendly use of geothermal energy, in particular concerning protection of underground drinking water resources, emissions, etc.
- Regulating competing uses and securing sustainable use of geothermal energy
- Granting to the investor a firm right to use geothermal energy in a given area and to a given extent, as the basis for business plans

There is a wide variety of regulations in the studied countries which either support or inhibit the enhanced use of geothermal energy in Europe.

There are countries with barriers of fiscal nature (i.e. mining royalty, sewage penalty, groundwater use fee, environmental tax), of licensing....

The arsenal of supporting instruments is colourful too, but limited.

The relevant national legislation is spread throughout the mining, energy, environmental, water management and geological acts, sometimes in a contradicting way, and the



licensing authority framework for geothermal facilities is rather complex in most countries.

▷ A Community level communication shall foster Member States to adopt a coherent legislation system and to designate a rational framework of competent authorities in order to ease application for geothermal energy use.

The definition of geothermal energy is lacking in the *acquis communautaire* and the national practice is diverse - some authorities consider it as a type of energy carried by thermal waters exclusively -, which hampers the distribution of most up-to-date technologies using shallow depth reserves via heat-pumps or deeper closed-circuit heat-exchanger fluids.

▷ A broad sense legal definition of geothermal energy is needed in a relevant piece of Community legislation, e.g. the heating-cooling legislation in preparation.

As in the case of other state-owned territorial commodities, low-resolution, static inventories of geothermal resources are available or being prepared by water research institutes or geological services, that are not capable of meeting the requirements of neither the investing enterprises nor the licensing environment protection and water management authorities. In some countries nor even the data access for the competent agency hosting the geoinformation and/or the inventory is enforced by the law.

▷ The development of national dynamic inventories of geothermal energy resources and reserves designed as to being capable of registering annual changes and allowing country-scale modelling is highly recommended. To make such inventories comparable on pan-European level a common basic methodology shall be elaborated, preferably via the assistance of Community level professional associations, e.g. EGEC, EuroGeoSurveys.

The environmental impacts of geothermal installations are limited, it is a green energy source. In terms of environmental sustainability, the maintenance of stable, close-to-original temperature and pressure status of an exploited groundwater reservoir is of prime importance as well as the protection against pollution of surface waters by untreated outflow of saline or used thermal waters. However, the national emission limit values, and re-injection provisions show a certain diversity.

▷ The new Groundwater Directive and its implementing measures shall provide more detailed prescriptions on surface discharge and re-injection criteria of used geothermal waters. This environmental action, together with the need for harmonised inventories, technology development and raising the public awareness shall optimally be accompanied by a more definite availability of EU funds for the above objectives.

It is foreseen that Community institutions and Member States will face a growing number of related legal disputes at the European Court of Justice in near future.

▷ There is an immediate need to highlight the economic discrepancies on the Community level and to urge Member States harmonising financial solutions in reaching their indicative targets, and in improving the energy mix for being less dependent on outside sources.

As a general conclusion and recommendation, geothermal experts agreed upon that under the realm of the IPPC Directive a best available technology reference document



on geothermal energy describing the state-of-art of geothermal energy exploitation, the up-to-date technologies and their environmental aspects, and the economic instruments could serve as strong, quasi-legal document which all stakeholders can refer to in their future activities in direction of the enhanced, sustainable use of geothermal energy.



INTRODUCTION

Geothermal energy is a promising component of the renewable energy mix in the European Union. As set by the Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market, the overall EU target is to double the share of renewables to 12 % by year 2010 in the gross energy consumption and in particular to achieve a 22.1% indicative share of electricity produced from renewable energy sources. The directive and its amendments due to the Accession Treaty published reference values for each Member State. Recent Community legislation, such as the Water Framework Directive, the Cogeneration Directive, the draft on heating and cooling, the Buildings Directive and the Thematic Strategy on Natural Resources have a major impact on the exploitation of geothermal energy.

The above facts justify why there was a need for

- (1) screening the Community legislation with regard to provisions and their implications on geothermal energy use;
- (2) benchmarking national legislation that promote or limit the sustainable management of this energy source;
- (3) mapping the common conflict fields inhibiting the exploitation of geothermal resources;
- (4) defining legal solutions and good practices that may develop to a common platform of understanding on which a new Community strategy might be based in helping Members States to meet their indicative target values;

The presentation address:

- an analytical evaluation of relevant legislation;
- relevant regulatory authority and legislation framework, including the property rights over geothermal energy, environmental protection, water management and energy provisions;
- to regulations supporting geothermal heating and cooling, referring to shallow and deep geothermal energy.

Definitely more supportive governmental policies and efforts are needed to speed up the development of geothermal resources for direct use. Only by these means can their great potential be tapped and utilized.

The Situation of Geothermal Energy in EU :

The situation is very different in the various countries and geothermal technologies, according to natural resources and political issues.

Shallow Geothermal Energy :

For shallow geothermal systems, in several countries a market-driven economy exists. This will be further boosted by the expected oil price development. These countries



comprise Sweden, Switzerland, Germany, Austria, and to a lesser extent Norway, Netherlands, etc.

A transition is underway of Ground Source Heat Pump (GSHP) technology into two new areas:

- Southern Europe and Mediterranean, with an emphasis on cooling and heating
- Eastern and South-eastern Europe, where slowly a demand for more comfort in houses is growing, and a group of people who can afford it.
- Countries are in particular Czech Republic and Poland, with others following
- In United Kingdom and Ireland, meanwhile interest grows, and some prestigious plants have been built. The number of systems is rising, however, the technology used typically is under some US-influence.

Deep Geothermal Energy :

In most countries, geothermal district heating needs regulations and some investment support, reduced interest loans, etc. to become economic. Cascade uses (district heating, industry, agri-culture, and other) improves economy, but usually are very difficult to achieve due to legal obstacles, distances, etc. For heat distribution, Eastern European countries may have an advantage due to existing networks.

There are some distortions to be mentioned that impact certain national markets. ; for example, in Poland:

- Concession fee
- Mining royalty
- Fee for geological information
- Tax for surface installations
- New parliamentary initiative for tax on geothermal water

OVERVIEW ON THE DIFFERENT REGULATIONS

Clear energy and environmental policies and regulations are of paramount importance for the development of renewable energy sources. The institutional framework, legislation and legal constraints are borderlines to delimit development, especially in view of environmental protection. Within these limits there should be unequivocal administration of law.

In reality, governments often lack clear energy policies and environmental policy does not address energy sources but rather the mitigation of their effects. Geothermal energy in general, and geothermal resources in particular, are usually not well defined in legal terms, and the regulation of their development and utilisation is correspondingly diffuse.

In many countries, the geothermal resources are dealt with in the Mining Law whereas the production of geothermal fluids from the subsurface is regulated by Water Protection legislation. This implies that responsibilities are assigned to different Ministries, with often limited cooperation and interaction between them.

A survey of the relevant legislation in various countries results in the perception that the situation is different in each country. Therefore the situation is summarized for a number of selected European countries with the aim of identifying supports and burdens, similarities and differences. In the countries addressed in this paper, the utilisation of geothermal energy is for heating and cooling. Policy situations in view of promoting geothermal development are also summarized.

The different burdens in EU are :

- Royalties in France, Hungary (2 % of turnover), Poland, Romania (2 % of turnover), Slovenia
- Groundwater exploitation / sewage fee in most countries, usually no fee when re-injected

For royalties, a distinction has to be made for thermal water and energy. There should be no or a very low royalty on the energy (there is also no solar or wind tax!).

The ownership of the resource has to be stated clearly in legal regulations.

CASE STUDIES :

GERMANY

The Deep Geothermal Sector

In that sector, two types of plants exist or are under construction in Germany:

- geothermal district heating from hydrogeothermal resources, typically from depth >1000 m
- geothermal power plants using hydrogeothermal resources or Enhanced Geothermal Systems (the latter under development), the depth exceeds always 2000 m

The Heat Pump Sector

The absence of political acceptance is a considerable handicap. The importance of political acceptance to the development of the heat pump market is evident in the provinces of Bavaria, Baden-Württemberg, Brandenburg and Nordrhein-Westfalen.

In those provinces the heat pump technology is accepted by the local governments and in some cases it is forced in the form of incentive measures. In those provinces the heat pump market is much stronger than in the rest of Germany.

The share of market of these four provinces is about 78% of the whole country, although just 52% of the population live there.

Legislation

In Germany, the geothermal energy use is mainly in small plants (ground-coupled heat pumps, commonly for individual space heating), with 400 MWt installed capacity, in addition to larger plants (district heating systems) with 65 MWt. Balneological or agricultural use is not reported.

Laws exist both on the federal level (*Bund*) and on the state level (*Länder*). Geothermal energy in Germany is governed by the Federal Mining Act (*Bundesberggesetz*, or BBergG for short).

According to § 3 BBergG (“Bundesberggesetz”; Federal Mining Act), geothermal energy is not a property of the land owner, but belongs to the federal administration (bergfreier Rohstoff).

Exploration and exploitation of this kind of resources, like coal, various types of ore, oil, or natural gas, is regulated by the authorities and is granted to an applicant, usually with a certain regular payment to be made according to the amount of the resource exploited (*Förderzins*). However, for geothermal energy, because of the still poor economics and the wish to foster environmentally benign energy, a royalty payment is not required.

The first application is for exploration, after proving the resource, a license for exploitation is given.

A license for exploration and, if the resource has been proven, for exploitation gives a rather strong legal position to its holder. If necessary, even the (temporary) right for land use against the will of the owner can be obtained through court order, of course with fair financial compensation. The extension of a mining field according to such license is delineated on the earth surface and shown in a map, and in the vertical dimension it always starts at the ground surface and extends downward (theoretically down to the centre of the earth). When a mining license is given, other aspects like water protection and environmental issues are dealt with by the mining authorities in collaboration with the relevant offices, and the necessary approvals are included in the mining license.



The further use (heating, power plant) is not governed by mining law.

An exception is stated in the mining act for the use of a bergfreie resource, if it is used on the same lot where it is exploited, and is used only for the construction and operation of buildings on that lot, belonging to the owner of the lot (§ 4 BBergG). In this case no license is required.

However, even here the mining authorities might come into the play again, if § 127 BBergG is fulfilled, asking for a specific approval for boreholes which penetrate into the underground more than 100 m. Use of this exception is made for most of the ground-source heat pump (GSHP) plants in the residential sector, and this fact is the explanation why so many borehole heat exchangers for heat pumps in Germany have a depth of 99-100 m.

For shallow geothermal systems, usually the exception of § 4 BBergG takes care.

In this case, the water authorities need to give a license according to § 3 and § 7 WHG ("Wasser-haushaltsgesetz"; Water Framework Act), and the relevant state laws (water law is governed by the states)

In cases where the mining law is not applicable, other authorities ascertain that there is no harm done to the environment by a geothermal application. Thus shallow geothermal energy is mainly governed by the water law. The Federal Water Household Act (*Wasserhaushaltsgesetz* WHG) only gives a framework, and the relevant state laws handle the details. Water authorities are purely state authorities; on the federal level,

there is only a regular coordination group of the states (*Länderarbeitsgemeinschaft Wasser LAWA*).

According to WHG and the state water laws, the use of groundwater requires a license from the water authorities (in a mining license, the right to use groundwater is included, if it is part of the exploitation). The case is obvious for ground water heat pumps; however, by definition even borehole heat exchangers use ground water, if the physical properties of the groundwater are changed (i.e. the water is heated or cooled). Another area of concern is possible groundwater pollution, which may occur during drilling operation, by connecting different aquifers, or in the case of a leakage of antifreeze from a borehole heat exchanger.

Some of the states (Bayern, Baden-Württemberg, Rheinland-Pfalz) already have guidelines how the licensing procedure should be handled; in other states (e.g. Hessen and Nordrhein- Westfalen) such guidelines are in preparation.

In general, the guidelines require standard VDI 4640 to be followed for the technical part. The basic technical requirements for sound design, safe construction and reliable operation of shallow geothermal installations (down to about 400 m) are given in the guideline VDI 4640 of the Association of German Engineers (*Verein Deutscher Ingenieure*, VDI). To facilitate the site-specific design of smaller plants, the Geological Survey of Nordrhein-Westfalen has compiled a database of ground thermal parameters down to 100 m depth for the whole area of the state, available on CD-ROM. Similar work is under way in other states also to increase the use of GSHPs.

Licences for exploration and production are given, upon submitted programs, for specified licence areas (*Erlaubnisfelder*). Herein the surface area is delimited without a depth limitation. A particular problem may arise here when a larger ground-source heat pump (GSHP) plant, serving more than one owner and thus not eligible for the exception according to § 4 BBergG, has a mining license, and the site is inside an area in which a Hot Dry Rock (HDR) plant is planned (Schulz, 2003). Of course, in practice these two installations would not influence each other, given the several kilometres vertical distance between the HDR heat exchanger and the shallow GSHP plant. Legally, the right to use the geothermal heat resides with the owner of the mining license, no matter what the depth of that use will be. So in said case, the constructors of the HDR plant would need to negotiate with the owner of the license to be allowed to exploit geothermal energy, and they most probably will have to pay the owner. In the worst case, the owner of a mining license for a shallow borehole heat exchanger could prevent the construction of a deep geothermal plant, and vice versa. Now an amendment to the mining law is under discussion to allow for depth-specific mining fields for geothermal energy, in order to avoid the aforementioned problems.

FRANCE

French legal regulations of geothermal operations are based upon two main decrees. Decree 77-620 (16 June 1977) added a new title “Low temperature geothermal deposits” to the Mining Law (Code Minier), creating an obligation to obtain an exploration permit before drilling and an exploitation permit before starting up production. Decree 74-498 (24 March 1978) defined legislation concerning “Geothermal prospecting and exploitation licenses”. According to these decrees, geothermal resources are considered concessible and therefore assimilated to mines.

In the field of the sub—surface, geothermal energy is regulated by mining legislation the main objectives of which are:

- fully optimizing the exploitation of sub—surface resources;
- minimizing the risks and pollution created by this exploitation, both for the natural and human environment;
- guaranteeing the health and safety of workers.

Legislation concerning water (law 64—1245 of 16 December 1964 and its texts of application) and its concerns geothermal energy as regards extractions from and discharges into surface and ground waters.

Geothermal deposits are classified as “mines” according to article 3 of the mining code (1st article of law 77—620 of 16 June 1977) which distinguishes between low enthalpy and high enthalpy geothermal deposits:

- low enthalpy geothermal deposits are those with water the temperature of which, measured at the surface during exploitation drilling tests, is equal to or below 150°C (article 1 of decree 78—498 of 28 March 1978);
- high enthalpy geothermal deposits comprise all others.

The mining legislation deals mainly with:

a) legal questions, which define the status under which the various phases of the life of geothermal projects take place, and which include mainly:

- the attribution of mining claims, their renewal, withdrawal, waiver, transfer or leasing : for low enthalpy geothermal energy by decree 78—498 of 28 March 1978

For low enthalpy energy:

- Research authorizations awarded by prefectoral order giving exclusive drilling rights for the exploration of geothermal deposits for a maximum of 3 years;
- Exclusive exploitation licences awarded by the Prefect for a maximum of 30 years with a possibility of continuation for a maximum of 15 years.

The exploration license is granted on the basis of a Prefectoral (=state regional representation) decision following a public enquiry. The license fixes the drill sites or determines a perimeter within which the wells can be drilled. The exploration right is exclusive, and is granted for three years. A number of documents (technical, economical, administrative, financial, environmental) must be submitted by the applicant



in support of the request. The holder of an exploration permit has the right to an exploitation permit, if requested, before expiration of the prospecting permit.

The exploitation license is also compulsory and is issued by the Prefect. It grants exclusive exploitation rights by drilling within the authorized perimeter. The license defines the volume of exploitation by the surface perimeter and two depths. The application must be backed by pertinent information on the drilling locations, the fluid and heat volume yields, the extraction and reinjection dispositives, and the characteristics of the heat uses.

The permit is granted for a maximum of 30 years, which can be prolonged by periods of less than 15 years each.

An environmental impact study must be carried out before completion of the project.

A simplified procedure is foreseen for operations whose overall cost is under 1 million €. So far, no formal regulation has been issued for royalties to be paid for geothermal operations. Nevertheless, in principle, geothermal operations can be subject to two types of taxes:

1. The professional tax paid by any registered commercial/industrial entity, which varies locally depending on the municipal financial policy; and
2. The tax on water withdrawals.

The latter does not apply to Paris Basin geothermal district heating systems, which apply the doublet concept. Water taxes are paid by the doublet systems operating in the Aquitaine Basin (Southwestern France), as well as by singlet operators.

The French legislation is very specific in considering low enthalpy utilization concepts and in specifying the application and granting procedures for permits and leases. It is less precise and practical from the operational point of view. Although many conditions specific to geothermal heat extraction and uses have been taken into account in adapting mining and hydrocarbon legislation, the legal formulations are in many aspects not well defined and may be interpreted in different ways.

Work to address ground-source heat pumps specifically is under way.

Low enthalpy geothermal projects with a maximum possible heat flow rate, calculated with reference to a temperature of 20°C, of below 200 therms/hour and, wells of below 100 metres depth are exempt from these authorisations or licences.

In addition to a public enquiry, the procedure, whatever the type of geothermal energy, consists of a consultation of the various services of the state and town councils concerned and can be the subject of claims in competition or opposition.

Without entering into the details it is worth mentioning that a permit of exploration or exploitation can be withdrawn, in particular (article 119—1 of the mining code) when the operator or prospector commits serious offences regarding the mining regulations, for persistent inactivity of exploration or exploitation or when the method of exploitation threatens the good utilization of the deposit.

- the relations of the explorers and operators with the surface owners :
“no right of exploration or exploitation without the consent of the surface owner” and if it indicates that the boreholes and wells of more than 100 metres and the galleries cannot be opened within a radius of 50 metres of dwellings and ground in the adjoining enclosures, without consent of the owners of these dwellings (article 70),



b) administrative supervision of the work exercised during the starting up of the work, the carrying out of the work and the abandoning et the work :

The object of the mine policy is to warn of or halt damage or pollution that a mining activity could cause as regards the interests mentioned in the mining code and by the law of 10 July 1976 relating to the protection of the environment (article I of decree 80—330 of 7 May 1980).

The opening of works of research and exploitation of geothermal deposits is subject to an impact study and a public enquiry in accordance with article 10 of the decree of the police.

c) applicable technical regulations;

d) registration of excavations and geophysical surveys;

e) the reporting of offences and penalties.

All drillings deeper than 100m are ruled by the Mining Code and thus subject to declaration to the competent authority (DRIRE: Direction Regionale de l'Industrie, de la Recherche et de l'Environnement) which is linked to the Ministry of Industry through DGEMP (Direction Générale de l'Energie et des Matières Premières).

Applications are handled by DRIRE and the authorisation to drill and exploit is attributed by a Prefectoral Order (Arrêté Prefectoral).

Geothermal operations which fulfill the following conditions are exempted from declaration/ authorisation:

1. Drilling to depths < 100m; and
2. Maximum possible heat extraction rate is < 200 Thermies per hour (calculated for a 20°C reference temperature; 1 Thermie = 1.128 kJ).

Whenever an operation falls out of the scope of the current Mining Law, two types of regulations may apply:

1. Either Classified Installations (Installations Classées) relevant to the Environmental Code (Code de l'Environnement); or
2. Authorisation/ declaration in compliance with the Water Law (Loi sur l'Eau).

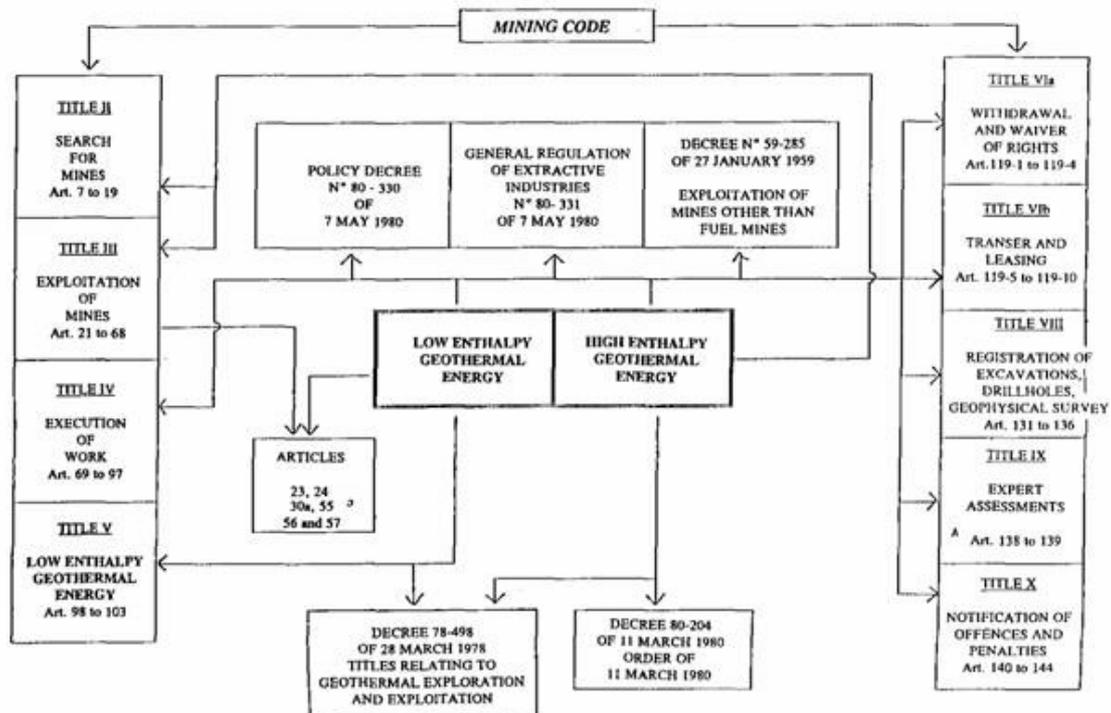
Abstractions in groundwater are generally subject to simple declaration (decree-law 73-219 of 23 February 1973) except in the Aquitaine and Ile de France regions where abstractions beyond a certain depth are subject to a permit issued by the Prefect (decree—law of 8 August 1935).

However, in the case of low enthalpy geothermal energy, the authorization of exploration or the mining licence have the same power as the decisions according to the title et the decree—law of 8 August 1935 (the reason being that the two cases are within the competence of the Prefect).

The discharge of waste from geothermal operations into surface water is subject to prefectoral authorization in accordance with the provisions of decree 73-218 of 23 February 1973 except when the discharges are hardly noxious (order of 13 May 1975).

The reinjection of the geothermal fluid into its deposit is not subject to decree 73-118 of 23 February 1973 as long as it has not been polluted or received any additives article 7 of the order of 13 May 1975).

In all other cases an authorisation of discharge is normally required.



IRELAND

In Ireland, the National Climate Change strategy aims to reduce Greenhouse Gas emissions by 15 MT/CO₂ by 2012. The SEI 2004 brought notably Carbon tax introduction.

But there is no specific legal framework nor are there specific barriers to geothermal energy exploitation in Ireland, but a number of matters may function as barriers.

The lack of a financial support for the installation of geothermal systems was a barrier to their adoption. Since 26th March 2006, this barrier has been removed by the provision of a grant scheme. This "Greener Homes" grant aid scheme for domestic renewable heat technologies, is the financial incentives schemes dealt with in this response.

1) Shallow Systems :

There are no specific legal controls on geothermal energy development. Shallow systems include horizontal collectors and vertical collectors, usually <200m deep. There appears to be very little impact on them by the legal framework. The discharging from open-loop systems must comply with the EU Groundwater Framework Directive.

This Environmental Legislation : Water Framework Directive 2000/60/EC – drives the community water policy including groundwater and will be fully implemented by 2015. Groundwater protection schemes are being developed and implemented by the Environmental Protection Agency (EPA) and GSI. Aquifers and other groundwater used for geothermal projects will be protected from contamination.

A Planning Permission is not required for the geothermal aspect of a development. And no building codes of practice or standards regulate the use of Geothermal heat pumps.

In order to improve the technical regulations, a Ground Source Heat Pumps Installer Certification Training Program was done by Arsenal, SEI & FÁS.

The recently introduced grant system (The "Greener Homes" grant aid scheme for domestic renewable heat technologies) for some renewable energies has produced a new regulatory framework. This only affects those who wish to avail of the grant system. Although this response deals with geothermal energy, the regulation applies to other forms of renewable heating technologies.

Initial results are very positive, with over 1,000 heat pump applications received so far in 3 months. It is likely therefore that the following estimates will be significantly surpassed.

2) Medium to Deep Systems

Also, There are no specific legal controls on geothermal energy development.

Non-specific regulations influences the geothermal activity :

- Planning permission :



This is needed for any building associated with the geothermal system and it may be needed for deep drilling. Noise level restriction limits may be placed on the decibels which may not be exceeded during drilling. Similarly dust level limitations may be imposed, even if they are unlikely to be exceeded.

Planning permission is operated by local government – the County Councils and subject to a national appeals body – An Bord Pleanála

- **Other Regulations**

If this was a hydrocarbon exploration borehole, it would need a license from the Petroleum Affairs Division (PAD).

If this was a mineral exploration borehole, it would need to be drilled on a license granted by the Exploration and Mining Division (EMD) of the Department of Communications, Marine and Natural Resources

It is probable that it would escape the regulation of these two bodies, though the PAD would have concerns if there was a possibility of encountering hydrocarbons, with the requirement for blow-out prevention, etc.

Similarly EMD would have some concerns about the nature of completion of abandoned boreholes.

- **Licenses**

Open loop systems need a Discharge License from the Environmental Protection Agency, especially since deeper systems produce brines. This is a non-specific requirement, since no geothermal legislation is in place.

There would also be concerns from the EPA if there was potential for any pollution problems

3) Barriers

The apparent lack of ownership of deep heat sources is a significant barrier to the financing of these projects.

HUNGARY

Hungary developed its geothermal resources (thermal waters in sedimentary aquifers) in the 1960s for agricultural use (greenhouses), in addition to bathing and swimming.

Now, the breakdown is:

balneology and swimming pools 36.7%; drinking water 29.9%; agriculture 29.6%; space heating and domestic hot water 3.8%. Nowadays, spa development is increasing.

Several laws cover the issues of geothermal development in Hungary: Mining Law (no. XLVIII, 1993); Water Management Law (no. LVII, 1995); Concession Law (no. XI, 1991). In the use of thermal waters, the components of water, production (reinjection) well(s), and the land property are dealt with by different laws :

1) The Legislation - Act XLVIII of 1993 On Mining

The exploitation of geothermal energy in the scope of this legislation, but exploration and extraction of ground-water carrying geothermal energy, medical and balneological use, water supply is out of scope.

In situ geothermal energy is the property of State : a 2% royalty after geothermal energy quarterly, and 0% above the 50% efficiency.

The Geothermal mining plot is max. 100 km², and we can have 8 plots / licensee.

The Hungarian Bureau of Mines is the licensing authority (see the regulatory authority framework)

2) The Legislation on Environment and water :

- Act LVII of 1995 on water management

The Annex indicates : "16. *Thermal water*: groundwater (originating from aquifer), the outflow temperature (measured on surface) of which is 30 °C or higher"

- the 219/2004 Government Decree on protection of groundwaters

It mentions that re-injection can be licensed :

- into the same aquifer or the aquifer of the same use provided that the re-injected is fluid is of the same quality or does not impact groundwater quality
- for the purpose of geothermal energy utilisation using closed circulation technology

3) The 20/2001 Gov. Decree on environmental impact assessment

- facilities with obligatory detailed Environmental Impact Assessment :
 - geothermal power plant >20 MW; or on protected zone of potable, mineral and medicinal waters, or nature protection
 - mining activities
 - thermal energy power plant above 50 MW
 - deep drilling above 650 m depth on protected zones
- facilities, where the authority decides on a detailed EIA:
 - groundwater use above 5 million m³/year
 - re-injection above 3 million m³/year

4) 28/2004 KvVM Min. Decree on emission limits of water pollutants

No mixing of chloride-treated water with thermal water!

Limit values of waste water before discharge:



This legislation is unbalanced and often contradictory.

For example, the Mining Law states, “Geothermal energy exploited with thermal water is not geothermal energy, because it entails thermal water production”. Therefore, it is not subject to the Mining Law, but is subject to the Water Management Law. The latter, however, does not include the terms of geothermal energy and its utilization.

The thermal water occurrences belong to the State. But for obtaining a concession for thermal water production, the current legislation does not allow opening up a tender.

In addition, for geothermal exploration and exploitation no concession perimeters can be delimited. The property rights of tens of thousands of abandoned oil/gas exploration wells (many of them with identified rich thermal water occurrences) are presently under examination.

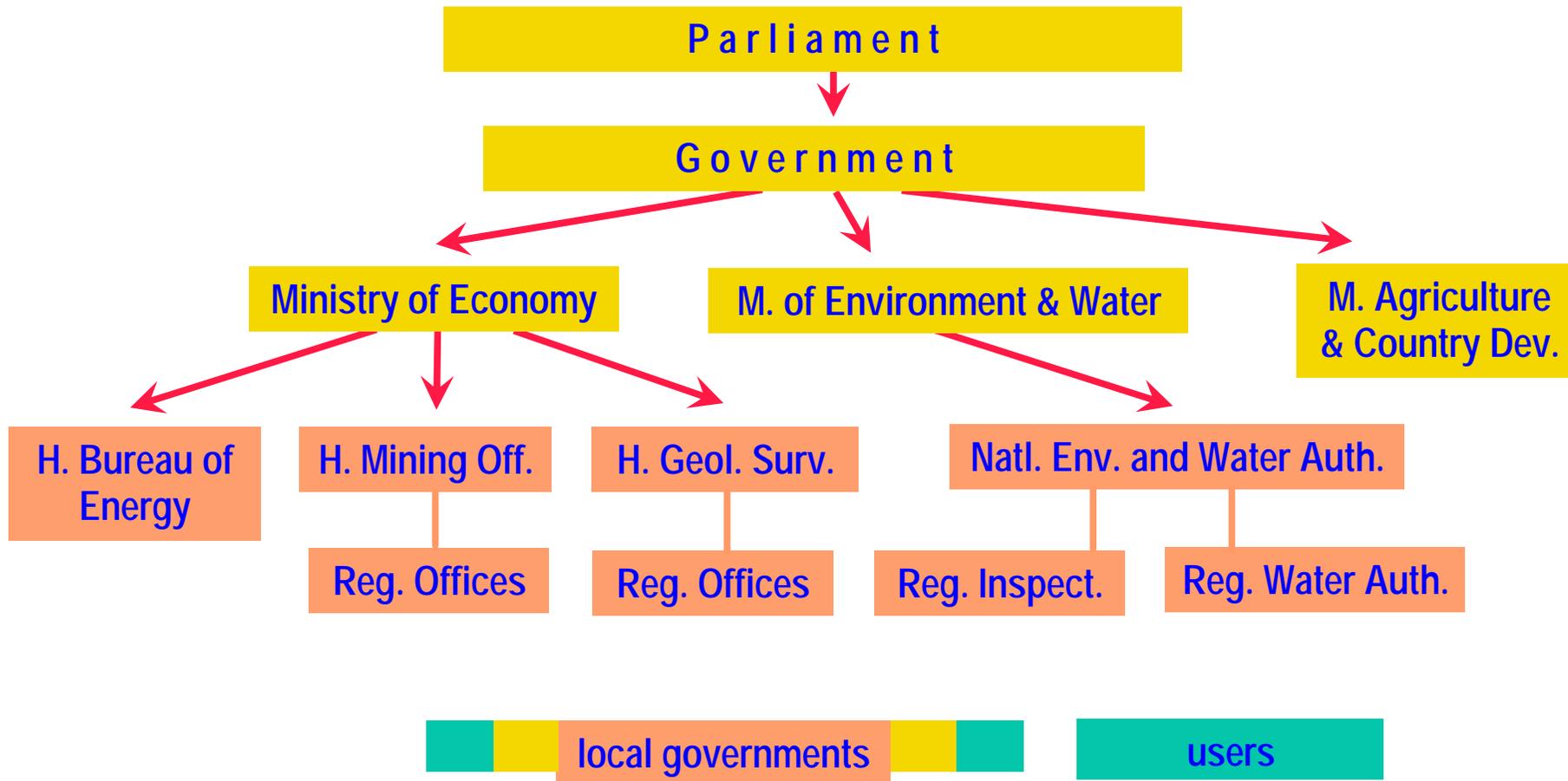
The situation concerning environment protection is equally contradictory. Users for agriculture (greenhouses) and space heating are now forced to reinject the used water, which is considered by authorities to be wastewater, even if it is of drinking water quality.

On the other hand, water after being used for balneology cannot be reinjected!

The development of the rich geothermal resources of Hungary is severely hampered by taxes and royalties for thermal water production as well as by low natural gas prices, subsidized by the Government.

Very recently, the Hungarian Mining Law has been reformulated and relabeled (now “Gas Law”). The new change for geothermal is that for temperatures < 30°C there is no need for licensing .

REGULATORY AUTHORITY FRAMEWORK



Legend

legislation

authorities

interested parties

POLAND

In the 1990-s and at the beginning of 2000-s they experienced a gradual increase of the share of RES. Among the contributing factors was notably the commissioning of six geothermal heating plants : These are located in Podhale region (38 MW geothermal, 78 MW total (gas peaking)), in Pyrzyce near Szczecin (13 MW, 50 MW total), Mszczonów near Warszawa (3.8 MW, 10.2 MW total), Uniejów (3.2 MW, 5.6 MW total), Słomniki near Kraków (0.3 MW, 2.3 MW) and Stargard Szczeciński near Szczecin (ca. 14 MW geothermal/total).

Some rising of using geothermal heat pumps is observed in the country. Absorption heat pumps have been working in three geothermal plants. Besides, a progress in development of heat pumps based on ground or groundwater for the individual consumers and office buildings has been observed. Very roughly one can suppose a number of at least 700 – 1000 such pumps within the country (installed capacity ca. 10 MW_t and heat production ca. 80 TJ/yr). However, these figures do not represent all installed devices. The interest in using heat pumps would increase especially when the cheapest devices would become available on the market, and the investment costs would be lower.

In case of Poland, there exist no specific regulations regarding particular RES (geothermal including) and heat production from them. Therefore, only general acts referring to various aspects of geothermal energy are given, more detailed are given for the geological and mining law.

The existing legal regulations do not provide special preferences for geothermal energy exploration, exploitation, use and heat, therefore a decision about using this type of energy and heat should be undertaken by entrepreneurs on the basis of detailed geological, environmental and economic analyses. Geothermal investments can be subsidised in compliance with regulations concerning financing all renewable energy sources.

Present Polish regulations differentiate between energy of soil and rock mass (possible to use via heat pumps) from energy of groundwaters, in that thermal (geothermal) waters, which are treated as primary useful resources.

1) Geological and Mining Law (Official Journal No. 27, item 96 with amendments)

Geological and Mining Law is a basic act referring – among others – to geothermal waters. It defines conditions of geothermal waters' exploration, exploitation and protection, other environmental issues. According to the act, deposits of useful minerals, in that geothermal waters, are owned by the State Treasury, which may exclusively use these deposits and dispose of them through the mining clause settlements. In view of this, prospecting, exploration and exploitation of geothermal waters can be realized only in line with respective legal acts, based on a concession by the Minister of Environmental Protection. Such activities are charged by several fees and taxes, defined in details in respective decrees. In the cases of shallow rock formations and water on which heat pumps are based, either Geological and Mining Law or Water Law (Official Journal No. 115, item 1229 with amendments) apply. The Geological and Mining Law is

expected to be novelized. According to the new version, geological works will also cover works related with the use of Earth heat Earth via heat pumps. The Law defines also the right to geological data resulted from geological works (i.e.drilling the wells) and through which the Treasury disposes of this right.

The issues covered by this act eventually have implications to Geothermal heat pumps (“shallow“geothermics”) and Geothermal district heating (“traditional” one, i.e. based on geothermal waters addressed by Geological and Mining Law)

2) Economic Activity Law - act of 19 November 1999 (Official Journal No. 101, item 1178 with amendments)

This Law claims that economic activity, embracing prospecting, exploration and exploitation of natural resources, in that geothermal waters, requires a concession. Prospecting, exploration and exploitation of geothermal water (similar to other useful minerals) can be undertaken by everybody, on the same rights, under the same legal regulations. Economic activity can be commenced after putting to the company register or to economic activity register.

3) Environmental Protection Law (Official Journal No. 62, item 627 with amendments)

The Law claims that concessions for prospecting, exploration and exploitation of geothermal water should be preceded by evaluation of environmental impact of the planned undertaking. According to the Cabinet Regulation of 24 September 2002 types of activities of potential environmental impact, and detailed criteria for activities requiring reports on their environmental impact (Official Journal No. 179, item 1490), drillings made for geothermal waters intaking and exploitation belong to the group of activities which may require reports on their environmental impact. This requirement is imposed by a concession agency in the form of a statement, where the scope of the environmental impact report is indicated.

In the case of undertakings requiring environmental reports, society has to be given a chance to participate in the procedure prior to granting the concession.

4) Act on Public subsidy procedures of 30 April 2004 (Official Journal No. 123, item 1291), enacted on the day of publication, i.e. 31 May 2004, and art. 2 of an act of 19 September 2003 – amendment to the act about conditions of accessibility and supervision of public subsidies for companies (Official Journal No. 189, item 1850)

This Act refers to detailed conditions of granting public subsidies – including investments in renewable energy sector. They are specified in the Regulation of the Cabinet of 27 April 2004 (Official Journal No. 98, item 996). On the basis of §2, section 1, pt. 6, subsidies can be granted for investments on the construction or modernization of geothermal water recuperation installments; on the basis of §2, section 1, pt. 9 subsidies can be granted for investments employing heat pumps, using Earth heat. The aid can take a form of a donation, preference loan, bank credit, subsidized loans or bank credits, or partial remission of loans or credits.

According to §5, section 8, the condition of the subsidies for a new investment is that the company covers at least 25% of capital costs from own funds. Subsidies for an old investment can be used for modernization of infrastructure, related with the renewable energy sources (§6, section 1). In this case, the expenditures entitling to subsidies are equal to the surplus of capital costs related with the renewable energy use, compared

with its conventional counterpart, of comparable capacity (§7). The subsidy cannot exceed 60% of costs qualifying for financial support. Only in specific cases, when the positive environmental influence of the investment is significant, the subsidy can be increased to 100% of costs qualifying for financial support, provided no other aid has been ever granted for the investment in question.

As already mentioned, Poland possesses prospective potential to develop geothermal direct uses (space heating in particular – realized either as geothermal only or as integrated schemes). However, this will never happen at satisfactory level if the projects are affected by not fully adequate Geological and mining law providing many taxes, fees and royalties which create serious problems for already working plants and can even stop the new projects by making them not economically feasible and viable.

The list of basic fees and taxes to be paid by investor or operator of geothermal plant is given below. Important is not only the number of them but also the fact that they are too high as compared with yearly heat sales and related income (even in the case of the biggest plant in the Podhale Region – heat sales ca. 300TJ/y):

- concession fee;
- mining royalty;
- fee for geological information: to illustrate the problem one can say that for the geological information on 1 deep well (ca. 2.5 - 3 km deep) the operator may pay ca. 6 thousand euro (if the information comes from the-so-called hydrogeological documentation) or 0.6 mln euro for this same information from the-so-called geological documentation. This sum has to be paid to the National Treasury during the period for which the concession is issued (5 –25 years). It amounts even to 10 – 30% of the value of well;
- fee for geothermal water production (exploitation) – introduced by Sejm (a parliamentary chamber) in April 2005 (before it was zero as a governmental promotion tool to enhance geothermal energy use). It equals PLN 0.26 – 0.75 /1m³ of water (ca. 0.06 – 0.19 euro/1m³) and is very curious in case of water which is in almost all cases injected back to the reservoir after heat extraction to maintain its renewability.

Besides, a tax exists for surface infrastructure (heating pipelines, surface facilities): 1-2% of their book value. It gives high amounts specially that all installments are new and length of distribution networks is sometimes significant (14 km – main distribution pipeline in case of the Podhale project).

The listed fees and taxes results in high production costs and prices of heat from geothermal sources.

All above is existing despite declared by the government promotion of geothermal as one of the RES. These facts create negative atmosphere for geothermal energy development and arise many financial problems for the plants already on-line.

Some of these fees should be cancelled or limited to reasonable levels.

There are a number of barriers hindering the development of the renewable energy sources. The barriers are a set of legal, economic, institutional, and – for a less and less extension - social and psychological factors.

They include :

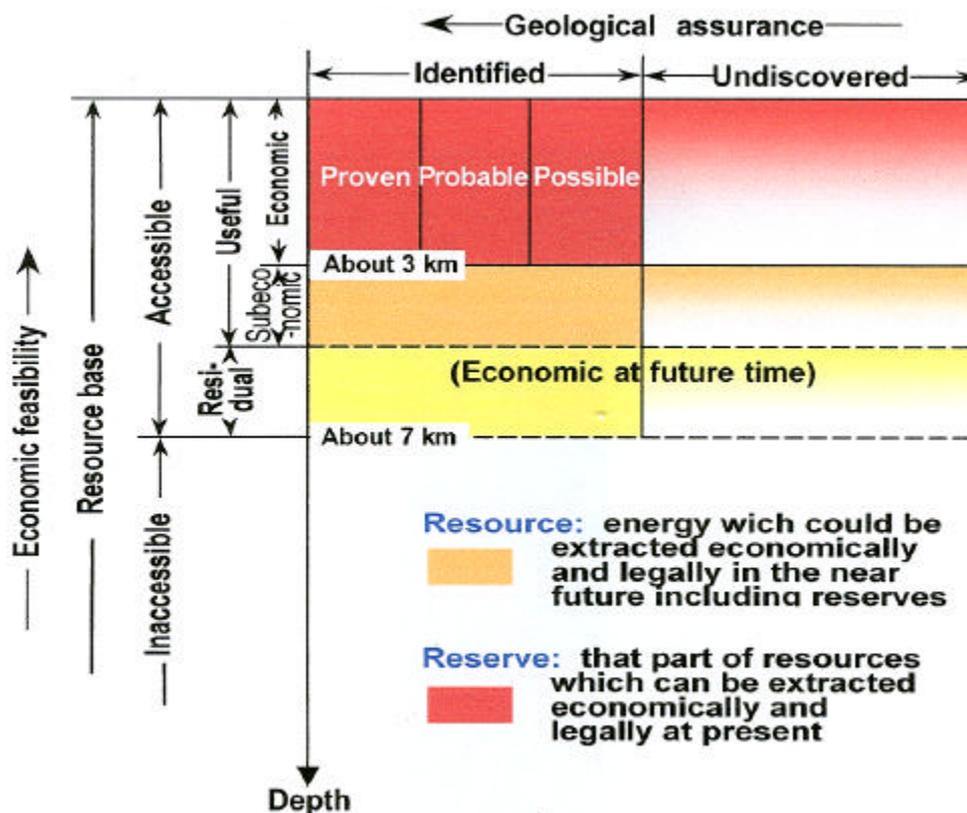
- the lack of regulations clearly defining a programme and policy concerning the utilisation of renewable energy sources (the Strategy of Renewable Energy Sources Industry Development approved by the Cabinet in 2000 and the Polish Sejm in August 2001 - which specifies quantitative objectives of renewable energy share of 7.5% and 14% in the total energy balance of Poland by the year 2010 and 2020, respectively – is regarded as too general). New Strategy is expected to be elaborated and approved ;
- the lack of legal acts and regulations tailored to the specific features of particular renewable energy sources;

OVERVIEW OF THE EUROPEAN SCHEMES

To start, green certificates and carbon credits are now increasingly discussed and their impact on further development of renewable energy systems is foreseeable. Not so for geothermal direct use. So far, no “green label” is being issued for geothermal space heating, although it saves fossil fuel and thus reduces CO₂ emissions. However, indirect supporting means that the installation of heat pumps can have significant impact.

A decisive role in boosting geothermal direct use by heat pumps could be played by the utilities. An example to be followed is given by the Swiss EKZ (Electricity Company of Canton Zurich): it provides “Energy Contracting” which means that EKZ installs, owns, and operates the system and sells the heat (\pm domestic hot water) at a fixed price to the building owners.

For geothermal energy, the EU Classification System is :



To finish, our analysis is based on the other interesting EU countries, not seen in our case studies.

Austria

Barriers to the enhanced use of geothermal energy in Austria are provided by Austrian water law, which states that the groundwater below the land belongs to the landowner, regardless of depth. This fact is extremely important when deviated drillings have to be realized.

Portugal

According to the Portuguese Decree-Law n.º90/90, of 16th March, geothermal resources are “the fluids and underground geological formations, of high temperature, whose heat can be susceptible of utilization”. This definition is sufficient wide to cover all the modern utilizations of this energy.

Furthermore, Decree-Law n.º87/90 and n.º90/90, of 16th March, determine that geothermal resources belong to the public domain, but private companies and municipalities can apply for the right of exploration and exploitation, on the basis of a concession granted by the Ministry of Economy, or in the Autonomous Region of Azores by the Regional Secretariat of Economy. As for the mining industry, the exploration and exploitation of geothermal resources have to be carried out under the supervision of a “Technical Director”, generally a geologist or mining engineer, employed by the concessionaire and accepted by the Direcção Geral de Geologia e Energia (DGGE), the governmental agency in charge of all mining and oil development as well energy subjects in Portugal, or in The Azores by the regional authorities.

Bulgaria

Thermal waters are integral part of the total water resources in Bulgaria but due to their particular qualities they are treated separately by the legislation.

According to the Water Law (1999) thermal waters are owned by the State or by the Municipalities. Ministry of Environment and Waters (MOEW) approves the exploitable thermal water resources and hydrothermal energy and sets up the wellhead protection zones of all reservoirs (state-owned and municipal). Ministry of Health controls mineral composition and general state of all water sources.

State-owned water sources have a leading role in geothermal application of the country. Until 1990 the geothermal systems were entirely financed by the state. Bulgaria has no specific legislation for geothermal energy. Regulations exist however for obtaining permits and concessions, and there are guidelines in place for geothermal exploration. Thermal waters as a product of the bowels of the Earth are under the jurisdiction of the Constitution and the Water Law.

The following laws govern the use of geothermal waters for energy purposes:

Law on Waters, Law on Concession, Energy and Energy Efficiency Law, Law on Territorial Structure and Municipality Property Law.

The Law on Waters states that the sole right for the use of waters is owned fully by the State and may be delivered via concession only for mineral waters when the use is for bottling, energy generation and extraction of chemical elements and derivatives.

Permits issued by the Minister of Environment and Water are required for state-owned thermal waters used for treatment, rehabilitation and prevention, swimming pools, thermal water supply for domestic, technical and industrial aims.



The Law on Concessions regulates the conditions and order for delivery of concessions. They are awarded on the basis of a tender and are issued for up to 35 years. The Council of Ministers issues geothermal licensing.

Energy and Energy Efficiency Law states that electricity produced by renewable energy sources or combined-heat power plants (CHP) may be purchased at a preferential price, which is defined by regulations accepted by Energy Regulation Commission under the Council of Ministers.

A fund called “Energy Efficiency and Renewables” has been set up under the supervision by the Minister of Energy and Energy Resources in order to promote these energies.

Major current barriers for geothermal development in the country are:

Lack of administrative and practical expertise in geothermal development under the new social and economic conditions in Eastern Europe after 1990.

The procedure for obtaining a concession for water use is very complicated and time consuming. In some cases, the investors have to finance complex preliminary geological and hydrogeological study without having guarantee for gaining the concession after completing the procedure.

The investor who intends to utilize geothermal energy is expected to develop simultaneously other geothermal applications.

The Government policy is encouraging customers for a cascade use but these requirements increase additionally investor's expenses often change their business plans.

Local taxes and fees are important but very insufficient source of funds for the Municipalities budgets.

The Municipalities are also not allowed to influence on the size of these taxes.

Romania

The current Romanian legislation relevant to geothermal development is harmonized with European Union principles and supports renewable energies, among which geothermal is specifically mentioned. The mineral resources (including geothermal) are owned by the State, their exploration and exploitation being regulated by the Mining Law issued in 1998. The National Agency for Mineral Resources is the Governmental institution in charge with issuing exploration and exploitation permits (long term concession).

The main direct uses of the geothermal energy in Romania are: space and district heating 37%; bathing and swimming including balneology 30%; greenhouse heating 23%; industrial process heat 7%; fish farming and animal husbandry 2%. The total used capacity of 152 MWth produces 2.9 PJ/a.

The Mining Law regulates the mining activities in Romania, stimulating the capitalization of the mineral resources, which are public property. The Law assures maximum transparency of the mining activities and a fair competition, without discrimination between the property forms, the origin of capital and the nationality of the operators.

The investments in the mining domain are encouraged by fiscal and administrative facilities, being free of any constraint concerning the return of investment and the utilization of the obtained profit.

The mineral resources located on the territory and in the subsoil of the country and of the continental shelf in the Romanian economic area of the Black Sea (delimited in accordance with the principles of international law and of international regulations to

which Romania is a party), are the exclusive object of public property and they belong to the Romanian State.

Among the mineral resources that are the subject of the present law is the heat contained in hydrothermal systems, mineral and plain waters, and mineral-thermal waters.

The mineral resources shall be turned into value through mining activities for which these activities shall be concessioned to national mining companies and societies and also to Romanian or foreign legal persons or given into administration to public institutions by the Competent Authority, according to the present law. The National Agency for Mineral Resources, established in 1993, is the regulatory authority to administer the mineral resources as well as the competent authority which coordinates the mining operation under the Mining Law. In particular, the Agency is authorized to institute hydrogeological protection perimeters, for the underground waters (mineral and thermomineral).

Exploration shall be conducted on the basis of an exclusive license, issued upon request, to the interested Romanian or foreign legal persons selected through a semestrial public offering by the Competent Authority, based on a work program and an adequate bank guaranty to be applied for environmental restoration purposes. The exploration license shall be granted for a maximum period of 5 years, with a renewal right of no more than 3 years, paying an annual fee in advance. The title holder of an exploration license has the right to obtain, upon request, the exploitation license for any mineral resources discovered, according to the present law. Mining shall be conducted on the basis of an exclusive license, granted for all the mineral resources within an exploitation perimeter. The exploitation license shall be granted to:

- a) The titleholder of the exploration license, on its request.
- b) The winner of a public tender, organised by the Competent Authority, according to the present law.

The exploitation license shall be granted, through negotiation, based on an application, accompanied by:

- a) Feasibility study which ensures the capitalisation of the mineral resources and the deposit protection.
- b) Development plan of the exploitation.
- c) The environmental impact study, approved according to the law.
- d) Environmental rehabilitation plan accompanied by a bank guaranty, based on the value of the development plan and the environmental impact study, and calculated according to norms for applying the present law.

The exploitation license shall be granted for a maximum of 20 years, with the right of continuation for successive periods of 5 years each. The titleholder of the exploitation license will pay an annual tax on surface and mining royalty, according to the present law.

Besides the Mining Law, the Romanian legal/institutional framework of the energy industry is also relevant: for the electric and thermal energy sectors the Urgency Ordinance no. 63/1998. Here the competent authority is the National Authority of Energy Regulation.

Law no. 199/2000 concerning efficient use of energy was adopted. Currently, proposals are produced at the Ministry of Industry and Resources which concern changes in the Petroleum Law and Mining Law as well as the initial text of the law concerning electric and thermal energy. The aforementioned legislative projects will soon be forwarded for analysis and adoption to the Romanian Parliament.



Denmark

The attitude of the Danish Government towards geothermal energy is positive, and the legal framework is in place. It is, however now up to the industry to prove that geothermal energy technically and economically is viable. No public funding is available for geothermal plants any more, but the high taxes on fuel for heating, and long periods with low sales prices for electricity from combined heat and power plants have made geothermal heat more attractive.

The sale of heat to district heating systems is regulated to protect the customers against the otherwise very strong position the limited number of local producers could have on local price setting. Generally the price is thus only allowed to include certain well defined elements as pay back of normal loans to necessary investments in plants, purchase of fuels, maintenance.

To ease the risk associated investments in geothermal plants, the regulations, however, allow for a surplus to be added into the price, thereby opening up for private industry investments. The surplus shall cover the increased risk level, primary the exploration risk. However an independent board, Energitilsynet, shall approve the prices and has at any time the power to change the price.

Exploration and production of geothermal energy requires a concession granted by the Energy Agency who also shall approve the final plant together with the local authorities.

Lithuania

The legal basis of country's power sector and national electricity market is based on the Law on Energy (2002) and the Law on Electricity (2000). These acts have been fully harmonized with EU directives. The Law on Energy defines five main objectives of the State in energy regulation:

- 1) Security of supply;
- 2) Energy efficiency;
- 3) Reduction of the negative environmental impact;
- 4) Promotion of competition;
- 5) Promotion of the local and renewable energy use.

The purchasing prices of "green electricity" are set by National Control Commission for Prices and Energy (NCC). RES-Electricity prices (Euro/MWh) for purchase by grid operators are: hydro power plants - 58.0, wind power plants - 63.8, power plants, using biofuel - 58.0, other power plants, using renewable or waste energy resources - price is set by separate NCC decision.

According to Law on Heat, State and municipalities shall encourage the purchase of heat fed into heat supply systems if produced from biofuel, renewable energy sources and geothermal energy (!). (Chapter I, Article 1, Item 2)

The objectives of the Law:

- 1) To guarantee the reliable and high quality least-cost heat supply to consumers.
- 2) To legally establish the reasonable competition in the heat sector.
- 3) To defend the rights and legitimate interests of heat consumers.
- 4) To improve the efficiency of heat production, transmission and consumption.
- 5) To increase the utilization of local fuel, biomass and renewable energy resources in heat production;
- 6) To reduce the negative impact of heat energy industry on the environment.

(Chapter II, Article 4, Item 3)

The state (municipalities) shall promote the buying of heat produced from biomass, renewable sources of energy, waste incineration and geothermal energy for the heat



supply systems. The buying of such heat shall be assigned to the public service obligations.

(Chapter III, Article 7, Item 4)

In preparation of the Municipal Heat Plan, all heat and gas undertakings servicing the territory of this municipality, other legal persons related to the heat sector as well as the organizations protecting the customer rights shall take part.

The ecologically clean heat energy sources (electric, geothermal, etc.) shall be permitted in the whole territory of municipality.

The follow-up secondary act to Law on Heat, namely Procedure of Purchase of Heat from Independent Producers to Heat Supply Systems (2003, July) sets the rank (merit order) of heat to be purchased into DH systems.

If the independent producers offer the same heat price, the heat supplier chooses the heat by following order:

- 1) from cogeneration units fuelled by renewable energy resources;
- 2) from non-cogeneration units using renewable energy resources or geothermal energy;
- 3) waste heat from industry;
- 4) from efficient cogeneration units;
- 5) from boiler-houses firing fossil fuel.

The minimum requirements for an independent heat producer to include in the share of his delivery is above 1% of peak demand in heat supply systems, and no less than 1MW. Nevertheless, the heat supply entity is entitled to derogate from this provision and to connect the installations of an independent producer below 1MW to a pipeline system and purchase heat from them.

Switzerland

Switzerland has “normal” geothermal conditions, the utilization is entirely for direct use. The total capacity in 2001 was 485 MWt, which produced 3.7 PJ/a heat.

The breakdown is:

ground-source heat pumps (for space heating) 62.3%; balneology 31.7%; deep aquifers for district heating 3.7%; others like tunnel waters (also for space heating) 2.3%.

Being a country of federal structure, there is legislation in Switzerland on the state (Confederation) and the county (Canton) level. According to federal law, the ground property extends to the realm of direct practical interest (a few layers); below that depth everything belongs to the government. No mining law exists on the federal level.

Geothermal energy utilization is not well defined in federal and cantonal legislation. Legal experts like Gottesmann (1985) make a distinction between geothermal heat (an energy source, given by the physical conditions of the subsurface) and geothermal energy, which is used and distributed at the surface. Geothermal heat is thus dealt with by public law and geothermal energy, through its use in private law. So far, geothermal energy is not covered by federal law; existing federal legislation regulating electricity, atomic power and pipelines is not applicable.

On the other hand, in cases where the use of geothermal energy involves water as the heat carrier, water management legislation comes into play. Since shallow and deep groundwater belongs to the cantons, they are regulating the tapping and use of geothermal fluids. In this sense, the use of geothermal energy needs permit and concession. In this, existing and well-established cantonal water laws are being applied.

A special situation exists with ground-source heat pumps involving borehole heat exchangers (BHE). Although such systems operate in closed circuit, their construction

and operation falls under environmental legislation. It is feared that the BHEs could establish hydraulic connections between otherwise separated aquifers and/or could have negative effects on groundwater quality. In fact, both the federal Environment Protection Law (*Umweltschutzgesetz USG*) and the Water Protection Law (*Gewässerschutzgesetz GSchG*) are applicable.

This leads to permitting regulations:

- a) No permits can be obtained within groundwater protection zones or in areas with potential groundwater occurrences.
- b) In special areas like border zones of the above category, karstic areas and environs of thermal and mineral springs, the permits are given on the basis of detailed investigations.
- c) For all other areas, the permits can be obtained.

Based on this practice, several cantons have published maps of BHE exclusion zones. As an example, such a map can be seen for the canton St.Gall (SG) on www.geoportal.ch). The list of permitting cantonal authorities can be found on www.fws.ch. The applications must name the applicant, the geologic advisor, the location, the BHE and heat pump technicalities, as well as the foreseen safety and control measures. The open-mindedness of cantonal authorities allowed rapid BHE development in Switzerland.

For large installations like geothermal district heating systems (>5 MWt) an environmental impact report must be submitted.

So far, no tax must be payed for geothermal energy utilization in Switzerland. Recently, however, the administration of canton Berne considered the introduction of geothermal taxation: a fee of 3 Swiss francs (equivalent of 2 US\$) per year and MWt capacity was foreseen for thermal water production from deep drillholes; 0.5 – 2 Swiss francs per BHE meter and year(!). Fortunately, thank to the protests of national and international organisations, the legislative body (cantonal Parliament) did not follow the suggestion of the administration.

CONCLUSIONS

Definitely more supportive governmental policies and efforts are needed to speed up the development of geothermal resources for direct use. Only by these means can their great potential be tapped and utilized.

Clear energy and environmental policies and regulations are of paramount importance for the development of renewable energy sources. The institutional framework, legislation and legal constraints are borderlines to delimit development, especially in view of environmental protection.

A review of selected countries in Europe, representing EU countries, EU candidate countries, as well as non-EU countries, reveals great differences in existing legislation.

In this situation, it is clear that some harmonization is needed. The EU could and should take the lead here.

At the same time, simplifications of application and licensing procedures should be implemented. An example for harmonization within the EU is given by the Mining Waste Directive now under preparation.

Environmental considerations are key elements in legislation relevant for geothermal energy. Herein not only the geothermal resources need to be clearly defined but the sustainable use of the resources and protection of the environment need to be addressed.

Equally important for increased development of geothermal energy utilization, not only for power generation but also for direct use, are appropriate governmental policies. For renewable energies, the EU has issued the *Directive 2001/CE du Parlement Européen et du Conseil du 27 septembre 2001 relative à la promotion d'électricité produite à partir de sources d'énergie renouvelables*.

Also herein, the reexamination of administrative procedures with the aim of simplification is foreseen. The Directive also lists geothermal energy as a renewable source. Agencies like the International Energy Agency (IEA) could and should become instrumental in leading governments to supportive legislations. Unfortunately, not much happened since the promises of the IEA Policy Office.

In summary, clear and supportive energy and environmental legislations as well as governmental policies are vital for the future development of geothermal energy. The findings presented above show that at present only a fraction of what is needed is available and still a lot remains to be done. Such tasks are usually completed by legal specialists like lawyers. It cannot only be hoped, but must be ascertained that they will rely on knowledgeable geothermal specialists like reservoir engineers in their work.

An EU framework policy would be extremely useful:

- recognising the special merits of this energy source;
- promoting the economic take-off of this energy source;
- supporting an intensified research effort
- action to promote the idea of an FP7 European Technology Platform could be useful if the geothermal industry support can be obtained



Tables :

Summary of legislation characteristics relevant to geothermal energy utilization for selected European countries. (Kistelek Workshop).



	Legislative framework							
	Geothermal energy explicitly treated in					Specific legislation on geo-thermal energy	Ownership of in situ geothermal energy	
	mining	water	environmental	energy or electricity	other legislation		state	land-owner
Albania	No	Yes	No	No	No	No	Yes	No
Belgium	No	No	No	No	No	No		
Czech Republic	no	yes	no	yes	no	no	-	-
France	yes	no	no	no	no	yes	yes	no
Germany	yes	yes	yes	yes	no	yes	yes	no
Germany II	yes	no	no	no	yes	no	yes	sometimes
Hungary	yes	yes	yes	yes	no	no	yes	no
Latvia	no	yes	no	yes	no	no	yes	no
Lithuania	yes	yes	yes	yes	no	no	yes	no
Poland								
Romania	yes	yes	no	yes	no	no	yes	no
Serbia and Montenegro	yes	no	no	no	no	no	yes	no
Slovakia	no	yes	no	no	no	no	yes	no
Slovenia	yes	yes	yes	yes	no	no	yes	no
Switzerland	no	yes	no	no	no	no	yes	no



	Legislative framework					
	Assessment methodology applied			Major regulatory authorities	Duration of exploration license and renewal (in years)	Duration of exploitation license and renewal (in years)
	ground-water body	geothermal province	occurrence level			
Albania	Yes			National Technical Secretariat of Water	n.a.	n.a.
Belgium	No	No	yes	Energy departments of the 3 regions	na	na
France	no	no	yes	Min. of Environment, DRIRE	3	15
Germany	no	yes	yes	mining authorities	max 5 years + prolongations of each 3 years possible	up to complete usage of reserve, fees have to be paid
Germany II	mostly	no	?	State ministries, which may be for economy or for environment	max. 5 years	no fixed value, usually 20 years
Hungary	yes	yes	no	Bureau of Mines, Inspectorate for Environment and Water, Bureau of Energy	4+2+2	n.a.
Latvia	no	yes	yes	Latvian Environmental, Geological and Meteorological Agency	n.a.	n.a.
Lithuania	no	yes	no	Ministries of Economy/Environ.	3.0-5.0	5.0+5.0+...
Romania	yes	yes	yes	Romanian Energy Regulatory Authority, NAMR	5 + 3	20+ every 5 years renewal
Serbia and Montenegro	no	yes	no	Ministry of Science and Environmental Protection		
Slovakia	yes	no	yes	Ministry of Environ. SR	yes	yes
Slovenia	yes	no	yes	Environmental Agency of Republic Slovenia, Ministry of the environment and spatial planning, Ministry of the economy	1+1 (water lax); 1+5+3 (mining law)	max. 30 years (water law); max. 50 years (mining law)
Switzerland	no	no	yes	Water Protection Agencies of Cantons	n.a.	n.a.



	Environmental aspects			
	Re-injection in your legislation		Specific thresholds on surface discharge of geothermal water	What geothermal installations require Env. Impact Statement
	obligatory	optional		
Albania	no	no	no	no
Belgium	no	no	no	no
France	no	yes	30 oC	bigger than 1 MWth
Germany	no	yes	not known	each
Germany II	Y	very restricted exemp-tions	Not set, as re-injection is the standard case	depending on size (energy produced), usually for all deep geothermal projects
Hungary	yes	no	available	EIA for each
Latvia	yes	yes	mineralization	no
Lithuania	no	yes	mineralization	deep wells, pipelines
Poland				
Romania	no	no	max.+35°C in rivers	All kind of installations
Slovakia	no	yes	individual	yes (every)
Slovenia	no	no	max.2% of daily averages does not exceeds +1.5°C in salmonide rivers or +3.0°C in cyprinid rivers; one of daily averages does not exceed 21.5°C in salmonide waters or 28°C in cyprinid waters.	none
Switzerland	no	no	max. +1.5°C in rivers	>5 MWth

REFERENCE TO MORE DETAILED SOURCES OF INFORMATION

- Antics, M., and Cohut, I. (2001). Experiences and prospects regarding geothermal energy development in Romania. What are the main financial and institutional barriers for implementation of geothermal projects? In: *Proc. International Workshop on the Future of Geothermal Energy in Central and Eastern European Countries (CEECs), Russia and Ukraine, Copenhagen/Denmark*, 8-9 October 2001.
- Antics, M., and Rosca, M. (2003). Geothermal development in Romania. In: *Proc. European Geothermal Congress 2003, Szeged/Hungary*, 26-28 May 2003, CD-ROM.
- Árpási, M. (2002). Institutional barriers to the development of geothermal energy in Hungary. IGA News No.50, p. 6-7.
- Árpási, M., Kovács, L., Szabó, Gy. (2000). Geothermal development in Hungary – Country Update Report 1995 – 1999. In: *Proc. World Geothermal Congress 2000, Kyushu – Tohoku, Japan*, 28 May – 10 June 2000, Vol. 1, p. 59-69.
- Energie extra (2003). Energie extra, 3.03, Swiss Federal Office of Energy, Berne.
- Eugster, W.J. (2003). Der Untergrund gehört allen - Gesetzliche Rahmenbedingungen. In: *Energie aus dem Untergrund / Erdreichspeicher für moderne Gebäudetechnik*. Sia Workshop, Dübendorf/Switzerland, 6 May 2003.
- Gottesmann, J. (1985). Rechtliche Probleme der Alternativenergie Erdwärme (Geothermische Energie) in der Schweiz. *Natur + Recht*, 9/91, p. 406-416, Paul Parey Hamburg und Berlin.
- Hámor, T. (2002). *Legislation on mining waste management in Central and Eastern European Candidate Countries*, EUR 20545 EN, 196 p.
- Kohl, Th., Andermatten, N., Rybach, L. (2002). *Statistik Geothermische Nutzung in der Schweiz für die Jahre 2000 und 2001*. Report to Swiss Federal Office of Energy Bern, 25 p.
- Laplaige, P., Jaudin, F., Desplain, A., Demange, J. (2000). The French geothermal experience – Reviews and perspectives. In: *Proc. World Geothermal Congress 2000, Kyushu – Tohoku/Japan*, 28 May – 10 June 2000, Vol. 1, p. 283-295.
- Luketina, K.M. (2000). New Zealand geothermal resource management - A regulatory perspective. In: *Proc. World Geothermal Congress 2000, Kyushu – Tohoku/Japan*, 28 May – 10 June 2000, Vol. 1, p. 751-756.
- Ortega-Rubio, A., Argüelles-Méndez, C., Romero-Schmidt, H. (1995). Legislation for environmental protection in the case of geothermic drillings in Mexico. In: *Proc. World Geothermal Congress 1995, Firenze/Italy*, 18-31 May 1995, Vol. 1, p. 563-565.
- Rybach, L., and Kohl, Th. (2003). The geothermal heat pump boom in Switzerland and its background. In: *Proc. International Geothermal Conference IGC-2003, Reykjavik/Iceland*, 14-17 September 2003.
- Rybach, L. (2003): Regulatory framework for geothermal in Europe – with special reference to Germany, France, Hungary, Romania and Switzerland - Lectures on the Sustainable Use and Operating Policy for Geothermal Resources, UNU Geothermal Training Programme 2003-1, 43-52, Reykjavik
- Sanner, B., and Bussmann, W. (2003). Current status, prospects and economic framework of geothermal power production in Germany. In: *Proc. European Geothermal Congress 2003, Szeged/Hungary*, 26-28 May 2003, CD-ROM.
- Schulz, R. (2003). Bergrecht und Erdwärme – Gesichtspunkte zur Bemessung von Erlaubnis und Bewilligungsfeldern. *Geothermische Energie*, 40/2003, p. 9-16.
- Skinner, R. (1995). Geothermal energy in a changing policy environment. In: *Proc. World Geothermal Congress 1995, Firenze/Italy*, 18-31 May 1995, Vol. 1, p. 447-451.
- Ungemach, P. (1982). Development of low-grade geothermal resources in the European Community – present status, problem areas, future prospects. In: *Proc. International Conference on Geothermal Energy, Florence, Italy*, 11-14 May 1982, Vol 2, p. 1-42.
- Ungemach, P. (2003). Written communication.
- Environmental Policy : Renewable energy sources in figures – national and international development - Status: June 2005
- 2005 Report by the Federal Republic of Germany on achievement of the indicative target for electricity consumption from renewable energy sources by 2010. Berlin, October 2005. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)



Government of The Republic of Lithuania : Resolution on The Resume of The Revised And Updated National Energy Efficiency Programme And Core Directions For Implementation Of The Programme In 2001 To 2005. Resolution No. 1121 of September 19, 2001. Vilnius

Renewable Energy Danish Solutions. Published by the Danish Energy Authority. Printed in Denmark, September 2003

Council of Ministries The Republic of Poland : Development Strategy of Renewable Energy Sector, Adopted Warsaw, 5th September 2000

European Union Structural Funds And Priority 4 “Infrastructure And Local Development” Of The Estonian National Development Plan : “The Estonian National Development Plan for the Implementation of Structural Funds – Single Programming Document 2004–2006” (SPD).

Presentations from the Kistelek seminar on geothermal regulations, April 8, 2005; by various authors, for download at: <http://www.mgsz.hu/english/index.html>