K4RES-H

KEY ISUE 4 : FINANCIAL INCENTIVES SCHEMES FOR GEOTHERMAL ENERGY

EXECUTIVE SUMMARY

Geothermal energy is a specific natural resource because :

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..

There is a wide variety of economic instruments in the studied countries which either support or inhibit the enhanced use of geothermal energy in Europe.
There are countries where the financial burden of fiscal nature (i.e. mining royalty, sewage penalty, groundwater use fee, environmental tax) are multiple, which breaches general taxation law. The arsenal of supporting instruments is colourful too, including tax exemptions, guaranteed take-over prices, green certificates, direct subsidies, to mention a few.

The German example shows clearly how much these supportive tools can contribute to the high growth rate of renewables in a country with moderate natural setting.
Moreover, there is a relatively low rate of return of the investment in geothermal energy and the economic risk is higher as compared to other energy sources.
This economics does not ensure the security of interested stakeholders and lead to a serious distortion of equal and open competition on the European level.

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, 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

The financial incentives schemes supporting geothermal heating refer to shallow and deep geothermal energy.

Different financial incentive schemes exist in the European Union to support the uptake of RES-H.
In this Report, indicators are developed against which existing incentive schemes are to be evaluated. These indicators include the following aspects:

- quantitative results (e.g. energy saved, number of newly installed RES heat systems, growth rates)
- impact on the development of healthy markets for RES-H (for ex: positive impact through the diffusion of expertise among heating installers or negative impact through stop-and-go dynamic caused by subsidies inconstant in time)
- easy of use (both for the beneficiary and for the body administering the scheme)
- cost effectiveness (ratio between public money spent and results in terms of RES-H installations)
- quality assurance and innovation
- possible negative effects (market distortion or others)

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.
For example, the Swiss Federal Office of Energy sustained a heat pump promotion program in the years 1990 – 1997. For the installation of heat pumps to replace fossil-fuel heating systems a subsidy of 300 CHF (200 €) per kWe was contributed. Nowadays, a large number of communal and cantonal utilities provide similar subsidies. This led to a veritable boom of ground-coupled heat pumps.

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 (± domestic hot water) at a fixed price to the building owners.

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 Economic 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 extend 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 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 business obstacles, distances, etc. The main financial obstacle is the heat distribution network (example: Bruchsal, D). For heat distribution, Eastern European countries may have an advantage due to existing networks.
In countries with high enthalpy resources, geothermal energy production can be quite economic : Italy (since 1904!), Iceland, but also Greece and Turkey Islands like Acores, Antilles, etc.
In other countries, support measures like feed-in tariffs are required; these are backed by the relevant EU directive on Electricity generation from Renewable Energy Sources.

There are some distortions to be mentioned that impact certain national markets. In France e.g., heat from geothermal district heating carries the full VAT, natural gas only a reduced value. Competition from conventional sources (in particular natural gas) even uses dumping prices to keep costumers. Cost for electric power from coal and/or nuclear in many countries is subsidised more or less obviously. Even with existing feed-in tariffs, cost for grid connection and other obstacles are prohibitive to geothermal power use. Projects are affected by not adequate mining law, many taxes, fees and royalties. These expenses are too high compared to the annual heat sales, even in the biggest plant .
Expenses comprise e.g. 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 FINANCIAL SCHEMES

A) Support

The summary of existing tools permits us to see in Europe :

- Tax exemptions/reductions exist in Hungary, France
- Loans are possible in Germany, Lithuania (theoretically) and Slovenia
- Direct subsidies in Belgium, Germany (limited), Lithuania and Slovenia
- Indirect support in most countries
- Guaranteed feed-in tariffs (yet for electricity only):
  - Germany: 8-15 €-ct/KWh
  - Hungary: ca, 12-14 €-ct/kWh (?)
  - Slovenia: 5.86 €-ct/KWh
  - Austria: ca. 7 €-ct./kWh
  - Lithuania, Latvia have obligation to purchase power from RES (but not from geothermal in Lithuania)
- Green Certificates in Hungary and Romania
- Carbon credits in Romania (first positive experiences in geothermal, with Denmark as partner; 5 €/t CO_2 avoided); in Germany, Poland etc. they exist, but do not yet have impact for Geothermal
- Covering the geothermal risk, it is crucial for private investors

From this, we distinguish 3 successful tools:

- Loans/subsidies for installation
- Feed-in tariffs (with related regulations on grid connection etc.)
- Carbon credit trading as an external help

Even if there are good regulation / tools in theory, they do not help if the conditions, availability etc. are not clearly defined.

B) Burdens

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.

Barriers to overcome, Limited awareness

High initial cost :
High initial costs are in many cases a barrier, in spite of the fact that the overall lifetime cost of the system is very satisfactory. Those promoting and marketing heat pump systems may here be facing a pedagogical, or educational challenge. In addition to marketing arguments, environmental and comfort benefits of heat pumps should be stressed and valued.

Low energy prices :
Low energy prices, which do not fully reflect the external cost of the different energies, are a significant barrier in some European countries. This is often related to the fact that even if a heat pump system is economically competitive, the energy cost difference may be too small to decide for the heat pump system. This is in spite of other benefits that a heat pump system offers, such as reduced CO2 emissions, more comfort etc. This barrier can only be overcome by offering incentives, grants, renewable energy tax benefits for heat pumps, exempted or reduced CO2 taxes etc.

EVALUATION OF THESE SCHEMES

Positive effects of subsidies:

The largest positive effect of subsidies is probably the publicity and the focus it gives to the product and the increased activity it brings to the entire market. When a subsidy is introduced, media coverage is stimulated. This brings additional coverage on the television, newspaper and radio. Professional literature and monthly/weekly magazines write editorial texts about product marketing in a very positive and professional way.
The government which is responsible for the subsidy distributes information to the public. This is done, when the subsidy is introduced, during the time it is available and before it expires, through mailing and in the mass media.

This information plays a very important role for a product that is new and still not well tried. It creates a governmental-acceptance of it. Once the product is authorised by the government and the authorities, the lack of confidence and the scepticism is diminished radically. The market players, the manufacturers and the installers are also activated when there are subsidies for their products.
It makes them more focused on the specific product, inventing new forms of marketing, pulling the market onwards through information seminars, direct mailing and advertising.
The non monetary effects of a subsidy, described above, are probably the most important to the market introduction of a new product or technology.

Without any doubt the subsidy itself helps to increase installations. The investment cost becomes lower and the profitability gets higher, which brings greater business opportunities.

The subsidies also work in a somewhat irrational manner, meaning that the subsidies are highly valued in the eyes of the investor. In other words, the customer buys the product because he feels that he can not "afford" to miss out on a governmental subsidy.

When a subsidy is introduced it always involves certain rules and regulations.
This creates a need for standardisation/regulations for the product which, in most cases is positive for the long-term development on the market. The sooner these regulations are introduced the better, provided that they are relevant.

Disadvantages with subsidies

Subsidies also have a lot of disadvantages.

When a subsidy is introduced the whole chain of market players are subject to great stress. The manufacturers are faced with sudden high demand on volume; retailers, consultants and installers get very busy. This causes a lack of products and trained personnel within the whole market chain. And the quality suffers. The rising demand also lures less serious parties, "gold diggers", to the line of business.

The construction of a subsidy can help sell a product or a system that would not be interesting for the market without subsidies. If this happens, the boost provided by the subsidy will work only to prolong the continued market introduction.

An example is that if sufficiently large subsidies are given, the dimensioning of the heat pumps will be a hundred percent of the heat demand.

When the subsidy expires there will be no market/profitability for the systems that have evolved during the time of subsidies. The market players must once more undertake adaptations to the new situation and the timeframe for sustainable growth will be postponed.

Rumours on subsidies, changes in subsidies or diffuse announcements on the subsidies often cause large interruptions in the market introduction of heat pumps. A frightening example of this was displayed in Sweden in 1998. In February of that year, the authorities announced that subsidies for heat pump and bio-energy installations would be introduced. What they did not say, on the other hand, was which conditions that applied, what products that were included, how large the subsidies would be and during what time period they would be valid. Not until the month of May, four months later, were the conditions published. The consequences were devastating. All sales on products related to this ceased during this period. Many companies went bankrupt or placed in severe economical difficulties. Who would buy a heat pump now if they think that there will be subsidies to do so in the near future?

Recommendations

However it takes a period of 5 - 10 years to create a market. Therefore it is necessary that the subsidy is valid over a long time period.
The market players must know the conditions and be given an opportunity to develop products, marketing/sales channels and educate installers and service technicians over a reasonable timeframe.

The introduction of a subsidy must be loud and clear. When a subsidy is introduced, all parts of it must be described :

What is the nature of the subsidy?
How large amount is it?
When is it valid?
For how long is it valid?
Who will receive the subsidy?
How does one apply?

The transition from a period of a certain subsidy to another or to a time without subsidies must be very smooth, and with great notice.
For a subsidy to have the intended effect it must be neither too large nor too small.
Too large an amount will create a great change in the demand of the product that the market players will not be able to deal with.
Too small an amount, on the other hand, will not give the boost that is intended.

A subsidy should be just large enough to give reasonable profitability to a heat pump installation to a real estate owner.
Judging from the experiences in Sweden and Germany, a heat pump installation should have a pay-back period of 5~7 years compared to other heating systems, in order to be attractive.

CASE STUDIES :

GERMANY

	Geothermal heat [a]
	[GWh]
1990	N/A
1991	N/A
1992	N/A
1993	N/A
1994	N/A
1995	1,425
1996	1,383
1997	1,335
1998	1,384
1999	1,429
2000	1,433
2001	1,447
2002	1,483
2003	1,532
2004	1,558

Support programmes for renewable energy sources

The Federal Government supports renewable energies through research and development as well as various measures for the expansion of the market. The Market Stimulation Programme for the support of measures for the utilisation of renewable energy sources, which is also financed through the Eco-Tax Reform, serves primarily for the expansion of heat generation from biomass, solar power and geothermal energy. In 2004, around 200 million euros were allocated.

Smaller facilities of private investors are supported with subsidies, larger facilities with loans at a reduced rate of interest and partial debt acquittal. Details of the support are stated in the promotion directives.
Furthermore, biogas plants, plants for the utilisation of solid biomass and geothermal energy are partially supported with district heating systems. As from July 2005, new support guidelines apply to the Market Stimulation Programme.
The previous support rates for biomass plants, biogas plants and geothermal plants remain unaffected. Alternative support programmes of the Reconstruction Loan Corporation (Kreditanstalt für Wiederaufbau) KfW are available, e.g. the KfW Environmental Programme (KfW-Umweltprogramm).

In the building sector, the Reconstruction Loan Corporation (KfW) has attractive financing programmes. These include the use of renewable energy sources and the conversion of heating systems.

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

For the district heating plants, support through the Market Stimulation Programme is available since 1999. However, in the first version the rules for application were done in such a way that virtually no requests could be made:

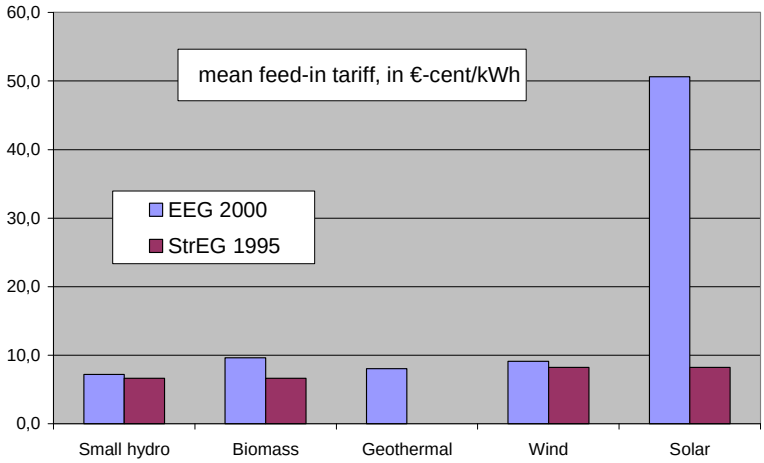
- mandatory co-financing from the state level; relevant programmes on state level did not exist
- no support for public bodies or companies with majority public ownership (most existing geothermal district heating companies are mainly owned by the municipalities!)

This led to no grants for the first years of the programme, and the funds could be diverted to support of solar heat. It is a clear example of how to make a scheme in such a way as to have it officially covered, but practically not accessible.

Meanwhile in new guidelines, the latest from 2005, these obstacles have been removed, and the first new plants with support from that scheme are producing heat (in the Munich area). Support now can also be granted for another barrier to geothermal district heating, the cost of establishing a distribution network. The support is granted through special loans by KfW. This kind of support is suitable for large installations run by utility companies (for private house owners, the direct support as described in the heat pump section is more appropriate).

There is still a problem with the scheme for plants producing both district heat and electricity. Here the owner has to decide to use support for either heat or power. Support for heat is small, and the amount of power in such combined plants is only a fraction, so a combination of both would be highly desirable. A future revision should remove this obstacle, too. In general, the Market Stimulation Programme for deep geothermal plants shows how an inappropriate measure can be converted into a very helpful tool.

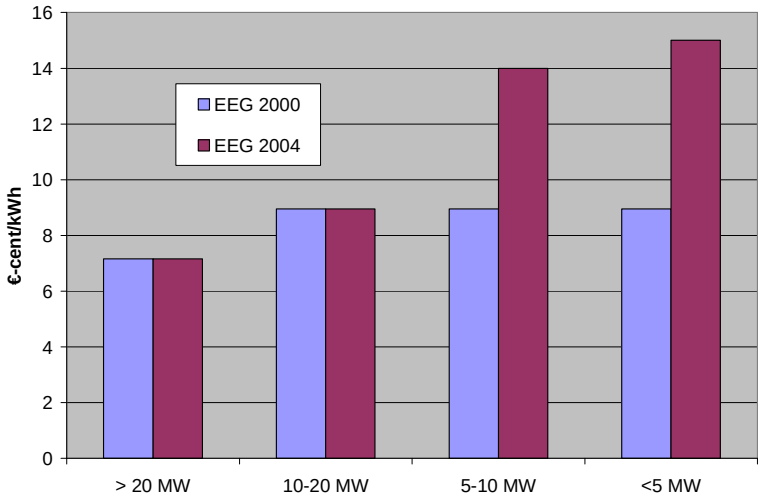
For quite some time, geothermal power production in Germany was considered to be only possible with Enhanced Geothermal Systems (formerly called Hot Dry Rock). R&D on this technology was supported over many years, in research plants in Germany and later as part of the European EGS project in Soultz-sous-Forêts in France. No support at all was foreseen for actual geothermal power production. The first German law on feed-in-tariff for renewables, the Stromeinspeisegesetz from 1995 (StrEG), did not cover geothermal power. In the new law, the Erneuerbare Energien Gesetz (EEG), geothermal power was included following some pressure from the renewable energy lobby. It took until November 2003, before the first geothermal electricity was supplied to the grid.



Comparison StrEG-EEG2000 for all renewables

The inclusion into EEG sparked a substantial effort to investigate possible sites and to plan geothermal power plants. Of course, the fist attempts where limited to smaller plants in the 1-3 MW range, as financial and technical constraints were experienced. After first economic calculations it became clear that the price of ca. 7-9 €-cent/kWh was

to low for these smaller plants. The economy of scale cannot yet apply. In the first revision of the law some new values for smaller plants have been included accordingly.



Comparison EEG2000-EEG2004 for geothermal power

With the new tariffs, some of the studied projects could actually start construction. At the moment, power plants are planned or built mainly in two areas with favourable geological conditions, the Upper Rhine Graben and the area around Munich. First wells have been drilled successfully at several sites, producing water of >120 °C at reasonable flow rates. In a few projects already the second wells are under construction, first power can be expected from new plants by the end of 2006 or early 2007. Without the EEG this development would not have been possible.

The Heat Pump Sector

Subsidies for heat pumps:
Like in Austria and other federal countries supportive measures for heat pumps are different from province to province.
In Bavaria for example the following subsidies for heat pump systems were available in the year 2003. € 150 for every installed kilowatt of heat capacity in existing buildings, if the heat-distribution system is adapted at the same time € 100 for every installed kilowatt of heat capacity in every other case. The maximum support is 25% of the concerned investment costs but maximum € 12.500 per heat pump system.
In Brandenburg the use of heat pump systems for hot water preparation or/and for heating is supported. The level of supportive measures goes up to 30% of the investment costs, but it is limited to 613,55 Euro/kW proven heat demand. The maximum amount per system is 102.258,35 Euro. The seasonal performance factor of the system has to be at least 3,8. This has to be proven for every concerned project.
The heat distribution in buildings is not supported. In Nordrhein-Westfalen there was a promotion for heat pumps within the REN-programme (Rationelle Energieverwendung und Nutzung unerschöpflicher Energiequellen – rational use of energy and use of inexhaustible energy sources) until the 30.9.2003. At the moment there are no incentive

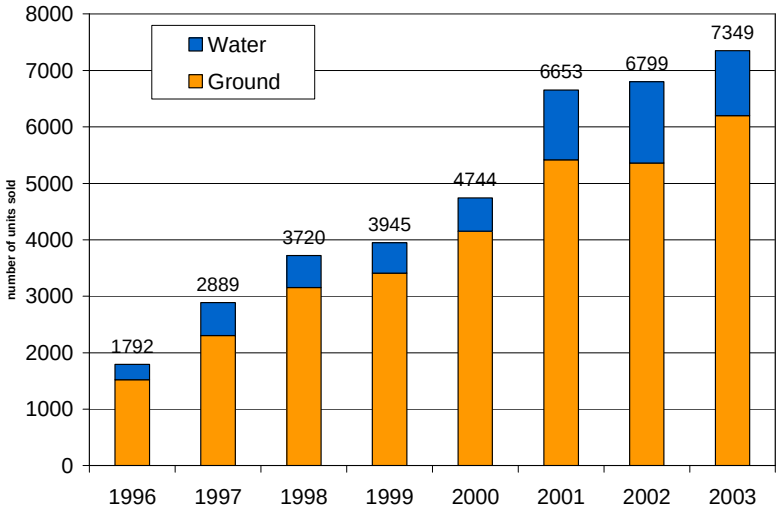
measures for heat pump systems, but a resumption of the REN-program is planned, but today the conditions that are tied up in a support measure are not known.

Success story of federal scheme 1995-98:
The only direct support measure for geothermal heat pumps on the federal level was part of the Market Stimulation Programme. In the years 1995-98, a subsidy was paid per kW_{th} of installed heating capacity. The amount started with 300 €/kW_{th} and was decreasing to 200 €/kW_{th}, before the programme was phased out in 1999. The subsidies where also subject to certain standards:

- the heat pump installation must be built to achieve a minimum annual COP of 3.5, increasing up to 3.8 during the course of the scheme; this had to be certified in the design plans by an engineer
- the heat pump must use non-chlorinated refrigerants (to support early phase-out of ozone-depleting refrigerants)

The scheme had been developed and carried out by the Federal Ministry of Economics in close cooperation with the relevant associations for geothermal energy and for heat pumps.

The application was relatively easy, carried out by the Bundesamt für Wirtschaft (Federal Office of Economy) on a rather simple form. Acceptance was sufficiently quick to allow for waiting for the granting before starting the construction, as otherwise the support would be lost. There was a good success of this programme, leading to a modest, but relatively stable market development. About 1000 new plants for geothermal application (the scheme covered also other heat sources) have been supported each year, only a fraction of all new plants built. The market development continued even after the end of that programme:



Geothermal heat pump sales in Germany 1996-2003 (after data from BWP, IZW, VdEW)

There where a few drabacks of that programme:
limited financial amount per year, as to the federal budget restrictions

- in the fall of each year, no more money available
- support had to be applied for and granted before start of construction, but construction had to end in the same fiscal year (calendar year); this led to certain problems when construction delays occured

- At the end of the programme, the phase-out was too sudden. The market development continued, but mainly because only part of the projects had been financed, because some support schemes on state level took over (e.g,. the REN-programme in Nordrhein-Westfalen), and because the economics of the systems had improved.

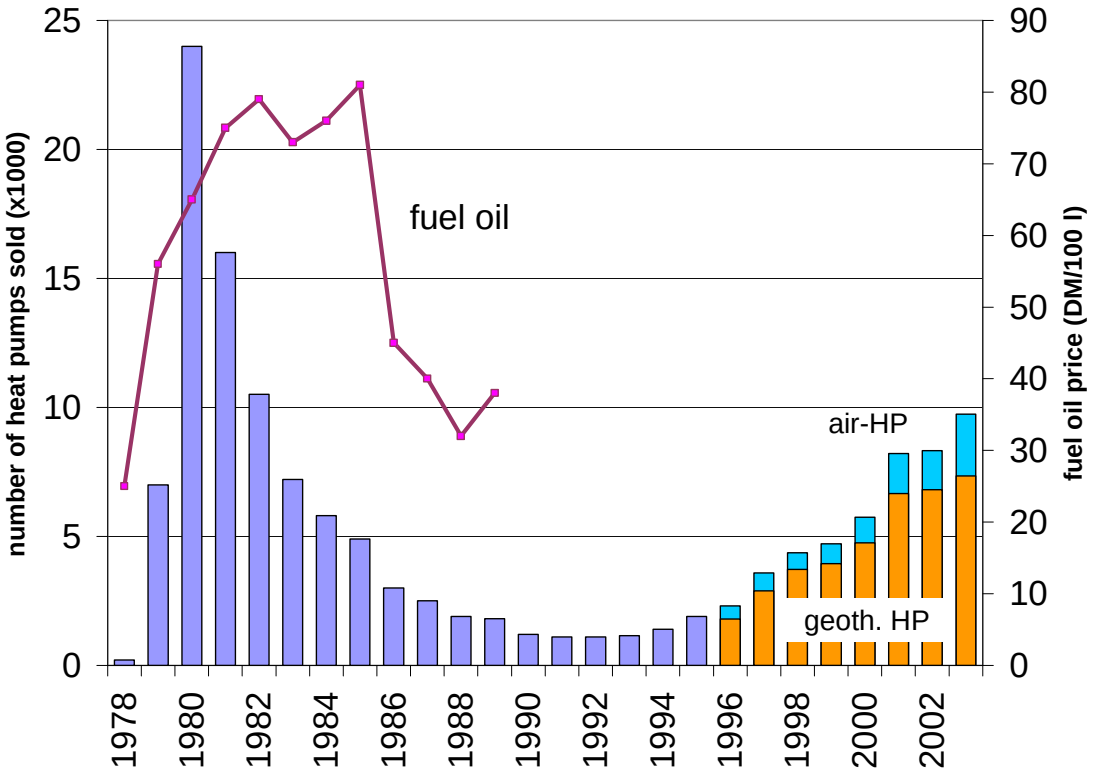
The latter was the main positive result of the programme. However, it also had to be accompanied by technical development, of which the relevant result is the guideline VDI 4640 “Thermal Use of the Underground”, issued first in 1998.
This kind of technical advise and support was crucial to not only achieve increasing numbers, but also increasing efficiency and quality.

The heat pump market :
While the market introduction of heat pumps in the USA started just after the second world war (popular were primary heating pumps which could be changed from cooling in summer times to heating in winter times) there were just a few systems in Germany in the 50’s, mostly for agricultural milk cooling and simultaneous water heating.
At the end of the 60’s low investment costs for heating and warm water preparation were much more important for private investors than the energy costs. The market for heat pumps was therefore concentrated just on a few systems for heating swimming pools and for heatrecovery in large scaled buildings.
This changed after the oil crisis in 1973 and particularly in 1979. While in the year 1973 just around 500 heat pumps were sold, the number of electrical heat pumps sold particularly in single and multi family houses climbed up to more than 12000systems in the years 1980/81, a number that has never been reached again till today.

With the following fall of the oil price and because of many bad experiences caused by poorly installed systems the heat pump fell into disrepute and the market collapsed again at the end of the 80’s.
It stagnated for several years at just 500 sold systems a year. At the beginning of the 90’s the thermodynamic heating with heat pumps as a contribution to environmental protection became more important caused by the realization that the CO_2 emissions influence the greenhouse effect and the resulting change of the climate.

Supportive measures of the Federal Government, its counties and many utilities, the slowly climbing oil prices and the foundation of both the German Geothermal Association (GtV) and the German Heat Pump Association (BWP) led to a revival of the heat pump market. Sales figures recovered slowly and achieved good rates of increase.

The following figure shows the heat pump sales in general, until 1995 all heat pumps, from 1996 on divided into air heat pumps and geothermal heat pumps. In the boom around 1980, most of the heat pumps used just air as heat source. .



Heat pump sales in Germany, after date from Zaugg (1993), IZW and BWP

As in Austria, Germany also suffered the oil price shocks in the 70's, which generated the first boom for heat pumps. The high prices for fossil energies and the simple possibility of combining the existing oil boiler with a heat pump to decrease heating costs where the main reasons. As previously mentioned, the technology in Germany was unsuccessful mainly due to quality-problems and installation mistakes. After the fall of oil prices, the market collapsed. The heat pump market did not recover until the beginning of the 90's, but since then it has achieved positive sales figures.
What was the reason why the heat pump became interesting at this time? First of all the basic conditions for using heat pumps in view of building standards had been clearly improved; secondly the acceptance and the interest in ecological, energy efficient technologies were much higher than in the 70's. But also the problem with the greenhouse effect and the associated necessity to save CO_2 emissions were already a topic. The energy utilities recognized this potential and saw a possibility to come into the heat market with the help of the heat pump. The utilities had been supported by the heat pump producers, which continued to exist throughout the bad years by supplying, in particular, the Austrian and Swiss heat pump market.

The current heat pump market
The high energy prices of the last few years and the fact that the prices for electricity are more stable than the oil and gas prices have strengthened the German heat pump market. This development is recognizable in the sales figures of the recent years. Since the liberalization of the electricity market the utilities had to withdraw themselves from active lobbying activities in the field of heat pumps because of the cost pressure

between the competitors. Generally, the German utilities still think positive about the heat pump technology. In many supply areas special tariffs are offered for using heat pumps, but price politics are different from region to region.
Because of low running costs and relatively high costs of fossil fuels, an amortisation within acceptable periods of time is realistic. For low energy and passive houses the heat pump is ideally suited, because of their smaller heating loads. In future heat pumps for heat recovery in the area of ventilation systems will become more and more important.
The acceptance of heat pump technology and also the desire to participate in the field of sustainable energy politics are beginning to be embraced by end users, but this will only continue if economical aspects work in their favour.

The main barriers to overcome?

Main barriers during the seventies: At the beginning of heat pump technology the biggest barriers were definitely the lack of awareness of heat pump technology among end users and also the high investment costs.

Main barriers of the current market :
In the field of marketing the heating heat pump suffers from the supremacy of the overpowering boiler manufacturers. On principle market transparency, knowledge of the technology and availability of information for end users are still too little. To use electricity for heating applications meets with negative and sceptical attitude, because electric current as a heat producing energy is perceived to be unprofitable. The general more stable prices for electricity have positive effects on the heat pump sector. The investment costs for the heat pump, the heat source and the installation are still relatively high in comparison with conventional technologies.

The partly considerable high pricing pressure between the companies distorts the competition; small companies which are specialised in heat pump technology have often price disadvantages. When buying a heating system the price is still the most important consideration. Here the costs for a vertical collector reflect negatively on the total costs. With systems that use ground water there are sometimes problems during the procedures for permission to obtain water rights. Proceedings are often tedious and misjudged during the planning stage.

The trades have the key position in the realization of heat pump systems in the area of single family houses as they are the interface between supply and demand. The installation of heat pumps can be done by different trades (heating engineers, electricians, refrigeration) but the demand is directed mainly at heating engineers. But not every heating engineer is interested in installing a heat pump system, therefore many inquiries of clients are still diverted to conventional heating systems.

Technically qualified companies are often specialised in the installation of heat pumps and develop high sales figures. Outside the representatives of the different branches there is hardly any lobbying for the heat pump, since the liberalisation of the electricity market the utilities do not conduct any active promotion for heat pumps and also within the political arena there is no recognizable lobby for the heat pump.

Way to success

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 Nordrein-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.

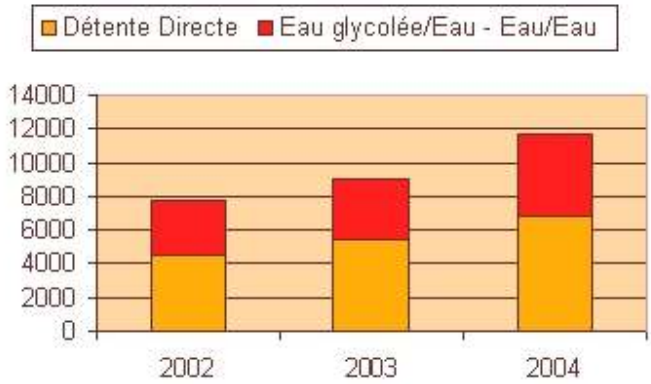
The share of market of these four provinces is about 78% of the whole country, although just 52% of the population live there.

FRANCE

The perspectives for France concerning the different incentives shows us that if Ecotax is unlikely, Tax credits are likely and Carbon credits are online.

The Incentives concerns firstly the DISTRICT HEATING (GDH) : The State support (40% of CI costs) to extension of existing GDH grid/facilities.
For the HEAT PUMPS (GHP), we have Subsidies for domestic use up to 20% of CI costs (existing dwellings) ; Bonus for 1800 € for ground source HPs ; and Fiscal incentives as Tax credit: up to 15% of actually incurred expenses (purchase only) or VAT reduction (from 19.6 to 5.5%).
For the Carbon credits, the Creation of a EU market for CC was 01/01/2005. In February 2005 – 1400 French sites identified 157 million quotas (i.e. tons) allocated for year 2005 (≥20 MWt installed). The GDH expectation is to have 15000 t saved per doublet i.e. ≅ 150 000 €/yr credit.

For few years, the ground source heat pump market for domestic use sees in France a big development, as we can see in other countries (Germany, Sweden, Austria…).
To have an idea, there are 180 000 new houses built in France each year, so there's a big potential. And in 2004, there were 11 700 GSHP sold (in comparison it was 700 in 1997).



In 2002 geothermal installed capacity in France was 4.3 MWe. There were 36, 500 geothermal heat pumps installed at the end of 2002 with a capacity of 541 MWth. France is the second largest geothermal country in Europe. In a recent report, ADEME assessed France's primary energy production using geothermal energy at nearly 128 000 toe (including 103 200 toe from the Ile-de-France region alone) for a capacity in the region of 330 MWth.

For very low temperature applications (geothermal heat pumps), the classification according to installed capacities is totally different from that for direct uses.
France comes in at third place (541 MWth) after Sweden and Germany. According to the AFPAC (French Heat Pump Association), the 2002 market represented 8 000 units (with average capacity included between 10 kW and 12 kW) for a cumulated installed total of 36 500 units (396 MWth).

So it exists different answers to explain this growth. The different incentives schemes could be one.

► It exists a tax reduction called "crédit d'impôt » dedicated to the sustainable development (energy efficiency and renewables). The authority in charge of this programme inside the Ministry of Finance is the department : DGEMP-DIDEME.

The finance law ' La loi de finances 2005' permitted this tax reduction. In order to reinforce the interest of this tax scheme for the house equipments, this measure is now targeted on the most energy efficient equipment and on equipment for renewable energy installations.

The tax reduction concerns the expenditures for certain equipments supplied by companies realising the works and providing an invoice, according to the legal conditions (article 90 of the loi de finances 2005). It concerns equipments for : heating, insulation, heat pumps for heating…

The tax breaks is 40 % for a heat pump. The GSHP needs to have a COP ≥3.

The maximum costs for an house is 8000 € for one person and 16000 € for a family.

►State-Region plan contracts (CPER) (2000-2006)

The "pluriannual" framework agreements between ADEME and the Regions for the period 2000-2006 is an annexe to the State-Region contracts in order to set concrete targets for the actions to be undertaken. In each of the 26 Regions a framework agreement has been signed by the Region, State ("Prefet" for the Region) and ADEME.

There are eight targeted programmes, dedicated to RES deployment, identified as the 6 key areas, and notably Geothermal heat pumps and Geothermal district heating :

- Geothermal energy (heat production from low enthalpy sources) is again considered as a promising area as the greenhouse effects (CO2 avoided emissions) are recognised ; geothermal heat pumps will enter a phase of dissemination after preliminary demonstration project being supported (2001-2003).

Financial resources to be involved for programme implementation :

Under the State-Region contracts, over the period 2000-2006, ADEME mobilises 535 M€, i.e. 75 M€ a year. Around 26% of this package is devoted to renewable energy projects, totalling over 135 M€ over the period as a whole. Over the period 2000-2006, the 26 Regional councils will mobilise 442 M€ and "structural" funds (EU origin) will mobilise a total package of 274 M€. The European rules governing state aid are taken into consideration at the implementation stage.

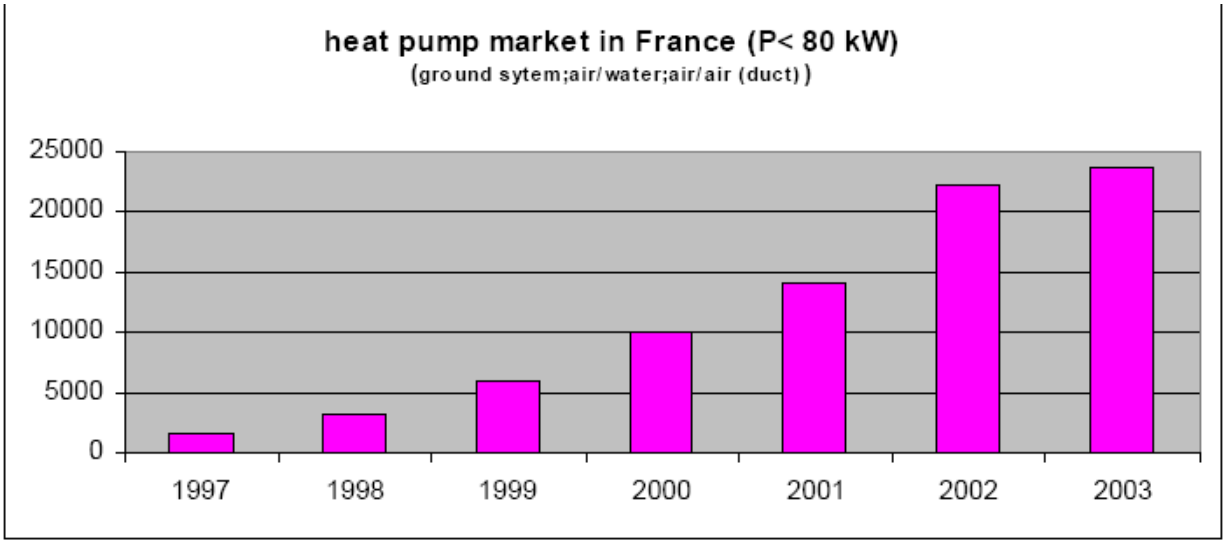
The general principle retained in the State-Regions Plan Contracts (CPER) is the equal funding of actions by ADEME and Region.

	1st area of actions - Direct Impacts by 2006	2nd area of actions - Indirect Impacts	3rd area of actions - additional Impacts
VIII- Geothermal energy (heat market focused through centralised and domestic end uses)	✓ 30 000 additional dwellings connected on existing geothermal district heating systems √ 10 demonstration projects launched before 2010, √ geothermal heat pumps promoted on the market(500 000 by 2010)		

► The FACE fund is a source of finance for investments in renewables and demand-side management in rural areas. The annual budget for FACE is about 15 million €). The majority of funds are spent on PV systems in rural areas, and aim to reduce either grid extensions or grid strengthening, via reducing peak demand or increasing stand-alone generation capacity. There is an investment subsidy of 4.6 € per installed W_p or 6.1€ in case of supply secured through a battery system. This subsidy was used in the calculation of the total feed-in tariff.
A private investment fund called FIDEME exists which invests in projects (mainly RES projects): the maximum financial share of 25% of the total project costs. ADEME is providing one third of the fund financing and private banks are providing two thirds. This idea is to promote investments according to classical financial appraisal techniques but with a higher risk acceptance (which is balanced by higher commissions and interest rates).

► In the heat pump technology for house heating (out of split systems), ~85% are French national manufacturers, ~5% French brands with imports, and ~10% foreign brands. Heat pump systems permits people to claim back part of their income tax. ANAH (National Agency for Existing Building) has a grant for heat pump systems up to 900€ (for air/water system) and 1800€ (for ground/water); for the latter, ADEME (Agency of Environment and Demand Side Management) can add subsidies in some cases (for demonstration for tertiary and collective dwelling building). EDF, which is in France at the moment about the only electricity supplier, can grant a loan with a low rate (for high quality (label) electrical systems, including heat pumps. EDF is also active in heat pump activities: tests of innovative systems or new refrigerants, free advice to customers who want to install a heat pump. For heat pump systems taking heat from aquifer, Aquapac proposes an insurance policy that guarantees against the lack of resources for 10 years.

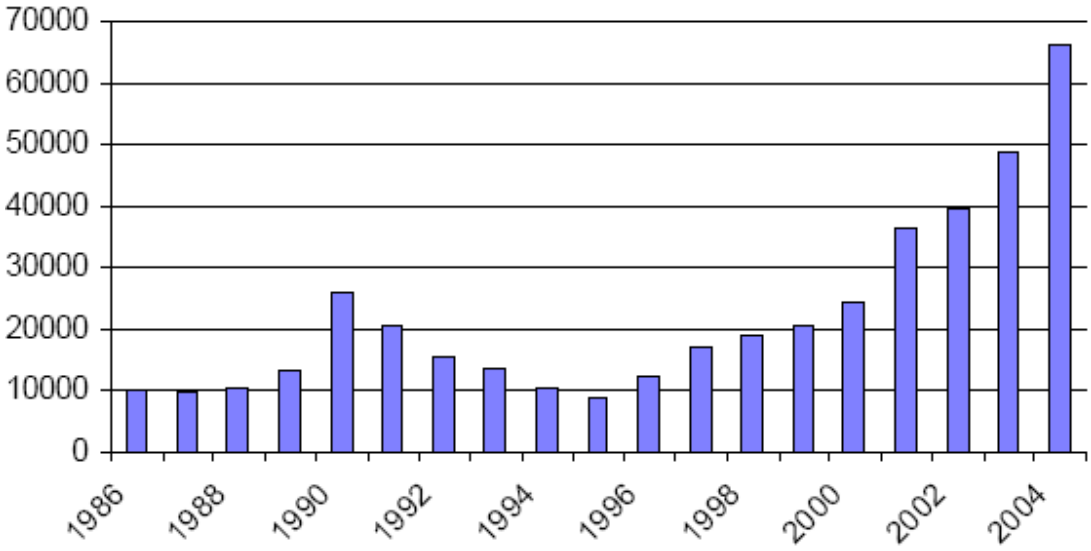
► Taken as a whole, these initiatives, together with research activities, efforts to simplify administrative procedures and adapt current legislation and the considerable financial sources clearly demonstrate a change in attitude and a likely shift in trends over the coming years.



SWEDEN

The market for domestic heat pumps in Sweden has during the last decade gone through an enormous development (see figure). The total sales of domestic heat pumps reached over 66 thousand units 2004 (Swedish Heat Pump Association 2005). All together more than 100 thousand heat pumps were thus sold in Sweden 2004, a country consisting of approximately 1.6 million single-family houses. Due to escalating price of oil and electricity in conjunction with the increase on energy related taxes the market for heat pumps continuous to grow at a high pace.

Heat pump market development in Sweden 1994-2004 (Swedish Heat Pump Association 2005)



At the beginning of the eighties generous subsidies and a lot of talk about energy crises made it easy to market heat pumps. Subsidies were given in the form of interest free state loans. This was a time when the market was invaded by a large number of fortune seekers, offering products often of poor quality and promises of enormous savings, which the installations never could achieve. All this led to a large number of failed installations and the market lost almost all credibility.

1984 the market reached a peak, but then because of poor reputation the market was stricken at the same time as the subsidies were withdrawn and the market dropped. The fact that oil prices at this time were decreasing contributed to the market decline. Only a very small number of manufacturers survived this period.

It wasn't until the end of the eighties when Sweden was reaching the top of the economic boom that the market recovered. This was helped by increasing oil prices and the fact there were a large number of houses being built.

Then a recession hit Sweden in the beginning of the nineties, people had little hope for the future and even less interest for heat pumps. There were hardly any houses built and the market dropped once again. The change in sales trend is a result of the ending recession and a successful heat pump competition that received a lot of good publicity.

Current market situation

The Swedish heat pump market is very strong at the moment. Nearly 40 thousand units were sold in the year 2002 and there are no signs of market decline, in fact the market has shown strong growth ever since 1995. As previously mentioned the Swedish building stock of single-family houses is old with relatively high demands for heating. This fact gives the opportunity for the relatively expensive ground source heat pumps to become more cost effective than the cost of ever-rising bills from electricity- and oil suppliers.
The Swedish heat pump market is currently prospering as oil burners and electric boilers are replaced by heat pumps at a high rate. Substitute products such as district heating and wood pellet burners that benefits from lower initial cost, challenge the heat pump.
The Swedish heat pump market is now self-sustaining and has reached a level where heat pump programs initiated by authorities are welcomed but not indispensable. It has however been a bumpy ride for the manufacturers that have endured the market development. The preferred system solution has evolved over the years.
Today we see that integrated ground source heat pumps (unit including domestic hot water container and distribution pumps) dominate the refurbishment segment and exhaust air heat pumps dominate the segment of new construction.

Future perspectives

The Swedish heat pump market today is very successful, Sweden is one of the countries where the technology is not only a curiosity. The heat pump technology is a real competitor to conventional heating systems. The Swedish market is in a position were it is self sustainable, without the need for governmental support. The heat pump technology is today a “conventional” heating system and nobody needs convincing about the efficiency and the functionality of this technology. Therefore, in the future the heat pump technology would also be an important part of the Swedish heating market; even though the heat pump would receive more competition from other alternative heating systems (e.g. biomass).

Why the time was ripe for the heat pump technology As in the other countries during the oil price shock in the eighties people were looking for alternatives to conventional oil boilers. The installation of heat pumps became an interesting alternative, because of the low operating cost due to low electricity prices and the relatively high cost of oil, heat pumps were also a fully automatic heating system and the required space for heat pump installation was little. The implementation of financial incentives by the government for replacing direct electric or fuel heating was also an incentive for the heat pump technology. The environmental policy of Europe was also a driving force. Under the pressure of environmental requirements and in particular the reduction of CO2 released into atmosphere, the development of the heat pump market has, since the beginning of the 1990s, been given a fresh impetus.

What were the main barriers to overcome The predominance of water type central heating systems and direct electrical systems without hydronic heat distribution and the low degree of development in air conditioning systems in Europe meant that the conditions for replacing old systems by heat pumps were technically difficult and that the qualification of plumbers for installing these type of products were non-existent.

Furthermore there was no ecological awareness for reducing energy consumption and for the use of renewable energy systems in the population. People could not imagine how such a machine could heat the house with the cold earth and they were sceptical about the new technology.

Way to success

Governmental subsidies were given from the year 1981 to the year 1991 financial grants for heat pump installations were available. The form of subsidies has varied in type and size during the years. In the 1980s, subsidies were available for single and multifamily housing facilities, but during the 90s they have been available mostly for single family dwellings.
Sweden has had the following types of subsidies over the years:

- Loans with special interest subventions for single and multifamily houses
- Cash contributions to multifamily housing installation, dependent on the number of installations
- Cash contributions to multifamily housing installation, dependent on the total costs of installation
- Income tax reduction for single house residents equivalent to a certain percentage of the total cost up to a fixed amount (renovation subsidy)

The different subsidies have had a different effect on the market. The first two types aimed to increase the number of heat pump installation while the third aimed to stimulate the conversion of direct electric heated buildings into water loop systems and the fourth subvention aimed to stimulate the overall building industry and was valid for any kind of investment concerning the building fabric or the heating system.
The subsidies contributed to an increase of heat pumps sales, but they had to be carefully drafted. If the subsidies in Sweden had been drafted with better judgement from the beginning the effects could have been much more powerful and the establishment and growth of a functioning heat pump industry would have been faster.

Alternatives to subsidies

- Legislation, massive training of the market players and extensive long-term marketing of the technology can be alternatives to subsidies to hasten the market transformation for the heat pumping techniques.
- Other governmental support The Swedish government has followed an active heat pump development policy. Beside the subsidies, the Swedish government was also active in the field of communication and Information. Efforts were made, not only in technical publications, but also and above all in the general press and on television, an effort which had a very strong impact on market development. In Sweden, heat pumps are now considered a «natural heating» solution.
- Electricity utility Vattenfall The electricity utility Vattenfall was especially dedicated in the field of heat pumps. They have financed manufacturers for research and development in the field of heat pump technology and they worked together with the energy engineer association and the plumbing association. Furthermore they have accompanied the movement through the setting up of a heat pump promotion program, and providing financial incentives with a view to reducing investment costs.

SLOVENIA

Legislation basis for the implementation of active policy on RES and efficient energy use is the Energy act from 1999. In the year 1996 the Resolution of strategy of use and supply of Slovenia with energy was prepared which was substituted in 2004 with Resolution of national energetic programme. The late programme implements all the goals set by the European Commission in White Paper COM/97/599 and Directive 2001/77/EC of the European Parliament and of the Council. Fundamental orientation in the field of the RES is to reach the 12 % share of RES in the primary energy.

For the attainment of this objective the following goals are set up in the individual domains:

- increase of the share of the RES in the heat supply from 22 % in 2002 to 25 % until 2010, above all with the change of liquid fuels,

The energy act determines programmes and instruments, respectively, which are used for encouragement of the RES and efficiency energy use. That is the programs of education, public informing, energy consulting, stimulation of the energy overviews, stimulation of community energy concepts, preparation of standards and technical measures, fiscal measures, financial and other stimulating forms.

The two Regulatory Autorithy in charge if Renewable Energy in Slovenia are :
. Ministy of the Environment and Spatial planning and Environmental agency of the Republic of Slovenia (water act, environment act)
. Ministry of the Economy, Ministy of the Environment and Spatial planning and Directorate for Energy (mining act, energy act)

The Financial Support Tools are :

- Subventions and loans for development of new geothermal locations (Public Funds)
- Subventions for heat pumps installation, promotion, education (Agency for Efficient use and Renewable energy Resources)
- Suported price for electricity from geothermal resources, guaranteed sale

Financial Support Tools

There isn't any tax reduction or tax exceptions for companies in geothermal energy use. There is no tax reduction for exploratory drilling or any other research, connected to geothermal energy use. The government supports the use of geothermal energy through different projects where few leading agencies are involved in geothermal development. In recent years the government funding improved.

For example, in years 2004/05 Public Fund of the Republic of Slovenia for Regional Development and Preservation of the Settlement of Slovene Rural Areas will support eight geothermal projects (drilling for exploration wells) with 0.8 million € funding and 0.6 million € loans (estimate that this is half of the cost for all eight research boreholes). At least half of this projects are considered risky (wild cat boreholes) in regions with low to moderate geothermal potential. But none out of four already finished projects are considered negative after preliminary testing.

Under the patronage of the Ministry for Environment and Spatial planning both the Agency for Efficient use and Renewable energy resources (AURE in Slovene) and the Ecological Development Fund of Slovenia (ECO – fund) are active.

In the year 2004 AURE financial support for investments in the domestic sector, and notably : heat pumps for central space heating (22) and heating of sanitary water – mostly air based (564), and company or public sector (geothermal borehole (1), heat pumps (10)) reached the value of 1.9 million €, that stimulated in the overall 9.3 million € of investment.

Ecological Development Fund of Slovenia (ECO – fund) was established in the year 1994. It is a public fund, which operates with the capital from state budget, World Bank and European Investing Bank loans, privatization funds and PHARE funds. ECO – fund at present credits mostly water supply systems, sewage systems and waste treatment plant, etc.
It supports the use of geothermal energy as well, but there hasn't been much inquiry for crediting from the users. The founder, Ministry for Environment and Spatial planning, considers extending the fund activities to cover also the risky investments into environmental technologies as i.e. FIDEME in France and Green Investment Fund in Netherlands. The only irreparable part of funds is the subsidized part of interest rate. In the year 2004 the Eco – fund lent 20 million €.

Financial Burden

There are two legislation acts that regulate the exploitation fees (water act and mining act) and there are also several regulations which regulate the environmental tax.

The terms for the thermal water concessions according the water act are still in preparation. One of discussed possibility is that concession should be proportional to extracted water quantity and to heat quantity that could originate from thermal water that would cool down by conduction in the environment with the constant temperature of 285 K. This potential energy approach is being introduced to promote the efficient use of the geothermal water or re-injection.
The concession height is equal to sum of annual quantity and annual heat of extracted water. The concession value for quantity unit of extracted thermal water is equal to 3 % of average sales price for drinking water from public water network for drinking water supply, while for heat unit of extracted thermal water it is equal to 3 % of average sales price for heat, that originate with combustion of extra light oil for heating purpose. Average prices for drinking water and extra light oil is determinated by the minister, competent for environment, until December 31 for the next year.

The mining right for geothermal energy utilization is calculated as follows. For one m^3 of exploited geothermal water 5 points are prescribed, and the mining rights are 2 % from 5 points. The value of one point in year 2005 is 1.216 SIT (0.5 €c). The measurement unit is not appropriate, because the density of hot water or vapour is considerably different from cold water. At the present there is no conflict, because there isn't any geothermal energy concessionaire following the mining legislation. In the future it should be changed to kg as is usual for geothermal industry measurements. Additionally to mining rights one should pay exploration and exploitation area fee.

Environmental tax is paid for pollution which is a consequence of draining industrial, communal or precipitate waste water into sewage system, direct in surface water or indirect into the groundwater. Height of the tax is defined by the number of pollution load units. Load unit number is proportional to quantity of waste water and the load factors which depend on drainage mode (with or without waste treatment plant, groundwater, direct in surface water,..).

Good and Bad Experience with Geothermal Energy Use

Regulation of the geothermal energy exploration and utilization field in Slovenia is still in preparation phase. There was some competence interference between water and mining act; by now there is no problem anymore.
The public is still uninformed about opportunity to use the geothermal energy instead of conventional. Much of work waits to be done in the promotion and informing the public.

The exact procedure should be written about the issues in one guide : how to manage the geothermal project, where permission should be got and the appropriate order of actions necessary to achieve the certain results, who is responsible for supervision and control of the project and what financial stimulation could be got.

Working in geothermal exploration for several years we observe that mainly private investors without necessary experience are not aware that the first proposal from geothermal consultant or technology provider should be examined carefully. One should take second opinion or revision of the project before beginning of exploration. It is frequently that borehole is drilled first without any other research (geothermal reconnaissance, geophysical research, etc.). Result is often negative borehole and negative publicity on geothermal energy. One bad example adverts several potential investors, on the contrary positive borehole attracts new investors.

At the end we show an example of the subsurface temperature map, which is use for planning of the geothermal energy exploration and utilization. The map is autonomous; no data from the adjacent countries are used. In this year a proposal for the Transtherm project is made in the Interreg IIIa SLO-AUT programme in which the geothermal data of border regions between Slovenia and Austria will be exchanged.

This is possible because of the basis of long term cooperation with Austrian colleagues certain confidence was established. Result of the project (if we succeed with application) will be better geothermal maps of both Slovenia and Austria, the common working (open only to experts) and public geothermal databases and the map of potentially areas for geothermal exploration. In the future the data should be exchanged with all neighbouring states; we think that this is good approach even for all other EU member and candidate states.

Heat Pump

In recent years, the government (MOPE) intervened in the heat pump market with its specialised agency (AURE). They prepared calls for applications of subsidies to individuals (domestic applicants) to install a heat pump in their house.

Subsidies for domestic applicants were according to usage divided into :

- Heat pumps for preparation of hot sanitary water and
- Heat pumps for heating of buildings (mostly single houses)

Subsidies were also issued and assigned for installation of industrial heat pumps. With this intervention, the government has strongly increased the interest in the use of heat pumps. Unfortunately, it is estimated that the market has developed sufficiently, and thus future subsidies are not regarded as necessary any more.

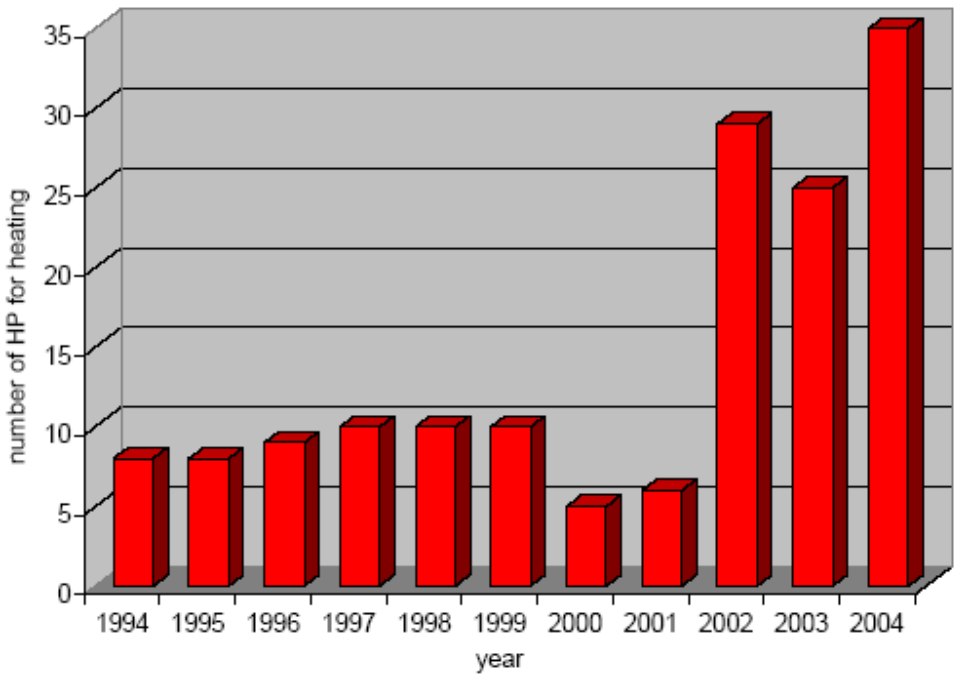
Governmental support

MOPE agency, together with its specialised AURE agency, has prepared calls for applications (in the years 2000-2004) to subsidise the efficient use of energy and renewable energy sources.
The call for applications for the year 2004, which was intended for domestic applicants, has anticipated non-returnable funds:

- for the preparation of sanitary water in the amount of 45,000 SIT (~€190) or up to 40%
- for the heating of buildings in the amount of 500,000 SIT (~€2,100) or up to 40%.

Previous calls for applications anticipated higher non-returnable funds for preparation of sanitary water (90,000 SIT ~ €380).
In the year 2003, 396 heat pumps for preparation of sanitary water for households were subsidised and 12 heat pumps for the heating of buildings. The total amount of subsidies for households was 40,000,000 SIT (~€170.000). As to the industry in the year 2003, 10 heat pumps were installed with the help of subsidies in the total amount of 26,000,000 SIT (~€110.000), which on average represented 27% of the total investment.

Number of heat pumps for heating (households)



AUSTRIA

Strategies by the Government

Based on the IEA Strategy Study and its own Energy Report the Austrian Government decided to support energy saving measures, especially in the field of building technologies. Such measures were the improvement of the thermal insulation of buildings, solar thermal systems, biomass boilers and heat pumps. The subsidy programme was based on tax deduction, an adult could deduct ATS 10,000.- (€ 727,-) per year, a child ATS 5,000.- (€ 363,-) from the investment cost of one of the technologies mentioned above.
As the sales figures show this programme was a success, at least in the first two years. But what happened in these two years? Encouraged by the generous subsidies many people wanted a heat pump, but not all of the companies which offered heat pumps were serious. They installed systems without any knowledge of system layout and they promised their costumers energy savings and energy cost savings far removed from reality.
The market reacted very fast, the sales figures decreased quickly to a very low level and only the serious companies with reliable products and trained installers survived this market break down.
This experience shows that the subsidy itself helps to increase sales. The investment cost becomes lower and the profitability gets higher, which brings greater business opportunities. The subsidies also work in an “irrational manner”, the customer/investor buys the product because he feels that he can not "afford" to miss out on a governmental subsidy.
The support of a technology only with subsidies is not target oriented because it could result in an undesired effect. Therefore it is important to couple the subsidies on the observation of quality standards.

Subsidies for heat pumps

In Austria there are different subsidies in each of the nine federal states. The most common form of subsidies is direct financial grant, but in some regions there are also subsidies in form of cheap credits or grant for interests existing.
Additional to the subsidies mentioned in the Table most of the utilities have also special prices for electricity. The information mentioned above is from the Austrian heat pump association.

Wien	direct financial grant in the amount of 2000 €
Vorarlberg	subsidies depends on the heat source: -air: 700 € -water and earth with horizontal collectors: 1200€ -earth with vertical collectors: 1600 €
Niederösterreich	heat pump for hot water supply: 1100€ heating heat pump: 2200 €
Burgenland	heat pump for hot water supply: 750€ heating heat pump: 1800 €
Steiermark	cheap credits for heat pumps
Salzburg:	174 € per kW electrical power
Tirol:	maximal 3270 €; if the heat pump has no DACH quality label, or the installer have no certification the subsidy will be reduced
Kärnten:	cheap credits for heat pumps
Oberösterreich	heat pump for hot water supply: 370 € heating heat pump (air as heat source): 1500 € heating heat pump (water or earth as heat source): 2200 €

Success Story

In the 70's in Japan and in the USA the marketing of heat pumps began.
The Austrian heat pump market started after the second oil price shock. After reaching a peak in installations in 1981, the market collapsed and the sales figures stabilized at a lower level and dropped again at the end of the eighties. In the early nineties the heat pump market was recovering and since then has grown steadily.

At the beginning of the market development the price ratio of electricity/oil (oil was the main fuel used for heating purposes) was somewhere in the range of 2:5, and subsidies were based on a tax deduction model.
The results of these positive basic conditions were a peak in heat pump sales and installations, but also a lot of failing systems. The main reason for these failing systems was not the heat pump unit itself; it was mostly incorrect integration of a heat pump unit into a hydraulic system. Due to a lack of information and experience the system integration of heat pumps was carried out in much the same way as the integration of oil boilers.

After an initial peak at the beginning of the eighties the market stabilised. The remaining companies – many of the companies of the first phase disappeared from the market - had learned valuable lessons.
The most successful region was the supply region of OKA, a utility which has studied heat pump systems and which has supported customers, not financially, but in the case of failing systems. This region, a relatively small part of Austria, still accounts for about 50 % of the total heat pump installations.
In 1985 two things happened : the oil price dropped and government subsidies were cancelled. Due to the high investment costs and the falling prices of fossil oil, bivalent systems, which had held the main market shares, were no longer cost effective, and manufacturers and installers had to concentrate on monovalent systems for new buildings.
In addition to the use of ground water systems, ground was introduced as a heat source and with secondary loop systems, direct expansion systems started dominating the market because of their higher efficiency. Since the early nineties the heat pump market has had a slow, but steadily rising development. The ground became the main heat

source, and due to a better framework (i.e. better insulated houses, improved compressors and heat exchangers) Seasonal Performance Factors in the range of 4 plus had been achieved relatively quickly, especially with direct expansion systems.

Also the government recognised the requirement for a change in the energy policy in terms of the import dependency of Austria.
So subsidies based on a tax deduction model were implemented for all renewable energy technologies and also for heat pumps. Due to price ratio of electricity/oil and the subsidies given from the government, heat pumps were a very attractive alternative to oil boilers. OKA, the electric utility of Upper Austria, has recognised the potential of heat pump technology and started to actively support this technology. As a result of environmental requirements and in particular the reduction of CO2 released into the atmosphere, the development of the heat pump market has been given a boost since the beginning of the 1990's.

Current situation : Heat pump market

Now sales figures of heat pumps for space heating in the residential sector are steadily rising. Reasons for this development can be found in the activities of the Austrian heat pump association LGW, in the increasing quality of the systems and in the rising awareness of the end users. The main market shares are in new single-family houses. The figure shows that in Austria the market share of direct-expansion ground-coupled heat pumps is almost 43,4 %.
Presently in Austria more than 159,698 heat pump units are in operation, about 119.929 heat pump water heaters and 39.769 heat pumps for heating purposes. The installed thermal capacity is about 833,5 MW, the annual heat delivery 1.972,6 GWh, corresponding to an oil equivalent of 264.637 t/yr.; the CO2 emission reduction counts for 781,000 t/yr., based on the electricity generation mix in Austria and oil-fired boilers.

The main barriers

One of the biggest problems at the beginning of the market development in the eighties was the lack of information for the end users. During this stage it was especially difficult to convince people of the possibility to heat the house with the "cold" earth or air. But at the same time due to the high oil prices people were looking for alternative systems with lower running costs than conventional oil boilers.
Therefore a heat pump was a good option and a few people overcame their reservations and tried the new technology. Consequently, the first promotion work was done by word of mouth, the rest was done by the activities of the utilities and by the governmental grants for renewable systems.
So the market demand for heat pumps was rising fast, but companies had very little experience with this technology and there were few products on the market. This situation created the following developments :

- A few serious companies started production of heat pumps and they also started internal training programs for the installers with whom they were in partnership.

- Apart from these serious companies, many small companies motivated by favourable conditions, were founded by those from a refrigeration background. These refrigeration technicians knew how a refrigeration cycle, i.e. a heat pump unit, should be designed, but often did not know anything about heating technology and especially hydronic heating systems.

- Installers knew how conventional hydronic heating system work, but knew little about the characteristics of heat pumps and how to size and integrate a heat pump into such a system.

Too many failures occurred during the start-up period of the market by all parties involved and so the reputation of heat pump systems was destroyed. The market reacted very quickly, and the serious companies with reliable products and trained installers survived this market break down.
At this initial phase electric utilities were split up into two groups :
. The larger group saw in the heat pump a competitor for direct electric heating with the disadvantage of less electricity consumption; they fought against this technology.
. The smaller, farsighted group saw in the heat pump a new interesting potential market, the market of fossil fuel fired hydronic systems, and they started to support heat pumps.

The rapid drop in oil prices in 1985 combined with the ending of the tax reduction subsidies in Austria reduced sales figures significantly (especially of bivalent outside air heat pump systems integrated into high-temperature hydronic heat distribution systems). Due to their low Seasonal Performance Factors the operation of the oil-fired system alone became cheaper than the operation of the bivalent outside air system.
After the oil price shocks, when the price for fossil fuel was moderate the higher investment costs for heat pumps became one of the most serious barriers to the heat pump technology.

Way to success

Market strategies for the dissemination of heat pumps can be initiated by different bodies like the Government, electric utilities, heat pump manufacturers and distributors, and heat pump installers. The best precondition for the market introduction is, of course, if all these bodies and organisations work together; however, most commonly this goal cannot be achieved.
However, the development in the past shows, that market strategies have to be carried out very carefully, and it is not always money, which makes a strategy successful.

POLAND

At the moment, the basic sources of renewable energy in Poland are biomass and hydro. Geothermal energy, wind power and solar energy are of lower significance.
In the 1990.s they experienced a gradual increase of the share of RES. Among the contributing factors was notably the commissioning of two geothermal heating plants,

Geothermal waters have been used in Poland for a long time for therapeutic purposes. In recent years, the possibilities of using geothermal waters for heating purposes have been investigated. Whilst the technical potential of this resource has been examined in detail, there is a need for further investigation into the possibilities of re-injection of used geothermal waters back to the orogen. The resources of geothermal waters occur mainly in the Polish lowlands, particularly from Szczecin to Łódź, in the Grudziądz-Warsaw area and in the Carpathian Foreland.
At the moment, two geothermal installations are working in Poland. These are located in Bańska at the Tatra Foothills (4,5 MW, 70 MW planed), and in Pyrzyce near Szczecin (15 MW, 50 MW planned). Another installation (7.3 MW) in Mszczonów near Warsaw is about to be commissioned.
It is also expected that while the growth of the use of thermal collectors will accelerate considerably, that of geothermal technology will not be so fast.

Financing Renewable Energy Projects

The development of renewable energy projects is facing financial problems. These problems relate to the high investment costs although operational costs are relatively low. Given the current level of prices of fossil fuels, the above cost structure is the reason why the payback time of renewable energy projects is long. Another problem is that renewable energy equipment is typically manufactured by small and medium enterprises with low capital, who are often unable to survive in the current bank loan system if their financial resources are frozen. The lack of necessary know-how and experience in the formulation and financing of projects are yet further problems.

At the moment, there are a number of financial institutions supporting renewable energy sources. These institutions include: the National Fund for Environmental Protection and Water Management, EcoFund, Thermal Renovation Fund, and provincial funds for environment protection and water management. There are also financial organisations which may support renewable energy projects if these contribute to the development of rural areas . such organisations include the Foundation for Assistance Funds for Agriculture, State Treasury Agency for Agricultural Property, Agricultural Foundation. These institutions give preferential loans and grants which usually do not exceed 50% of the costs of the project.

Notwithstanding the funds for the development of the renewable energy sector which are available in Poland, the possibilities of utilising foreign financial sources are growing. Apart from the World Bank and recognised European banks financing large renewable energy projects, the European Commission programmes earmarked for specific purposes will become more and more important. The programmes in question include:

Altener II, Synergy, Life, 5th Framework Programme on Research, Technological Development, Demonstration and Promotion.
In many cases, the above funds and programmes make it possible to obtain grants for the preparation of investments and the construction of demonstration projects. In relation to the ongoing integration process with the European Union, the PHARE Programme as well as preaccession funds such as ISPA and SAPARD may be important. Apart from international funds, money for the development of the renewable energy sector may be generated from bilateral programmes for co-operation with Western countries, e.g. Denmark, Germany, Sweden, etc.
The possibilities of arranging financial support to the renewable energy sector in Poland have been presented :

Annex no. 4

Scenarios of RE technologies development for the year 2010 at 7.5% share of RE in the Primary Energy balance in 2010

Scenario - 7,5% of electric energy from RE, 2010.						Scenario - 9% of electric energy from RE, 2010.					Scenario - 12,5% of electric energy from RE, 2010.				
RE Technology	Additional power installed in the years 2000-2010, MW	Total annual production of electricity from RE in Poland in 2010, GWh	Total annual production of heat from RE in Poland 2010, TJ	Total energy production from RE in Poland in 2010, TJ	Share of energy produced from RE in 2010, %	Additional power installed in the years 2000-2010, MW	Total annual production of electricity from RE in Poland in 2010, GWh	Total annual production of heat from RE in Poland in 2010, TJ	Total energy production from RE in Poland, in 2010, TJ	Share of energy produced from RE in 2010, %	Additional power installed in the years 2000-2010, MW	Total annual production of electricity from RE in Poland in 2010, GWh	Total annual production of heat from RE in Poland in 2010, TJ	Total energy production from RE in Poland in 2010, TJ	Share of energy produced from RE in 2010, %
Geothermal heating stations	400	0	2400	2400	1,0	400	0	2400	2400	1,0	400	0	2400	2400	1,0

Type of support	Beneficiaries Investors	National institutions									Foreign institutions														
		Ecological funds and fundations						Agencies			European Union							UN			Bilateral funds				
		Investments						Technical support		R&D	Development and Policy		R&D		Infrastructure			Climate protection		Infra-structure	JI	Investments Technical support			
		EkoFundusz	NFOŚ	WFOŚ	BOŚ	Agricultural fund	Term. fund	PFE Foundation	FAPA	KBN	ATT	ALTENER II	SYNERGY	JOULE/ HERMIE	FP5	PHARE	ISPA, SAPARD	EIB/EBOIR	GEF	CIF	World Bank	Holland	Denmark DEPA	Germany FWPN	Sweden EAES	UK BK-HF
Loans	Local authorities*		√	√	√	√												√			√					
	R&D institutes		√								√															
	Entrepreneurs		√	√	√	√	√				√							√			√			√		
	Individuals		√	√	√	√	√																			
Grants	Local authorities*	√	√	√				√	√			√	√		√	√	√		√	√		√	√	√	√	√
	R&D organisations		√						√	√		√	√	√	√	√							√	√	√	√
	Entrepreneurs	√	√							√		√	√	√	√	√	√		√	√		√	√			
	Individuals	√	√									√			√	√						√	√			

Possibilities of obtaining financial support to renewable energy sector in Poland

Economic instruments enhancing economic viability of renewable energy sources
In the initial phase of the implementation of the Strategy investments in renewable energy sources should be supported mainly through earmarked funds, EU preaccession funds and structural funds, foreign support programmes, which should comply with the current regulations on the public support to private entrepreneurs and regional development.
Current tax relief to investments in agricultural production related to the purchase and installation of equipment for the utilisation of renewable energy sources. Act on Agricultural Tax from 15 November 1984, article No.13 (Official Journal from 1993, No. 94, point 431 with later amendments). Within state budget limitations when possible it

should considered to provide support to renewable energy investments, mainly through direct grants to be systematically phased out and grants to reduce interest rates of commercial bank loans, guarantees and bank warranties. These instruments should be in place until renewable energy sector is fully competitive on the market.

Barriers to the Development of Renewable Energy Sector

Currently, systems utilising renewable energy sources are often not economically viable in Poland. Financial mechanisms addressed directly to the independent producers of energy from renewable sources are insufficient, neither.
Existing law offers possibility of tax relief in case of investments in agricultural production related to the purchase and installation of equipment for the utilisation of renewable energy sources. Act on Agricultural Tax from 15 November 1984 (Official Journal from 1993, No. 94, point 431 with later amendments), but the addressees of this regulation are only the payers of the agricultural tax.
A traditional old-established custom of using coal as a main fuel, the former subsidising of the energy sector and low prices of conventional energy carriers significantly hindered the introduction of energy from renewable sources (with the exception of hydro power). Relatively high investment costs are a barrier difficult to overcome. In consideration of an economic aspect (on which a noticeable share of energy from renewable sources in the energy balance is dependent), one must recognise that a higher price of energy produced from renewable sources (compared with conventional ones), if it is used locally, may at least partially be offset against the costs of redundant transmission. However, in a number of cases the costs of reserving energy supply from a grid and/or gas network must be kept in mind. From the point of view of production costs, renewable energy technologies may be divided into three groups :

- Technologies with energy production costs lower than/comparable with costs or prices of conventional energy carriers to be replaced. The groups includes: air solar collectors (heat production cost PLN 20.2/GJ), small manually operated wood- and straw-fired boilers (heat production cost PLN 20.2-25/GJ), automatic straw-fired heating plants (heat production cost PLN 29.1/GJ), small hydroelectric power stations erected on existing dams (electricity production cost PLN 0.23/kWh), and landfill gas installations for generation of electricity (electricity production cost PLN 0.22/kWh).

- . Technologies which produce energy at costs higher than the national average price but may be competitive under the following conditions: available preferential loans and grants are taken advantage of, or projects are located in areas with the highest prices of conventional energy (caused by higher cost of transport, transfer and distribution of conventional energy carriers in rural and remote areas as well as by the higher costs of supplying energy to scattered consumers). The group comprises, inter alia, large wind power plants connected to the grid (electricity production cost PLN 0.51/kWh), automatic biomass heating plants (heat production cost PLN 33.2/GJ), and even the least economically viable photovoltaic technologies in special niche areas (e.g. power supply to marine navigational marking).

- The remaining technologies, which are unable to compete with the highest prices of energy generated in Poland in fossil fuel installations even if 50% of the total investment cost is covered by grants. The group includes: water solar collectors (heat production cost PLN 147.3/GJ), photovoltaic systems (electricity production cost PLN 8.89/kWh), small wind turbines connected to the grid (electricity production cost PLN 1.02/kWh), farm biogas plants for heat production (heat production cost PLN 51.1/GJ), geothermal heating plants (heat production cost PLN 61.8/GJ),

The following were the prices of heat and electricity in 1999 in Poland :

- electricity sold to households . PLN 0.261/kWh
- electricity sold to farms . PLN 0.266/kWh
- electricity sold to industry . PLN 0.123/kWh
- average grid selling price for electricity . PLN 0.215/kWh
- heat from the combined heat and power plants . PLN 26/GJ
- average selling price for centralised heat . PLN 24.90/GJ

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

The main barriers are legal and financial barriers, they include :

- the lack of regulations clearly defining a programme and policy concerning the utilisation of renewable energy sources;
- insufficient economic mechanisms in the state budget, including particularly tax mechanisms permitting adequate benefits from relatively high capital intensive investments in facilities, installations and plants for the generation of energy from renewable sources;
- the relatively high investment cost of renewable energy technology as well as high costs of works (e.g. hydro-geological surveys) necessary to obtain energy from renewable sources.

LUXEMBOURG

Règlement grand-ducal du 3 août 2005 : This legislation introduces a financial incentives for the persons using and acting in rational use of energy and promotion of renewables.

To summary, for projects in renewable energies, the Ministry of Environment accords subventions to private persons.
This programme is from 01/01/2005 to 31/12/2007. The applications have to be sent before 1st of march of each year following the investments.

SUBVENTIONS		
Summary of "investments" dossiers submitted in 2001 - 2004 (Situation at 24.1.2005)		
	Applications sent	**16669**
	Dossier needing more information	**1425**
	Dossier accepted	**9917**
	Dossier rejected	**190**
	Dossier in course	**5137**
Number and subventions accepted for geothermal installations and others (Situation at 24.1.2005)		
Type of installation	**Number**	**Subvention**
Energy Concept	22	13 000 €
Technical consultancy	7	600 €
Geothermal conversor	5	1 600 €
House with low energy	14	137 000 €
Passive house	5	88 900 €
Heat Pump	7	17 000 €
Connection to the heating system	8	13 000 €
Total:	**10 463**	**49 250 300 €**

Some cities have their own subventions for renewables. The energy agency and other public utilities supply technical consultancy to private persons for example concerning the heat pumps.

Description :

There are subventions in capital for rationale use of energy :

Beneficiary , examples :

- Connection to heating systems : 38.- euros by kW for a house (thermal power < 20 kW) and 15.- euros by kW for an apartment (thermal power < 12 kW).

- Heat pumps : Installation of HP for heating or sanitary hot water. Subvention up to 40% of effective costs, with a maximum of 4.000.- euros for an individual house. Apartments : 40% of effective costs, maximum = 4.000.- euros multiplied by number of apartments with a limit = 10.000.- euros.

The amount is decided for each project separately.

There are subventions for the renewable energies but we don't find no references to geothermal energy, only to heat pumps.

For the Heat Pump are eligible :

- the module of the HP;
- the connected installations, notably the heat exchangers;
- the technical study;
- the installation

The technical criteria imposed to the HP :

1. The HP have to be used only for heating and production of hot sanitary water. It doesn't be used for cooling.
2. The COP has to be more than 3,8;
3. The COP has to be calculated according to the norm VDI 4650 *«Berechnung von Wärmepumpen, Kurzfassung zur Berechnung der Jahresaufwandszahl von Wärmepumpenanlagen»*;
4. There's an application to complete and provide to the Ministry of Environment.

In analysing this support system for HP we see a lot of similarities with the schemes present in Germany for the programme 1995/99.
But the figures in the table show us that the heat pump market is still low. Why ?
The main explication is that a lack of awareness and of a state programme to inform people about geothermal heat pump, is a big barrier and not allow the subsidies to support the market.
Moreover, the lack of geothermal engineers and industries don't permit Luxembourg to disseminate information on this technology. The solution could be to create an organisation helping the Luxembourg State in this task.

OVERVIEW OF THE EUROPEAN SCHEMES

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

Our methodology proposed the connection of two categories of criteria.
Firstly, We tried to see the situation of the financial incentives schemes from a division of the support to :

- All the geothermal sector
- the district heating
- the heat pumps

Secondly, we distinguish the main economic instruments :

- supportive economic instruments :
- tax exemptions
- tax reductions
- favourable loans
- preferential direct subsidies
- indirect support schemes (funds : EIB, Regional or national programme on RES, EU structural funds…)
- guaranteed takeover prices, tariffs
- obligation on utilities to purchase these tariffs
- competitive tendering
- green certificates
- carbon credits, bonds
- other : geological risk coverage,…
- financial burden :
- mining royalty
- sewage penalty
- ground water exploitation fee
- environmental tax, levy
- other : fees for licensing,…

In the majority of the European territory, the financial supports to geothermal heating are only through indirect schemes. This situation is notably present in Hungary, Lithuania, Estonia, Ireland, Malta, Poland, Portugal, Spain, Cyprus, Latvia and Slovakia.

Than, various ministries can finance geothermal energy projects within their own administrative sector : Ministry of Energy, Ministry of Agriculture, Ministry of the Environment, Ministry of Economy, Ministry of Industry-Commerce-Tourism.
Energy aid is then a State aid granted on a discretionary basis.

We see also the creation of special funds dedicated to promote RES, notably in new EU member States : ECO-Fund in Slovenia and Bulgaria, State Environmental Fund in Czech Republic and Romania, National Environmental Protection Fund in Estonia and in Latvia, for Latvia also the Latvian Environmental Investment Fund, like in Lithuania, the EKOFUNDUSZ in Poland, KAC in Hungary, and FACE and FIDEME in France.

The main schemes offered are through the Cohesion Fund or EU structural funds.

For the energy sector and so geothermal energy, with the regional funds (EFRD…), the subsidies is between 15% to 85% of the total costs of the project. The EU just intervenes by a co financing, associated to the European Investment Bank (EIB) or national or local subsidies.
The regulations also encourage the use of part of the Community finance in a form other than direct assistance, such as, for example, repayable assistance, interest-rate subsidies or venture capital holdings. In such cases, the ceilings provided for can be increased by 10%.

The co financing from the European Investment Bank is limited for RES in general because loans are dedicated medium or large scale plants.
But in their priorities we can see the increase of its support to renewable energy with use of European Investment Fund venture capital, financing of low enthalpy geothermal energy developments, financing of the manufacture of industrial equipment and carbon credits (including green certificates).

Moreover, it's extremely rare to find a special support to district heating. Surely because it's necessary to have deep geothermal energy which is not present everywhere. In 'geothermal regions', the supports exist.

For example, in Toscana the regional programme on geothermal energy permits a financial support to district heating.
In the frame of the "2001 Financial Law" (Law 388/00), the Italian Government has taken further steps to promote renewables through:
· financial support to District Heating fuelled with geothermal fund creation, by setting aside 3 % of the income from the Carbon Tax;
· a specific fund for the Ministry of the Environment and Territory Protection, with €130 mover three years, for sustainable development including a greater use of RES. The government's measures also include Law N. 112/98, which transfers competencies to regional Governments on local energy planning and RES exploitation.

For the development of deep geothermal energy in some countries (The Netherlands,…) it is very important that the advantages of geothermal heating (zero nuisance levels, no visual impact…) will be demonstrated in a number of practical examples or pilot projects.

A contrario, the financial incentives schemes to develop heat pumps market are often presents in EU countries ; notably where geothermal energy is not at its primary stage.
In some countries financial support is dependent from the relevant region (Belgium, Germany, Austria…).

This support can be through direct subsidies to the installation of the HP, favourable loans, preferential direct subsidies, grants.

The development of these HP markets indicates a positive influence of state subsidies on HP installations in family houses or subsidies and low interest rates for credits for HP installations in commercial and industrial buildings.

Although heat pumps have been available in the UK for a long time, very few have so far been installed specifically for space heating in residential and commercial buildings, and the market penetration lags far behind most other countries in Europe.

The UK Government does however recognise the benefits of reduced carbon emissions from heat pumps and financial incentives are now available under several programmes. These incentives, coupled with increasing awareness of the benefits amongst potential installers and increasing choice of systems, have boosted the market for heat pumps, but it is still tiny compared to conventional gas boilers.

Heat pumps are promoted by the English Government through various bodies including:
- Clearskies Programme (support for demonstration projects)
- Energy Saving Trust/Energy Efficiency Best Practice in Housing (financial support and advice to householders)
- Action Energy (advice for businesses)

In general, the implementation of heat pumps derived particular benefit from subsidy programmes.

To balance this, we underline that this support could be limited by rules for subsidy assignment when they are highly restrictive and impossible in practice to meet (like in Czech Republic in 2003 and 2004).

The financial support to be efficient needs to be combined with other elements.
The lack of awareness of heat pump technologies and associated benefits is one of the main barrier. The lack of qualified installers and engineers in some countries is a big problem, with the quality of installation unpredictable with no trades taking overall responsibility for problems or poor system design.
In this case the solution could be to propose subsidies only for advanced systems or standard-certified geothermal energy installations.

At another level, a barrier could be the lack of commitment at the national policy making level regarding the acceleration of market take-up of renewable energy technologies.
The administrative barrier is an important point.
For example in Slovakia, a number of criteria used to select proposals which will be funded by state support programmes are very difficult to meet and *de facto* excludes potentially good projects. For example applicants for state funding may not have any debts. This severely limits the number of eligible private or public entities. Furthermore, the criteria might vary from a scheme to another. It is essential to review the conditions laid out by each of these schemes, and to prepare common criteria and a common methodology for the selection of proposals.

The gap between economic and market potential is smallest for geothermal energy, indicating that little state intervention is necessary to motivate the market actors into investing. For example in Hungary :

Table. Technically available potential of renewable energy sources, in TJ

Type	Technical potential	Current exploitation	Available potential
Geothermal energy	22,680	1,224	21,456

Source: Energy Policy of Slovak Republic, Ministry of Economy, 2000, updated by EGU for biomass, 2002.

The difference between the economic and market potential, is an important indicator for identifying energy policy targets and instruments .

Another example is provided by Spain. The energy-saving potential of Spain's geothermal resources located in the Canary Island is estimated at around 600 ktoe/yr. However, extremely limited interest has been shown in development of geothermal resources: only two projects producing 0.4 ktoe of heat have been initiated under the renewables portion of the PAEE plan, and no further plants are under construction. This is due to the delays in the construction of the most important of these geothermal plants in Madrid.
Unless increased interest in geothermal energy sources is shown, the government's target is extremely unlikely to be met.

CONCLUSIONS

Low energy prices, which do not fully reflect the external cost of the different energies, are still a significant barrier in some European countries. This is often related to the fact that even if a geothermal heating system is economically competitive, the energy cost difference may be too small to decide for this system. This is in spite of other benefits that a geothermal system offers, such as reduced CO2 emissions, more comfort etc. This barrier can only be overcome by offering incentives, grants, renewable energy tax benefits for heat pumps, exempted or reduced CO2 taxes etc.

The German example shows clearly how much these supportive tools can contribute to the high growth rate of renewables in a country with moderate natural setting.

In a lot of countries, indirect support schemes are the only financial incentives for geothermal energy.
EU structural funds are mainly used for geothermal heating in Central and Eastern Europe Countries and Italy.
In federal States, the financing programmes are regional (Austria, Germany).

In some countries, we don't have any references to geothermal energy in programmes on renewable energy, but it exists financial incentives for heat pumps (Denmark, Finland).

In Italy, geothermal energy is mainly present in region Toscana. In this region there are financing programme to develop this technology, but no national programme is a barrier to develop geothermal heating all over the country.

A contrario, in Greece an important national programme on RES permits to this country to develop a lot of projects in geothermal heating and cooling.

In the countries like Portugal, Spain, Ireland where the financial incentives schemes don't mentioned geothermal energy, we don't see no development of this technology.

Another barrier is found in Slovakia. It exists a programme to develop RES and notably geothermal energy, but the limited budget, the bureaucratic procedures and a lack of information about this technology are important barriers.
The budget is insufficient to meet requests from applicants to existing funds.. If a real and effective policy is to be implemented, a political commitment has to be made and resources allocated to release its objectives.

In many of the European countries it is expected that the heat pump market will annually increase by 10% or more during the next decade. Few countries expect a smaller increase. The attitude of the authorities to the use of heat pumps will be crucial.

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.

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