

## Geotraineret – A New European Initiative for Training and Education of Planners, Drillers and Installers of Geothermal Heat Pumps

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### ABSTRACT

The aim of the project "Geo-Education for a sustainable geothermal heating and cooling market", GEOTRAINERET, is to develop the training of professionals involved in Ground Source Heat Pump installations (GSHP). From the different groups of professionals involved in a GSHP, the GEOTRAINERET project is focused on two target groups: designers (who undertake feasibility studies including geology) and drillers (who make the boreholes and insert the tubes). The project includes the creation of an EU-wide certification scheme for both planners and installers of GSHP. Another project activity will be the definition and development assistance for the necessary EU-wide technical standards.

Visible results of the project will be the curricula, learning tools, manuals, an e-learning platform for the designers and the trainers, and several courses to be launched during the project duration. The goal, however, is to co-operate with the relevant professional associations, teaching institutions, etc. in order to establish a training and education framework going farther and lasting longer than the project – and providing the human resources necessary to sustain a sound and healthy growth of the GSHP market in Europe.

### 1. INTRODUCTION

The European Federation of Geologists is the Co-ordinator of a large group of partners which has made a successful application to the European Commission, "Intelligent Energy – Europe" Programme, for a grant to run a project for the training of professionals to install ground source heat pumps across Europe.

Ground Source Heat Pumps, GSHP, contribute greatly to energy saving and emission reduction. In Europe, a sustainable market has only been established in some countries like Sweden, Switzerland, Germany and Austria. Research in Europe shows that one of the barriers to a sustainable and growing geothermal market is the lack of appropriate skilled personnel; quality of design and work are not always satisfactory. Furthermore, to keep quality up, a certification programme for the GSHP workforce is required. The objective of this project is to develop a European Education programme to go towards the certification of the workforce involved in geothermal installations. It will prepare an education programme, didactic materials, training courses, and develop an e-learning platform. Training structures in 8 EU countries will be established for professionals of the geothermal

sector. A European certification framework will be proposed. Standards and codes will be suggested to permit a certain harmonization.

The need for good work is evident when looking back at the heat pump industry. With the second oil price crisis in 1980, heat pump sales skyrocketed, as people were asking for energy efficient heating systems. However, with the oil price still high, heat pump sales collapsed shortly after the peak year, 1980 (Fig. 1a and 1b). So clearly not the economic circumstances, but a frequent lack of quality and experience in both the heat pump manufacturing and the system installation created certain resentment against that technology. With the oil prices rising again in the last years, another GSHP boom can be seen, and it is up to us to make sure that the same does not happen as in the early 1980s.

The main goal of the project is to promote geothermal energy in training geothermal installers, this removing one of the main barriers for Geothermal Energy on H-&C in many European Countries. The results of the project will be a European Certification to support and improve the quality of geothermal installations, with an Education programme to support a Continual Professional Development (CPD) for Earth Science Experts and Drilling Professionals.

An international platform of experts on Geothermal Energy H-&C will be established to provide the knowledge required for education in this area by Training Courses and a European E-learning platform for shallow geothermal applications.

The project will also improve the access to geological data needed for the design of GSHP installations, and propose high standards on the professional needs for Geothermal Energy Heating and Cooling in Europe.

GEOTRAINERET is divided into phases permitting the creation of an education programme to provide a certification framework and to train geothermal installers.

The work will be as follows: 1) Research into data currently useful for GSHP installers; 2) Evaluate skills required to design, drill and install GSHP; 3) Create curricula for installers: designers and drillers; 4) Create training tools. Test and optimization of the products; 5) Suggest standards and codes to create a European market; 6) Propose a European certification framework; 7) Launch training courses.

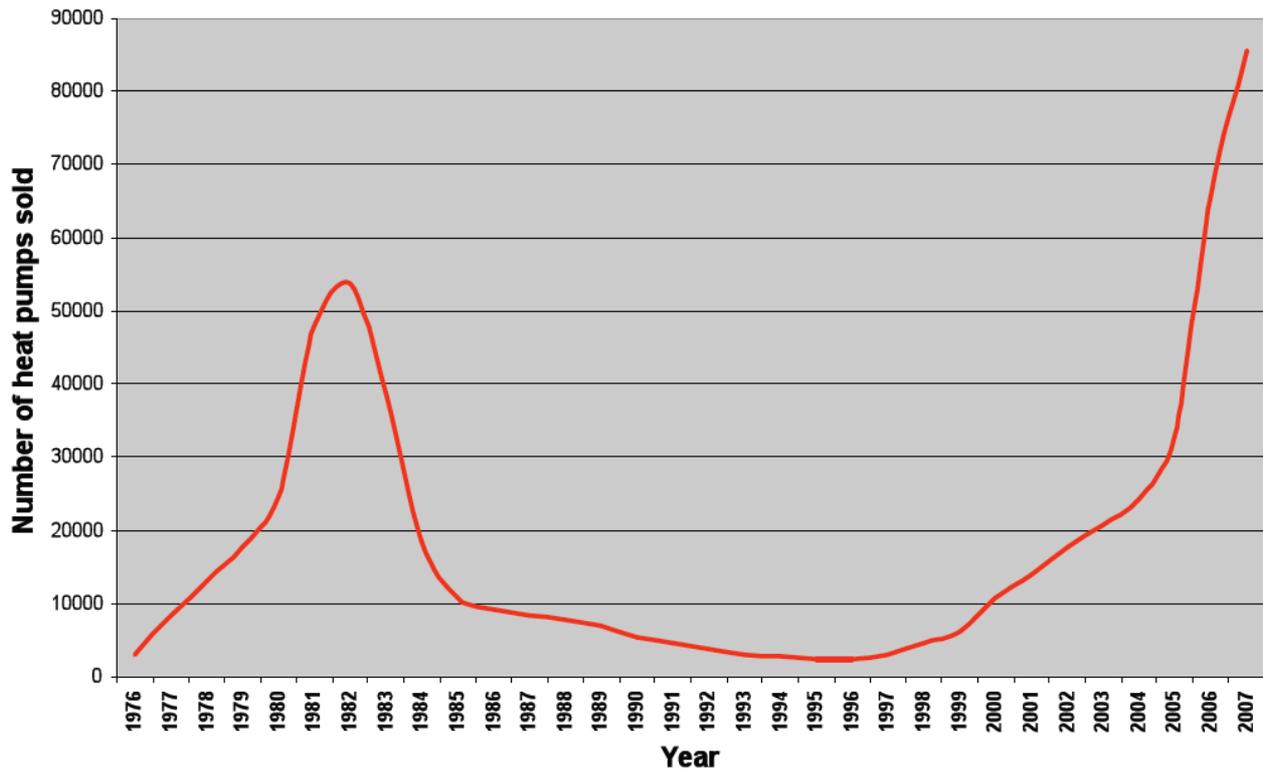


Figure 1a: 30 years of Heat Pump Sales in France after data from EHPA, BWP, EIA and others

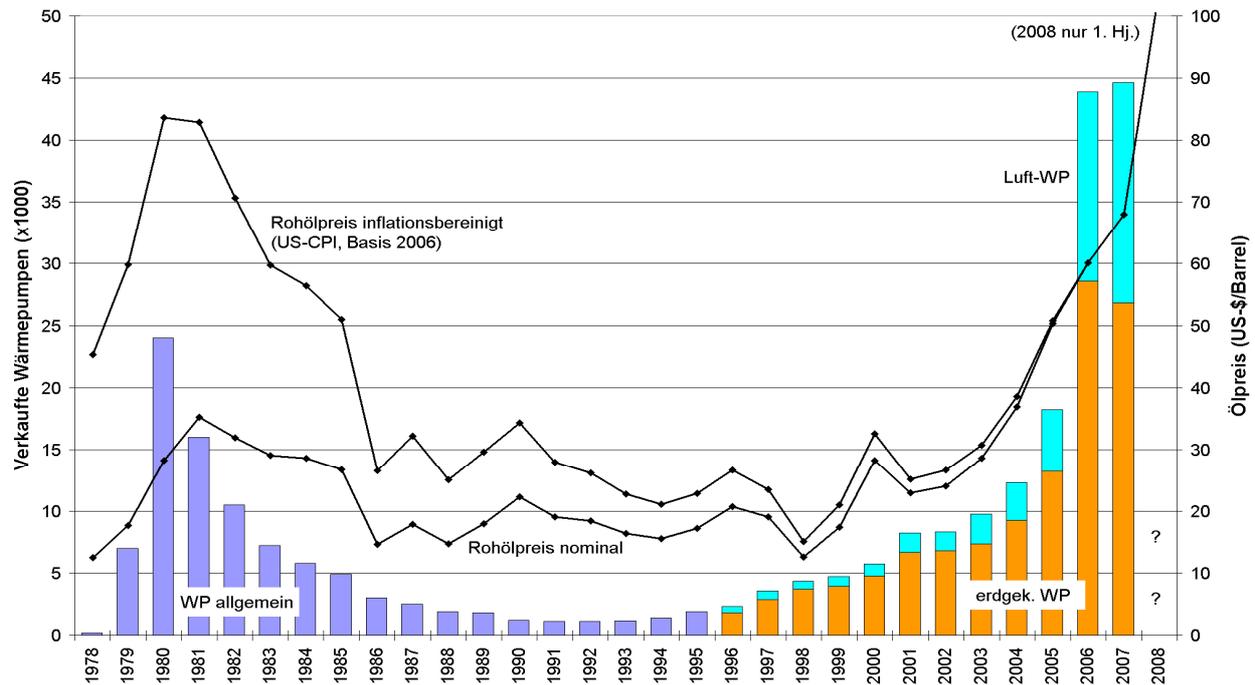


Figure 2b: 30 years of Heat Pump Sales in Germany after data from EHPA, BWP, EIA and others.

The group of partners of GEOTRAINET represents: the European industry in the sector, the European Geothermal Energy Council; the European professionals, European Federation of Geologists; research centres, Arsenal Research Austria and BRGM France; private companies, GT Skills, Ireland and Geoexchange Society Romanian; and Universities, Universidad Politécnica de Valencia, Spain, University of Lund, Sweden, and Newcastle University, UK.

The duration of the project will be 30 months from the 1<sup>st</sup> of September 2008.

**2. CURRICULA FOR GSHP GEOSCIENCES AND DESIGN**

The training of geologists or geoscientists is necessary to give them a complete GSHP competence:

. Environmental respect: take into consideration potential contamination of soil and groundwater, ground stability, hydrogeological knowledge, ensuring protection of the environment (in particular groundwater) while drilling;

. Ground thermal conditions: the shallow geothermal installer training will cover geothermal resources and ground source temperatures of different regions, soil and rock identification for thermal conductivity, regulations on using geothermal resources, determining the most suitable geothermal heat pump system;

. Technical conditions: familiarity with different drilling and digging technologies, choice of the optimum drilling method, ensuring protection of the environment (in particular groundwater) while drilling, well construction, pressure testing, logistics, building laws, and safety.

To achieve these objectives the establishment of a European expert platform will be necessary. This platform will work on creating Curricula for geosciences and design, and assigning contents and programmes to the work items identified in the Curricula.

The professional experience of the expert platform will help to define in a precise manner the most relevant areas and knowledge blocks inside the geothermal profession, the most relevant aspects for a quality technical assessment of the GSHP installations. The main goal of this Platform of experts is to work on the programme of education, including necessary content and skills requirement, the didactic materials and an identification of profile and required professional experience of the teachers.

The platform will define the general methodology and the strategy, agreed and shared by the partners, for the common activities (data collecting, e-learning modules,...) that are going to give a common product (database, e-learning platform, guidelines,...).

The qualification of geologists covers an extensive spectrum of disciplines. Depending on the employment demands geologists have continuously adapted their level of specialisation. There are certain specialisations, such as Geotechnics, Hydrogeology, Geophysics, that are of particular relevance for the analysis of the ground in view of geothermal objectives.

The first task of the Expert platform will be to assess the data required for geothermal h&c installations, in order to define the curricula necessary for the Geoscientists active in GSHP. A second task for the geoscientist's expert platform is to define the knowledge needed and required to advise on GSHP ground installations. A third task is to present the programme of the design training courses in order to prepare the didactic materials.

### **3. ASSESSMENT OF GEOTHERMAL DATA REQUIRED FOR GSHP DESIGN AND INSTALLATION**

Assessment of geothermal data required for design and installation, involves the following activities:

. Inventory of data available in the Geological Surveys or other equivalent authorities. A first approach is to realise a catalogue on ground meta-data dedicated to the GSHP.

. Collect and evaluate data to determine knowledge and skills required for design and installation of geothermal heating and cooling.

Site conditions are factors impacting on GSHP (heating and cooling efficiency, drilling methods, heat exchange performance, protected areas....). It is essential to have these data for the feasibility study of the GSHP system. It is necessary to know for designers in each EU-27 country how to access the necessary data. In different countries (Germany, France, UK,...), local documents are available (local GIS -Geographical information system- or specific reports) to support decision-makers. In those documents initial consideration (geological) before installing a GSHP are presented (more or less detailed). A catalogue of the types of available information and their mode of presentation is essential for EU countries to compare and develop new supports and collect new data mainly for GSHP.

A best practice case exists in Germany where the Geological Survey of Nordrhein-Westfalen provides freely the geological data on a CD-rom. Other Lander are developing the same products. In some countries, this vital information for the designers has to be paid for.

The goal is to present what are the geological data available in 7 EU countries, how they are available for the designers, and what is the methodology needed to have them available for designers, in order to replicate these actions in the other EU countries. The data assessment will also include a Guideline to facilitate the acquisition of the geological data for the geothermal professional. This Guideline will be included in the didactic material. BRGM will coordinate this task, and EFG, the Panel of Experts on Geothermal Energy, prepares a report on Geological Studies, the influence of the ground on the Geothermal installations. Other partners will collect data for their countries.

The Geological Survey of France, BRGM, will coordinate the contribution on the project from 6 national geological surveys (CGS, Czech Republic Geological Survey; IGME, Spain Geological Survey; PGI, Poland Geological Survey; INETI, Portugal Geological Survey; BGS, British Geological Survey; TNO, Dutch Geological Survey)

An internal group of experts will work on the technical assessment of the project. The result of this group of experts will be a report on the project by BRGM as project partner. It will involve listing and categorising all the geological data produced by these national authorities for geothermal applications in the countries involved in the project and will be a template for EU-27, looking in particular at the following tasks:

. Metadata on the ground;

. Geological maps, hydrogeological conditions, ground physical characteristics and ground thermal conductivity; and,

. Local environment to install shallow geothermal systems: geological conditions and climate.

### **4. CURRICULA FOR GSHP DRILLING AND INSTALLATION**

A European expert platform dedicated to the drilling and installation part of a GSHP will be established. It involves the creation of Curricula for drillers and installers, and the creation of contents for the work items identified in the

Curricula. The objective is to provide the content of the curricula and didactic material for the drillers who would opt for a professional activity in the GSHP area.

The platform of experts will define the:

- . Programme of education, including necessary content and skills requirements to train drillers;
- . Didactic materials to prepare the learning materials for drillers; and,
- . Identification of profile and required professional experience of the teachers for the training of the trainers.

The objective here is to create European materials, updating the existing ones, and targeting them more to professionals. Specific materials have to be created for vocational training for the drillers. From our point of view, existing training material for drillers is more or less specific for each country (legal aspects, but also focuses on a few techniques locally used).

The objective is to collect existing materials in the EU countries, and to propose a homogeneous material. This material could be translated and completed with national data and legal information.

## **5. CREATION OF NECESSARY TEACHING/LEARNING MATERIALS AND OF THE E-LEARNING PLATFORM**

The panel of experts will work to develop the necessary teaching system to support Geothermal Heating and Cooling and train professionals (geologists, drillers, installers, salespersons, planners and others) with an e-learning platform and other learning tools.

The goal is to develop best practice documentation and to create all the necessary documents to help in the training courses. The documents will be used during the courses, to be disseminated and for the courses organised after the project. The documents will be in English, German, French and Spanish. They will be adapted for the 8 project targeted countries to take into account the national specifications.

An e-learning platform will be created to train mainly designers all over Europe but the information will be available publicly. The information will be free and online.

## **6. ESTABLISHMENT OF CERTIFICATION FRAMEWORK AT EUROPEAN LEVEL AND PROPOSAL FOR STANDARDISATION**

Certification means that an installer has demonstrated necessary skills, knowledge and ability typically required of a practitioner to competently install and maintain a GSHP installation. Certification is provided via training programmes for designers, drillers and installers. These training programs need to be accredited by a credible authority to make sure they apply sufficiently stringent and uniform training standards and are suitably designed to reach their goals. One part of the project aims at presenting uniform training programmes with a certification framework to be replicated in the EU.

The goal is to propose a framework permitting the certification of professionals having followed and succeeded in the learning and e-learning courses dispensed by Geotrained. This framework will result in the adoption of

comprehensive schemes for accreditation and certification based on jointly elaborated and agreed success criteria.

The certification will concern the different categories; geologists, designers, installers and drillers. The certification will be issued on a voluntary basis by the national competent authorities in close consultation with the relevant stakeholders, allowing it to be recognized on an EU-level.

The project will underline the advantages of a Certification: it can be a help in access to incentive and support programmes, and may become a requirement with respect to environmentally friendly drilling and installation.

To complete the European certification framework, standards and codes will be suggested for the ground part of a GSHP (from the existing ones or new ones) to contribute to the creation of an uniform market.

The goal is to avoid unskilled work and develop a harmonized European market. For the heat pumps, EN standards are well adapted and allow for a free circulation of machines and components within the common market. For the ground side of shallow geothermal installations, relevant standards and codes exist only in a few countries with developed GSHP market (AT, DE, SE and CH). In FR, IE and NL the matter is somewhat covered, and work is ongoing on developing standards and codes. A common EU-wide harmonisation is not in sight. An approach for common standards can be seen between AT, DE and CH, where geology and work practice is similar.

The eight target countries will organize direct training courses. The logistic base for each training course will be ensured by the local partner involved in the project. There will be 8 direct training courses: 2 for trainers, 3 for drillers and 3 for designers. In addition, the WP covers two e-learning courses, one for trainers and one for designers. The total period for this WP corresponds to month 6 until month 26. The levels of existing skills and knowledge expected of the people who are to be trained are:

For Designers/Planners:

- . Students: post graduate, more than 3 years in geology, hydrogeology, etc;
- . Professionals: engineers, geologists, technicians with 5 years of experience

For Drillers:

- . Professionals with 3 years of experience;
- . Students with background in mechanics.

In the case of shallow geothermal installers, accredited training programmes will be offered to installers with working experience, who have undergone, or are undergoing, the following types of training: as a driller or pipe layer and having basic geological skills as a prerequisite. The evaluation system consists of two parts:

- a) an assessment of the skills and knowledge of the professionals having taken the course
- b) an evaluation questionnaire filled in by the course participants on the quality and relevance of the course

c) an overall evaluation report on the training courses, summarising the results of the course and the evaluation questionnaire filled in by the students

The theoretical part of the shallow geothermal installer training will cover geothermal resources and ground source temperatures of different regions, soil and rock identification for thermal conductivity, regulations on using geothermal resources, determining the most suitable geothermal heat pump system, system layout, drilling technologies, installation of borehole heat exchangers, well construction, pressure testing, logistics, building laws and safety.

The training will also provide good knowledge of any European standards for shallow geothermal, and of relevant national and European legislation.

At the end, the level of skills achieved and certified as a result of the proposed training courses will be that the installers demonstrate the following key competences:

- . understanding geological and geothermal parameters of the ground and knowing their determination, nomenclature and identification of soil and rock types, preparing borehole reports including lithology, groundwater, etc.; basic geological and hydrogeological knowledge;
- . familiarity with different drilling and digging technologies, choice of the optimum drilling method, ensuring protection of the environment (in particular groundwater) while drilling;
- . ability to install borehole heat exchangers, to grout, backfill or otherwise complete the ground source system, and to perform pressure tests; skills for welding of plastic pipes and other connection methods;
- . ability to construct groundwater wells, to install the relevant pipes, pumps and control systems; and,
- . ability to perform the relevant documentation including identification and drawing of drilling locations.

## 7. CONCLUSIONS

The European Union adopted in December 2008 the Climate and Energy Package.

Agreement has been reached on the Directive on the promotion of the use of energy from renewable sources: have 20% RES by 2020 in the European Union.

For the first time, each EU Member State has a legally binding renewables target for 2020 along with a clear trajectory to follow. By June 2010 the Member States will draw up Renewable Action Plans detailing the ways in which they are to meet their 2020 targets, which will then be submitted to the Commission for assessment. They will report on how they are doing every two years. These measures will lead to real progress in the 27 countries.

One important measure is that “*Member States shall ensure that certification schemes are available by 2012 for installers of shallow geothermal systems and heat pumps*”.

Indeed, heat pump, shallow geothermal and other small-scale installers shall be certified by an accredited training programme or training provider.

Research in Europe shows that one of the barriers to a sustainable and growing GSHP market is the lack of appropriate skilled personal, and quality of design and works are not always satisfactory. To keep quality up, a certification program for GSHP workforce is required.

The objective of “Geo-Education for a sustainable geothermal heating and cooling market” project, is to develop a European Education program to get towards the certification of geothermal installations:

Develop the training of professionals involved in Ground Source Heat Pump installations (GSHP)

Create a EU-wide certification scheme for both planners and installers of GSHP.

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## REFERENCES

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC