

STSM – Short Term Scientific Missions within the Action TU1405 –
European Network for Shallow Geothermal Energy Applications in buildings
and infrastructures (GABI)

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REPORT

The legislative framework on Shallow Geothermal Energy in
Europe, in the spectrum of the Welfare State

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Duration: February 8th to March 8th 2016

1 Introduction

As a postgraduate student at the Environmental Engineering Department, Democritus University of Thrace, under the supervision of Prof. Konstantinos P. Tsagarakis, I was granted by GABI, as part of a one-month Short Term Scientific Mission, to analyze the legislative framework of Shallow Geothermal Energy in Europe, in the spectrum of the Welfare State. The research took place at the Cyprus University of Technology, Energy and Environmental Economics and Policy Group (3EP) from February 8th to March 8th 2016. During this period, I cooperated with Dr. Apostolos Michopoulos, Senior Researcher, in order to collect and analyze the legislation of the 28 EU countries.

The European mainland consists of nations with different cultures and traditions. This ethnic diversity is reflected in every single country's welfare and legal system. In Europe of the 28, despite the differences, clusters of countries have been developed, characterized by the sharing of common characteristics of well-being. United Kingdom and Ireland represent the model of liberal welfare state. The liberal welfare state prioritizes the market over the traditional family and promotes “*means- tested assistance, modest universal transfers or modest social-insurance*” (Esping-Andersen, 1990). This model provides low social benefits, thus creating a significant gap between the different social strata (Esping-Andersen, 1990). Countries such as Germany and Austria have adopted the conservative-corporatist welfare state (Esping-Andersen, 1990), a traditional state that gives priority to familyhood. National support exists only in the case of the family's weakness to protect its members. This type of state maintains the differences between class and status. Consequently, the rights and the grants depend on the different class and status. The Scandinavian countries have developed the social-democratic welfare state, which provides equal rights to everyone irrespective of their status. According to Esping-Andersen (1990) “*the right to work has equal status to the right of income protection*”. This way, this type of welfare state puts an end to the dilemma between market and traditional family. The state is responsible for children, aged and helpless. Finally, Greece, Italy, Portugal and Spain belong in the southern welfare state (Ferrera, 1996), which has a lot of similarities with the corporatist model, especially concerning the predominant role of traditional family. Nevertheless, this type of state is being characterized by inequality on rights between different groups of people, especially by overprotecting the aged, and insufficiently granting family-support. A clientelistic system has been developed and there is an uneven weight distribution between different classes of workers.

In view of the aforementioned classification, a need that rises is to examine whether or not the same conditions occur in the legal systems of the member States of European Union (EU). By conducting the present study, we aim at examining the legislative framework on Shallow Geothermal Energy in the EU. During the last years, EU has recognized the need to use energy from Renewable Sources in buildings and infrastructures. Geothermal energy is a legally recognized form of Renewable Source according to Directive 2009/28/EC (RES Directive). The RES Directive defines geothermal energy as “*energy stored in the form of heat beneath the surface of solid earth*” (Article 2, par. (c)). Nevertheless, the RES Directive does not make any distinction between shallow and deep geothermal energy. Accordingly, Directive 2010/31/EU on energy performance of buildings (EPBD), regulates the energy use and efficiency in buildings and infrastructures among the Member-States. The EPBD obliges the Member-States to develop

a methodology for calculating the energy performance of buildings, according to certain parameters, such as the thermal characteristics of a building. The EPBD is applicable in new buildings and existing buildings under renovation, and, for the first time in EU, introduces the term of ‘nearly zero-energy building’, i.e. *“a building that has a very high energy performance”* whose *“amount of required energy should be covered to a very significant extent from energy from renewable sources produced on-site or nearby”* (Article 2, par.2)), with the provision for all new buildings to become nearly zero-energy buildings by December 31st, 2020. The application of Shallow Geothermal Energy in the building sector is a way for the Member-States to obtain the aforementioned target by December 31st, 2020. Finally, [Directive 2012/27/ EU](#) on the energy efficiency (EED) obliges Member States to set up energy efficiency obligation schemes and to set target, which would be *“at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1,5 % of the annual energy sales to final customers of all energy distributors or all retail energy sales companies by volume, averaged over the most recent three-year period prior to 1 January 2013”* (Article 7, par.1), and, therefore, to carry out a cost-benefit analysis covering their territory, based on climate conditions, economic feasibility and technical suitability, which could be part of an environmental assessment under Directive 2001/42/EC (Article 14, par.3).

Two systems of installation have been developed in order to fulfill the buildings' needs in cooling and heating. Open loop systems consist of wells or surface systems and use local groundwater or surface water in order to transfer energy directly into buildings ([Mustafa Omer, 2008](#); [Vangkilde-Pedersen et al., 2012](#)). Closed loop systems use vertical borehole heat exchangers, or horizontal heat exchangers ([Haehnlein et al., 2010](#)) or geostructures ([Antics & Sanner, 2007](#)). They use a heat-transfer fluid which *“is circulated within the buried closed tube system to transport heat stored in the subsurface to the aboveground heating system of a building”* ([Haehnlein et al., 2010](#)). The development of Shallow Geothermal Energy is attributed to the fact that Shallow Geothermal Energy is considered to be an ecological method for cooling and heating for domestic use ([Haehnlein et al., 2010](#)).

The Member-States are committed to apply the European Legislations, by setting national legislations. Due to the lack of relevant European legislation on Shallow Geothermal Energy, the Member States have set legislative frameworks depending on the technology they apply. Besides the diversity of law between the 28 EU Member-States, in some cases such as Belgium ([Fallon & Croufer, 2013](#)), Germany ([Sanner, 2013](#)) and Sweden ([Jardeby et al., 2013](#)), different regulations exist between various states or regions. This legal fragmentation results in the lack of a national legal framework, so, in order for a full categorization of the legal EU frameworks in Shallow Geothermal Energy to be obtained, this subject needs to be examined and recorded in detail; this being the main objective of the present study.

2 Research Methodology

This research provides an insight into the variability of current legislative frameworks on Shallow Geothermal Energy in the EU countries in buildings and infrastructures, in comparison with the four types of welfare states that occur worldwide. For this reason, we created a questionnaire that seeks to gather the relevant information for Shallow Geothermal Energy on buildings and infrastructures. The use of a questionnaire is the most appropriate -if not the only- approach for the carrying out of this research, especially in the cases of legal fragmentation in a regional level as in Belgium, Germany, Sweden etc, as only experts on Shallow Geothermal Energy can provide important and reliable data, due to lack of existing literature on the subject.

Questionnaire

The questionnaire is divided in four sections (Figures 1-13). Section 1 refers to general information on Shallow Geothermal Energy, including questions about shallow geothermal energy in general and about the national license/permit scheme. Section 2 includes questions about the technical requirements of the open loop Shallow Geothermal Energy systems. Section 3 includes questions about the technical requirements of the closed loop Shallow Geothermal Energy systems. Section 4 aims at collecting further information on Shallow Geothermal Energy, e.g. on the subsidization scheme, and asks for final remarks.



Shallow Geothermal Energy applications in buildings and infrastructures

Dear Geothermal expert, this questionnaire is about Shallow Geothermal Energy (SGE) applications in buildings and infrastructures under the COST Action TU1405. The researcher, Ms Loukia Efthymiou, has been granted to analyze the legislative framework of shallow geothermal energy in Europe, in the spectrum of the Welfare State. This research takes place in collaboration with Dr. Konstantinos Tsagarakis, Associate Professor at Democritus University of Thrace, and Dr. Apostolos Michopoulos, Senior Researcher at Cyprus University of Technology. For further information about the questionnaire, please don't hesitate to contact us via e-mail or telephone, or visit the COST Action's webpage (<http://www.foundationgeotherm.org>).

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Figure 1. Introduction Page



Shallow Geothermal Energy applications in buildings and infrastructures

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Section I: General Information

1 Please state the country that the questionnaire refers to:

2 Is a legislative framework for Shallow Geothermal Energy (SGE) and its applications effective in your country?

☐ Yes ☐ No

3

Please state what kind of legislation is applied by National/Federal Authorities.

Please report all the relevant legislations.

Copy, paste and fill in the following fields:

Reference Number....

Title.....

Date of Issue....

Issuing Authority....

Other comments...

- ☐ National Law
- ☐ Ministerial Decision/s
- ☐ National Standard/s
- ☐ Regulation/s (Technical or not)
- ☐ Technical Rule/Note
- ☐ Other:

Figure 2. Section I

4

Please state what kind of legislation is applied by Regional Authorities in prefectural and/or canton level.

Please report all the relevant legislations.

Copy, paste and fill in the following fields:

Reference Number....

Title.....

Date of Issue....

Issuing Authority....

Other comments...

- ☐ Regional Law
- ☐ Ministerial Decision/s
- ☐ National Standard/s
- ☐ Regulation/s (Technical or not)
- ☐ Technical Rule/Note
- ☐ Other:

5 Does one or more definition/s of Shallow Geothermal Energy exist in your country?

☐ Yes ☐ No

6

If yes: Please report the definition/s

Copy paste and fill in the following fields:

Provider.....

Administrative level of the provider (eg. Official Institutions, Associations, or Other).

Report the type of the document (eg. Law, regulation, standard).

Copy, paste and fill in the following fields:

Reference Number....

Title.....

Date of Issue....

Issuing Authority....

Other comments...

Figure 3. Section I cont.

7 Based on the national legislation framework, please report the depth up to which the Shallow Geothermal Energy is applicable (e.g. 100m, 400m, 500m, etc.)

8 Are there any Best Practice guideline Documentations concerning Shallow Geothermal Energy installations?

☐ Yes ☐ No

9

If yes, Please report the documentations

Copy, paste and fill in the following fields:

Reference Number:...

Title:...

Date of Issue:...

Issuing Authority:...

other comments:....

In addition, please indicate what kind of information they include:

- a. Energy performance of the Shallow Geothermal Energy (SGE) installations**
- b. Economic benefits of Shallow Geothermal Energy (SGE) installations**
- c. Environmental impact of Shallow Geothermal Energy (SGE) installations.**

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Figure 4. Section I cont. i



Shallow Geothermal Energy applications in buildings and infrastructures

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Section II: Technical requirements of the OPEN LOOP Shallow Geothermal Energy (SGE) systems

10 Based on your national/ regional legislation framework, does the installation of open-loop Shallow Geothermal Energy (SGE) systems require a specific license or permit of a national authority?

☐ Yes ☐ No

11 If yes:

Check any that apply

Comment only when you choose an answer.

- ☐ In every installation
- ☐ It depends on the size/specific details of it (please detail as follows)
- ☐ It depends on regional regulation (please detail as follows)
- ☐ Other (please detail as follows)

12

Please report the legislation.

Copy, paste and fill the following fields:

Reference Number:...

Title:...

Date of Issue:...

Issuing Authority:...

Other comments:...

Figure 5. Section II

13 Based on your national/regional legislation, what kind of open loop Shallow Geothermal Energy (SGE) systems are permitted for installation in your country?

Check any that apply

- ☐ Well systems
- ☐ Surface water systems

14 If there are specific regions in which one or both of the above systems are not applicable, please report.



15 Which is the National Authority or body that issues the installation license/permit?

Check any that apply

- ☐ The Central Government
- ☐ The Regional Government
- ☐ The Prefecture
- ☐ The Municipality
- ☐ Other:

16 In order to get the installation permit, are there any other accompanied and/or complementary licenses/permits required?

☐ Yes ☐ No

Figure 6. Section II cont.

17

If yes, please report the type of permit/license and the issuing body/ies with reference to the following:

- a. The Water Authorities
- b. The Mining Authorities
- c. The Archeological Authorities
- d. Forestry Authorities
- e. Other:.....

18 Based on the national/regional legislation framework, what are the minimum required criteria that should be fulfilled in order for a license/permit to be issued? (Please check all that apply and provide the requirements)

Comment only when you choose an answer.

Please select at most 7 answers

- | | |
|--|----------------------|
| <input type="checkbox"/> Protection of groundwater as a resource for drinking water | <input type="text"/> |
| <input type="checkbox"/> Leakage of hazardous materials, (e.g. heat carrier fluid, drilling fluid, secondary contaminants of drilling apparatus, etc.) | <input type="text"/> |
| <input type="checkbox"/> Changes in groundwater ecology | <input type="text"/> |
| <input type="checkbox"/> Hydraulic contacts between different aquifer systems | <input type="text"/> |
| <input type="checkbox"/> Accumulation of temperature changes | <input type="text"/> |
| <input type="checkbox"/> Interaction with other shallow geothermal systems | <input type="text"/> |
| <input type="checkbox"/> Other | <input type="text"/> |

Exit and clear survey

Resume later

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Figure 7. Section II cont. i



Shallow Geothermal Energy applications in buildings and infrastructures

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Section III: Technical requirements of CLOSED LOOP Shallow Geothermal Energy (SGE) systems

19

Based on your national/regional legislation, does the installation of closed loop Shallow Geothermal Energy (SGE) systems require a specific license or permit of a national authority?

☐ Yes ☐ No

20 If yes:

Check any that apply

Comment only when you choose an answer.

- ☐ In every installation
- ☐ It depends on the size/specific details of it (please detail as follows)
- ☐ It depends on regional regulation (please detail as follows)
- ☐ Other (please detail as follows)

21

Please report the legislation

Copy, paste and fill the following fields:

Reference Number:...

Title:...

Date of Issue:...

Issuing Authority:...

Other comments:...

Figure 8. Section III

22 Please report the type/s of closed loop system that are permitted for installation in your country:

Check any that apply

- ☐ Horizontal systems
- ☐ Vertical systems
- ☐ Geostructures

23 If there are specific regions in which one or more of the above systems are not applicable, please report:

24 Which is the National Authority or body that issues the installation permit?

Check any that apply

- ☐ The Central Government
- ☐ The Regional Government
- ☐ The Prefecture
- ☐ The Municipality
- ☐ Other:

25 In order to get the installation permit, are there any other accompanied and/or complementary licenses/permits required?

- ☐ Yes ☐ No

Figure 9. Section III cont.

26

If yes, please report the type of permit/license and the issuing body/ies with reference to the following:

- a. The Water Authorities
- b. The Mining Authorities
- c. The Archeological Authorities
- d. Forestry Authorities
- e. Other:.....

27

Based on the national/regional legislation framework, what are the minimum required criteria that should be fulfilled in order for a license/permit to be issued?

Please check all that apply and copy paste the following to provide the requirements with reference to the applicable system type:

- a. Horizontal systems
- b. Vertical systems
- c. Geostructures

Check any that apply

Comment only when you choose an answer.

- | | |
|--|----------------------|
| <input type="checkbox"/> Maximum and/or minimum heat flow rate (injection/absorption) per borehole meter | <input type="text"/> |
| <input type="checkbox"/> Maximum and/or minimum ground temperature | <input type="text"/> |
| <input type="checkbox"/> Maximum and/or minimum working fluid temperature | <input type="text"/> |
| <input type="checkbox"/> Maximum and/or minimum distance between boreholes | <input type="text"/> |
| <input type="checkbox"/> Maximum and/or minimum distance between borehole and property boundaries | <input type="text"/> |
| <input type="checkbox"/> Environmental requirements about the type, properties, and quality of the heat transfer fluid | <input type="text"/> |
| <input type="checkbox"/> Maximum and/or minimum distance between the borehole/pipe loop and the soil's surface | <input type="text"/> |
| <input type="checkbox"/> Thermal, environmental and other requirements for the grout solution/material Please provide the requirements with reference to the system type | <input type="text"/> |
| <input type="checkbox"/> Other | <input type="text"/> |

Figure 10. Section III cont. i



Shallow Geothermal Energy applications in buildings and infrastructures

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Section IV: Final Remarks

28 Based on your experience, please provide any comments about the improvement of your national/regional legislation. Are there any restrictions that limit the broader installation of the Shallow Geothermal Energy (SGE) systems?

29 Based on your legislative framework, is there any subsidization scheme concerning the Shallow Geothermal Energy (SGE) installations?

☐ Yes ☐ No

30 If yes, please report:

Check any that apply

Comment only when you choose an answer.

- ☐ Subsidy on the installation cost (percentage)
- ☐ Subsidy on the installation cost (up to a maximum amount of cash)
- ☐ Coupon
- ☐ Subsidy on the electricity bill
- ☐ Other

Figure 11. Section IV

31 On a scale from 1 to 5 (5 being the highest), please provide the importance of Shallow Geothermal Energy (SGE) in the total energy production from Renewable Energy Sources in your country.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

32 Please add any other comments you have about this topic.

33 We are willing to inform you about the results of our research. Please provide your contact details in order for us to share them with you.

Exit and clear survey
Resume later
Submit

Figure 12. Section IV cont.

Thank you very much for your time and effort to complete the questionnaire.

Your contribution is much appreciated!

Ms. Loukia Efthymiou

Dr. Apostolos Michopoulos

Prof. Konstantinos Tsagarakis

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Your survey responses have not been recorded. This survey is not yet active.

Figure 13. Finish Page

In addition, apart from the creation of the aforementioned questionnaire, I have collected information, based on literature review, on the legislative framework of Shallow Geothermal Energy some of the EU Member-States. For example, information about the national legislation in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, United Kingdom, Greece, Hungary, Ireland, Lithuania, the Netherlands, Poland, Portugal, Romania,

Slovakia, Slovenia and Sweden have been collected from [Haehnlein et al. \(2010\)](#). Furthermore, *REGEOCITIES* a programme co-funded by the intelligent Energy Europe Programme of the European Union, provides information about the legislative framework of Belgium, Denmark, France, Germany, Greece, Ireland, Italy, the Netherlands, Romania, Spain and Sweden.

3 Expected Results & Future Research

After I receive the filled in questionnaires by the experts of the 28 countries, I will proceed with the classification of the EU countries into one of the four models of welfare state: the liberal, the corporatist, the social-democratic and the southern European. Therefore, I will proceed in comparing the legislative frameworks on Shallow Geothermal Energy of each country of every group. After completing the comparative analysis of each group of countries, I will demonstrate results on the existence of correlation between the legal status on Shallow Geothermal Energy in Europe and the existing four welfare models and I will present the findings on a paper, which could be a unique and useful guide for every researcher who seeks to get information on the legal framework of Shallow Geothermal Energy on buildings and infrastructures in the EU.

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