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GSSkills – Geothermal and Solar Skills

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Report WP5: 1st International workshop 5

WP LEADER: DEBEGESA

DURATION: 2 DAYS

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Place: Eibar – Basque Country- Spàin

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1.1 INTRODUCTION

The main aim of the 1st GSSkills workshop was to test the formerly developed project materials (GSSkills Research implemented in WP2), and to provide feedback to research's results. This was achieved with the participation in the workshop of businesses elaborating in Geothermy and Solar Systems, professionals in the field and representatives of educational and training centres and professional chambers, at a national and EU level.

The first international workshop was held between the 6th and 8th of October of 2014, as part of the GSSkills - Geothermal and Solar Skills project. In order to establish the outcomes to include for evaluation and dissemination in the workshop we firstly analysed the skills needed in each country in order workers to be able to develop and implement a Geothermal or Solar Installation. During the tasks implementation of WP2 we conducted a survey among different green installation companies, in order to identify what skills and competencies are required to work in specific jobs (plumbers and electricians) in green installations sector. In the research participated the countries of Greece, France and Spain: 33 questionnaires where filled in total by companies that are expertised in Geothermal Installations (12 by French, 11 by Greek, and 11 Spanish companies) and 34 questionnaires where filled in total by companies that are expertised in Solar Installations (10 by French, 9 by Greek, and 14 Spanish companies).

1st International Workshop of GSSkills programme was implemented in Eibar, Spain and participated 15 experts; 8 from Greece and 7 from Spain. Because of the fact that no one expert took part from France, partners from Greece and Spain invited more participants than those was stated in the application of GSSkills project. The structure of the workshop was designed as following:

1st DAY: 07/10/2014

A. *Brief introduction to the project GSSkills:*

   In the first part of GSSkills 1st workshop Mrs. Kalli Rodopoulou from ECTE presented to participants the GSSkills programme (aims, past tasks, future tasks, outcomes). Then Mrs. Aitziber Cortazar Altuna from DEBEGESA presented to workshop participants the situation in Spain regarding the geothermal and solar installations policies, regulations and trends. Followed the presentation of the situation in France

provided by Mrs. Leticia Hernandez from AOCDTF and the presentation of situation in Greece provided by Mr. Manolis Karapidakis from ECTE.

B. *Presentation of GSSkills research results:*

Representatives of consortium partners (Mr. Fortsas from CCIC, Mr. Karapidakis and Mrs. Rodopoulou from ECTE) implemented a presentation of GSSkills research results covering the cases of Greece, France and Spain. After the presentation of results per participating country, partners underlined the common and different findings of the research regarding the fields/ questions of the questionnaires used for the survey.

C. *Workshop implementation:*

After the presentations facilitators of the workshop (Mr. Fortsas from CCIC, Mr. Karapidakis and Mrs. Rodopoulou from ECTE) divided the participants in two groups for the realization of the workshops round tables. Two groups of experts were created: a) one for geothermal and b) one for solar installations. Participants worked on the base of a list of key questions that were presented by the workshop moderators. Experts debated in order to reach valuable conclusions and guide the next stages of the project implementation. Participants prioritised the necessary skills and identified the common points and differences, through the information exchange that was based on the survey results.

D. *Workshop conclusions:*

Workshops' conclusions were listed per thematic field: 1) for Geothermal Installations and 2) for Solar Installations. (See 1.4 Results of this report)

2nd DAY: 08/10/2014

E. *Visiting the Stakeholders in Basque Country*

Aim of the visits of workshop participants to key stakeholders in Basque country was to present them the main conclusions of the GSSkills survey and the main outcomes of the workshops. For the above mentioned reasons were organized visits with consortium partners and participants of the 1st workshop in order to increase the awareness of the stakeholders about the problems identified in the GSSkills 1st

workshop and to promote the dialogue on possible solutions, to exchange information about the workers needed skills in geothermal and solar installations, as well as to disseminate the project's developing training materials to the following institutions:

- ***Tknika:*** *Tknika is a centre promoted by the Basque Department of Education, Universities &Research, under the direct auspices of the Sub-Department of Vocational Training & Lifelong Learning. Tknika is the innovation tool for the Basque Vocational Training System. Under Tknika INNOVA, the Centre's innovation management model, Tknika incorporates into its activities companies, technology centres, research centres, universities and other institutions that can add value to the system – all based on the dynamic open innovation.*
- ***Giroa Company. Dalkia Group****: Facility located in Intxaurrondo quarter of San Sebastian (Gipuzkoa), which provides service to 125 dwellings. The facility was launched in 2011 and it is provided with geothermal and solar photovoltaic panels. The Geothermal installation goal is heat generation for heating and production of domestic hot water. The photovoltaic installation, registered in the special regime, exports to the grid the energy produced. The income coming from the photovoltaic export goes to the Neighbours Community prompting in the global balance a big saving, covering currently the 90% of the electrical cost of the general services of the community and the 80% of the community consumption. That is to say, the building fulfils the initial internal consumption goal clearly. Visit goals:*
    - *Identify necessary knowledge for the development of this kind of installation.*
    - *To get to know the main challenges that companies have to face for developing this Kind of installations.*
    - *Identify necessary knowledge so as to ensure its proper functioning.*

1.2 MATERIALS AND METHODS

In order to ensure the complete map of the different agents involved in the geothermal and solar skills systems for each country, we did a preliminary analysis through the GSSkills research implemented in WP2 of the project. The analysis of research findings support us to determine which experts should be invited in the workshop. After that, representatives from educational institutions, public authorities, companies and business community from Greece, France and Spain, were invited to take part in the workshop. Finally, it was not possible to have any expert from France. However, 15 experts from Greece and Spain took part in 1st GSSkills International Workshop.

In order to assist the facilitators and participants of the workshop we designed a template in order to identify the professional profile and specialization of the experts invited to take part in the workshop (see ANNEX 1). In the same way, we designed the workshops' agenda; we worked on the possible days for the meeting and the methodology. All these items were shared and discussed by the partners until was arranged the final version of the 1st GSSkills International Workshop (see ANNEX 2).

The workshop was celebrated in Debegesa´s premises in Eibar, Spain. Regarding the material resources that were provided to the participants during the 1st workshop the most important were: GSSkills printed versions of presentations implemented by consortium partners regarding the research's results and findings (see ANNEX 3), leaflet (see ANNEX 4), three rooms for round tables and discussions implementation, three computers and the supporting materials like papers, labels, etc.

1.2.1 Introducing the surveys and the items for each country

For introducing to the participants of the workshop the GSSkills project and the GSSkills survey results were prepared different power point presentations:

- *Presentation of the GSSKill project (see ANNEX 5).*
- *Analyse of the solar and geothermal systems situation in Greece, Spain and France.*

- *Presentation of the surveys results conducted in each country.*

1.2.2 Implementation of workshop's round tables

In order to facilitate better the discussions and debates that were conducted in the round tables, participants of the workshop were divided into two different groups; one group was created for solar installations and one group for geothermal installations. Aiming to ensure the proper dynamic of the groups were prepared the following documents, which were focused on solar and geothermal skills that were clarified as essential according the GSSkills research results. For the realization of the round tables were used the following documents:

- *Workshop guide which included a group of general questions for the workshop. The workshop guide was sent to participants before the implementation of the workshop in order participants to be prepared in advance.(see ANNEX 6)*
- *A set of specific questions about theoretical knowledge both for geothermal and solar installations, listed in different documents (see ANNEX 7 for Geothermal Installations and ANNEX 8 for Solar Installations).*
- *A set of specific questions for practical knowledge and skills both for geothermal and solar installations, listed in different documents (see ANNEX 9 for Geothermal Installations and ANNEX 10 for Solar Installations).*

1.2.3 Goals of the workshop:

General issues discussed and presented in the workshop:

- ✓ *Green Installations technology penetration targets and the expected impact on energy policy goals.*
- ✓ *Community policies and initiatives on geothermal/solar installations per participating country.*
- ✓ *Interactions with other competing or synergetic technologies and community policies and initiatives.*

Experts from Greece and Spain were participating in the 1st GSSkills workshop were called to answer and discuss a pack of questions, that were also listed in the GSSkills research. The questions were divided in theoretical and practical skills that are needed in solar and

geothermal installations (see ANNEX 7 for Geothermal Installations and ANNEX 8 for Solar Installations/ Theoretical skills and ANNEX 9 for Geothermal Installations and ANNEX 10 for Solar Installations/ Practical skills).

1.3 RESULTS

GENERAL QUESTIONS:

A. ***QUESTION:*** *Present the community policies and initiatives on geothermal and solar installations in your country:*

Countries	Answer	Common points	Differences
Greece	**A) Policies and initiatives:** through the realization of LLL programmes for plumbers in geothermal and solar installations. **B) Hotel construction**; all new hotel buildings could take a financial contribution on their geothermal or solar plants from state capital. **C) Saving residents:** 2014-2020: • 700M€ • 200M€ professional premises • 250M€ public buildings	National & EU subsidies to SMEs and building owners for energy retrofitting and energy saving	The only differences are the financial and technical details of these applied subsidies.
Spain	EVE (The Basque Energy Board) provides direct subsidies depending on the installed capacity, both in photovoltaic and thermal installations. For a maximum, regarding		

	thermal installations amounting to the 35% of the investment and the 30% for the photovoltaic. From the Provincial Councils tax deductions are offered, for investments carried out.		

B. ***QUESTION:*** *Discuss the legislative and administrative barriers which limit or prevent the deployment of solar and geothermal technology and need to be addressed in your countries. Please propose proactive measures.*

Countries	**Answer**	**Common points**	**Differences**
Greece	Although there are initiatives and polices, established bureaucracy postpones and/or prevents solar and geothermal development Proactive measures: ✓ Simplify the relevant legislation in order not to discourage all the involved actors. ✓ Promote and provide information for advanced energy performance and sustainability.	There is a roughly adequate legislation but current administration structure doesn't support it	Not a significant difference has been emerged.
Spain	Currently, the energy Lobby is putting pressure and the regulation regarding energies is going through a process of change considering as a dynamic the		

	elimination and the reduction of premiums. Proactive measures: ✓ Require compliance with the building technical code enabling tools for its control and monitoring. ✓ Expand to the field of rehabilitation ✓ Provide information to users so as to promote attitudes and decisions energetically more sustainable. ✓ Improve subsidies in order to increase their effectiveness. From the Provincial Councils tax deductions are offered, for investments carried out.		

C. ***<u>QUESTION:</u>*** *Are any interactions of solar and geothermal installations with other competing or synergetic technologies and community policies and initiatives in your country.*

Countries	**Answer**	**Common points**	**Differences**
Greece	Energy Performance Enhancement of residential buildings	There is an interaction of solar and geothermal installations with all the relevant energy technologies under national energy saving and/or certification programmes.	The only differences are the financial and technical details of these relevant incentives.

Spain	Building technical envelope.		

SOLAR THERMAL THEORETICAL SKILLS:

A. QUESTION: *Do you agree with the attached list of the needed theoretical knowledge that a technician should have in order to implement solar thermal installations?*

Countries	Answer	Common points	Differences
Greece	The experts mostly agreed that the below mentioned theoretical knowledge is essential except from: - Theoretical skills pointed at (2) and (5) questions: experts defined these skills optional and essential for the future - Theoretical skills pointed at (6) and (8) questions: experts defined these skills necessary for a designer - Theoretical skills pointed at (10) and (12) questions: experts underlined that these skills need is depending on installation type needs.	Experts from Greece and Spain agreed that essential theoretical skills for a worker in solar thermal installations are the skills pointed at questions (1), (3), (4), (9), and (11). Experts from both countries agreed that theoretical skills pointed at question (6) are some needed and mostly acquired for designer studier and not for technicians.	Experts in Spain count as essential theoretical knowledge for a technician in solar thermal installations the skills pointed at questions (2), (5), (8) and (12). Greek experts characterised the skills pointed at question (2) as good knowledge for the future, the skills pointed at question (5) as optional knowledge, the skills pointed at question (8) as mostly needed skills for a designer, and the skills pointed at question (12) that these skills need is depending on installation type needs. Greek experts characterised the skills pointed at question (7) as important for a technician. Spanish experts count the theoretical knowledge pointed t question (7) as "some" needed for a technician.
Spain	Before analysing the results obtained through the surveys of		

	theoretical and practical skills required for the solar installations, the need to distinguish the skills required for the design and for the implementation has arisen. The experts at the same time, underline the need to subdivide the skills for implementation, in the ones required for the installation, maintenance and reparation. Furthermore and with regards to solar installations, it is necessary to underline that the results are concentrated on solar thermal installations. The experts mostly agreed that the below mentioned theoretical knowledge is essential except from skills mentioned at questions (6), (7), and (10).		

Regarding theoretical knowledge, the following skills have been considered as most important:

Knowledge	Answers	Percentage	GREECE	SPAIN
Knowledge of panel types basic structure and operation principles and obstacles	**"A lot / very much"**	90%	Crucial knowledge	"A lot / very much"
	"Some»	10%		
Knowledge of hot water uses and space heating calculations	**"A lot / very much"**	80%	Good knowledge for the future	"A lot / very much"
	"Some»	13,33%		
Knowledge of building thermal distribution systems and relevant equipment operation	**"A lot / very much"**	76,67%	very crucial knowledge	"A lot / very much"
	"Some»	20%		
Knowledge of hot water storage technologies and thermal efficiency techniques	**"A lot / very much"**	76,67%	very important	"A lot / very much"
	"Some»	20%		
Knowledge of switching, control, and operation of electrical part of the systems	**"A lot / very much"**	76,66%	Optional knowledge	"A lot / very much"
	"Some»	16,67%		
Knowledge of specific raw materials, insulation processes and techniques for maximizing effectiveness	**"A lot / very much"**	60%	designer/ studier knowledge and not for technical staff	"Some»
	"Some»	33,33%		
Knowledge of the contemporary development and future trends of solar thermal	**"A lot / very much"**	60%	important knowledge	"Some»
	"Some»	33,33%		
Knowledge of accompaniment	**"A lot / very much"**	56,66%	knowledge mostly for	"A lot /

electric pumps, and ventilators	**"Some»**	33,33%	designer/ studier	very much"
Knowledge of thermodynamics principles and heat exchange basics	**"A lot / very much"**	53,33%	Essential knowledge	"A lot / very much"
	"Some»	36,67%		
Knowledge of space and water heat relevant costs and quality control	**"A lot / very much"**	53,33%	Desired knowledge	Don't Understand
	"Some»	33,33%		
Knowledge of design techniques, and tools, involved in production of precision technical plans, and blueprints	**"A lot / very much"**	46,67%	Extremely essential knowledge. knowledge mostly for designer/ studier	"A lot / very much"
	"Some»	46,67%		
Knowledge of physical principles, laws and their interrelationships with applied science (understanding solar physics, seasonal variables, and atmospheric dynamics)	**"A lot / very much"**	43,33%	Depending on the needs	"A lot / very much"
	"Some»	30%		

B. <u>QUESTION:</u> *Do the technicians on solar thermal installations in your country have the above mentioned theoretical knowledge?*

Countries	Answer	Common points	Differences
Greece	Technicians have a good knowledge of the needed theory on solar thermal installation. In Greece, in order a technician to take the licence to work as a plumber has; a) or to complete a specific	Both in Spain and Greece, the technicians fulfil the basic theoretical knowledge on solar thermal technology. The years that a technician should complete in compulsory or vocational education are depending in both	The main differences are referred to the duration of the corresponding studies for the needed theoretical in order a specific certification to be received.

	amount of working hours that are certified via a professional assessment body, or b) to attend specialized vocational education and training offered by several educational and vocational institutions.	countries from the degree level of specialization and certification. The majority of the technicians doesn't meet the advanced requirements regarding the most specific and contemporary theoretical knowledge on solar thermal installations	
Spain	Professionals often lack the necessary specific knowledge for the design and execution of the installations. They have experience in electricity and plumbing. This knowledge can be applied to renewable energies with the assumption of a few basic principles, but they have to know how these basic principles.		

Spain:

CENSOLAR Basque Public University Polytechnic University of Madrid. ATECYR CSTV/ Belenos/ Insol/ CESP	Technical Project Worker in thermal solar energy installations Degree in Renewable Energies Manda Nieves Master degree in Renewable Energies Energies and Master in Energy Auditor Solar Keymark for enterprises (not

	individual education)
INSTAGI	Plumbing Termical installations Electronical installations

France:

National Institute of solar energy (INES) in cooperation with Association Ouvriere des Compagnons du Devoir du Tour de France..	Short and long term tailor made training. 150 days "Installations and maintenance of solar thermal photovoltaic systems" 25 days Certificate of Installation and maintenance of photovoltaic installations 50 days Solar Heating Installer

Greece:

Technological Education Institute of Crete	Master degree in Energy Technologies ies Energies and Master in Energy Auditor
Vocational Training Centres	Short courses on Energy Auditing to be able to pass exams for Energy Auditor Certification.

C. ***QUESTION:*** *If the technicians in your country do not have theoretical knowledge on solar thermal installations please explain; how these technicians are gaining their theoretical skills?*

Countries	Answer	Common points	Differences
Greece	The theoretical skills	There are two way to	The only significant

	have been gain by specific technical schools (*part of secondary level*). Additionally, in order a solar thermal technician to receive his certification is obligated to complete a specific amount of working hours in practical training provided via real working condition.	gain these specific theoretical skills, (a) Public Vocational Secondary Schools (under the supervision of Ministry of Education) and (b) Manpower Employment Organization's Schools (under the supervision of Ministry of Labor). Furthermore, in order to obtain their certifications, solar thermal technicians should follow "on the job training" after the completion of their corresponding theoretical courses.	difference is the duration of corresponding theoretical curriculum in order a solar thermal technician to receive his vocational permit.
Spain	They are provided with a regulated offer in vocational training. Equally, from the different associations. For instance: Instagi offers this kind of training to the enterprises, certifying that training and providing them with a qualified installer license.		

SOLAR THERMAL PRACTICAL SKILLS

A. *QUESTION:* *Do you agree with the attached list of the needed practical skills that a technician should have in order to implement solar thermal installations?*

Countries	Answer	Common points	Differences
Greece	The experts mostly agreed that the below mentioned practical skills are essential except from practical skills pointed at (9), (12) and (13) questions: experts defined these skills as theoretical and mostly needed for designers. Also, the practical skills referred at question (1), Greek experts characterized them as "desired" practical knowledge.	Experts from Greece and Spain agreed that essential practical skills for a worker in solar thermal installations are the skills pointed at questions (3), (5), (6), (8), and (10). Experts from both countries agreed that theoretical skills pointed at questions (4), (7), (9) and (12) are "some" needed/ desired practical skills, important for further professional growth, and mostly acquired for designer studier and not for technicians.	Experts in Spain count as essential practical skills for a technician in solar thermal installations the skills pointed at questions (1) and (13). Greek experts characterised the skills pointed at question (1) as desired knowledge, and the skills pointed at question (13) as mostly needed skills for a designer. Greek experts characterised the skills pointed at question (2) as important for a technician. Spanish experts count the practical knowledge pointed at question (2) as "some" needed for a technician.
Spain	The experts mostly agreed that the below mentioned practical skills are essential except from practical skills pointed at (2), (4), (7), (9), (11) and (12) questions: experts defined these skills as "some" needed.		

Regarding practical knowledge, the following skills have been considered as most important:

Knowledge	Answers	Percentage	GREECE	SPAIN
Formulated and reliable maintenance	**"A lot / very much"**	90%	Desired knowledge	"A lot / very much"
	"Some»	10%		
Coupling of solar thermal with space heating technologies	**"A lot / very much"**	90%	important	"Some»
	"Some»	10%		
Formulated malfunction investigation and repair	**"A lot / very much"**	83,33%	crucial	"A lot / very much"
	"Some»	16,67%		
Electric water pumps and relevant equipment supervision	**"A lot / very much"**	83,33%	desired knowledge	"Some»
	"Some»	16,67%		
Antifreeze protection techniques	**"A lot / very much"**	83,33%	significant expertise	"A lot / very much"
	"Some»	13,33%		
Optimal angle of panels' gradient calculation	**"A lot / very much"**	80%	Extremely essential knowledge	"A lot / very much"
	"Some»	20%		
Technical plans and blueprints understanding	**"A lot / very much"**	80%	Significant expertise for professional growth	"Some»
	"Some»	16,67%		
Boiler dimensioning and	**"A lot / very much"**	80%	Important	"A lot /

efficient positioning	**"Some»**	16,67%		very much"
Installation techniques of different type of panels (collectors)	**"A lot / very much"**	76,67%	Theoretical knowledge	"Some»
	"Some»	23,33%		
Hot water needs calculation	**"A lot / very much"**	76,66%	Important	"A lot / very much"
	"Some»	16,67%		
Efficient panels-boiler-distribution coupling and mounting	**"A lot / very much"**	70%	Important	"Some»
	"Some»	23,33%		
Optimal architecture selection (Active/passive, closed/open loop, hybrid)	**"A lot / very much"**	60%	Desirable theoretical knowledge	"Some»
	"Some»	30%		
Insulation and sealing techniques	**"A lot / very much"**	56,66%	knowledge mostly for designer/ studier	"A lot / very much"
	"Some»	33,33%		

B. ***<u>QUESTION:</u>*** *Where the technicians in solar thermal installations acquire their practical skills in your country; in their working environment and through the working experience? Or, practical training is necessary and part of the curriculum for a technician in solar/ thermal installations?*

Countries	**Answer**	**Common points**	**Differences**
Greece	Mainly, in their working environment and their relevant working experience. Some of them have attended a few intensive courses but with limited practical interaction.	There is a luck of highly practical training programs that will enhance technicians' working skills in contemporary solar and thermal installations.	The only significant difference is the duration of corresponding practical training in order a solar thermal technician to receive his vocational permit.

Spain	The expert consider that practical training is necessary and part of the curriculum for a technician in solar/ thermal installations		

GEOTHERMAL THEORETICAL SKILLS

A. QUESTION: *Do you agree with the attached list of the needed theoretical knowledge that a technician should have in order to implement geothermal installations?*

Countries	Answer	Common points	Differences
Greece	The experts mostly agreed that the below mentioned theoretical knowledge is essential except from: - Theoretical skills pointed at (2) and (5) questions: experts defined these skills optional and essential for the future - Theoretical skills pointed at (6), (8), (10) and (13) questions: experts defined these skills necessary for a designer - Theoretical skills pointed at (12) question: experts underlined that these skills need is depending on installation type needs.	Experts from Greece and Spain agreed that essential theoretical skills for a worker in geothermal installations are the skills pointed at questions (1), (3), (4), (7), (9) and (11).	Experts in Spain count as essential theoretical knowledge for a technician in geothermal installations the skills pointed at question (8). Greek experts characterised the skills pointed at question (8) as essential for an installation designer and not for a technician. Greek experts characterised the skills pointed at question (6) as essential for an installation designer and not for a technician. Spanish experts count the theoretical knowledge pointed t question (6) as "some" needed for a technician.
Spain	The experts mostly agreed that the below mentioned theoretical knowledge is essential except from skills mentioned at questions (2), (5), (6), (10), (12) and (13).		

Regarding theoretical knowledge, the following skills have been considered as most important:

	Knowledge	Answers	Percentage	GREECE	SPAIN
1.	Knowledge of HVAC relevant costs and quality control	**"A lot / very much"**	85,71%	crucial knowledge	"A lot / very much"
		"Some»	14,29%		
2.	Knowledge of design techniques, and tools, involved in production of precision technical plans, and blueprints	**"A lot / very much"**	85,71%	good knowledge for the future	"Some"
		"Some"	7,14%		
3.	Knowledge of low surface geological principles and earth heat exchange basics	**"A lot / very much"**	82,15%	very crucial knowledge	"A lot / very much"
		"Some»	14,29%		
4.	Knowledge of switching, control, and operation of electrical part of the systems	**"A lot / very much"**	82,14%	very important	"A lot / very much"
		"Some»	17,86%		
5.	Knowledge of the contemporary development and future trends of geothermal energy	**"A lot / very much"**	78,57%	optional knowledge	"Some"
		"Some»	14,29%		
6.	Knowledge of accompaniment circuit boards, and electronic equipment	**"A lot / very much"**	75%	designer/ studier knowledge and not for technical staff	"Some"
		"Some»	21,43%		
7.	Knowledge of HVAC systems basic structure and operation principles and obstacles	**"A lot / very much"**	71,43%	important knowledge	very much
		"Some»	28,57%		
8.	Knowledge of specific raw materials, insulation processes and techniques for maximizing effectiveness	**"A lot / very much"**	71,43%	knowledge mostly for designer/ studier	very much
		"Some»	25%		

9.	Knowledge of building thermal distribution systems and relevant equipment operation	**"A lot / very much"**	67,86%	essential knowledge	very much
		"Some»	28,57%		
10.	Knowledge of seasonal thermal energy storage and thermal efficiency techniques	**"A lot / very much"**	64,28%	desired knowledge for a studier	some
		"Some»	32,14%		
11.	Knowledge of the worldwide state of the art in geothermal applications	**"A lot / very much"**	64,28%	extremely essential knowledge	very much
		"Some»	14,29%		
12.	Knowledge of the relevant chemicals, properties of substances and their interactions, danger signs, production techniques, and disposal methods	**"A lot / very much"**	60,72%	depending on the needs	some
		"Some»	28,57%		
13.	Knowledge of physical principles, laws and their interrelationships with applied science (*understanding fluid mechanics, and atmospheric dynamics*)	**"A lot / very much"**	60,71%	knowledge mostly for designer/	some
		"Some»	28,57%		

B. . QUESTION: *Do the technicians on geothermal installations in your country have the above mentioned theoretical knowledge?*

Countries	**Answer**	**Common points**	**Differences**	
Greece	In Greece, in order a technician to take the licence to work as a plumber has; a) or to complete a specific amount of working hours that are certified via a professional assessment body, or b) to attend specialized vocational education and training offered by several educational and vocational institutions.	Both in Spain and Greece, plumbers in order to obtain their diplomas have to acquire theoretical knowledge and practical skills. The years that a technician should complete in compulsory or vocational education are depending in both countries from the degree level of specialization and certification.	The differences that we found among the two countries are referred in the years that both theoretical and practical training last in order someone to become a plumber. Below are presented the differences concerning the years of training that a technician should complete in order to obtain his/ her diploma in Spain and Greece:	
Spain	Also, in Spain, in order someone to become a technician in geothermal installations is compulsory the technician to attend specialized vocational education and training offered by several educational and vocational institutions		**GREECE** **A)** Three years in vocational lyceum: 1 year theoretical general education and 2 years vocational specialized education. **B)** After a student finished the general lyceum could attend a two years vocational school of OAED	**SPAIN** **A)** Two years of vocational training for basic level (when compulsory education ends up to 16 years old). **B)** After a student completes the education described above at point **A),** could

			(Manpower Employment Organization) or a three years vocational programme in OAED in case the student has finished only the general gymnasium. **C)** Attending private schools in big cities for a post secondary degree of specialization. **D)** For a higher tertiary degree students should follow the lessons provided by higher technological institutes.	continue his/ her education for two more years in order to obtain a higher degree in mechanical installations or in heating and cooling. **C)** For a higher tertiary degree students should follow the lessons provided by Universities in order to become a mechanical engineer.

C. ***QUESTION:*** *If the technicians in your country do not have theoretical knowledge on geothermal installations please explain; how these technicians are gaining their theoretical skills?*

Countries	Answer	Common points	Differences
Greece	In case that a plumber has no previous theoretical knowledge in geothermal installations could attend in training centres a specialised vocational training seminar in geothermal installations.	In both countries the gap in knowledge on theoretical part of geothermal installations is solved by private vocational training centres, through the implementation of specialized seminars.	NO DIFFERENCES
Spain	Through the attendance of specialized vocational seminars.		

GEOTHERMAL PRACTICAL SKILLS

D. QUESTION: *Do you agree with the attached list of the needed practical skills that a technician should have in order to implement geothermal installations?*

Countries	Answer	Common points	Differences
Greece	The experts mostly agreed that the below mentioned practical skills are essential except from practical skills pointed at (3), (5), (8) and (13) questions: experts defined these skills as "some" needed and the practical skills referred at questions (10) and (11) desired skills for designers.	Experts from Greece and Spain agreed that essential practical skills for a worker in geothermal installations are the skills pointed at questions (1), (3), (4), (7), and (12). Experts from both countries agreed that practical skills pointed at questions (2), (5), (8), (11) and (13) are "some" needed/ desired practical skills, and mostly need to be acquired for designer studier and not for technicians.	Experts in Greece count as essential practical skills for a technician in geothermal installations the skills pointed at questions (6) and (9). Spanish experts characterised the skills pointed at question (6) and (9) as "some" needed skills for a worker. Greek experts characterised the skills pointed at question (9) as important for a technician. Spanish experts count the practical knowledge pointed at question (9) as "some" needed for a technician.
Spain	The experts mostly agreed that the below mentioned practical skills are essential except from practical skills pointed at (2), (5), (6), (8), (9), (11) and (13) questions: experts defined these skills as "some" needed.		

Regarding practical knowledge, the following skills have been considered as most important:

	Knowledge	Answers	Percentage	GREECE	SPAIN
1.	Installation techniques and handling of different type of tubes	**"A lot / very much"**	96,43%	crucial knowledge	"A lot / very much"
		"Some»	3,57%		
2.	Building distribution system installation (fun coils, etc.)	**"A lot / very much"**	92,86%	"Some"	"Some"
		"Some»	7,14%		
3.	Formulated and reliable maintenance	**"A lot / very much"**	92,85%	"A lot / very much"	"A lot / very much"
		"Some»	7,15%		
4.	Heat exchanger dimensioning and positioning	**"A lot / very much"**	89,29%	"A lot / very much"	"A lot / very much"
		"Some»	10,71%		
5.	Technical plans and blueprints understanding	**"A lot / very much"**	89,29%	"Some"	"Some"
		"Some»	10,71%		
6.	Efficient heat exchanger-heat pump-distribution coupling and mounting	**"A lot / very much"**	89,28%	"A lot / very much"	"Some"
		"Some»	7,14%		
7.	Drilling techniques, reliable and effective restoration	**"A lot / very much"**	89,28%	important knowledge	very much
		"Some»	3,57%		
8.	Formulated malfunction investigation and repair	**"A lot / very much"**	85,71%	"Some"	"Some"
		"Some»	14,29%		
9.	Electric water pumps and relevant equipment supervision	**"A lot / very much"**	85,71%	important knowledge	"Some"

		“Some»	14,29%		
10.	Thermal energy balance and total needs calculation	**“A lot / very much”**	82,15%	desired knowledge for a studier	very much
		“Some»	14,29%		
11.	Optimal architecture selection (horizontal/vertical, closed/open loop, direct/indirect)	**“A lot / very much”**	82,14%	desired knowledge for a studier	some
		“Some»	14,29%		
12.	Insulation and sealing techniques	**“A lot / very much”**	78,57%	important knowledge	very much
		“Some»	17,86%		
13.	Coupling of ground heat exchanger with heat pumps technologies	**“A lot / very much”**	75%	“Some”	“Some”
		“Some»	17,86%		

E. ***QUESTION:*** *Where the technicians in geothermal installations acquire their practical skills; in their working environment and through the working experience? Or, practical training is necessary and part of the curriculum for a technician in geothermal installations?*

Countries	**Answer**	**Common points**	**Differences**
Greece	In Greece, in order a plumber – specialized in geothermal installations, to obtain his diploma is obligated to complete a specific amount of working hours in practical training provided via real working conditions (implementation of geothermal installations in real working environments). The	Both in Spain and Greece, plumbers in order to obtain their diplomas have to acquire beyond the theoretical knowledge, practical skills via “on the job training”. The hours that a technician should complete in real	The differences that we found among the two countries are referred in the years that both theoretical and practical training last in order someone to become a plumber. Below are presented the differences concerning the years of training that a technician should complete in order to obtain his/ her diploma in Spain

	amount of the hour that a plumber should complete are depending of the degree level.	working environments are depending in both countries from the degree level of specialization and certification.	and Greece:	
Spain	In Spain, in order someone to become a technician in geothermal installations is compulsory and included in training curriculums for plumbers, the practical training in specialized laboratories and in real working environments; for this case a real geothermal installation.		**GREECE** **A)** Three years in vocational lyceum: 1 year theoretical general education and 2 years vocational specialized education. **B)** After a student finished the general lyceum could attend a two years vocational school of OAED (Manpower Employment Organization) or a three years vocational programme in OAED in case the student has	**SPAIN** **A)** Two years of vocational training for basic level (when compulsory education ends up to 16 years old). **B)** After a student completes the education described above at point **A),** could continue his/ her education for two more years in order to obtain a higher degree in mechanical installations or

			finished only the general gymnasium. **C)** Attending private schools in big cities for a post secondary degree of specialization. **D)** For a higher tertiary degree students should follow the lessons provided by higher technological institutes.	in heating and cooling. **C)** For a higher tertiary degree students should follow the lessons provided by Universities in order to become a mechanical engineer.

1.4 ANNEXES

Any detailed information, such as sample questionnaires, which is not essential for the reader to understand the outcomes or conclusions of a report, but which can provide them with a more complete understanding of how the information was collected or analysed should be included as an appendix.