



# GSS-VET

## *Geothermal & Solar* skills

VOCATIONAL EDUCATION AND TRAINING

WP5 / D 5.2

### Reports on trainings' Implementation – **INSTALLERS**

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**REPORT ON TRAININGS' IMPLEMENTATION  
IN ALL COUNTRIES: LEARNERS**



**GSS-VET**

Geothermal and solar skills - Vocational education and training



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## TRAINING IN GREECE

### Introduction

In this deliverable is included the description of pilot training of trainees of the GSS-VET project carried out in Hellenic Mediterranean University (HMU) and the European Center in Training for Employment (ECTE) in collaboration with the Hellenic Association of Photovoltaic Companies (HELAPCO) and the Chamber of Commerce of Industry of Chania. The objectives of the pilot training during the project implementation were:

- ✓ to test and validate the effectiveness of the training platform in a real training environment with trainees from all countries that participate in the project consortium (Greece, Spain, Germany, and Bulgaria)
- ✓ to collect feedback from trainees (experienced and non-experienced in the field of photovoltaic, solar-thermal and geothermal systems) on the quality of the training platform that has been created and use their proposals to enrich and improve the contents of the training platform or certain characteristics in the training process
- ✓ to disseminate the results of the GSS-VET project to as many as possible shareholders (technicians as constructors, electricians, hydraulics, engineers, environmentalists, etc.) to be trained in the future after the end of the project.



## Training by the HELLENIC Mediterranean University of Crete (HMU)

The training process that is described in this deliverable took place during the time from March till August 2020. In total 53 people (45 in HMU and 8 in HELLAPCO) expressed their interest to participate in this program and were registered in the pilot training of the program.

The participants per training curriculum were:

- 53 for photovoltaic systems
- 40 for solar-thermal systems
- 16 for geothermal systems

**Note:** *Many of the trainees who registered in the pilot training process registered in the beginning in more than one training curriculums and chose the curriculum that was more interesting for them in the process of the pilot training.*

This pilot training program for all trainees was promoted from the personnel of HELLAPCO and HMU (the members from laboratories of “Environmental and Photovoltaic Systems” and “Renewable Energy Engineering”) and the trainers who have attended both workshops (in 2-3/9/2019 and 18-21/2/2020) which had been organized (see deliverable in WP5, 5.2.3-a). Unfortunately, due to the coronavirus pandemic, the training plan that was developed before the training process had to be significantly modified. Up to date (August 2020), it has been partially completed. In March 2020, when the pilot training process began, all training activities, mainly the ones that included practice training and teaching in laboratories, were postponed. Part of them took place in laboratory with physical presence on June 2020 or by distance for the trainees of HELLAPCO and for the trainees who could not be present by using teleconferencing. More analytically this process included audio and video conferencing by using the hosting services of HMU. All trainees that participated in these meeting by distance by using computer, internet connection, microphone, and webcams. All activities with physical presence, both the practice training and laboratory exercises, were applied with significant limitations, since access to HMU premises was limited and under strict rules (minimum number of trainees per square meter in laboratories and classes).



Finally, many of the trainees who had registered in the pilot training process of the program dropped out due to reasons mainly derived from the COVID-19 crisis or have delayed in finalized their training process which is still in progress.

At this point we must mention that only one of the trainees who had registered to attend the training course in geothermal systems finalized the training process till today. The reason was that from the beginning few trainees were interested to attend this course. All trainees who were registered to geothermal systems had also registered and to at least one of the other two training courses (photovoltaic and/or solar thermal systems) in which they were more interested to attend them and update their skills, since the demand in Greece for high skilled technicians in photovoltaic and solar-thermal systems is quite significant. Although currently in Greece the demand for skilled technicians in geothermal systems is not so significant it is expected that this situation will change in the next years and the application of geothermal systems will be increased. For that reason, many from the trainees were interested, for now, to see the training material in geothermal systems and mentioned in their comments concerning the program that they will register in the future in the training course of geothermal systems to get certified also in these systems.

## Training of Installers

This section describes the pilot training plan in the three training curricula of the GSS VET project (photovoltaics, solar-thermal and geothermal).

### Organization of the trainings

The trainers used in the training process of all groups were the trainers that were the people who were trained in the 2<sup>nd</sup> workshop of trainers' training of the project (that took place on 18-21/2/2020).

Also, in the pilot trainings worked as co - trainers and members of the project team.



Also two external associates of HMU and members of the GSS VET Project Team, worked in all management tasks concerning logistic actions as:

- gather and group all data from trainees from questionnaires, applications, necessary documents for the certification process, etc.)
- organize all activities for practice training (divide trainees in small groups, check the availability of safety means during training sessions, organize for the trainees who could not be present to attend the practice training sessions by distance and make arrangements with the personnel of HMU for the disinfection of the laboratories between all training sessions)

The preparatory actions for the pilot training process that were finished till the end of February included:

- Preparation of announcements concerning the training process.
- Disseminate (through workshops of trainers, daily events in HMU and HELAPCO, website, in person communication with local associations of technicians and the Technical Chamber of Greece) the training program of the project in photovoltaic, solar-thermal and geothermal systems that can offer in the end for the participants certified training.
- Finalization of certification schemes for all training curricula in English and translated in Greek – Spanish – Bulgarian and German (prepared from the project partner No.5 - TUV Austria). These certification schemes are included in project deliverables in WP4 – Task 4.3.
- Form the final version of the document of “Persons’ Certification Application” (prepared from the project partner No.5 - TUV Austria) that included the requested information from all applicants that wanted to participate in the pilot training process:
  - Personal information
  - Requested certification (scheme / level)
  - Accompanying documents

Also, in the same document were included data for applicants for special needs, information for applicants and applicant’s commitment.

- Preparation of the laboratory exercises and the practice training.



- Creation of a separate folder, accessible from the trainees, where additional material (e-books, student-notes, exercises, other educational material) was included for the trainees with limited knowledge and experience in the field to fill any knowledge gaps they have on specific issues of the training material that is included in the training platform.
- Collect all applications from trainees that expressed interest to participate in the pilot training process of the program.

The beginning of the pilot training process started on the beginning of March 2020. At that time, the problems caused from the spread of COVID-19 had already started to affect all training activities of HMU since the University stopped all in person training activities after the 10<sup>th</sup> of March of 2020. This fact caused changes in the pilot training process plan to include as less as possible face-to-face activities and teaching in laboratories in classrooms (all these activities were scheduled, based on the COVID-19 situation, to take place after the end of May when was expected, based on the daily reports of the Greek Government, that the problems caused by COVID-19 would be minimized).

The actions in the beginning of the pilot training process included:

1. Divide all trainees that were registered in the pilot training in 6 groups.
  - a. Two groups in training of photovoltaic systems (for advanced and basic level of certification)
  - b. Two groups in training of solar-thermal systems (for advanced and basic level of certification)
  - c. Two groups in training of geothermal systems (for advanced and basic level of certification)

All trainees registered in the program sometime in the period March – June 2020.

2. Send user credentials and instructions to all trainees after their registration process is completed. At this stage, the credentials for all trainees were created from the company SQLearn (No.6 partner of the project) who has created the project platform. After the end of the project the process for trainees to get credentials to attend any of the training programs will be an automated process from the project webpage.



3. Confirmation from all participants that they meet the entry in the platform requirements and can open and study the training material and the time of the pilot training process began.
4. Afterwards, all trainees got by e-mail some general guidelines/suggestions how to study to training material. These suggestions included the following:
  - a. Proposed study hours of the training platform one to two hours per day (for the trainees who are active workers). For the trainees who are currently unemployed the proposed study hours per day were three to four hours per day. In any case it was recommended to all trainees to study the training material in a daily basis (at least for an hour) to understand what they study easier and to not lose their interest in the training program.
  - b. The estimated time to finalize the training process for each training course was two to four months. This is an estimation that depends on the existing knowledge and skills of each trainee on the training subject, the age and the familiarity of each trainee with online training and of course on the current psychological status of each trainee after the COVID-19 situation (stay at home many hours, to be anxious for his future employment status and his health, etc.).
  - c. In case they had questions concerning the training material or want to ask guidance for further reading they could ask the trainers of their program by e-mail.
  - d. They should participate in discussions, meetings that the trainers of each program will organize in the training period. In these meetings all trainees will have the chance to discuss on the material they read, exchange views, and understand better the training material. Also, the trainers will have a feedback from the trainees and check the problems they face concerning the training process and how they can optimize it.

Although in the training course for the geothermal systems there was from the beginning of the pilot training process lower demand from trainees to attend it, courses were organized and for this course because the need for technicians in geothermal systems is expected to be significantly increased in the future in Greece (*Reference 1: Papachristou M, et al "Geothermal Energy Use, Country Update for Greece (2016-2019), presented in European Geothermal Congress, 2019 – Reference 2: <https://www.geoenergymarketing.com/energy-blog/the-geothermal-potential-in-greece>*).



## Performance of the trainings

All groups started their training process simultaneously because the training process had delayed based on the existing timetable of the project activities (the situation in February of 2020, based on the approval of the Amendment No. 3 of the project on 7/8/2019, was that the project should end on 31/3/2020). Because of the problems caused by COVID-19 we asked on February 2020 from EACEA an extension in the project duration till August 2020. The official request was sent by email on 24/3/2020 (Amendment No. 4) and was approved by the EACEA. Based on this amendment and the new approved timetable of the project, the pilot training process should be completed till 14/8/2020. This fact resulted for most of the activities in the pilot training process to be completed as scheduled successfully or to be re-scheduled in a way (e.g. minimize training activities with physical presence in classrooms and/or laboratories) that they could be completed. In Annex A are presented the lists of trainees that registered to the training program per training course and level of expertise (Tables 1 – 6).

Milestones in the training process were:

March – July 2020	On-line training of trainees in all groups.
<p>During this period there was regular communication of trainees with trainers through emails and scheduled on-line meetings for questions and discussions on the topics of the training material. For the trainees who had limited expertise in the field the trainers proposed additional bibliography to be studied in parallel.</p> <p>The proposed bibliography included:</p> <ul style="list-style-type: none"> <li>✓ Student notes of the course: “Renewable Energy Sources (RES) II” of Dept. of Natural Resources and Environment of HMU</li> <li>✓ Student notes of the course: “Modeling and Simulation of RES Systems” of Dept. of Natural Resources and Environment of HMU</li> <li>✓ Student notes of the course: “Photovoltaic Systems” of Dept. of Electrical and Computer Engineering of HMU</li> </ul>	



June 2020	Practice training of trainees in laboratories (organized face to face and by distance)
<p>Training sessions with physical presence were organized, for photovoltaic systems, in Laboratory of Environmental and Photovoltaic Systems in HMU on 1<sup>st</sup>-2<sup>nd</sup> and 9<sup>th</sup>-10<sup>th</sup> of June 2020. During these sessions it took place practice training and presentation of exercises in installation and maintenance of photovoltaic systems. The trainees where divided in small groups, 5-8 persons per group, and attended 2-hours course per day (total hours of practice training 8 hours / per trainee). Based on the COVID-19 rules for education activities with physical presence between all sessions there was a break of 15-20 minutes when the laboratory was disinfected before each training session began. Also, safety measures were taken in each session (use of face masks and gloves). The trainees that were not in Crete and the trainees who had problems (belonged in vulnerable group and was necessary to take in the maximum extend precaution measures to be protected from COVID-19) attended these sessions via teleconferencing.</p> <p>Training sessions physical presence were organized, for solar thermal systems, in Laboratory of Renewable Energy Engineering in HMU on 8<sup>th</sup>-15<sup>th</sup>-16<sup>th</sup> and 17<sup>th</sup> of June 2020. During these sessions it took place practice training and presentation of exercises in installation and maintenance of solar thermal systems. The trainees where divided in small groups, 5-6 persons per group, and attended 2-hours course per day (total hours of practice training 8 hours / per trainee). Based on the COVID-19 rules for education activities with physical presence between all sessions there was a break of 15-20 minutes when the laboratory was disinfected before each training session began. Also, safety measures were taken in each session (use of face masks and gloves) (photos from these training sessions are in Annex C). The trainees that were not in Crete and the trainees who had problems (belonged in vulnerable group and was necessary to take in the maximum extend precaution measures to be protected from COVID-19) attended these sessions via teleconferencing.</p>	



## Work-based training

All trainees that followed the evaluation and certification process in the end of the training process, were technicians / engineers with experience in installation and maintenance of solar – thermal and/or photovoltaic and/or geothermal systems. So, after the study of the training material and the 8-hour practice training it was not necessary for them to attend additional hours of practice training in real cases. If any of the trainees with basic experience and skills in the field (from the tables of Annex A) would have finalized the study of the training material and attended the practice training sessions in June 2020, then there would be organized additional work – based training session of 10 to 20 hours so he could in the end of the program to get certified (in that case the evaluation process would be both online and examination with physical presence in the laboratory on a real case study). So, in the pilot training process that is described in this deliverable, no work – based training took place.

## Evaluation of Learners and internal certification

The evaluation and certification plan for the trainees who studied the training material and attended (by presence or by distance) the 8-hour practice training process in laboratory took place in the end of the pilot training process of the project.

## Organization of the evaluation and certification process

Up to this point – mid of August 2020 - all trainees that fulfilled all steps in the pilot training process were expert trainees' in the field of solar-thermal, photovoltaic and geothermal systems. So, for their certification it was necessary for them just to pass the online exam in the end of the training process. This fact simplified the evaluation and certification process since each trainee was examined by distance so there was no need to organize classroom for examination, people to supervise the process and safety measures to minimize the risks because of COVID-19.



For the trainees who did not finish their training up to the mid of August the HMU project team has decided that the following process should take place in the future: For all trainees (experts and non-experts) who have not managed to finish their training till today and they want to get the certification from the project they had the option till the mid of September to pass the on-line test and finish all steps for their certification.

Additionally, for the trainees with limited years of expertise in their profession, if they want to finalize the evaluation process, to be able after they pass their online test to take also and the practice training exam sometime in the period from the mid of September till the end of October 2020. Because of the fact that this exam has to take place by physical presence it is estimated that after the 1st of September (when the academic year 2020-2021 in HMU will begin) the practice training exam process will be possible to be organized in the premises of HMU based on the restrictions because of the COVID-19 that will be valid at that time.

## Evaluation results

In Annex B is the list of trainees who took the online test and got a passable result. As mentioned before there were not trainees who took the practical exam test till today.

- 6 solar thermal technicians out of a total of 40 in HMU enrolled in the training program were awarded the project certificate as Solar Thermal Energy Systems Installers, Advanced Level
- 17 photovoltaic technicians out of a total of 43 in HMU enrolled in the training program were awarded the project certificate as Solar Photovoltaic Installers, Advanced Level
- 11 photovoltaic technicians out of a total of 11 in HELAPCO enrolled in the training program were awarded the project certificate as Solar Photovoltaic Installers, Advanced Level
- 1 geothermal technician out of a total of 16 enrolled in the training program were awarded the project certificate as Geothermal Installer, Advanced Level



## Evaluation of training process

In the end of the training and evaluation process all trainees filled in a satisfaction questionnaire to mention their comments concerning the program and make suggestions to be improved. This questionnaire in Greek (prepared from the project partner No.5 - TUV Austria) is presented in **Annex**

**C.** Main results that came out of the answers of the trainees were:

- Most of the trainees (29 out of 35 – percentage 83%) were pleased from the training process and the contents of the training material since in question 1 “General Impression – Comments” and question 5 “Training Material – Comments” they marked the grade 4 or 5.
- In question 3 “Subjects Coverage / duration”, 27 out of 35 - percentage 77%, marked the grade 4 or 5. In the comments in question 3 many of the trainees mentioned that the training material covered their needs and expectations, they learned new trends and technologies in their profession that will help them and upgrade their skills.
- In question 2 “Trainers’ Competence”, 31 out of 35 – percentage 89%, marked the grade 4 or 5.
- The expectations of trainees for the training process organization (question 5 “Location and visual means” and questions 6 “Training center personnel”) were also positive ,29 out of 35 - percentage 83%. In the comments in questions 5 and 6 most of the trainees mentioned the organization of the training process was quite successful if are taken under consideration and the problems caused by the COVID-19 crisis.

As strong points of the training process, the trainees mentioned:

- During the training process many trainees had questions based on their experience or shared with the rest of the trainees in the online discussions, organized by the trainers, real cases where they could apply what they learned. This helped trainees to understand in depth the training material.
- Trainees realized that although some of them have many years of working experience it is profitable for them to update their knowledge and get trained in their profession. Through GSS-VET program many of them realized they can become better in their profession.



As improvement suggestions were mentioned:

- In the future there should be included in the training process more practice training hours in specialized topics as residential buildings and public buildings (new or retrofitted) with lot of energy needs as schools, hospitals, etc.
- To include in the training material additional notes concerning financing process and legal status of installing solar-thermal and photovoltaic systems in Greece.
- Also, the training platform needs to be updated in a regular basis in the future to cover the needs of potential future trainees and include dynamic procedures such as:
  - Easy navigation and friendly structure
  - Continuous standard help and helpdesk provision to users
  - Structured material per country
  - Centre for discussions (forums)
  - Suggested reading for experts and non-experts in the field
  - Group potential trainees that face similar problems to exchange experience and information.
  - To contain training material to be translated in more languages which will give the chance to more technicians in Europe to use it to get certified.

## REGISTRATION OF PARTICIPANTS IN THE EURES PORTAL

Some of the trainees have shown interest to register in the EURES platform. It is expected that they will sign in this database in the near future. The project team has already notified all trainees that in case they need any assistance in this process they can send an email and ask for help.

## SUMMARY OF RESULTS

Main results from the pilot training process were:

- 55 participants registered in pilot training process of all courses
- 6 solar thermal systems installers certified according to the GSS-VET internal certification scheme



- 28 solar photovoltaic systems installers certified according to the GSS-VET internal certification scheme
- 1 geothermal systems installer certified according to the GSS-VET internal certification scheme



## Annexes

Satisfaction Questionnaire of the training Program Assessment in Greek all trainees have filled in after they finished their online exams

Ερωτηματολόγιο Ικανοποίησης – Αξιολόγησης Εκπαιδευτικού Προγράμματος	
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QUE\_WP5\_satisfaction assessment-trainee\_06022020

ΤΙΤΛΟΣ ΠΡΟΓΡΑΜΜΑΤΟΣ	:	
ΤΟΠΟΣ/ ΗΜΕΡΟΜΗΝΙΑ ΠΡΟΓΡΑΜΜΑΤΟΣ	:	
ΟΝΟΜΑΤΕΠΩΝΥΜΟ ΣΥΜΜΕΤΕΧΟΝΤΑ (προαιρετικό)	:	

Αξιολογήστε την ικανοποίησή σας στην κλίμακα  
1: Καθόλου, 2: Λίγο, 3: Μέτρια, 4: Καλά, 5: Πολύ καλά

	1	2	3	4	5
1. ΓΕΝΙΚΗ ΕΝΤΥΠΩΣΗ Παρατηρήσεις:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ΕΠΑΡΚΕΙΑ ΕΙΣΗΓΗΤΗ Παρατηρήσεις:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ΚΑΛΥΨΗ ΘΕΜΑΤΟΣ / ΔΙΑΡΚΕΙΑ ΕΚΠ. ΠΡΟΓΡΑΜΜΑΤΟΣ Παρατηρήσεις:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ΣΗΜΕΙΩΣΕΙΣ & SLIDES Παρατηρήσεις:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. ΑΙΘΟΥΣΑ ΚΑΙ ΕΠΟΠΤΙΚΑ ΜΕΣΑ Παρατηρήσεις:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. ΠΡΟΣΩΠΙΚΟ ΕΚΠΑΙΔΕΥΤΙΚΟΥ ΚΕΝΤΡΟΥ Παρατηρήσεις:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. ΔΥΝΑΤΟ ΣΗΜΕΙΟ:					

QUE\_WP5\_satisfaction assessment-  
trainee\_06022020

Σελίδα 1 από 1



Ερωτηματολόγιο Ικανοποίησης –  
Αξιολόγησης Εκπαιδευτικού Προγράμματος



QUE\_WP5\_satisfaction assessment-trainee\_06022020

8. ΠΡΟΤΑΣΕΙΣ ΓΙΑ ΒΕΛΤΙΩΣΗ:

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9. ΑΛΛΑ ΣΧΟΛΙΑ:

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Το ερωτηματολόγιο αποστέλλεται στ....  
με email στη δ/νση ....., ή με fax στο .....

QUE\_WP5\_satisfaction assessment-  
trainee\_06022020

Σελίδα 2 από 2

**Note:** The questionnaire was prepared from the project partner No.5 - TUV Austria.



Photos from the practice training sessions in June 2020 in premises of HMU



## TRAINING BY THE EUROPEAN CENTER IN TRAINING FOR EMPLOYMENT – ECTE

This section describes the trainings of trainees carried out by ECTE with the collaboration of the Chamber of Commerce and industry of Chania (CCIC). There were implemented two trainings, one for electricians in the field of photovoltaic installations and one for plumbers in the field of solar thermal installations. The training was implemented in collaboration with Chamber of commerce and industry of Chania, who is the successor institute of partner ETAN, the developmental agency of Chania, and been both partners in GSS VET consortium.

### Organisation of the trainings

ECTE and CCIC collaborated in the selection of the trainees (plumbers and electricians), who attended the training sessions. The objective was to organize trainings in a classroom with the use of the GSS e-learning platform, as most of the trainees had not relevant experience in e-learning processes. An objective was also to pilot test the ubiquitous learning procedure, to groups of trainees who have not enough digital knowledge for using the e-platform. So, the challenge was to organize as many training sessions in classroom, as needed to cover the theoretical part of the training and at the same time the trainees have the possibility to review the theoretical part in any time, any place they felt convenient. The basic structure of the courses (ubiquitous = e-learning + mobile + classroom) can be seen in the following Figure.

Training characteristics:

- course of photovoltaic solar systems. Duration 100 h.
- course on thermal solar systems. Duration: 100 h
- Both courses included facilitated online training in ECTE IT lab (100%).
- There was not any practice program as all trainees were active professionals having more than two years of experience, registered for the advance level of certification, for not any practical training and the relevant examination is needed.
- Then program included not less than eight hours per week, to attend the online course in a facilitated environment in IT classroom in ECTE. Additionally, they had the chance of



reviewing the online contents from the home or working place. In this way, it was possible to specify the time frame of the courses and the entire training plan that was completed in a 12 weeks period.

- The examination was implemented one week after the last online training.

### Performance of the training of installers

In general, during the first 4 weeks, according to the established programs, the trainees' work was focused on studying the online content with the support and dynamization of expert tutors. The assignment and dedication of the tutors was done in this way:

- **1 tutor facilitator per course** for 8 hours per week. No need to be specialized in PV or the ST systems installations, however has to be experienced in use of online platforms and training.

Dedication:

On March the 15<sup>th</sup>, all training activities were cancelled, because of the lock down of training centers. The training started again from the 1<sup>st</sup> of June.

### Train of installers of Solar PV systems.

The courses of Solar Photovoltaic and Solar Thermal systems had a common design and activity program, adapted to the particular conditions of Crete. In essence, the courses (with a standard duration of 100H) were conceived structured according to an online tutored phase (50%) around learning the fundamentals, regulation framework, techniques and means of installation and maintenance of solar photovoltaic systems and another phase (50%) aimed primarily at application of previously learning knowledge, and skills development. The training program associated with the structure of the courses for installers of solar photovoltaic systems, as it is listed below:

#### PHOTOVOLTAIC (PV) TECHNOLOGY

- Basic solar engineering
- Energy storage technologies and PV systems
- Professionalism issues



**PHOTOVOLTAIC SYSTEMS**

- Grid-connected PV systems with or without battery storage
- Off-grid PV systems with or without battery storage
- PV system performance

**INSTALLATION AND MAINTENANCE OF PHOTOVOLTAIC SYSTEMS**

- PV systems' installation
- PV systems' inspection
- PV systems' maintenance

The practical training in the classroom, was implemented with a selection of exercises, practices or projects related to the related learning outcomes supported by appropriate equipment and other resources.

It should be noted that, in general, these courses went smoothly in the first few weeks before they had to be interrupted. There was time to experiment with online training and practice sessions in the partners' training centers, too. And the trainers were able to gather first impressions from the participants.

**Train of installers of Solar Thermal systems**

The courses for installers of Solar Thermal Systems were implemented with a similar approach to that of the Solar Photovoltaic course, associated with the structure, as it is listed below

**DESIGN OF SOLAR THERMAL INSTALLATIONS**

- National regulations
- Design of the solar collectors field
- Heat storage systems
- Auxiliary systems
- Components of the hydraulic systems
- Regulation and control systems



- Measurement systems
- Schemes of solar thermal installations

**EXECUTION OF SOLAR THERMAL INSTALLATIONS**

- Prevention of occupational risks
- Execution of a solar thermal installation
- Start-up of the solar thermal installation

**MAINTENANCE OF SOLAR THERMAL INSTALLATIONS**

- Monitoring plan
- Preventive and corrective maintenance

**Train of installers of Geothermal systems**

There was not any training in Geothermal Installations by ECTE.

**WORK-BASED TRAINING OF INSTALLERS**

As indicated above, the courses organized were of the "Advanced" type for experienced installation professionals. Therefore, it was not considered necessary to include this module, which is more appropriate for student (initial VET) or occupational (professional retraining, etc.) trainings.

**EVALUATION OF LEARNERS AND INTERNAL CERTIFICATION**

This section describes the specific actions relating to the certified assessment of installers and the processing of certificates.

**Organisation of the evaluation and certification process**

The evaluation and certification process for installers participating in the pilot courses was originally scheduled to be implemented at the end of the training (Figure 1). In addition, the certification route



was that corresponding to the "advanced" profile of the participants. That is, they did not need to pass the practical exam. Also, the option of **online theoretical exam** (automatically generated by the platform) was chosen, which does not require the simultaneous presence, physical or virtual, of the participants. These features simplified the process organizationally. The coronavirus crisis forced to postpone the certification evaluation process. Once the process was resumed, only a part of the registered participants managed to finish their training and take the theoretical certifying test (in July 2020).

## Evaluation of participants in the trainings for Solar PV installers

### Theoretical exam

The students, after the end of the training procedure participated the theoretical exams which were supervised by ECTE's tutor. 14 photovoltaic installers out of a total of 16 who attended the training procedure, were positively evaluated and got the certificate which was issued by TUV AUSTRIA Hellas, which is an officially accredited certification body.

### Practical exam

All the students qualified as "Advanced" level applicants and therefore the practical exam was not applicable.

### Certification

14 solar photovoltaic system installers out of a total of 16 attended the training procedure were awarded the internal project certificate (issued by TUV AUSTRIA). All installers were trained by ECTE.



## Evaluation of participants in the trainings for Solar Thermal installers

### Theoretical

The students, after the end of the training procedure participated in the theoretical exams which were supervised by tutor. The examination process was in written form in ECTE premises, using questions from the GSS platform.

### Practical

All the students qualified as “Advanced” level applicants and therefore the practical exam was not applicable.

### Certification

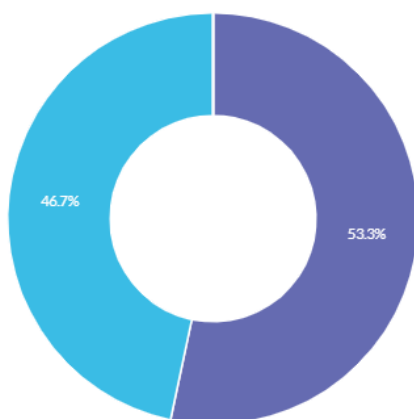
10 solar thermal systems installers out of a total of 12 attended the training were positively evaluated and got the certificate which was issued by TUV AUSTRIA. All installers were trained by ECTE.

## Evaluation of training

The original training plan as referred in the GSS “Framework for training implementation” that developed in WP5, included a satisfaction survey for trainees (<https://s.surveypal.com/lv5rkTsj>). The general impression of trainees was above the 53% Very good and 47% Good. They referred to the strong points of the training program which are the validation and certification of the learning outcomes, the GSS learning platform and the effective training material as well as the educational methods, pointing mainly at the ubiquitous learning environment. Finally, it is proposed more courses related to the needs of the professionals to be developed and delivered with this educational method, and leading to an official validation of the acquired competences through certification



Q2 ΓΕΝΙΚΗ ΕΝΤΥΠΩΣΗ  
Rating



Choice	Rating	Total
1 - Πολύ καλά	16	16
2 - Καλά	14	7
3 - Μέτρια	0	0
4 - Λίγο	0	0
5 - Καθόλου	0	0

Unanswered  
0

Answered  
23

Average Rating  
1 - Πολύ καλά

[See all answers >](#)



Answers

Εκπαιδευτικό παιχνίδι με πραγματικές καταστάσεις που αντιμετωπίζουμε στη δουλειά

Θέμα εκπαίδευσης, Πιστοποίηση. Εκπαίδευση από απόσταση

ΔΥΝΑΤΟΤΗΤΑ ΕΚΠΑΙΔΕΥΣΗΣ ΟΠΟΙΟΔΗΠΟΤΕ ΩΡΑ.

Καλή εκπαίδευση και πιστοποίηση

Πιστοποίηση, μη απαραίτητη παρουσία στη τάξη, Εκπαίδευση μέσω ηλεκτρονικής πλατφόρμας

Δυνατότητα εναλλακτικής εκπαίδευσης εκτός αίθουσας, σεκατάλληλες ώρες. Σενάρια εργασίας. Πιστοποίηση

Δυνατότητα εκπαίδευσης από το σπίτι, ή τη δουλειά, μέσω κινητού Πιστοποίηση

Πιστοποίηση

Η ΠΛΑΤΦΟΡΜΑ ΕΚΠΑΙΔΕΥΣΗΣ

ΤΟ ΠΑΙΧΝΙΔΙ ΑΦΟΜΟΙΩΣΗΣ ΓΝΩΣΗΣ

Η ΠΙΣΤΟΠΟΙΗΣΗ

Η ΠΛΑΤΦΟΡΜΑ ΕΚΠΑΙΔΕΥΣΗΣ

Η ΠΙΣΤΟΠΟΙΗΣΗ

ΤΟ ΠΑΙΧΝΙΔΙ ΑΦΟΜΟΙΩΣΗΣ ΓΝΩΣΗΣ

Η ΠΙΣΤΟΠΟΙΗΣΗ

Η ΠΛΑΤΦΟΡΜΑ ΕΚΠΑΙΔΕΥΣΗΣ

ΠΛΑΤΦΟΡΜΑ ΕΚΠΑΙΔΕΥΣΗΣ

ΌΛΑ ΠΟΛΥ ΚΑΛΑ

ΤΟ ΠΑΙΧΝΙΔΙ ΑΦΟΜΟΙΩΣΗΣ ΓΝΩΣΗΣ

Η ΠΙΣΤΟΠΟΙΗΣΗ



*Answers*

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Ανάπτυξη και άλλων παρόμοιων εκπαιδευσεων από απόσταση, με πιστοποίηση.

Περισσότερα εκπαιδευτικά προγράμματα για υδραυλικούς, για χρήση νέων τεχνολογιών, από απόσταση.

Προτεινόμενες εκπαιδευτικές σημειώσεις

Συνοδευτικό εκπαιδευτικό υλικό

Η εκπαίδευση να μπορεί να εξελιχτεί πέραντας υπόψιν τα νέα συστήματα και τεχνολογίες στον τομέα



## EURES REGISTRATION

Due to the specific situation of the COVID-19, not many trainees interested in having opportunity to move for working in another European country. However 11 participants uploaded their CVs in the EURES platform

## SUMMARY OF RESULTS

The main results of the pilot training activities for installers carried out by ECTE in Greece are:

- **One training course for PV system** installers completed implemented by ECTE.
- **One training course for installers** of solar thermal systems completed implemented by ECTE.
- 26 participants in total registered in the two training courses
- **14 solar photovoltaic** systems installers **certified** according to the GSS-VET respective certification scheme.
- **10 solar thermal systems** installers **certified** according to the GSS-VET respective certification scheme
- 11 registered in Eures



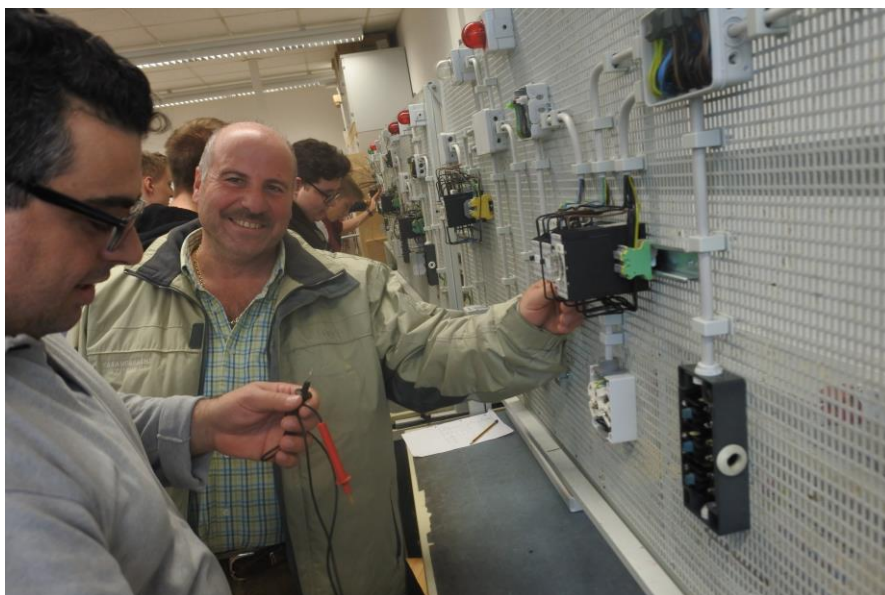
## ANNEXES

The trainers of other VET institutes 1<sup>st</sup> workshop.



Training of electricians – PV systems installation IT lab ECTE





Training of trainers of other Vet institutes.



Training of electricians – PV systems installation – practical training.

## Training in Bulgaria

### Introduction

All Bulgarian partners participated in the training activities. The organization of the trainings started since the beginning of the project when, on 29<sup>th</sup> May 2017, was organized a round table for presenting the GSS-VET project. The round table was attended by 3 experts from the National Agency for Vocational Education and Training (NAVET) who gave us very useful comments and advices for the smooth execution of the training activities. During the whole process of implementation of the training activities, the Chamber of Installation Specialists in Bulgaria was in touch with NAVET for the adaptation of the training and evaluation mechanisms according to the national legislation.

The training activities were implemented following the curricula, teaching methods and training



content developed in the frame of the GSS-VET project, where needed these were slightly adapted according to the requirements of the national legislation. The selection of trainers and trainees was done following the requirements of the Professional Qualifications Standard elaborated by TUV AUSTRIA HELLAS for the GSS-VET project. The evaluation of learners was conducted according to the examination mechanism approved by NAVET. The examination mechanism is conforming to the requirements of ISO/IEC 17024 and it follows the ECVET recommendations. The Certification Scheme consists of two levels, the Basic and the Advanced Level, depending on the

professional experience of the candidates. In Bulgaria, all participants passed the Advanced Level, as they have relevant education and more than 2 years of experience in these fields.

### Training of installers

Two trainings of installers were performed in Bulgaria:



- Training of installers of PV systems for electricians
- Training of installers of solar thermal systems for plumbers

The trainings were organised by the Chamber of Installation Specialists in Bulgaria (CISB). The training centre of CISB is certified by the National Agency for Vocational Education and Training as a centre for professional training.

Innovative training methods of ubiquitous learning were used – 3 different forms of teaching and learning, namely:

- Flipped classroom;
- Self-training using the specially developed e-Learning Platform of the Project, with personalized access to training content, quizzes, tests and games;
- Work-based module - practical training in a real-life working environment.

The participants were selected according to the requirements of the certification schemes developed for the GSS-VET project and the requirements of the national legislation:

- at least eighteen (18) years old
- hold a valid professional license for electrical works
- applicants wishing to participate in the examination for the Advanced Level shall have additionally a minimum of a two (2) years previous professional experience in the specific field (all applicants have the required experience for the Advanced Level)

## Training of installers of photovoltaic systems

The training of installers of photovoltaic systems was conducted in 3 parts:

- theoretical in class room



ПРОГРАМА

Обучение на специалисти по фотоволтачни системи по проект GSS-VET

20.01.2020г. - понеделник

09.00-09.15 Регистрация

09.15-09.30 Откриване, зелени професии и икономика - д-р инж. Ирина Терзийска - ЕИТ

09.30-10.15 Основни концепции при соларните технологии- слънчево лъчение, соларна константа, спектор, въздушна маса, стандартни тестови условия. Фотоволтачно използване на слънчевата енергия, соларни клетки- технологии, нови поколения соларни клетки.

10.15-11.00 Функции и приложение на компонентите на PV система, електрически характеристики, свързване на клетките в модули и стрингове, видове PV системи, батерии, контролери, инвертори.

11.00-11.30 Кафе- пауза

11.30-12.15 Акумулиране на електроенергията от PV система- видове акумулатори, основни изчисления, рискове и безопасност

12.15-13.15 Обяд

13.15-14.00 Създаване с мрежата ФВ системи- определяне на батериите, конфигуриране на PV системата.

Несъвръзки с мрежата системи, инвертори, контролери, изправители

14.00-14.45 Проектиране на PV системи.

Използване на безплатен софтуер - за оценка на характеристиките и производителността на PV системата. Системи за мониторинг на PV системата

Как различните условия влияят на характеристиките и производителността

14.45-15.15 Кафе пауза

15.15-16.00 Добри практики и „клетки“, които трябва да се избягват. Основните правила по отношение на електрическите и структурни въпроси. Стандарти и правила за безопасност при монтаж на PV системата.

Трешки и откази по време на монтаж на PV системата.

Идентифициране и инсталиране на различните компоненти на една PV система

Изследване и експериментирание с различни начини за комбиниране на системните компоненти.

16.00 - Дискуси

Funded by the  
Erasmus+ Programme  
of the European Union



- self- training and
- practical part in companies member of CISB

### Theoretical part



The theoretical part of the training was performed from 20<sup>th</sup> to 23<sup>rd</sup> January 2020 in the premises of the International Meetings Centre "Helmut Boehme" of the Technical University of Sofia. The training was conducted according to the Curriculum based on the syllabuses developed under GSS-VET Project. It included 40 academic hours covering all topics and an exhaustive presentation and

demonstration of the e-learning platform. The lectures were presented by trainers who passed the training of trainers under the GSS-VET project, according to their field of expertise. According to the requirements of the national legislation and the certification schemes an attendance diary was kept during the training process where were recorded the attendance of the participants. 30 trainees attended the theoretical part of the training of PV installers.





The training seminars were followed by a 10 hours self-training using the e-Learning Platform of the Project, or the training materials that were distributed on USB memory stick.

### **Practical training**

The practical training was performed according to the requirements in four companies working in the field of photovoltaic installations.



## Evaluation and certification

### Evaluation

The training activities were followed by exams:



Име, презиме, фамилия .....

въпрос 1

Кой е оптималният наклон за фотоволтаичен (PV) модул, монтиран с фиксиран ъгъл през зимния сезон за страна от Северно полукълбо?

- a. 7-10° по-малко от географската ширина на местоположението
- b. 10-15° по-малко от географската ширина на местоположението
- c. Равна на географската ширина на местоположението
- d. 10-15° повече от географската ширина на местоположението

въпрос 2

Кой е оптималният наклон за фотоволтаичен (PV) модул, монтиран с фиксиран ъгъл през цялата година за страна от Северно полукълбо?

- a. Равна на географската ширина на местоположението
- b. 7-10° по-малко от географската ширина на местоположението
- c. 10-15° по-малко от географската ширина на местоположението
- d. 10-15° повече от географската ширина на местоположението

въпрос 3

Фотоволтаични (PV) системи, свързани с мрежата :

- a. може да задоволят постоянноковни натоварвания
- b. се нуждаят от дизелов генератор за да работят
- c. се нуждаят от батерии за да работят
- d. се нуждаят от инвертор за да работят

въпрос 4

Това изображение на инфрачервена камера показва :

- a. Разклонителна кутия на PV модул с прегрята клема
- b. DC комбинираща кутия с прегрял сериен предпазител
- c. Явление на потенциална индуцирана деградация (PID) в соларна клетка
- d. прегрял DC конектор в сериен инвертор



- **Theoretical examination in written**

The theoretical examination was performed in written. To the participants was distributed a test with 50 multiple choice questions of graded difficulty, randomly selected from the Examination Question Bank. The questions with regard to difficulty were: 20 with low difficulty, 20 with medium difficulty and 10 with high difficulty. They had one hour to fill-in the test.

The theoretical examination was conducted by a trainer, having more than two years of experience in the sector of RES systems.

A Technical Committee was created to validate the examination results.

- **Theoretical examination – second part**

The trainees were invited to fill the test in the e-learning platform.

- **Practical examination**

As all participants in the training course are at Advanced Level, no practical examination was performed.

- **Certification**

The image shows a sample of a Bulgarian certificate for professional training. The certificate is titled "РЕПУБЛИКА БЪГАРИЯ" (Republic of Bulgaria) and "УДОСТОВЕРЕНИЕ за професионално обучение" (Certificate for professional training). It includes fields for the recipient's name, address, and details of the training course. The certificate is signed by the Director of the Centre for Vocational Education of CISB.

The results of the written test and the data of each participant were reviewed by the director of the Centre for Vocational Education of CISB, who took the decision to award 30 participants with a certificate for professional training. These certificates are recognised by NAVET and are uploaded in the data base of NAVET. They are recognised and valid for all EU countries.

The written tests, attendance diaries and curricula are also sent to NAVET as proofs of compliance with the National Legislation. They also are uploaded in the data base of the

Agency for Sustainable Energy Development. 30 certificates for installers of PV systems were issued. To the participants who successfully passed also the test in the learning platform where issued certificates by TUV AUSTRIA. 17 installers of PV systems were awarded with such certificates.



## Training of installers of solar thermal systems

The training of installers of solar thermal systems was conducted in 3 parts:

- theoretical in class room
- self- training and
- practical part in companies member of CISB

### Theoretical part

The theoretical part of the training was performed from 23rd to 26th January 2020 in the Lecture hall and laboratory at the University of Food Technologies in Plovdiv



23.01.2020 г. - четвъртък	
09.00	Регистрация
09.00-09.30	Откриване на курса – инж. А.Стамболова
09.30-10.30	Базови топливни изчисления. Европейско и национално законодателство. Основни константи при соларните технологии- слънчево лъчение, соларна константа, спектр, въздушна маса, стандартни тестови условия. Основни характеристики на слънчевите топливни инсталации. Слънчеви колектори – конструкция, видове и основна характеристика.
10.30-11.00	Кафе- пауза
11.00-12.00	Акумулиране на топлина – видове, материали, топлоизолация. Топлообменници. Разширителни съдове. Циркулационни помпи.
12.00-13.30	<b>Обяд</b>
13.30-15.00	Тръбна система, тръбна арматура – изисквания към материалите. Системи за изтичане. Системи за регулиране и контрол. Обезопасяване на инсталациите срещу обратна циркулация, повишаване на налягането и прегряване.
15.00-15.30	Кафе- пауза
15.30-16.30	Класификация на слънчевите топливни инсталации. Термосифонни инсталации – схеми и характеристика на зависим, независим и силни системи.
16.30	Дискусии
24.01.2020 г. - петък	
09.00-10.30	Помпни слънчеви топливни инсталации – основни схеми.
10.30-11.00	Кафе- пауза
11.00-12.00	Колекторно поле – схеми на свързване, монтаж, диагностика, поддръжка и ремонт. Монтаж на допълнителните системи. Топлоносител в слънчевите топливни инсталации – характеристика, запълване на системата. Проверка функционирането на обезопасяващите компоненти и системата за регулиране и контрол. Мониторинг и поддръжка на системите в слънчевите топливни инсталации
12.00-13.30	<b>Обяд</b>
13.30-14.30	Запознаване с ползване на Платформата за самообучение. Он-лайн игра.
14.30 - 15.00	Кафе- пауза
15.00-16.30	Финален тест. Проверка на резултатите от теста.



The training was conducted according to the Curriculum based on the syllabuses developed under GSS-VET Project. It included 40 academic hours covering all topics and an exhaustive presentation and demonstration of the e-learning platform. The lectures were presented by trainers who passed the training of trainers under the GSS-VET project, in accordance according to their field of expertise. According to the requirements of the national legislation and the certification schemes an attendance diary was kept during the training process where were recorded the attendance of the participants. 17 trainees attended the theoretical part of the training of installers of solar thermal systems. The training seminars were followed by a 10 hours self-training using the e-Learning Platform of the Project, or the training materials that were distributed on USB memory stick.





### Practical training

The practical training was performed according to the requirements in five companies working in the field of photovoltaic installations.





## Evaluation and certification

### Evaluation

The training activities were followed by exams:

- **Theoretical examination**

The theoretical examination was performed in written. To the participants was distributed a test with 50 multiple choice questions of graded difficulty, randomly selected from the Examination Question Bank. The questions with regard to difficulty were: 20 with low difficulty, 20 with medium difficulty and 10 with high difficulty. They had one hour to fill-in the test.



ТЕСТ

Име, презиме, фамилия .....

№	ВЪПРОС	ПРИМЕРНИ ОТГОВОРИ				Вярно
		A	B	C	D	
1	Инсталациите за слънчево отопление на външни басейни работят в температурния диапазон на:	Под 40	40 -60	Над 60	Под всички споменати	
2	Лъчистият поток върху хоризонтална повърхност е 1000 W/m <sup>2</sup> . Каква ще бъде стойността му, ако наклоним повърхността под 60° спрямо хоризонта?	1000W/ m2	0	500 W / m2	866W / m2	
3	Ако по някаква причина не мога да монтирам слънчевия си колектор с най-добрата ориентация, трябва:	Не правете нищо. Ефектите на ориентацията върху ефективността са много ограничени.	Увеличете повърхността на колектора, ако разстоянието е голямо.	Надвишава ориентацията с наклон.	Промяна на типа на слънчевия колектор или технологията.	
4	Директивата на ЕС (2020 г.), която задължава държавите-членки да въведат мерки в националните строителни норми за увеличаване на дела на всички видове енергия от ВЕИ, е	EED	RED	EPBD	LED	
5	Термосифонната сл. инсталация (SWH) се класифицира като:	Активна SWH система	Пасивна директна SWH система	Пасивна индиректна SWH система	Пасивна система. Директна, или индиректна	
6	Всички слънчеви активни топлинни технологии използват:	Дестилирана вода като топлоносител (HTF)	Всяка течност с приемливи свойства за пренос на топлина като топлоносител	Непитейна вода или разтвор на гликол като топлоносител	Вода или други течности с топлопреносни свойства или въздух като топлоносител	
7	Необходимо е да се управлява директна сл. система за топла вода с принудителна циркулация с диференциален контролер	Най-малко един температурен датчик в най-горещата точка (колектори).	Най-малко два температурни датчика: една в най-горещата точка (колектори) и друга в най-студената точка (акумулатор)	Най-малко два температурни датчика: един в най-горещата точка (акумулатор) и друг в най-студената точка (вход за слънчев колектор).	Най-малко два температурни датчика: един в най-горещата точка (колектори) и други в най-студената точка (акумулатор, отгоре).	

The theoretical examination was conducted by a professor exhaustive experience in the sector of RES systems. A Technical Committee was created to validate the examination results.

- Theoretical examination – second part**

The trainees were invited to fill the test in the e-learning platform.

- Practical examination**

As all participants in the training course are at Advanced Level, no practical examination was performed.

- Certification**

The results of the written test and the data of each participant were reviewed by the director of the Centre for Vocational Education of CISB, who took the decision to award 17 participants with a certificate for professional training. These certificates are recognised by NAVET and are uploaded in the data base of NAVET. They are recognised and valid for all EU countries. The written tests, attendance diaries and curricula are also sent to NAVET as proofs of compliance with the National





Legislation. They also be uploaded in the data base of the Agency for Sustainable Energy Development. 16 certificates for installers of solar thermal systems were issued. To the participants who successfully passed also the test in the learning platform where issued certificates by TUV AUSTRIA. 6 installers of solar thermal systems were awarded with such certificates. **Additional trainees**

In addition to the participants in the training course, 8 experts used the on-line platform for self-preparation and passed successfully the test in the e-learning platform.

### Evaluation of the trainings

#### Evaluation of trainings

A questionnaire was distributed to the attendees about their satisfaction from the training. The results of the questionnaires show that the participants evaluate the training as:

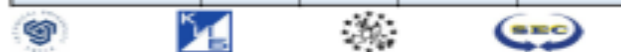



**АНКЕТА**  
**Оценка за работа с обучителната платформа по проект GSS-VET**

Моля разкажете ни за Вашите впечатления от работата с обучителната платформа. Обратна връзка с Вас играе важна роля за повишаване на качеството на образованието Ви. Наберете по един отговор на всеки въпрос.

→ Моля, отбелязвайте с X или ✓ Вашите отговори и събвайте резултати.

ЗА ОСЪРЧЕВИЕТО В ПЛАТФОРМАТА	НАДЪЛЖНО СЪСЪЛАСЕН	СЪСЪЛАСЕН	НЕСЪСЪЛАСЕН	НАДЪЛЖНО НЕСЪСЪЛАСЕН
Няма проблеми за инсталиране и ползване на он-лайн Платформата				
Инструкциите за ползване на Платформата са ясни и подробни				
Учебният материал е разработен на достъпен език				
Информацията е често в актуална и полезна				
Учебният материал улеснява Вашите знания и компетентност				
Обучението в он-лайн Платформата е полезно за моята работа и карьерно развитие				
Въпросите за самоподготовка потвърждават придобитите знания от учебния материал				
Ефективните на финален тест са действително предизвикателство за оценка на придобити знания				
Разработените игри са иновативна форма на обучение и адекватно допълнение за тест на знанията				



- Good – 4 participants
- Very good – 15 participants
- Excellent – 28 participants



## Evaluation of e-learning platform

Funded by the  
Erasmus+ Programme  
of the European Union



### АНКЕТА

#### Оценка за работа с обучителната платформа по проект GSS-VET

Моля разкажете ни за Вашите впечатления от работата с обучителната платформа. Обратната връзка с Вас играе важна роля за повишаване на качеството на образованието Ви. Изберете по един отговор на всеки въпрос.

• Моля, отбележете с X или ✓ Вашият отговор в следната таблица.

ЗА ОБУЧЕНИЕТО В ПЛАТФОРМАТА	НАПЪЛНО СЪГЛАСЕН	СЪГЛАСЕН	НЕСЪГЛАСЕН	НАПЪЛНО НЕСЪГЛАСЕН
Нямах трудности при вливането в платформата	6	2		
Инструкциите за ползване на платформата са ясни	6	1	1	
Учебните теми са разработени на разбираем за мен език	8			
Обучението ме подготви за работата, която ще извършвам	4	4		
Въпросите са структурирани разбираемо	3	3		
Въпросите съответстват на разработения учебен материал	6	2		
Смятам, че представеното on-line обучение е полезно за моята работа и кариерно развитие	3	3		
Въпросите за самооценка затвърждават придобитите знания	3	3		
Нямах проблеми с решаването на теста в платформата	6	1	1	
Професионалната играта беше много полезна	3	3		



A questionnaire was distributed to the attendees of the training of trainers performed on 27<sup>th</sup> February in Sofia. The results of the questionnaires show that the participants evaluate the e-learning platform as:

- Good – 2%
- Very good – 29%
- Excellent – 74%

They gave the following recommendations:

- To perform another training in this field
- In the platform it should indicated in advance how many points are required for the test to be successfully passed.
- Some translations need improvements.



## Results - summary

The results of the training activities carried out in Bulgaria were:

- 2 training of trainers
- 1 training for installers of PV systems
- 1 training for installers of solar thermal systems
- 13 trained trainers from:
- 9 VET providers organisations
- 30 certified installers of PV systems, 17 of them are also awarded with GSS-VET certificates
- 16 certified installers of solar thermal systems, 6 of them are also awarded with GSS-VET certificates
- 6 installers of PV systems passed the test in the e-learning platform after self-preparation
- 8 installers of solar thermal systems passed the test in the e-learning platform after self-preparation.



ANNEXES



Annex 1 License of CIBS's centre for professional education and training

Annex 2 Announcement of trainings and registration form



КАМАРА НА ИНСТАЛАТОРИТЕ В БЪЛГАРИЯ



Geothermal and solar systems - Vocational education and training



КАМАРА НА ИНСТАЛАТОРИТЕ В БЪЛГАРИЯ



Geothermal and solar systems - Vocational education and training

Уважаеми дами и господа,

Камара на инсталаторите в България е партньор по проект GSS-VET.

От българска страна, в него участват още:

- Технически университет- София;
- Европейски институт по труда;
- Енергиен център София.

След направено анкетно проучване и определяне на необходимите теоретически знания и практически умения на техници и инсталатори на фотоволтаични и соларни инсталации, по проекта бяха разработени иновативни учебни програми и материали, които ще бъдат тествани с пилотно обучение, както следва:

**Фотоволтаични соларни системи – 20 до 23 януари 2020г. в София,** в конферентната зала на ТУ-София;

**Соларни отоплителни енергийни системи – 23 до 26 януари 2020г. в Пловдив,** в учебна зала на ЦПО към КИБ

Обучението ще завърши с тестови изпит, а успешно представилите се на него ще **получат „Удостоверение за професионално обучение по част от професията Техник на енергийни съоръжения и инсталации”, специалност „Възобновяеми енергийни източници”- „Фотоволтаични соларни системи” или „Соларни отоплителни енергийни системи”.**

Обучението е **без такса за участие.** Членовете на Камара на инсталаторите в България са с предимство при формиране на групите за обучение.

**Изисквания към кандидатите –** Да имат придобита **трета степен на професионална квалификация** (техник на енергийни съоръжения и инсталации или електротехник)

**Краен срок за записване – 15 януари 2020г.**

Регистрационната форма изпращайте на един от следните мейли: [nis@dir.bg](mailto:nis@dir.bg) или [installators@abv.bg](mailto:installators@abv.bg)

**РЕГИСТРАЦИОННА ФОРМА**

за

участие в обучение/направете отметка/

- Фотоволтаични соларни системи – 20 до 23 януари 2020г. в София
- Соларни отоплителни енергийни системи – 23 до 26 януари 2020г. в Пловдив

No	Име, презиме, фамилия	Завършено образование	Контакт тел/email	Месторабота/Фирма





**Обучение на специалности по fotovoltaични системи по проект GSS-VET**

**20.01.2020г. - Понеделник**

09.00-09.30 Репетиция

09.30-09.30 Откриване, въвеждане професионалисти и асистенти - д-р инж. Ирина Терасова - ДИТ

09.30-10.15 Основни концепции при соларните технологии: слънчево излъчване, соларни константи, спектъри, въздушна маса, стандартни тестови условия, ориентацията на соларните панели, соларни клетки - монокристални, поликристални соларни клетки.

10.15-11.00 Функции и приложения на компонентите на PV системи, алгоритми за управление, свързване на клетките в модули и строенето, видове PV системи, батерии, контролери, инвертори.

11.00-11.30 Кафе пауза

11.30-12.15 Акмулатори на електроенергията от PV системи- видове акумулатори, основни изчисления, рискове и безопасност

12.15-12.17 Обяд

12.17-14.00 Свързване с верижна AB система- управление на батериите, конфигуриране на PV системите, изчисления с верижна система, инвертори, контролери, изчисления

14.00-14.45 Проектиране на PV системи, използване на безплатен софтуер - на основата на архитектурните и производствените на PV системите. Системи за мониторинг на PV системите при различни условия влияят на ефективността и производителността

14.45-15.15 Кафе пауза

15.15-16.00 Добра практика и „случаи“, които трябва да се избегнат. Основни правила по отношение на безопасността и структурен избор. Стандарти и правила за безопасност при монтаж на PV системи. График и списък по време на монтаж на PV системите. Идентифициране и инсталиране на различните компоненти на една PV система. Изследване и установяване на различните начини за монтиране на системните компоненти.

16.00- Дискуси

Funded by the Erasmus+ Programme of the European Union



Annex 3 Programme for the first day of training of installers of PV systems



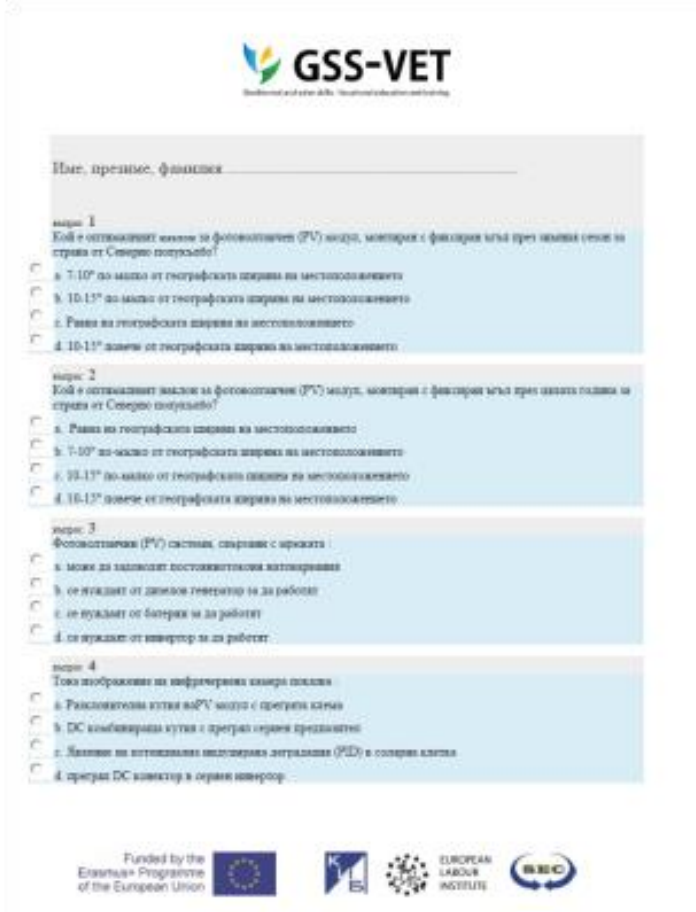
**Geothermal and solar systems - Vocational education and training**  
**ПРОГРАМА**

**Обучение на специалности по слънчеви топливни системи по проект GSS-VET**  
**Местно Пазарско**

23.01.2020г. - СРЕДА	
09.00	Регистрация
09.00-09.30	Откриване на курс - инж. А.Стефанов
09.30-10.30	Базови топливни изчисления, Европейско и национално законодателство. Основни концепции при соларните технологии- слънчево излъчване, соларни константи, спектъри, въздушна маса, стандартни тестови условия. Основни характеристики на слънчевите топливни инсталации. Слънчеви колектори - конструкция, видове и основни характеристики.
10.30-11.00	Кафе- пауза
11.00-12.00	Акмулатори на топлина - видове, материали, топлинкопазители. Топлообменници, Разширители съдове, Перфузионни помпи.
12.00-13.30	Обяд
13.30-15.00	Тръбна система, тръбна арматура - изчисления към материалите. Системи за изгоряване. Системи за регулиране и контрол. Обясняване на инсталациите срещу обратна циркуляция, повишаване на налягането и прогревами.
15.00-15.30	Кафе- пауза
15.30-16.30	Класификация на слънчевите топливни инсталации. Термосифонни инсталации - схеми и характеристики на зависим, независим и сплит системи.
16.30	Дискуси
24.01.2020г. - ПЕТАК	
09.00-10.30	Попълни слънчеви топливни инсталации - основни схеми.
10.30-11.00	Кафе- пауза
11.00-12.00	Колектори поле - схеми на свързване, монтаж, диагностика, поддръжка и ремонт. Монтаж на допълнителните системи. Топлоносители в слънчевите топливни инсталации - характеристики, излъчване на системата. Проверка функционирането на обезопасяващите компоненти и системата за регулиране и контрол. Мониторинг и поддръжка на системите в слънчевите топливни инсталации
12.00-13.30	Обяд
13.30-14.30	Заместване с обучение на Платформата за самообучение. On- line и off- line.
14.30 - 15.00	Кафе- пауза
15.00-16.30	Финален тест. Проверка на резултатите от теста.

Annex 5 Programme for the first two days of training of installers of solar thermal systems





Annex 6 Written test for theoretical examination of installers of PV systems



Annex 7 Bulgarian Certificate for professional training



ТЕСТ

Име, презиме, фамилия .....

№	ВЪПРОС	ПРИМЕРНИ ОТГОВОРИ				Вярно
		A	B	C	D	
1	Инсталациите за слънчево отопление на външни басейни работят в температурния диапазон на:	Под 40	40 -60	Над 60	Под всички споменати	
2	Лъчистият поток върху хоризонтална повърхност е 1000 W/m <sup>2</sup> . Каква ще бъде стойността му, ако наклоним повърхността под 60° спрямо хоризонта?	1000W/ m2	0	500 W / m2	866W / m2	
3	Ако по някаква причина не мога да монтирам слънчевия си колектор с най-добрата ориентация, трябва:	Не правете нищо. Ефектите на ориентацията върху ефективността са много ограничени.	Увеличете повърхността на колектора, ако разстоянието е голямо.	Надвишава ориентацията с наклон.	Промяна на типа на слънчевия колектор или технологията.	
4	Директивата на ЕС (2020 г.), която задължава държавите-членки да въведат мерки в националните строителни норми за увеличаване на дела на всички видове енергия от ВЕИ, е	EED	RED	EPBD	LED	
5	Термосифонната сл. инсталация (SWH) се класифицира като:	Активна SWH система	Пасивна директна SWH система	Пасивна индиректна SWH система	Пасивна система. Директна, или индиректна	
6	Всички слънчеви активни топлинни технологии използват:	Дестилирана вода като топлоносител (HTF)	Всяка течност с приемливи свойства за пренос на топлина като топлоносител	Непитейна вода или разтвор на гликол като топлоносител	Вода или други течности с топлопроводни свойства или въздух като топлоносител	
7	Необходимо е да се управлява директна сл. система за топла вода с принудителна циркулация с диференциален контролер	Най-малко един температурен датчик в най-горещата точка (колектори).	Най-малко два температурни датчика: една в най-горещата точка (колектори) и друга в най-студената точка (акумулатор)	Най-малко два температурни датчика: един в най-горещата точка (акумулатор) и друг в най-студената точка (вход за слънчев колектор).	Най-малко два температурни датчика: един в най-горещата точка (колектори) и други в най-студената точка (акумулатор, отгоре).	

Annex 8 Written test for theoretical examination of installers of solar thermal systems



QUESTIONNAIRE  
GSS-VET project training evaluation

Please, express your opinion on your training. The feedback from you is important in order to improve its quality.  
In this Questionnaire, the term "training" refers to the performance of the training organization. The term "trainer" refers to teachers or instructors.  
Please, choose only one answer to each question.

\* Please, mark with X or ✓ your answer in the following table.

ABOUT THE TRAINING	COMPLETELY AGREE	AGREE	DISAGREE	COMPLETELY DISAGREE
I have mastered the skills as expected from the training.				
The training was focused on developing of relevant skills.				
I have mastered the knowledge as expected from this training.				
The training has prepared me for the work I do.				
The training offers a good balance between theory and practice				
I am satisfied with the training as a whole.				
I would recommend the organization - training provider to other people				
The team of the organization - training provider - respected my experience and needs.				
Now, I understand important things which were not clear to me before.				
The trainers showed profound knowledge of the material thought.				



Annex 9 Satisfaction questionnaire – trainees



## TRAINING IN SPAIN

This document is the evaluation report corresponding specifically to the **Training of Trainees plan** of the GSS-VET project carried out by the Spanish partners of the consortium. This plan and the training actions included have been conceived and implemented globally within the Pilot Training (WP5) framework of project, being therefore in line with the objectives and general guidelines of this key process of GSS-VET.

As it is known, the purpose of the training with trainees is the pilot application of the training framework of the GSS-VET project, to assess it in its globality and validate it; and, based on this experience, to disseminate it to other interested training providers, or to elaborate post-project recommendations related to its sustainability at national and European level and practical applications.

To this end, the whole training process of trainees described in this document was planned to be executed in a maximum period of 8 weeks starting in February 2020 and ending in April 2020 (See Figure 1), following in a logical way the initial training actions (workshops) of trainers. In line with the guidelines for the pilot training, the action plan defined had to be first and foremost consistent with the training framework. In other words, it had to:

- **Apply the basic course/program designs developed for installers** by target sector (Solar PV, Solar Thermal and Geothermal), completing them or adapting them to specific training application contexts.
- **Distribute part of this training online (theoretical content, above all) using the project's e-Learning platform.** The curricular framework establishes the duration of this component for each course or Program (credit hours, basic content).



- **Distribute part of this training in a classroom format (practice sessions, above all).** The curriculum framework establishes the duration of this component for each course (credit hours, content).
- **Implement, to the extent possible, the innovative training approaches suggested in the curriculum framework.** Such as, ubiquitous training or the flipped class method.
- **Offer participants, if applicable, a work-based learning module or program.**
- **Use the materials and other resources developed for learners and trainers.**
- **Offer participants who passed the training the possibility, at least, to see their competence as installers of renewable energy systems (Solar and Geothermal) accredited,** according to the certificated evaluation schemes, and to the internal mechanism of certification developed ad hoc in the project.
- **Offer participants other complementary services:** registration in EURES platform, orientation.



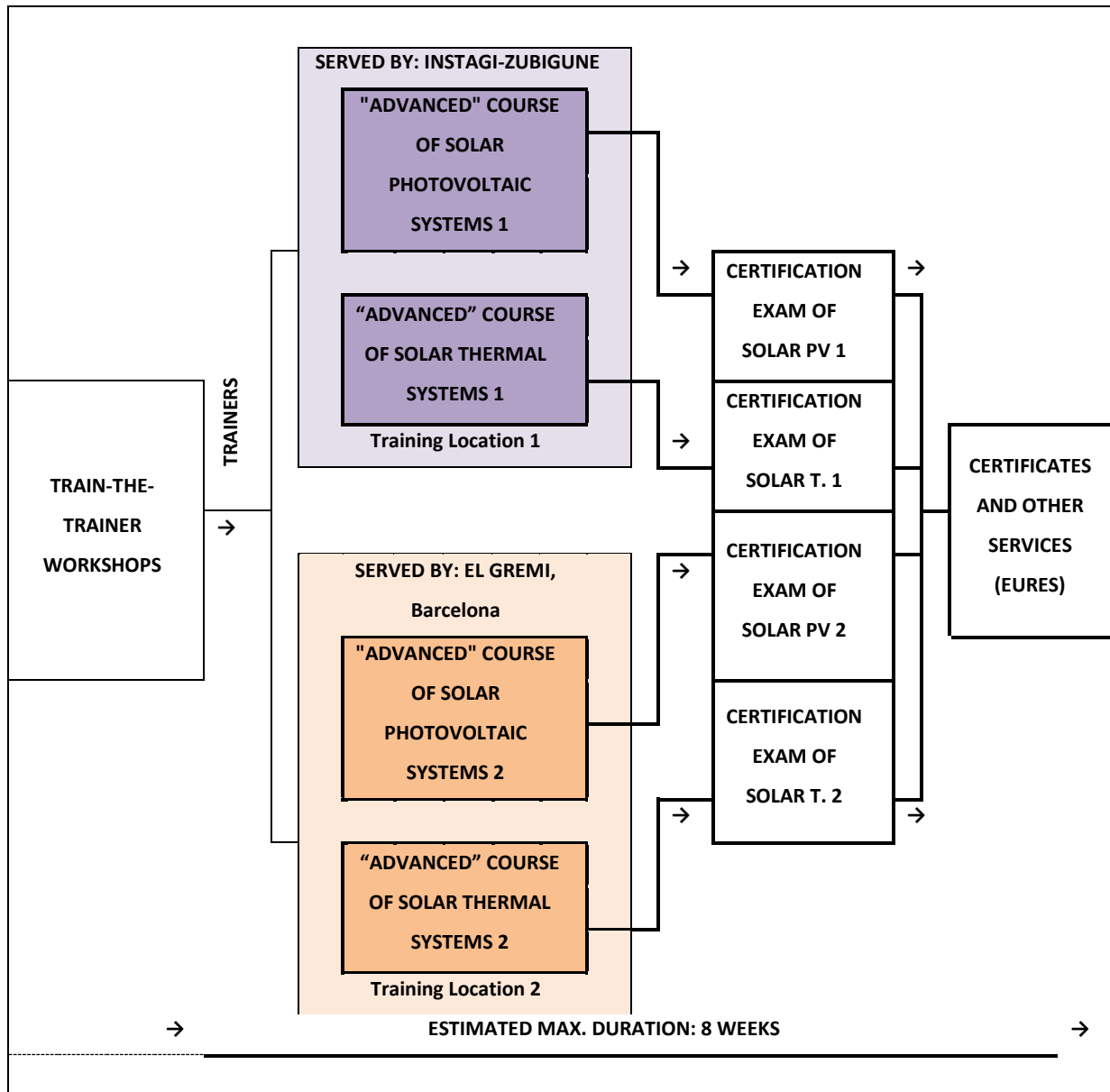


Figure 1. Representation of partner VET providers' training plan for trainees/installers (Spain)

Both Spanish partners (INSTAGI and ALECOP) conceived the training plan for the students, INSTAGI being the provider of the training and ALECOP its expert collaborator. The plan was carried out with the additional collaboration of other training centers and entities: the ZUBIGUNE



foundation, of whose board of trustees INSTAGI is a member, as well as the CIFP Usurbil (a VET school); and, the Escuela Gremial de Instaladores de EL GREMI de Barcelona (EL GREMI'S Guild School of Installers in Barcelona, a continuous and occupational training center). These organizations provided tutors and were particularly responsible for the delivery of the classroom-based practice sessions. They also collaborated in the promotion of the courses and in the enrollment of participants in their respective training contexts. As can be seen in Figure 1, the plan consisted of holding **4 simultaneous courses, 2 in photovoltaic solar energy and 2 in thermal solar energy, in 2 different physical locations** (INSTAGI-ZUBIGUNE, in Guipúzcoa and EL GREMI-Escuela Gremial, in Barcelona). A total of 46 people registered for these courses.

It is relevant to point out that **no Geothermal system installers have been trained** during this pilot training plan because not significant demand for these qualification profiles has been found in the training application contexts considered.

The training plan was mainly promoted among the associated companies of INSTAGI (Association of Installation Companies of Guipúzcoa-Basque Country) and those of the GREMI (Association of Installation Companies of Barcelona-Catalonia) with activity in the same targeted sectors of the project (Solar PV and Solar Thermal systems for buildings), as well as in other nearby sectors (such as: plumbing, electricity, HVAC, building automation, energy efficiency, etc.). Consequently, the audience of these courses was delimited, although not exclusively, around a group of **active and experienced professionals**; even, professionals with experience in installation tasks and services related to solar systems and/or other renewable energies applied combinedly to the building environment.

Most of these professionals also had official accreditations (academic degrees, official licenses or professional certifications) as electricians, plumbers, or other professionals close to them; also, in the same sectors of the project (i.e. accreditations related to the installation of solar PV and Thermal systems, official or not, already existing in Spain specifically). This finally made possible the organization of **4 "Advanced Level" courses**. That is, courses for which the access



requirement was to have at least 2 years of accredited professional experience as installers, which is in line with the requirements set out in the corresponding internal certification schemes.

This kind of course enabled an emphasis to be placed on the **online component of the training**, characterized by asynchronous, flexible and tutored access of the participants to the content. The tutors were own trainers, and also external ones, previously trained in the project partners' train-the-trainer workshops (case of INSTAGI-ZUBIGUNE), and workshops for other training providers (case of El GREMI, from Barcelona).

Also, although these "Advanced" courses did not require work-based learning or a certification practical exam, they did include a program of distributed classroom-based practices supported by real equipment and tools, in accordance with the basic design (content modules, credits hours) of the GSS-VET courses. Considering that the participants already had fundamental installation skills (of hydraulic, electrical and even solar systems in some cases), the focus should be put on **application or integrative practices related to the Calculation, Installation and Maintenance of solar systems** (Photovoltaic and Thermal respectively). It was also thought that these practices could be voluntary for those participants who already had experience working with the installation of solar systems (photovoltaic or thermal).

Finally, the training was scheduled, the promotion and registration processes were executed, and everything was prepared to distribute the pilot actions effectively and on time.

Unfortunately, **due to the coronavirus pandemic, the training plan had to be significantly modified** and, to date (July 2020), it has only been partially completed. All training activities initiated with students had to be temporarily suspended in March. In June they were resumed with the intention of finalizing them, which could only be partially achieved. While the courses at INSTAGI-ZUBIGUNE have been completed, those at El GREMI in Barcelona could not be finished before the term of the project. Practice sessions have experienced important limitations, since access to training centers has been restricted or suspended; also, an appreciable percentage of



the participants originally registered have dropped out due to different causes derived from the crisis.

It should be noted that the training courses for installers, those that have been able to be completed, have had a high level of acceptance, according to the surveys carried out on participants and instructors. In qualitative terms, four of the main conclusions that can be drawn from the pilot training experience are:

- **The content and training programs of GSS-VET are highly valued, from the point of view of the continuous training needs that the installers themselves want to be met in order to be able to perform effectively according to the requirements that come from their own companies, or from the sectors and labor market.** From these opinions it can be concluded that, in fact, the training proposal of the project as a whole, and the design of the programs, seem relevant (in the context of the implementation of this pilot training in Spain).
- **The online component, the ubiquitous methodologies and the virtual learning environment are also highly valued.** According to these opinions, these modalities and resources should be further promoted in continuous vocational training (of installers, in this case) and adult training contexts at local and other levels, being the GSS-VET training framework a good practice to be taken into consideration.
- **For the participants, and for other beneficiaries (employers), a reasonable doubt arises regarding the practical usefulness of the internal certification, as it is compared with existing official certifications for the same sectors of the project (the case of Spain and for the Solar Energy sector with applications in buildings).** Ways of making the training framework sustainable after the GSS-VET project has been completed should be analyzed, including reviewing this certification, which either could be kept, adapted or replaced by others. In Spain it could be useful in the area of so-called "in-demand job training" managed by the social stakeholders. A "persons certification" provides attractiveness that can help to make the GSS-VET training more valued and therefore be more easily integrated into the supply and public mechanisms of the referred "job training".



- **The training that participants and trainers have generally experienced also receives good marks, even with the limitations suffered.** This is relevant from the point of view of the validation of the GSS-VET training framework, which is the pilot training's general objective.



## TRAINING OF INSTALLERS

This section describes the trainings of trainees carried out by the project partners and collaborators.

### Organization of training.

Figure 1 represents the general outcome of the planning and organizing processes of the training of trainees. A set of important decisions that led to this overall plan are listed below:

- **INSTAGI and ALECOP, as project partners, assume all the general management tasks necessary to design, organize and implement the training courses with trainees.** For this purpose, they constitute a joint work team where INSTAGI is presented as the promoting training organization and responsible for the preparation, distribution and administration of the training, and ALECOP as an expert collaborator in the area of content. This team, with the necessary reinforcements at each stage, has been maintained throughout the pilot training, covering both, the action plan for training of trainers and the trainings of trainees.
- **The overall strategy to address the challenge of training of trainees was to organize as many training events as possible, in the time available and considering the pre-established targets for the pilot training** (there are indicators of the results intended, and they are: number of participants per partner country, number of certificates issued per sector, among some others). To this end:
  - It was decided to direct the training to the INSTAGI partner companies and ZUBIGUNE foundation's training beneficiaries (businesses), all with activity or strategic interest, in some of the project's sectors. Finally, the selected areas were Solar Photovoltaic and Solar Thermal and the final beneficiaries were active professionals (electricians, plumbers, other nearby occupations and even already existing installers of renewable energy systems). The scope of this training would be local-provincial (companies from the capital San Sebastian and perhaps other regional ones - from Guipuzcoa, province) given that a plan of face-to-face sessions was foreseen, involving travel and other costs for participants and organizers.



- In accordance with the approach adopted, the aim was to extend the scope of the training by also involving other business associations and training centers. A Train-the-Trainer workshop for other training providers had recently been completed, so contact was maintained in particular with the EL GREMI in Barcelona and its School of Installers. Advised by INSTAGI, the GREMI conducted its own analysis and concluded that the greatest interest, feasibility and foreseeable impact of the pilot training would be achieved by acting in the same two occupational sectors: Solar PV and Solar Thermal.
- Therefore, the decision was taken to discard the offer of pilot training in Geothermal systems for installers due to low demand, and to organize only the courses addressed to the Solar Photovoltaic and Solar Thermal sectors and their installers.
- Moreover, this training had to take place practically simultaneously in both locations (Guipúzcoa and Barcelona) as the time available was very tight. It was therefore necessary to act in a coordinated manner. In short, it was agreed to establish a **joint work program** for INSTAGI-ZUBIGUNE in Guipúzcoa and EL GREMI/Guild School for Installers in Barcelona; this, established the following coordinated work process:
  - Determine (meaning, complete or adapt) the training programs for Solar PV and Solar Thermal installers that would finally be offered, with the help of the trained instructors and the advice of ALECOP. In principle, these programs would be the same per sector for each location, would have the same access requirements and would have a common basic structure. In detail, however, they would have to take into account certain contextual factors (availability of resources, characteristics of participants, groups sizes, etc.).
  - Promote the courses and organize the registration of participants, using similar approaches, messages, registration systems, etc. In this regard, a priority order for access to courses was established. The highest priority was given to electricians and plumbers with experience of 2 years or more. They were followed by other experienced professionals in nearby occupations such as HVAC installers, home automation system installers, etc. Then, other professionals with experience in the same sectors of the



project; that is, with experience installing or servicing solar systems in the building. Finally, the lowest priority was given to other interested people (management profiles, students, etc.). It was considered that these profiles together would simplify the whole training process (i.e. with them it was possible to organize "Advanced" level courses which are actions that have less certification and organizational requirements).

- Prepare the necessary resources and support so that the courses could be distributed in each location and on time. Including the trainers (tutors, practice instructors).
- Completing the registration process, ensuring that participants meet the entry requirements.
- Delivering the courses and "academically" evaluating (and/or guiding) the participants.
- Organize and implement the certification evaluation process.
- Carry out the post-training administration. In this respect, INSTAGI is responsible for collecting general information and processing applications for certificates, registration in EURES and drawing up registers and general reports, with the assistance of ALECOPI.

As a result of the initial activities of this joint work plan, these relevant results were produced:

- **Specific programs, based on the basic designs of the project** and available resources:

The basic structure of the courses (mixed: online + classroom) can be seen in Figure 2.

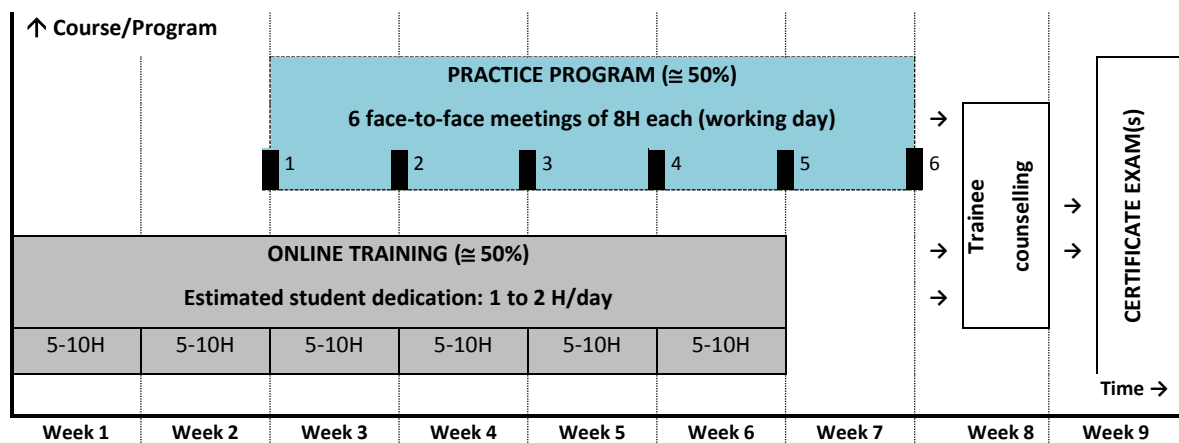


Figure 2. Structure and basic organization of pilot courses with trainees (Spain). Scheme valid for Solar PV and Solar T.



## Characteristics:

- 1 program or course of photovoltaic solar systems. Standard duration: 100 H.
- 1 program or course on thermal solar systems. Standard duration: 100 H
- Both courses include an online part (50%) and a classroom part (50%).
- Determination of two basic practice programs for Solar FV and Solar T, with its requirements: necessary equipment, spaces, trainer, consumables, etc.
- Taking into account the characteristics of the participants (mostly active professionals), it was estimated a dedication of 1 to 2 hours/day to the study of online contents would be realistic. On the other hand, the practice programs would be distributed in working sessions of 8H long, 1 per week (on Saturdays). In this way, it was possible to specify the time frame of the courses and the entire training plan.
- From the beginning, the organization of a work-based training module was ruled out.
- **Courses scheduled for simultaneous delivery on the following dates:**
  - February 17 to March 20. Online tutored training.
  - March 2 to March 27. Face-to-Face practical training.
  - March 27 to March 31. Certification exam (theoretical).
- **Advertised courses and participant registration:**

Training provider: INSTAGI / ZUBIGUNE

  - Course 1 of Solar Photovoltaic Systems. Registered participants: 16
  - Course 1 of Solar Thermal Systems. Registered participants: 16

Training provider: EL GREMI

  - Course 2 of Solar Photovoltaic Systems. Registered participants: 7
  - Course 2 of Solar Thermal Systems. Registered participants: 7
- **Prepared courses, for implementation:**
  - Courses prepared in their respective spaces of the virtual learning platform.
  - Materials folder for participants in face-to-face practice sessions.
  - Assigned spaces and resources, including trainers.
  - Logistical and administrative and other support aspects arranged.



## Performance of the training of installers.

In accordance with the joint work plan between INSTAGI/ZUBIGUNE of Guipúzcoa and EL GREMI/GREMIAL SCHOOL of Barcelona, when the scheduled dates for the training arrived, all the courses started on time in February.

In general, during the first 4 weeks, according to the established programs, the trainees' work was focused on studying the online content with the support and dynamization of expert tutors. The assignment and dedication of the tutors was done in this way:

- **1 tutor per course.** Preferred profile: expert trainer in the installation of solar systems (PV or ST).
- **Dedication: 2 hours/day (60 tutor hours in total)** for the resolution of doubts with the content and dynamization in the platform (messages, forums, questions, etc.).

In addition, all courses included in the first 4 weeks at least two days of classroom-based practices, exercises and general learning consolidation and orientation, according to the designed practice plans, and by assigned specialist instructors. These days were held respectively at the facilities of the VET school Usurbil (INSTAGI-ZUBIGUNE, Guipúzcoa) and the Guild School of Installers (EL GREMI, Barcelona). Both collaborating training centers have laboratories, workshops, equipment and other appropriate environments for learning about renewables and for optimum group management. Since the course groups formed were not numerous, the available resources and spaces were sufficient to attend to all the participants simultaneously and, therefore, there was no need to split up or apply other management solutions.

On 15 March all national non-essential economic activities were closed, and training courses were suspended after being active for almost one month. Although the restart of general productive activity took place in April, many companies and professionals were not able to do so normally. In particular, some companies and workers involved in the GSS-VET pilot training were affected and, in addition, the training centers had to remain closed, or operate under severe restrictions. In conclusion, it was no longer possible to continue with the face-to-face practice sessions. Students continued to have access to the contents of the platform, but without tutors. During this period, the activity of the participants decreased significantly.



It should be noted that this period of suspension coincided with the last extensions of the project, so that the time available to complete the pilot training was extended (until July).

It was only at the end of June that it was possible to resume the outstanding training actions according to the original planning. And of these, **only the courses delivered by INSTAGI-ZUBIGUNE could be completed**, although with a restricted training plan. There have been withdrawals from these courses. The EL GREMI'S Guild school of Installers in Barcelona, for its part, has continued to be closed and without trainers.

It is worth noting that, even with these limitations, during the month of July the participants have had the option of completing their online training, attending additional practice sessions, receiving orientation and taking their certification exams.

#### Training of Installers Solar Photovoltaic Systems.

The courses of Solar Photovoltaic Systems had a common design and activity program, adapted to the particular conditions of each place of delivery (Guipúzcoa and Barcelona).

In essence, the courses (with a standard duration of 100H) were conceived structured according to an online tutored phase (50%) around learning the fundamentals, regulation framework, techniques and means of installation and maintenance of solar photovoltaic systems and another phase (50%) aimed primarily at application of previously learning knowledge, and skills development.

Table 1 summarizes the training program associated with the structure or basic design of the courses for installers of solar photovoltaic systems, as it is shown generically in Figure 2.



CONTENT (online)		PRACTICE PLAN (face-to-face)
Modules	Units	
1. AN INTRODUCTION TO SOLAR PHOTOVOLTAIC TECHNOLOGY	1.1. UNDERSTAND BASIC SOLAR ENGINEERING	<p style="text-align: center;"><u>Foundation Block</u></p> <p><b>Practice session 1:</b></p> <ul style="list-style-type: none"> <li>• (Contextualization) Overview of the occupation. Spain:                             <ul style="list-style-type: none"> <li>- Sector and companies.</li> <li>- Technology.</li> <li>- Regulatory framework.</li> <li>- Installers. Main functions.</li> <li>- Current and prospective employment.</li> </ul> </li> <li>• Exercises:                             <ul style="list-style-type: none"> <li>- Review of electrical and electronic concepts.</li> <li>- Review of physical concepts (the sun).</li> <li>- Handling of solar charts.</li> </ul> </li> <li>• Practices:                             <ul style="list-style-type: none"> <li>- Instruments for measuring solar irradiation.</li> </ul> </li> <li>• Practices:                             <ul style="list-style-type: none"> <li>- Basic analysis of the solar panel. Structure, operation, associated technical documentation.</li> <li>- Curve I-V. Efficiency and factors (angles, shadow).</li> </ul> </li> <li>• Exercises:                             <ul style="list-style-type: none"> <li>- Calculation of electrical consumptions.</li> <li>- Calculation of necessary PV panels.</li> </ul> </li> </ul> <p><i>(Note: the practices corresponding to this block will be carried out using didactic trainers and laboratory material).</i></p>
	1.2. UNDERSTAND ENERGY STORAGE TECHNOLOGIES AND SOLAR PV SYSTEMS	
	1.3. EXHIBIT PROFESSIONALISM	
2. SOLAR PHOTOVOLTAIC SYSTEMS	2.1. UNDERSTAND GRID- CONNECTED SOLAR PV SYSTEMS WITH OR WITHOUT BATTERY STORAGE	<p style="text-align: center;"><u>Technology Block</u></p> <p><b>Practice session 2:</b></p> <p>Practices:</p> <p><i>(Note: the practices will be carried out with didactic trainers of photovoltaic technologies and associated documentation according to this basic procedure: interpretation of specifications and diagrams → assembly → checking and analysis of operation → practice report):</i></p> <ul style="list-style-type: none"> <li>• Identification of components and means (PV solar trainer).                             <ul style="list-style-type: none"> <li>- Solar modules or panels.</li> <li>- Accumulators.</li> <li>- Regulators.</li> <li>- Inverters.</li> <li>- Other electrical components: load modules, controls ...</li> </ul> </li> </ul>
	2.2. UNDERSTAND OFF-GRID SOLAR PV SYSTEMS WITH OR WITHOUT BATTERY STORAGE	



	<p><b>2.3. UNDERSTAND SOLAR PV SYSTEM PERFORMANCE</b></p>	<ul style="list-style-type: none"> <li>• Solar panel installation.</li> <li>• Connection of solar panels.</li> <li>• Connection of battery banks.</li> <li>• Measurement of solar irradiation, or alternative insolation source.</li> <li>• Measurement of panel voltage at no load.</li> <li>• Measurement of voltage and current under load.</li> <li>• Regulation and charging of the battery.</li> <li>• Solar installation of direct current.</li> <li>• Solar installation of alternating current.</li> <li>• Solar installation public grid connected.</li> <li>• Calculation of a residential isolated photovoltaic installation.</li> </ul>
<p><b>3. INSTALLATION OF PV SOLAR SYSTEMS</b></p>	<p><b>3.1. BE ABLE TO INSTALL SOLAR PV SYSTEMS</b></p>	<p style="text-align: right;"><u>Installation block:</u></p> <p><b>Practice session 3:</b></p> <p>Exercises:</p> <ul style="list-style-type: none"> <li>• Analysis of the documentation of a PV installation project.             <ul style="list-style-type: none"> <li>· Diagrams, bills of materials, calculations, etc.</li> </ul> </li> <li>• Analysis of a real installation (single-family house):             <ul style="list-style-type: none"> <li>· Identification of actual equipment and material used.</li> <li>· Installation process: inspection, installation, testing, delivery.</li> </ul> </li> <li>• Safety during installation work:             <ul style="list-style-type: none"> <li>· Safety plan and risk identification in transportation, assembly, testing, maintenance ...</li> <li>· Use/installation of protective means and equipment.</li> </ul> </li> <li>• Identification of tools and other specific means of the photovoltaic installer.</li> </ul> <p><b>Practice sessions 4-5:</b></p> <p>Projects:</p> <ul style="list-style-type: none"> <li>• Installation of solar panels on a flat roof.</li> <li>• Installation of solar panels on a sloping roof.</li> <li>• Installation of photovoltaic solar house, cc</li> <li>• Installation of photovoltaic solar house, 220 ac</li> <li>• Installation of solar house grid connected.</li> <li>• Commissioning of a photovoltaic installation.</li> <li>• Other applications:             <ul style="list-style-type: none"> <li>· Autonomous solar streetlight.</li> <li>· Solar powered pumping station.</li> <li>· Mini power station.</li> </ul> </li> </ul>



		<i>(Note: the practices in this block will be carried out supported by real and didactic equipment, and the analysis of existing systems)</i>
<b>4. MAINTENANCE OF SOLAR PV SYSTEMS</b>	<b>3.2. BE ABLE TO INSPECT SOLAR PV SYSTEMS</b>	<p style="text-align: center;"><u>Maintenance block:</u></p> <p><b>Practice session 6:</b></p> <p>Exercises:</p> <ul style="list-style-type: none"> <li>• Analysis of:                             <ul style="list-style-type: none"> <li>- Regulations applicable to maintenance.</li> <li>- Solar PV installation manual and other doc.</li> <li>- Preventive maintenance programs.</li> <li>- Energy management programs.</li> </ul> </li> </ul>
	<b>3.3. BE ABLE TO MAINTAIN SOLAR PV SYSTEMS</b>	<p>Practices:</p> <ul style="list-style-type: none"> <li>• Checking and adjusting the installation parameters to the set values (radiation, temperatures, electrical parameters, etc.).</li> <li>• Performance evaluation.</li> <li>• Practices:                             <ul style="list-style-type: none"> <li>• Basic maintenance by the user. Cleaning of collectors, accumulators, inspection of connections, etc.</li> <li>• Identification of the most common critical system faults.</li> <li>• Basic maintenance of the technician:                                     <ul style="list-style-type: none"> <li>- Mechanical parts.</li> <li>- Electrical parts.</li> </ul> </li> <li>• Systematic troubleshooting and repair.                                     <ul style="list-style-type: none"> <li>- Troubleshooting.</li> <li>- Disassembly and repair / replacement of elements.</li> </ul> </li> </ul> </li> </ul> <p><i>(Note: the practices in this block will be carried out supported by real and didactic equipment, and the analysis of existing systems)</i></p>
	<b>≈ 50H</b>	<b>≈ 50H</b>

**Table 1. Summary of the training program of the GSS-VET pilot course for installers of solar PV systems (Spain)**

According to the basic design of the training, the practice plan should be offered in coordination with the content covered. The content of the Solar Photovoltaic Systems courses is essentially structured in three (or four) main sections: Fundamentals, Technology and Calculation/Design, Installation and Maintenance. Therefore, the practices sessions, as it is illustrated in Table 1, was planned with a selection of exercises, practices or projects related to these broad domains of knowledge supported by appropriate equipment and other resources (Figure 3).





**Figure 3. Sample of equipment and facilities available at the CIFP Usurbil for teaching and practicing solar photovoltaic and thermal installations**

Finally, the courses are of a certifying nature. In other words, they constitute a preparation mechanism for a certification exam (that included in the internal certification scheme), which only participants who have passed this training can access. Therefore, the courses had to incorporate some mechanism of evaluation of the readiness of the students.

Within the framework of the pilot training implemented in Spain, it was decided to carry out **an individualized assessment and give counsel to each participant, taking into account their progress in the course** (study of the units, completion of questionnaires, etc.) and behavior (attendance, participation, etc.). In any case, the participants (considering that they all met the "expert" profile condition) could voluntarily take the certification exam, regardless of the assessments made.

The trainers and other staff involved Course 1 and course 2 of Solar Photovoltaic were one **online course tutor and practice instructor(s)**

It should be noted that, in general, these courses went smoothly in the first few weeks before they had to be interrupted. There was time to experiment with online training and practice sessions in the

partners' training centers, too. And the trainers were able to gather first impressions from the participants.

Their specific assessment of the programmes and materials was generally good, although some content needed better translation into Spanish. The practice simulators ("serious games") that completed the theoretical content were positively evaluated as an innovative resource that, nevertheless, should include more cases or simulation assumptions in order to enhance their usefulness and that of the online training itself (less dependence on face-to-face practice sessions, as far as possible).

After the interruption, only the INSTAGI-ZUBIGUNE courses could be completed, with some restrictions regarding the practice plan.

### Training of Installers of Solar Thermal Systems

The courses for installers of Solar Thermal Systems were planned with a similar approach to the Solar Photovoltaic courses. Table 3 summarizes the original training program.

CONTENT (online)		PRACTICE PLAN (face-to-face)
Modules	Units	
1. INTRODUCTION TO SOLAR THERMAL ENERGY	1.1. SOLAR ENERGY	<p><u>Block of fundamentals and technologies</u></p> <p><u>Practice session 1</u></p> <ul style="list-style-type: none"> <li>• (Contextualization) Overview of the occupation. Spain:               <ul style="list-style-type: none"> <li>- Sector and companies.</li> </ul> </li> </ul>



	<p><b>1.2. NATIONAL REQUIREMENTS (REGULATIONS)</b></p>	<ul style="list-style-type: none"> <li>- Technology.</li> <li>- Regulatory framework.</li> <li>- Installers. Major functions.</li> <li>- Current and prospective employment.</li> </ul> <p>Exercises:</p> <ul style="list-style-type: none"> <li>• Review of hydraulic concepts (DHW installations).</li> <li>• Review of physical concepts (the sun).</li> <li>• Handling of solar charts.</li> </ul>
	<p><b>1.3. TYPES OF SOLAR THERMAL INSTALLATIONS AND COMPONENTS</b></p>	<p>Practices:</p> <ul style="list-style-type: none"> <li>• Instruments for measuring solar irradiation.</li> </ul>
	<p><b>1.4. MEASURING INSTRUMENTS</b></p>	<p>Practices:</p> <ul style="list-style-type: none"> <li>• Basic analysis of the solar thermal collector (Flat Plate, Evacuated Tube). Structure, operation and basic documentation.</li> <li>• Performance vs. irradiance curve. Efficiency and factors (angles, shadows, temperature gradient, design and materials).</li> </ul> <p>Practices:</p> <ul style="list-style-type: none"> <li>• Basic analysis of SHW systems:             <ul style="list-style-type: none"> <li>- Passive types.</li> <li>- Active or forced types.</li> <li>- Direct and indirect types.</li> </ul> </li> </ul>
	<p><b>1.5. BASIC CALCULATION OF ST INSTALLATIONS</b></p>	<ul style="list-style-type: none"> <li>- Identification of parts, circuits and basic components:             <ul style="list-style-type: none"> <li>· Flat and vacuum tube collectors.</li> <li>· Solar accumulator.</li> <li>· Pumps, solar pump stations, solar circuit and consumption circuits.</li> <li>· Controller.</li> <li>· Auxiliary system.</li> <li>· Heat exchangers.</li> <li>· Expansion tank (DEV).</li> <li>· Control valves, gauges and others.</li> <li>· Heat transfer fluids.</li> </ul> </li> <li>- Basic assemblies, operation and measurements.</li> </ul> <p><b>Practice session 2</b></p> <p>Exercises and practices:</p> <ul style="list-style-type: none"> <li>• Calculation of hot water consumption in residential and commercial environments.</li> <li>• Simplified calculation process for DSHW systems (forced):             <ul style="list-style-type: none"> <li>- DHW demand and consumption pattern.</li> <li>- Intensity of solar radiation available on site.</li> </ul> </li> </ul>



		<ul style="list-style-type: none"> <li>- Solar fraction.</li> <li>- Estimation of collection area. Selection of collectors.</li> <li>- Solar hot water storage calculation. Solar tank selection.</li> <li>- Auxiliary system.</li> <li>- Pipe calculation. Pressure loss.</li> <li>- Pump calculation. Head.</li> <li>- Other calculations: expansion vessel (safety).</li> </ul> <ul style="list-style-type: none"> <li>• Basic use of software por ST calculation and analysis.</li> </ul> <p><i>(Note: the practices in this block will be carried out with didactic trainers or laboratory material fundamentally. Also, instruments and software will be used).</i></p>
<p style="text-align: center;"><b>2.</b> <b>SOLAR THERMAL INSTALLATIONS FOR DHW AND SPACE HEATING IN SINGLE- FAMILY HOUSES</b></p>	<p><b>2.1. PASSIVE SOLAR DHW SYSTEM. THERMOSIPHON.</b></p>	<p><u>Block of basic installations.</u> <u>(single-family houses and small commercial applications)</u></p>
	<p><b>2.2. THE HEAT STORAGE. BASIC CONCEPTS (SOLAR HOT WATER STORAGE TANKS)</b></p>	<p><b>Practice session 3</b></p> <p>Practices:</p> <ul style="list-style-type: none"> <li>• Analysis of real systems and installations of small dimension (residential / commercial):</li> </ul>
	<p><b>2.3. THE HYDRAULIC SYSTEM: PIPES AND THE HTF</b></p>	<ul style="list-style-type: none"> <li>- Passive. SHW system Thermosiphon. Direct or Indirect.</li> <li>- Active. Glycol and Drainback (indirect systems).</li> </ul>
	<p><b>2.4. THE SOLAR COLLECTOR AND DIFFERENT ANCHORING TYPES</b></p>	<ul style="list-style-type: none"> <li>- Combined system: DHW and heating / air conditioning.</li> <li>- Components of the solar loop.</li> </ul>
	<p><b>2.5. ACTIVE SOLAR DHW SYSTEM.</b></p>	<ul style="list-style-type: none"> <li>- Auxiliary and consumption system circuits and components.</li> </ul>
	<p><b>2.6. THE AUXILIARY SYSTEM.</b></p>	<ul style="list-style-type: none"> <li>- Fixing systems and mechanical support. Types of installation of the solar collector, associated anchorage systems and complementary elements (pipe flashing system, etc.).</li> </ul>
	<p><b>2.7. THE HYDRAULIC CIRCUIT</b></p>	<ul style="list-style-type: none"> <li>- Insulation, special elements (heat sinks, etc.), measurement and protection.</li> </ul>
	<p><b>2.8. THE REGULATION AND CONTROL SYSTEM.</b></p>	<ul style="list-style-type: none"> <li>• Basic system operations, tests and programming:</li> <li>- Glycol mixture.</li> <li>- Flush, fill and drain.</li> <li>- Pressure and flow rate adjustment.</li> </ul>
	<p><b>2.9. PREVENTION OF OCCUPATIONAL RISKS AND SAFETY WORK ON THE CONSTRUCTION SITE</b></p>	<ul style="list-style-type: none"> <li>- Monitoring.</li> <li>- Programming. Change of basic parameters.</li> </ul> <p><b>Practice session 4</b></p>



	<p><b>2.10. START UP OF SOLAR THERMAL INSTALLATIONS</b></p>	<p>Exercises:</p> <ul style="list-style-type: none"> <li>• Analysis of documentation of a solar thermal project. <ul style="list-style-type: none"> <li>- Manufacturer's installation manual.</li> <li>- Installation drawings.</li> </ul> </li> <li>• Installation process: site inspection, installation, commissioning.</li> <li>• Safety in installation work: <ul style="list-style-type: none"> <li>- Safety plan and risk identification in transportation, assembly, testing, maintenance ...</li> <li>- Protection means and equipment.</li> </ul> </li> <li>• Tools and other specific means of the solar thermal installer.</li> </ul> <p>Practices / projects:</p> <ul style="list-style-type: none"> <li>• Installation and commissioning of the ACS Thermosiphon system.</li> <li>• Installation of solar collectors: <ul style="list-style-type: none"> <li>- FPC and ETC.</li> <li>- Flat surface and sloped surface mounting techniques.</li> </ul> </li> <li>• Installation of a forced DSHW system.</li> <li>• Commissioning of a forced DSHW system.</li> </ul> <p><i>(Note: the practices in this block will be carried out with the help of real and didactic equipment, and the analysis of existing facilities)</i></p>
<p><b>3. SOLAR THERMAL ENERGY SYSTEMS FOR BUILDINGS (RESIDENTIAL &amp; COMMERCIAL)</b></p>	<p><b>3.1. SOLAR COLLECTORS ARRAYS</b></p> <hr/> <p><b>3.2. TYPES OF INSTALLATIONS FOR MULTIFAMILY BUILDINGS AND LARGE COMMERCIAL APPLICATIONS</b></p> <hr/> <p><b>3.3. MONITORING PLAN AND PREVENTIVE AND CORRECTIVE MAINTENANCE</b></p>	<p style="text-align: center;"><u>Block of advanced installation (multifamily buildings, large commercial), and Maintenance</u></p> <p><b>Practice session 5</b></p> <p>Exercises:</p> <ul style="list-style-type: none"> <li>• Analysis of the documentation of a regulated solar thermal project. <ul style="list-style-type: none"> <li>- Diagrams, lists, calculations, etc.</li> <li>- Legalization process of regulated systems.</li> </ul> </li> <li>• Analysis of a real communal SHW installation (residential block, commercial application, etc.): <ul style="list-style-type: none"> <li>- Collector field. Structure, hydraulics.</li> <li>- Centralized or distributed hot water storage system.</li> <li>- Centralized or distributed auxiliary system.</li> <li>- Other components: hot water and energy meters, etc.</li> <li>- Installation documentation.</li> </ul> </li> <li>• Project: <ul style="list-style-type: none"> <li>- Installation of a battery of solar collectors.</li> </ul> </li> </ul>



		<p><b>Practice session 6</b></p> <p>Exercises:</p> <ul style="list-style-type: none"> <li>• Analysis of:             <ul style="list-style-type: none"> <li>- Regulations applicable to maintenance.</li> <li>- Solar thermal installation manual.</li> <li>- Preventive maintenance programs.</li> <li>- Energy management programs.</li> </ul> </li> </ul> <p>Practices:</p> <ul style="list-style-type: none"> <li>• Checking and adjusting the installation parameters to the set values (flow rates, pressures, temperatures, etc.).</li> <li>• Performance evaluation.</li> <li>• Basic maintenance operations by the user.</li> <li>• Maintenance by the technician. Inspection and preventive maintenance of:             <ul style="list-style-type: none"> <li>- Solar collection subsystem.</li> <li>- Solar loop. Pipes and HTF.</li> <li>- Hot water storage system and general hydraulics.</li> <li>- Electric parts and others.</li> </ul> </li> <li>• Systematic troubleshooting and repair of frequent SHW systems breakdowns.</li> </ul> <p><i>(Note: the practices in this block will be carried out with the help of real and didactic teams, and the analysis of existing facilities)</i></p>
≈ 50H		≈ 50H

**Table 2. Summary of the training program of the pilot course for installers of thermal solar systems (Spain)**

**An online course tutor and practice instructor (s) were** involved respectively in course 1 (INSTAGUI-ZUBIGUNE) and course 2 (EL GREMI, Barcelona) of Solar Thermal Systems.

It should be noted that, in general, these courses went smoothly in the first few weeks before they had to be interrupted. After the interruption, only the INSTAGI-ZUBIGUNE courses could be completed, with some restrictions regarding the practice plan.

### 2.2.3. Training of installers of Geothermal Systems.

As indicated before, no training was planned for this sector due to what considered as a lack of significant demand.



## WORK-BASED TRAINING OF INSTALLERS

As indicated above, the courses organized were of the "Advanced" type for experienced installation professionals. Therefore, it was not considered necessary to include this module, which is more appropriate for student (initial VET) or occupational (professional retraining, etc.) trainings.

## EVALUATION OF LEARNERS AND INTERNAL CERTIFICATION

This section describes the specific actions relating to the certified assessment of installers and the processing of certificates.

### Organization of the evaluation and certification process

The evaluation and certification process for installers participating in the pilot courses was originally scheduled to be implemented at the end of the training (Figure 1). In addition, the certification route was that corresponding to the "advanced" profile of the participants. That is, they did not need to pass the practical exam. Also, the option of **online theoretical exam** (automatically generated by the platform) was chosen, which does not require the simultaneous presence, physical or virtual, of the participants. These features simplified the process organizationally.

The coronavirus crisis forced to postpone the certification evaluation process. Once the process was resumed, only a part of the registered participants managed to finish their training and take the theoretical certifying test (in July 2020).

### Evaluation of participants in trainings for Solar Photovoltaic installers

#### Theoretical exam

The students, after being assessed and counselled, were invited to take the theoretical exam on the e-learning platform.



### **Practical exam**

All the students qualified as “Advanced” level applicants and therefore the practical exam was not applicable.

### **Certification**

11 solar photovoltaic system installers out of a total of 16 enrolled in the training were awarded the internal project certificate (issued by TUV AUSTRIA). All installers were trained by INSTAGI-ZUBIGUNE.

## **Evaluation of participants in trainings for Solar Thermal installers**

### **Theoretical exam**

The students, after being assessed and counselled, were invited to take the theoretical exam on the e-learning platform.

### **Practical exam**

All the students qualified as “Advanced” level applicants and therefore the practical exam was not applicable.

#### **4.2.3. Certification**


2 solar thermal systems installers out of a total of 16 enrolled in the training were awarded the internal project certificate (issued by TUV AUSTRIA). All installers were trained by INSTAGI-ZUBIGUNE.

## **Evaluation of training**

The original training plan included a satisfaction survey for trainees. Due to the interruption of the training, only a fraction of the participants has completed this questionnaire (Figure 4).



**Encuesta de satisfacción -  
Evaluación de la formación piloto GSS-VET para  
instaladores de sistemas de Energía Solar y  
Geotermia**



---

*Nos gustaría que contestara este sencillo cuestionario para que podamos valorar la formación en energía solar térmica, fotovoltaica y geotermia de la plataforma de e-learning, resultado del proyecto GSS-VET financiado por la Unión Europea a través de Erasmus+*

*Por favor, indique su grado de satisfacción utilizando la siguiente escala  
1: Nada satisfecho, 2: Un poco satisfecho, 3: Satisfecho, 4: Bastante satisfecho, 5: Muy satisfecho*

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
1. IMPRESIÓN GENERAL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
				30%	70%
2. APTITUD DE LOS FORMADORES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
				20%	80%
3. INTERES DEL CONTENIDO/DURACIÓN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
				18%	82%
4. MATERIAL DE FORMACIÓN Y RECURSOS	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
			10%	30%	60%
5. ENTORNO VIRTUAL DE FORMACIÓN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
				10%	90%
6. LUGAR Y MEDIOS AUDIOVISUALES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
				10%	90%
7. APOYO DEL CENTRO DE FORMACIÓN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
					100%
8. QUE DESTACARIA COMO PUNTOS FUERTES:					
9. SUGERENCIAS DE MEJORA:					
10. OTROS COMENTARIOS:					

Figure 4. Results of the INSTAGI-ZUBIGUNE training participant satisfaction survey (22 surveys completed)



The survey asked participants about 7 key aspects of the training experience, in addition to including other open-ended questions. The results were generally good, as can be seen in Figure 4.

It should be noted that **the e-Learning platform was particularly well considered** (Question 5). Also, the learning materials and the design of the certification test (Question 4) have satisfied the participants, although some of them have suggested in their comments:

- It should be revised the translations into Spanish of some texts and images.
- Add or adapt certain contents to national professional contexts. Regulations, technology used, examples of documents, etc.

These aspects are particularly relevant for the validation of the GSS-VET training framework, as they are basic components of it. In this regard, it is also noted that the theoretical exam (Solar Thermal) in online format initially presented a technical deficiency that prevented its completion. Once diagnosed, the problem was solved with diligence and the users were able to complete their exams; it can be concluded that the technical support processes of the pilot training also operated correctly and incidents like this one did not have a major impact on the degree of satisfaction of the participants (Questions 1 and 7).

## TASK 5.6-c. REGISTRATION OF PARTICIPANTS IN EURES PORTAL

17 students have shown interest in registering on the EURES platform.



## SUMMARY OF RESULTS

The main results of the pilot training activities for installers carried out in Spain are:

- **A total of 46 participants registered in 4 training courses in two locations.**
- **1 training course for PV system installers completed.**
- **1 Training course for installers of solar thermal systems completed.**
- **11 solar photovoltaic systems installers certified according to the GSS-VET internal certification scheme.**
- **2 solar thermal systems installers certified according to the GSS-VET internal certification scheme**
- **17 Participants registered in EURES**



## ANNEXES



Figure 5. Views of facilities, equipment and practice sessions held at INSTAGI-ZUBIGUNE (San Sebastian) and ESCUELA GREMIAL DE INSTALADORES (Barcelona)


Encuesta de satisfacción - Evaluación de la formación piloto GSS-VET para instaladores de sistemas de Energía Solar y Geotérmica					
<p><i>Nos gustaría que contestara este sencillo cuestionario para que podamos valorar la formación en energía solar térmica, fotovoltaica y geotermia de la plataforma de e-learning, resultado del proyecto GSS-VET financiado por la Unión Europea a través de Erasmus+</i></p> <p><i>Por favor, indique su grado de satisfacción utilizando la siguiente escala</i>                      1: Nada satisfecho, 2: Un poco satisfecho, 3: Satisfecho, 4: Bastante satisfecho, 5: Muy satisfecho</p>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
1. IMPRESIÓN GENERAL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. APTITUD DE LOS FORMADORES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. INTERES DEL CONTENIDO/DURACIÓN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. MATERIAL DE FORMACIÓN Y RECURSOS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. ENTORNO VIRTUAL DE FORMACIÓN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. LUGAR Y MEDIOS AUDIOVISUALES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. APOYO DEL CENTRO DE FORMACIÓN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. QUE DESTACARIA COMO PUNTOS FUERTES:	<hr/> <hr/> <hr/>				
9. SUGERENCIAS DE MEJORA:	<hr/> <hr/> <hr/>				
10. OTROS COMENTARIOS:	<hr/> <hr/> <hr/>				
GRACIAS POR SU COLABORACIÓN					

Figure 6. Satisfaction Survey template used in training of trainees (Spain)



## TRAINING IN GERMANY

This report includes the description of the geothermal pilot training in Germany. Responsible organization was the HS BO who carried out the training. The objectives of the pilot training during the project implementation were:

- to test and validate the effectiveness of the training platform in a real training environment with real trainees from Germany
- to collect feedback from trainees on the quality of the training platform that has been created. The feedback is the base for a further development of the content of the training platform and also of the different processes
- to disseminate the results of the GSS-VET project to as many as possible shareholders. The training process that is described in this deliverable took place during the time from March till August 2020.

In total 47 people expressed their interest to participate in this program and were registered in the pilot training of the program. All of them were part of the geothermal course. The course starts at July 2020.

This pilot training program for all trainees was promoted from the personnel HS BO and IEG by the trainers who passed the trainer workshop and be familiar with the whole course (content and process) Unfortunately, due to the coronavirus pandemic, the training plan, that was developed before the training process, had to be significantly modified. In Germany - at the HS BO - practical face-to-face education is still not allowed since the shutdown of the universities. First of all, we decided to wait a while and hoped that the Corona situation will change quickly. As this did not take place we have to make changes in the structure.



So the following decision was made:

- Start with the theoretical E-Learning phase in July 2020
- The practical phase to be postponed at a later stage - Sadly we cannot determine this stage yet. All students were informed about the situation
- The students cannot pass the exam yet.
- In this way they cannot be certified at the moment

We will finish the practical course, the exam and the certificate as soon as possible.

At the end of the day, depending on the Covid-19 crises we and the students are still in progress.



## TASK 5.3-a TRAININGS OF INSTALLERS

This section describes the pilot training plan in the training curricula of the GSS VET project

### Organization of the trainings

The trainers used in the training process of all groups where the trainers that were trained in the workshop of trainers' training of the project.

The preparatory actions for the pilot training process included:

- Preparation of announcements concerning the training process.
- Disseminate (through workshops of trainers, daily events in Bochum / Germany, website, in person communication with local associations of technician's chambers / institutions) the training program of the project that can offer in the end for the participants certified training.
- Finalization of certification schemes for all training curricula in English and translated in Greek – Spanish – Bulgarian and German (prepared from the project partner No.5 - TUV Austria). These certification schemes are included in project deliverables in WP4 – Task 4.3.

The final version of the document of "Persons' Certification Application" (prepared from the project partner No.5 - TUV Austria) included the requested information from all applicants that wanted to participate in the pilot training.

The pilot trainings started at July 2020. As shown above the Corona Situation causes seriously changes in the planned training. The practical parts could not took place.

The following actions - according to the process-schemas was done by the Hochschule Bochum

1. Collection of user data. (name, references, ...)
2. Sending the data to the partners in the GSS-VET project



3. User credentials was created (by SQL-Learn)
4. Sending of credentials and instructions to the participants
5. feedback of the participants --> Using of the E-Learning platform starts successfully
6. Communication weekly with the students
  - Suggestion for schedule, time and speed
  - Corona gave most of the students the opportunity to spend more time - most of the student reached the end of modules till end of August
7. Feedback opportunity - open questions (content and technic) could be discussed with the trainers
8. Supplemented by two online Meetings with all participants (who wants to participate) for an open discussion

## Performance of the trainings

The organizational preparation was smooth. There were only a few small queries about the technical handling, which could be answered easily and immediately by the trainers.

## Performance of the practical parts

As shown did the practical parts not took place. The trainers from the Hochschule Bochum have successfully completed the necessary preparation. All practical exercises have been completed and are ready to be carried out. On the basis of the heat pump laboratory, corresponding practical tasks were developed and tested. The corresponding material is completely available.

It was planned to divide the course into two phases. (practice and theory), which partly took place simultaneously.

### **Phase 1 - E-learning theory**

Implementation successful

### **Phase 2- Practical phase on site and in the laboratory**

Postponed - timeline uncertain



## **WORK-BASED TRAINING OF INSTALLERS**

The practical phase could not be implemented



## EVALUATION OF LEARNERS AND INTERNAL CERTIFICATION

### The certification process

In order to receive the certification as a successful completion, the participants have to pass the intended examinations. In the geothermal course, the examination is divided into a theoretical and a practical part (see the certification guideline).

Participants have not yet been able to take the exams. As has been mentioned several times, the practical part has so far been prepared comprehensively, but not carried out. Since the contents could not be taught accordingly, it is not possible to conduct the examination in a meaningful way. The participants are aware of this and take the exams immediately after the practical phase. Formally, therefore, nobody has yet received a certificate in the geothermal pilot course. However, this is not an expression of lack of success, but simply due to the situation.

### The Evaluation process

The evaluation should be carried out using a standardized form which can be read and evaluated by machine. Here too, the final evaluation without the practice phase has no real value. The evaluation is finally prepared. The form is created and ready for use.



GSS VET – Geothermische Systeme

Kursbezeichnung: **GSS-VET**  
 Modulbezeichnung: **GSS-VET**  
 Kurszeitraum/-datum: **BO**

Bitte so markieren:    Bitte verwenden Sie zum Ausfüllen einen Kugelschreiber oder einen dünnen Filzstift und die Bei Korrektur:    links gegebenen Hinweise, um eine optimale Erfassung Ihrer Angaben zu ermöglichen.

Liebe Kursteilnehmerin, lieber Kursteilnehmer,  
 durch das Ausfüllen dieses Fragebogens helfen Sie uns, unser Bildungsangebot weiter zu verbessern. Die Beantwortung der Fragen ist freiwillig und erfolgt anonym.

**A. Angaben zur Person**

A1 Alter  <30 Jahre  30 - 40 Jahre  40 - 50 Jahre  >50 Jahre  Keine Angabe

A2 Geschlecht  Weiblich  Männlich  Keine Angabe

**B. Rahmenbedingungen der Veranstaltung**

	trifft voll zu	trifft teilweise zu	trifft überwiegend nicht zu	trifft gar nicht zu	Keine Angabe
B1 Die Veranstaltungen des Moduls sind gut organisiert.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2 Die technische Nutzung der E-Learning Plattform war problemlos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B3 Die Lehrinhalte stimmen mit der Modulbeschreibung überein.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B4 Die Menge des vermittelten Stoffes ist angemessen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B5 Mein Vorwissen war ausreichend, um der Veranstaltung folgen zu können.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**C. Stoffvermittlung und Arbeitsaufwand**

C1 Die Aufbereitung des Stoffes ist gut strukturiert und hat eine klar erkennbare Konzeption („roter Faden“).

C2 Folien und Inhalte sind klar strukturiert und waren für mein Verständnis der Lehrinhalte hilfreich.

C3 Die Interaktion mit den Dozenten war gut

C4 Die Lehrinhalte verbessern meine Chancen auf dem Arbeitsmarkt

C6 Das Tempo der Stoffvermittlung ist für mich ...  zu schnell  genau richtig  zu langsam

C7 Mein Arbeitsaufwand für die Vor- und Nachbereitung der Module ist ...  eher groß  mittel  eher gering

C8 Die innovativen Lehrmethoden (E-Learning / Serious Game) waren für mich hilfreich.

**D. Gesamtbewertung**

	Sehr gut	Gut	Befriedigend	Unbefriedigend	Mangelhaft	Sehr mangelhaft
D1 Wie <u>interessant</u> die Dozentin/des Dozenten?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D2 Wie beurteilen Sie die Eignung der Lehrmaterialien (z.B. Skripte) und der empfohlenen Literatur?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D3 Wie bewerten Sie Ihren Lernerfolg?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D4 Welche Note geben Sie der Veranstaltung insgesamt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**E. Persönliche Kommentare und Anregungen**

GSS VET – Geothermische Systeme

**Hinweis:**  
 Bei der Auswertung der Fragebögen werden die Antworten auf die folgenden Fragen bei Bedarf eingeschickt und dann als Grafiken dem Eigenverantwortlichen der Dozenten beifügt. Theoretisch ist es möglich, über die Handschrift Rückschlüsse auf die Bearbeitenden der Fragebögen zu ziehen.

E1 Ich bin damit einverstanden, dass meine Antworten auf die Freitextfragen an die Dozentin/den Dozenten weitergeleitet werden.  Ja  Nein

E2 Was sollte der Dozent auf jeden Fall beibehalten?

E3 Was sollte der Dozent auf jeden Fall ändern?

E4 Welche anderen Verbesserungsvorschläge oder Anregungen haben Sie für das Seminar?

The final evaluation was not carried out, but will be carried out after the practical phase.

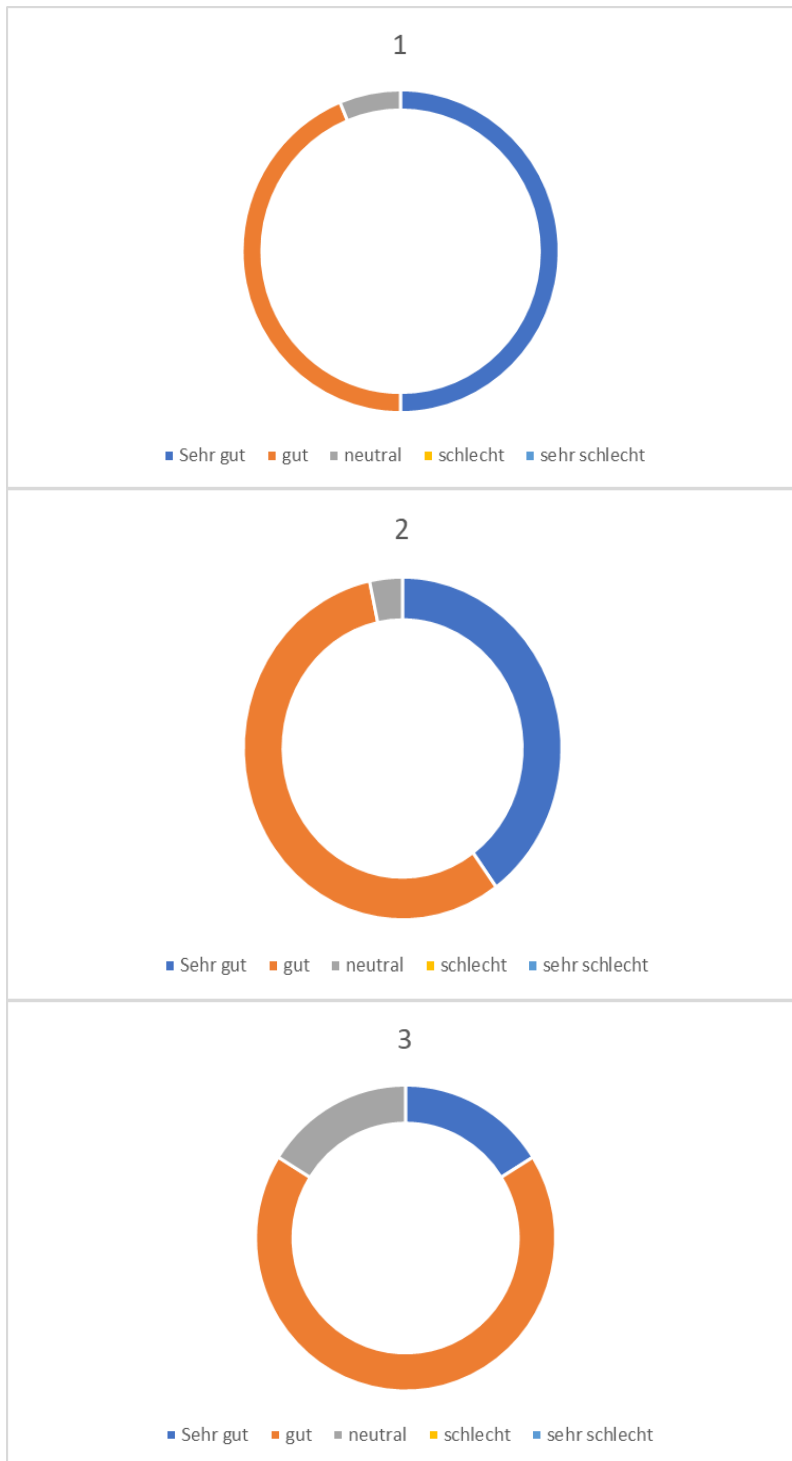
## The Evaluation results

Instead, a short evaluation was conducted during the two online meetings. For this purpose, general questions were asked by means of a voting function:

- How satisfied are you with the e-learning platform? (1)
- How do you rate the content of the modules and units? (2)
- How do you estimate the effects on your future professional life? (3)



These are the results:



In Addition, we got a couple of qualitative comments:

- The anticipation of the practical phase was stressed several times
- Trainers were praised for their competence and helpfulness
- It was suggested to include more examples in the units. The contents should be illustrated by an example at the end of each unit
- Multilingualism was praised
- Some of the contents were described as too extensive (too much theoretical foundation)
- The e-learning concept and the teaching methods met with universal approval

## REGISTRATION OF PARTICIPANTS IN THE EURES PORTAL

As long as the exam is not passed, there is no certification and the registration is not possible.



## SUMMARY OF RESULTS

Main results from the pilot training process in Germany were:

- 40 participants registered in the pilot trainings sadly we couldn't finish the courses - the practical phase is missing
- Because of the open end, there is no certification yet
- The evaluation is not finished - but we got promising results in a short evaluation
- Sadly, there was only a Geothermal course in Germany - no solar thermal and no PV. This caused by the structure other German partners, they are working in the field of geothermal only.





# GSS-VET

## *Geothermal & Solar* skills

VOCATIONAL EDUCATION AND TRAINING

WP5 / D 5.2

### Reports on trainings' Implementation – TRAINERS

Erasmus + Sector Skills Alliances 575891-EPP-1-2016- 1-EL-EPPKA2-SSA



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