

A holistic framework for Empowering SME's capacity to increase their energy efficiency

Project: **SME mPower Efficiency**

Deliverable number: **3.4**

Deliverable Name: **E&T reports**

Document Properties	
Dissemination level	Public report
Lead beneficiary	Technical University of Cluj-Napoca (UTC) Universitat Politècnica de Valencia (UPV)
Prepared by	Technical University of Cluj-Napoca (UTC) 19/05/2021
Checked by WP leader	20/05/2021
Approved by Project Coordinator	24/05/2021
Submission due date	28/02/2021
Actual submission date	24/05/2021

7.0



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 847132.

Document History

Version	Date	Contributor(s)	Description
1.0	31/03/2021	Denisa Şteţ, Claudia Mureşan, Alexandru Mureşan (UTC)	Creation of template
2.0	28/04/2021	ALL	Feedback and data provision
3.0	30/04/2021	Denisa Şteţ, Claudia Mureşan, Alexandru Mureşan (UTC)	Preparation of draft report
4.0	16/05/2021	Denisa Şteţ, Claudia Mureşan, Alexandru Mureşan, Ştefan Cîrstea (UTC)	Final draft report
5.0	19/05/2021	ALL	Feedback on the report
6.0	21/05/2021	Denisa Şteţ	Final report
7.0	24/05/2021	Grigoris Papagiannis	Final

List of Acronyms

Acronym	Meaning
E&T	Education & Training
ECTS	European Credit Transfer and Accumulation System
EQF	European Qualification Framework
LU	Learning Unit
M&T	Monitoring & Targeting
M&V	Measurement & Verification
Q&A	Questions and Answers
SME	Small and Medium Enterprise
WP	Work Package

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Partners



Description of Work package

Work Package named ***Individual Dimension–Education & Training Courses for SMEs*** is dedicated to the design, implementation and evaluation of an Education and Training (E&T) course, mainly targeting the existing or prospective staff of SMEs with energy related responsibilities. The staff trainings of SMEs will be open also to managerial staff that can take decisions due to the strategic target of the project, which is to train SME key staff in a way to be able to use intelligent energy management solutions, design, propose and successfully find pathways to fund intelligent and affordable energy efficient investments, inflict a change in behaviour and gain the support of decision makers. The trainings will go beyond the energy audit, to effectively implement energy management techniques, instruments and solutions, so as to achieve energy savings, emissions reduction and welfare.

Description of Task

Task name: ***Delivery of E&T program in each country***

Main activities related to Task and Deliverable:

1. Preparation of material: development of a specialized handbook for the needs of the program, covering all thematic units, including the necessary theoretical background, working examples, tutorials etc. The aim is to develop a contemporary and advanced training material that will be available indefinitely after the end of the project to all interested professionals.
2. Call for participants to the E&T Program and selection.
3. Scheduling of E&T program: attention is paid to planning all courses in all countries at approximately the same period to benefit from the interaction of professionals through the platform and web portal.
4. E&T program delivery: 3 editions in 8 countries; total of 24 courses; 3 in each country, delivered during project's duration.

Description of Deliverable

This deliverable highlights the conclusions of the delivery of the 1st edition training courses, also including suggestions for improvement, in all project partner countries.

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Executive summary

This Report has been developed through the implementation of the “SMEmPower Efficiency” project, funded by the Horizon 2020 under the Grant Agreement No. 847132/ 2019.

The SMEmPower Efficiency project is based on a holistic framework to “empower” SMEs to undergo energy audits and implement their proposals. An integrated Education & Training (E&T) program is going to support this objective, targeting energy related SMEs staff.

At the early stage of SMEmPower Efficiency, the consortium developed a methodology to gather data on SMEs energy cost, energy efficiency and other important parameters. Thus, a questionnaire was developed, which was used to conduct a survey among 213 SMEs located in the 8 participating EU countries. Moreover, targeted workshops were organized to identify which are the main barriers (Legislative, Institutional, Technical, Financial, Communication) that prohibit the implementation of energy efficiency measures in SMEs and to propose solutions. The conclusions were presented in a public report that highlights the current situation in SMEs regarding energy efficiency and the barriers that influence the further promotion of energy audits/energy management and the implementation of energy efficiency measures [1].

Following the survey and analysis of the collected data, it is worth mentioning that there are many similarities among the SMEs from different regions. For example, most of the SMEs have not appointed an energy manager, they have not implemented environmental/ energy standards and energy audits have never been carried out in the 50% of the SMEs that participated in the survey. The results confirm that SMEs do not put energy efficiency in high priority and that there is a need for training, to increase the skills and qualifications of SMEs personnel [1].

Another finding of the survey results analysis is that the SMEs staff is generally motivated to attend further training to improve skills and competences. This is a gap that the SMEmPower Efficiency project and the proposed E&T Program will bridge. A positive outcome from the survey is that the level of awareness of SMEs regarding environmental issues is high and this was taken into consideration when designing the SMEmPower Efficiency training course.

Another important activity of the SMEmPower Efficiency project was to carry out a comparative analysis of current implementation practices, tools and instruments related to the availability of training courses, certification/accreditation of energy managers/auditors, registration procedures and competent authorities within the different SMEmPower participating countries. Based on this analysis a major gap was highlighted between energy professionals training courses and the specific market requirements: the lack of specialized educational courses at undergraduate level. Additionally, most of the available training programs present a lack of modules e.g.: onsite visits, practical case studies, and Monitoring & Targeting (M&T) / Measurement & Verification (M&V) instrumentation knowledge [2].

Taking these into account, a novel training program was designed in SMEmPower Efficiency project, with a common curriculum in 8 countries, aiming to provide an in-depth multidisciplinary harmonised approach, in order the qualified engineers graduated from SMEmPower courses to meet the

expectations of a growing market. The proposed E&T Program will complement the European Commission's effort to promote energy efficiency actions also among small and medium enterprises (SMEs) in EU member states, and ensure the use of high quality, cost-effective energy audits and energy management systems to final customers.

Each partner was responsible for presenting the features of the E&T program to the relative accreditation body in order to be certified formally and being awarded the corresponding ECTS. [3]

The E&T program was designed as a two-stage one: the first step includes lectures and tutorials and the second one involves practical action, as the trained staff will apply their acquired knowledge to their working environment as case studies or any other case studies prepared by the trainers. The contents of the E&T program are based on the desired learning outcomes identified in previous work activities of the project and are common to all partner countries [3].

SMEmpower courses will offer 3 editions of this professional E&T program with at least 30 trainees per edition. Thus, a total of 24 courses, 3 in each project participating country, will be delivered during the project's duration; accounting for at least 720 trained professionals.

This report deals with the delivery of the first edition. The outputs will be used as input to other SMEmpower Efficiency project activities such as: improvement of SMEmpower Efficiency E&T Program and improvement of Training Handbook.

The report is structured in the following sections:

- Chapter 1: An overview of the context in which the E&T Program was designed, highlighting the importance of the project in contributing to the energy efficiency of SMEs via connecting professionals, promoting intelligent energy tools, traditional and innovative technologies, and decision support for various stakeholders.
- Chapter 2: Description of the E&T Program delivery across 8 European countries (organizing details and how the project partners conducted the program in their country).
- Chapter 3: Analysis of the first edition delivery, Feedback analysis and further improvements.
- Chapter 4: Final remarks on the report and activities carried out for the delivery of the E&T Program.

More information about the SMEmpower Efficiency project can be found at <https://smempower.com/>.

1. Introduction

1.1. Context of E&T Program design

Horizon 2020 is the EU's growth strategy that aims to ensure a smart, sustainable and inclusive economy, driven by five interrelated headline targets. These targets refer to education, employment, poverty and social exclusion, research and development as well as climate change and energy. Afterwards, specific targets were set that included achieving 20% of energy supply from renewable sources, a reduction of greenhouse gas emissions of at least 20% as compared to 1990 levels, and an increase of energy efficiency by 20% as compared to a baseline projection [4].

The transition to energy efficiency societies requires a specific and multidisciplinary education for engineers, managers and policy makers. Related to this aspect, energy professionals have become a very complex figure with updated knowledge and skills crossing many fields beyond energy, including people management, environmental science and technology, finance, personal and enterprise communication, information and communication technologies, and even teaching skills [5].

Based on SMEmPower Efficiency concept, the E&T program is focusing on the presentation of the possible energy efficiency measures, in strong relation with energy surveys and technical data to quantify the best energy saving possibilities, and, by using financial tools, to prove the cost effectiveness of them. The uniqueness of the whole training program is proved by the application of the knowledge on the pilot sites or in the company of the trainee.



Figure 1. Diagram of SMEmPower Efficiency concept

The carefully selected pilot sites through the 8 countries come to help the trainees during the E&T program to put into practice the actual knowledge gained and using the Monitoring & Targeting (M&T) and the Measurement & Verification (M&V) tools developed within the project to perform energy surveys and propose specific energy saving measures for each pilot site [6].

In close correlation with the Education & Training program of the project, the working groups will consist of course participants and each working group will work on an SME pilot. The working groups will use existing energy audits where is the case and by using the specific M&T and the M&V tools to effectively prove the potential saving and to develop an energy efficiency action plan [7].

The SMEmPower concept highlights the importance of encouraging a large and vast community of SMEs to undergo energy audits and implement energy efficiency measures. But facts need action;

therefore, the SMEmPower team selected 51 SMEs for the first edition of the E&T courses in the 8 project partner countries: Cyprus, Germany, Greece, Italy, Romania, Slovenia, Spain and United Kingdom. The aim is to reach at least 20 pilots in each country until the end of the three editions of the E&T courses.

In this context, SMEmPower Efficiency E&T Program will contribute to the energy efficiency of SMEs via connecting professionals, promoting intelligent energy tools, traditional and innovative technologies, and decision support for various stakeholders.

1.2. Description of E&T Program

The main goal of the training courses is to increase the knowledge and skills of professional experts on energy efficiency issues, while at the same time recognize and accredit the knowledge and qualifications acquired widely throughout Europe. Along with that, a specific aim is to enhance and promote the participation of existing or prospective SME staff with energy related responsibilities. The strategic target is to accelerate the energy efficiency culture in existing professional and SMEs, in order to reduce the gap of knowledge actually existing on the technical implementation of energy efficiency solutions especially in SMEs.

The main topics of the SMEmPower Efficiency E&T Program are [3]:

1. European and national policies and legislation for energy efficiency
2. Energy efficiency systems, measures & solutions – energy management opportunities
3. Basics of Energy Surveys & standards
4. Tools for Monitoring & Managing Energy
5. Financing energy efficiency measures, tools and evaluation
6. Practical on-site Action.

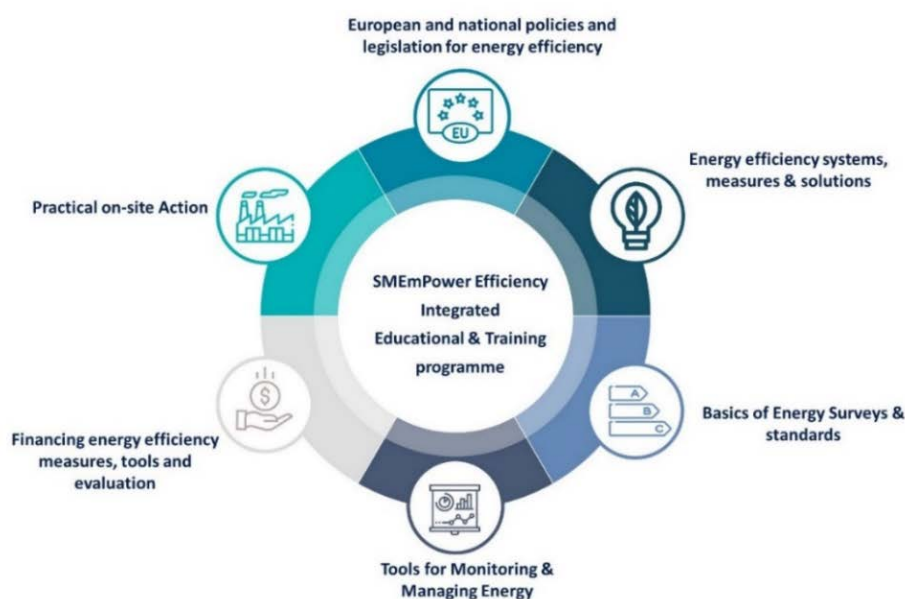


Figure 2. The main topics of the E&T program

The E&T program was designed as a **two-stage** one:

1. The first stage includes **lectures and tutorials** (either through face-to-face, distance or combined educational activities). The E&T program will **focus on financial and technical data** required to prove that specific measures are cost-effective.
2. The second stage is focused on **practical action** in specific industries or services sector installations. At this stage, the trained staff was encouraged to **apply their acquired knowledge to their working environment as case studies**.

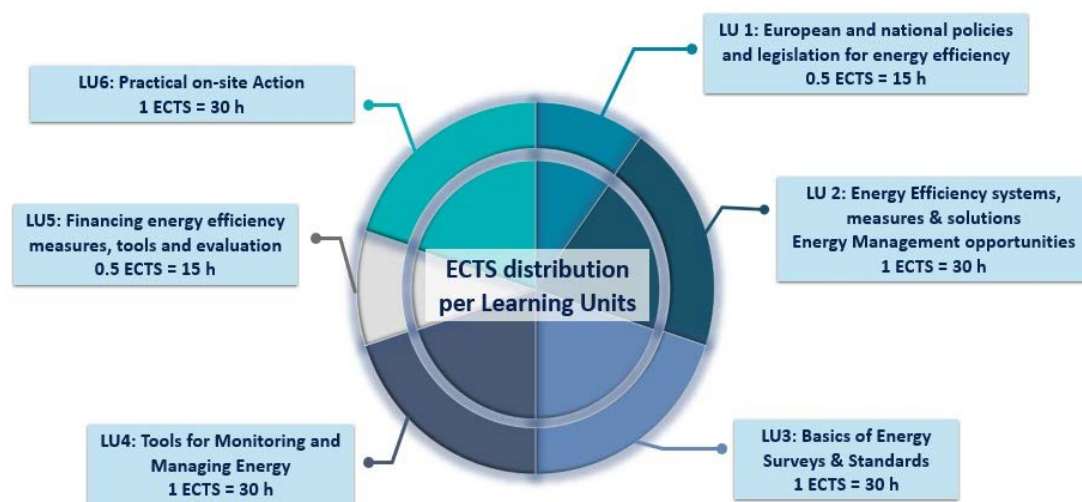


Figure 3. The allocation of ECTS credits to each learning unit

The delivery of the E&T Program, in each project partner's country, included the following tasks:

- ✓ **Preparation of material**; including selection of case studies to be used for practical activities, working examples, tutorials etc.
- ✓ **Preparation of a specialized handbook** for the needs of the program, covering all thematic units. The handbook was translated in all consortium languages (English, German, Greek, Italian, Romanian, Slovenian and Spanish) and was available for all the participants.
- ✓ Development of the **SME mPower Efficiency web platform & Energy Analytics Tools**, which is going to be used among the trained staff, and it is designed to be the "Call to action" of the courses. Besides the web platform design, Monitoring & Targeting (M&T) and Measurement & Verification (M&V) tools, a distant learning feature is planned to be involved in WP4, including webinars, case studies from pilot sites.
- ✓ **Call for participants and selection**; identification of requirements for trainees, a number of at least 30 professionals/country will be trained in each course. In most of the partner countries (Cyprus, Germany, Romania, Slovenia, Spain, UK), the candidates for the course have been selected from contacted SMEs (during project meetings, from workshop etc.) and those that specifically have signed project participation agreement. Usually, the SME will assign a person, who can attend the lectures and complete the course, since they can then use his/her knowledge to implement some proposed measures in their company. Therefore, such candidates will already have relevant degrees that are somewhat connected to energy management, resources management or other relevant degrees.

- ✓ ***Scheduling of E&T Program*** - effort will be made to schedule all courses in different countries at approximately the same period to benefit from the interaction of professionals through the SME mPower portal.
- ✓ SME mPower courses will offer ***3 editions of this professional E&T program*** with 30 trainees per edition. Thus, a total of 24 courses, 3 in each project participating country, will be delivered during the project's duration; accounting, at least, 720 trained professionals.

This report corresponds to the first training edition of E&T Program, which has been carried out from December 2020 to April 2021, in all project partners countries.

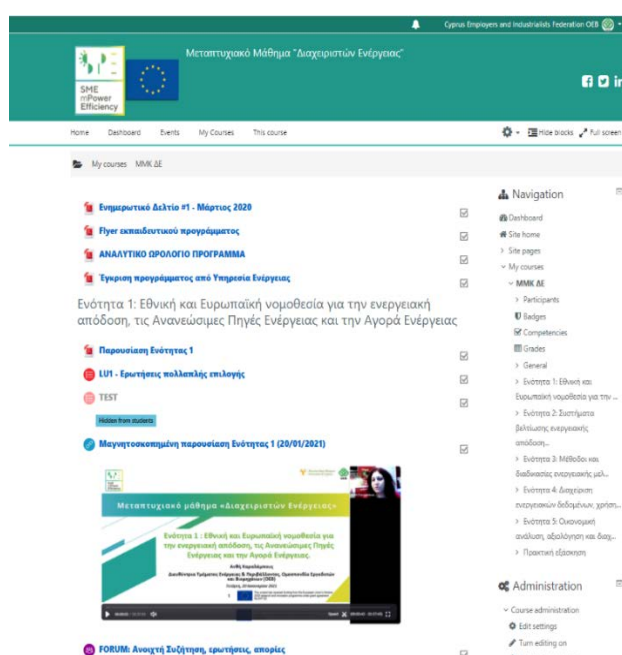
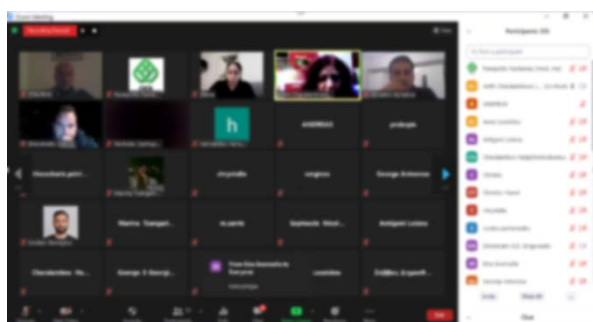
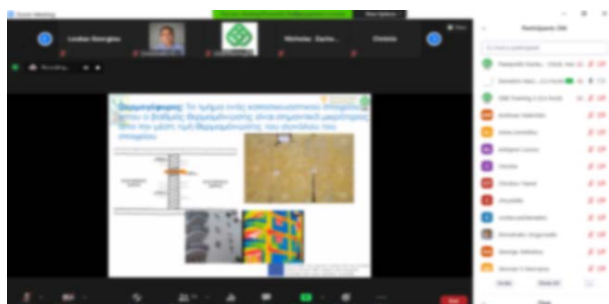
2. Description of the E&T Program across Europe



Cyprus

Administrative issues

- The training course for energy managers was organized in collaboration with the University of Cyprus, as a Postgraduate Course.
- The training course was addressed to people who handle energy issues within their business, local authorities or other bodies and organizations, without necessarily having specialization or related academic qualifications.
- Course attendance has a total credit of 5 ECTS (level 5 EQF).
- A total of 29 people registered in the training course. 24 of the participants were employees and 5 were postgraduate students.
- Online-registration through Google Forms, starting from 21st of October 2020.
- The theoretical training started on the 20th of January 2021 and ended on 27th of March 2021.
- All theoretical lessons were delivered online once a week in the afternoon (18:00 - 21:00 p.m.) to be more convenient for participants who work.
- All theoretical lessons were delivered through the ZOOM Platform.



- All participants registered on the project platform where the presentations of the Learning Units, the lecture recordings as well as other useful information about the course were uploaded and constantly updated.
- For the practical action, site visits were organized in 5 SMEs, coming from different economic sectors. One was a hotel, one was an airport, one was a wood industry, one was a sewage

treatment plant and the last was an industry that manufacture plastic tanks. Participants were divided into 5 groups of 5-6 people each. Each site visit lasted approximately 3-4 hours.

- Throughout the course, communication with the participants was maintained constantly via e-mail and phone calls.
- The training materials were translated in Greek language and were available for all the participants.



Lecturers

Mrs. Anthi CHARALAMBOUS is a Chemical Engineer, graduated of the National Technical University of Athens (NTUA), with specialization in Environmental Engineering (MSc), holds a Master in Business Administration (MBA) and P.Dip. in Renewable Energy and Energy Management. At the beginning of her career (1997) she worked abroad in environmental projects, environmental impact assessment studies, in the management and processing of liquid and solid wastes and in designing biomass to energy plants. In 2001, she started working in the field of renewable energy and energy saving in the Cyprus Institute of Energy and in 2004 she was appointed as Energy Attaché, in the Permanent Representation of Cyprus to the EU in Brussels. In 2007, she joined the European Commission's Directorate-General for Energy (DG ENER) at renewable energy technologies Unit. For the period 2009 – 2016 she was the Director of the Cyprus Energy Agency. She joined the workforce of OEB in October 2016, and today holds the position of Director of the Department of Energy & Environment. She has participated in numerous conferences, in Cyprus and abroad, as a guest speaker and has several publications to her credit.

Dr. Democratis GRIGORIADIS received his degree in Mechanical Engineering from UMIST University (Manchester, England) and his postgraduate specialization in environmental and applied Fluid Dynamics from the Von Karman Institute of Fluid Dynamics (Brussels), Brussels. Since 1996, he has worked as a researcher at the "DEMOKRITOS" research centre, initially in the field of environmental fluid dynamics and later in the field of computational and experimental nuclear thermohydraulics in the GRR-1 nuclear reactor of the Nuclear Reactor centre of the Institute of Nuclear Technology and Radiation Protection. In 2003, he obtained his PhD from the Department of Mechanical Engineering of the Aristotle University of Thessaloniki. Since 2006 he is a member of the Ucy-CompSci research team, in the Department of Mechanical Engineering and Construction of the University of Cyprus.

Mr. Dimitris CHATZIGRIGORIOU is a qualified mechanical engineer. He has worked in the private sector both as a mechanical installation contractor and as a designer. He has extensive experience in renewable energy systems, HVAC technologies, heat recovery systems and automation. He has

extensive work experience in the design and installation of heat pumps, of different types and capacities. He is a certified vocational training instructor from the HRDA.

Mr. Panayiotis KASTANIAS is a Mechanical Engineer, graduated from the University of Cyprus and holds a master's degree in Environmental and Energy Engineering from the University of Sheffield. At the beginning of his career he worked in Cyprus Energy Agency, as a mechanical engineer. He currently works as an officer in the Energy and Environment Department of the Cyprus Employers and Industrialists Federation (OEB). Throughout his academic studies and professional career, he gained valuable knowledge and expertise in the fields of energy management, energy efficiency and renewable energy technologies. He participated in co-funded European projects as a special expert as well as in studies and actions to promote renewable energy, rational use of energy, sustainable transport, information and awareness campaigns.

Evaluation methodology

- The training course combined theoretical lessons, exercises, individual learning and practical training, lasting a total of 44 hours.
- The award of the certificate requires mandatory attendance, submission of written work and the promotion of a written examination.
- The evaluation of the participants was done online through the training platform after the completion of each Learning Unit, based mostly on multiple-choice questions.
- Practical action was assessed with the delivery of a high-quality technical report and its presentation.

E&T program in numbers

- **Number of participants:** 20 males and 9 females. 24 of the participants were employees and 5 were postgraduate students.
- **Level of studies:** 13 participants have a Bachelor degree; 14 participants hold a Master Degree; 1 participant has a PhD.
- **Already employed as an energy manager:** 7 out of 29 participants are appointed as Energy Managers within their companies, and 13 participants are in charge of the energy related issues within their companies.
- **Number of lecturers:** 4 instructors.

Feedback and future improvements

- The general feedback about the training platform is that it was very useful and user friendly.
- Regarding the time schedule (day, time and duration) of the training course the feedback was that the course was ideal for those who has a daily working schedule. However, some participants mentioned the possibility of having the sessions twice per week.
- Regarding the overall duration of the training course, most of the participants mentioned that the duration of the training was just right to cover the scope of the course.

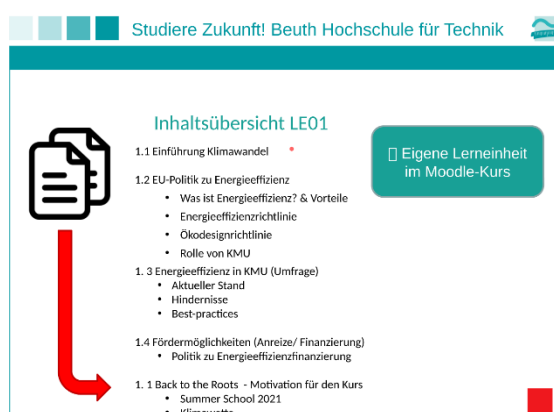
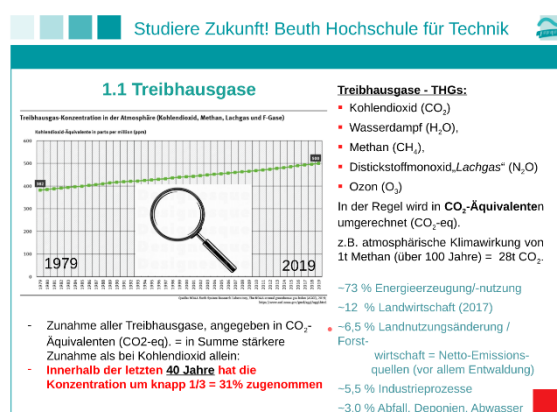
In the question of what should be improved in the training course, some participants mentioned that more explanations should be given on the calculations and more practical examples could be used in order to be clear to all who are not engineers or have no prior exposure to such topics.



Germany

Administrative issues

- **Call for participants:** on university website and via business networks to attract SMEs
- Course is organized by Beuth Hochschule [\[Link\]](#);
- **Online-registration** through the website of the university, starting from December 2020;
- First online meeting date: 15 February, on the platform Big Blue Button;
- The course runs for 9 weeks;
- The e-learning platform Moodle was used to communicate with students and share course material. Furthermore, updates on the Moodle platform were also communicated via E-mail.

Lecturers

Prof. Dr. Florian SCHINDLER is heading the Distance Learning Institute at the Beuth University of Applied Sciences Berlin. His major fields of interest are environmental management, resource and energy efficiency, process engineering as well as international project management. Prof. Schindler holds a PhD in environmental engineering; an engineering degree in biotechnology and is a business administration graduate of the Business and Administration Academy in Coblenz. Furthermore, he is an international consultant and accredited auditor according DIN ISO 14001 (TÜV Süd), Energy Manager according DIN EN ISO 50001, member of the DIN "Energy Efficiency in Buildings" Standard (EnEV) editorial board and multiplier in the field of workers safety and health (IAG-Institute for work and safety) and last but not least a trained online tutor on the Global Campus 21 (German International Cooperation Agency -GIZ) and in Moodle. Prof. Dr. Schindler has vast international experience, as an international consultant he worked for the German International Cooperation agency (GIZ) in Asia and South America for more than 10 years. As an international expert he was leading environmental and resource efficiency projects.

Dr.-Ing. Volker ALBRECHT is the owner of a management consultancy and has more than thirty years of experience as a project manager and consultant for the areas of planning and construction of district heating and energy supply plants. He has also worked for over ten years as a consultant and auditor for environmental, quality and energy management systems in energy-intensive industry.

Evaluation methodology

- 60 min online closed book exam;
- Theoretical knowledge was evaluated combining either short-answer questions, multiple choice questions or/and open-ended questions, in similar structure to exercises done in the course throughout the semester.

E&T program in numbers

- 35 registrations, 28 participants;
- Large majority of participants (about 70%) is between 30-49 years old, 25% younger than 30, rest is above 50;
- Level of education: 2/3 of participants have an education comparable to a Bachelor, the rest is split evenly between high school graduates and master/PhD graduates;
- Most participants have a background in engineering;
- While half of the participants are currently working for an SME, 85% have work experience at a SME;
- Number of lecturers: 2

Feedback and future improvements

- The course was a success as all 28 participants passed the final exam.

Due to the COVID-19 pandemic the course fully took place online. Due to the restrictions under the pandemic, unfortunately it was not possible to visit SMEs for the practical action.

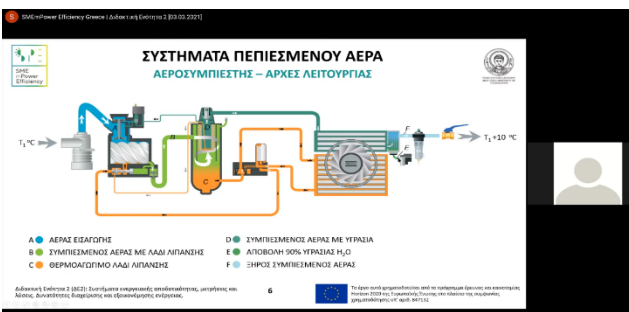
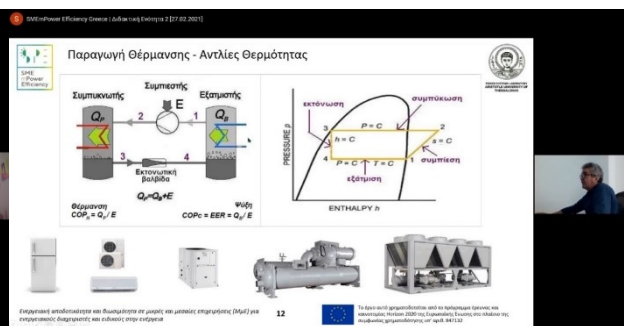
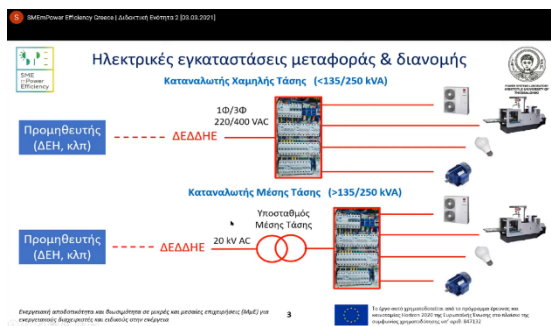
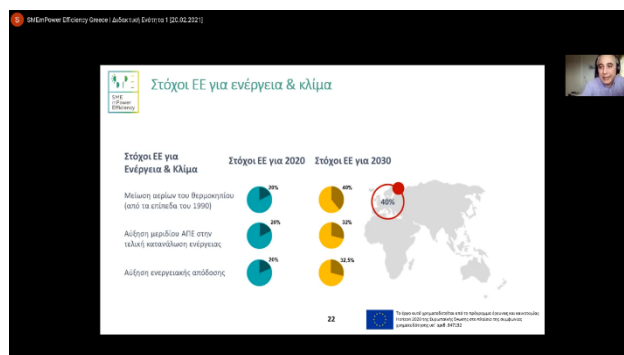
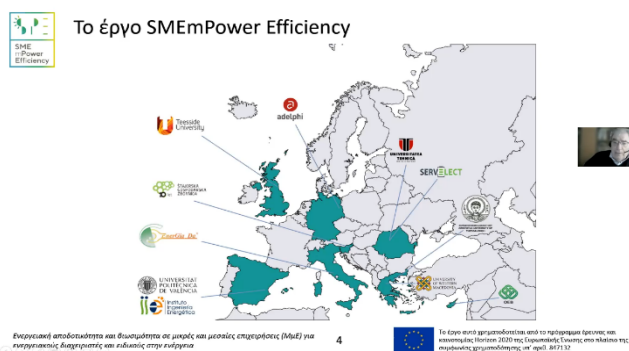
Greece


Administrative issues


- **Call for participants:** The training program was publicly announced both through the official website and the communication channels of the accreditation entity, the Center for Education and Lifelong Learning of the Aristotle University of Thessaloniki, and through local media, logs, websites, gaining high attention among employees from SMEs, energy professionals, engineers and students. Out of the sixty-three (63) applications received, forty-five (45) participants, instead of the scheduled thirty (30), were thoroughly selected according to their professional experience, the relevance of their studies and their grade scores. The main links for the public announcements are: www.diaviou.auth.gr, www.energyup.gr, www.b2green.gr, www.energyin.gr, www.energypress.gr
- This first edition, as well as the following editions of the training program, has been accredited by the Center for Education and Lifelong Learning of the Aristotle University of Thessaloniki with 5 ECTS (www.diaviou.auth.gr)
- The **online registration** was done through the platform of the Center for Education and Lifelong Learning of the Aristotle University of Thessaloniki, starting from January 2021.
- The training courses were held exclusively online, using Zoom platform. Moreover, there was an extensive use of the project training portal (<https://training.smempower.com/>) to disseminate the training material to the participants, who were asked to create accounts to access it. Among the material provided were the project training handbook, after being

translated in Greek, and any other relative material used by the instructors. The first part of the E&T Program was structured based on the five LUs, consisting the theoretical part. The lectures were launched on February 20th, 2021, conducted every Wednesday afternoon and Saturday morning, in order to be easily attended by the professionals. According to the Course Syllabus, attendance to the lectures was obligatory and justified by the participants lists at the beginning and at the end of the lecture, which were properly monitored. The attendees were allowed not to attend only one lecture. For those who missed one of the lectures, they were recorded and available also through the project training platform, for asynchronous learning, after receiving the participants' consent.

- The theoretical part of the courses was concluded on the 27th of March 2021. Throughout the whole duration of the training courses, members of the delivery team were in constant communication with the participants to provide feedback and answer any questions posed, regarding either the content of the courses, or the procedure.







- The conclusion of the theoretical part, i.e., the lectures corresponding to the five LUs, was followed by the practical action, in collaboration with the engaged SMEs, as they were described in the project deliverable D5.1 *Pilot sites selection*. For this first edition of the training courses, 5 SMEs were engaged to act as pilot sites. The trainees who successfully concluded the lectures and the evaluation procedure, as described later in this section, were divided into 9 working groups. Each one of the working groups was assigned to work with a specific SME out of the engaged ones, under the supervision of an expert, having experience in the energy audits and belonging to the delivery team. Moreover, representatives of the pilot sites participated in the procedure, to facilitate the provision of the necessary input data and the description of the production process, of the SME equipment and of the energy consumption centres. Also, the SME representatives will transfer to the SMEs the outcomes of the pilot work regarding the implementation of energy savings measures and any further outcome regarding the behavioural change by the engaged SMEs employees.

Unfortunately, due to COVID-19 pandemic, the practical action was also conducted exclusively online. The members of each one of the practical action teams communicated through separate teleconferencing, to exchange contact information and to be informed on their assignment by their supervisors. Throughout the whole duration of the practical action, the experts were in constant communication with the trainees and the companies' representatives, providing feedback and instructions.

Lecturers

Mr. Grigoris K. PAPAGIANNIS received his Diploma in Mechanical & Electrical Engineering and his PhD from the Aristotle University of Thessaloniki in 1979 and 1997 respectively. He is Professor of Power System Analysis at the School of Electrical and Computer Engineering at the Aristotle University of Thessaloniki, Greece. He has more than 35 years of experience as researcher and instructor in under- and post-graduate courses, vocational training, life-long learning programs etc. He has 174 publications in the fields of electric power systems, renewables, smart grids, rational use of energy and energy policy and a book on Electric Power Systems (in Greek). He participated as coordinator or key researcher in 48 regional and European projects. He is a Senior member of IEEE and member of the Technical Chamber of Greece, IET and CIGRE. Prof. G. Papagiannis collaborated as consultant with the Greek Ministries of Development, of Energy and Environment, of Finance as well as with the Greek DSO and TSO. He has been Head and Deputy Head of the School of Electrical and Computer Engineering (2017-2020, 2015-2017), Director of the Department of Electric Energy and of the Power Systems Laboratory.

Mr. Georgios C. CHRISTOFORIDIS was born in Thessaloniki, Greece, and he is Professor at the School of Electrical and Computer Engineering at the University of Western Macedonia. He received the Dipl. Eng. Degree from the Electrical Engineering Department of the Aristotle University of Thessaloniki in 1998, the M.Sc. degree in Power Electronics & Drives, with Distinction, from the Electrical and Electronic Engineering Department of the University of Birmingham, UK, in 1999, and in 2004 the PhD degree from the Aristotle University of Thessaloniki, (under industrial scholarship from the Public Power Corporation). He has participated in more than 20 European and national projects. His research interests include: Power systems, energy efficiency, integration of renewable energy systems, smart grids and electromagnetic compatibility. He has published 31 papers in international peer-reviewed scientific journals, 2 book chapters and 75 papers in international conference proceedings.

Mr. Nikolaos LETTAS, Dipl. Electrical and Computer Engineer from Aristotle University of Thessaloniki. From 2001 to 2005, he was in charge of the projects department at NRG-ORION SA, preparing energy saving reports for 32 large Greek industries. From 2006 to 2017, he was Technical Director of SEMAN SA, implementing more than 60 major energy saving projects in industries in Europe, the USA, and the Middle East. Since 2017, he is co-founder and General Manager of the company ENERCA - Energy Consulting & Applications PCC, with the main objective to increase energy efficiency, mainly in the industrial and tertiary sector. He is the company responsible for the design and implementation of large-scale electromechanical projects in the industrial sector, with emphasis on the medium voltage level. He is a co-author of ten (10) publications in international peer-reviewed scientific journals and conferences on distributed generation, energy management and power quality. He has participated in eleven (11) research projects of the Power Systems Laboratory of the Aristotle University of Thessaloniki, funded by European or national resources. He is a Senior member of IEEE, and member of CIGRE, ASHRAE and of the Technical Chamber of Greece, while he is a Certified Energy Auditor of level 3 of the Ministry of Environment and Energy.

Mr. Nikolaos PASIALIS, Dipl. Electrical and Computer Engineer from Aristotle University of Thessaloniki. In 2005 he worked as a maintenance manager at ATLAS Lime Industry of Northern Greece Ltd., an industrial unit producing CaCO_3 with vertical oven, where, as being responsible for the uninterrupted operation of E/M equipment, he was actively involved in automation systems and maintenance of industrial E/M equipment. From 2006 to 2017, he was the director of the energy management department of SEMAN SA, where he carried out many large-scale energy saving projects in industries in Europe, the Middle East and the USA. Since 2017, he is co-founder and Technical Director of the company ENERCA - Energy Consulting & Applications PCC. He has extensive experience in industrial installations, while he has a very good knowledge of industrial communication protocols, and he is in charge for the development of the company's Energy Management (EnMS) platform 'AVAX'. He is also actively involved in telemetering systems and in the collection and management of big data in real time. He is a member of IEEE and of the Technical Chamber of Greece, while he is a Certified Energy Auditor of level 3 of the Ministry of Environment and Energy.

Mr. Dimitris BOZIS, Mechanical Engineer, he holds a PhD from the School of Mechanical Engineering of the Polytechnic School of the Aristotle University of Thessaloniki and he is a partner

in the engineering services and consultancy company SKEMMA ENGINEERS S.A.. He has extensive experience in engineering projects for the public and private sector and in electromechanical installations in buildings. He has participated in research projects for energy savings in buildings and for the building integration of renewable energy sources. The most important of them are the Simulation of the Thermal Behavior of Buildings in the Evaluation of Solar Village Systems in Lykovrysi, Attica and the Geothermal System of the New City Hall of Pylea, under the Department of Energy of the School of Mechanical Engineering of Aristotle University of Thessaloniki. He has participated in many big engineering projects, the most important of them being the refurbishing and extension of Thessaloniki Airport, the Macedonian Museum of Contemporary Art, the Training Buildings at the American College Anatolia, the Boarding House of Perrotis School in the American Farm School, the Department of Automation Engineering of the Alexander Technological Educational Institute of Thessaloniki, the Treasury of the Bank of Greece in Thessaloniki, the New Beach of Thessaloniki, the Swimming Pool in Alana of Toumpa and the reconstruction of the hotel complex IKOS OLIVIA and SANI in Chalkidiki. He has delivered many lectures in workshops and seminars on energy saving in buildings and on the integration of renewable energy sources in them, in training seminars for energy inspectors of buildings and air conditioning installations, and in the HORIZON 2010 - MENs for Nearly-Zero Energy Buildings in Aristotle University of Thessaloniki in 2016. He is the author of a significant number of scientific and technical publications and papers in Greek and international conferences and journals.

Mr. Pantelis BISKAS, Dipl. Electrical and Computer Engineer in Aristotle University of Thessaloniki (1999), and PhD from the same School in 2003, on 'Decentralized Power Systems Management'. In 2005 he has completed his Post Doc research in Power Systems Management in the same School. From 2005 to 2009, he was a power system specialist at the Hellenic Transmission System Operator (HTSO), Market Operation Department. Since 23/07/2009, he is a faculty member of the School of Electrical and Computer Engineering with the scientific subject of 'Power Systems Management', where he teaches the courses of 'Power Systems Economics', 'Power Systems Analysis' and 'Power Systems Management'. His research interests include the analysis and management of electricity generation and transmission systems, the liberalized electricity market models, and the electricity transmission services. He has been the coordinator in over 55 research projects, and he has worked in about 30 other research projects as key researcher. He has 47 publications in international peer-reviewed scientific journals and more than 55 papers in international scientific conference proceedings. Since November 2019, he is the Chairman of the Energy Committee of the Aristotle University of Thessaloniki. He is also a member of the IEEE and of the Technical Chamber of Greece.

Mr. Dimitris TAMPAKIS, Dipl. Electrical Engineer – Aristotle University of Thessaloniki (1981), Dr. Electrical Engineer – Aristotle University of Thessaloniki (1984), with 40 years of experience in energy and building installations. Project and supervising engineer at TIF-HELEXPO, Technical Director and currently Project Manager of the refurbishment of the Thessaloniki Exhibition Center. He has been research associate, since 1985, with the Power Systems Laboratory of the Aristotle University of Thessaloniki, participating in many research projects. Medium Voltage Substations, electricity distribution facilities, lighting, renewable energy sources and storage are his main areas of expertise. He is an Energy Inspector Instructor and a Certified Energy Auditor of level 3.

Mr. Charis Demoulias received the Dipl. and PhD degrees in Electrical Engineering from the Aristotle University of Thessaloniki, Thessaloniki, Greece, in 1984 and 1991, respectively. Currently he is Professor in the School of Electrical and Computer Engineering of the Aristotle University of Thessaloniki. His research interests include power electronics, harmonics, electromotion systems and the integration of renewable energy sources in the power grid. He has 90 publications in the fields of renewable energy sources, power quality and microgrids. From 1991 to 2003 he co-founded ALTEREN SA, an engineering and technical consulting company offering engineering services in private and public energy-saving and renewable energy projects. From 1997-2003 he was also contractor for power quality projects (harmonic filters), industrial energy-saving projects and PV installations (stand-alone and grid-connected). He has participated as coordinator or partner in 10 EU-funded projects and 10 national projects. Since 2011 he has been evaluator and reviewer of EU-funded and national projects. He is a Senior member of IEEE and member of the Technical Chamber of Greece. Prof. Ch. Dimoulias is currently the Director of the Department of Electric Energy of the School of Electrical & Computer Engineering of AUTH.

Mr. Aggelos BOUHOURLAS received his Diploma in Electrical and Computer Engineering and his PhD from the Aristotle University of Thessaloniki in 2005 and 2010, respectively. Since 2019, he has been working as an Assistant Professor at the School of Electrical and Computer Engineering of the University of Western Macedonia, while from 2012 to 2018 he has worked as an adjunct Assistant Professor at the School of Electrical Engineering of the former Technological Educational Institute of Western Macedonia. From 2017 to 2019 he has worked as an academic and scientific fellow in the School of Electrical and Computer Engineering of the University of Thessaly. He is the author/co-author of 14 international peer-reviewed scientific journals and of 41 papers in international scientific conference proceedings. He has also authored four (4) chapters in scientific books. He has participated in various national and international research projects.

Mr. Ioannis PANAPAKIDIS received his Diploma in Electrical Engineering and Computer Engineering from Democritus University of Thrace, a MSc and a Ph.D. degree both from the Aristotle University of Thessaloniki. Currently he is an Assistant Professor in the School of the Electrical Engineering and Computer Engineering of the University of Thessaly, Greece. His research interests lie primarily in the fields of electrical consumers modelling, demand side management and energy policy. He has participated in research projects funded by national and European organizations. During the periods 2007-2009 and 2010-2013, he has been a member of the Permanent Committee of Energy of the Technical Chamber of Greece, Section of Central Macedonia. Also, he is a member of the Technical Chamber of Greece, the Institute of Electrical and Electronics Engineers and the Council on Large Electric Systems.

Evaluation methodology

- The course bylaws, following the requirements for the accreditation, indicated that the attendance of the course lectures is obligatory and is proven by the teleconferencing participation lists in the beginning and at the end of the lecture. Participants can be absent only from one of the Lectures. After the conclusion of the lectures corresponding to each one of the five course LUs, the participants are evaluated through assessment quizzes. These tests consisted of selected multiple-choice questions, related to the contents of the LU with no

requirements of background knowledge. Each of the quizzes was scheduled to last 40 – 50 min, and was accessible through the project training platform, for one calendar week. For the successful conclusion of the first part of the courses, the trainees are obliged to conclude at least 4 out of 5 tests, achieving a cumulative score equal to, or greater than 50%.

- Based on the participants lists and the scores achieved in the assessment quizzes, 42 out of 45 participants successfully concluded the 1st theoretical part of the training program.
- Except for the evaluation of the 1st part, the trainees had also to submit a project report for the practical action in LU6. This report included the description of the SME for the practical action, the input data for the energy consumption and the production, the proposed energy efficiency improvement measures, their technical and financial analysis and the estimations for the energy and costs savings, as well as the CO₂ reduction. Following a predefined scheduling for the conclusion of the practical action, each one of the 9 working groups presented their assignment, based on the reports used for energy analysis and energy auditing.

E&T program in numbers

- Number of participants: Male-27, Female- 18; 23 from SMEs
- Number of participants that graduates the program: Male-25, Female-17; 21 from SMEs
- Age range: 15 25-30; 10 30-35; 5 35-40; 6 40-45; 9 over 45
- Level of studies: 3 bachelor; 40 master program; 2 PhD studies
- Already employed as an energy professional: 36 out of 45 participants
- Number of lecturers: 10

Feedback and future improvements

- Through the feedback questionnaires, the trainees expressed their satisfaction regarding the structure, the organization, the course syllabus, the instructors, and the training material. They claimed that also the video recordings were very useful throughout the duration of the course, helping them to understand better the presented topics and achieve high scores in the assessment tests.
- The COVID-19 pandemic affected the implementation of this first edition of the E&T course. The most challenging issue to be overcome was the inability of the participants to visit the engaged SMEs in the framework of the practical action. All the necessary data were provided by the SMEs representatives, who were also team members for the implementation of the final study. However, the distance learning feature allowed participants and SMEs from across the whole country to participate.
- Moreover, through the implementation of the practical action, the trainees had the opportunity to do teamwork with professionals having different scientific and technical background. This synergy allowed them to enhance their new knowledge, while also to establish communication paths with other energy experts for the future.
- Some of the participants claimed that some of the subjects presented in the different Learning Units were too dense to be totally comprehensive. Thus, the lecture hours could be increased, or the presented subjects could be perhaps refined, focusing only to specific parts of the presented material.

- Moreover, concerning the practical action, even though successfully completed by all the trainees who had previously concluded the first theoretical part of the training course, its duration could be increased to enhance the participants involvement, without affecting their overall daily employment schedule.

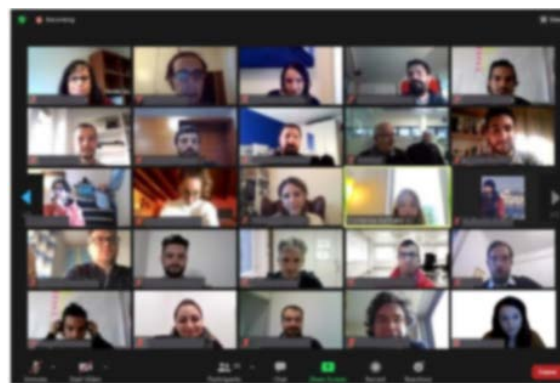
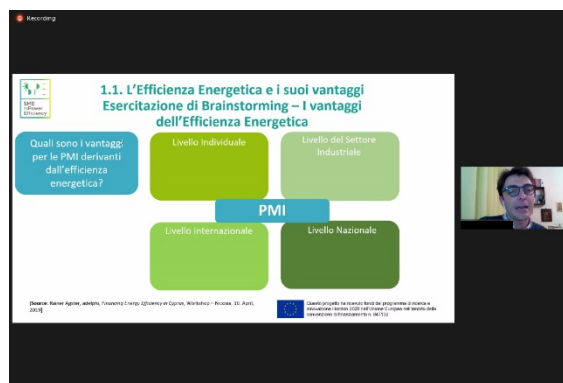
Italy

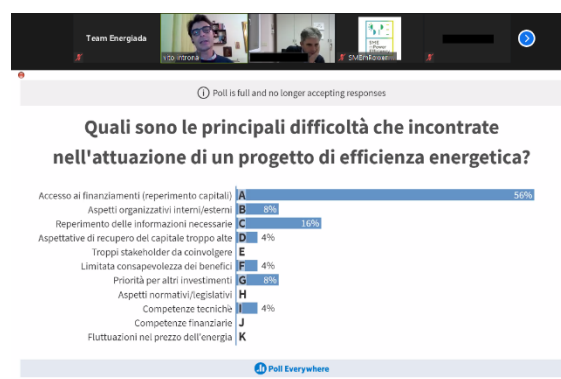
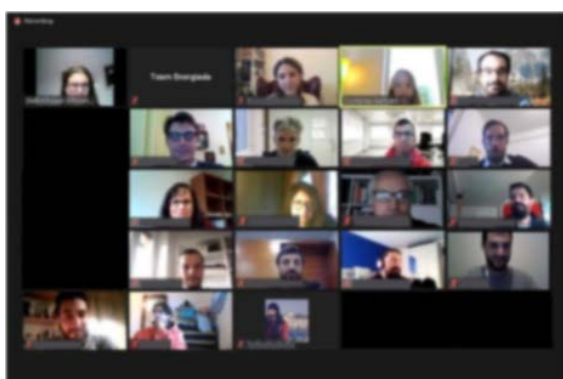
Administrative issues

- **Call for participants:** public announcements on official websites and official social media pages of the Italian partners (ENEA, University of Rome Tor Vergata), public announcements on personal social media pages of lectures and collaborators, targeted invitation by SMEs associations for their associated SME and public announcements on official social media pages of SMEs Associations (www.efficienzaenergetica.enea.it, www.linkedin.com, www.assosistema.it, www.facebook.com, twitter.com).
- The courses will be held **exclusively online**, through ZOOM platform. All lessons have been recorded and uploaded on the training platform to make able all participants to view the lectures in asynchronous way.
- **Registration** by form sent to the official Italian SEmPower Efficiency email starting from November 2020 and Online-registration through the Long-Life Learning Platform (PoliformaT) of the Universitat Politècnica De Valencia, stating from December 2020.
- The **duration** of the courses will be 30 hours (face to face teaching hours), split in 5 weeks of online lectures, from December 2020 to February 2021, with a break for the Christmas holiday.

First online meeting date: 4th December 2020; Last online meeting date: 19th February 2021

- After the online lectures, **four weeks working group sessions** were organized. A Cloud repository was provided to each group to offer participants the opportunity to share all documents needed for developing their final projects (audit report). A tutor was assigned to each working group. During the last online meeting, a public presentation of the results of the practical action was done by each group.





- Throughout the course, communication with the participants was constantly maintained by e-mail. During the working group session, the communication between the participants and the tutors was constant and intensive.
- The handbook was translated in Italian language and was available for all the participants through the training platform. The lectures integrated the training material with some practical applications much appreciated by the participants and with other information relevant for the national contest.
- The assignments and the tests followed the guidance and text provided and agreed with the Consortium.

Lecturers

Prof. Ing. Vito INTRONA - Professor at Tor Vergata University of Rome, with a PhD degree in Product and Industrial Process Engineering. It carries out scientific research in the following areas: Maintenance and efficiency of industrial plants, Statistical Quality Control of production processes, Automated handling and storage systems, Control of plant energy consumption (Energy management) and Project Management. He is the author of over 80 national and international scientific publications in journals and conference proceedings, he has been Supervisor or Co-Advisor of over 150 degree theses in Energy, Management, Mechanical and Mechatronic Engineering.

Ing. Ania LOPEZ - Master of Science in Mechanical Engineering, she graduated in Italy and Cuba. Energy Manager of Quality House with Studio V srl. Since 2011 has been a Councilor of the Italian National Council of Engineers, a member of the Board of Directors of Foundation of National Council of Engineers of Italy, Component of UNI (technical committee) in Project Manager of Italian Government and Manager of Sustainability & Environment of PMI Central Italy Chapter. Winner of National Competition of Ministerial Technical Officer by Ministry of Justice. Membership of UNI Committee of Project Management UNI/CT 040/GL 13. Since 2013 she has been a component of WFEO, The World Federation of Engineering Organizations, a non-governmental organization representing the engineering profession worldwide. She participates in technical committees, that of women WIE Women in Engineering and Energy. She coordinates the Women Engineers Committee established by her for the first time in the CNI at the national level.

Dr. Angela AUGUSTI - is researcher at the CNR-IRET. After the Biology studies at University of Naples, Italy and her PhD in Plant Physiology at University of Umeå, Sweden, she spent several years

working at the INRA in France. She studies the effects of climate change on ecosystem processes, mainly Carbon metabolism aiming at looking at the contribution of vegetation as sink for atmospheric CO₂. She focuses, among the other things, on photosynthetic assimilation and carbon compound translocation, on below-ground respiration in response to the increase of CO₂ and air temperature and to drought. She has established collaborations with University of Umeå, INRA-UREP of Clermont Ferrand, Max Planck Institute of Jena, University of Innsbruck, Norwegian Polar Institute of Tromsø. Her contribution to the project is based on her expertise in using gas exchange analysis either at leaf, soil and ecosystem level and isotope approach analysis.

Ing. Claudia TORO - Researcher at the Energy Efficiency in Economic Sectors Technical Unit of ENEA (National Agency for New Technologies, Energy and Sustainable Economic Development, Rome, Italy). Previously she has been a Post-Doc research fellow at the Department of Mechanical and Aerospace Engineering of the University of Rome "Sapienza". Her research activities include participation in collaborative projects with national and international partners. She also worked as scientific collaborator for the development of R&D activities in the energy sector. She has co-authored 13 publications on International Journals and 25 publications in International Conferences on the topics of Energy conversion and Exergy analysis.

Ing. Edoardo PIGNA - Graduated with honors in Energy Engineering from the University of Rome Tor Vergata. He has achieved and obtained the certification in Project Management (ISIPM certification). In September 2016, he worked at ENEA, specifically at the Technical Energy Efficiency Unit (UTEE), dealing with the study of the energy sector of steel mills starting from the energy audits received by ENEA following the obligation introduced by Legislative Decree 102/2014. Since May 2017, he has been working at TEP Energy Solution, the SNAM group company leader in the energy efficiency sector.

Ing. Alessandro ZANINI - Owner and General Director in NSP S.r.l. POWER · CONTINUITY · EFFICIENCY · QUALITY, manages projects, budget, R&D and customer with the collaboration of a large group of technicians and partner companies, with an actual result of approximately 6.500 technical services for year in Italy. Master Degree cum laude in Mechanical Engineer, PhD in "Design of Mechanical Systems", holds second level master degree in "Photovoltaic Engineering". He is also attended training courses in Project Management, Energy Efficiency, Energy Management and Power Plant Design. He has been designer of plant powered by renewable sources, solar, wind and biomass. As teacher, he holds training courses in Renewable Energy and Energy Management for public and private companies. He is the author of numerous scientific publications in national and international journals.

Evaluation methodology

- Theoretical knowledge was evaluated through the SMEmPower training Platform, combining either short-answer questions, multiple-choice questions, or/and open-ended questions, one evaluation per learning unit.
- Practical learning was assessed with the delivery of the high-quality practical report (the audit report) and its presentation. Each working group, one for each pilot case, presented the result

of the practical report during the last online lesson. Subsequently, all tutors evaluated the reports

E&T program in numbers

- Number of participants: 43 in which 29 Male and 14 Female. 19 from SMEs
- Number of participants that graduates the program: 22 in which 14 Male and 8 Female. 11 from SMEs
- Level of studies: 3 Higher Technical Diploma; 8 bachelor; 31 master program; 1 PhD studies
- Already employed as an energy professional: 17 out of 43 participants
- Number of lecturers: 7 plus 4 tutors

Feedback and future improvements

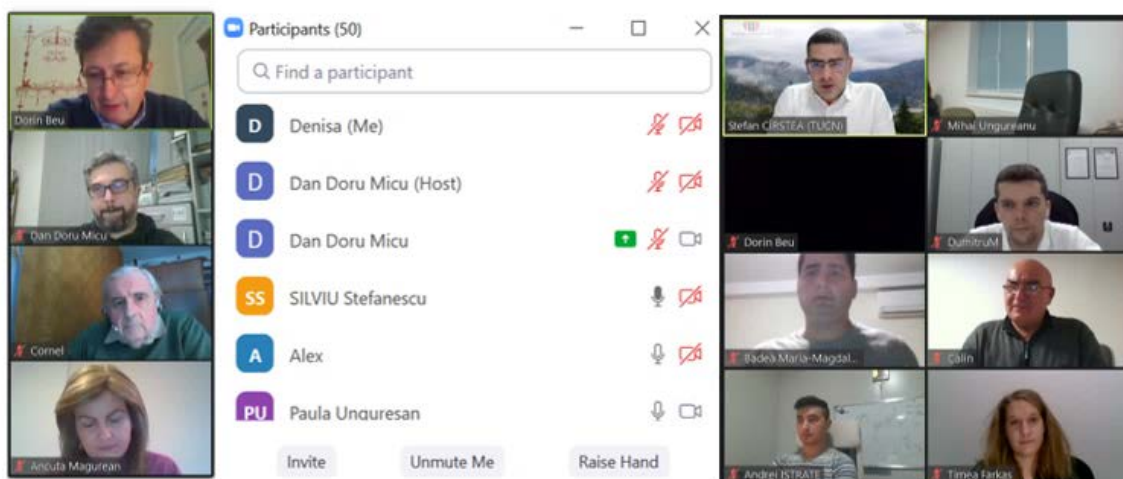
- Assignments and evaluation: to use only multiple-choice questions in the tests for faster evaluation;
- Training portal: set up the exercise to be viewed by the participant after the submission;
- Requirements: to provide clear information on the minimum requirements to pass, e.g. all class attended, 80% of assignments completed, compulsory participation to LU6;
- Contents of LUs: in LU2 to cut the theory part and add practical examples of possible interventions and technical information on green technologies; LU4 and LU5, the lecturers integrated some practical applications much appreciated by the participants;
- Feedback questionnaires: to have two different types, one for participants and one for pilots; to introduce multiple-choice Q&A with evaluation scale, e.g. number;
- LU6: detailed lists of data to request to pilots for the audit; instructions to facilitate the first phase of the audit (data gathering); more practical examples for LU6 (real energy audit)
- Introduction of a gender ratio and priorities for the registration (50%).

Romania

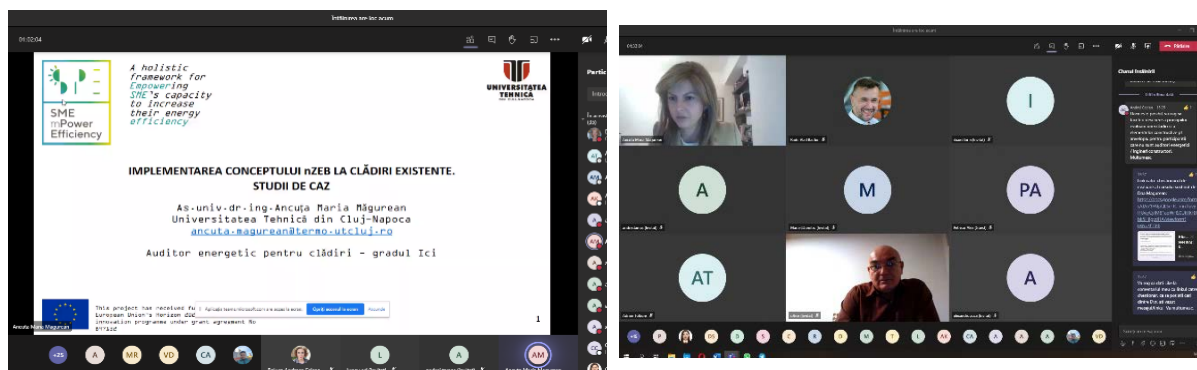
Administrative issues

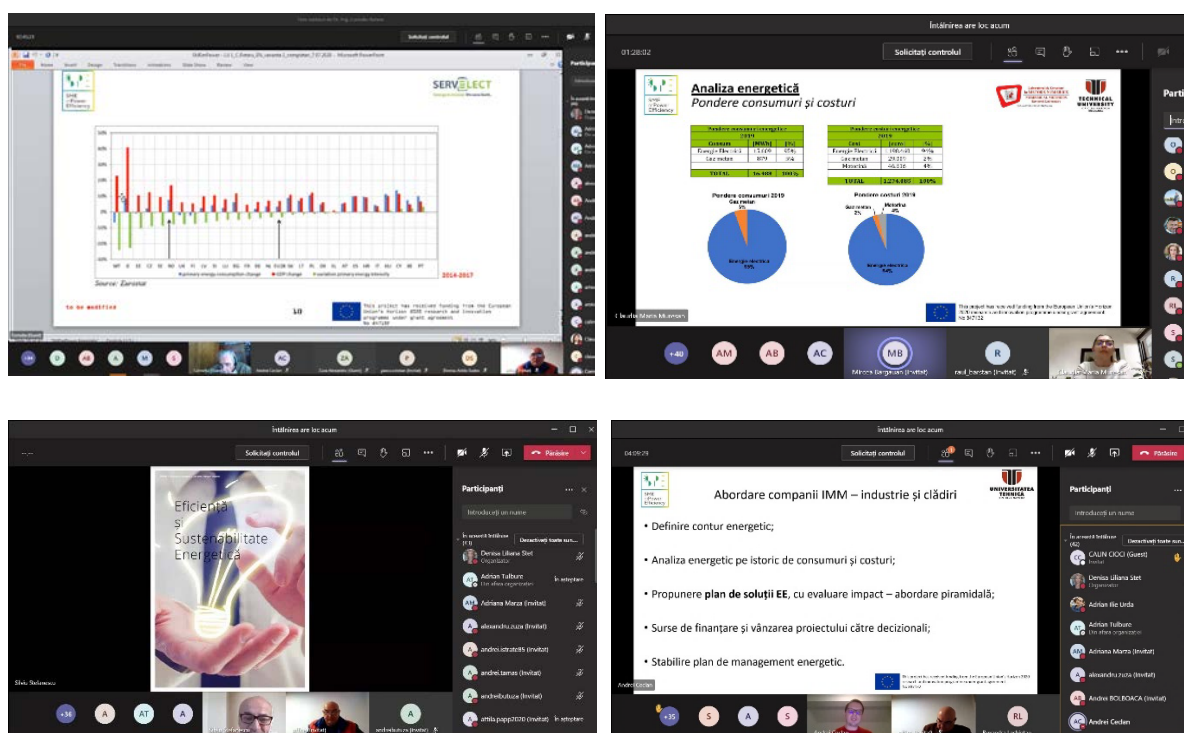
- **Call for participants:** The training program was announced firstly using targeted invitation sent by e-mail to collaborators who are part of the professional area that the course aims to develop (energy representatives from SMEs, energy auditors, teachers from other technical universities in Romania, PhD students etc.). Public announcements were made on the official website of Long Life Learning Department (DECIDFR) of Technical University of Cluj-Napoca and also on the social media pages of Numerical Methods Research Laboratory (LCMN) and DECIDFR, at the following links: [DECIDFR](#), [LCMN Social Media Page](#), [DECIDFR Social Media Page](#). By this way, the information has been shared with a large number of people in the target group of the course, ensuring a diversity of professional experience and expertise among the participants.
- The course was organized through Long Life Learning Department (DECIDFR) of Technical University of Cluj-Napoca (www.decidfr.utcluj.ro)

- **Online-registration:** All participants had to submit an online-registration using DECIDFR platform, stating from November 2020.
- The entire training program was held online, using ZOOM platform for the first meeting and Microsoft Teams platform for all the other meetings.
- **First online meeting** took place on 4 December 2020, on ZOOM. The aim of this first meeting was a brief presentation of the course content, each participant (lecturers and attendees) had a short intervention to introduce himself and administrative issues were discussed (meetings schedule, graduation conditions, evaluation methodology etc.).



- **The theoretical part of the course** started on 11 December 2020 and for four weeks the lectures took place on Friday (from 16⁰⁰ to 20⁰⁰) and Saturday (from 9⁰⁰ to 18⁰⁰, with 1 hour lunch break), on Microsoft Teams platform. Due to the two weeks Christmas holiday, the theoretical part was concluded on 16 January 2021.
- **The practical action** followed the conclusion of the theoretical part of the program, in collaboration with the engaged SMEs. The participants were split in 9 working groups and each group assigned to one of the SMEs engaged to act as pilot site. Due to the pandemic situation, on site visits to the pilot sites were not possible, even so the representatives of the SMEs provided all the necessary data for the final projects carries out as a teamwork by the attendees.





- After the **four weeks of online lectures**, a series of discussion sessions were organized to offer participants the opportunity to consult with lecturers on the development of their final projects.
- **Final project presentation:** the attendees presented their teamwork on 5 February 2021 in an online meeting, using Microsoft Teams platform.
- Throughout the course, **communication with the participants** was constantly maintained both by e-mail and Microsoft Teams. Both organizers and lecturers were available to provide feedback and answers to any question, regarding either the content of the courses or any other administrative issues.
- The handbook was translated in Romanian language and was available for all the participants.

Lecturers

Mr. Dan D. MICU is Full Professor at Technical University of Cluj-Napoca and director of the Numerical Methods Research Laboratory. He received the MS degree and the PhD degree in Electrical Engineering from the Technical University of Cluj-Napoca, Romania, in 1999 and 2004, respectively. He lectured at more than 40 Universities all over the world. In the period of Sept. 2017 - Feb. 2018 he was a Fulbright Senior Fellow at Electrical and Computer Engineering, University of Florida, US. He worked as a Part-time Professor at Beijing Jiaotong University, China: Feb.-June 2019, Feb.-June 2020. He was project manager at 10 research grants obtained by national and international competitions (6 Horizon2020 Projects). Also, he was leading more than 20 research projects for industry. He has authored and co-authored more than 250 scientific papers published in peer-reviewed journals and presented at international conferences, is member of 6 International Steering Committees and reviewer at 12 International scientific journals. Research interests are in the field of: numerical methods; energy analytics numerical tools; electromagnetic field analysis, synthesis and optimization; energy efficiency in buildings & industry.

Mr. Corneliu ROTARU is an energy efficiency consultant having more than 35 years' experience in energy saving and energy efficiency. He graduated from the University Politehnica from Bucharest, Romania, with bachelor degree in Energy and a PhD thesis in energy saving in industry. His activity had three main directions: 11 years in a research institute for metallurgy in a specific fuel and energy saving laboratory, 25 years in governmental bodies, acting as general director for National Energy Conservation Agency and director in charge with Energy Efficiency Projects and Authorization Division in National Energy Regulatory Authority and Associate Professor in UNESCO Chair at University POLITEHNICA. His experience includes energy audits in various industrial sectors, performance testing of new equipment, preparation of a national strategy for energy conservation and law for rational use of energy, capacity building and training for energy efficiency territorial offices and international cooperation including EnR member organizations, UN-ECE, EU programs for energy efficiency, World Bank, EBRD and EIB support programs. He currently works as independent consultant and advisor for Society of Authorized Energy Managers and Auditors from industry and municipalities.

Mr. Dorin BEU is associate professor at Technical University of Cluj-Napoca, in charge of the Lighting Engineering Laboratory [\[Link\]](#). Former president of Romanian Green Building Council RoGBC [\[Link\]](#) between 2016-2019, former president of Romanian National Lighting Committee [\[Link\]](#) between 2012-2016, member of Romanian European Energy Award (EEA city assessment which covers, building, energy, mobility and communication) project, implemented since 2016 by RoGBC [\[Link\]](#) and of H2020 CoME EAsy project for synchronizing EEA and Covenant of Mayor [\[Link\]](#), continue from 2020 by Exc!te project [\[Link\]](#). Member of the RoGBC team that established the assessment criteria for the GREEN HOMES certification system. Part of the team that discussed the GREEN HOMES financing schemes with Raiffeisen Bank, Alpha Bank and Banca Transilvania. Between 2012-2016-member COST action ES 1204 – LoNNE Loss of Night Network (Manager of National Committee). From 2017 till 2021, member of COST RESTORE CA 16114 [\[Link\]](#) in charge of Training School. Chief Editor of *International Journal of Sustainable Lighting* [\[Link\]](#) and Reviewer for Building and Environment Journal [\[Link\]](#). Introduced a new profession in Romania: Lighting Specialist in 2013.

Ms. Paula V. UNGURESAN is an Associate Professor at the department of Mechanical Engineering in the Thermal Engineering group. Her work focuses on complex energy systems analysis, feasibility analysis of different cogeneration systems and modelling of renewable energy systems. She was the main coordinator of one national research grant, about cogeneration with internal combustion engine and one international research project with the industry environment, where she conducted heat and mass transfer studies for efficient data centres cooling. She has been involved in the development of European projects SEEDS within TUCN research group and member in 5 national research grants in the fields of biodiesel cogeneration, combustion, indoor environmental quality. Also, she is an authorized Energy Auditor, Class I – Thermal energy - ANRE (2014-present); she performed several energy audits on large power plants and industrial facilities. She is a trainer for the Energy managers in industry post-graduate course organised by Technical University of Cluj-Napoca.

Mr. Andrei CECLAN is actively involved in energy management projects in Romania and several other EU countries, as a Certified Energy Manager (AEE), acting as president of the Romanian Society

of Energy Auditors and Energy Managers and as an active member of Association of Energy Engineers. He has 15 years of experience in energy efficiency and energy management in different public infrastructure and deep renovation of buildings. Currently he is engaged in the team he belongs in seven ongoing Horizon 2020 European projects dealing with energy management and innovative energy efficiency solutions: www.re-cognition-project.eu, www.smempower.eu, www.eland-h2020.eu, www.edream-h2020.eu

Ms. Ancuța M. MĂGUREAN is Assistant Professor at Technical University of Cluj-Napoca, Romania, with a PhD degree in Civil Engineering and Building Services. She is Vice President of the Association of Energy Auditors for Buildings in Romania. Her scientific research is focused on the energy efficiency of buildings, including advanced hygrothermal simulations, based on numerical methods and Artificial Intelligence techniques, introduced and applied in the civil engineering field. She was part of international teams in 3 European funded research programs (IEE, HORIZON 2020), which involved pilot projects for NZeB implementation to non-residential buildings and postgraduate university courses to increase the competences of professionals (architects and engineers) in energy efficiency. Her professional work was focused on the development of energy audits, with the proposal of technical solutions (for building envelope, HVAC, DHW, RES) which leads to the increase of the building's energy performance, including NZeB implementation, development of energy performance certificates for a large range of existent buildings and, as well, technical support provided for public authorities.

Mr. Ștefan D. CÎRSTEĂ is Associate Professor at Technical University of Cluj-Napoca with a PhD degree in Economic Sciences. His research is focused on the field of socio-economic impact of renewable energy, implementation awareness and acceptance of renewable energy related technologies, energy culture, energy consumer behaviour and energy efficiency. Since 2018, he is member of Numerical Methods Research Laboratory and of Romanian Academic Society of Management. Starting with 2018, he is founder and mentor in the Student entrepreneurial society. In the past, he was part of various HORIZON 2020 project (www.espesa.utcluj.ro, www.re-cognition-project.eu, www.smempower.eu) or national projects (www.urbivel.utcluj.ro, MicroInv). Currently, he is involved as member of the implementation team GEAR@SME H2020 research project (www.gearatsme.eu), EU+ project (www.univ-tech.eu) and other national projects.

Mr. Bogdan BĂRGĂUAN is an energy manager and energy auditor for industry at Servelect energy service company from Cluj-Napoca. In his 10 years of activity, he has been involved in more than 100 energy audits for industry and he managed an average of 20 energy management contracts per year. Within Servelect, he is responsible for Energy Audit department, as Manager, having in coordination a team of 10 engineers involved in consulting projects in the energy field. Also, he is involved in research and innovation Horizon 2020 projects (Dr. BoB, SMEPower Efficiency, RE-COGNITION). From the professional point of view, he is an electrical engineer, graduate of the Faculty of Electrical Engineering within the Technical University of Cluj-Napoca, graduate of the master's program Modern Techniques of Computer-Aided Design in Electrical Engineering within the same institution, and in 2021 he defended his doctoral thesis with the topic "Scientific and experimental research on using Demand Response in groups of buildings with aggregate energy consumption". He holds professional training courses for people who want to obtain the certificate

of energy manager in industry, at the North University Center in Baia Mare. In 2020 he was responsible for the first energy efficiency project in buildings where a number of 7 office buildings in Bucharest, with a total area of 70,000 sqm, were evaluated, which were brought to the nZeB stage through quantified energy efficiency measures.

Evaluation methodology

- Theoretical knowledge was evaluated combining either short-answer questions, multiple choice questions or/and open-ended questions, one evaluation per learning unit.
- Practical learning was assessed with the delivery of the high-quality practical report and its presentation. Both the report and the presentations were made following the imposed template in order to provide all the relevant information about the analyzed pilot site: brief presentation of the pilot project, technological process, energy profile, thermo-energetical installations, building characteristics, lighting system, energy audit and energy management status, energy efficiency proposed measures, economic efficiency of the proposed measures analysis, possible financing sources and energy management plan.
- Another important graduation condition was the attendance of the participants to at least 10 lectures. This aspect was justified by the attendance lists generated from Microsoft Teams, which were properly monitored.

E&T program in numbers

- Number of participants: 53 participants (39 Male and 14 Female).
- Number of participants that graduates the program: 41 (31 Male and 10 Female) out of 53 participants;
- Level of studies: 10 bachelor, 15 master program, 16 PhD studies;
- Already employed as an energy professional: 20 out of 41 graduated participants;
- Number of lecturers: 9

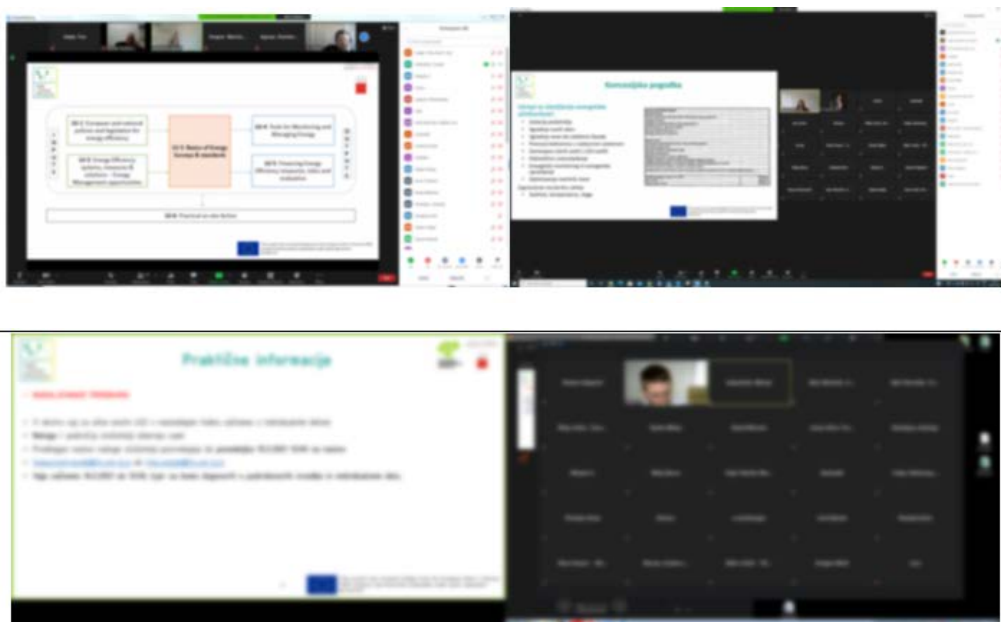
Feedback and future improvements

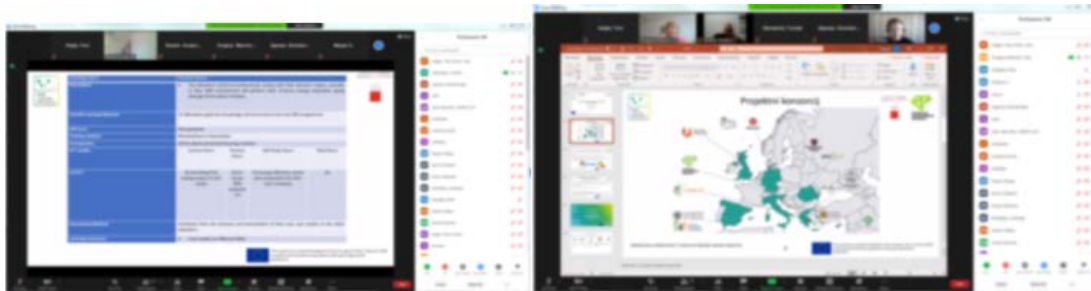
- The general feedback about the E&T Program content was very good.
- The majority of the participants mentioned that the duration of the training was just right to cover the scope of the course.
- Good appreciation of the Training Handbook content.
- In the question of what should be improved in the training course, some participants mentioned that more explanation should be given on the calculations and more practical examples could be used in order to be clear to all who are not engineers or have no prior exposure to such topics.
- Some of the participants proposed to put more emphasis on “more background information on climate change, information on international politics on climate targets” and “more details on the economic feasibility of energy efficiency measures in the building sector”.
- Adapting the second edition of the course will align the general topic to one of the most important part of the European Recovery and Resilience Plan “raising the awareness among professionals and citizens through a better energy culture and energy behaviour”.

Slovenia

Administrative issues

- Invitation and delivery of the courses, apart from the program accreditation was delivered in September 2020 instead of June 2020, aspect that did not impact the delivery of the program.
- Preparatory actions for program implementation and alignment on details, including time plan and involvement of SMEs were settled bi-laterally between the Chamber of Commerce and Industry of Stajerska and University of Ljubljana, Faculty of mechanical engineering on 22.12.2020.
- The call for participants was announced via The Chamber of Commerce and Industry of Stajerska as well as through University of Ljubljana, Faculty of mechanical engineering which was the contractor for the program delivery.
- Announcements were done on homepage of:
 1. University of Ljubljana, Faculty of Mechanical Engineering [\[Link\]](#)
 2. Chamber of Commerce and Industry of Stajerska [\[Link\]](#)
- The registrations were made via application form, sent to either the University or to the Chamber of Commerce and Industry.
- The lectures started on 02.02.2021 and finished on 04.01.2021.
- The lectures ran online on ZOOM platform, where all participants were present simultaneously and their cooperation was encouraged through active involvement to help steer the complexity, pace and emphasizes of the content. After the finish of lectures of LU2, the participants were asked to provide their desired detailed orientation and preferred topic for the LU2 - LU5 in order to build on the expertise and extend it to LU6 on the selected challenge within their companies. By this, the participants had the opportunity to strengthen the knowledge on the recognized challenges within their companies with high efficiency and enable them to comprehensively elaborate and construct a fully relevant feasibility study, performed under LU6.





Lecturers

Mr. Tomaž KATRAŠNIK is a full professor and head of the Laboratory for Internal Combustion Engines and Electromobility at the University of Ljubljana. He devotes his research activities to various Energy Engineering fields including utilisation of alternative fuels in transport and stationary applications, conventional, hybrid, electric and fuel cell powertrains, heat and mass transfer, fluid mechanics as well as numerical simulations of powertrains. He is currently no. 1 researcher in the Field of Energy Engineering ARRS (Slovenian Research Agency) for the period 2014-2019. He was the leader of projects in the field of, alternative and renewable fuels for transport applications, Biofuel for cogeneration of el. energy and heat and on Prediction of transferred electricity over Slovenian electrical grid until 2054. He is a member of EARPA, EGVI, SAE, Combustion Institute, leading person in Slovenian Strategic Development and Innovation Partnerships on Mobility and Circular Economy.

Mr. Mihael SEKAVČNIK is a full professor head of both the Department of Energy Engineering and the Laboratory for Heat and Power. His research activities concern broad spectrum of energy conversion technologies and research methods such as a) thermal power plants (fossil and nuclear), b) hydrogen technologies, c) industrial furnaces, d) efficiency measurements, e) analysis, numerical modelling & optimization of thermoeconomic performance of energy systems, f) holistic life-cycle-assessment (LCA) of technologies and products and g) energy management and rational use of energy in the industry. He coordinated various national research projects and participated as a partner in EU research projects (FP7, H2020, LIFE). He is a member of a) Council of Energy at Slovenian Academy of Science and Art, b) Scientific Advisory Board at VGB as well as c) VDI.

Mr. Tine SELJAK is an assistant professor in Laboratory for Internal Combustion Engines and Electromobility at the University of Ljubljana. His research activities envelope a wide spectra of Energy studies with particular focus on Alternative fuels and their use in conventional and novel power generation and transportation technologies. Besides fundamental and applied research on combustion of alternative fuels, his expertise extends to energy policy related topics, particularly in the area of renewable energy and uptake of transportation fuels. He is involved and has lead several projects on innovative utilization of renewable fuels, optimization of transportation fuel-mix and optimization of renewable fuel production processes. On strategic level he is a member of S3P Bioenergy partnership, co-leader of pillar Sustainable Energy within SRIP - network for transition into circular economy and member of Combustion Institute.

Mr. Uroš STRITIH studied Mechanical Engineering at the University of Ljubljana – Faculty of Mechanical Engineering and defended Ph.D. in 2000. He is Associate professor for the field of Thermal and Environmental Engineering and gives lectures of Building engineering, Heating, Cooling and Air-conditioning. He is a head of Laboratory for Heating, Sanitary, Solar Technology & Air-

conditioning and has been person in charge of many national and EU projects on the field of thermal energy storage. Dr. Stritih is Slovenian delegate in International Energy Agency - Energy Conservation though Energy Storage Program and a president of Slovenian society of Heating, Refrigerating and Air-conditioning engineers which is member Federation of European Association (REHVA) and American Association (ASHRAE).

Mr. Sašo MEDVED is a full professor at the University of Ljubljana, Faculty of Mechanical Engineering. He also lectures at the Faculty of Architecture (Building Physics and Utility Technologies) and at the Faculty of Health Sciences (Energy and the Environment). Professor Medved is a former and leader of Laboratory for sustainable building technologies. He is the holder of the several subjects in the Doctoral studies in field of energy efficient buildings and environmental impact assessment. He is author of several educational books, scientific monographies, multimedia packages and computer software codes and several hundreds expertise in field of renewable energy, utilization of solar energy and heat, sustainability and mass transfer in buildings. His research areas include renewable energy sources, environmental engineering, heat and mass transfer in buildings, heat and mass transfer in urban environments, and mitigating climate change.

Mr. Andrej KITANOVSKI is a vice-dean of the Faculty of Mechanical Engineering of the University of Ljubljana and head of the Laboratory for refrigeration and district energy. His expert area covers refrigeration and heat pumping, solar engineering, and district energy, geothermal energy, heat pumping and district heating and cooling where he was involved in several EU or national projects. He is a member of relevant international associations (IIR, ASHRAE, EHPA, ASME), a founding member of the Slovenian District energy Association (SDDE) and Slovenian Energy association (SZE). In January 2020 he is taking the role of the president of the Slovenian Academic Society for Engineering and Natural Sciences (SATENA). He was member of the EU High Level Group of the Competitiveness and Innovation, and of the Working Group for the Slovenian National Research Program.

Evaluation methodology

- The evaluation of theoretical and practical knowledge was performed through delivery of comprehensive feasibility analysis for a given challenge within the SME. Each participant positioned their own challenge into high-level perspective, thus implementing policy knowledge from LU1, selected relevant technologies required for implementations by capitalizing on the knowledge gained through LU2, where specific technologies were discussed. The content of LU3 and LU4 was implemented through evaluation of impact of proposed solutions in terms of energy auditing and standards, while the knowledge obtained through LU5 was proven through evaluation of possible financing options. Ultimately, the Practical action report, that consisted of all upper elements served as an evaluation tool withing LU6 as well.

E&T program in numbers

- Overall, 38 applications were received with 33 being from SMEs and 5 others. Out of these, 6 were female and 32 male students.
- 24 participants graduated the program, 3 Females and 21 males, 23 overalls being from SMEs.
- Most of the participants held a bachelor degree.

- The majority of participants were employed as energy professionals or employees, responsible for energy management and energy efficiency improvement projects. A sizable portion of participants was working in SMEs which offer their services to external partners for improvement of energy efficiency.
- 6 lecturers participated in each LU, where everyone covered their own area of expertise.

Overall, the program in its first edition had 38 applicants, from which 25 were actively participating in the program.

Spain

Administrative issues

- **Call for participants:** Universitat Politècnica de València (UPV) launched a public call for the Spanish first edition of the SMEmPower course in November 2020. The call was published for the targeted audience on this webpage: [\[Link\]](#)
- The course was organized through the Long Life Learning Center (CFP) within the Universitat Politècnica de València [\[Link\]](#);
- **Online-registration** was carried out through the Life-Long Learning Center (Centro de Formación - CFP) platform. Registration was opened started in November 2020;
- During the course, learning units were explained during lecturer sessions together with the final practical case studies.
- The course was taught in Spanish. Handbook and all the course documentation were translated into Spanish.

Lecturers

Mr. Carlos ÁLVAREZ-BEL. He received his MSc and PhD in Electrical Engineering in 1976 and 1979 from the Universidad Politécnica de Valencia, where he is Professor since 1989. His professional activity has been performed in the electric energy systems field in the framework of utilities, research centres and Universities. He has been involved in many projects and consulting work with utilities both in Spain and abroad, in the fields of state estimation, load modelling, standard markets, micro-grids, etc. He was consultant in Electricity Supply Commission (ESKOM, South Africa, 1981) and has developed research programs and projects with utilities in and out of Spain. He was visiting professor and researcher (1984/85) at the Energy Systems Research Center of the University of Texas at Arlington (Texas, USA), where he participated in projects for the utility Dallas Power and Light. He is currently involved in a project with Progress Energy Florida in the area of Responsive Demand Participation in deregulated electricity markets.

Ms. Elisa PEÑALVO-LÓPEZ. Ph.D. in Industrial Engineering (Polytechnic University of Valencia, Spain) has 17 years of experience in Research Project Management. Along these years, she has closely collaborated with Universities, Research Centers and Industry in numerous R&D projects, national and internationally. Collaborations include: Brunel University in London, Iberdrola, RWE Electricity, Gaz De France, RWE, Tractebel, Siemens, and Unión Fenosa. As a researcher, her main areas of research are: Decarbonization of Cities, Energy Communities, Smart Energy Contracts, Energy Markets, Energy Efficiency in Buildings, Integration of Renewable Energies, Consumers

Demand Response and Energy Planning. Furthermore, she has also carried out several research fellowships at international research centres, such as University Tor Vergata in Rome, Lawrence Berkeley National Laboratory in San Francisco, or Université Libre De Bruxelles (ULB).

Evaluation methodology

- Theoretical knowledge was evaluated combining either short-answer questions, multiple choice questions or/and open-ended questions, one evaluation per learning unit.
- Practical learning was assessed with the delivery of the high-quality practical report and its presentation.

E&T program in numbers

- Number of participants: Male -21, Female-9
- Number of participants that graduates the program: 7 participants (Male -4, Female-3)
- Number of lecturers: 2

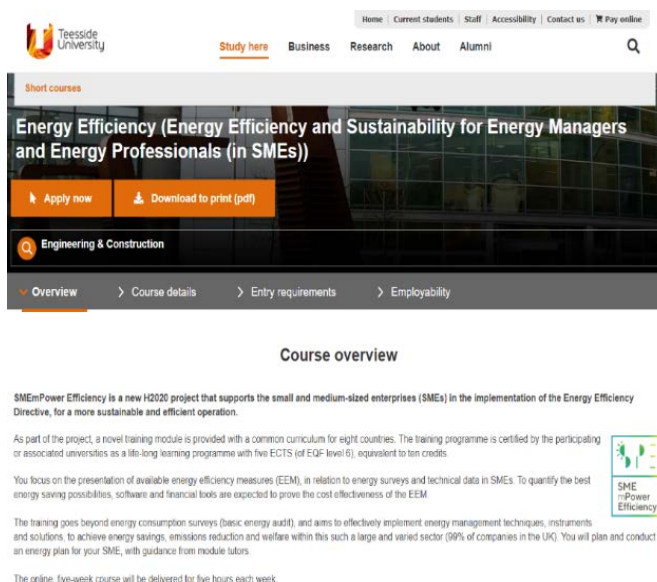
Feedback and future improvements

General comments of the course were very positive. Mainly, it was highlighted and value the documentation provided and the lecturing. However, the context of the pandemic limited the graduation of all the participants. Nevertheless, all participants received the theoretical and practical training.

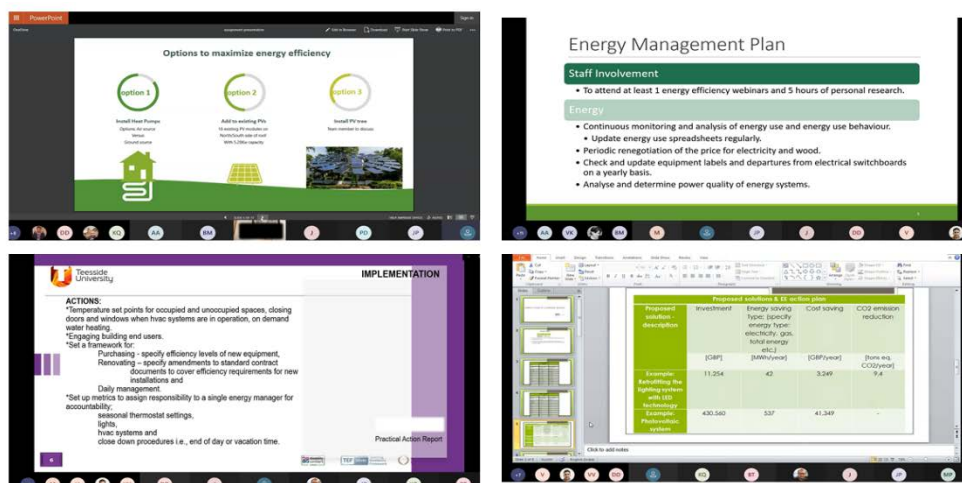


Administrative issues

- **Call for participants:** Recruitment for the course consisted of general calls for participants using Teesside University's website and social media (LinkedIn). In addition, targeted recruitment actions for SMEs were developed in conjunction with MakeUK – an organization for businesses in the manufacturing sector, Durham County Council, and the Institution of Civil Engineers (ICE).
- The course was **organized through** Teesside University's Virtual Learning Environment (VLE), where students were provided with a university account to access a series of IT resources and tools to successfully follow and complete the course assignments. This included access to a range of IT software, as well as access to the university library and its online resources.
- **Online registration** opened in Feb. 2020. The first edition of the CPD ran from 11th March to 22nd April. The course ran for a total of five 5-hour long sessions, once a week (with 2 weeks break for Easter, determined by Teesside University's academic calendar), using the Blackboard and Microsoft Teams online platforms.



- The **practical action** was presented during the third online session of the course, and groups were formed consisting of a mixture of SME participants and post-graduate (MSc and PhD) students of different backgrounds (including MSc and PhD students in civil engineering, mechanical engineering, and project management). The course finished on the 22nd April with the presentations of the results of the practical action assignment by the groups.
- Throughout the course, **communication** with the participants was maintained both by email and Microsoft Teams.



Lecturers

Dr Sergio Rodriguez-Trejo is a Senior Lecturer in Construction Management and Researcher in Engineering/BIM technologies and processes. He is in charge of the BSc (Hons) in Construction Management. His study areas include energy and comfort conditions in the built environment, BIM, Sustainable Facility Management and building energy retrofitting strategies. During his previous post at the Technical University of Madrid, he worked as a coordinator for national and European proposals and bids for the TISE research group, involved in research projects focused on housing stock energy retrofitting, SIREIN (2011/2014), INVISO project and Solar Decathlon Europe (2008/2010) as Competition Strategies Manager. He has also been involved in the development of European projects 10ACTION (for Intelligent Energy Europe) and SEEDS (for FP7), within CEMOSA engineering group. Additionally, he worked as an independent consultant and architect within the Madrid area, mainly for residential buildings, independent reviewer for high impact factor energy journals and as an expert for the Spanish scientific construction institute (Torroja Institute of Construction sciences. CSIC).

Dr Huda Dawood is a lecturer in Engineering in the school of Computing, Engineering and Digital Technologies (SCEDT). She has a BEng (hons) in Chemical Engineering and a PhD in Measurement and Control. Dr Dawood has a wide research experience including Energy Optimisation solutions and environmental and energy economics in Smart Grids, sustainable energy efficient building through whole life cycle and in particular, building information modelling (BIM) and digital construction optimization and data-driven predictive control for building energy management.

Dr. Joao Patacas is a Research Associate at Teesside University where he is working on the SMEmPower Efficiency H2020 project. He has previously worked on DR-BoB & eDREAM H2020

energy research projects, as well as on the TCN+ project entitled 'Putting people at the heart of future social housing design and manufacture'. His PhD focused on the use of BIM for the management of building asset data by building owners and facility managers. He has an MSc degree in Civil Engineering (Construction) and BSc degree in Civil Engineering, both from the New University of Lisbon (Universidade Nova de Lisboa). His experience and research interests include the use of BIM, GIS and digital twin technologies in the AEC/FM industry; Linked Data applications for buildings and industrial facilities; reality capture methods and VR/AR applications for buildings and facilities; energy efficiency in buildings.

Mr. Bjarnhedinn Gudlaugsson is an Early-Stage Researcher / PhD Student (PhD title: „Development of a Decision support tool based on Sustainability Assessment and System Dynamic Modelling for Assessing Energy transition and New Energy Technology Integration into an Urban Energy System. “) at the School of Computing, Engineering and Digital Technologies (SCEDT) at Teesside University. He is utilizing qualitative and quantitative methods to design dynamic sustainability assessment model to investigate the impact and sustainability of transitioning towards decarbonization energy system and integration of the new energy technology into the energy system. He is also currently working on H2020 inteGRIDy project conducting cost-benefit/cost-efficiency analysis and environmental impact assessment on various pilot sites across eight EU countries, including the UK.

Evaluation methodology

- Theoretical knowledge was evaluated based on the engagement of the students during the online sessions – in discussions and short exercises based on the Training handbook content.
- Practical knowledge was evaluated based on the delivery of the practical action report and its presentation. In this activity the students were split into 6 groups - one group per participating SME (4 in total), and 2 groups formed solely by post-graduate students. We provided an additional theoretical case study, using data from Teesside University's Clarendon building for the 2 groups composed solely of students.

E&T program in numbers

- Number of participants: 27, 6 from SMEs ; Male – 15, Female-12
- Number of participants that will graduate from the program: 15 in total; Male 8/ Female 7 / 4 from SMEs (2 M, 2 F)
- Level of studies: 27 BSc graduates; 15 MSc students; 9 MSc graduates; 5 PhD students, 1 PhD graduate
- Already employed as an energy professional: 7 out of 27 participants
- Number of lecturers: 4

Feedback and future improvements

Overall feedback for the course has been positive. The most appreciated aspects by the students were: the variety of topics presented, the relevance of the course in the context of energy reduction and energy efficiency, and the opportunities to interact with students of different backgrounds, with the industry (SMEs), and with the lecturers.

Some aspects that need improvement include: increasing the duration of the course and decreasing the duration of the sessions (e.g. instead of 5 hour sessions, provide 2 or 3 hour sessions over a longer period of time); increasing the duration of the practical action and providing more support for the task; additional guidance on how to use some of the university's IT resources; some students would have preferred the closer interaction of a classroom environment, but this was not possible due to COVID-19 restrictions.

During the course, the lecturers adapted and added content to the existing learning materials, based on their expertise. These improved presentations will provide a basis for the delivery of the next editions of the course at Teesside University, and can also be used to improve the common Training handbook for all the project partners.

3. Analysis of the 1st edition

3.1. General aspect

The administrative process of Course Accreditation for E&T program finalized by October 2020. Course advertisement for the first edition started in September 2020 in some of the countries, dedicating significant efforts to contact professionals from SMEs and distribute course information former students and potential participants.

Table 1: Information about the accreditation of the E&T Program in all partners countries

Country	Course Host Institution	Course title	Accreditation Institution	ECTS Credits
Cyprus	Department of Mechanical and Manufacturing Engineering, University of Cyprus	Μεταπτυχιακό μάθημα «Διαχειριστών Ενέργειας»	The training course for "Energy Managers" is offered as an optional module at a post-graduate course offered by the Department of Mechanical and Manufacturing Engineering of the University of Cyprus. All post-graduate courses offered by the Department of Mechanical and Manufacturing Engineering are already accredited and therefore the internal approval from the University bodies was the only requirement for the approval of the "Energy Managers" training course.	5
Greece	Aristotle University of Thessaloniki	Ενεργειακή αποδοτικότητα και βιωσιμότητα σε μικρές και μεσαίες επιχειρήσεις (ΜμΕ) για ενεργειακούς διαχειριστές και ειδικούς στην ενέργεια	Κέντρο Επιμόρφωσης και Δια Βίου Μάθησης Αριστοτελείου Πανεπιστημίου Θεσσαλονίκης – ΚΕΔΙΒΙΜ ΑΠΘ (Center for Education and Lifelong Learning of AUTH) [Link]	5
Germany	Beuth Hochschule für Technik Berlin	Energieeffizienz und Energiemanagement in Unternehmen (KMU)	Beuth Hochschule für Technik Berlin	5
Italy	Energiada Srl	Efficienza energetica e sostenibilità per energy manager e energy professional nelle PMI	Long-life Learning Committee (LLC) of the Universitat Politècnica De Valencia	5
Romania	Technical University of Cluj-Napoca	Eficiența și sustenabilitate energetică pentru manageri energetici și specialiști în energie (în IMM-uri)	Autoritatea Națională pentru Calificări (National Authority for Qualifications) www.anc.edu.ro	10
Slovenia	University of Ljubljana, Faculty of mechanical engineering	Energetska učinkovitost v malih in srednje velikih podjetjih	University of Ljubljana, Faculty of mechanical engineering	5

Spain	Universitat Politècnica de València	EFICIENCIA ENERGÉTICA Y SOSTENIBILIDAD PARA GESTORES Y PROFESIONALES DE LA ENERGÍA (en PYMES)	Universitat Politècnica de València	5
UK	Teesside University	Energy Efficiency (Energy Efficiency and Sustainability for Energy Managers and Energy Professionals (in SMEs))	Teesside University	5

During the 1st Edition of the E&T program, a total of **213 graduated participants** (62 female and 151 male) have been trained in theoretical and applied activities in accordance with the certified SEmPower efficiency E&T Program.

Courses were organised online but, in some countries, despite of the COVID-19 pandemic situation, face-to-face meetings also took place, offering different alternatives to professionals with interest in energy efficiency. This approach has allowed reaching a wide variety of professionals in different circumstances. From the total number of attendees, **148 participants were SMEs** employees, significant part of them having responsibilities in the field of energy management.

Table 2: Information about the delivery of the E&T Program in all partners countries

Country	Mode of study	Course Mode	Training methods	Period
Cyprus	Part Time	online	Distance learning, site visits for the practical action	January 2021 – April 2021
Greece	Part Time	online	Distance learning. Theoretical lectures and case studies	February 2021 – April 2021
Germany	Part Time	online	Lectures and exercises	February 2021 – April 2021
Italy	Part Time	online	Distance learning, practice on study cases	December 2020 – February 2021
Romania	Part Time	online	Distance learning, practice on study cases	December 2020 – February 2021
Slovenia	Part Time	online	Online	February 2021 - March 2021
Spain	Part Time	online	Online	December 2020 – February 2021

UK	Part Time	online	Distance learning/online	March 2021 – April 2021
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Courses received great interest across the different European countries, proved by more than 300 persons registered. At the end of the program, 213 participants graduated the 1st edition of the courses (Figure 4). It can be highlighted that the interest for the energy efficiency issues is highly requested by the SME area (more than 50% of the graduated participants are employed in SMEs). In the same context, it can be noticed that more the 75% of the graduated participants are energy professionals or their activities are related to the energy efficiency sector.

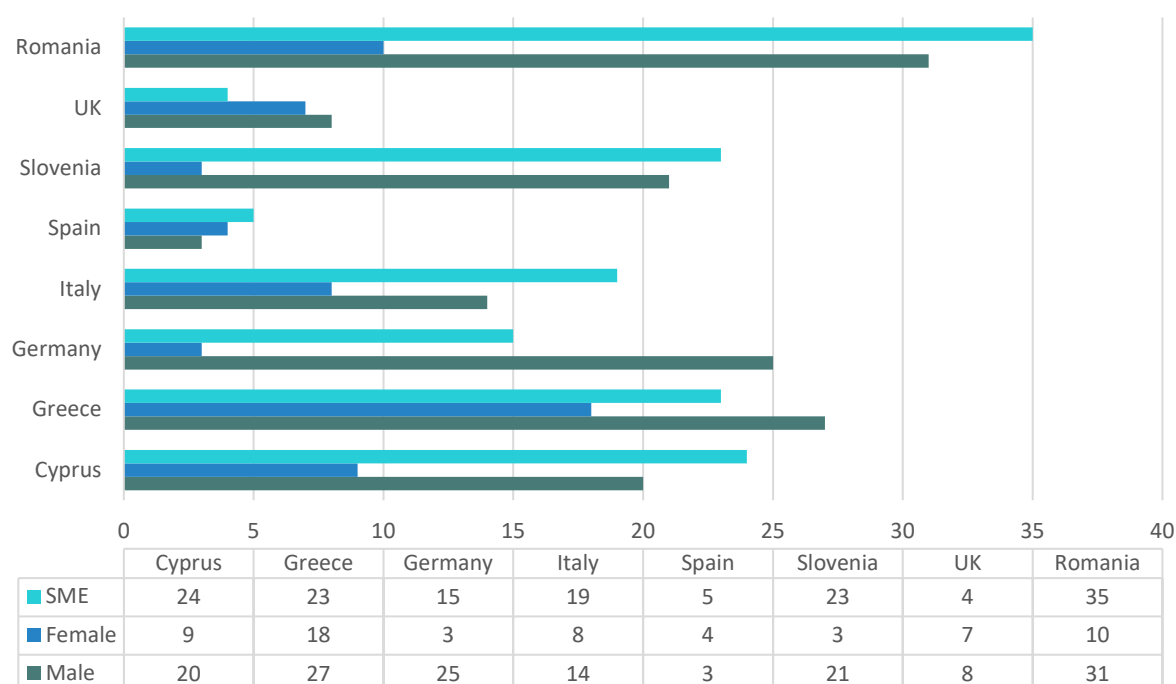


Figure 4. 1st Edition E&T course attendance statistics (graduated participants)

It is important to underline that all the participants, regardless of their level of education, were interested in improving their skills and competences in the field of energy efficiency. An overview of the education level of the participants is presented in Figure 5.

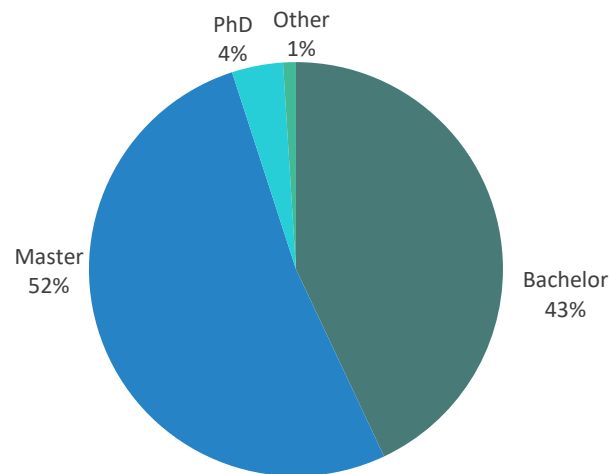


Figure 5. Education level of the participants

Related to the lecturers involved in the E&T Program, they were from various sectors such as: academia, business environment and policy. In all project partners countries, 44 lecturers, with high expertise in their field of activity, delivered valuable theoretical and practical courses built upon LUs highly appreciated by the participants.

3.2. Feedback analysis and further improvements

The course evaluation was carried out by means of questionnaires to continuously **improve the educational program** during the project's work. Course experience questionnaire is an instrument to monitor educational programs which allows measuring improvements in training quality, assessing the call for participants, objectives, contents and lectures.

The questionnaire was design and developed for all courses in order to have common data and is made of 2 parts: PART A includes professional data about participants, while PART B allows to evaluate some aspects of the course. [3]

The issues on which the participants' opinion were requested are:

- E&T Program content (objectives, topic, relevance and usefulness of the information provided by the program etc.);
- Program materials and teaching techniques (clearness of the materials, up to date of the used references, teaching techniques and used methods etc.);
- Program instructors (level of expertise, teaching ability and his/her interaction with the participant etc.);
- Quality of delivery (quality of the location and the used infrastructures);
- Improvements suggested by the participants.

The main objectives pursued by the implementation of the questionnaire are:

- The usefulness and applicability of the presented information;
- Up to date and relevance of the content;

- Directions for improving and optimizing course materials.

Overall, the first edition of the course had a positive outcome in all delivered countries. The course allowed for a varied audience of SME participants and post graduate students to collaborate and establish valuable connections for the future. Due to COVID-19 restrictions the course was delivered fully online, which allowed to have participants (including SMEs) from different parts of the countries. This would not have been possible otherwise. While the online nature of the course resulted in some challenges in communication between lecturers and students, it provided an added value, by allowing for a more diverse cohort of students to participate and collaborate on the course, as well as raising awareness for the project throughout the Europe. Various participants have expressed their interest in continuing collaboration with the SMEs involved. Additionally, various participants expressed interest in future collaboration opportunities across the SEmPower Efficiency consortium.

Analysing the feedback of the participants from country to country, strong points and areas for improvement was identified, related especially to program content, practical actions, course lecturers and quality of delivery, duration of the program.

3.2.1. E&T program content

This section of the questionnaire collects participants data related to their expectations of the E&T program content and how the delivered courses may help them in the development of their professional careers. In Table 3, the aggregation of participants feedbacks is illustrated. The questions were clustered considering the following topics:

- General assessment of the course related to topics and objectives;
- Utility of practical examples;
- Correlation between the course topics and the participants companies interests;
- Materials and teaching techniques;
- Lectures assessment;
- Assessment of course registration procedures.

In order to quantify the quality of certain topics of the course through the eyes of the course participants, the average of the grades for each aforementioned sub-sections was computed (see Table 3).

Based on the aggregation of different questions on main topics, the second edition of the course will be updated to provide materials and teaching techniques adjusted according to students requests and observations.

Table 3: Aggregation of participants feedbacks

QUESTION	Cyprus	Germany	Greece	Italy	Slovenia	Romania	UK	Spain	QUESTION TOPIC
	Average Grade								
How clearly were the training objectives stated?	4.56	4.15	4.27	4.8	4.25	4.67	3.75	4.09	General assessment of the course, topics and objectives
How well did the training meet the stated objectives?	4.56	4.27	4.17	4.6	4.3	4.65	4.00	4.12	
How well the received information covers the topic of the proposed learning units?		4.04	4.22	4.7	4.33	4.67	3.75	4.14	
What is your overall assessment of the training?	4.56	4.29	4.32	4.7	4.58	4.63	4.00	3.88	
How the interaction between the participants was encouraged?	4.38	4.09	3.7	4.9	4.33	4.6	3.42	4.15	
How do you rate the utility of practical examples (relevance of studied cases)?	-	4.08	4.27	4.8	4.42	4.64	4.00	4.11	Utility of practical examples
How do you rate the value of the training to you and your company ?	4.56	4.21	4.1	4.5	4.3	4.5	4.00	4.17	Correlation between the course topics and the participants interests
How do you rate the relevance of the subjects covered to your professional needs?	4.69	4.33	4.25	4.6	4.27	4.56	3.92	4.15	
How clear were the materials used during the training?	4.38	4.15	4.22	4.4	4.36	4.64	4.00	4.16	Materials and teaching techniques
How do you rate the up to date of the used references?		4.22	4.25	4.7	4.33	4.67	3.67	4.20	
How do you rate the teaching techniques and methods used?	4.31	4.11	4.09	4.5	4.33	4.66	3.83	4.18	
What is your overall assessment of the technical side of the presentation (accessibility to the online platform, audio, visual presentation of materials)?	4.5	4.3	4.56	4.6	4.42	4.62	5.00	4.20	
How knowledgeable was the lecturer about the topics covered?	4.81	4.34	4.57	4.8	4.89	4.8	5.00	4.19	Lecturers' assessment
How well did the lecturer present the materials?	4.44	4.44	4.24	4.7	4.71	4.68	5.00	4.18	
How well did the lecturer interact with the participants and respond to their questions?	4.69	4.19	4.22	4.8	4.76	4.71	5.00	4.14	
What is your overall assessment regarding the course registration procedures and requirements?	4.69	4.13	4.56	4.8	4.5	4.64	4.00	4.19	Assessment of course registration procedures
AVERAGE RATING OF THE E&T PROGRAM	4.55	4.21	4.25	4.68	4.44	4.65	4.15	4.14	

Moreover, the average grades are transformed into participants needs fulfilment, based on the Table 4. Starting from the idea that each participant enrolled in this course to satisfy his or her professional needs a correlation between the grades and certain levels of “Needs Fulfilment” is created. The feedback provided by each attendee represent her/his perception regarding how the SMEmPower Efficiency program satisfied the professional needs.

Table 4: E&T program participants needs fulfilment

Grade	Grading System	Observation	Needs Fulfilment
1	Bad	The course does not fulfil the candidates needs related with the initial stated objectives and topics. The initial stated objectives were not achieved during the course.	20%
2	Poor	The course hardly satisfies the students’ needs related with the initial stated objectives and topics. Major improvements and changes need to be employed.	40%
3	Sufficient	The course fulfils the basic candidates needs related with the initial stated objectives and topics. Several improvements need to be employed.	60%
4	Good	The course fulfils the candidates needs related with the initial stated objectives and topics. However, little improvements are needed.	80%
5	Very good	The course fulfils the candidates needs related with the initial stated objectives and topics. The objectives of the course were fully accomplished, and the presented information could be easily correlated with the professional needs of the students.	100%

The overall assessment of the course, according to attendees’ feedback, can be described as good to very good with variations from one country to another. The average grade of the course, presented under the form of “needs fulfilment” percentage as it was previously presented, reflects the hard work and pro-active involvement of the SMEmPower Efficiency consortium in the preparation of the teaching materials, which were based on the identified needs of each country.

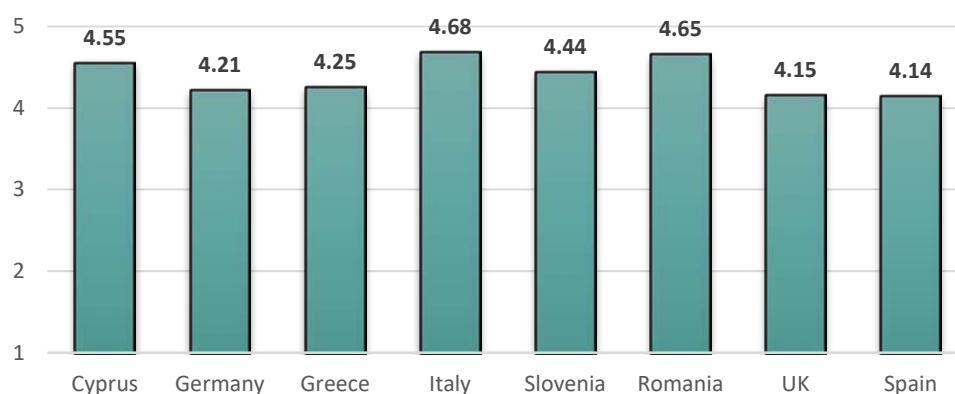


Figure 6. Average rating of the training program

One of the most appreciated aspects related to the E&T program content was the variety of topics presented, the relevance of the course in the context of energy reduction and energy efficiency and the opportunities to interact with professionals of different backgrounds, with the industry (SMEs), and with the lecturers.

The structure and the contents of the E&T course LUs clarified from the very beginning the importance of the energy efficiency in SMEs, starting from the legislation, continuing with the technical and economic analysis, and finally concluding with the practical action, in order to apply all the gained knowledge.

A Training Handbook was translated in all project partner languages and was available for all the participants through online platforms. The lectures integrated the training material with some practical applications, much appreciated by the participants, and with other information relevant for the national context. The participants expressed their satisfaction regarding the course syllabus, the available training material, and the video recordings uploaded to the well-structured and user-friendly training platform.

In almost all countries, the M&T and M&V tools prepared in the framework of the project were both used for the preparation of the final reports, to propose and analyse targeted measures for the energy efficiency improvement in the engaged SMEs.

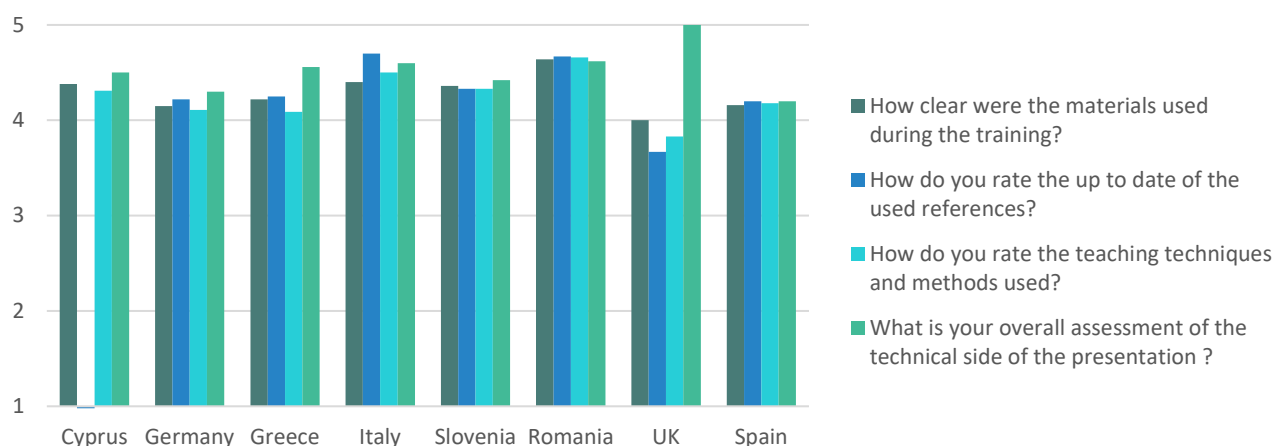


Figure 7. Evaluation of the training material and course delivery techniques

Further improvements related to course content:

- ✓ Even though well structured, the topics presented in each one of the LUs were many, covering a wide range of technologies, to be totally comprehensive, especially for those not having a proper technical background. Thus, the LUs presented could be perhaps refined to include and focus on the most important topics.
- ✓ More explanation should be given on the calculations; more exercises could be performed by the participants during the course presentations to be clear to all who are not engineers or have no prior exposure to such topics.
- ✓ During the course, the lecturers adapted and added content to the existing learning materials, based on their expertise. These improved presentations will provide a basis for the delivery of the next editions of the course and will be used to improve the common Training handbook for all the project partners.

3.2.2. Practical action

The COVID-19 pandemic affected the implementation of this first edition of the E&T course especially in case of the delivery of LU 6, i.e. the Practical actions. The most challenging issue to be overcome was the inability of the participants to visit the engaged SMEs in the framework of the practical action (only in Italy and Cyprus, the practical session involved face-to-face meetings between the participants). All the necessary data were provided by the SMEs representatives, who were also team members for the implementation of the final study. However, the distance learning feature allowed participants and SMEs from across the whole country to participate.

Moreover, through the implementation of the practical action, the trainees had the opportunity to do teamwork with professionals having different scientific and technical background. This synergy allowed them to enhance their new knowledge, while also to establish communication paths with other energy experts for the future.

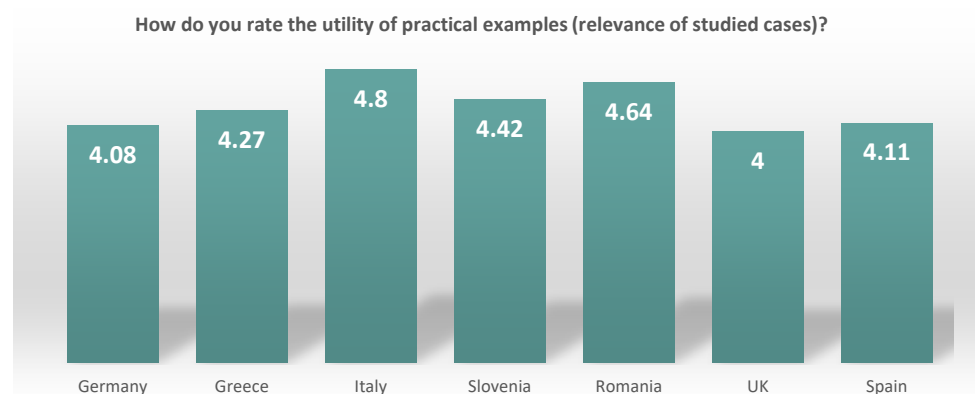


Figure 8. Evaluation of the practical impact of the case studies

Considering the variety of the students professional background it is difficult for the lecturers to provide appropriate practical examples satisfying each participant needs. Comparing the “The utility of practical examples” average scores, it can be observed that in most of the countries the grades are below the average feedback of the course, aspect highlighted in Figure 8. As it was previously mentioned, considering the worldwide medical context the lectures made additional efforts to compensate the lack of physical interactions which in general generate insightful debates. Nevertheless, it is quite clear that the second course edition must incorporate more practical examples and onsite activities.

Further improvements related to practical actions:

- ✓ Duration allocated to this activity could be increased to enhance the participants involvement, without affecting their overall daily employment schedule;
- ✓ Detailed lists of data to request to pilots for the audit; instructions to facilitate the first phase of the audit (data gathering); more practical examples for LU6 (real energy audit);
- ✓ Practical examples of possible interventions, more technical information on green technologies; same case studies in all LUs focusing on different aspects.

3.2.3. Course lecturers and quality of delivery

Lecturers were one of the **strongest points** in all courses. Higher scores were found in this section of the questionnaire (Figure 9). In most of the countries, the maximum grades were given to the lecturers. Although the attendees pointed out things to be improved among the learning units, the lecturers were highly appreciated.

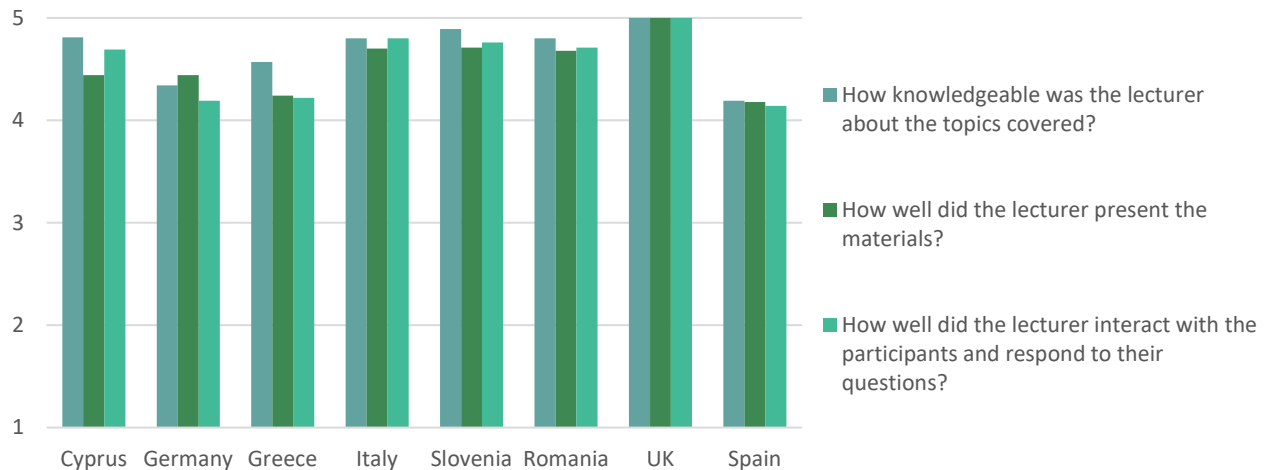


Figure 9. Evaluation of course lecturers

The average “fulfilment needs” grades describing the correlation between the course topics and the applicability in participants professional needs are located between “Good” and “Very good” levels meaning that the participants consider the SMEmPower courses useful in daily professional activities.

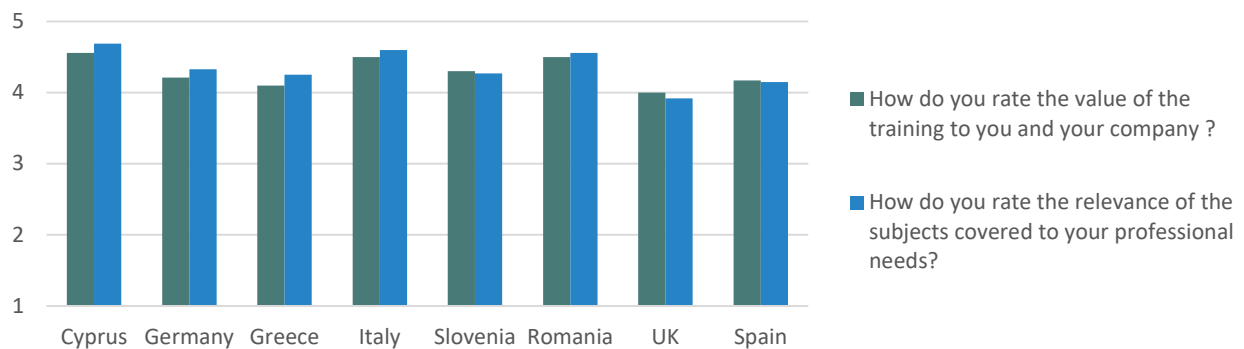


Figure 10. Evaluation of the correlation between program topic and participants interests

However, if comparing with the average grade of the course, it can be concluded that improvements can be conducted. Most of the collected feedback indicates a more theoretical character of the lectures rather than practical. It is important to keep in mind the online nature of the lecturer-attendee and attendee-attendee interactions which is an important barrier for open discussions and experiences sharing among the involved actors.

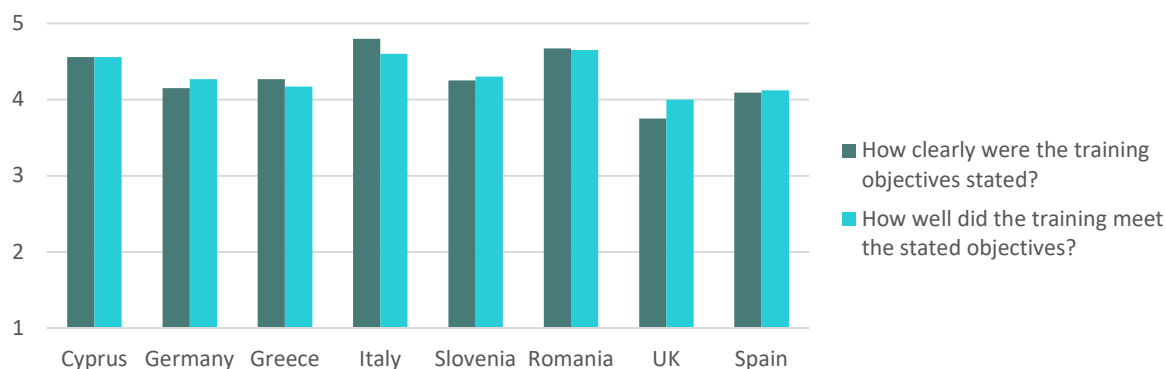


Figure 11. Feedback analysis of correlation between program topic and participants interests

According to Figure 11, the majority of the SME mPower Efficiency first course edition attendees has clearly understood the stated objectives of the course. Moreover, almost in all the analysed countries the respondents consider that the course objectives were successfully accomplished. However, the average grade varies from one country to another, with minimum grades recorded in Greece and maximum in Italy. The understanding of initial objectives of the course is strictly related with the communication procedure, between the future participants and the course staff. With applicability for the countries with lower feedback assessments but not only, the marketing campaign impacting the next course edition should be improved, briefly highlighting the proposed objectives and topics within the brochures (rather than commercial content).

3.2.4. Duration of the program

Regarding the overall duration of the training courses, most of the participants mentioned that were just right to cover the scope of the course. The time schedule was appreciated as being very well adapted to the fact that participants were professionals with jobs and students. However, several improvements of the course were mentioned that need to be made for the next editions.

Further improvements related to course duration and schedule

- ✓ **Cyprus:** Regarding the time schedule (day, time and duration) of the training course the feedback was that the course was ideal for those who has a daily working schedule. However, some participants mentioned the possibility of having the sessions twice per week (it should be considered of having the sessions twice per week. For people that are familiar with the subject that would be ideal but for those that are not familiar it is better once per week).
- ✓ **Greece:** Considering the schedule of the course, the calendar duration should be extended. The lectures of 3 to 4 hours are difficult to be attended after a working day, also considering the wide variety of the subjects presented.
- ✓ **UK:** Increasing the duration of the course and decreasing the duration of the sessions (e.g. instead of 5 hour sessions, provide 2 or 3 hour sessions over a longer period of time); increasing the duration of the practical action and providing more support for the task; additional guidance on how to use some of the university's IT resources.
- ✓ In all **other consortium countries**, program schedule was in accordance with the participants expectations. No future improvements are needed.

4. Final remarks

Due to the restrictions imposed by COVID-19 pandemic, difficulties were encountered in accessing participants and SMEs from the launch and promotion phase. However, the course has had a significant impact on energy efficiency professionals. The impossibility to interact in physical form has resulted in some challenges in communication between lecturers and attendees. But the involvement and good collaboration within the consortium led to the **achievement of the indicators proposed in the project**.

However, we can also notice an aspect that proved to be useful in the delivery of the course, in this context marked by restrictions. The online nature of the course provided an added value, by allowing for a more diverse cohort of professionals to participate and collaborate on the course, as well as raising awareness for the project throughout the Europe. Various participants have expressed their interest in **continuing collaboration with the SMEs involved**. Additionally, they expressed interest in future collaboration opportunities across the SMEmPower Efficiency consortium.

Following the research carried out within the project, the **need for programs regarding energy efficiency skills** was highlighted. Such courses are useful and attract the attention of professionals in the field. The professional interest is high in terms of the need to improve their skills in the field and to be up to date with the **latest tools for analysis and monitoring of energy consumption** within the SME.

Energy tends to be **included in the core business of the companies**. Awareness of the benefits of rational use of resources, along with increasingly difficult economic conditions have led to changes in the behavior of SMEs and in terms of energy used. To withstand current conditions, SMEs are optimizing their use of resources and **engaging in training programs** that can help achieve strategic goals in terms of energy and energy efficiency.

A loop will be utilized to **continuously improve the SMEmPower Efficiency E&T Program** during the project work. In this process, all the involved entities (Universities, market players and program attendees) will provide valuable inputs. Updating of the contents will be made at the end of each edition. At the end of each course edition, also the contents of the handbook will be reviewed and updated, considering the feedback from the participants.

In this context, SMEmPower Efficiency will **contribute to the energy efficiency of SMEs** via connecting professionals, promoting intelligent energy tools, traditional and innovative technologies, and decision support for various stakeholders.

Short term: SMEmPower Efficiency will ensure that barriers to energy efficiency projects are removed for an uptake of energy efficiency projects by decision triggering of the teaming between energy professionals and decision makers, as SMEmPower Efficiency trainees' experts, SME consulting companies, financing entities and ESCOs, relevant associations and especially industrial professional or patronal associations.

Medium term: SMEmPower Efficiency will enable better implementation of energy-efficiency policies and enhance the digitalization of industry towards the fourth industry revolution.

Long term: SMEmPower Efficiency will be strongly promoted, enabling and supporting the Energy experts to use effective tools for energy optimization, new technologies and processes driven by energy efficiency, in a close and improved connection with top decision makers –CEOs, CFOs etc.

Update for this report will be made after the delivery of second edition of the E&T Program.

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