D5.3

Evaluation of training activities

skillbill

SKILL TO BOOST INNOVATION & PROFESSIONAL FULFILLMENT IN A SUSTAINABLE ECONOMY

SINERGIE

26 / 05 / 2025

Funded by the European Union

PROJECT INFORMATION

PROGRAMME	Horizon Europe
TOPIC	HORIZON-CL5-2021-D3-02-02
TYPE OF ACTION	HORIZON Coordination and Support Actions
PROJECT NUMBER	101075587
START DAY	1 September 2022
DURATION	36 months

DOCUMENT INFORMATION

TITLE	Evaluation of training activities
WORK PACKAGE	WP5 Skilling, reskilling, upskilling: vocational education and training
TASK	5.3 Piloting and validation of training courses
AUTHORS (Organisation)	Giovanni Pede (SINERGIE), Simona Baldovskà (PEDAL)
REVIEWERS	E.G. Facci, A. Rosati (AzzeroCO2)
DATE	26/05/2025

DISSEMINATION LEVEL

PU	Public, fully open	x
SEN	Sensitive, limited under the conditions of the Grant Agreement	
Classified R-UE/EU-R	EU RESTRICTED under the Commission Decision No2015/444	
Classified C-UE/EU-C	EU CONFIDENTIAL under the Commission Decision No2015/444	
Classified S-UE/EU-S	EU SECRET under the Commission Decision No2015/444	

DOCUMENT HISTORY

VERSION	DATE	CHANGES	RESPONSIBLE PARTNER
V0.1	22/05/2025	Initial version shared with partners for review	SINERGIE
V1.0	26/05/2025	Final version incorporating reviewers' feedback	SINERGIE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

ToT	Training of trainers
EM	Energy Manager
PV	Photovoltaic Panels
KPIs	Key Performance Indicators
AR	Augmented Reality
VR	Virtual Reality

Executive Summary

This deliverable, D5.3: Evaluation of Training Activities, presents a comprehensive overview of the design, implementation, evaluation, and future prospects of the SKILLBILL Vocational Education and Training (VET) initiatives developed under Work Package 5 (WP5). The activities addressed the skilling, reskilling, and upskilling of professionals and educators in the renewable energy sector, with a focus on Energy Management and Photovoltaic (PV) Panels technologies.

SKILLBILL's training model integrated digital innovation - particularly Augmented and Virtual Reality (AR/VR) simulators and serious games - to enhance both the accessibility and effectiveness of technical learning. This approach supported immersive, practice-oriented education while fostering engagement among a diverse learner base.

Training activities were conducted across multiple countries and delivery modes. After a testing phase with international participants, local replications of both the trainers' and the technical courses have been realised in Italy and Slovakia. Globally, 142 trainees were trained directly by SKILLBILL learning activities.

Finally, the deliverable outlines a forward-looking exploitation strategy focused on further integration into national VET systems, translation and localization efforts, and extended dissemination through replication seminars. These actions ensure the continuity, relevance, and scalability of the SKILLBILL educational offer in support of the green transition and lifelong learning across Europe.

1. SKILLBILL VET COURSES

1.1 Implementation of SKILLBILL Training Courses under WP5

In the framework of Work Package 5, a comprehensive training programme was implemented, encompassing both Training of Trainers (ToT) and Technical Courses. These were developed and delivered with the objective of equipping professionals and educators with the knowledge and tools necessary to effectively apply the SKILLBILL training methodology and related digital resources, including simulators and serious games. The courses were structured across multiple thematic areas and delivery formats, ensuring accessibility and adaptability to various learner profiles and institutional contexts.

The Energy Manager ToT course was launched in its first round in March 2024 and conducted online over a two-hour live session. This initial edition focused on presenting the trainer's kit, conducting a critical analysis of training materials, and introducing participants to the AR/VR audit simulation. The subsequent phase included both the first and second rounds of the Energy Manager ToT, reinforcing the training outcomes and extending the engagement to a broader audience.

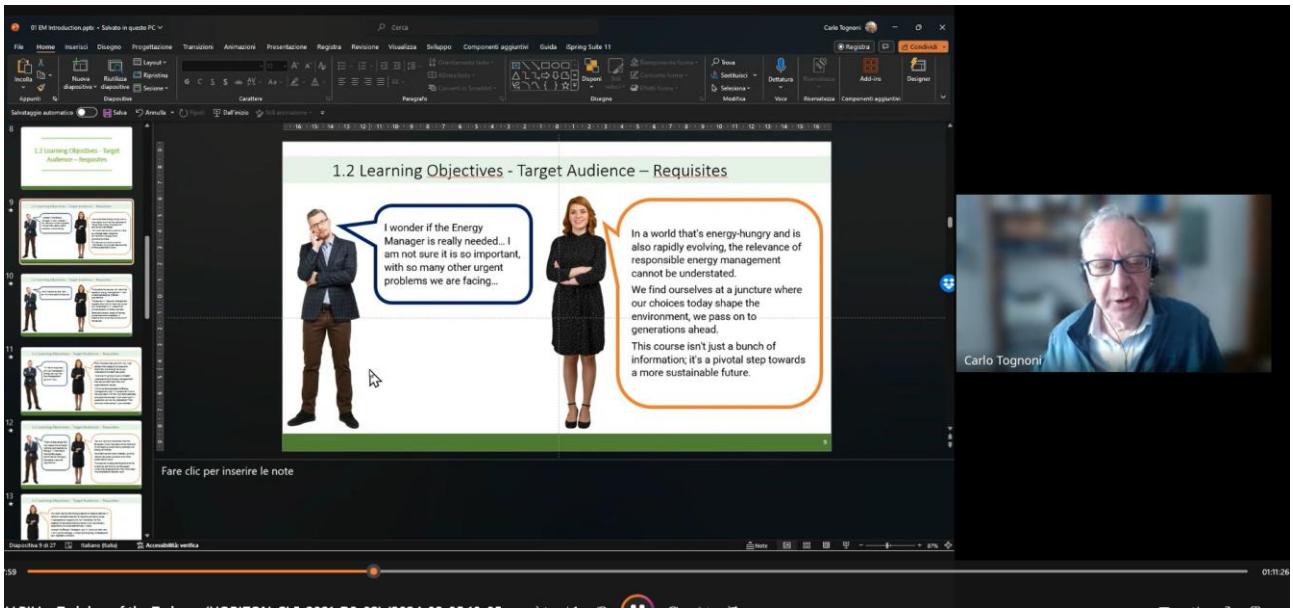


Figure 1: Energy Manager ToT live session

In parallel, the Energy Manager Technical Course was launched in September 2024. This round combined asynchronous content delivered through the Moodle platform with two synchronous twin live sessions held on 26 and 27 September 2024. The training included in-depth exploration of energy auditing practices, supported by interactive simulator-based learning, to ensure practical application of theoretical knowledge.

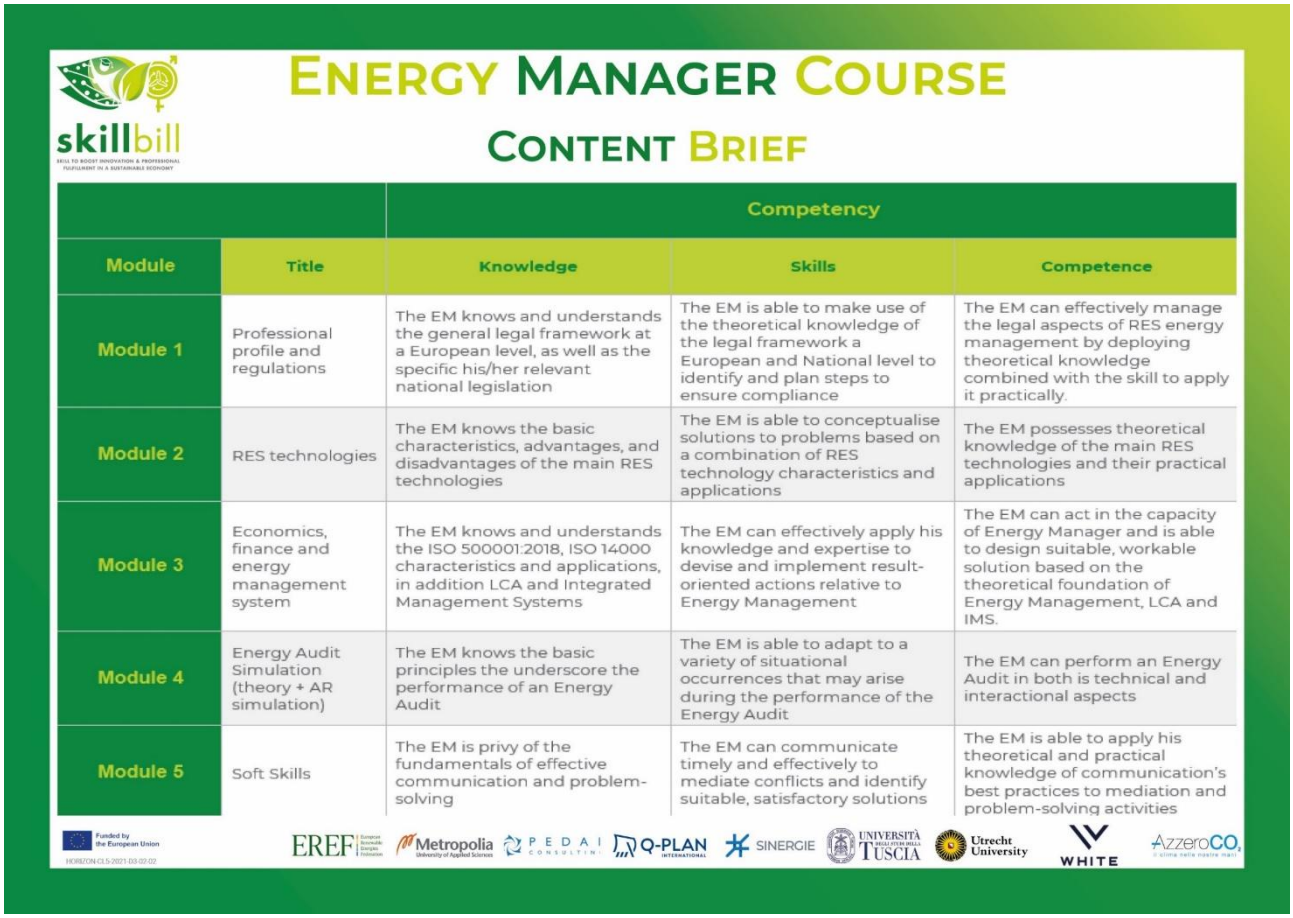


Figure 2: Energy Manager Technical training contents

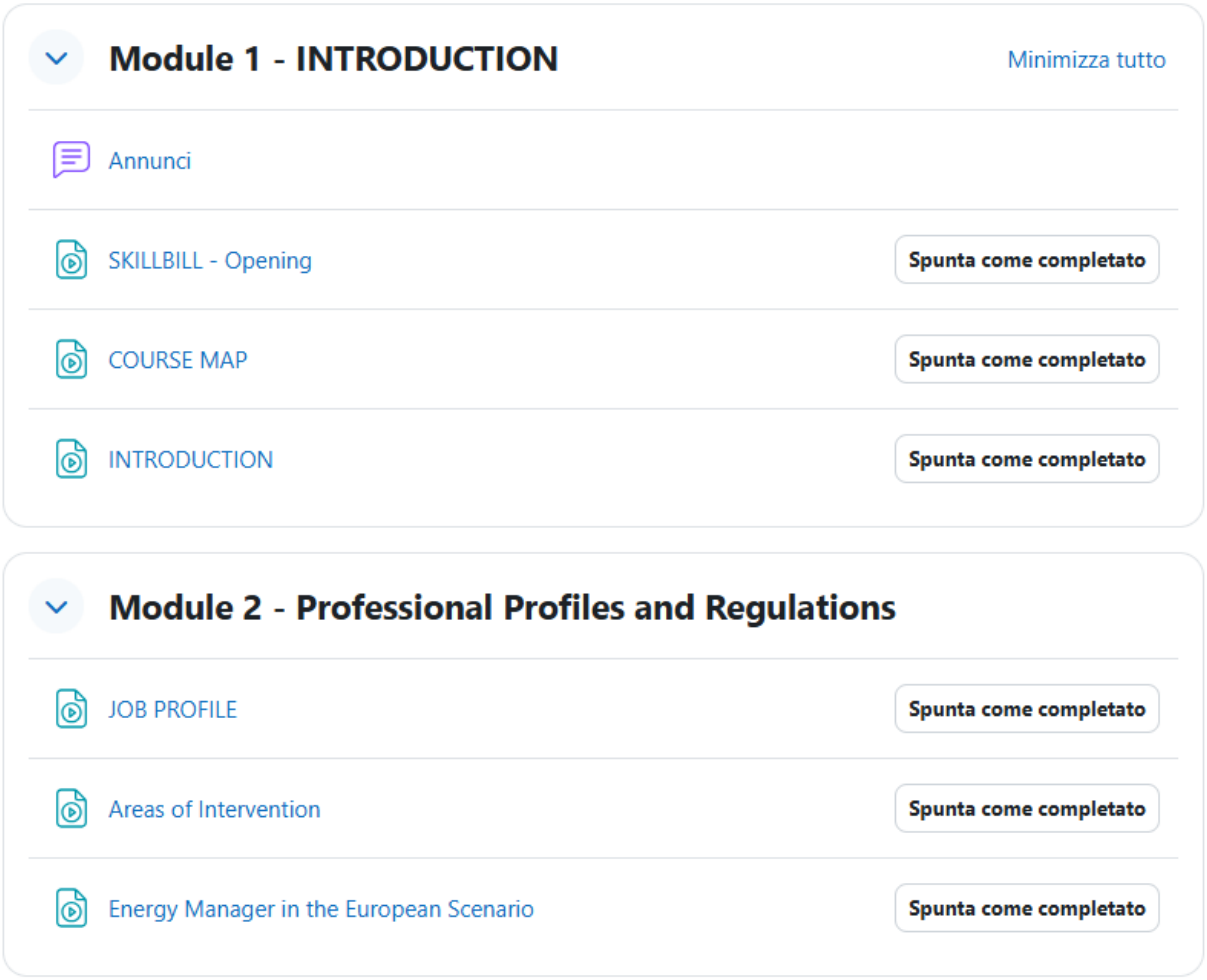


Figure 3: Energy Manager course – asynchronous part

Figure 4: Energy Manager course – synchronous part

The Photovoltaic Panels training followed a similarly dual-structured approach. The first round of the Photovoltaic Panels ToT was conducted through live sessions, starting with participant introductions and moving through the trainers' kit, training materials, and the game-based learning experience. Particular attention was given to the use of the final assessment tools and the collection of real-time feedback through Q&A interactions.

Figure 5: Photovoltaic Panels ToT

The second round transitioned to an asynchronous format: the original content was repurposed into video lessons hosted on Moodle, and a new module was added to support the design of tailored training courses, enhancing the adaptability of the material for future replication.

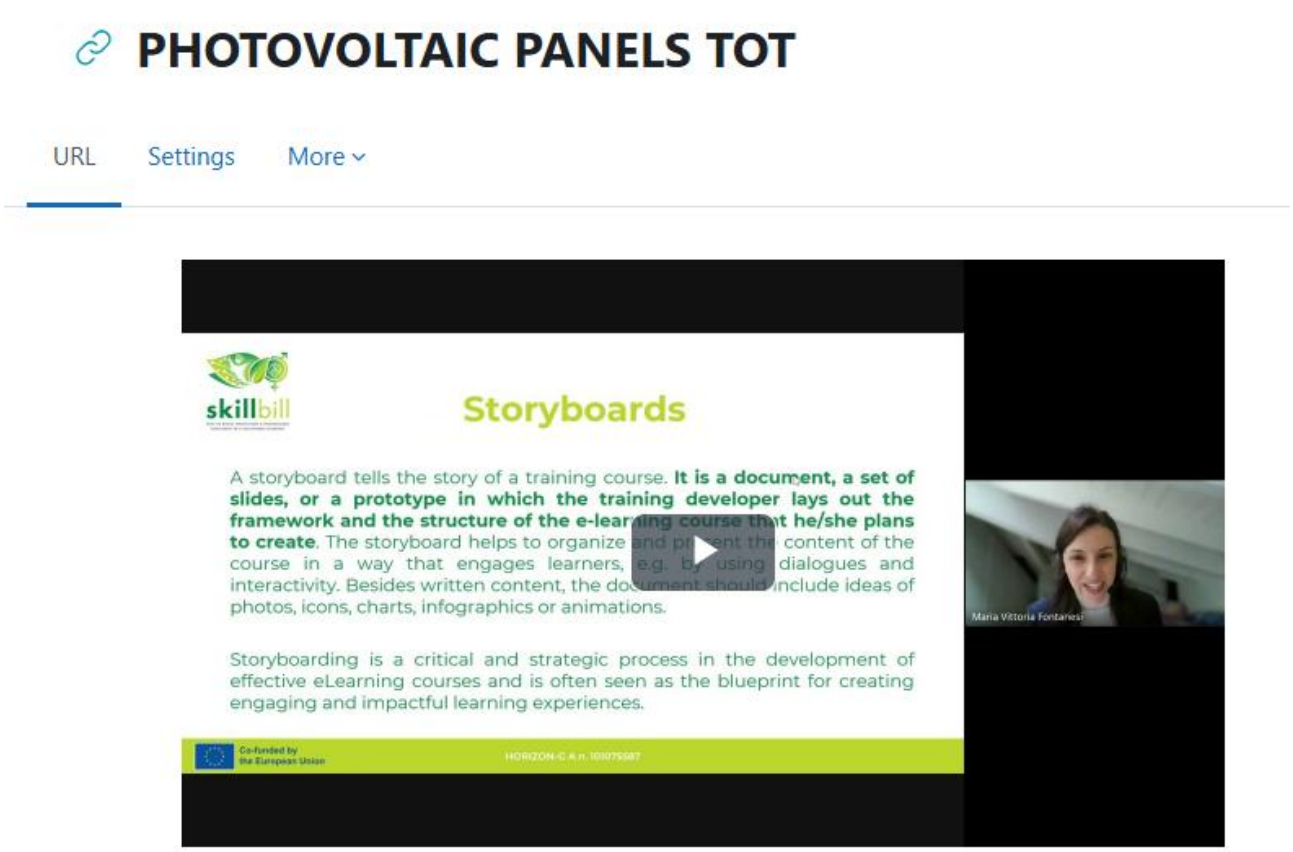


Figure 6: Photovoltaic Panels ToT – video lesson of Round 2

The Photovoltaic Panels Technical Course, also delivered via Moodle, was made available in an entirely asynchronous format, allowing participants to engage flexibly with the content according to their schedules and needs.

Figure 7: Photovoltaic Panels – asynchronous course

1.1.1 *SKILLBILL Courses (Replications in Italy and Slovakia)*

Beyond these core courses, replication initiatives were launched in Lazio and Emilia Romagna, Italy, as well as in Slovakia. While the targeted Vocational Education and Training (VET) in Italy were addressed to project managers, designers, coordinators, and trainers affiliated with accredited bodies in the respective regions, in Slovakia they were targeted to the educational institutions. The replications were aligned with regional training needs and aimed to embed the SKILLBILL approach within local institutional strategies.

EM + PV Joint ToT replication in Emilia Romagna

The course delivered in **Emilia-Romagna** was a **training session on instructional design for European projects**, with a specific focus on the SKILLBILL case.

This course, led by Giovanni Pede, focused on equipping participants — primarily women, professionals coming from accredited VET bodies — with the competencies to **design training paths aligned with European frameworks**, integrating digital, green, and transversal skills in line with Horizon Europe priorities and SKILLBILL's methodology. A particular focus was given on how to include AR tools as a gamification tool for technical learning.

The training introduced learners to:

- **European programme structures and funding logic** (e.g., Horizon Europe, Erasmus+, LIFE+), with a detailed look at the funding mechanisms and thematic axes relevant to skills and innovation.
- **The SKILLBILL project as a case study**, analyzing its training model, VET-oriented structure, and inclusive goals.
- **Testing the AR Simulators developed for the PV and EM courses**.
- **The concept of "Value Proposition" in training design**, applied to educational products: identifying key benefits, expected outcomes, and differentiators that make a course relevant and attractive to both learners and stakeholders.
- **Market analysis tools**, including how to use regional sources like *Skills Intelligence* by ART-ER and national/international data from UnionCamere, Eurostat, and ISTAT to design context-aware training offers.
- **Identification of macro, micro, and mega-trends** (e.g., digitalization, green transition, hybrid work, AI, microlearning) and their incorporation into modern, forward-looking curricula.
- **Competence-based training design**, using regional and European standards such as:
    - Atlante del Lavoro (INAPP)
    - SRFC (Regional System for the Recognition of Competences – Emilia-Romagna)
    - DigComp, GreenComp, LifeComp, EntreComp
    - EQF and CEFR frameworks
- **Evaluation and validation methods** for training outcomes, including:
    - Messa in trasparenza (validation of prior learning and non-formal competencies)
    - Use of dossiers and structured evidence
    - Certification pathways and standards (e.g., UNI, FIMA, third-party exams)

Participants were also introduced to examples of existing course models designed around this logic, including training profiles for Energy Managers, Event Organizers, Project Managers for the ecological transition, and green marketing experts.

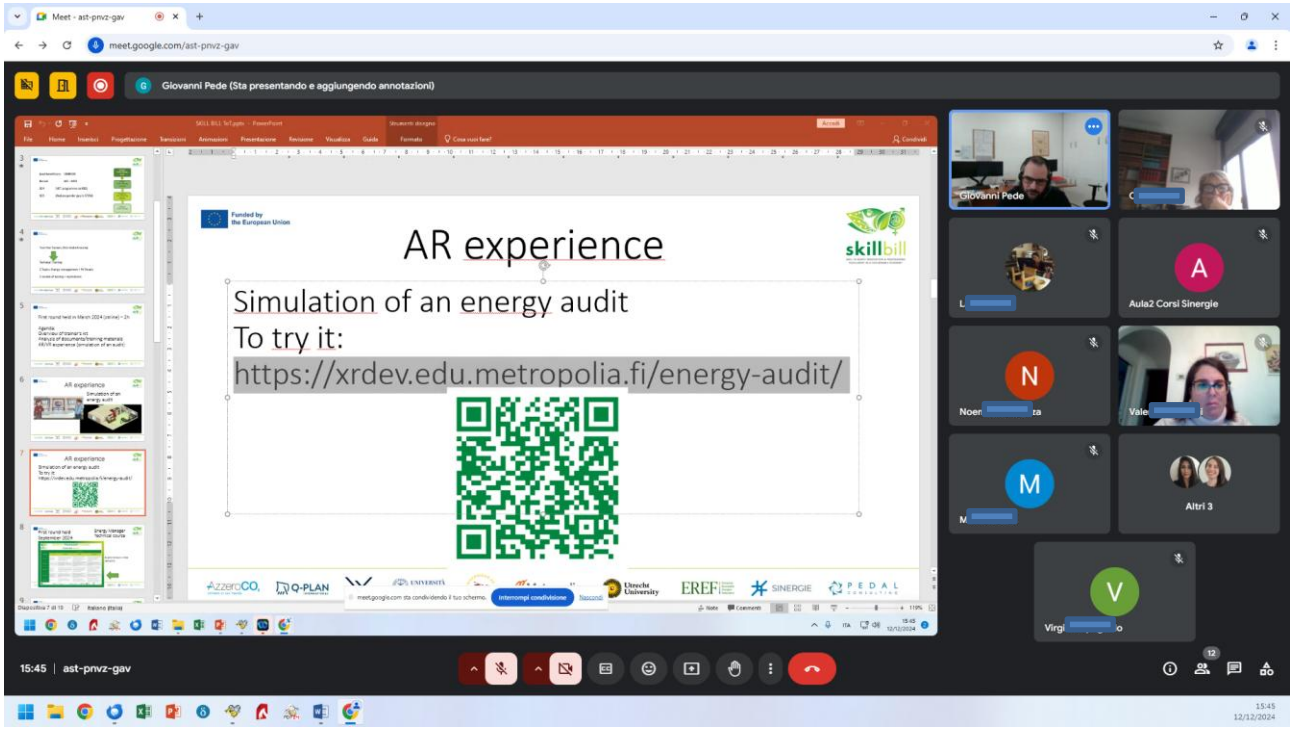


Figure 8: SKILLBILL ToT Replication in Emilia Romagna

The course provided a practical and strategic overview of how to **design high-impact training pathways** that are fundable, certifiable, and market-relevant.

The course was held on the 21st of December 2024.

EM + PV Joint ToT replication in Lazio

The course titled **"Progettazione della formazione"**, conducted on November 15, 2024, was a **Training of Trainers (ToT)** activity carried out within the framework of the SKILLBILL project in collaboration with *Porta Futuro Lazio*. The session was specifically aimed at developing the instructional design capabilities of VET professionals engaged in delivering or adapting renewable energy training courses.

Led by Giovanni Pede from SINERGIE, the session focused on equipping trainers with the necessary skills to **design structured, effective, and outcome-oriented training pathways**, particularly in the field of energy transition and green skills development. The training addressed not only pedagogical frameworks but also the integration of budgeting and project-based planning within course design — two crucial elements when aligning training with EU-funded programme structures.

Key activities during the session included:

- **Instructional design methodology**, with a focus on defining learning outcomes, structuring training modules, and sequencing content based on adult learning principles and labour market needs;
- **Analysis of European funding opportunities**, particularly under Horizon Europe, and how to align training programmes with thematic priorities and calls;
- **Application of project cycle management principles** to the educational context, with practical exercises in drafting Work Packages (WPs), tasks, deliverables, and defining indicators for results and impact;

- **Hands-on simulation**, in which participants collaborated on the design of a full e-learning pathway, including the definition of credentials, Gantt timelines, budget planning, and risk identification. The exercise was framed around a fictional EU project coordinated by Wageningen University, training professionals in sustainable food marketing.
- **Testing of the AR Simulators developed within the SKILLBILL project**.

By the end of the session, participants gained not only a clearer understanding of how to structure and budget a training course within the SKILLBILL framework, but also practical experience in shaping it to fit European project standards. This aligns with the broader SKILLBILL objective of creating scalable and transferable training models that can be embedded in formal and non-formal VET systems.

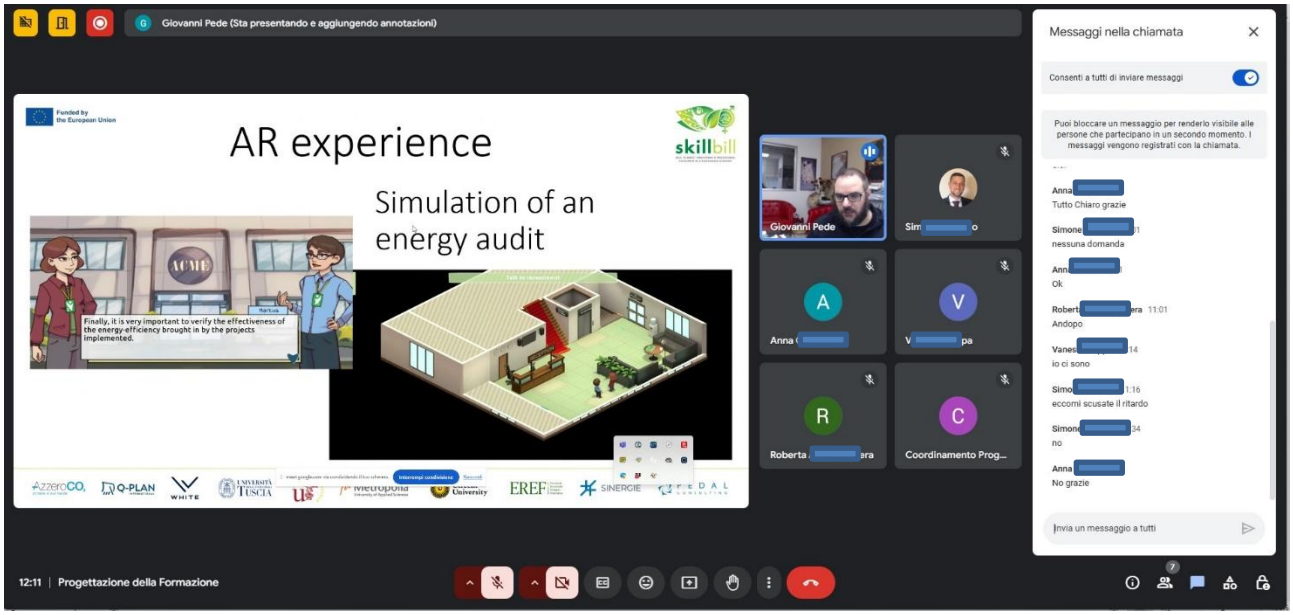


Figure 9: SKILLBILL ToT Replication in Lazio

Replication of a technical joint EM + PV Panels installation training course in Lazio

The "**Management dell'energia**" course is a structured 16-hour training programme delivered in synchronous online format, aimed at providing foundational knowledge in energy management, with a particular focus on the role of the Energy Manager and the application of photovoltaic (PV) technologies. It is designed for learners beginning their journey into the energy sector, combining theoretical instruction with practical and interactive components.

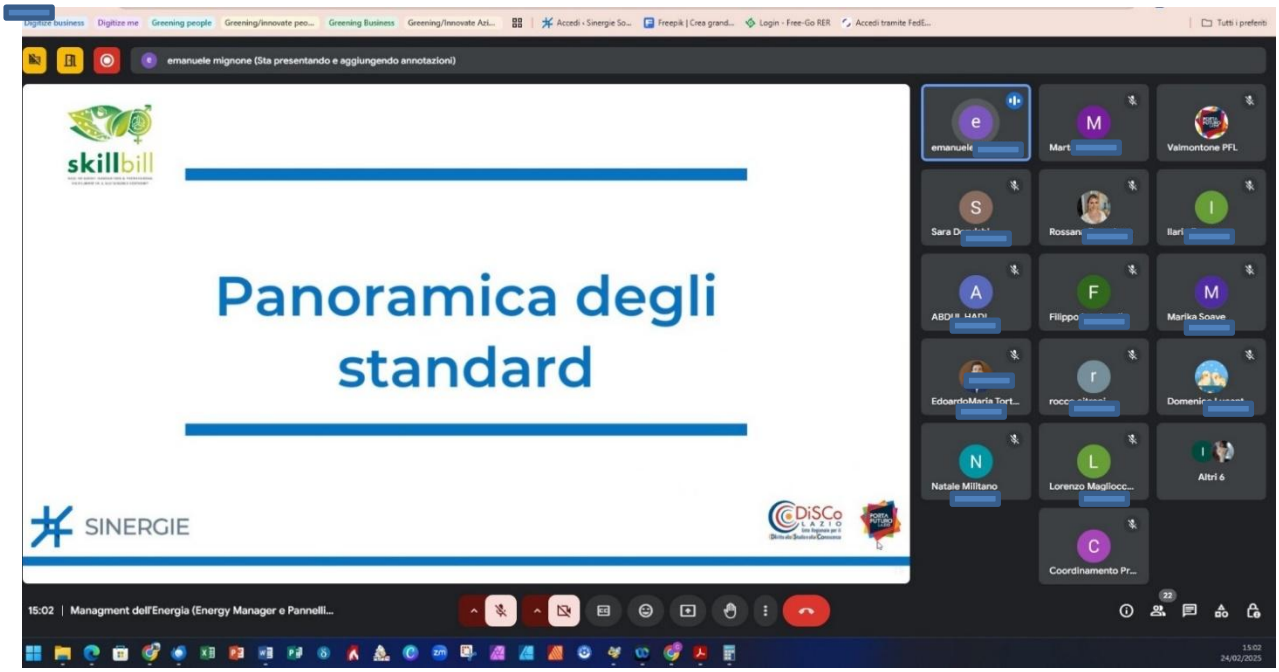


Figure 10: SKILLBILL Replication in Lazio (Management dell'energia)

The course content is organized into four modules. The first module introduces the concept of energy management, highlighting its significance and the role of the Energy Manager, alongside a brief overview of relevant European and national regulations. The second module focuses on renewable energy sources, particularly solar energy, and covers the basic functioning, installation, and maintenance of photovoltaic panels. It also contrasts renewable sources with fossil fuels, underscoring environmental and efficiency advantages.

In the third module, the programme addresses strategies for improving energy efficiency within enterprises. It includes methodologies for energy consumption analysis, energy auditing techniques, and monitoring tools. The final module explores sustainability and the broader transition to renewable energy. Here, participants engage with two interactive digital games specifically developed for the course: one simulates the responsibilities of an Energy Manager and the other focuses on solar panel technologies, reinforcing the practical understanding of the concepts presented.

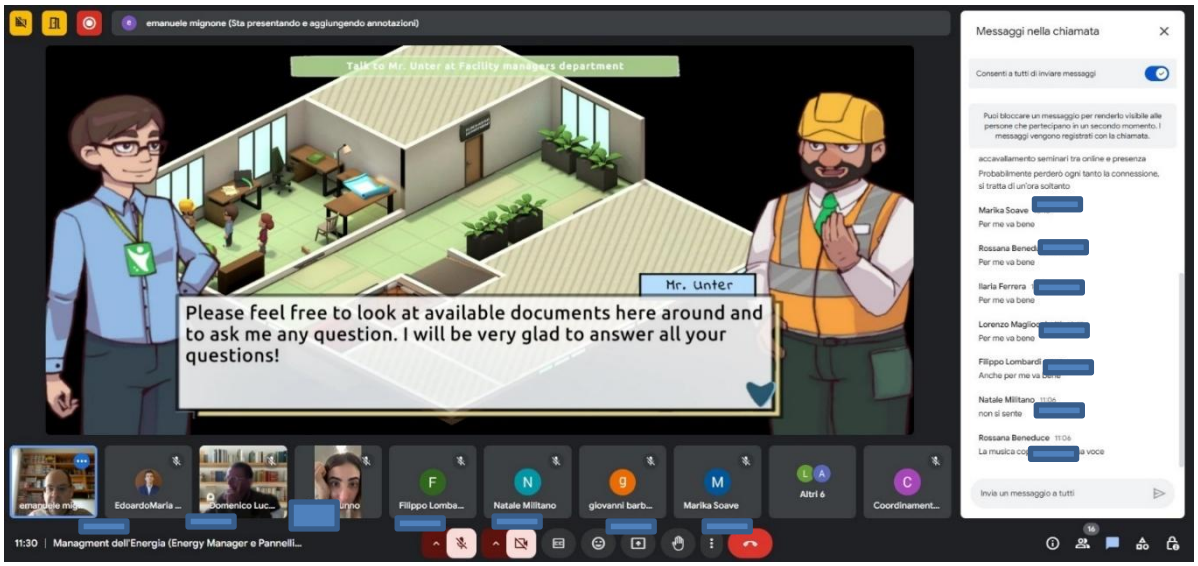


Figure 11: SKILLBILL Replication in Lazio (Management dell'energia) – using the AR Simulator

The course was scheduled across four consecutive afternoons and accommodated a maximum of 15 participants to ensure effective interaction. Expected outcomes included a solid grasp of energy management principles, knowledge of renewable technologies, and the ability to evaluate and manage energy consumption in business contexts. Participant engagement and comprehension are monitored through ongoing assessments, including quizzes and gamified learning tools, ensuring an engaging and effective educational experience.

The course was held from 19/05/2025 to 22/05/2025 for a total of 16h.

Second Replication of a technical joint EM + PV Panels installation training course in Lazio (planned for June 2025)

The course titled "**Impianti a fonti rinnovabili**" offers a comprehensive overview of renewable energy systems, covering the core technologies, principles of design, installation procedures, and management practices related to energy plants powered by renewable sources. It was tailored to meet the needs of technicians, designers, and professionals aiming to deepen or update their expertise in the fast-evolving renewable energy sector.

Structured to balance both theoretical knowledge and practical application, the course provides participants with solid competencies across a range of renewable technologies. These include photovoltaic systems, solar thermal solutions, wind power installations, biomass conversion systems, and geothermal energy applications. Throughout the training, emphasis is placed on the regulatory frameworks, economic implications, and safety standards relevant to each technology.

The course starts with a general introduction to Renewable Energy Sources (RES), establishing foundational concepts and contextualizing the role of renewables in contemporary energy strategies. It then progresses into specific modules focusing on each major technology: photovoltaic systems, exploring solar panel operation and integration; solar thermal systems, examining heat generation and storage; wind power installations, analyzing turbine types and site suitability; and biomass and geothermal energy, which delve into both solid biofuels and subsoil heat capture techniques. The programme concludes with a forward-looking module on future scenarios, encouraging participants to consider innovation trends and potential developments in the renewable energy landscape.

This targeted, multi-topic training path equips learners with the ability to distinguish between the characteristics and performance of different renewable energy systems, assess their suitability in residential and commercial contexts, and evaluate the return on investment of various technologies. By the end of the course, participants are expected to read and interpret technical specifications of renewable energy systems and apply this knowledge to real-world planning and implementation scenarios.

Expected results of the course include the ability to clearly distinguish the functional and technological characteristics of various renewable energy systems used in the building sector, both electrical and thermal. Participants are expected to understand the operational principles behind photovoltaic, solar thermal, wind, biomass, and geothermal technologies. Moreover, they should be capable of selecting the most appropriate renewable energy technology based on different environmental and contextual variables. A critical component of the learning outcomes is the understanding of the advantages and limitations of each system type, especially in residential applications.

Evaluation of results is conducted through ongoing case studies and project-based simulations, which serve to assess participant engagement and comprehension throughout the programme. These practical exercises are integral to verifying not only the assimilation of theoretical knowledge but also the capacity to apply it in real-world scenarios.

The course was held from 18/06/2025 to 20/06/2025 for a total of 12 h.

Replication in Slovakia

In line with the objectives of the SKILLBILL project to transfer innovative training approaches and digital tools for renewable energy and green skill development, replication activities of the Photovoltaic Panels Training Course in Slovakia were successfully launched during April and May 2025. These replications were implemented onsite **in two different educational institutions at the secondary and university levels.**

Namely, Matej Bel University in Banská Bystrica with its Faculty of Natural Sciences and Gymnázium Fiľakovo, a high school located in the southern part of Slovakia. Both institutions share a long-term interest in **enhancing their green education curricula** and expressed formal commitments to **integrating SKILLBILL methods and Augmented Reality (AR)-based learning tools into their regular teaching practices**.

Figure 12: Replication at Matej Bel University

Replication at Matej Bel University in Banská Bystrica

The replication activities at **Faculty of Natural Sciences of Matej Bel University** took place in April 2025 and involved testing the AR Simulators developed within the Photovoltaic panels course (VET). This step was preceded by personal meetings of PEDAL Consulting s.r.o, Simona Baldovska, with a member of the research and teaching staff aimed at the introduction of the PV course and exploring its potential applications. The trainer had previously **completed a Training of Trainers (ToT) course on photovoltaic panels**, providing a solid foundation for the subsequent replication.

Replication and testing the AR Simulators developed within the Photovoltaic panels course (PV VET) were successfully piloted and tested within the framework of the university subject **"Technique and Environment",** which includes partially a thematic focus on Renewable Energy. The training was initially designed for students, including both Slovak nationals and international students currently undertaking exchange or fellowship programs at the university. The first round of replication reached 15 students (8 female, 7 male). Other planned sessions will further expand the pool of trained students and contribute to the institutional mainstreaming of the methodology.

The replication served as an **effective opportunity to validate the pedagogical and technical relevance of the AR-based learning methodology**. Designed as a complementary tool to classroom-based instruction, the AR simulator facilitated a highly interactive and immersive learning experience, enabling students (particularly those with limited prior technical background) **to bridge theoretical content with practical, real-world applications**. By engaging with the simulator, students acquired foundational knowledge of photovoltaic technologies alongside professional-level insights into solar panel installation and operation principles.

The Faculty of Natural Sciences commended the pedagogical value of the simulator, noting its contribution to enhancing student motivation and comprehension through gamified, scenario-based learning. Considering the positive feedback and learning outcomes, the faculty has expressed strong interest in sustaining the use of SKILLBILL outputs beyond the project lifetime. Plans are currently under consideration **to integrate selected modules of PV course, along with the AR simulator (mobile game) into the regular curriculum of environmental science and teacher education programs, particularly those focused on STEM and sustainable development topics**.

Additional replication rounds are planned, aiming to expand the outreach to a wider student cohort and support the institutional mainstreaming of innovative teaching tools aligned with green and digital transition priorities.

Figure 13: Replication at Matej Bel University (2)

Replication at High School - Gymnázium Fiľakovo

In May 2025, a high school - **Gymnázium Fiľakovo** -, located in one of Slovakia's less developed regions, successfully replicated the photovoltaic (PV) panel training course. The training targeted two classes of **second- and third-year students enrolled in Physics and Computer Science within the Natural Sciences and Mathematics track, specifically under the thematic block Renewable energy and photovoltaics.** As with the UNI model, this replication was preceded by preparatory personal meetings with a member of the research and teaching staff to introduce the PV course and discuss its potential applications. The trainer, having previously completed the **Training of Trainers (ToT) programme** on photovoltaic panels, was well equipped to deliver the course effectively.

As part of the replication efforts, Gymnázium Fiľakovo implemented the Photovoltaic (PV) panels training course using the augmented reality (AR) simulator as a core teaching component. The activity reached a total of 29 students: 14 in the third grade (9 male, 5 female) and 15 in the second grade (9 male, 6 female) - within the broader thematic focus on renewable energy.

The primary learning objective was to increase students' awareness, knowledge and foundational understanding of renewable energy system, with an emphasis on photovoltaic technologies. The AR simulator served as a central pedagogical tool, enabling students to interactively explore (to visualize, manipulate, and understand) the principles of PV installation, grid integration, and environmental impact. Its use supported visual and experiential learning, significantly improving students' ability to conceptualize complex technological processes.

The feedback from both students and teachers was overwhelmingly positive, highlighted a high level of satisfaction, with many citing **increased motivation, greater and even more dynamic engagement with the subject matter, and a clearer understanding of real-world energy challenges and issues**. The immersive learning format and game-based interaction were especially effective in raising interest in STEM-related topics among younger students.

As formally expressed in a letter of intent, this institution also intends to annually integrate selected modules of the PV course and the mobile game AR simulator into its standard curriculum, particularly within physics and ICT instruction. This mirrors the commitment of Matej Bel University reflects a **shared strategy for institutionalizing green and digital learning approaches**. The relevance of this initiative and the expressed commitment is particularly significant in the context of southern Slovakia, where the integration of green competencies (energy literacy and green skills) into secondary education remains limited. As a STEM-focused institution, Gymnázium Fiľakovo, is well-positioned to serve as a regional frontrunner in piloting 21st-century innovative educational tools aimed at equipping students/young generations with 21st-century skills for the green transition.

Figure 14: Replication at Gymnazium Filakovo

Future outlook and institutional commitment

The successful replication in Slovakia established a strong foundation for further institutional cooperation and cross-border knowledge exchange within the European education ecosystem. Both participating institutions (Gymnázium Fiľakovo and Matej Bel University in Banská Bystrica) have expressed their intent to **mainstreaming the PV panels course**, embed the replication of the PV panels course - with particular emphasis on embedding the interactive digital game (AR game) simulating **solar panel installation and operation** - into their regular teaching cycles.

This institutional uptake reflects a broader pedagogical shift toward **experiential, competence-based learning**, aligned with national and EU-level goals for **the digitalization and greening of education systems**. These replications directly support the SKILLBILL project's objectives of strengthening vocational and general education pathways with applied, digitally supported training content.

Moreover, the Slovak replications demonstrate the transferability and scalability of the SKILLBILL approach across different education levels - from secondary schools to university - and across varying regional contexts. Looking ahead, the groundwork laid through these initial implementations opens up opportunities for future **national-level collaboration**, including the potential expansion of replication activities through partnerships with other Slovak educational institutions and stakeholders engaged in green skills development.

1.1.2 *SKILLBILL Courses KPIs*

Achieved Results and Alignment with Specific Objectives SO4 and SO5

Under Work Package 5, significant progress was made in developing and disseminating the SKILLBILL training courses. The training sessions were successfully implemented across multiple rounds and formats, involving both Training of Trainers (ToT) and Technical Courses focused on Energy Management and Photovoltaic Panels. The training materials were enhanced with digital tools such as AR/VR simulators and serious games, promoting immersive learning experiences.

In terms of outreach, the project achieved broad geographical and institutional engagement through targeted replication activities in regions such as Lazio and Emilia Romagna in Italy, as well as beyond - in Slovakia. These replications involved VET project managers, designers, coordinators, trainers, research and teaching staff, students etc. demonstrating the transferability and adaptability of the SKILLBILL methodology to diverse contexts, professional profiles as well as educational needs.

With reference to Specific Objective 4 (SO4), which aimed to promote the replicability and transferability of the project's innovative training approach, several milestones were reached. The use of Moodle for asynchronous access, the localisation of materials into national languages, and the deployment of replication seminars all contributed to achieving this objective. These actions showed that the SKILLBILL training resources can be flexibly embedded in existing VET structures and can be adapted for use by a wide range of education and training providers.

Specific Objective 5 (SO5) focused on ensuring gender balance, with a target of at least 20% female participation. According to the latest status report as of May 2025, this target was met or exceeded, marking a notable success in promoting inclusivity within the technical and energy-related training sectors — areas that have historically shown gender disparities. The project's outreach strategy and inclusive communication likely contributed to this achievement.

The training outcomes, participant feedback, and data collected from questionnaires will be included in the final deliverables. These will be supplemented by formal letters of endorsement from at least three organisations or companies that benefitted from the courses, further demonstrating the impact and sustainability of the project's training initiatives.

Course	Total n.	Women
EM ToT round 1	12	4
Em Course round 1	11	3
EM course round 2	9	4
PV ToT round 1	5	3
PV course round 1+2	6	2
Replication ToT Lazio	5	4
Replication ToT Emilia-Romagna	9	9
Replication PV+EM Lazio	19	8
EM ToT round 2	6	4
PV ToT round 2	6	3
PV replication Slovakia (University)	15	7
Replication PV+EM Lazio ed. 2	10	7
PV replication Slovakia (High school)	29	13
TOT	**142**	**71**
		50%

Table 1: SKILLBILL KPIs

The “snowball effect” – indirect impact of training

The letters of interest and commitment from partner organizations confirm the activation of targeted replication activities based on the SKILLBILL training courses and their associated digital tools. These letters provide concrete examples of the training model’s transferability and integration into existing or newly planned educational frameworks, and support the achievement of the project's replication and impact objectives.

The Faculty of Natural Sciences at the University of Matej Bel in Banská Bystrica (Slovakia) expressed its formal appreciation for the Photovoltaic Panels course and the AR simulator, highlighting their effectiveness in translating theoretical knowledge into practical understanding. The university recognized the educational value of the interactive tools and confirmed their intention to replicate selected modules, including the Mobile Game, within the subject Technique and Environment. **This activity targets 42 students**, both domestic and international, during the April–May 2025 semester. Furthermore, the university signaled its intention to continue replicating the course in subsequent academic years as part of its regular curriculum. This marks a concrete institutional embedding of the SKILLBILL methodology into formal higher education programming.

Faculty of Natural Sciences, Matej Bel University in Banská Bystrica

doc. PaedDr. Ján Stebila, PhD.
Vice-Dean for Education

Letter of Interest

[Institution Letterhead]
Faculty of Natural Sciences
University of Matej Bel in Banská Bystrica
Tajovského 40
Banská Bystrica (SK)
fpv@umb.sk

03.04.2025

To:
Sinergie soc.cons. a r.l.
SINERGIE
Via Martiri di Cervarolo 74/10
Reggio Emilia (IT)

Subject: Appreciation for the Course and Interest in AR Simulator

Dear Representatives of Sinergie soc.cons. a r.l.,

On behalf of Faculty of Natural Sciences University of Matej Bel in Banská Bystrica, I would like to express our sincere appreciation for the training and educational courses. We appreciate the effort invested in developing the Photovoltaic panels course and its value in enhancing learners' understanding of photovoltaic (PV) panel installations. The hands-on methodology, particularly the use of interactive tools to illustrate real-world applications, aligns with our educational objectives.

As an organization dedicated to education and capacity building, we recognize the immense potential of the SKILLBILL course aimed to PV panels and the AR simulator in bridging the gap between theoretical knowledge and practical application. We find the course highly relevant, practical, and engaging, and we are interested in implementing it within our institution to enhance skill development and professional training.

We intend to replicate selected modules and incorporate the Mobile game as part of our educational activities within the subject Tecnique and Environment targeting 42 domestic and foreign university students during April and May 2025. Furthermore, we would like to continue replicating the course in the next academic year as part of our regular teaching curriculum.

Thank you for your dedication to advancing training methodologies in renewable energy and look forward to potential collaboration avenues.

Best regards,
doc. PaedDr. Ján Stebila, PhD.
Vice-Dean for Education
Faculty of Natural Sciences
University of Matej Bel in Banská Bystrica

Univerzita Mateja Bela v Banskej Bystrici
Fakulta prírodných vied
Tajovského 40
974 01 Banská Bystrica
-5-

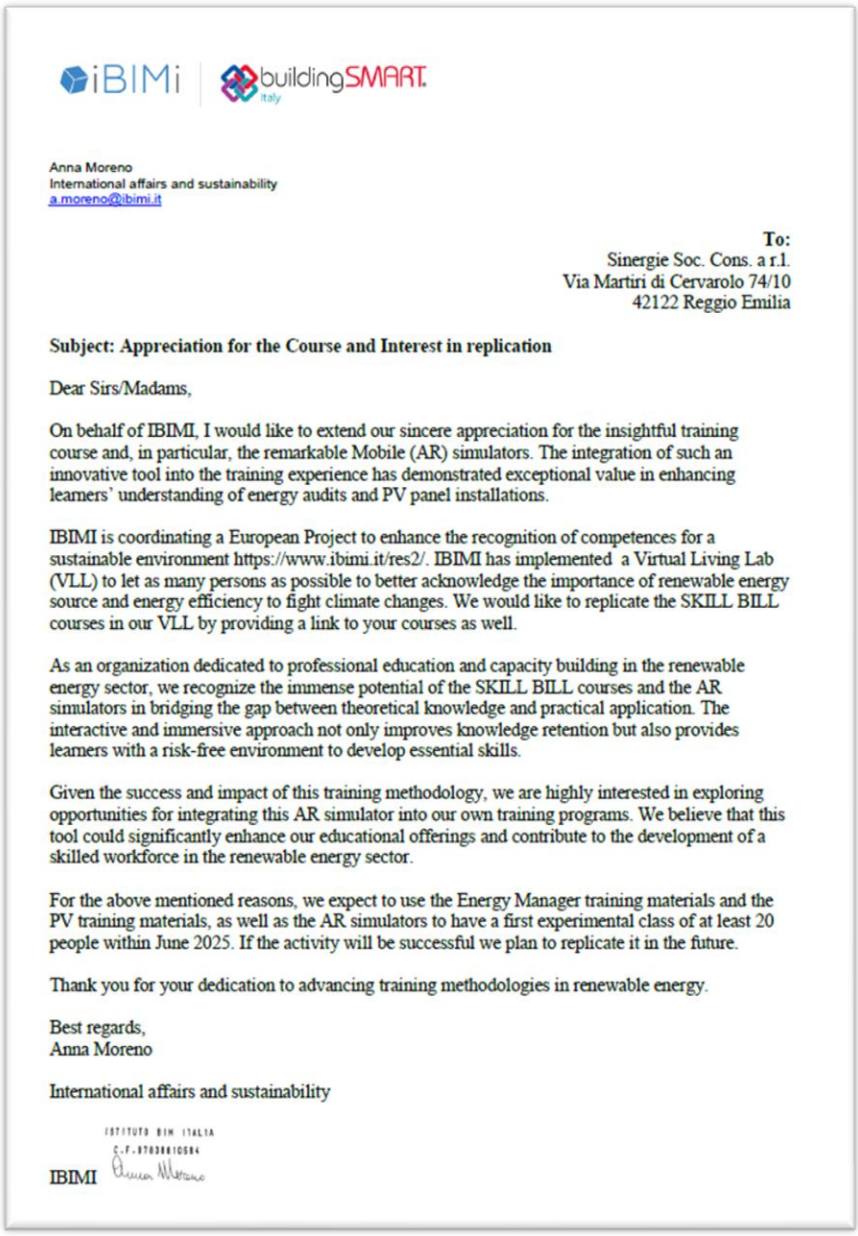
Tel: +421 48 446 7433
Tel: +421 905 198 054

Email: jan.stebila@umb.sk
Web: www.fpv.umb.sk/jstebila

Tajovského 40
974 01 Banská Bystrica

Figure 15: Matej Bel University replication letter

Additionally, IBIMI – the Italian Institute for Building Information Modeling, which is coordinating a European project on competence recognition for sustainability, confirmed its intent to replicate the SKILLBILL courses within its Virtual Living Lab (VLL). The VLL is designed to provide open access educational resources promoting awareness on renewable energy and energy efficiency. IBIMI plans to integrate the SKILLBILL Energy Manager and Photovoltaic Panels training materials, along with the AR simulators, into this platform. Their goal is to organize an experimental class of **at least 20 participants** by June 2025. Conditional on the outcome of this pilot, further replications are foreseen. This initiative also involves direct digital linkage to the original SKILLBILL materials, further amplifying dissemination.



iBIMi | buildingSMART italy

Anna Moreno
International affairs and sustainability
a.moreno@ibimi.it

To:
Sinergie Soc. Cons. a r.l.
Via Martiri di Cervarolo 74/10
42122 Reggio Emilia

Subject: Appreciation for the Course and Interest in replication

Dear Sirs/Madams,

On behalf of IBIMI, I would like to extend our sincere appreciation for the insightful training course and, in particular, the remarkable Mobile (AR) simulators. The integration of such an innovative tool into the training experience has demonstrated exceptional value in enhancing learners' understanding of energy audits and PV panel installations.

IBIMI is coordinating a European Project to enhance the recognition of competences for a sustainable environment https://www.ibimi.it/res2/. IBIMI has implemented a Virtual Living Lab (VLL) to let as many persons as possible to better acknowledge the importance of renewable energy source and energy efficiency to fight climate changes. We would like to replicate the SKILL BILL courses in our VLL by providing a link to your courses as well.

As an organization dedicated to professional education and capacity building in the renewable energy sector, we recognize the immense potential of the SKILL BILL courses and the AR simulators in bridging the gap between theoretical knowledge and practical application. The interactive and immersive approach not only improves knowledge retention but also provides learners with a risk-free environment to develop essential skills.

Given the success and impact of this training methodology, we are highly interested in exploring opportunities for integrating this AR simulator into our own training programs. We believe that this tool could significantly enhance our educational offerings and contribute to the development of a skilled workforce in the renewable energy sector.

For the above mentioned reasons, we expect to use the Energy Manager training materials and the PV training materials, as well as the AR simulators to have a first experimental class of at least 20 people within June 2025. If the activity will be successful we plan to replicate it in the future.

Thank you for your dedication to advancing training methodologies in renewable energy.

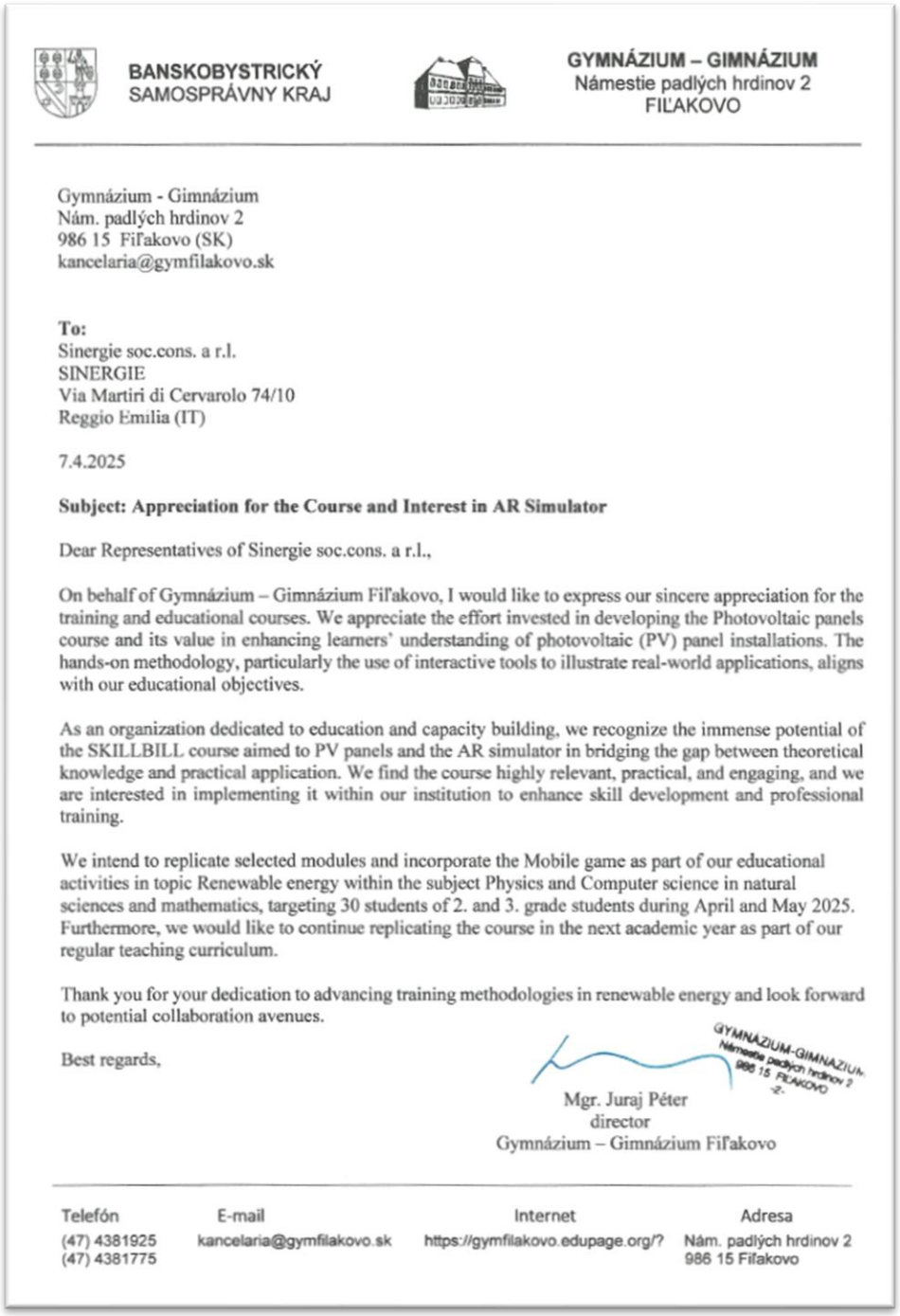
Best regards,
Anna Moreno

International affairs and sustainability

IBIMI

Figure 16: IBIMI replication letter

A third letter of interest came from Gymnázium – Gymnázium Fiľakovo, a High School in Banska Bystrica self-governing region (Slovakia). It expressed appreciation for the SKILLBILL training course on photovoltaic (PV) panels, praising its practical, hands-on methodology and the use of interactive tools. The school finds the course highly relevant and expresses interest in implementing it, including the AR simulator and mobile game, into their curriculum for about 30 second- and third-grade students in April and May 2025. They also indicate plans to continue using the course in the following academic year.



BANSKOBYSTRICKÝ
SAMOSPRÁVNY KRAJ

GYMNÁZIUM – GIMNÁZIUM
Námestie padlých hrdinov 2
FIĽAKOVO

Gymnázium - Gimnázium
Nám. padlých hrdinov 2
986 15 Fiľakovo (SK)
kancelaria@gymfilakovo.sk

To:
Sinergie soc.cons. a r.l.
SINERGIE
Via Martiri di Cervarolo 74/10
Reggio Emilia (IT)

7.4.2025

Subject: Appreciation for the Course and Interest in AR Simulator

Dear Representatives of Sinergie soc.cons. a r.l.,

On behalf of Gymnázium – Gimnázium Fiľakovo, I would like to express our sincere appreciation for the training and educational courses. We appreciate the effort invested in developing the Photovoltaic panels course and its value in enhancing learners' understanding of photovoltaic (PV) panel installations. The hands-on methodology, particularly the use of interactive tools to illustrate real-world applications, aligns with our educational objectives.

As an organization dedicated to education and capacity building, we recognize the immense potential of the SKILLBILL course aimed to PV panels and the AR simulator in bridging the gap between theoretical knowledge and practical application. We find the course highly relevant, practical, and engaging, and we are interested in implementing it within our institution to enhance skill development and professional training.

We intend to replicate selected modules and incorporate the Mobile game as part of our educational activities in topic Renewable energy within the subject Physics and Computer science in natural sciences and mathematics, targeting 30 students of 2. and 3. grade students during April and May 2025. Furthermore, we would like to continue replicating the course in the next academic year as part of our regular teaching curriculum.

Thank you for your dedication to advancing training methodologies in renewable energy and look forward to potential collaboration avenues.

Best regards,

GYMNÁZIUM-GIMNÁZIUM
Námestie padlých hrdinov 2
986 15 FIĽAKOVO

Mgr. Juraj Péter
director
Gymnázium – Gimnázium Fiľakovo

Telefón	E-mail	Internet	Adresa
(47) 4381925 (47) 4381775	kancelaria@gymfilakovo.sk	https://gymfilakovo.edupage.org/?	Nám. padlých hrdinov 2 986 15 Fiľakovo

Figure 17: Gymnazium Fil'akovo replication letter

These replication activities demonstrate strong stakeholder engagement and institutional endorsement of the project's outputs. They also underline the adaptability of SKILLBILL content to different training contexts - ranging from university-level teaching to professional upskilling in the energy sector - validating the relevance, quality, and sustainability of the developed training resources.

In addition to the directly trained people listed in table, the collaboration with these 3 replicators generates a "snowball effect" (i.e. additional people indirectly trained by SKILLBILL) of 92 people:

Course	Total n.
IBIMI course RES2 (LIFE+ project)	20
University of Matej Bel in Banská Bystrica	42
Gymnasium Filakovo	30
TOT	**92**

Table 2: SKILLBILL "snowball effect"

2. EVALUATION OF SKILLBILL COURSES

2.1 General Evaluation of SKILLBILL Courses

A sample of 42 participants to training courses filled in a feedback questionnaire.

The questionnaire was collected embedding a QR code in live lessons and including the link to a Google form within the training modules offered through Moodle.

Here is a copy of the Evaluation questionnaire.

Nationality

What is your profession?*

In which course are you enrolled*

Energy Manager

Photovoltaic Panels

Energy Manager Training of Trainers

Photovoltaic Panels Training of Trainers

Other: local editions

Please indicate how much you agree with the following statements:

I'm excited about participating in the SKILLBILL project*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

I understand what the SKILLBILL project is about, and how I can contribute to its success*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

I've already used Simulation Technology (e.g. VR/AR, gaming…) in training session*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to develop technical skills*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

I think that using Simulation Technologies (eg.e.g. VR/AR, mobile games, etc.) is useful to develop soft skills (behaviours, time management)*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to maintain adequate level of safety during training*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

Please take a few minutes to complete these questions. There are no right or wrong responses. You can be as honest and direct as you like. Your answers will help us deliver a better training for you.

By attending this training, I expected to learn more about the following:

[text box]

Thinking about using mobile simulators or VR/AR technologies in my training activities, I anticipate the following difficulties:

[text box]

The mobile simulator I tried is well conceived*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

The mobile simulator I tried is useful in developing technical skills*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

The mobile simulator I tried is useful in developing soft skills (role, behaviours)*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

The mobile simulator I tried is useful in learning safety skills*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

The training kit for trainers is well conceived and useful*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

I am satisfied about the training session I participated*

	1	2	3	4	5	
completely disagree	○	○	○	○	○	completely agree

Data Analysis

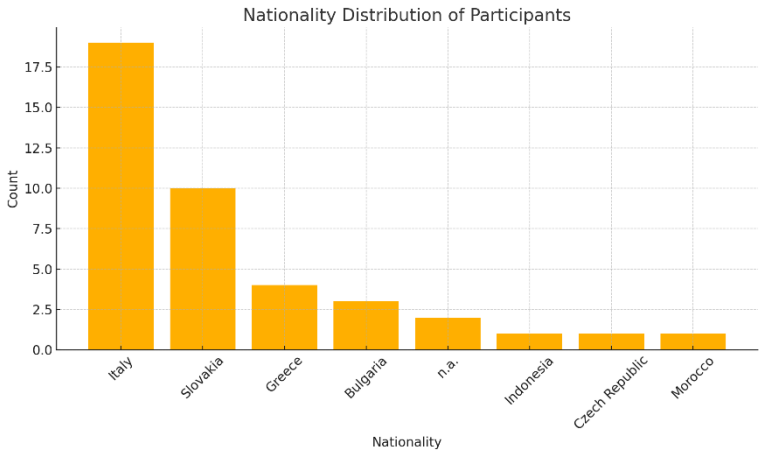


Figure 18: Distribution of courses participants' nationality

Italy is the most represented nationality (19), followed by Slovakia (10) and Greece (4). The chart and table show a clear concentration from a few countries, with a few participants from Bulgaria, Indonesia, Morocco, and others.

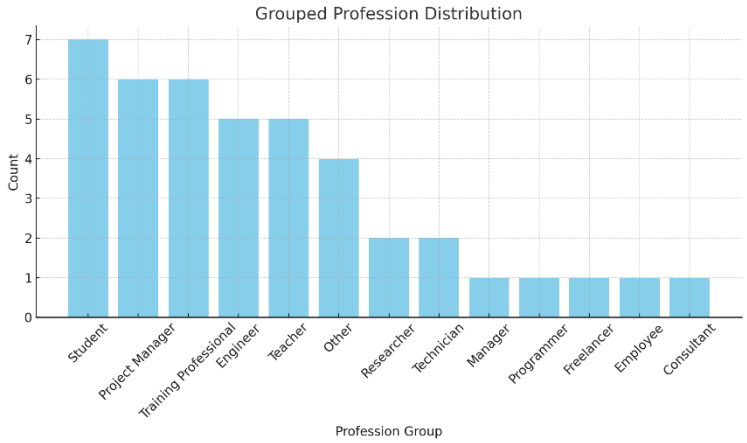


Figure 19: Distribution of participants' profession

The chart reveals a diverse distribution of professions among the participants, with certain categories standing out:

- Students form the largest group (7 participants), followed closely by Project Managers and Training Professionals (6 each).
- Engineers and Teachers also have significant representation (5 each), reflecting a strong technical and educational profile within the group.
- Smaller categories such as Researchers, Technicians, and Managers show a broader range of professional backgrounds, although with fewer individuals.

Overall, the data suggests a multidisciplinary audience, predominantly composed of individuals from the education, training, engineering, and management sectors. This implies that the program or activity is particularly relevant and appealing to these professional profiles.

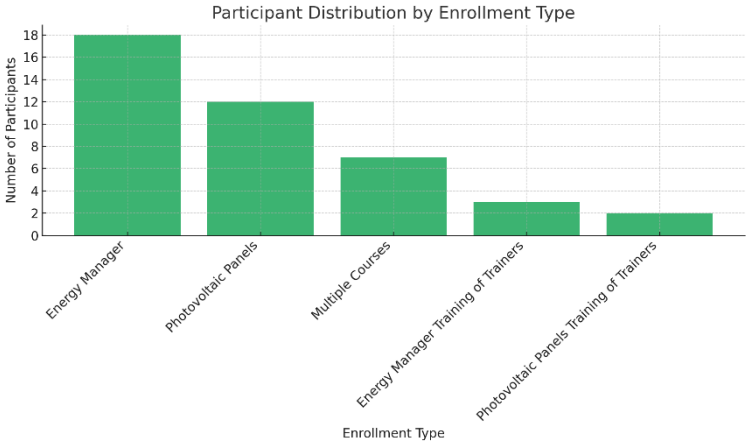


Figure 20: Distribution of attended courses

The chart illustrates the distribution of participants based on their course enrollment types, with a total of 42 individuals.

- "Energy Manager" is the most attended course, with 18 participants, highlighting strong interest in energy management roles and topics.
- "Photovoltaic Panels" follows with 12 participants, showing a significant engagement in solar energy solutions.
- "Multiple Courses", with 7 participants, indicates that a notable portion of attendees are pursuing a broader training scope by enrolling in multiple learning paths.

- "Energy Manager Training of Trainers" is selected by 3 participants, suggesting a smaller but specialized group focused on cascading energy management knowledge.
- "Photovoltaic Panels Training of Trainers", with 2 participants, represents a niche audience aiming to train others in photovoltaic technologies.

This distribution shows a dominant interest in foundational and professional energy training, with a meaningful segment of participants invested in teaching and knowledge dissemination, especially in the renewable energy sector.

2.2 Evaluation of the AR Simulators

Comprehensive Evaluation of Training and Simulation Tools

The table below presents the average scores for all evaluation questions included in the SKILLBILL Training of Trainers feedback questionnaire. Participants rated items related to their engagement, understanding, and perception of the tools and methodologies used, including mobile simulators and AR-based technologies.

Question	Average Score
I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to develop technical skills	4.36
I am satisfied about the training session I participated	4.21
I'm excited about participating in the SKILLBILL project	4.19
I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to develop soft skills (behaviours, time management)	4.12
I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to maintain adequate level of safety during training	4.10
The mobile simulator I tried is useful in learning safety skills	4.07
The mobile simulator I tried is useful in developing technical skills	4.02
The mobile simulator I tried is useful in developing soft skills (role, behaviours)	4.02
The training kit for trainers is well conceived and useful	4.02
The mobile simulator I tried is well conceived	3.98
I understand what the SKILLBILL project is about, and how I can contribute to its success	3.93

I've already used Simulation Technology (e.g. VR/AR, gaming...) in training session	3.62

Table 3: AR simulators global evaluation

The overall satisfaction with the SKILLBILL training program appears to be very positive, based on the average scores reported across key evaluation questions:

- The statement "I am satisfied about the training session I participated" received an average score of 4.21 out of 5, placing it among the highest-rated aspects. This indicates a high level of participant satisfaction with the experience, reflecting well on both the structure and delivery of the training.
- The high score of 4.36 for the usefulness of simulation technologies in developing technical skills reinforces this satisfaction, showing that participants value the practical relevance and innovation embedded in the program.
- Similarly, scores above 4.0 for items related to soft skills development, safety training, and the trainers' kit suggest that the materials and tools provided are seen as effective and professionally enriching.
- The slight dip in the score (3.98) for how well the mobile simulator is conceived suggests room for improvement in design or usability, but the impact on overall satisfaction appears minimal.

In summary, the data highlights **strong participant engagement, satisfaction, and appreciation** for the modern training methods used—particularly AR and mobile simulations—with minor areas identified for enhancement.

Participants' responses to the open-ended questions reflect thoughtful engagement with both the training content and the tools used. In terms of learning expectations, many hoped to deepen their understanding of technical skills—particularly those related to photovoltaic panel installation—and how to effectively design and deliver training projects. Several respondents emphasized their interest in applying these skills to real-world, blue-collar work contexts. Regarding anticipated difficulties with implementing mobile simulators or AR/VR technologies, participants identified potential barriers such as high technical costs, limited digital skills among target learners, and the need to complement digital tools with traditional, face-to-face instruction. Despite these concerns, some participants noted no significant difficulties, indicating an overall openness to adopting innovative training methods.

Energy Manager vs PV Panels course and AR simulator

This table presents the average scores for evaluation questions answered by participants enrolled in the Energy Manager and PV course. The feedback reflects participants' perspectives on the training experience, the use of simulation technologies, and overall satisfaction. The evaluation did not take into consideration those enrolled in multiples courses as their feedback includes both the simulators and course packages.

Question	Energy Manager	Photovoltaic Panels
I'm excited about participating in the SKILLBILL project	4.45	4.50

I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to develop soft skills (behaviours, time management)	4.18	4.38
I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to develop technical skills	4.09	4.38
I think that using Simulation Technologies (e.g. VR/AR, mobile games, etc.) is useful to maintain adequate level of safety during training	4.09	4.25
I am satisfied about the training session I participated	4.00	4.12
I understand what the SKILLBILL project is about, and how I can contribute to its success	3.82	4.12
The mobile simulator I tried is useful in developing soft skills (role, behaviours)	3.73	4.00
The training kit for trainers is well conceived and useful	3.64	4.00
The mobile simulator I tried is well conceived	3.55	3.88
The mobile simulator I tried is useful in learning safety skills	3.55	3.88
The mobile simulator I tried is useful in developing technical skills	3.45	3.50
I've already used Simulation Technology (e.g. VR/AR, gaming…) in training session	3.36	3.50

Table 4: AR simulators compared evaluation

The comparative analysis of participant feedback for the Energy Manager and Photovoltaic Panels courses highlights some clear trends in terms of overall satisfaction and perceived effectiveness.

Overall Satisfaction

Both courses received high satisfaction scores, but the Photovoltaic Panels course slightly outperformed the Energy Manager course, with an average satisfaction score of 4.12 compared to

4.00. This suggests that, while both programs were well received, participants in the Photovoltaic Panels course found the experience marginally more satisfying.

Engagement and Clarity

Participants in the Photovoltaic Panels course also reported slightly higher enthusiasm about participating in the SKILLBILL project (4.50 vs. 4.45), and felt better informed about the project's objectives and their role (4.12 vs. 3.82). This indicates more effective communication and engagement in the Photovoltaic Panels training.

Perceived Usefulness of Simulation Technologies

On all three dimensions of simulation effectiveness (technical skills, soft skills, safety), Photovoltaic Panels scored consistently higher, suggesting that participants viewed the simulation tools as more impactful in this course. For instance:

- Technical skill development: 4.38 (PV) vs. 4.09 (EM)

- Soft skill development: 4.38 (PV) vs. 4.18 (EM)

- Safety training: 4.25 (PV) vs. 4.09 (EM)

Evaluation of Simulation Tools

The mobile simulator and trainer kit also received higher ratings from the Photovoltaic Panels group:

- Simulator conception: 3.88 (PV) vs. 3.55 (EM)

- Usefulness in safety: 3.88 (PV) vs. 3.55 (EM)

- Usefulness in soft skills: 4.00 (PV) vs. 3.73 (EM)

- Trainer kit: 4.00 (PV) vs. 3.64 (EM)

Prior Experience with Simulation

A similar portion of participants in both groups had used simulation technologies before, with Photovoltaic Panels showing a slightly higher average (3.50 vs. 3.36), but this difference is marginal.

Conclusion

While both courses are well-regarded by participants, the Photovoltaic Panels course demonstrates higher satisfaction and stronger perceived value across nearly all evaluation dimensions. This could be attributed to more engaging content, better integration of AR/VR tools, or more effective delivery strategies. These insights could help inform enhancements to the Energy Manager course, particularly in communication, simulator integration, and training support materials.

Considering the roles, we had 32 participants to Technical Courses (EM, PV or EM+PV) and 10 participants to the training of trainers (EM, PV or EM+PV). Technical courses participants showed an overall satisfaction of 3.98/5, Trainers scored 4.29/5.

This suggests that Trainers, possibly due to their instructional background, were more aligned with the strategic aspects of the initiative.

Both groups viewed simulation technologies positively, though Trainers consistently rated their effectiveness slightly higher. For example, they rated the usefulness of simulations for developing technical skills at 4.5, while Technicians gave a slightly lower score of 4.31. A similar trend is observed for soft skill development, where Trainers rated the tools at 4.3 compared to 4.06 from Technicians. These results indicate that Trainers may be more attuned to the broader educational potential of such tools.

Overall, while both groups responded positively to the training, Trainers evaluated the program more favourably in terms of understanding, tool effectiveness, and integration into learning strategies. Technicians showed strong engagement but could benefit from clearer orientation and contextual framing to fully appreciate the scope and purpose of the initiative.

3. THE FUTURE OF SKILLBILL COURSES

3.1 Exploitation strategy and further developments

Further replication was also planned through the integration of SKILLBILL modules into existing training offers. Examples include the embedding of the Energy Audit module—presented as PowerPoint slides and videos—and the mobile game within a 300-hour Energy Manager Qualification Course, as well as the inclusion of materials in ISO 50001 training programmes and broader catalogues of VET courses for professionals and companies.

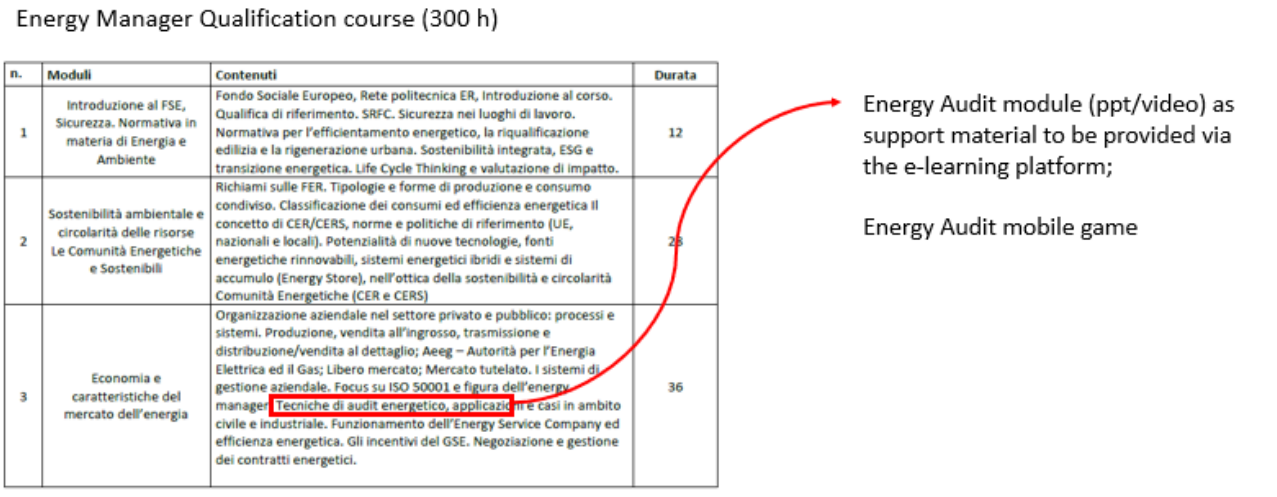


Figure 21: Embedding EM Simulator in a 300h Qualification Course

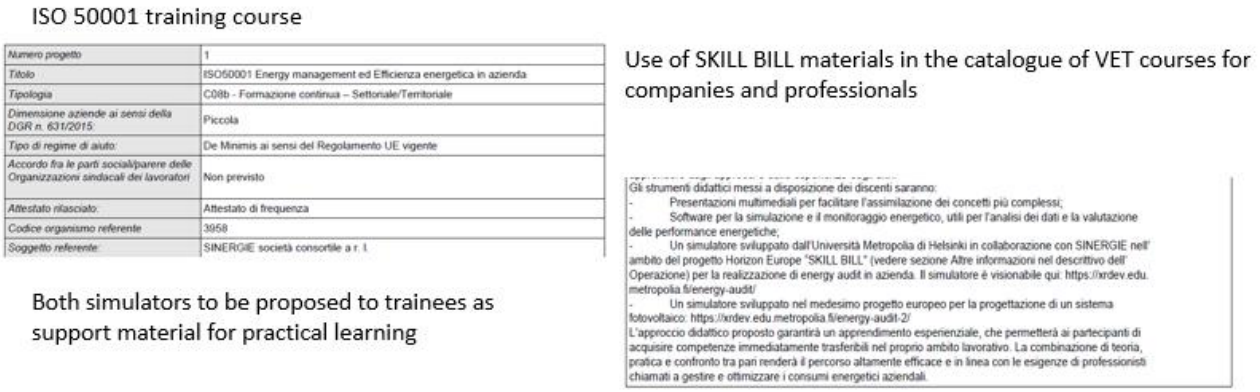


Figure 22: Embedding EM Simulator in company training

To ensure accessibility across linguistic and national contexts, localised versions of selected SKILLBILL courses were under development, using AI-assisted translation followed by partner-led review. Additional replication seminars were envisaged to present SKILLBILL materials and simulators in local languages, targeting VET bodies, professional associations, companies, and VET schools. These seminars mirrored the ToT format and included translated presentations and storyboards to facilitate effective dissemination.

This multi-layered training offer has demonstrated the scalability and adaptability of SKILLBILL courses, supporting their deployment in diverse educational and professional settings. The project ensured the collection of participant feedback and committed to including narrative and quantitative documentation of training outcomes and replications in the final deliverables, to be submitted in May 2025.

4. CONCLUSIONS

The evaluation of the SKILLBILL training activities confirms the project's success in designing, implementing, and scaling innovative, inclusive, and replicable vocational education and training (VET) pathways in the renewable energy sector. By combining technical instruction with pedagogical training and digital innovation—including AR/VR simulators and serious games—the project effectively equipped a diverse audience of students, trainers, and technicians with the skills necessary for the green transition.

The project demonstrated that a blended learning model, integrating asynchronous online modules with live sessions and interactive simulations, enhances accessibility and learner engagement. Participants responded positively to the simulation-based methods, particularly in the Photovoltaic Panels courses, which received high satisfaction ratings for their impact on technical, behavioural, and safety-related skills.

SKILLBILL’s approach proved highly adaptable across different educational systems and regional contexts. Successful replications in Italy and Slovakia, involving secondary schools, universities, and training institutions, confirm the model’s transferability and potential for broader institutional uptake. This was further reinforced by strong institutional partnerships and formal commitments to embed SKILLBILL resources into regular curricula.

A key achievement was the project’s commitment to gender inclusion, achieving a 50% female participation rate and expanding its reach through a “snowball effect” that indirectly trained an additional 92 learners via partner-led implementations. This success was supported by targeted outreach and inclusive design choices.

Training of Trainers (ToT) activities emerged as a cornerstone for sustainability, with trainers not only expressing high satisfaction but also acting as multipliers capable of cascading the methodology within their institutions. Their alignment with the project's strategic goals suggests strong potential for ongoing dissemination and advocacy.

However, the deployment of digital tools highlighted the need for supportive infrastructure and pedagogical framing. The effectiveness of AR/VR technologies depended on early onboarding, user-friendly interfaces, and their integration within structured instructional frameworks. Lessons also pointed to the need for local customization, including language translation and alignment with national standards and labour market demands, to maximize relevance and uptake.

The project

SKILLBILL's overall objective is to develop a large and strong foundation for the growth and acceleration of renewable energy's deployment, thanks to engaging with stakeholders of the whole chain, diffusing scientific culture and skilling multi-level workers. The basic idea underling the project is that the knowledge should be diffused at several different levels and qualitatively appropriate both to train the adequate number of workers and to increase RES awareness and to reach a more social and inclusive Europe. The project aims at creating several pathways to induce target groups to get interested or involved in RES besides their initial level of education and their working position. It's important, beside the creation of instruments for the upskilling and reskilling of workers, technician and designers, to have awareness modules for unspecific public in order to fight against lack of information, bad quality material, gender gap and the phenomenon of functional illiteracy: it is widely documented that lifelong suitable learning process is the fundamental driver to support the development, maintenance and update of skills. Thus, SKILLBILL proposes concrete actions to accelerate the deployment of renewable energy at different levels to analyse and involve all the interested parts in open discussion using adequate language; create several different pathways to increase skills after having mapped knowledge gap and without gender prejudice; develop and implement innovative learning method; and evaluate the work performed.

Coordinator: **AZZERO CO2 SRL (AzzeroCO2)**

PARTNER		SHORT NAME
AzzeroCO2 climate in our hands	AZZERO CO2 SRL	AzzeroCO2
Q-PLAN INTERNATIONAL	Q-PLAN INTERNATIONAL ADVISORS PC	Q-PLAN
WHITE	WHITE RESEARCH SPRL	WR
Università degli Studi della Tuscia	UNIVERSITA DEGLI STUDI DELLA TUSCIA	UNITUS
Universidad de Sevilla	UNIVERSIDAD DE SEVILLA	USE
Metropolia University of Applied Sciences	METROPOLIA AMMATTIKORKEAKOULU OY	METROPOLIA
Utrecht University	UNIVERSITEIT UTRECHT	UU
EREF European Renewable Energies Federation	EUROPEAN RENEWABLE ENERGIES FEDERATION	EREF
SINERGIE	SINERGIE SOC CONS ARL	SINERGIE
PEDAL CONSULTING	PEDAL CONSULTING SRO	PC