

# Smart Energy Solutions for a Sustainable Future S3SF

## Transnational VET curriculum

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# Transnational VET curriculum

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## The S3SF Project

The Smart Energy Solutions for a Sustainable Future (S3SF) project aims to develop a transnational vocational education and training program. It will equip professionals with smart energy system skills and provide a methodology and digital platform for simulating energy savings.

The training will focus on energy efficiency, user-centric systems, entrepreneurial attitudes, and digital skills. It also promotes a decentralized training approach and smart energy system adoption through simulations.

The project will develop an innovative curriculum and implement a digital platform for energy savings simulation. Pilot training sessions across partner countries will assess and refine the project. Additionally, S3SF seeks to build a network of VET providers, engage stakeholders, and disseminate results. S3SF targets digital skills, energy & resources, and green skills, addressing the demand for a skilled green energy workforce and enhancing the Smart Energy Systems (SES) workforce across the value chain. It involves analysing current training programs and engaging stakeholders to identify gaps and opportunities. This analysis will inform the development of training and SES strategies.

The project also includes skills mapping in the construction industry, identifying existing gaps and informing future training development.

The program aims to foster collaboration, encourage diversity, business attitudes, and digital skill development, contributing to upskilling in Smart Energy Solutions.

## Table of Contents

<b>1. Introduction</b> .....	5
1.1 The S3SF Transnational VET Curriculum .....	5
<b>2. Target groups</b> .....	5
2.1 Target group description .....	5
2.1 Analysis of training needs of target groups .....	6
<b>3. The S3SF training programme and qualification frameworks</b> .....	7
Introduction .....	7
3.1 EQF level descriptors .....	7
3.2 ECVET (European Credit System for Vocational Education and Training) principles .....	8
3.3 Definition of Learning Outcomes .....	8
<b>4. The S3SF training programme</b> .....	10
4.1 The S3SF training programme: overview.....	10
4.2 Structure of the S3SF modular course material .....	17
<b>5. Assessment and Certification</b> .....	18
5.1 Key concepts .....	18
5.2 Digital badge definition .....	18
5.3 The S3SF badges .....	18
<b>6. Definition of methods and approaches</b> .....	19
6.1 Blended and online learning.....	19
6.2 The S3SF training platform .....	19
<b>Annex - Module frameworks</b> .....	21
Module 1 - Energy Generation and System Integration with Commissioning.....	21
Module 2 – Energy Economics. Understanding and Managing Costs .....	23
Module 3 – Operational Security and Compliance .....	28
Module 4 – Energy Management Systems .....	31
Module 5 – Project Execution and Professional Skills in the Energy Sector .....	33
Module 6 – Technology Application and Innovation .....	35
<b>List of Figures and Tables</b> .....	37
<b>References</b> .....	37

## 1. Introduction

### 1.1 The S3SF Transnational VET Curriculum

The S3SF transnational VET curriculum was developed with the help of various interdisciplinary stakeholders of groups, who are interested in highly qualified graduates in the field of energy efficiency and carbon emission reduction experts from academicians, VET providers and technicians, who can integrate the training content into their work.

In particular, Vocational education and training (VET) providers play a crucial role in the implementation and delivery of the training program developed within the S3SF project, ensuring that the curriculum reaches energy professionals entering or advancing in the smart energy systems field.

The present VET curriculum provides guidance in using the S3SF modules and related units of learning in different settings:

- face-to-face teaching
- blended or distance learning with trainer support
- self-directed and/or group study

The modules and units of learning are created as Open Educational Resources (OER) and licensed under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. They are free to download, adapt and use within the terms and conditions of the license. The online version of the training material can be found on the project website. The modules are available in English.

## 2. Target groups

### 2.1 Target group description

The S3SF target groups (Fig.1) include a diverse range of professionals involved in the energy sector (see Result 2.1 Comprehensive analysis report). The main target groups of S3SF are:

- **Energy professionals:** The project aims to develop and deliver a vocational education and training program specifically designed for professionals in the energy sector, with a focus on smart energy systems and energy efficiency.
- **Vocational education and training (VET) providers:** VET providers play a crucial role in the implementation and delivery of the training program developed by S3SF, ensuring that the curriculum reaches professionals entering or advancing in the smart energy systems field.
- **Businesses and households:** By training professionals in smart energy systems, S3SF can ultimately help businesses and households adopt more energy-efficient technologies and practices, contributing to overall energy savings and reducing costs.

- **Policymakers and regulatory bodies:** Engaging with these stakeholders can help ensure that the S3SF project aligns with existing policies and regulations, while also influencing future policy development to support the widespread adoption of smart energy systems.
- **Industry associations and organizations:** These groups can help promote the S3SF project, disseminate best practices, and facilitate networking and collaboration among energy professionals, businesses, and other stakeholders.
- **Underrepresented groups:** S3SF aims to promote equal opportunities and encourage participation from underrepresented groups in the energy sector, such as women and minorities, fostering diversity and inclusivity in the field.



Figure 1: The S3SF target groups

## 2.1 Analysis of training needs of target groups

The Comprehensive analysis report: Analysis of Current Training Programs & Best Practices (Project result 2.1) revealed a lack of comprehensive courses covering the combined fundamentals of existing and emerging energy systems. It also suggested to the project consortium the need for holistic and integrated training designs, incorporating innovative systems proposed by focus groups and project partners.

The key focus areas for enhancing Smart Energy Vocational Education and Training are:

- **Renewable Energy Technologies:** Tailoring training to focus on solar, wind, and other renewable sources, adapted to regional climates.
- **IoT and Smart Grid Technologies:** Courses on Internet of Things applications in energy management and smart grid tech.

- Data Analytics and AI in Energy Systems: Educating on big data and AI for energy system optimization and modelling.
- Project Management in the Energy Sector: Practical skills in managing energy projects, including EU regulations and funding aspects.
- Energy Storage Solutions: Training on emerging technologies for energy storage, critical for renewable integration.
- Cybersecurity in Energy Systems: Emphasizing the importance of securing energy systems against cyber threats.
- Policy and Regulation: Understanding the influence of national and EU policies on the energy sector.

### 3. The S3SF training programme and qualification frameworks

#### Introduction

The S3SF training programme serves as a guide for curriculum development, training programs, and certification processes, ensuring that individuals can acquire and demonstrate the necessary competences for successful careers in smart energy systems. It outlines the key competencies and skills needed in the domain of smart energy systems. It provides a comprehensive view of the specific knowledge areas, technical skills, and soft skills required for professionals working in this field.

Qualification frameworks provide a structured approach to organizing and recognizing qualifications at different levels within a specific field or sector. In the context of smart energy systems, qualification frameworks help establish a hierarchy of qualifications, making it easier for employers, educators, and learners to understand the levels of expertise and competencies associated with different qualifications.

#### 3.1 EQF level descriptors

The S3SF training programme is aligned to the EQF descriptors. The European Qualifications Framework (EQF) helps to compare national qualifications systems and enables communication among them.

At the core of the EQF are eight common European reference levels, which are described in learning outcomes: knowledge, skills, responsibility and autonomy (i.e., attitudes). This makes it clear what a learner with a qualification related to the EQF knows, understands and is able to do.

The S3SF programme consider the following EQF levels (from level 4 to level 5) and related descriptors:

EQF level 4 descriptors elements		
Knowledge	Skills	Responsibility and autonomy
Factual and theoretical knowledge in	A range of cognitive and practical skills required to generate	Exercise self-management within the guidelines of work or study contexts that are usually



broad contexts within a field of work or study	solutions to specific problems in a field of work or study	predictable but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.
EQF level 5 descriptors elements		
Knowledge	Skills	Responsibility and autonomy
Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge.	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems.	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others.

Table 1: EQF descriptors elements for level 4 and 5.

### 3.2 ECVET (European Credit System for Vocational Education and Training) principles

ECVET is recognised as a mechanism for the official recognition, accumulation and transfer of individually achieved learning outcomes, thus guaranteeing equity of the different forms of learning (formal education and training; non-formal training and informal learning).

The S3SF curriculum is aligned to ECVET principles in terms of:

1. Units of learning outcomes.
2. Learning outcomes described in terms of knowledge, skills and attitudes.
3. Teaching and learning hours with allocation of respective ECVET points.

Currently, across Europe, it is consensual to commensurate 1 ECVET point to approximately 25 hours of learning (i.e., hands-on, self-study and assessment hours).

### 3.3 Definition of Learning Outcomes

The **2017 EQF recommendation**<sup>1</sup> defines learning outcomes as: *‘statements regarding what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills, and responsibility and autonomy’*.

<sup>1</sup>[https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017H0615\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017H0615(01)&from=EN)

- **Learning outcomes** are statements regarding what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills, responsibility and autonomy.
- **‘Knowledge’** means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that are related to a field of work or study. In the context of the EQF, knowledge is described as theoretical and/or factual.
- **“Skills”** mean the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);
- **“Responsibility and autonomy”** mean the ability of the learner to apply knowledge and skills autonomously and with responsibility.
- **“Competence** means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development

To define a Learning Outcome, the following scheme should be followed:

<b>Learning outcomes = Achievement (VERB)+ Purpose (OBJECT)+ Learning situation (CONTEXT) +[Conditions]</b>			
<b>Learning outcome</b> is the final objective of the learning process	VERB OBJECT CONTEXT	Achievement Purpose Learning Situation Conditions	<p>It expresses the action that must be performed with the content: an action verb</p> <p>expresses the content, the object of the achievement</p> <p>describes the situation through which the trainee gets the achievement (How): context</p> <p>Optional, considers some specific aspects/restrictions</p>

*Table 2 – Learning Outcomes definition.*

Below are some examples from the Cedefop’s “Defining, writing and applying learning outcomes A European handbook “(2022).

The basic structure of learning outcomes statements should:			
<ul style="list-style-type: none"> <li>address the learner</li> </ul>	<ul style="list-style-type: none"> <li>use an action verb to signal the level of learning expected.</li> </ul>	<ul style="list-style-type: none"> <li>indicate the object and scope (the depth and breadth) of the expected learning.</li> </ul>	<ul style="list-style-type: none"> <li>clarify the occupational and/or social context in which the qualification is relevant.</li> </ul>
Examples			
The student...	<ul style="list-style-type: none"> <li>is expected to present ...</li> </ul>	<ul style="list-style-type: none"> <li>...in writing the results of the risk analysis</li> </ul>	<ul style="list-style-type: none"> <li>...allowing others to follow the process replicate the results.</li> </ul>
The learner...	<ul style="list-style-type: none"> <li>is expected to distinguish between...</li> </ul>	<ul style="list-style-type: none"> <li>...the environmental effects...</li> </ul>	<ul style="list-style-type: none"> <li>...of cooling gases used in refrigeration systems.</li> </ul>

Figure 2 – The basic structure of learning outcomes statement.

## 4. The S3SF training programme

### 4.1 The S3SF training programme: overview

The S3SF transnational vocational education and training (VET) curriculum in smart energy systems is designed to be comprehensive, adaptable, and aligned with the identified needs and best practices identified in different EU regions.

The S3SF training programme is composed of 6 training modules. Each module is divided into several learning units. The notional learning time (also known as workload) is the estimated learning time taken by the 'average' student to achieve the specified learning outcomes. A total of 78 hours of learning time is required to complete the full S3SF training programme.

	Learning unit	Notional learning time
<b>Module 1- Energy Generation and System Integration with Commissioning</b>	Unit 1 - Introduction to smart renewable energy technology	12h
	Unit 2 - System Commissioning and Communication	
	Unit 3 - Training and Maintenance of Smart Renewable Energy Systems	
<b>Module 2 - Energy Economics: Understanding and Managing Costs</b>	Unit 1 - Introduction to Energy Economics	15h
	Unit 2 - Analyzing Electricity bills	
	Unit 3 - Selecting Electricity Contracts	
	Unit 4 - Optimizing energy Costs	
<b>Module 3 - Operational Security and Compliance</b>	Unit 1 - Introduction to operational security	12h
	Unit 2 - Regulatory compliance in the energy sector	
	Unit 3 - Cybersecurity for smart energy	

	systems: case studies and best practices	
<b>Module 4 - Energy Systems Management</b>	Unit 1 - Building Management Systems (BMS) Unit 2 - Energy Storage System (ESS) Unit 3 - Internet of Things (IoT) Devices Optimizing Energy Consumption	12h
<b>Module 5 - Project Execution and Professional Skills</b>	Unit 1 - Project Planning and Stakeholder Management Unit 2 - Communication and Teamwork in Project Execution	12h
<b>Module 6 - Technology Application and Innovation</b>	Unit 1 - Innovative Energy Technologies and System Performance Unit 2 - Commissioning and Integration of Advanced Energy Systems	15h

An overview of the S3SF training programme consisting of its 6 training modules, related units and learning outcomes is presented below:

Module title	Learning unit title	Learning outcomes The learner is expected to...
<b>Module 1 – Energy Generation and System Integration with Commissioning</b>	Unit 1 – Introduction to smart renewable energy technology	<ul style="list-style-type: none"> <li>• Define key components and characteristics of smart renewable energy technologies.</li> <li>• Identify the role of these technologies in the broader context of sustainable energy.</li> <li>• Explain the significance of integrating smart renewable energy systems into modern power grids.</li> <li>• Analyse the benefits and challenges associated with the integration process.</li> <li>• Stay informed about current trends in smart renewable energy technologies.</li> <li>• Identify innovative developments shaping the future of the industry.</li> </ul>
	Unit 2 – System Commissioning and Communication	<ul style="list-style-type: none"> <li>• Explain the steps involved in the commissioning process for smart renewable energy systems, including pre-commissioning checks, initialization, testing, and validation.</li> <li>• Demonstrate the ability to set up and troubleshoot communication between smart energy systems, the power grid, and other relevant entities.</li> <li>• Stay informed about current trends in smart renewable energy technologies.</li> <li>• Identify innovative developments shaping the future of the</li> </ul>

		industry. <ul style="list-style-type: none"> <li>• Comply with relevant regulations governing the integration of smart renewable energy systems into the grid.</li> </ul>
	Unit 3 – Training and Maintenance of Smart Renewable Energy Systems	<ul style="list-style-type: none"> <li>• Demonstrate Proficiency in System Installation, Maintenance, and Commissioning</li> <li>• Ensure Proper Communication Setup with the Grid and Other Entities</li> <li>• Train Operators on Smart System Adjustments &amp; emphasize the Importance of Maintaining correct Settings and Operations</li> </ul>
<b>Module 2 - Energy Economics: Understanding and Managing Costs</b>	Unit 1 – Introduction to Energy Economics	<ul style="list-style-type: none"> <li>• Define energy economics and its relevance to daily life and the broader economy.</li> <li>• Explore how energy drives economic activities, impacts prices, and contributes to overall economic growth.</li> <li>• Demonstrate an understanding of the basic principles of energy supply, demand, and pricing.</li> <li>• Grasp the basics of energy economics.</li> <li>• Understand the role of energy in the economy.</li> <li>• Recognize the impact of energy pricing and policy on economic activities.</li> </ul>
	Unit 2 – Analyzing Electricity bills	<ul style="list-style-type: none"> <li>• Identify the different sections of an electricity bill.</li> <li>• Understand the role of each component in the overall cost.</li> <li>• Observe usage patterns as reflected in billing statements.</li> <li>• Utilize this information in practical contexts, potentially leading to more informed choices regarding energy consumption and cost management</li> </ul>

	<p>Unit 3 – Selecting Electricity Contracts</p>	<ul style="list-style-type: none"> <li>• Understand the variety of electricity contracts,</li> <li>• Interpret terms and conditions and</li> <li>• Develop the ability to select the most appropriate contract based on specific needs and usage patterns.</li> </ul>
	<p>Unit 4 – Optimizing energy Costs</p>	<ul style="list-style-type: none"> <li>• Understand how to evaluate energy usage,</li> <li>• Identify inefficiencies, and</li> <li>• Apply cost-optimization strategies for better energy management</li> </ul>
<p><b>Module 3 - Operational Security and Compliance</b></p>	<p>Unit 1 - Introduction to operational security</p>	<ul style="list-style-type: none"> <li>• Define operational security and its significance for the energy sector.</li> <li>• Identify common cyber threats and vulnerabilities in operational security in the energy sector considering OT/IT convergence</li> <li>• Explain the importance of operational security in protecting critical infrastructure to facilitate cybersecurity risk management in the energy sector</li> </ul>
	<p>Unit 2 - Regulatory compliance in the energy sector</p>	<ul style="list-style-type: none"> <li>• Identify and define key terms related to regulatory compliance in the energy sector.</li> <li>• Describe the purpose and significance of regulatory compliance in ensuring safety, environmental protection, and fair competition in the energy industry.</li> <li>• Adapt to the regulatory environment and maintain secure and compliant energy operations</li> </ul>
	<p>Unit 3 - Cybersecurity for smart energy systems: case studies and best practices</p>	<ul style="list-style-type: none"> <li>• Identify and explain key operational security practices in the energy sector</li> <li>• Analyze real-life examples to illustrate the consequences of cyber-attacks to critical infrastructures</li> </ul>

		<ul style="list-style-type: none"> <li>Evaluate and propose strategies for achieving operational security and regulatory compliance to ensure cybersecurity preparedness in the energy sector</li> </ul>
<b>Module 4 -Energy Systems Management</b>	Unit 1 – Building Management Systems (BMS)	<ul style="list-style-type: none"> <li>Concept and knowledge about BMS and ESS</li> <li>Operate and manage BMS and ESS effectively</li> <li>Utilize IoT devices for energy monitoring and optimization</li> <li>Train building operators on the effective use and maintenance of energy management systems</li> <li>Apply strategies for energy efficiency and optimization in building operations</li> </ul>
	Unit 2 – Energy Storage System (ESS)	<ul style="list-style-type: none"> <li>Concept and knowledge about ESS</li> <li>Operate and manage ESS effectively</li> <li>Train building operators on the effective use and maintenance of energy storage systems</li> </ul>
	Unit 3 – Internet of Things (IoT) Devices Optimizing Energy Consumption	<ul style="list-style-type: none"> <li>Define the Internet of Things</li> <li>Define key concept about energy optimization by Internet of Things</li> <li>Apply energy consumption detection and assessment based on Internet of Things</li> </ul>
<b>Module 5 - Project Execution and Professional Skills</b>	Unit 1 – Project Planning and Stakeholder Management	<ul style="list-style-type: none"> <li>Define key project planning methodologies.</li> <li>Explore stakeholder identification and engagement strategies.</li> <li>Demonstrate the development of a project charter and stakeholder management plan</li> </ul>

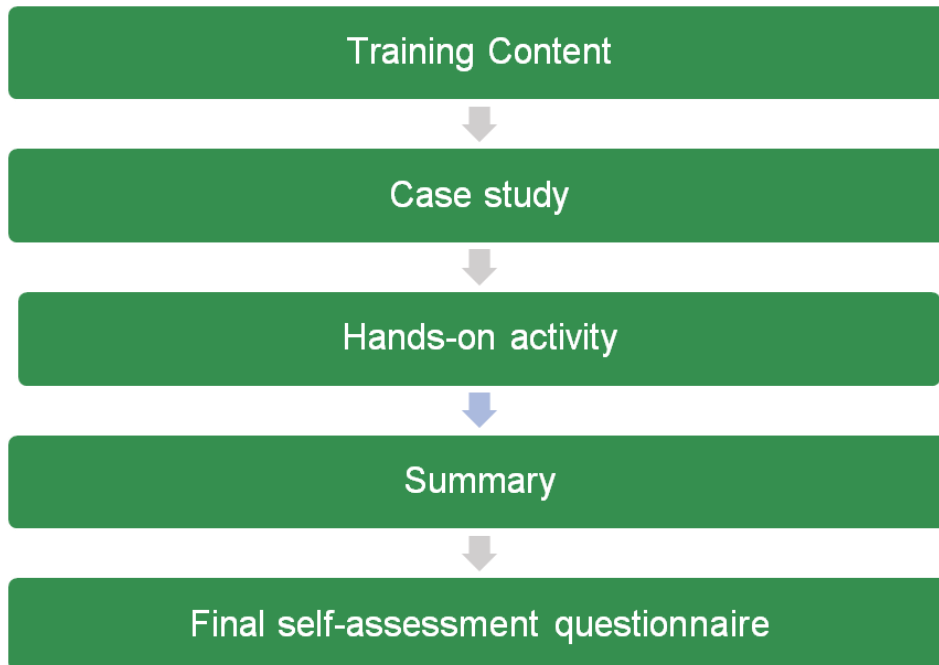


	Unit 2 - Communication and Teamwork in Project Execution	<ul style="list-style-type: none"> <li>• Understand the importance and methods of efficient communication within project teams.</li> <li>• Recognize the elements of successful teamwork and how to foster them in project settings.</li> <li>• Apply conflict resolution strategies to maintain project momentum.</li> <li>• Employ techniques for consensus building to align project goals with team and stakeholder interests.</li> </ul>
<b>Module 6 – Technology Application and Innovation</b>	Unit 1 - Innovative Energy Technologies and System Performance	<ul style="list-style-type: none"> <li>• Understand cutting-edge energy technologies and their operational principles.</li> <li>• Apply advanced solutions to improve the performance of energy systems.</li> <li>• Assess the impact of innovative technologies on system efficiency</li> </ul>
	Unit 2 – Commissioning and Integration of Advanced Energy Systems	<ul style="list-style-type: none"> <li>• Commission new energy technologies while ensuring their compatibility and integration with existing systems.</li> <li>• Communicate effectively the advantages and operational protocols of new energy technologies to building owners and operators.</li> <li>• Choose suitable technologies based on specific project goals and energy management needs.</li> </ul>

Table 2: S3SF training programme

## 4.2 Structure of the S3SF modular course material

Each one of the S3SF training modules is divided into several learning units. Each unit is designed according to the following a structure:



### **Training content**

It covers the “Knowledge Domain” of the learning outcomes presented at the beginning of each learning unit. Training content is presented via text, images, and videos related to the main topic of each learning unit.

### **Case study**

Each unit presents one or more case studies based on real-world scenarios, allowing learners to connect theoretical knowledge to practical situations. This helps them understand how concepts apply in the real world.

### **Hand-on activity**

It is designed to help learners to reinforce their attitude toward the competences of the “Skills” and “Responsibility and autonomy” domain. Learners are presented step by step instruction and a list of external resources to carry out this practical activity.

### **Summary**

Learners are presented with a list of key statements summarizing the competences they have developed.

### **Final self-assessment questionnaire**

At the end of each unit, learners are asked to self-assess their knowledge about the unit topics. Each questionnaire is composed of 10 questions.

The S3SF, this learning roadmap, is designed to both support learners in developing key competences related to smart energy systems and trainers in assisting and assessing the S3SF training programme. Modular course materials and online learning resources support flexible and remote learning.

## 5. Assessment and Certification

### 5.1 Key concepts

The S3SF training program also relies of the following key concepts:

1. **Assessment of learning outcomes** means methods and processes used to establish the extent to which a learner has in fact attained particular knowledge, skills and competence.
2. **Validation of learning outcomes** means the process of confirming that certain assessed learning outcomes achieved by a learner correspond to specific outcomes which may be required for a unit or a qualification.
3. **Recognition of learning outcomes** means the process of attesting officially achieved learning outcomes through the awarding of units or qualifications (e.g., digital badges)

Specifically, the S3SF training programme includes:

- An initial self-assessment questionnaire to allow learners to self-assess their pre-existing knowledge before undertaking each learning unit.
- A final self-assessment questionnaire to assess the learner's knowledge after completing each learning unit.

### 5.2 Digital badge definition

According to Cedefop, a digital badge is: *“a validated graphical visualisation of a learning experience – e.g. participation in a course, seminar or workshop, or acquisition of knowledge, skills and competences – with or without certification.”*

The main characteristics of digital badges are:

- A digital badge can be shared on social media, added to email signatures, embedded on a CV or portfolio, or added to digital badge wallets.
- A digital open badge is a digital badge whose content (e.g., identity of the holder, learning content, learning outcomes, issuing organisation, issuing or expiration date, assessment criteria) is verifiable and portable; open badges can be issued, earned, and managed by using a certified open badge platform.
- Digital badges are issued in a variety of formal or non-formal settings.

### 5.3 The S3SF badges

On the S3SF training platform, digital badges are automatically released to learners according to the following criteria:

1. The learner has completed the activities foreseen in each Module. Learners can see the requirement of each activity by clicking on the “Completion” label, on the right corner.
2. For each unit, the learner has passed the final self- assessment questionnaire with a score of at least 70%. The number of attempts allowed is 5. This indicates that learners have a good understanding of the training material and have met the required passing criteria and can receive the Module digital badge.

The graphic design of the digital badges for each S3SF training module is presented below:



Figure 3– Graphical representation of the digital badge used for Module 1

## 6. Definition of methods and approaches

### 6.1 Blended and online learning

The S3SF modules are designed and implemented on-line using techniques for face to face or distance learning. Distance learning learners study independently, usually in their own home or workplace. Blended learning is a combination of distance learning and face-to-face learning. Distance learning also means that learners have to study on their own, so they will need considerable encouragement and help to keep motivated.

An important principle of effective distance or blended learning is that learners should not feel isolated. They require support that, most importantly, is provided by a dedicated tutor who can give clear guidance throughout their personal learning process. The S3SF training programme in a blended or distance programme therefore requires the appropriate organizational structure to be established to provide this essential support. The modules can be found on the S3SF training platform from the project website.

### 6.2 The S3SF training platform

The **S3SF training platform** (<http://moodle.s3sf.eu/>) is designed to provide a comprehensive and interactive learning experience for individuals interested in the field of

smart energy. It offers a variety of training modules, interactive simulations, and resources to help learners gain a deep understanding of the latest developments in this area.

The main features of the S3SF training platform are listed below:

- **Modularized Training:** The platform is divided into 6 modules and related units. Learners can customize their learning path based on their interests and needs.
- **Interactive OERs:** Each module is based on Open Educational Resources (OERs), namely collection of resources, including articles, case studies, and videos, is available for further exploration and reference that can be reused.
- **Progress Tracking:** The platform tracks learners' progress, allowing them to monitor their achievements and identify areas for improvement.
- **Community Forums:** A community forum is available for VET trainers, teachers and learners to connect, share ideas, and discuss topics related to the training modules.

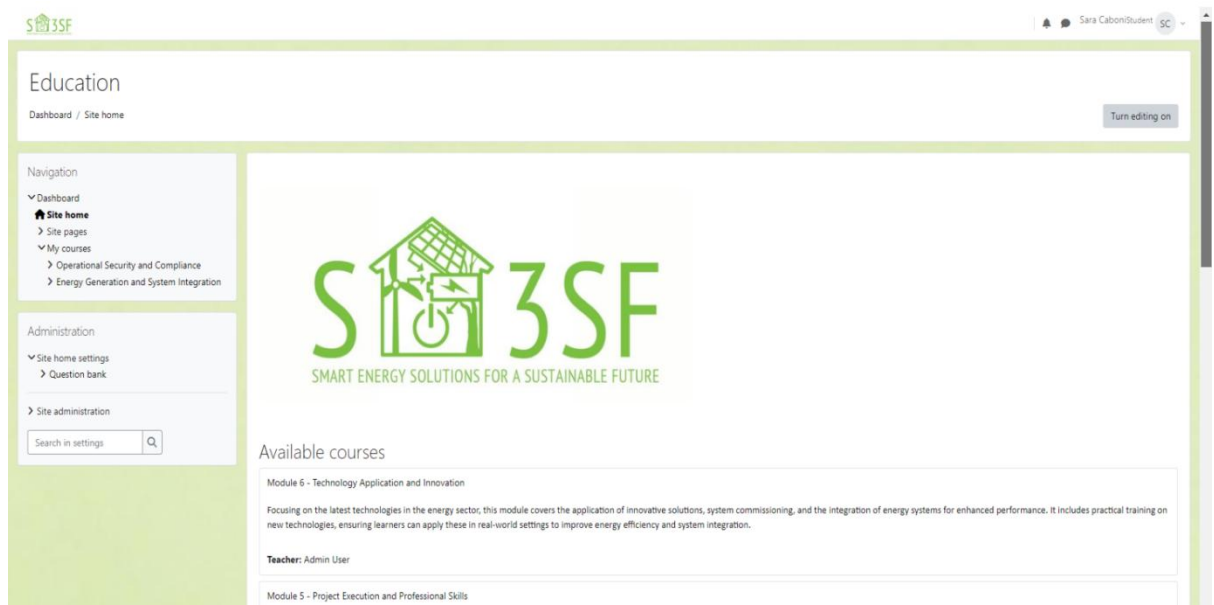


Figure 4 – The S3SF training platform

## Annex - Module frameworks

### Module 1 - Energy Generation and System Integration with Commissioning

<b>Module 1: Energy Generation and System Integration with Commissioning</b>	
<b>Notional Learning time</b>	12 hours
<b>EQF level</b>	4
<b>Units title</b>	Unit 1. Introduction to smart renewable energy technology Unit 2. System Commissioning and Communication Unit 3. Training and Maintenance of Smart Renewable Energy Systems
<b>Authors &amp; Affiliation</b>	Technological University of the Shannon- TÚS (Ireland)
<b>Description of the Module / Unit</b>	This module expands on renewable energy technologies and their integration into the power grid, emphasizing the critical process of system commissioning. It covers the practical skills necessary for installing, maintaining, and commissioning renewable energy systems, ensuring they communicate effectively with other equipment, the grid, and energy users or suppliers. The module also focuses on training building owners, facilities managers, and staff on operating and maintaining these systems, including setting adjustments and understanding what controls should remain untouched.
<b>Learning outcomes</b>	<p>Unit 1 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Demonstrate proficiency in installing, maintaining, and commissioning renewable energy systems.</li> <li>• Ensure proper communication setup between energy systems, the grid, and other entities.</li> <li>• Train operators on system adjustments, emphasizing the importance of maintaining correct settings.</li> <li>• Educate relevant personnel on which system components should not be altered to preserve functionality and efficiency.</li> </ul> <p>Unit 2 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Identify and define key terms related to regulatory compliance in the energy sector.</li> <li>• Describe the purpose and significance of regulatory compliance in ensuring safety, environmental protection, and fair competition in the energy industry.</li> <li>• Adapt to the regulatory environment and maintain secure and compliant energy operations</li> </ul>

	<p>Unit 3 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Identify and explain key operational security practices in the energy sector</li> <li>• Analyze real-life examples to illustrate the consequences of cyber-attacks to critical infrastructures</li> <li>• Evaluate and propose strategies for achieving operational security and regulatory compliance to ensure cybersecurity preparedness in the energy sector</li> </ul>
<p><b>Step by step indication for learners</b></p>	<p>Step 1: Assess your knowledge and skills about the Module/unit topic through the initial self-assessment questionnaire</p> <p>Step2: Read the interactive presentation and carry out the activities foreseen</p> <p>Step 3: At the end of each unit, assess the learning outcomes through the final self-assessment questionnaire</p>
<p><b>Training material/ Educational resources</b></p>	<p>Interactive videos implemented with H5p</p>
<p><b>External resources</b></p>	<p>Unit 1:</p> <p><a href="https://www.enisa.europa.eu/publications/enisa-threat-landscape-2023">https://www.enisa.europa.eu/publications/enisa-threat-landscape-2023</a></p> <p><a href="https://www.pwc.com/gx/en/services/forensics/economic-crime-survey.html">https://www.pwc.com/gx/en/services/forensics/economic-crime-survey.html</a></p> <p><a href="https://youtu.be/WTPv3tzXIRg">https://youtu.be/WTPv3tzXIRg</a></p> <p><a href="https://ses.jrc.ec.europa.eu/electricity-security">https://ses.jrc.ec.europa.eu/electricity-security</a></p> <p><a href="https://www.enisa.europa.eu/publications/artificial-intelligence-and-cybersecurity-research">https://www.enisa.europa.eu/publications/artificial-intelligence-and-cybersecurity-research</a></p> <p><a href="https://www.frontiersin.org/articles/10.3389/fenrg.2023.1274451/full">https://www.frontiersin.org/articles/10.3389/fenrg.2023.1274451/full</a></p> <p>Hands-on activity: <a href="https://www.cyber.gc.ca/en/guidance/cyber-threat-bulletin-cyber-threat-operational-technology#defn-ransomware">https://www.cyber.gc.ca/en/guidance/cyber-threat-bulletin-cyber-threat-operational-technology#defn-ransomware</a></p> <p>Unit 2</p> <p><a href="https://www.youtube.com/watch?v=ev6tQbnI22Q">https://www.youtube.com/watch?v=ev6tQbnI22Q</a></p> <p><a href="https://energy.ec.europa.eu/topics/oil-gas-and-coal/critical-infrastructure-and-cybersecurity_en">https://energy.ec.europa.eu/topics/oil-gas-and-coal/critical-infrastructure-and-cybersecurity_en</a></p> <p><a href="https://digital-strategy.ec.europa.eu/en/policies/nis-directive">https://digital-strategy.ec.europa.eu/en/policies/nis-directive</a></p> <p><a href="https://www.entsoe.eu/network_codes/nccs/">https://www.entsoe.eu/network_codes/nccs/</a></p> <p><a href="https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/radio-equipment-directive-red_en">https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/radio-equipment-directive-red_en</a></p> <p><a href="https://digital-strategy.ec.europa.eu/en/policies/cyber-resilience-act">https://digital-strategy.ec.europa.eu/en/policies/cyber-resilience-act</a></p> <p><a href="https://gdpr.eu/">https://gdpr.eu/</a></p> <p><a href="https://youtu.be/B_OmAg9nOVI">https://youtu.be/B_OmAg9nOVI</a></p> <p><a href="https://gdpr.eu/italy-fines-energy-company-for-multiple-gdpr-violations/">https://gdpr.eu/italy-fines-energy-company-for-multiple-gdpr-violations/</a></p> <p>Hands-on activity:</p>

	<p><a href="https://www.enisa.europa.eu/topics/cybersecurity-policy/nis-directive-new/nis-visualtool">https://www.enisa.europa.eu/topics/cybersecurity-policy/nis-directive-new/nis-visualtool</a></p> <p>Unit3</p> <p><a href="https://attack.mitre.org/techniques/T1566/">https://attack.mitre.org/techniques/T1566/</a></p> <p><a href="https://attack.mitre.org/software/S0604">https://attack.mitre.org/software/S0604</a></p> <p><a href="https://cyberlaw.ccdcoe.org/wiki/Colonial_Pipeline_ransomware_attack_(2021)">https://cyberlaw.ccdcoe.org/wiki/Colonial_Pipeline_ransomware_attack_(2021)</a></p> <p><a href="https://attack.mitre.org/campaigns/C0024/">https://attack.mitre.org/campaigns/C0024/</a></p> <p><a href="https://attack.mitre.org/software/S0603/">https://attack.mitre.org/software/S0603/</a></p> <p><a href="https://attack.mitre.org/software/S0089">https://attack.mitre.org/software/S0089</a></p> <p><a href="https://www.cisa.gov/sites/default/files/publications/Cybersecurity_Best_Practices_for_Industrial_Control_Systems.pdf">https://www.cisa.gov/sites/default/files/publications/Cybersecurity_Best_Practices_for_Industrial_Control_Systems.pdf</a></p> <p><a href="https://www.enisa.europa.eu/cybersecurity-maturity-assessment-for-small-and-medium-enterprises#/">https://www.enisa.europa.eu/cybersecurity-maturity-assessment-for-small-and-medium-enterprises#/</a></p> <p>Hands-on activity: <a href="https://www.youtube.com/watch?v=1Gyr1wH45E8&amp;t=9699s">https://www.youtube.com/watch?v=1Gyr1wH45E8&amp;t=9699s</a></p>
<b>Evaluation</b>	<p>Final self-assessment test: multiple choice. Learners receive a digital badge after completing the following activities (badge criteria):</p> <ul style="list-style-type: none"> <li>• Completing the Module activities</li> <li>• Passing the final post-knowledge assessment questionnaire (70% passing score)</li> </ul>
<b>ECVET points<sup>2</sup></b>	3 ECVET points

## Module 2 – Energy Economics. Understanding and Managing Costs

<b>Module 2: Energy Economics. Understanding and Managing Costs</b>	
<b>Notional Learning time</b>	15 hours
<b>EQF level:</b>	4-5
<b>Units title</b>	Unit 1. Introduction to Energy Economics Unit 2. Analyzing Electricity Bills Unit 3. Selecting Electricity Contracts Unit 4. Optimizing Energy Costs

<sup>2</sup> <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:155:0011:0018:EN:PDF>



<b>Authors Affiliation</b> &	PPC SA (Greece)
<b>Description of the Module / Unit</b>	<p>This module explores the economic aspects of energy consumption, focusing on electricity costs and bills. It aims to empower learners with the knowledge to assist homeowners and building users in understanding electricity bills, choosing appropriate contracts, and leveraging contract adjustments for cost savings as building operations evolve. Theoretical insights into energy economics are paired with practical financial management skills related to energy consumption.</p> <p>This module is designed for learners at the upper secondary education level or higher, providing foundational to intermediate knowledge and skills in energy economics suitable for non-specialists and professionals in the early stages of their career in the energy sector.</p>
<b>Learning outcomes</b>	<p>Unit 1 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Define energy economics and its relevance to daily life and the broader economy.</li> <li>• Explore how energy drives economic activities, impacts prices, and contributes to overall economic growth.</li> <li>• Demonstrate an understanding of the basic principles of energy supply, demand, and pricing.</li> <li>• Grasp the basics of energy economics.</li> <li>• Understand the role of energy in the economy.</li> <li>• Recognize the impact of energy pricing and policy on economic activities</li> </ul> <p>Unit 2 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Identify the different sections of an electricity bill.</li> <li>• Understand the role of each component in the overall cost.</li> <li>• Observe usage patterns as reflected in billing statements.</li> <li>• Utilize this information in practical contexts, potentially leading to more informed choices regarding energy consumption and cost management.</li> </ul> <p>Unit 3 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the variety of electricity contracts,</li> <li>• Interpret terms and conditions and</li> <li>• Develop the ability to select the most appropriate contract based on specific needs and usage patterns.</li> </ul>

	<p>Unit 4 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Understand how to evaluate energy usage</li> <li>• Identify inefficiencies in energy usage</li> <li>• Apply cost-optimization strategies for better energy management.</li> </ul>
<b>Step by step indication for learners</b>	<p>Step 1: Assess your knowledge and skills about the Module/unit topic through the initial self-assessment questionnaire</p> <p>Step2: Read the interactive presentation and carry out the activities foreseen</p> <p>Step 3: At the end of each unit, assess the learning outcomes through: the final self-assessment questionnaire.</p>
<b>Training material/ Educational resources</b>	Interactive videos implemented with H5p
<b>External resources</b>	<p>Unit 1</p> <p><a href="https://en.wikipedia.org/wiki/Energy_economics">https://en.wikipedia.org/wiki/Energy_economics</a></p> <p><a href="https://web.stanford.edu/~jsweeney/paper/Energy%20Economics.PDF">https://web.stanford.edu/~jsweeney/paper/Energy%20Economics.PDF</a></p> <p><a href="https://www.sciencedirect.com/topics/social-sciences/energy-economics">https://www.sciencedirect.com/topics/social-sciences/energy-economics</a></p> <p><a href="https://web.mit.edu/D-Lab/Readings/energy1.pdf">https://web.mit.edu/D-Lab/Readings/energy1.pdf</a></p> <p><a href="https://www.iea.org/commentaries/energy-is-at-the-heart-of-the-sustainable-development-agenda-to-2030">https://www.iea.org/commentaries/energy-is-at-the-heart-of-the-sustainable-development-agenda-to-2030</a></p> <p><a href="https://www.sciencedirect.com/science/article/pii/S2211467X23000287">https://www.sciencedirect.com/science/article/pii/S2211467X23000287</a></p> <p><a href="https://www.worldbank.org/en/topic/energy/overview">https://www.worldbank.org/en/topic/energy/overview</a></p> <p><a href="https://www.weforum.org/publications/fostering-effective-energy-transition-2022/in-full/1-the-energy-transition-under-pressure/">https://www.weforum.org/publications/fostering-effective-energy-transition-2022/in-full/1-the-energy-transition-under-pressure/</a></p> <p><a href="https://www.iea.org/energy-system/electricity">https://www.iea.org/energy-system/electricity</a></p> <p><a href="https://www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/supply-and-demand-and-energy-prices#:~:text=Energy%20demand%20is%20a%20derived%20demand.,run%20motors%20and%20for%20process%20heat.&amp;text=Energy%20demand%20is%20a,and%20fo">https://www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/supply-and-demand-and-energy-prices#:~:text=Energy%20demand%20is%20a%20derived%20demand.,run%20motors%20and%20for%20process%20heat.&amp;text=Energy%20demand%20is%20a,and%20fo</a></p> <p>Case study 1: <a href="https://drive.google.com/file/d/1w6f006uGDDIIStjX4nlf0uVsthFxKRTb/view">https://drive.google.com/file/d/1w6f006uGDDIIStjX4nlf0uVsthFxKRTb/view</a></p> <p>Case study 2: <a href="https://drive.google.com/file/d/1AdzQOtcc6MXna8J31KVfcyboiKhFGlhu/view">https://drive.google.com/file/d/1AdzQOtcc6MXna8J31KVfcyboiKhFGlhu/view</a></p> <p>Hands-on activity: <a href="https://docs.google.com/document/d/1MhI9QkpXwWMpclDQR RY4vpX_U5NDsvel6rDTuZ8u8rl/edit">https://docs.google.com/document/d/1MhI9QkpXwWMpclDQR RY4vpX_U5NDsvel6rDTuZ8u8rl/edit</a></p>

	<p>Unit 2</p> <p><a href="https://futureenergygo.com/guide-to-electricity-bill-breakdown/">https://futureenergygo.com/guide-to-electricity-bill-breakdown/</a>  <a href="https://www.cnet.com/home/energy-and-utilities/how-to-read-a-power-bill/">https://www.cnet.com/home/energy-and-utilities/how-to-read-a-power-bill/</a>  <a href="https://www.eurelectric.org/in-detail/electricity_prices_explained/">https://www.eurelectric.org/in-detail/electricity_prices_explained/</a>  <a href="https://commission.europa.eu/document/download/f235da5d-5672-46a0-93e8-76342a10b907_en?filename=regular_electricity_bill_en.pdf">https://commission.europa.eu/document/download/f235da5d-5672-46a0-93e8-76342a10b907_en?filename=regular_electricity_bill_en.pdf</a>  <a href="https://www.energuide.be/en/questions-answers/how-do-i-read-my-energy-bill/22/">https://www.energuide.be/en/questions-answers/how-do-i-read-my-energy-bill/22/</a>  <a href="https://www.dei.gr/en/home/contact-support/electricity-bill-example/">https://www.dei.gr/en/home/contact-support/electricity-bill-example/</a>  <a href="https://www.eemg-mediators.eu/downloads/beuc_input_to_the_Consumer_Friendly_Energy_Bill_Initiative_-_May_2017.pdf">https://www.eemg-mediators.eu/downloads/beuc_input_to_the_Consumer_Friendly_Energy_Bill_Initiative_-_May_2017.pdf</a>            Case study 1 video implemented in Moodle            Case study 2: video implemented in Moodle            Hands-on activity:  <a href="https://www.interregeurope.eu/sites/default/files/good_practices/PolicyBrief_RECommunities_final.pdf">https://www.interregeurope.eu/sites/default/files/good_practices/PolicyBrief_RECommunities_final.pdf</a>  <a href="https://energy.ec.europa.eu/news/focus-energy-communities-transform-eus-energy-system-2022-12-13_en">https://energy.ec.europa.eu/news/focus-energy-communities-transform-eus-energy-system-2022-12-13_en</a></p> <p>Unit 3</p> <p><a href="https://www.europarl.europa.eu/RegData/etudes/STUD/2023/740094/IPOL_STU(2023)740094_EN.pdf">https://www.europarl.europa.eu/RegData/etudes/STUD/2023/740094/IPOL_STU(2023)740094_EN.pdf</a>  <a href="https://euesco.org/wp-content/uploads/2021/06/101006_euesco_ContractingFlyer_A4_final_low.pdf">https://euesco.org/wp-content/uploads/2021/06/101006_euesco_ContractingFlyer_A4_final_low.pdf</a>  <a href="https://energytheory.com/what-are-time-of-use-tou-rates/">https://energytheory.com/what-are-time-of-use-tou-rates/</a>  <a href="https://www.energysage.com/electricity/understanding-time-of-use-rates/">https://www.energysage.com/electricity/understanding-time-of-use-rates/</a>  <a href="https://www.consilium.europa.eu/en/policies/electricity-market-reform/">https://www.consilium.europa.eu/en/policies/electricity-market-reform/</a>  <a href="https://europa.eu/youreurope/citizens/consumers/energy-supply/access-use-energy-services/index_en.htm">https://europa.eu/youreurope/citizens/consumers/energy-supply/access-use-energy-services/index_en.htm</a>  <a href="https://www.watt.co.uk/energy-contract-self-terminating/">https://www.watt.co.uk/energy-contract-self-terminating/</a>  <a href="https://acuitylaw.com/switching-energy-supplier-force-majeure/">https://acuitylaw.com/switching-energy-supplier-force-majeure/</a>  <a href="https://www.cliffedekkerhofmeyr.com/en/news/press-releases/2020/Regulating-the-consequences-of-force-majeure-in-your-contract.html">https://www.cliffedekkerhofmeyr.com/en/news/press-releases/2020/Regulating-the-consequences-of-force-majeure-in-your-contract.html</a>  <a href="https://www.mondaq.com/uk/litigation-contracts-and-force-majeure/1010878/using-force-majeure-clauses-in-relation-to-inability-to-pay-a-forlorn-hope-">https://www.mondaq.com/uk/litigation-contracts-and-force-majeure/1010878/using-force-majeure-clauses-in-relation-to-inability-to-pay-a-forlorn-hope-</a>  <a href="https://www.electricrate.com/electricity-contract/">https://www.electricrate.com/electricity-contract/</a>  <a href="https://www.edgeinsights.com/types-of-energy-supply-contracts-choosing-the-best-option/">https://www.edgeinsights.com/types-of-energy-supply-contracts-choosing-the-best-option/</a></p>
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	<p><a href="https://www.chooseenergy.com/blog/energy-101/your-guide-to-choosing-an-energy-supplier/">https://www.chooseenergy.com/blog/energy-101/your-guide-to-choosing-an-energy-supplier/</a></p> <ul style="list-style-type: none"> <li>• <a href="https://www.uswitch.com/gas-electricity/guides/how-to-switch-gas-and-electricity/">https://www.uswitch.com/gas-electricity/guides/how-to-switch-gas-and-electricity/</a></li> <li>• <a href="https://www.ofgem.gov.uk/information-consumers/energy-advice-households/switching-energy-supplier">https://www.ofgem.gov.uk/information-consumers/energy-advice-households/switching-energy-supplier</a></li> <li>• <a href="https://www.energybot.com/blog/how-to-switch-electric-companies.html">https://www.energybot.com/blog/how-to-switch-electric-companies.html</a></li> <li>• <a href="https://energysavingtrust.org.uk/advice/switching-your-energy-supplier/">https://energysavingtrust.org.uk/advice/switching-your-energy-supplier/</a></li> <li>• <a href="https://www.moneysupermarket.com/gas-and-electricity/switching-suppliers/">https://www.moneysupermarket.com/gas-and-electricity/switching-suppliers/</a></li> <li>• <a href="https://www.spotdraft.com/blog/energy-contract-management">https://www.spotdraft.com/blog/energy-contract-management</a></li> <li>• Case study 1 video implemented in Moodle</li> <li>• Case study 2 video implemented in Moodle</li> </ul> <p>Unit 4</p> <ul style="list-style-type: none"> <li>• <a href="https://energy.ec.europa.eu/document/download/98b48972-0298-4984-8840-7f53d43f4aab_en?filename=good_practice_in_ee_web.pdf">https://energy.ec.europa.eu/document/download/98b48972-0298-4984-8840-7f53d43f4aab_en?filename=good_practice_in_ee_web.pdf</a></li> <li>• <a href="https://energy.ec.europa.eu/topics/energy-efficiency_en">https://energy.ec.europa.eu/topics/energy-efficiency_en</a></li> <li>• <a href="https://s3platform.jrc.ec.europa.eu/documents/20125/248546/Guide+on+good+practice+in+energy+efficiency+for+Central+and+.pdf/11b3b734-2825-7145-0691-a3d68bf923b5?t=1621268542712">https://s3platform.jrc.ec.europa.eu/documents/20125/248546/Guide+on+good+practice+in+energy+efficiency+for+Central+and+.pdf/11b3b734-2825-7145-0691-a3d68bf923b5?t=1621268542712</a></li> <li>• <a href="https://www.bdc.ca/en/articles-tools/sustainability/climate-action-centre/articles/how-aim-net-zero-energy-efficiency">https://www.bdc.ca/en/articles-tools/sustainability/climate-action-centre/articles/how-aim-net-zero-energy-efficiency</a></li> <li>• <a href="https://www.bdc.ca/en/articles-tools/sustainability/climate-action-centre/articles/how-aim-net-zero-energy-efficiency">https://www.bdc.ca/en/articles-tools/sustainability/climate-action-centre/articles/how-aim-net-zero-energy-efficiency</a></li> <li>• <a href="https://www.ef.org/2019/08/20/energy-optimization-its-time-to-reimagine-energy-efficiency/">https://www.ef.org/2019/08/20/energy-optimization-its-time-to-reimagine-energy-efficiency/</a></li> <li>• <a href="https://www.buildingsiot.com/blog/the-energy-management-maestro">https://www.buildingsiot.com/blog/the-energy-management-maestro</a></li> <li>• <a href="https://energyinformatics.springeropen.com/articles/10.1186/s42162-022-00207-6">https://energyinformatics.springeropen.com/articles/10.1186/s42162-022-00207-6</a></li> <li>• <a href="https://link.springer.com/chapter/10.1007/978-3-031-32439-0_53">https://link.springer.com/chapter/10.1007/978-3-031-32439-0_53</a></li> <li>• <a href="https://lp.iss-na.com/guide-to-industrial-process-optimization">https://lp.iss-na.com/guide-to-industrial-process-optimization</a></li> <li>• <a href="https://www.iea.org/articles/improving-industrial-waste-heat-recovery">https://www.iea.org/articles/improving-industrial-waste-heat-recovery</a></li> <li>• <a href="https://www.iea.org/reports/introduction-to-system-integration-of-renewables?mode=overview">https://www.iea.org/reports/introduction-to-system-integration-of-renewables?mode=overview</a></li> <li>• <a href="https://www.machinemetrics.com/blog/process-optimization-manufacturing">https://www.machinemetrics.com/blog/process-optimization-manufacturing</a></li> <li>• <a href="https://blog.se.com/industry/mining-metals-minerals/2021/11/03/sustainable-energy-for-industry-navigating-the-world-of-sustainability-for-a-better-future/">https://blog.se.com/industry/mining-metals-minerals/2021/11/03/sustainable-energy-for-industry-navigating-the-world-of-sustainability-for-a-better-future/</a></li> <li>• <a href="https://www.linklaters.com/en/insights/thought-leadership/cross-border-guide-energy-audits/cross-border-">https://www.linklaters.com/en/insights/thought-leadership/cross-border-guide-energy-audits/cross-border-</a></li> </ul>
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	<p><a href="#">guide-to-energy-audits</a></p> <ul style="list-style-type: none"> <li>• <a href="https://energy.ec.europa.eu/system/files/2016-10/eed-art8-energy_audits_recommendations-task_5-report_final-clean_0.pdf">https://energy.ec.europa.eu/system/files/2016-10/eed-art8-energy_audits_recommendations-task_5-report_final-clean_0.pdf</a></li> <li>• <a href="https://www.enable.com/blog/volume-incentive-rebate-examples">https://www.enable.com/blog/volume-incentive-rebate-examples</a></li> <li>• <a href="https://www.enable.com/blog/how-to-structure-and-implement-a-rebate-program">https://www.enable.com/blog/how-to-structure-and-implement-a-rebate-program</a></li> <li>• <a href="https://www.sei.org/publications/sdg-synergies-factsheet/">https://www.sei.org/publications/sdg-synergies-factsheet/</a></li> <li>• <a href="https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-019-0534-2">https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-019-0534-2</a></li> <li>• Case study 1 : video implemented in Moodle</li> </ul>
<b>Evaluation</b>	<p>Final self-assessment test: multiple choice.</p> <p>Learners receive a digital badge after completing the following activities (badge criteria):</p> <ol style="list-style-type: none"> <li>1. Completing the Module activities</li> <li>2. Passing the final assessment test (70% passing score)</li> </ol>
<b>ECVET points</b>	3 ECVET points.

### Module 3 – Operational Security and Compliance

Module 3: Operational Security and Compliance		
<b>Notional time</b>	<b>Learning</b>	12 hours
<b>EQF level:</b>		4
<b>Units title</b>		Unit 1. Introduction to operational security Unit 2. Regulatory compliance in the energy sector Unit 3. Cybersecurity for smart energy systems: case studies and best practices
<b>Authors &amp; Affiliation</b>		Training 2000 psc (Italy)
<b>Description of the Module / Unit</b>		<p>This module addresses the essentials of cybersecurity and regulatory compliance in the energy sector considering the convergence of Operational technologies (OT) and Information technologies (IT) typical of industrial environments. It focuses on introducing the learner to the basics of cybersecurity, the vulnerabilities of critical infrastructure in the energy sector, and on ways of implementing security measures to protect energy systems and ensuring adherence to policies and regulations. This module also presents the main regulations ensuring the transition towards secure data utilization and minimization of European-Union-wide information and cybersecurity risks</p>

	<p>(GDPR, NIS Directive, Cyber Resilience Act). The practical component includes case studies of cyber-attacks to critical infrastructure (electricity, oil, nuclear) and cybersecurity measures to consider when setting up IT systems securely. Cybersecurity best practices are disseminated through the module both from the user and the organization perspective.</p>
<b>Learning outcomes</b>	<p>Unit 1 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>● Define operational security and its significance for the energy sector.</li> <li>● Identify common cyber threats and vulnerabilities in operational security in the energy sector considering OT/IT convergence</li> <li>● Explain the importance of operational security in protecting critical infrastructure to facilitate cybersecurity risk management in the energy sector</li> </ul> <p>Unit 2 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>● Identify and define key terms related to regulatory compliance in the energy sector.</li> <li>● Describe the purpose and significance of regulatory compliance in ensuring safety, environmental protection, and fair competition in the energy industry.</li> <li>● Adapt to the regulatory environment and maintain secure and compliant energy operations</li> </ul> <p>Unit 3 - At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>● Identify and explain key operational security practices in the energy sector</li> <li>● Analyze real-life examples to illustrate the consequences of cyber-attacks to critical infrastructures</li> <li>● Evaluate and propose strategies for achieving operational security and regulatory compliance to ensure cybersecurity preparedness in the energy sector</li> </ul>
<b>Step by step indication for learners</b>	<p>Step 1: Assess your knowledge and skills about the Module/unit topic through the initial self-assessment questionnaire</p> <p>Step2: Read the interactive presentation and carry out the activities foreseen</p> <p>Step 3: At the end of each unit, assess the learning outcomes through the final self-assessment questionnaire.</p>
<b>Training material/ Educational resources</b>	Interactive videos implemented with H5p
<b>External resources</b>	<p>Unit 1</p> <p><a href="https://www.enisa.europa.eu/publications/enisa-threat-landscape-2023">https://www.enisa.europa.eu/publications/enisa-threat-landscape-2023</a></p> <p><a href="https://www.pwc.com/gx/en/services/forensics/economic-crime-survey.html">https://www.pwc.com/gx/en/services/forensics/economic-crime-survey.html</a></p> <p><a href="https://youtu.be/WTPv3tzXIRg">https://youtu.be/WTPv3tzXIRg</a></p> <p><a href="https://ses.jrc.ec.europa.eu/electricity-security">https://ses.jrc.ec.europa.eu/electricity-security</a></p> <p><a href="https://www.enisa.europa.eu/publications/artificial-intelligence-">https://www.enisa.europa.eu/publications/artificial-intelligence-</a></p>

	<p><a href="#">and-cybersecurity-research</a> <a href="https://www.frontiersin.org/articles/10.3389/fenrg.2023.1274451/full">https://www.frontiersin.org/articles/10.3389/fenrg.2023.1274451/full</a> Hands-on activity: <a href="https://www.cyber.gc.ca/en/guidance/cyber-threat-bulletin-cyber-threat-operational-technology#defn-ransomware">https://www.cyber.gc.ca/en/guidance/cyber-threat-bulletin-cyber-threat-operational-technology#defn-ransomware</a></p> <p>Unit 2 <a href="https://www.youtube.com/watch?v=ev6tQbnI22Q">https://www.youtube.com/watch?v=ev6tQbnI22Q</a> <a href="https://energy.ec.europa.eu/topics/oil-gas-and-coal/critical-infrastructure-and-cybersecurity_en">https://energy.ec.europa.eu/topics/oil-gas-and-coal/critical-infrastructure-and-cybersecurity_en</a> <a href="https://digital-strategy.ec.europa.eu/en/policies/nis-directive">https://digital-strategy.ec.europa.eu/en/policies/nis-directive</a> <a href="https://www.entsoe.eu/network_codes/nccs/">https://www.entsoe.eu/network_codes/nccs/</a> <a href="https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/radio-equipment-directive-red_en">https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/radio-equipment-directive-red_en</a> <a href="https://digital-strategy.ec.europa.eu/en/policies/cyber-resilience-act">https://digital-strategy.ec.europa.eu/en/policies/cyber-resilience-act</a> <a href="https://gdpr.eu/">https://gdpr.eu/</a> <a href="https://youtu.be/B_OmAg9nOVI">https://youtu.be/B_OmAg9nOVI</a> <a href="https://gdpr.eu/italy-fines-energy-company-for-multiple-gdpr-violations/">https://gdpr.eu/italy-fines-energy-company-for-multiple-gdpr-violations/</a> Hands-on activity: <a href="https://www.enisa.europa.eu/topics/cybersecurity-policy/nis-directive-new/nis-visualtool">https://www.enisa.europa.eu/topics/cybersecurity-policy/nis-directive-new/nis-visualtool</a></p> <p>Unit 3 <a href="https://attack.mitre.org/techniques/T1566/">https://attack.mitre.org/techniques/T1566/</a> <a href="https://attack.mitre.org/software/S0604">https://attack.mitre.org/software/S0604</a> <a href="https://cyberlaw.ccdcoe.org/wiki/Colonial_Pipeline_ransomware_attack_(2021)">https://cyberlaw.ccdcoe.org/wiki/Colonial_Pipeline_ransomware_attack_(2021)</a> <a href="https://attack.mitre.org/campaigns/C0024/">https://attack.mitre.org/campaigns/C0024/</a> <a href="https://attack.mitre.org/software/S0603/">https://attack.mitre.org/software/S0603/</a> <a href="https://attack.mitre.org/software/S0089">https://attack.mitre.org/software/S0089</a> <a href="https://www.cisa.gov/sites/default/files/publications/Cybersecurity_Best_Practices_for_Industrial_Control_Systems.pdf">https://www.cisa.gov/sites/default/files/publications/Cybersecurity_Best_Practices_for_Industrial_Control_Systems.pdf</a> <a href="https://www.enisa.europa.eu/cybersecurity-maturity-assessment-for-small-and-medium-enterprises#/">https://www.enisa.europa.eu/cybersecurity-maturity-assessment-for-small-and-medium-enterprises#/</a> Hands-on activity: <a href="https://www.youtube.com/watch?v=1Gyr1wH45E8&amp;t=9699s">https://www.youtube.com/watch?v=1Gyr1wH45E8&amp;t=9699s</a></p>
<p><b>Evaluation</b></p>	<p>Final self-assessment test: multiple choice Learners receive a digital badge after completing the following activities (badge criteria):</p> <ol style="list-style-type: none"> <li>1. Completing the Module activities</li> <li>2. Passing the final post-knowledge assessment questionnaire (70% passing score)</li> </ol>
<p><b>ECVET points</b></p>	<p>3 ECVET points</p>



## Module 4 – Energy Management Systems

<b>Module title: Energy Management Systems</b>	
<b>Notional Learning time</b>	12 hours
<b>EQF level:</b>	4-5
<b>Units title</b>	Unit 1. Building Management System (BMS) Unit 2. Energy Storage System (ESS) Unit 3. Internet of Things (IoT) Devices Optimizing Energy Consumption
<b>Authors &amp; Affiliation</b>	Aalborg University (AAU)
<b>Description of the Module / Unit</b>	This module explores the management of energy systems, focusing on the use of building management systems (BMS), energy storage, and IoT devices for optimizing energy consumption. This module emphasizes the practical application of these technologies in managing energy efficiently and includes training on system operation and maintenance
<b>Learning outcomes</b>	<p>Unit 1 - At the end of this unit, learners will be able to</p> <ul style="list-style-type: none"> <li>• Define basic concepts about BMS and ESS</li> <li>• Operate and manage BMS and ESS effectively</li> <li>• Utilize IoT devices for energy monitoring and optimization</li> <li>• Train building operators on the effective use and maintenance of energy</li> </ul> <p>Unit 2 – At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Define basic concepts about ESS</li> <li>• Operate and manage ESS effectively</li> <li>• Train building operators on the effective use and maintenance of energy storage systems</li> </ul> <p>Unit 3 – At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Define basic concept about Internet of Things</li> <li>• Describe the role of the Internet of Things in energy optimization</li> <li>• Explain energy consumption, detection and assessment based on internet of Things</li> </ul>
<b>Step by step indication for learners</b>	<p>Step 1: Assess your knowledge and skills about the Module/unit topic through the initial self-assessment questionnaire</p> <p>Step 2: Read the interactive presentation and carry out the activities foreseen</p>



	Step 3: At the end of each unit assess the learning outcomes through: the final self-assessment questionnaire
<b>Training material/ Educational resources</b>	Interactive videos implemented with H5p
<b>External resources</b>	<p>Unit 1</p> <ol style="list-style-type: none"> <li>1. Mariano-Hernández, D., Hernández-Callejo, L., Zorita-Lamadrid, A., Duque-Pérez, O., &amp; García, F. S. (2021). A review of strategies for building energy management system: Model predictive control, demand side management, optimization, and fault detect &amp; diagnosis. <i>Journal of Building Engineering</i>, 33, 101692.</li> <li>2. Di Piazza, M. C., La Tona, G., Luna, M., &amp; Di Piazza, A. (2017). A two-stage Energy Management System for smart buildings reducing the impact of demand uncertainty. <i>Energy and Buildings</i>, 139, 1-9.</li> </ol> <p>Unit 2</p> <p><a href="https://blog.upsbatterycenter.com/lead-batteries-at-the-heart-of-electric-cars/">https://blog.upsbatterycenter.com/lead-batteries-at-the-heart-of-electric-cars/</a></p> <p><a href="https://www.saurenergy.com/opinion/5-best-lithium-battery-recycling-firms-for-the-new-ev-world">https://www.saurenergy.com/opinion/5-best-lithium-battery-recycling-firms-for-the-new-ev-world</a></p> <ol style="list-style-type: none"> <li>1. Olabi, A. G., Onumaegbu, C., Wilberforce, T., Ramadan, M., Abdelkareem, M. A., &amp; Al-Alami, A. H. (2021). Critical review of energy storage systems. <i>Energy</i>, 214, 118987.</li> <li>2. Hannan, M. A., Hoque, M. M., Mohamed, A., &amp; Ayob, A. (2017). Review of energy storage systems for electric vehicle applications: Issues and challenges. <i>Renewable and Sustainable Energy Reviews</i>, 69, 771-789.</li> <li>3. Hasan, M. K., Mahmud, M., Habib, A. A., Motakabber, S. M. A., &amp; Islam, S. (2021). Review of electric vehicle energy storage and management system: Standards, issues, and challenges. <i>Journal of energy storage</i>, 41, 102940.</li> </ol> <p>Unit 3</p> <ol style="list-style-type: none"> <li>1. Ding, X., &amp; Wu, J. (2019). Study on energy consumption optimization scheduling for internet of things. <i>IEEE Access</i>, 7, 70574-70583.</li> <li>2. de Oliveira Cavalcanti, G., &amp; Pimenta, H. C. D. (2023). Electric Energy Management in Buildings Based on the Internet of Things: A Systematic Review. <i>Energies</i>, 16(15), 5753.</li> </ol>

<b>Evaluation</b>	<p>Final self-assessment test: multiple choice true/false/ fill in the blanks, etc.</p> <p>Learners receive a digital badge after completing the following activities (badge criteria):</p> <ol style="list-style-type: none"> <li>1. Completing the Module activities</li> <li>2. Passing the final assessment questionnaire (70% passing score)</li> </ol>
<b>ECVET points</b>	3 ECVET points

### Module 5 – Project Execution and Professional Skills in the Energy Sector

<b>Module 5: Project Execution and Professional Skills in the Energy Sector</b>	
<b>Notional Learning time</b>	12 hours
<b>EQF level:</b>	4
<b>Units title</b>	Unit 1: Project Planning and Stakeholder Management Unit 2: Communication and Teamwork in Project Execution
<b>Authors &amp; Affiliation</b>	Centre for Technology, Research & Innovation - CETRI (Cyprus)
<b>Description of the Module / Unit</b>	<p>This module focuses on the</p> <ul style="list-style-type: none"> <li>• Definition and purpose of a project charter.</li> <li>• Various project planning methodologies.</li> <li>• Techniques for stakeholder identification and engagement.</li> <li>• Development of a stakeholder management plan.</li> <li>• Effective communication with project stakeholders.</li> <li>• Basics of communication and teamwork in projects.</li> <li>• Importance of a communication plan.</li> <li>• Team roles and dynamics.</li> <li>• Conflict resolution strategies.</li> <li>• Consensus building techniques.</li> </ul>

<p><b>Learning outcomes</b></p>	<p>Unit 1 – At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the fundamentals of project planning.</li> <li>• Identify and engage key stakeholders.</li> <li>• Develop essential project documentation.</li> </ul> <p>Unit 2 – At the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> <li>• Develop effective communication plans.</li> <li>• Identify and implement key teamwork strategies.</li> <li>• Resolve conflicts constructively.</li> <li>• Build consensus among team members and stakeholders.</li> </ul>
<p><b>Step by step indication for learners</b></p>	<p>Step 1: Assess your knowledge and skills about the Module/unit topic through the initial self-assessment questionnaire          Step2: Read the interactive presentation and carry out the activities foreseen          Step 3: At the end of each unit, assess the learning outcomes through: the final self-assessment questionnaire</p>
<p><b>Training material/ Educational resources</b></p>	<p>Interactive videos implemented with H5p</p>
<p><b>External resources</b></p>	<p><a href="https://opentextbc.ca/projectmanagement/chapter/chapter-8-overview-of-project-planning-project-management/">https://opentextbc.ca/projectmanagement/chapter/chapter-8-overview-of-project-planning-project-management/</a>  <a href="https://project-management.com/project-management-phases/">https://project-management.com/project-management-phases/</a>  <a href="https://deeprojectmanager.com/stakeholder-analysis-tools-and-techniques/">https://deeprojectmanager.com/stakeholder-analysis-tools-and-techniques/</a>  <a href="https://www.float.com/resources/stakeholder-management">https://www.float.com/resources/stakeholder-management</a>  <a href="https://www.float.com/resources/stakeholder-management">https://www.float.com/resources/stakeholder-management</a>  <a href="https://www.apm.org.uk/resources/find-a-resource/stakeholder-engagement/">https://www.apm.org.uk/resources/find-a-resource/stakeholder-engagement/</a>  <a href="https://www.indeed.com/career-advice/career-development/importance-of-communication-in-project-management">https://www.indeed.com/career-advice/career-development/importance-of-communication-in-project-management</a>  <a href="https://www.apm.org.uk/resources/what-is-project-management/what-is-project-communication/">https://www.apm.org.uk/resources/what-is-project-management/what-is-project-communication/</a>  <a href="https://graduate.northeastern.edu/resources/communication-in-project-management/">https://graduate.northeastern.edu/resources/communication-in-project-management/</a></p>
<p><b>Evaluation</b></p>	<p>Final self-assessment test: multiple choice true/false/ fill in the blanks, etc.</p> <p>Learners receive a digital badge after completing the following activities (badge criteria):</p> <ol style="list-style-type: none"> <li>1. Completing the Module activities</li> <li>2. Passing the final assessment questionnaire (70% passing score)</li> </ol>

<b>ECVET points<sup>2</sup></b>	3 ECVET points
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## Module 6 – Technology Application and Innovation

<b>Module title: Technology Application and Innovation</b>	
<b>Notional Learning time</b>	15 hours
<b>EQF level:</b>	4
<b>Unit title</b>	Unit 1: Innovative Energy Technologies and System Performance Unit 2: Commissioning and Integration of Advanced Energy Systems
<b>Authors &amp; Affiliation</b>	PPC SA (Greece) and CETRI (Cyprus)
<b>Description of the Module / Unit</b>	This module focuses on:  An overview of advanced energy technologies. Methods for improving system performance. Impact assessment of new technologies. Practical considerations for implementation. Commissioning processes for new energy systems. Techniques for integrating advanced technologies. Effective communication with non-technical stakeholders. Criteria for selecting suitable technologies.
<b>Learning outcomes</b>	Unit 1 – At the end of this unit, learners will be able to: <ul style="list-style-type: none"> <li>• Grasp the principles of advanced energy technologies.</li> <li>• Implement solutions to enhance system performance.</li> <li>• Evaluate the effects of new technologies on energy efficiency.</li> </ul> Unit 2 – At the end of this unit, learners will be able to: <ul style="list-style-type: none"> <li>• Perform commissioning of new energy systems.</li> <li>• Integrate advanced technologies with existing infrastructure.</li> <li>• Effectively communicate technical details to non-technical stakeholders.</li> </ul>
<b>Step by step indication for learners</b>	Step 1: Assess your knowledge and skills about the Module/unit topic through the initial self-assessment questionnaire Step2: Read the interactive presentation and carry out the

	<p>activities foreseen</p> <p>Step 3: At the end of each unit, assess the learning outcomes through: the final self-assessment test</p>
<b>Training material/ Educational resources</b>	Interactive videos implemented with H5p
<b>External resources</b>	<p><a href="https://www.iea.org/reports/technology-innovation-to-accelerate-energy-transitions">https://www.iea.org/reports/technology-innovation-to-accelerate-energy-transitions</a></p> <p><a href="https://www.weforum.org/agenda/2023/09/renewable-energy-innovations-climate-emergency/">https://www.weforum.org/agenda/2023/09/renewable-energy-innovations-climate-emergency/</a></p> <p><a href="https://www.energy.gov/eere/iedo/articles/energy-performance-indicator-tool">https://www.energy.gov/eere/iedo/articles/energy-performance-indicator-tool</a></p> <p><a href="https://www.iea.org/reports/building-energy-performance-metrics">https://www.iea.org/reports/building-energy-performance-metrics</a></p> <p><a href="https://commissioningandstartup.com/the-commissioning-process-a-step-by-step-guide/">https://commissioningandstartup.com/the-commissioning-process-a-step-by-step-guide/</a></p> <p><a href="https://link.springer.com/referenceworkentry/10.1007/978-3-030-72322-4_93-1">https://link.springer.com/referenceworkentry/10.1007/978-3-030-72322-4_93-1</a></p> <p><a href="https://gaml.uis.unesco.org/wp-content/uploads/sites/2/2018/08/gaml4-communications-stakeholder-engagement-guide.pdf">https://gaml.uis.unesco.org/wp-content/uploads/sites/2/2018/08/gaml4-communications-stakeholder-engagement-guide.pdf</a></p>
<b>Evaluation</b>	<p>Final self-assessment test: multiple choice.</p> <p>Learners receive a digital badge after completing the following activities (badge criteria):</p> <ol style="list-style-type: none"> <li>1. Completing the Module activities</li> <li>2. Passing the final post-knowledge assessment questionnaire (70% passing score)</li> </ol>
<b>ECVET points<sup>2</sup></b>	3 ECVET points

## List of Figures and Tables

*Figure 1: The S3SF target groups*

*Table 1: EQF descriptors elements for level 4 and 5.*

*Table 2 – Learning Outcomes definition*

*Figure 2 – The basic structure of learning outcomes statement.*

*Table 2: S3SF training programme*

*Figure 3– Graphical representation of the digital badge used for Module 1*

*Figure 4 – The S3SF training platform*

## References

1. Europass. Description of the eight EQF levels. Retrieved from: Europass website <https://europa.eu/europass/en/description-eight-eqf-levels>
2. Cedefop (2017). *Defining, writing and applying learning outcomes: a European handbook*. Luxembourg: Publications Office. <http://data.europa.eu/doi/10.2801/7566770>
3. Cedefop (2022). *Defining, writing and applying learning outcomes: a European handbook - second edition*. Luxembourg: Publications Office. <http://data.europa.eu/doi/10.2801/703079>
4. COUNCIL RECOMMENDATION of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03) [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017H0615\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017H0615(01)&from=EN)