PUMP-UP

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1. Executive Summary

1.1 Overview of the PUMP-UP project

The **PUMP-UP Project** is a European initiative aimed at **enhancing training and upskilling opportunities in the Heating, Ventilation, and Air Conditioning (HVAC) sector**. With the increasing demand for greener heating and cooling solutions, the project focuses on updating **occupational requirements**, developing **innovative learning resources**, and promoting **EU-wide training standards**.

Bringing together partners from seven countries (Estonia, Greece, Belgium, Germany, Austria, Denmark, and Spain), PUMP-UP leverages expertise from universities, VET institutions, consulting firms, and industry experts. By fostering **transnational cooperation**, the project ensures that training aligns with **labour market needs**, integrates **flexible learning methodologies**, and adheres to EU frameworks such as EQF, EQAVET, and ESCO.

1.2 Purpose of the guide

This guide is designed to support **VET trainers and workplace mentors** in delivering the **PUMP-UP curriculum** effectively. It provides:

- **Detailed lesson plans** tailored to HVAC training needs,
- **Best practices** for delivering technical and practical sessions,
- **Guidance on integrating training materials** into formal and non-formal learning settings,
- **Assessment strategies** to track trainee progress and ensure learning effectiveness.

The handbook serves as a **practical resource** to help trainers equip HVAC professionals with the **skills needed for heat pump installation and maintenance**, contributing to the industry's **transition toward energy-efficient solutions**.

1.3 Target audience: VET trainers and workplace mentors

This handbook is intended for:

- **VET trainers** in technical schools, colleges, and training centres offering HVAC-related courses,
- **Workplace mentors** responsible for **on-the-job training** and **apprenticeship programs** in HVAC companies,

By providing **structured training methodologies and adaptable lesson plans**, the handbook empowers educators and mentors to **deliver high-quality, industry-relevant training**, fostering the next generation of skilled HVAC technicians across Europe.

2. Course Description

1.4 Overview of the PUMP-UP curriculum

Title: Comprehensive Heat Pump Technology Training Program (PUMP-UP Curriculum)

The PUMP-UP curriculum is a modular training program designed to equip HVAC technicians (both trainees and experienced professionals) with the knowledge and practical skills necessary for the installation, maintenance, and optimization of heat pump systems. In response to growing demand for sustainable and energy-efficient climate control solutions, this program aligns with key EU frameworks and standards such as EQF, EQAVET, and ESCO.

Spanning seven detailed modules, the curriculum combines theoretical foundations, hands-on exercises, and digital innovations. It supports vocational education and training (VET) providers, trainers, and workplace mentors in delivering up-to-date, high-quality instruction that reflects current industry needs.

1.5 Key learning objectives

The PUMP-UP curriculum is designed to:

- Provide **in-depth technical knowledge** on heat pump technologies and their applications,
- Teach **site assessment techniques** to determine system requirements and feasibility,
- Develop **competencies in system design, cost estimation, and energy efficiency calculations**,
- Equip learners with the skills to **install, configure, and commission heat pump systems**,
- Introduce **digital tools, IoT solutions, and smart monitoring technologies**,
- Enhance **troubleshooting and maintenance capabilities** for long-term system performance,
- Reinforce **health and safety best practices** in HVAC work environments.

1.6 Training structure and content

The training program follows a **modular structure**, covering seven key areas:

1. **M1: Essentials of Heat Pump Technologies** – Fundamentals of heat pump operation, components, and system types.
2. **M2: Site Assessment** – Evaluating environmental conditions, load calculations, and system suitability.
3. **M3: System Design & Costing** – Planning heat pump installations, selecting equipment, and estimating costs.

4. **M4: System Installation** – Practical installation procedures, commissioning, and performance optimization.
5. **M5: Digitalisation and IoT** – Smart controls, remote monitoring, and integration with digital platforms.
6. **M6: Troubleshooting & Maintenance** – Identifying system faults, performing diagnostics, and optimizing efficiency.
7. **M7: Health & Safety** – Ensuring compliance with regulations and maintaining a safe work environment.

Each module includes a **comprehensive set of learning materials** to support trainers and mentors in delivering structured and engaging lessons:

- **10 pages of lecture notes** providing in-depth theoretical knowledge,
- **40 presentation slides** to facilitate classroom and online instruction,
- **15 Q&As** to reinforce understanding and encourage discussion,
- **15 multiple-choice questions (MCQs)** for self-assessment and evaluation,
- **2 practical exercises** to develop hands-on skills in real or simulated environments.

1.7 Duration and Requirements

- Contact Hours: 90
- Total Hours: 140
- General Prerequisites: No prior knowledge of heat pump systems is required

1.8 Course Summary

Comprehensive Heat Pump Technology Training Program

The following table provides an overview of the PUMP-UP training curriculum, including module titles, key content, and available training materials for each module:

Module ID	Module Title	Description	Training Materials
M1	Essentials of Heat Pump Technologies	Introduction to heat pump types, operating principles, and applications, including environmental and energy efficiency aspects.	10 lecture pages, 40 slides, 15 Q&As, 15 MCQs, 2 practical exercises
M2	Site Assessment	Techniques for assessing installation sites, considering factors such as building dimensions, insulation quality, and external environmental conditions.	10 lecture pages, 40 slides, 15 Q&As, 15 MCQs, 2 practical exercises
M3	System Design & Costing	Designing heat pump systems based on requirements and constraints; understanding cost implications and optimizing designs for performance and efficiency.	10 lecture pages, 40 slides, 15 Q&As, 15 MCQs, 2 practical exercises
M4	System Installation	Practical skills in the installation of heat pump systems, including safety protocols, component integration, and system configuration for optimal performance.	10 lecture pages, 40 slides, 15 Q&As, 15 MCQs, 2 practical exercises
M5	Digitalisation and IoT	Use of digital tools and IoT solutions for monitoring, diagnostics, and optimization of heat pump systems.	10 lecture pages, 40 slides, 15 Q&As, 15 MCQs, 2 practical exercises
M6	Troubleshooting & Maintenance	Methods for identifying and resolving common issues in heat pump systems; preventive maintenance strategies.	10 lecture pages, 40 slides, 15 Q&As, 15 MCQs, 2 practical exercises

3. Learning Outcomes

The primary aim of this program is to provide participants with a robust understanding of heat pump technologies, integrating theoretical knowledge with practical skills. By completing this program, learners will not only understand how heat pump systems work but also gain the ability to apply this knowledge in real-world scenarios through design, installation, and maintenance. Sustainability, energy efficiency, and modern technological solutions such as IoT integration form the backbone of this training.

1.9 General competences developed

Participants will develop the following competences:

- A solid understanding of sustainability principles and the environmental impact of energy solutions.
- Proficiency in designing, installing, and maintaining heat pump systems for optimized performance.
- Adherence to safety protocols and regulatory compliance during all operations.
- Expertise in leveraging digital tools and IoT technologies for system diagnostics and optimization.

These competences ensure learners can operate effectively within the field of heat pump technology, addressing practical challenges with innovative solutions.

1.10 Learning Outcomes per module

- **Module M1: Essentials of Heat Pump Technologies**

Participants will:

- Comprehend the operational principles and types of heat pump systems (air source, ground source, water source)
- Understand the environmental benefits and limitations of heat pumps
- Be familiar with relevant regulations and how they affect heat pump applications.

- **Module M2: Site Assessment**

Participants will:

- Conduct comprehensive site evaluations to determine the most suitable system type and placement.
- Assess building characteristics, insulation quality, and external conditions for optimal performance
- Evaluate sustainability factors in site selection.

- **Module M3: System Design & Costing**

Participants will:

- Design heat pump systems tailored to the needs of specific buildings
- Balance energy efficiency with cost-effectiveness in their designs
- Integrate system components to ensure full functionality and minimal environmental impact.

- **Module M4: System Installation**

Participants will:

- Acquire hands-on skills for installing heat pump systems, ensuring proper integration of components.
- Test and balance systems post-installation to optimize performance.
- Follow strict safety protocols during the installation process.

- **Module M5: Digitalisation and IoT**

Participants will:

- Use digital interfaces and IoT solutions for remote system monitoring and diagnostics.
- Implement advanced control systems to regulate energy usage and optimize system functionality.
- Understand the role of modern digital tools in improving HVAC systems.

- **Module M6: Troubleshooting & Maintenance**

Participants will:

-Diagnose and resolve common technical issues in heat pump systems.
- Apply preventative maintenance techniques to extend system lifespan.
- Adjust and optimize control systems for maximum performance.

- **Module M7: Health and Safety**

Participants will:

- Handle refrigerants and other potentially hazardous materials safely, complying with regulations.
- Manage electrical and mechanical components with a focus on safety and reliability.
- Ensure all installations meet national and EU safety standards.

4. Training Modules and Lesson Plans

This section outlines the approach and structure for delivering comprehensive and effective training within the program. It provides guidance on practical training delivery and methods for ensuring inclusive and engaging learning environments.

1.11 Overview of Training Modules

M1: Essentials of Heat Pump Technologies	
General description	
This module provides a comprehensive introduction to heat pump technologies, covering their fundamental principles, types, efficiency metrics, and applications. Learners will explore how heat pumps function, their environmental benefits, and key considerations for design, installation, and maintenance. By understanding these concepts, participants will gain insight into the role of heat pumps in energy-efficient heating and cooling solutions. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will gain an understanding of the working principles of heat pumps and their role in energy transfer, exploring different types such as air-source, ground-source, and water-source systems. They will learn about key efficiency metrics like Coefficient of Performance (COP), Seasonal Energy Efficiency Ratio (SEER), and Heating Seasonal Performance Factor (HSPF). The module will cover essential components of heat pumps, including compressors, heat exchangers, and expansion devices, as well as their environmental benefits, such as reduced carbon emissions and integration with renewable energy sources. Additionally, learners will explore factors influencing heat pump performance, including climate conditions, system design, and maintenance requirements.
Skills	By the end of this module, learners will be able to explain how heat pumps transfer heat and function in different climate conditions while distinguishing between various types and their applications. They will develop the ability to assess the efficiency of heat pump systems using standard performance metrics and identify key components along with their functions. Learners will also be able to analyze installation requirements, anticipate potential challenges, and apply troubleshooting techniques to address common heat pump issues effectively.

Competences	Learners will develop the ability to evaluate and select the most suitable heat pump technologies for specific applications, ensuring efficient and sustainable operation. They will be able to apply best practices in installation, operation, and maintenance while considering regulatory and environmental factors. Effective communication of technical knowledge to both specialists and non-specialists will be emphasized, along with the capacity to support decision-making processes related to heat pump integration in residential, commercial, and industrial environments.
M2: Site Assessment	
General description	
This module focuses on the critical aspects of site assessment for heat pump installation, including client expectations management, technical site evaluation, and system compatibility analysis. Participants will explore best practices for conducting comprehensive site surveys, selecting the right heat pump based on environmental and structural conditions, and preparing installation sites efficiently. The module also covers regulatory compliance, funding opportunities, and post-installation support, ensuring a seamless and professional implementation of heat pump technology. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will gain an understanding of key factors influencing heat pump site assessment, including property evaluation, insulation quality, and system compatibility. They will explore best practices for client consultation, ensuring clear communication of performance expectations, energy savings, and system operation strategies. The module covers the methodology for heat loss calculations, the role of regulatory compliance, and coordination with Distribution Network Operators (DNO) and Microgeneration Certification Scheme (MCS) requirements. Additionally, learners will become familiar with funding programs and incentives that promote heat pump adoption, along with essential technical considerations for system installation, positioning, and electrical integration.
Skills	By the end of this module, learners will be able to conduct thorough site surveys by assessing existing heating systems, insulation levels, and space availability. They will develop the ability to explain heat pump operation to clients in an accessible manner while setting realistic performance expectations. Learners will be equipped to analyze heat loss calculations to determine appropriate heat pump sizing and integration strategies. They will also acquire the skills to identify optimal

	indoor and outdoor unit placement, manage installation challenges, and ensure compliance with regulatory and safety standards. Additionally, they will be able to guide customers through funding applications and coordinate with relevant authorities for grid and certification approvals.
Competences	Learners will develop the competence to conduct professional site assessments that ensure optimal heat pump performance and customer satisfaction. They will be able to balance technical, financial, and environmental considerations when designing and recommending heat pump solutions. By applying best practices in installation site preparation and system positioning, they will ensure efficient and compliant project execution. Additionally, learners will demonstrate the ability to communicate effectively with clients, providing guidance on system usage, maintenance, and long-term benefits. They will also develop the competence to navigate regulatory frameworks and funding mechanisms, contributing to the successful implementation and broader adoption of heat pump technology.

M3: System Design & Costing	
General description	
This module explores the design principles and economic considerations involved in implementing heat pump systems. Learners will gain insights into the appropriate sizing of heat emitters and pipework, material selection, and the integration of efficient control strategies for heating, cooling, and hot water systems. The course also examines the cost components of heat pump installation and operation, along with the impact of regional factors, subsidies, and market trends across Europe. By the end of the module, learners will be equipped to design cost-effective, energy-efficient, and regulation-compliant heat pump systems. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will understand the thermal and hydraulic design aspects of heat pump systems, including how emitter size and pipework dimensions influence system performance. They will become familiar with various materials used in heat distribution systems and their suitability for different applications. The module covers essential control options—such as time, temperature, and weather-compensated systems—for space heating, cooling, and domestic hot water production. Learners will also acquire knowledge of cost structures, including initial investment, operating expenses, and the influence of

	national subsidies and policy frameworks on affordability and market adoption.
Skills	By completing this module, learners will be able to perform calculations for sizing radiators, pipework, and underfloor heating systems in low-temperature heating applications. They will be capable of selecting appropriate control strategies based on building usage, user comfort, and energy savings. Learners will also gain the ability to assess the financial viability of different heat pump solutions by estimating installation and running costs, evaluating incentive schemes, and identifying region-specific cost drivers. Practical exercises will enhance their ability to analyze system performance and optimize designs for energy and cost efficiency.
Competences	Learners will develop the competence to design and cost heat pump systems tailored to specific buildings and user needs. They will be able to balance technical performance with economic and environmental objectives, ensuring compliance with local regulations and maximizing return on investment. Learners will be capable of advising clients on system configurations, control strategies, and financial planning, and will be prepared to contribute to sustainable building projects that support the energy transition. Their integrated approach will allow them to make informed design and business decisions in the context of evolving market and policy landscapes.
M4: System Installation	
General description	
This module focuses on the installation of heat pumps, covering both air source and ground source systems. It provides detailed guidance on the transportation, dimensioning, and installation of split and monoblock air source heat pumps, including best practices for outdoor and indoor unit placement, anchorage, and anti-vibration mounting. Learners will also explore common installation mistakes and how to avoid them. Additionally, the module covers ground source heat pumps, including different types of heat collectors such as horizontal ground loops, water loops, and boreholes. By the end of the module, learners will have a solid understanding of the installation process and the technical considerations necessary for efficient and safe system operation. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will gain an in-depth understanding of air and ground source heat pump installation, including the principles of correct transportation, dimensioning, and placement of units. They will learn about different mounting options such as floorstanding and wall-

	mounted installations, as well as the role of anchorage and anti-vibration systems. The module will provide knowledge on refrigerant line connections, evacuation procedures using vacuum gauges, and the importance of thermal insulation and condensate drainage. Additionally, learners will become familiar with common installation errors, their consequences, and corrective measures. They will also explore the characteristics of ground source heat pumps, including the advantages and limitations of different heat collector systems such as horizontal loops, water loops, and boreholes.
Skills	By the end of this module, learners will be able to correctly transport and handle air source heat pumps while adhering to recommended tilting angles and safety guidelines. They will develop the ability to size and position heat pumps based on site requirements, ensuring optimal efficiency and performance. Learners will acquire hands-on skills in securely mounting outdoor and indoor units, installing refrigerant lines, and performing vacuum procedures to eliminate contaminants. They will also be able to assess and apply proper thermal insulation techniques, set up condensate drains, and identify installation errors that could compromise system operation. Furthermore, learners will gain proficiency in determining the most suitable ground source heat pump configurations based on site conditions and energy needs.
Competences	Learners will develop the competence to install air and ground source heat pumps in compliance with industry standards and safety regulations, ensuring proper system functionality. They will be able to assess site conditions, select the most appropriate installation methods, and implement best practices for securing heat pump components. Additionally, they will demonstrate the ability to troubleshoot and correct common installation issues, optimizing system performance and longevity. By integrating knowledge of different heat collection methods, learners will be capable of advising clients on the most efficient and sustainable heat pump solutions. Effective problem-solving and decision-making skills will be emphasized, enabling learners to adapt to diverse installation scenarios and challenges.
M5: Digitalisation and IoT	
General description	
This module introduces the role of digitalisation and Internet of Things (IoT) technologies in the transformation of HVAC systems. It explores how connected devices and advanced control systems enable real-time monitoring, remote diagnostics, predictive maintenance, and energy optimization. Through this module, learners will understand how IoT enhances system performance, comfort, and sustainability. The course covers key components such as smart thermostats, building management systems (BMS), energy management systems (EMS), and	

fault detection and diagnostics (FDD), while also addressing data security and privacy considerations. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will gain a comprehensive understanding of the principles behind IoT and its application in HVAC systems, including connectivity, automation, and real-time data processing. They will become familiar with key technologies such as smart sensors, cloud computing, and machine learning. The module explains the benefits of IoT for energy efficiency, maintenance, and indoor comfort. Learners will also explore system components like smart thermostats, BMS, EMS, and FDD, as well as emerging trends such as AI-driven optimization, renewable integration, and smart city connectivity. Additionally, they will learn about cybersecurity, data privacy, and legacy system integration challenges.
Skills	By completing this module, learners will be able to install and configure IoT-enabled HVAC devices such as smart thermostats and sensors. They will develop the ability to monitor system performance using digital dashboards, perform diagnostics, and implement energy-saving adjustments. Learners will gain hands-on skills in setting up and integrating components like BMS and EMS, using predictive maintenance tools, and configuring alert systems based on performance metrics. They will also be able to assess compatibility with legacy systems, manage data security protocols, and apply IoT solutions to optimize energy usage and comfort.
Competences	Learners will develop the competence to implement and manage digital and IoT technologies within HVAC systems, contributing to increased efficiency, reliability, and sustainability. They will be equipped to support the digital transformation of buildings by integrating smart controls and analytics tools into HVAC operations. Competence will also include interpreting system data to guide decision-making, maintaining secure and compliant IoT environments, and responding proactively to performance issues. Learners will be prepared to contribute to the development of smart, connected, and energy-optimized buildings in both residential and commercial contexts.
M6: Troubleshooting & Maintenance	
General description	
This module equips HVAC technicians with essential skills for troubleshooting and maintaining heat pump systems. It emphasizes systematic diagnostic procedures, preventive maintenance	

strategies, and corrective techniques that ensure system efficiency, reliability, and longevity. Learners will gain practical knowledge in identifying faults, restoring performance, and performing routine maintenance tasks. The module also highlights the use of professional tools, documentation practices, and the economic and environmental benefits of well-maintained systems. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will understand the core principles of troubleshooting heat pump systems, including fault detection, root cause analysis, and problem resolution. The module covers preventive, condition-based, and corrective maintenance approaches. It provides knowledge about common system issues such as refrigerant leaks, electrical faults, airflow restrictions, and control problems. Learners will also explore the importance of refrigerant balance, airflow optimization, and seasonal maintenance routines. In addition, the course introduces key diagnostic tools and emphasizes compliance with warranty and safety standards.
Skills	By completing this module, learners will be able to identify, diagnose, and resolve a wide range of technical problems in heat pump systems using a structured approach. They will develop hands-on skills in component inspection, refrigerant management, filter and coil cleaning, and system calibration. Learners will practice preventive maintenance tasks, use diagnostic instruments like manifold gauges and multimeters, and maintain accurate service records. They will also be able to monitor performance indicators, recognize early warning signs, and perform seasonal system preparations.
Competences	Learners will develop the competence to maintain and troubleshoot heat pump systems professionally and efficiently. They will ensure optimal system operation, minimize downtime, and extend equipment lifespan through regular care and timely interventions. Learners will be able to implement structured maintenance schedules, interpret performance data, and apply safe and effective repair techniques. Their ability to use modern diagnostic tools and maintain compliance with manufacturer and regulatory requirements will support long-term system reliability and customer satisfaction.

M7: Health and Safety
General description

This module addresses the essential health and safety considerations for professionals involved in the installation, operation, and maintenance of heat pump systems. Although heat pump work typically involves low to medium risk, specific safety protocols must be followed, particularly in relation to electrical systems, refrigerant handling, and working at height, below the ground level and confined spaces. Learners will gain an understanding of proper safety procedures, the use of personal protective equipment (PPE), emergency response practices, and risk assessments. By the end of this module, participants will be able to ensure a safe working environment while performing heat pump-related tasks. The total duration of the module is **20 hours.**	
Learning outcomes	
Knowledge	Learners will gain an understanding of key health and safety principles applicable to heat pump installation and maintenance. This includes electrical supply requirements and hazards, such as circuit capacity and connections. They will learn about the properties and risks associated with different refrigerants, including risks to human health as well as environmental damages. The module also explains the appropriate use of PPE, site safety procedures, and legal obligations. Finally, learners will understand the risks and preventive measures involved in working at height, below the ground level and confined spaces, including fall protection and proper equipment usage.
Skills	By the end of this module, learners will be able to assess electrical systems for compatibility and safety prior to heat pump connection. They will be capable of identifying refrigerant-related hazards and applying appropriate safety measures such as evacuation procedures, protective gear, safe handling techniques and procedures in the event of accident. Learners will develop the ability to carry out site risk assessments, recognize confined space risks, and implement worksite safety protocols. Additionally, they will be able to plan and execute tasks at height safely by using suitable equipment, securing access points, and preventing accidents caused by overreaching or improper ladder use.
Competences	Learners will develop the competence to ensure a safe and compliant working environment while performing heat pump installations or maintenance. They will be able to apply relevant safety regulations and follow best practices for handling electrical and refrigerant systems. Through the correct use of PPE and adherence to site-specific procedures, they will minimize health risks to themselves and others. Furthermore, learners will demonstrate the ability to work responsibly at height, use risk mitigation strategies, and respond effectively to emergency situations. These competences will contribute to a culture of safety and professionalism within the renewable energy sector.

1.12 Lesson Plan Structure

1.12.1 Module 1: Essentials of Heat Pump Technologies

Suggestions for the developing of the lecture notes

Lesson beginning:

To introduce the topic, start by assessing the learners' prior knowledge of **heat pump technologies**. This can be done through open-ended questions such as:

- *"What do you already know about heat pumps?"*
- *"Where have you seen heat pump systems being used?"*
- *"What are the key differences between traditional heating systems and heat pumps?"*

Encourage trainees to share their experiences and any previous exposure to the subject. This initial discussion will help trainers tailor the lesson to the group's level of understanding.

Engage/motivation

To ensure engagement and motivation:

- Highlight the increasing demand for heat pump technologies due to the EU's green transition and energy efficiency targets.
- Present real-world applications of heat pumps in residential, commercial, and industrial settings.
- Show case studies or short videos demonstrating successful implementations of heat pump technology.
- Use interactive questioning to ensure understanding of key concepts such as efficiency, sustainability, and cost-effectiveness of heat pumps.

Emphasize the importance of this module as the foundation for the rest of the course, ensuring learners have a clear understanding of basic concepts before moving into more technical aspects.

Development of the lessons

To effectively develop the lesson, divide the topic into key areas:

1. **Introduction to Heat Pumps and types.**
2. **Fundamental Working Principles of HP systems (the HP cycle).**
3. **Principles of HP selection and System Design.**

Closing activities

To reinforce learning, conclude the lesson with:

- A summary of the key takeaways:
    - What a heat pump is and how it works.
    - Advantages of heat pumps over traditional heating systems.
    - Different types and applications of heat pumps.
- A Q&A session, where learners can clarify doubts.
- A quick quiz or poll to assess immediate understanding.
- Encouragement for learners to reflect on how heat pumps could be applied in their own work or projects.

Materials and teaching resources

- PowerPoint presentation: *Essentials of Heat Pump Technologies*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.
- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

1.12.2 Module 2: Site Assessment

Suggestions for the developing of the lecture notes

Lesson beginning

To introduce the topic of site assessment, begin by gauging the learners' prior knowledge and experience related to site evaluations for HVAC systems, specifically heat pumps. This can be done through open-ended questions such as:

- *"What factors do you think are important when assessing a site for installing a heat pump?"*

- *"What kind of challenges have you encountered or anticipate when evaluating a site for energy-efficient systems?"*
- *"How do you assess the suitability of a building or location for renewable energy solutions like heat pumps?"*

Encourage trainees to share any past experiences and real-life examples, which will allow the instructor to adjust the lesson based on the group's level of expertise and needs. This initial interaction will also help establish the relevance of site assessment in the context of heat pump installations.

Engage/motivation

To maintain engagement and motivation throughout the lesson:

- **Discuss the importance of site assessments** in the context of successful heat pump installations, emphasizing how proper evaluation can ensure energy efficiency, cost savings, and system longevity.
- **Highlight real-world consequences** of poor site assessments, such as inefficiency, higher operating costs, or system failure.
- **Present the broader environmental impact**: Explain how site assessments for heat pumps are crucial in optimizing energy consumption and supporting the green transition.
- Show **videos or before-and-after site assessments** demonstrating how professional evaluations can transform installation success and system performance.
- Incorporate **interactive questioning** such as:
    - *"Why is the building's insulation important when assessing its suitability for a heat pump?"*
    - *"How can climate affect your site assessment and choice of heat pump?"*

This approach will highlight the importance of understanding and conducting thorough site assessments, motivating the learners to appreciate the skill set they are about to develop.

Development of the lessons

To effectively cover the topic and maintain learner engagement, divide the lesson into key components:

1. **Client expectations management**
2. **Site examination & preparatory work**
3. **Site-specific heat loss, radiator energy output and hot water requirements calculations**

Closing activities

To reinforce key concepts and ensure learners leave with a strong understanding:

- **Summary of Key Takeaways**

- **Q&A Session:** allow learners to ask questions, clarifying any doubts they may have about the site assessment process and its practical applications.

- **Interactive Quiz or Poll:** conduct a quick quiz or poll to test learners' immediate understanding of the key concepts covered in the lesson.

- **Reflection and Application:** encourage learners to think about how they might apply the concepts of site assessment in their own work.

Materials and teaching resources

- PowerPoint presentation: *Site Assessment*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.
- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

1.12.3 Module 3: System Design & Costing

Suggestions for the developing of the lecture notes

Lesson beginning

To introduce the topic of System Design & Costing, begin by assessing learners' existing knowledge and experience with HVAC systems and heat pump technologies. Use open-ended questions to initiate discussion and activate prior understanding:

- *"What do you understand by system design in the context of heat pump installations?"*
- *"Which elements do you think influence the overall cost of a heat pump system?"*

- *"What steps would you take to design a heating and cooling system for a residential or commercial building?"*

  Encourage learners to share any professional experience with system design, equipment selection, or budgeting. This initial dialogue helps tailor the lesson to the group's level and sets the stage for a more practical and applied approach to the topic.

  Engage/motivation

  To engage learners and highlight the real-world relevance of the module:

- **Discuss the importance of efficient system design** in ensuring optimal heat pump performance, energy savings, and long-term sustainability. Emphasize that poor design can lead to higher operating costs and system inefficiency.

- **Use case studies and real-life examples** to compare well-designed vs. poorly-designed systems. Focus particularly on the economic implications and long-term impact of design decisions.

- **Highlight industry trends**: such as the rising demand for low-carbon technologies, changes in EU policy, and the increasing affordability of heat pumps in different European markets.

- Encourage **critical thinking** through interactive questions:
  - *"What risks could arise from miscalculating pipe dimensions or emitter sizing?"*
  - *"How might building type or regional regulations affect your design choices and cost estimation?"*

  Development of the lessons

  To cover the topic comprehensively and maintain engagement, break the lesson into key areas:

1. **Introduction to System Design**
2. **Dimensions of heat emitters, pipework & materials.**
3. **Selection of control options (space heating/cooling, hot water)**
4. **Cost assessment**

  Closing activities

  Wrap up the session with reflective and interactive components to consolidate learning:

- **Key takeaways review:** Summarize main concepts, such as the relationship between emitter sizing, system efficiency, and cost-effectiveness.

- **Q&A session**: Allow learners to raise doubts or request clarification on system dimensioning, material choices, or cost estimation procedures.

- **Quick quiz or poll:** Check comprehension with example questions:

- *"Which materials are most suitable for pipework in a low-temperature hydronic system?"*
- *"How does weather compensation affect the performance and cost of a heat pump system?"*

- **Application and reflection questions:**

- *"If tasked with designing a heat pump system for a residential building, how would you estimate its cost and define its components?"*
- *"How would you address a client's concern about high upfront costs?"*

This closing activity helps learners internalize the key principles and encourages them to transfer this knowledge to their future professional roles.

Materials and teaching resources

- PowerPoint presentation: *System Design & Costing*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.
- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

1.12.4 Module 4: System Installation

Suggestions for the developing of the lecture notes

Lesson beginning

To introduce **Heat pumps System Installation**, begin by assessing the learners' prior knowledge and experiences related to HVAC system installation and the specific challenges of heat pump systems. You can ask open-ended questions like:

- *"What do you think are the key steps in installing a heat pump system?"*
- *"What challenges do you foresee when installing a heat pump system in a building?"*
- *"How does the installation process differ between heat pumps and traditional HVAC systems?"*

Encourage trainees to share any previous experiences, either from training or practical work, so that the lesson can be tailored to their understanding level. This discussion helps set the stage for understanding the technical aspects of heat pump system installation.

Engage/motivation

To engage and motivate learners, emphasize the importance of proper installation for ensuring the system's performance, efficiency, and longevity:

- **Discuss the importance of correct installation**

- **Introduce real-world examples**

- **Highlight industry trends**: as renewable energy solutions like heat pumps become more popular, demand for skilled installers is growing, and proper training is essential for success in the field.

- **Interactive questioning** to ensure engagement:
  - *"What are the most common mistakes you think installers make during the installation process?"*
  - *"Why is the placement of the heat pump crucial for its efficiency and performance?"*

By framing the lesson this way, you can motivate the learners to appreciate the technical detail and care required in heat pump system installations.

Development of the lessons

To effectively develop the lesson, divide the topic into key areas:

4. **Introduction to System Installation**
5. **Air-water and air-air heat pumps installation**
6. **Ground-water heat pumps installation**

Closing activities

To wrap up the lesson and reinforce learning:

- **Summary of Key Takeaways**

- **Q&A Session:** allow learners to ask questions and clarify doubts related to installation processes or technical details.

- **Interactive Quiz or Poll:** conduct a short quiz or poll to assess the learners' understanding of the installation process.

- **Reflection and Application:** encourage learners to think about how they would apply the installation process to their own projects:
    - *"What steps would you take to ensure a successful heat pump installation in a new building?"*
    - *"What challenges do you think you might face when installing a heat pump in a tight space or older building?"*

  By engaging learners with practical examples, discussions, and a thorough understanding of the installation process, they will be better equipped to carry out installations with confidence and skill.

Materials and teaching resources

- PowerPoint presentation: *Heat Pump System Installation*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.
- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

1.12.5 Module 5: Digitalisation and IoT

Suggestions for the developing of the lecture notes

Lesson beginning

To introduce **Digitalisation and IoT** in the context of heat pump systems, start by assessing the learners' prior knowledge and experience with digital technologies, smart systems, and the role of IoT in HVAC applications. Open-ended questions to engage learners could include:

- *"What do you understand by the Internet of Things (IoT) in the context of HVAC systems?"*

- *"How do you think digitalisation can improve the performance of heat pump systems?"*
- *"Have you worked with any smart devices or systems that control energy usage or building comfort?"*

Encourage trainees to share any previous experiences with IoT or digital technologies in energy systems. This will allow the instructor to tailor the lesson to the learners' understanding and ensure the relevance of the content to their needs.

Engage/motivation

To engage and motivate learners throughout the lesson, emphasize the transformative role of digitalisation and IoT in modern energy systems:

- **Discuss the evolution of HVAC systems**: Highlight how traditional HVAC systems have evolved with the advent of digitalisation and IoT, leading to more efficient, flexible, and user-friendly systems.

- **Present the benefits of IoT in heat pump systems**: Emphasize how IoT-enabled heat pumps can enhance energy efficiency, reduce operational costs, enable remote monitoring, and provide data for predictive maintenance.

- **Showcase real-world examples**: Present case studies or videos of buildings that have integrated smart technologies, such as IoT-enabled heat pumps, to demonstrate improved system performance and energy management.

- **Interactive questioning** to ensure engagement:

    - *"What benefits do you think you could see from controlling a heat pump system remotely?"*
    - *"How do you think IoT could help with maintenance and monitoring of heat pumps?"*

This approach will help learners appreciate the relevance of digitalisation and IoT in the modern HVAC industry, as well as its impact on system performance and management.

Development of the lessons

To effectively cover the topic and maintain learner engagement, divide the lesson into the following key areas:

1. **Introduction to Digitalisation and IoT**
2. **IoT Integration in HVAC Systems**

3. **Transformation of HVAC through IoT**
4. **What is IoT?**
5. **IoT Integration with HVAC**
6. **Integration of the Internet of Things (IoT)**
7. **Applications of IoT in HVAC**

Closing activities

To reinforce learning and ensure retention of key concepts:

- **Summary of Key Takeaways:**

- **Q&A Session:** open the floor for questions and encourage learners to clarify doubts or explore aspects of IoT that they find most relevant to their work or projects.

- **Interactive Quiz or Poll:** use a quick quiz or poll to test learners' understanding of key topics.

- **Reflection and Application:**
  Encourage learners to reflect on how they could integrate IoT technologies into their own work:
  - *"How could IoT help you manage or monitor heat pump systems in your future projects?"*
  - *"What would be the benefits and challenges of implementing IoT-enabled heat pumps in a commercial building?"*

  This final reflection helps learners understand how to apply the concepts in real-world scenarios and encourages them to think critically about IoT's role in HVAC systems.

Materials and teaching resources

- PowerPoint presentation: *Digitalisation and IoT*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.
- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

1.12.6 Module 6: Troubleshooting & Maintenance

Suggestions for the developing of the lecture notes

Lesson beginning

To introduce **Troubleshooting & Maintenance** for heat pump systems, begin by assessing the learners' prior knowledge of basic HVAC troubleshooting, system malfunctions, and maintenance practices. Open-ended questions to engage learners could include:

- *"What types of issues have you encountered with heat pump systems in the past?"*
- *"What steps do you typically take when diagnosing a malfunction in an HVAC system?"*
- *"How do you prioritize maintenance tasks for heating and cooling systems?"*

Encourage trainees to share their experiences with system failures or common issues they have observed in previous work. This discussion will help tailor the lesson to the group's knowledge level and ensure the content is relevant to their needs.

Engage/motivation

To engage and motivate learners, emphasize the importance of troubleshooting and maintenance for ensuring heat pump system efficiency, longevity, and optimal performance:

- **Discuss the impact of poor maintenance**
- **Highlight the benefits of preventative maintenance**:
- **Real-world examples**:
- **Interactive questioning** to ensure engagement:
    - *"What common issues do you think contribute to heat pump failure?"*
    - *"How do you think routine maintenance can improve system efficiency and reliability?"*

This approach will emphasize the importance of proactive maintenance and the critical role of troubleshooting skills in preventing system issues.

Development of the lessons

To develop the lesson and keep it engaging, break it into the following key areas:

1. **Introduction to Troubleshooting & Maintenance:**

2. **Diagnosing and Fixing Issues in Heat Pump Systems**
3. **The Role of Troubleshooting and Maintenance**
4. **The Importance of Regular Maintenance**
5. **Enhancing Efficiency and Cost Savings**
6. **Extending Equipment Lifespan**
7. **Maintaining Optimal Comfort Levels**
8. **Preventing Unexpected Breakdowns**
9. **Troubleshooting Common Issues**
10. **Key Maintenance Practices**
11. **Conclusion: The Value of Maintenance**

Closing activities

To reinforce learning and ensure retention of key concepts:

- **Summary of Key Takeaways**

- **Q&A Session:** open the floor for questions to clarify any doubts or provide additional insights on specific troubleshooting methods or maintenance tasks.

- **Interactive Quiz or Poll:** conduct a short quiz or poll to assess the learners' understanding of the material.

- **Reflection and Application:** encourage learners to reflect on how they would apply troubleshooting and maintenance techniques in their work:
    - *"What are some of the most common issues you might face when troubleshooting a heat pump?"*
    - *"How will you prioritize maintenance tasks during a service visit to ensure optimal system performance?"*

This final reflection helps learners understand the practical applications of troubleshooting and maintenance skills in real-world scenarios and encourages them to think critically about how to integrate these practices into their workflow.

Materials and teaching resources

- PowerPoint presentation: *Troubleshooting & Maintenance*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.

- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

1.12.7 Module 7: Health and Safety

Suggestions for the developing of the lecture notes

Lesson beginning

To introduce **Health and Safety** in the context of heat pump systems, begin by assessing the learners' prior knowledge of safety practices in the workplace, particularly related to HVAC systems and installation. Open-ended questions to engage learners could include:

- *"What are some of the safety risks you've encountered while working with HVAC systems?"*
- *"What safety measures do you typically follow when installing or servicing a heating system?"*
- *"Can you think of any specific risks related to heat pump systems?"*

Encourage trainees to share their past experiences or observations regarding health and safety issues. This will help gauge the group's knowledge level and tailor the content to their specific needs.

Engage/motivation

To engage and motivate learners, emphasize the critical importance of health and safety in the HVAC industry, particularly when working with heat pumps:

- **Highlight the consequences of neglecting safety**: Discuss how poor safety practices can lead to accidents, injuries, or even fatalities, and the potential legal and financial repercussions for workers and employers.

- **Link safety to professional responsibility**

- **Real-life examples**

- **Interactive questioning** to ensure engagement:
  - "*What do you think is the most common safety risk when installing or maintaining heat pumps?*"

- *"How do you think following proper safety procedures affects the quality and efficiency of your work?"*

This approach will help learners understand the importance of health and safety practices and encourage them to actively engage with the topic.

Development of the lessons

To develop the lesson and keep it engaging, break it into the following key areas:

1. **Introduction to Health and Safety in HVAC**
2. **Electrical supplies safety**
3. **Refrigerant safety**
4. **Working at height**
5. **Working in confined spaces**
6. **Working below the ground level**

Closing activities

To reinforce learning and ensure retention of key concepts:

- **Summary of Key Takeaways**

- **Q&A Session:**open the floor for questions to clarify any doubts or provide additional insights on health and safety issues related to heat pump systems.

- **Interactive Quiz or Poll:**conduct a short quiz or poll to assess learners' understanding of the safety practices covered.

- **Reflection and Application:** encourage learners to reflect on how they would apply health and safety measures in their own work:
  - *"How would you handle a situation where you notice a safety hazard on a job site?"*
  - *"What are some ways you can ensure your work environment remains safe while working with heat pump systems?"*

This final reflection helps learners understand the importance of health and safety and motivates them to adopt these practices in their professional routines.

Materials and teaching resources

- PowerPoint presentation: *Health and Safety*
- Case studies: two case studies are proposed
- Questions and answers: there are **15 questions and answers** related to this unit. It is important for the trainer to have a previous look at the questions and all the answers in order to be able to clarify any further question that the pupils may have regarding the specific topic.
- Multiple choice questions: there are **15 multiple choice questions**. It is important that the trainer understands the overall progress of the pupils, in order to be able to evaluate the success of the training.

5. Work-Based Learning (WBL) Integration (Prepared by CELF)

Work-based learning is a key element of the PUMP-UP curriculum. It ensures that the knowledge, skills, and competences developed in the seven modules are applied, tested, and consolidated in authentic work environments. By integrating structured workplace activities with centre-based training and online learning, VET trainers and workplace mentors can support learners in transferring what they have learned into real installations, maintenance tasks, and customer-facing situations in the HVAC sector.

This section provides guidance on how to organise, support, and assess work-based learning in the context of the PUMP-UP program. It is intended for both VET trainers in schools and training centres and for workplace mentors in HVAC companies who supervise apprentices, trainees, or employees in upskilling pathways.

5.1 Purpose of work-based learning in the PUMP-UP curriculum

The PUMP-UP curriculum combines theoretical foundations, hands-on exercises, and digital resources to prepare learners for the design, installation, commissioning, troubleshooting, and maintenance of heat pump systems. Work-based learning complements these components by:

- Allowing learners to apply technical knowledge from the modules (e.g. site assessment, system design, installation, digitalisation, troubleshooting, and health and safety) in real projects and tasks.
- Providing exposure to authentic workflows, tools, materials, customers, and organisational procedures in HVAC companies.
- Supporting the development of transversal competences such as communication with clients and colleagues, problem-solving under time constraints, collaboration in teams, and adherence to company and regulatory standards.
- Strengthening links between VET providers and the labour market by aligning learning activities with current and emerging occupational requirements in the heat pump sector.

When WBL is purposefully aligned with the PUMP-UP modules, it significantly increases the relevance and impact of training for both learners and employers.

5.2 Planning and structuring WBL periods

Effective WBL integration begins with careful planning. Before a WBL period starts, VET trainers and workplace mentors should agree on the expected learning outcomes, the types of tasks learners will carry out, and how progress will be monitored. This planning should explicitly reference the PUMP-UP modules and their associated competences.

Key steps in planning include:

- Defining learning outcomes for WBL: Identify which knowledge, skills, and competences from the modules will be the focus during the WBL period (e.g. applying site assessment methods from Module 2, implementing installation procedures from Module 4, or practising troubleshooting routines from Module 6).
- Selecting appropriate workplaces and tasks: Choose companies and work settings that can offer relevant heat pump-related activities (e.g. residential or commercial installations, service and maintenance visits, diagnostic work, customer consultation).
- Developing a WBL plan or agreement: Draft a simple document that outlines the duration of the WBL period, expected activities, responsibilities of the learner, trainer, and workplace mentor, and any specific health and safety or quality requirements.
- Preparing learners: Before entering the workplace, trainers should brief learners on the objectives of WBL, expected professional behaviour, ethical standards, safety requirements, and how the experience links to the PUMP-UP curriculum.

A clear structure supports consistency across companies and ensures that WBL contributes directly to the overarching goals of the program.

5.3 Roles and collaboration between VET trainers and workplace mentors

Successful work-based learning relies on close cooperation between the VET provider and the company. The PUMP-UP project explicitly addresses both VET trainers and WBL mentors as key actors in delivering the curriculum.

- *VET trainers* are responsible for introducing and explaining the theoretical content, preparing learners before they enter the workplace, and helping them connect workplace experiences with the learning outcomes of the modules. They also manage assessment procedures and quality assurance at institutional level.
- *Workplace mentors* supervise learners on site, allocate tasks that are appropriate to their competence level, provide ongoing guidance and feedback, and ensure that company procedures and safety regulations are followed.
- *Joint responsibilities* include aligning expectations, maintaining regular communication, and jointly reviewing learner progress. This can be supported through short coordination meetings (physical or online), shared documentation (e.g. digital logbooks or checklists), and joint evaluation discussions at mid-point and end of the WBL period.

The Train-the-Trainer seminar foreseen in PUMP-UP provides an additional opportunity for trainers and WBL mentors to familiarise themselves with the curriculum and the project's instructional approach.

5.4 Linking workplace tasks to curriculum modules

To maximise learning, workplace tasks should be clearly connected to the content and learning outcomes of the seven modules. Trainers and mentors can, for example:

- For Module 1 (Essentials of Heat Pump Technologies): Encourage learners to identify components and system types on real installations and to discuss how environmental and efficiency aspects observed on site relate to the theoretical content.
- For Module 2 (Site Assessment): Assign learners to assist in site surveys, perform basic measurements, collect relevant data, and reflect on how site characteristics influence system selection and design.
- For Module 3 (System Design & Costing): Involve learners in preparing draft designs, comparing equipment options, or estimating costs under supervision, linking these activities to the design and costing methods presented in training.
- For Module 4 (System Installation): Allow learners to participate in installation tasks such as mounting units, connecting pipework, or commissioning checks, while reinforcing safety protocols and quality standards.
- For Module 5 (Digitalisation and IoT): Give learners opportunities to configure control systems, view system data, or use digital tools for monitoring and diagnostics in real projects.
- For Module 6 (Troubleshooting & Maintenance): Engage learners in systematic fault-finding, preventive maintenance routines, and documentation of interventions, under close supervision.
- For Module 7 (Health and Safety): Reinforce safe working practices (e.g. handling refrigerants, working at height or in confined spaces, using PPE) and encourage learners to identify and report potential hazards.

By explicitly mapping workplace activities to specific modules, both trainers and mentors can help learners see how classroom, online, and workplace learning form a coherent whole.

5.5 Monitoring, feedback, and assessment in WBL

Systematic monitoring and feedback are essential to ensure that work-based learning leads to real competence development. In line with the assessment strategies used in the PUMP-UP materials (e.g. Q&As, MCQs, and practical exercises), WBL should also be accompanied by structured reflection and documentation.

Suggested practices include:

- *Learning journals or logbooks:* Learners regularly document tasks performed, tools used, problems encountered, and lessons learned, with short reflections on how these relate to the module contents.

- *Observation and feedback:* Workplace mentors observe learners during key tasks and provide immediate, constructive feedback on technical performance, safety, communication, and problem-solving.
- *Review meetings:* VET trainers and mentors conduct periodic review meetings (for example at the beginning, mid-point, and end of the WBL period) to discuss progress against agreed learning outcomes and to adjust tasks if needed.
- *Integration into overall assessment:* Evidence collected from WBL (e.g. mentor evaluations, logbooks, completed tasks) can be combined with results from written tests, quizzes, and practical exercises to provide a more complete picture of the learner's achievement.

Feedback should be specific, supportive, and oriented towards improvement, helping learners to take increasing responsibility for their own professional development.

5.6 Practical suggestions for organising WBL

To facilitate smooth and meaningful work-based learning experiences, trainers and mentors may consider the following practical suggestions:

- Start with simpler, well-defined tasks and gradually increase complexity as learners gain confidence and competence.
- Combine observation of experienced technicians with supervised hands-on practice, ensuring that learners always work within their competence level and under appropriate supervision.
- Encourage learners to prepare for each WBL day by revising relevant sections of the lecture notes, slides, or MOOC units, so that they arrive with a clear understanding of the concepts they will apply.
- Use short debriefings at the end of the day or week, asking learners what they did, what they found challenging, and how they would approach similar tasks in the future.
- Maintain clear communication channels between the VET institution and the company to address any issues related to safety, workload, or learner support in a timely manner.

By embedding these practices into the organisation of WBL, partners can ensure that work-based learning becomes an integrated, high-quality component of the PUMP-UP training pathway, supporting both the professional growth of learners and the evolving skills needs of the heat pump industry.

6. Online Learning: The MOOC Component

6.1 What is a MOOC?

Massive Open Online Courses (MOOCs) are free online courses in different disciplines and fields of study, organised around an open, publicly shared curriculum, available for anyone to enrol. MOOCs provide an affordable and flexible way to acquire new skills, foster personal development and career advancement though informal quality educational experiences at

scale. Typically, MOOCs integrate social networking, accessible online resources, and are either self-paced or facilitated by experienced trainers in the field of study. MOOCs build on the engagement of learners who are at the centre of the learning process and self-organize their participation according to their own learning goals and skill development needs, prior knowledge and educational background, and available time and resources.

- **Course:** A MOOC supports the attainment of learning outcomes after certain activities within in a given period of time. It comprises learning materials and some kind of formative evaluation method to assess the knowledge acquired by learners. It involves facilitators and learners and enables the interaction among students and between students and facilitators.
- **Open:** On one hand, a MOOC should provide open and free access to educational resources and learning activities, which means that learners can enrol and attend the course without paying (however it is a common practice that some features such as obtaining a certificate, or the assessment of work assignments are provided with charge). On the other hand, a MOOC should be open to anyone without prerequisites such as country of origin, previous qualifications, or specific grades.
- **Online:** Course content is always available, over the internet, and through different devices. A MOOC does not require the physical attendance of learners at a classroom.
- Massive: A MOOC has no limitation on the number of participants, supporting the participation of thousands of learners from around the globe. Learners become part of the course by engaging with other people's work, and everybody learns from the work of the other participants.

6.2 The PUMP-UP MOOC: Pedagogical Principles

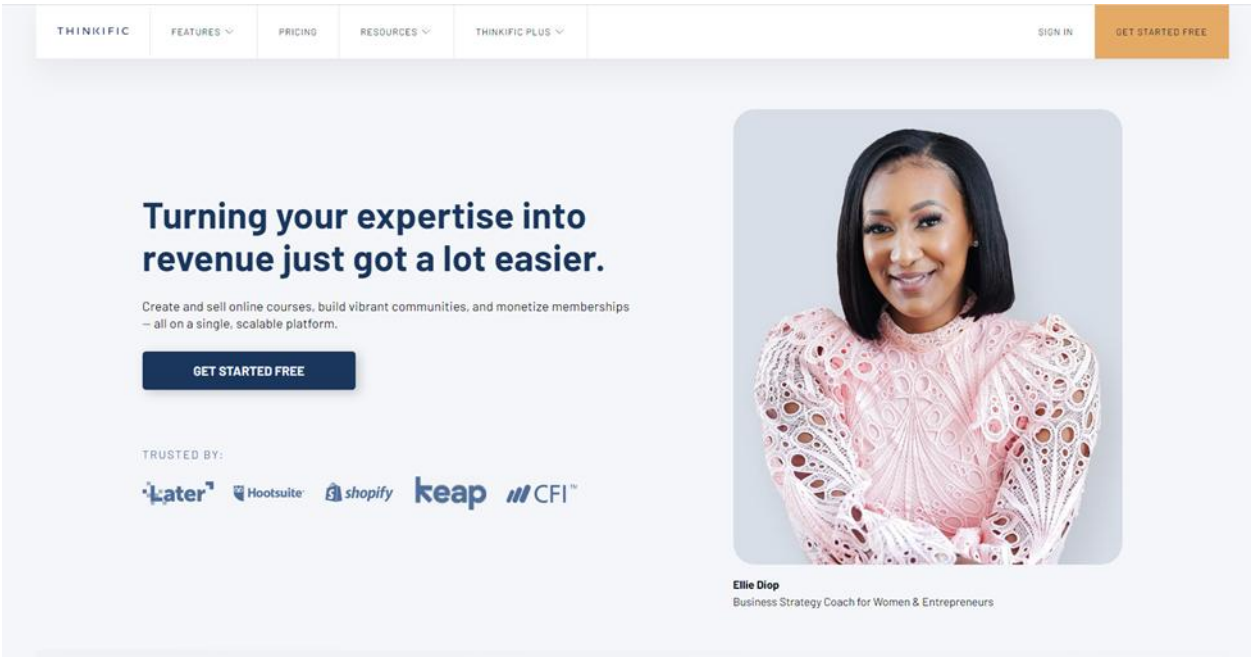
The PUMP-UP Massive Open Online Course is founded on the following pedagogical principles:

- **Learner-centeredness**: Learners are at the heart of the learning process, being able to establish individual learning goals and a personal learning path based on available content and materials.
- **Flexibility**: Learners are able to arrange their own learning schedule according to their resources within the lifecycle of the course and decide their level of engagement.
- **Interactivity**: The PUMP-UP MOOC makes explicit mention on the value of interactivity and the multiplying effects it has on learning and capacity building. Learners are encouraged throughout sections of the course to discuss with their peers and provide feedback on each other's work, where possible.

- **Ubiquitous learning**: Learners are able to experience learning activities and content in any context and situation 24/7 per week through mobile devices such as laptops, tablets and smart phones.
- **Teacher as facilitator**: In MOOCs, trainers should abandon their traditional role which is to convey information to learners and now act as facilitators, motivating learners to engage in course activities and providing feedback and assistance with their tasks.
- **Blended evaluation scheme**: One of the greatest challenges for a MOOC is to establish an assessment model that works at a much larger scale, with potentially thousands of learners participating in the course. To respond to this challenge, the PUMP-UP MOOC has employed an evaluation scheme that incorporates the method of self-assessment to evaluate learners' performance.

6.3 How to access and use the PUMP-UP MOOC

The PUMP-UP online course is hosted on **THINKIFIC** (https://www.Thinkific.com/); an online learning platform that allows individual educators (e.g. individual trainers, universities, colleges, VET providers, consortia, public & private institutions, companies) to create and deliver MOOCs in a wide range of disciplines and subjects. **THINKIFIC** gives anyone the opportunity to offer truly interactive instruction without the need to write any code. Learning activities are combined with social mechanisms and facilitation/monitoring tools that allow to create engaging online learning experiences. The platform is designed to provide a community-based learning environment in which learners are actively involved in the learning process and feel empowered, passionate communities of practice flourish, and deep learning experiences are fostered through carefully designed and interactive courses.



THINKIFIC forms a global educational community with 35+ countries represented and more than 100 million course enrolments at the end of 2020. This platform provides a wide range of authoring tools to make the process of learning easier and more entertaining (e.g., auto-assessment, blog, discussion forum). Courses are structured into (individual) learning modules that are populated with text, images, videos, presentations, info graphics, and exercises that essentially enhance the learning process and enable students to evaluate their knowledge and skill acquisition. **THINKIFIC** employs a social media workflow with built-in galleries, announcements, wikis, blog pages, and discussion spaces to encourage commenting and liking throughout students' learning journey. These tools aim to support interaction with peers and facilitators and ultimately foster a community of collaborative learners. The platform also supports content in different languages. Finally, to support flexible and ubiquitous learning, all courses are compatible with mobile devices such as laptops, smart phones and tablets.

PUMP-UP MOOC Landing page

Course curriculum

- Welcome Activity
- Module 1. Essentials of Heat Pump Technologies
- Module 2. Site Assessment
- Module 3. System Design & Costing
- Module 4. System Installation
- Module 5. Digitalisation and IoT

Show more

PUMP-UP

About this course

€ Free

➢ **Minimum system requirements**

This section presents the minimum system requirements for using **THINKIFIC**. These requirements may change over time, following future programming improvements or amendments.

In order to make sure that **THINKIFIC** runs well, please make sure your desktop computer, laptop, tablet, smartphone, or smart device has the following:

✓ The most recent version of one of the web browsers listed below

✓ JavaScript enabled

✓ PDF plugin

✓ Graphic and audio output capability

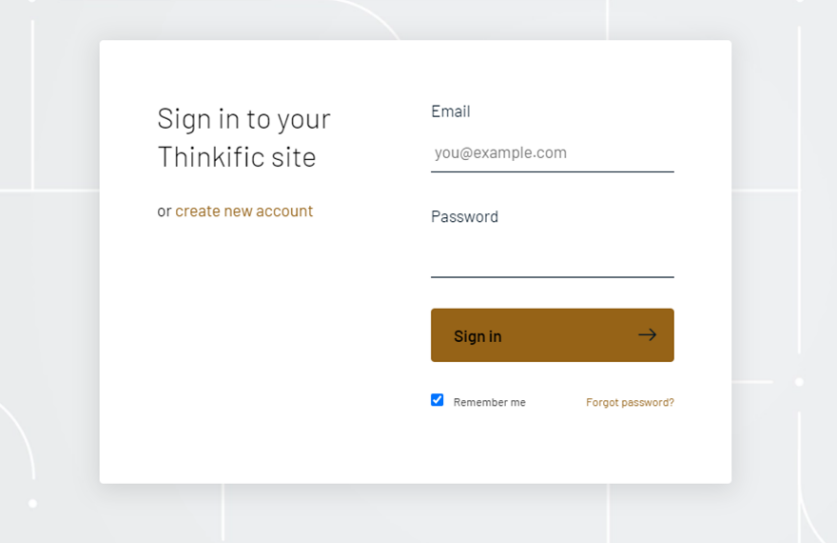
✓ Broadband internet connection with a minimum speed of 5Mbps (recommended)

✓ TLS 1.2 supported by your web browser

While the platform supports most of the browsers (Chrome, Firefox, Safari, Microsoft Edge), it is recommended using Chrome or Firefox on a desktop for best results while creating your courses.
For more information on minimum system requirements, please visit:
https://support.thinkific.com/hc/en-us/articles/360030354954-System-Requirements-and-Supported-Browsers

➢ **Creating an account on THINKIFIC**

All users (both educators and learners) on **THINKIFIC** need to create a user profile so as to get access to available courses and authoring tools. To create a new profile account, users must enter their full name, a valid e-mail address to use as the login and a profile name. The latter will be the name displayed on the platform.



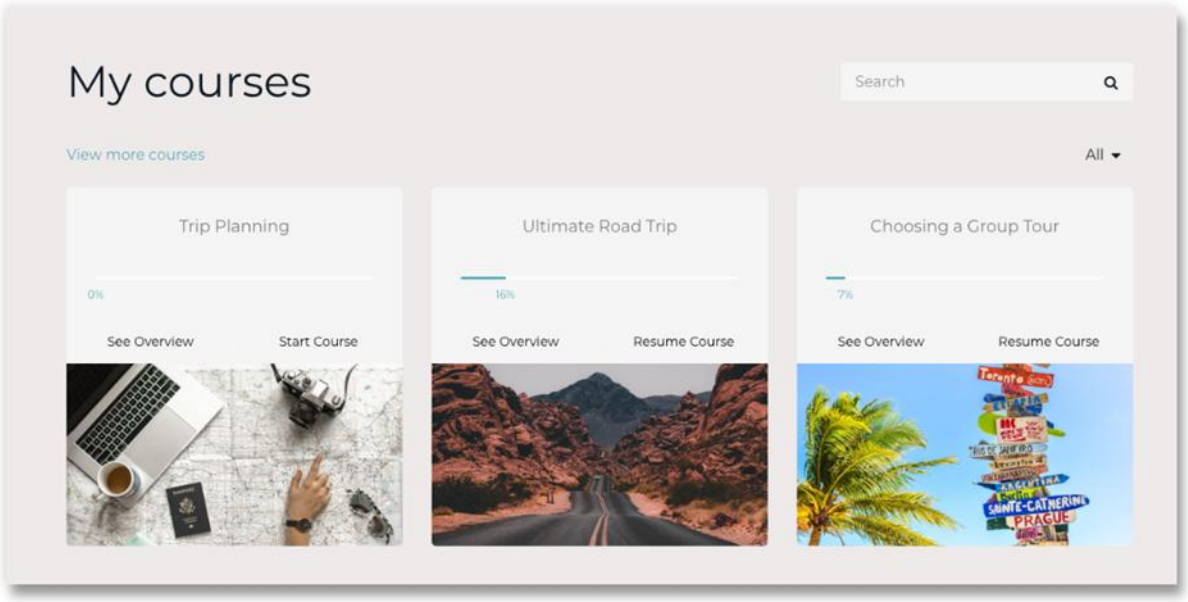
To sign up, an account password is also required. It is recommended that users should create a strong password that will include a mix of uppercase letters, lowercase letters, numbers, and symbols to prevent unauthorised access and keep their profile secure.

- **How to navigate within THINKIFIC**

Once the user is logged in to site, there are a few main areas that they will want to become familiar with as they begin building products and site. These areas include:

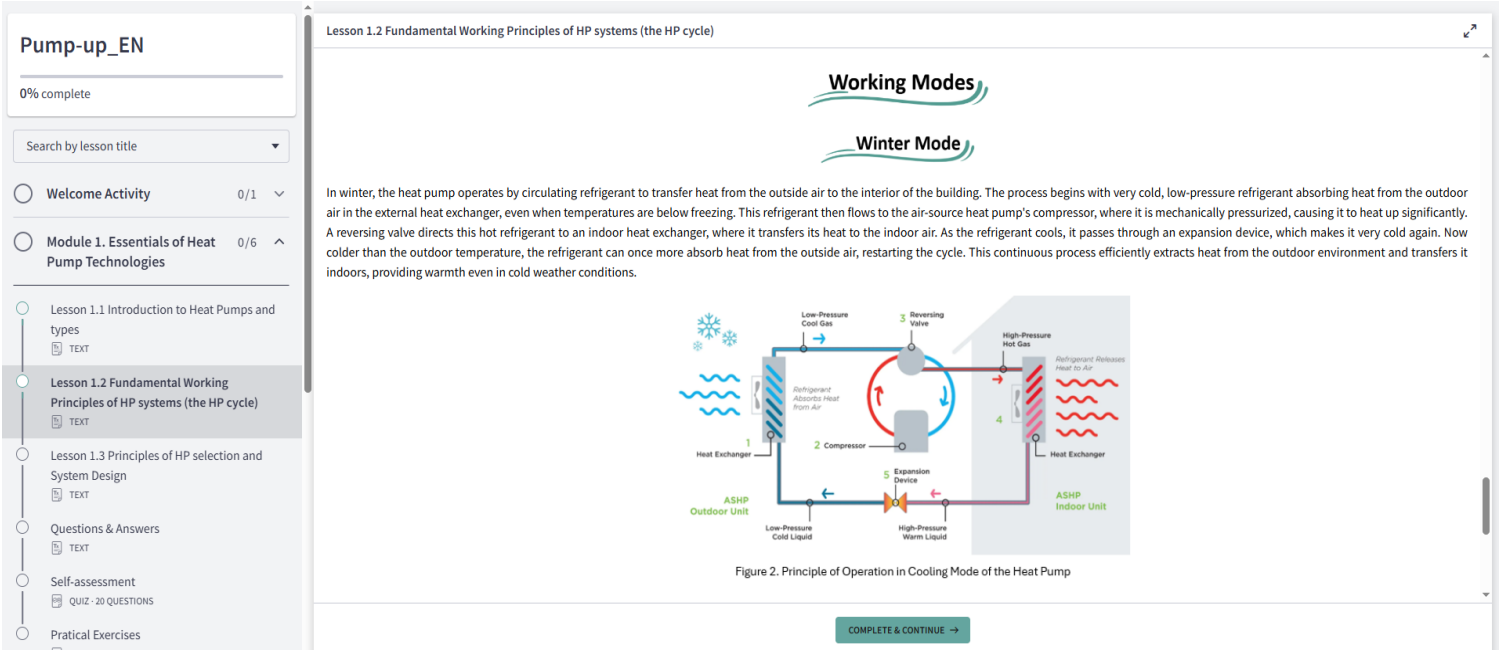
Student Dashboard

Students are immediately taken to their Student Dashboard when they login to your site. The Student Dashboard will display all product enrolments and students can simply click on any of the product cards available to access them or continue where they have left off!



Course Player

The THINKIFIC Course Player is what enrolled students experience when they access the course via the Course Player. The Course Player is the course-taking environment itself - the part of the site where students can go to view the curriculum, watch presentations, take quizzes, and more.



Troubleshooting Student Issues

The vast majority of the time when students have questions, they're product-specific. When they aren't, they're almost always a local computer issue.

The first step is to deal with the issue on admin's end - if it works for the admin, it's likely device or browser-related. The Site Owner or Admin can first confirm the student's enrolment in the course from the Users page. Check if the student may have just created an account on the site, and not fully enrolled themselves in the product (or just enrolled in a free preview).

Next, the student is asked what browser they're using and what device. If possible, have them send over a screenshot or two of what they see on their end.

Then, the following troubleshooting steps can be sent to the student - these should help resolve a lot of student issues!

1. Clear cache and restart the browser
2. Try a different browser (we like Google Chrome)

3. Try an Incognito / Private Window (this will rule out an issue with browser extensions)
4. Restart the device
5. If possible, try a different device
6. If possible, try a different internet connection

How to facilitate the PUMP-UP MOOC

The PUMP-UP MOOC employs a learner-entered and personalised learning approach that places the learner at the heart of learning activities and educational process. Learner-centeredness is an educational approach that leads to high motivation and personal commitment to learn, deeper immersion in learning activities, and greater knowledge acquisition. In this context, learners can determine their own learning path, formulate individual goals, and select educational material and resources that address their distinct needs, preferences, and expectations.

When teaching with the use of a MOOC, educators need to abandon their traditional role, which is to be the main source of information, and become a facilitator and motivator of learning. They should be more focused on the development of skills, competences, and attributes and on comprehensive feedback, rather than on the dissemination of content. In MOOCs, the responsibilities of trainers include:

- Encouraging critical thinking.
- Fostering self-directed learning and curiosity.
- Motivating learners to engage in learning activities and collaborative mechanisms.

In addition, trainers should find ways to create a learning environment that stimulates all participants in the virtual classroom, generates deep understanding, and promotes collaborative learning throughout the course.

Consequently, the trainer in PUMP-UP MOOC has to assume the role of facilitator a) providing regular and consistent feedback on tasks delivered by MOOC participants, b) encouraging learners to participate in learning activities, c) pinpointing learners' weaknesses and misconceptions, and d) responding to learners' questions and requests.

In the given scenario, the facilitator, having successfully enrolled in the PUMP-UP, can effectively deliver the course by utilizing the platform **enrolled as a learner but acting as a facilitator.** It's important to note that while THINKIFIC allows multiple educators to collaborate and create training content in real-time (as long as they have a subscription), only site owners, site admin and course administrators are involved in the course design and therefore have the right to add new material and resources or edit course structure and visual elements. **PROMEA, as the administrator of the PUMP-UP online course, retains the**

exclusive authority to provide rights to other users, upon consent and agreement from the consortium.

To ensure a professional approach, the facilitator should consider implementing the following tips while delivering the PUMP-UP course:

- **Introduce yourself to the class**

Trainers are encouraged to introduce themselves to the class by presenting a short personal bio that demonstrates their educational background and area of expertise. From the very beginning, trainers need to set the tone for the course and describe their expectations in the virtual classroom. An interesting introduction will effectively increase participants' willingness to experience new learning opportunities and develop a sense of connection between trainer and learners. Trainers can prepare a welcome video to introduce the course and help learners get used to the format of the PUMP-UP MOOC. Introductory videos should answer initial questions and concerns and set the course expectations while assisting in creating a positive first impression.

- **Promote online discussions and collaborative learning**

The PUMP-UP MOOC highlights the value of peer assistance and collaborative learning through the incorporation of discussion boards, online chat, social media links, and a students' area. The students' area (i.e., discussion forum) is the place where learners can share knowledge and information with other participants, discuss key concepts and problems associated with the course, exchange views and opinions with trainers, and cooperate with peers to complete tasks. Trainers should encourage learners to participate in the discussion forum by providing incentives (e.g., provision of access to additional learning materials and pedagogical resources). Also, trainers need to enhance learners' motivation by being explicit about expectations and ground rules for the online discussion forum, setting the framework for interaction, peer collaboration and dialogue. To moderate the forum, the trainer should become a facilitator and review the discussions without controlling or intervening in the dialogues. When it comes to questions, sometimes it is better to leave time for other participants to answer so as to encourage interaction among students.

- **Establish a communication scheme**

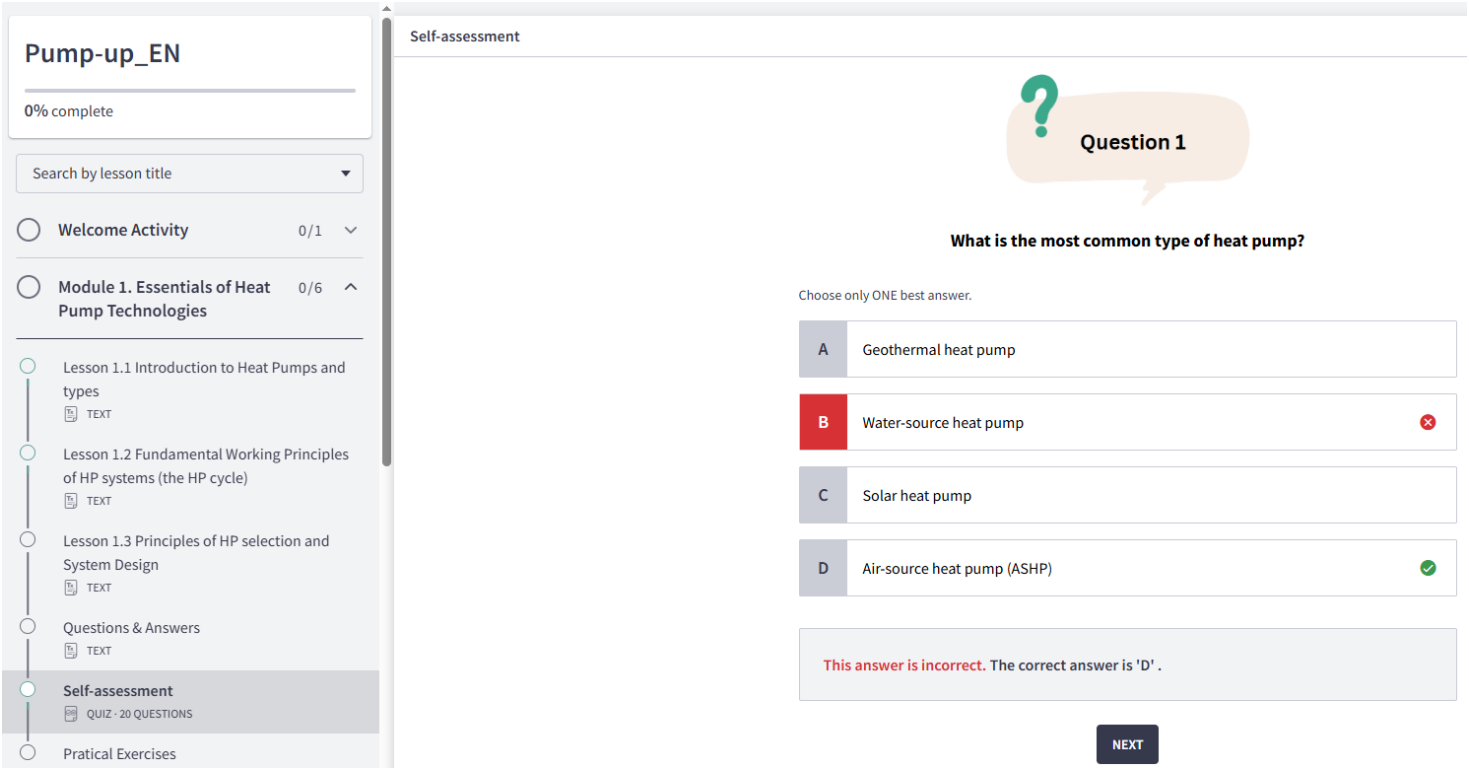
Trainers should establish a well-defined communication scheme to facilitate interaction with learners and support learning throughout the course. In addition, Trainers and Facilitators are encouraged to set/schedule online office hours once a week through the announcement section or the online chat, to engage in active discussions with learners, and provide assistance and clarifications, where needed. Strategic structured communication through regular emails and messages, including weekly feedback, announcements, and reminders will assist to maintain the engagement and focus of learners on the course experience and

enhance the perception of a “teaching presence” by participants. Another channel to interact and communicate with learners is through the PUMP-UP student area (discussion forum). Trainers and facilitators need to monitor and interact in the forum as well.

- **Monitor learners’ progress and engagement**

THINKIFIC provides several options to monitor learners’ activity throughout the course, providing analytics for all students such as enrolment and completion date, active time spent in the course, overall progress status, and comments posted in discussion boards. This allows facilitators to extract aggregate statistics for the course (e.g., dropout rate, engagement, interactivity) and most importantly to identify which students lag behind or demonstrate a low engagement so as to take remedial actions that increase their willingness to complete the course. For instance, facilitators can send reminder messages to students, indicating their progress and encouraging them to complete all sections.

The performance of a learner can be tracked from the quizzes and the score achieved. To track the progress, every time a learner completes and continues to a next section, a progress bar appears on the top left sided, as shown in the following image.



- **Sharing the course**

There are several options for sharing and disseminating the PUMP-UP MOOC:

✓ You can invite students via email through the platform.

- ✓ You can share the course in social media (Facebook and LinkedIn).
- ✓ You can email the link of the course.
- ✓ You can embed the PUMP-UP MOOC into your own blog or website.

- **Tips for trainers and facilitators**

- ✓ Facilitate the course and help learners achieve their personal learning objectives.
- ✓ Login daily to interact with participants and/or monitor course activity.
- ✓ Monitor learners' progress and send reminder messages to students indicating their progress status and encouraging them to complete all sections.
- ✓ Moderate learners' interaction in the PUMP-UP student area and chat rooms, as well as the comment threads on each course page.
- ✓ Respond to learners' emails, messages, and discussion postings.
- ✓ Prior to PUMP-UP MOOC release date, trainers should proofread the entire course, review all educational material, and it is recommended to provide contact details and set online office hours.

7. Ensuring Inclusivity and Engagement

The PUMP UP project promotes an inclusive and diversity-aware learning environment, ensuring that all participants—regardless of their background, gender, age, or learning needs—feel welcome, respected, and empowered to succeed. As trainers and mentors, you play a key role in creating learning spaces that reflect these values during the delivery of the modules related to heat pump technology.

1.13 Addressing Diverse Learning Needs

Participants may differ in terms of prior experience, learning pace, language skills, or technical background. Trainers should be prepared to adapt their teaching strategies accordingly. This could include using clear and simplified language when necessary, offering visual aids, encouraging peer-to-peer learning, and providing extra support for those who need it.

Inclusive training means recognising and valuing these differences rather than expecting all learners to progress in the same way. When possible, offer multiple ways of engaging with the content (e.g., demonstrations, hands-on tasks, group work, and individual reflection).

1.14 Promoting Gender Equality and Equal Participation

The HVAC sector is traditionally male-dominated. In PUMP UP, we are committed to encouraging the participation of women and other underrepresented groups in the heat

pump sector. Trainers should actively foster an environment where all participants feel confident to ask questions, contribute to discussions, and engage in practical tasks without bias or assumptions.

Language used in the classroom should be gender-neutral and inclusive, and trainers should intervene if discriminatory remarks or behaviours occur.

1.15 Creating a Safe and Respectful Learning Environment

Respect for each individual's perspective, identity, and learning journey is fundamental. Trainers should model respectful behaviour and establish clear ground rules for communication and group work. Feedback should always be constructive and supportive.

Encouraging active listening and respectful dialogue enhances the group dynamic and contributes to a more meaningful learning experience for everyone involved.

1.16 Supporting Accessibility

All training materials developed within the PUMP UP project have been designed with accessibility and inclusion in mind. Efforts have been made to ensure that the content is clear, user-friendly, and adaptable to a wide range of learners, including those with specific learning needs or disabilities.

This includes the use of plain language, visual support elements, and structured content to support comprehension. Digital materials are provided in accessible formats, with attention paid to layout, readability, and compatibility with assistive technologies. Where applicable, subtitles or transcripts accompany video content.

Trainers are encouraged to review and familiarise themselves with these materials in advance to ensure they are used effectively and inclusively during the sessions. Any additional adaptations needed to support individual participants can be made at the local level, depending on the specific context of the seminar or training environment.

8. Training Seminars

Within the framework of the PUMP UP project, seven in-person training seminars will be organised with the aim of enhancing the skills of more than 400 HVAC technicians across the partner countries. These seminars represent a key opportunity to test and improve the curriculum through direct feedback from field professionals. Each seminar will focus on a single module of the curriculum, with strong emphasis on practical, job-related tasks, ensuring that the learning experience is relevant and immediately applicable.

In addition to these technical seminars, the project also includes a Train-the-Trainer (TTT) seminar, specifically targeted at VET trainers and Work-Based Learning (WBL) mentors. This seminar will be delivered online, consisting of 8 sessions in English and gathering approximately 70 participants (around 10 per country). Each session will address a specific curriculum module, and one dedicated session will present the PUMP UP instructional methodology and its approach to reskilling and upskilling.

1.17 Defining Objectives

Seminars should have clear, focused objectives tied directly to the curriculum content. While each module may open the door to multiple competencies and discussions, it is crucial to maintain a clear direction. The main goal is to equip participants with applicable skills that improve their performance in real work settings. Organisers and trainers should work together to ensure the training remains within the project scope and contributes meaningfully to its outcomes.

1.18 Selecting participants

The responsibility for selecting seminar participants lies with each project partner, who will collaborate with VET centres, professional schools, and relevant local stakeholders. The goal is to engage a diverse group of HVAC technicians and professionals whose profiles match the objectives of each module.

By working directly with training institutions and industry representatives, partners can ensure the participation of individuals who will benefit most from the seminar content and are in a position to apply the skills acquired in real work contexts. This collaborative approach also reinforces the connection between the PUMP UP curriculum and the actual training and labour market needs in each partner country.

Understanding the existing skill levels and needs of participants is essential to provide relevant content and maintain training quality. While participants may vary in background, the seminars are designed to be inclusive and focused on hands-on, applicable knowledge.

1.19 Ensuring Training Quality

PUMP UP seminars are not intended to be passive lectures but interactive learning environments. Trainers should act as facilitators, encouraging active participation, group discussions, and hands-on practice wherever possible. The structure of each session should include estimated time slots for each module and practical segment. Special attention should be given to modules with complex technical content to ensure sufficient time is allocated for comprehension and interaction.

1.20 Encouraging Interaction and Questions

To foster engagement, seminars should include structured opportunities for participants to ask questions and reflect on what they are learning. This can be done both during the sessions and through designated Q&A slots. Such interactivity not only supports knowledge retention but also helps trainers gauge how well the content is being understood and applied. Active participation is a key indicator of a successful seminar.