WP4. “Training path design”

Training paths of “new skills” in Italy

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Content

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1 – Document synopsis

This document represents the final step in WP4 "*Training path design*" whose main objectives are to know the training offer in each country and its adaptation to "new skills" demanded by the industrialised construction systems in line with the principles and objectives of EE&CE, to analyse common and differential characteristics of these offers to fill competence gaps (EQF levels 3-4-5) and to design a common framework for the training path and determine the elements to be included: contents, methodology, assessment, resources, trainer profile and so on.

More in details, purpose of this document is the development of a training path, validated and established with European criteria to ensure a successful implementation for workers skilling and re-skilling, a referenced planning of training actions (VET centres, trainers), and an adaptation to training needs of the offsite area. This scenario for a new training offer has been built upon the major findings from the analysis of the training offer in each country and its adaptation to the "new skills" demanded by the industrialised construction systems in line with the principles and objectives of EE&CE. The analysis has been conducted as a desk research and is addressed mainly to experts and skills-based performance appraisers, VET trainers in the construction sector and experts in design of training actions in the construction industry. It started from the major findings of WP3 - "New Skills" Map elaboration by identifying the most relevant skills linked to the 4 targeted occupation: 1) Electrical installer, 2) HVAC engineering technician, 3) Roof labourer and 4) Building construction labourer. The desk research has been implemented using the most relevant sources available in the country and the most updated researches on the field, then has been sent to the selected experts via email as a basis for the feedbacks' interview. Purpose of the interviews has been the validation of key findings of the desk research and to complete any missing information on the current training offer in order to fill the identified skills gap.

Then the Analysis of the national training offer has been the target of a series of experts' interviews with the purpose of validating the key findings of the desk research and/or completing any missing information on the current training offer to fill the identified skills gap. Thus, all the feedback and inputs emerged from the interviews have been processed and integrated with the current training offer to create the new scenario.

Lastly, the same scenario has been validated via a dedicated experts' workshop held on October the 25th 2024 gathering relevant stakeholders and experts whose major findings are reported on Chapter 4.

2 – Major findings from the Analysis of the national training offer

The analysis of the training offer in Italy for various professions in the construction and engineering sectors reveals a robust and complex training panorama. This landscape is characterized by a variety of courses aimed at providing professionals with the skills necessary to meet the current and future needs of the sector. Below are the key features and gaps identified in available training programs:

Electrical Installers: extensive training options cover crucial skills such as using BIM models, installing smart devices, and interpreting 2D and 3D digital plans. Courses such as Electrical MEP BIM Specialist and AutoCAD Electrical provide specialized knowledge, while broader programs such as Technician in the Management of Intelligent Technology Systems offer a comprehensive skill set.

HVAC Engineering Technicians: focused BIM courses for HVAC systems, home automation, and geothermal heat pump installation ensure professionals are well-versed in modern HVAC technologies and regulatory compliance.

Roof Workers: courses on BIM technology, green roofing and CNC programming highlight the integration of modern construction techniques and sustainable practices. The training also places emphasis on safety, with specific courses on fall protection.

Construction workers: training programs cover BIM technology, ergonomic working practices and construction site safety. The courses also delve into specialist areas such as preparation for photovoltaic walls and waste management, highlighting the commitment to sustainability and safety.

The training programs are designed to provide both theoretical knowledge and practical skills. This dual focus ensures that trainees are not only familiar with advanced concepts but also able to apply these skills in real-world scenarios. Courses often combine technical instruction with regulatory and safety training, reflecting the industry's emphasis on compliance and worker safety.

Many training programs emphasize sustainable practices and energy efficiency. Courses on green roofs, ground source heat pumps and integrated solar envelopes reflect a growing trend towards environmentally friendly construction methods. The incorporation of BIM technology into various courses indicates a gradual industry-wide shift towards more efficient and collaborative design and project management practices.

However, the training offer in Italy contains incomplete coverage of some skills, showing **some gaps in the training offer** to meet the evolving demands of the construction sector, in particular in the specific context of the principles of industrialized industry, energy efficiency and the circular economy (EE&CE).

For example, the ability to calculate the orientation of solar panels for electrical installers does not have a corresponding training program.

Likewise, skills such as interpreting plans for modular construction and installing connections for modular building elements for construction workers are not addressed in current training offerings.

For HVAC engineering technicians, there is a lack of specific training focused on leading a team to perform maintenance on installed equipment. Leadership skills in this context are crucial for effective team management and ensuring maintenance quality.

The absence of courses aimed at recognizing the impact of maintenance and demolition materials for construction workers indicates a gap in training relating to life cycle analysis and sustainable management of materials.

In summary, from the analysis of the training offer in Italy, we can deduce some recommendations:

Develop courses to fill identified gaps, such as those focused on solar panel orientation for electrical installers and modular construction skills for construction workers.

Introduce specialized training on leadership and advanced maintenance practices for HVAC engineering technicians to ensure comprehensive skill development.

Continue to expand offerings related to sustainable practices and materials. Additional courses on life cycle analysis, material impacts and advanced recycling techniques would further strengthen the sustainability aspect of training programs.

Promote greater collaboration with industry stakeholders to continually update and expand the training curriculum, ensuring it is aligned with evolving industry needs and technical advances.

The Italian training offer for the construction and engineering sectors demonstrates a strong commitment to providing professionals with the skills necessary for the modern needs of the industry. While existing programs are comprehensive and forward-looking, addressing identified gaps and strengthening the focus on sustainability and leadership will ensure that training offerings remain robust and relevant as the sector continues to evolve.

3 – The Italian scenario for a new training offer

The scope of this activity is to design a common framework for the training path and determine the elements to be included starting from the existing courses mapped in task 4.1. A series of experts' interviews[1] has been conducted with the purpose of validating the key findings of the desk research and/or completing any missing information on the current training offer to fill the identified skills gap, and the tables are thus exploiting the experts' view on the new scenario right to be integrated with the current offer.

Course 1 - Technician in the Management of Smart Technological System (4 EQF Level)[2]

The course ***Technician in the Management of Smart Technological Systems*** has been evaluated as comprehensive and up-to-date by the experts who participated in the training offer validation group. Therefore, no modifications or additions are considered necessary.

Course 2 - Building Information Modeling technician (5 EQF Level)[3]

Experts point out that the Building information modeling technician course is adequate, especially for an initial level of BIM learning. It can then be integrated with an advanced module relating to ***Advanced BIM Integration for Multidisciplinary Collaboration*** which the details are reported below.

[1] At least 3 different experts have been interviewed in each country.
[2] For the current structure of the course see Annex 1.
[3] For the current structure of the course see Annex 2.

Title of the module	**Advanced BIM Integration for Multidisciplinary Collaboration** EQF Level 6
Target Audience: **Duration:** **Prerequisites:**	Construction managers, project coordinators, architects, engineers, and BIM coordinators (EQF Level 5-6) 80 hours knowledge and skills in Building Information Modelling (BIM) and experience in construction project coordination.
Expected results	Is able to: • Coordinate and integrate architectural, structural, mechanical, electrical, and plumbing models within a BIM framework. • Utilize advanced BIM tools for clash detection, conflict resolution, and model validation. • Facilitate multidisciplinary collaboration by ensuring all stakeholders can access and contribute to the BIM model. • Manage information flows in complex construction projects from design to handover, ensuring data accuracy and consistency. • Implement BIM-based project management techniques to track progress, monitor changes, and manage risks.
Indicators	• Successful integration of multidisciplinary models into a federated BIM environment. • Identification and resolution of at least 10 clashes between architectural, structural, and MEP models. • Setting up a BIM collaboration platform and demonstrating its use in coordinating project workflows.

	• Development and presentation of a BIM-based project management plan covering the entire project lifecycle. • Legal and contractual analysis of a real-world BIM project, addressing data ownership and liability.
Capacity	• to manage and integrate models from multiple disciplines within a BIM framework. • Expertise in identifying clashes and conflicts in multidisciplinary models and implementing effective resolutions. • to facilitate collaboration and communication among diverse stakeholders using BIM tools and platforms. • to manage BIM-based construction projects efficiently, tracking progress, managing risks, and ensuring smooth data flow from design to facility management. • Expertise in using cloud-based platforms to facilitate data sharing and project coordination
Knowledge	• Understanding of the theoretical foundations of BIM for multidisciplinary collaboration. • Concepts of integrated architectural, structural, and MEP models and resolving conflicts. • Clash Detection and Resolution, Knowledge of tools and techniques for identifying and addressing clashes between different disciplines. • Strategies for managing project information across the entire lifecycle, ensuring data consistency and smooth handover to facility management. • Familiarity with the legal and contractual challenges involved in BIM-based multidisciplinary projects, including data ownership and liability issues
Contents	**Advanced BIM for Multidisciplinary Collaboration**

	• Introduction to advanced BIM principles for collaboration across different disciplines. • Importance of information sharing and transparency in BIM. • Overview of data exchange standards (IFC) for interdisciplinary collaboration. **BIM Coordination and Model Integration** • Techniques for coordinating architectural, structural, and MEP (mechanical, electrical, plumbing) models. • Methods for integrating models from different disciplines into a single federated BIM model. • Practical exercises in managing model interdependencies and ensuring accuracy across disciplines. **Clash Detection and Conflict Resolution** • Identifying and resolving clashes between architectural, structural, and MEP • systems using BIM tools. • Techniques for automatic and manual clash detection. • Workflow optimization for addressing conflicts and improving project efficiency. **BIM Collaboration Platforms and Tools** • Review of cloud-based BIM collaboration platforms (e.g., Autodesk BIM 360,

	• Trimble Connect). • Features and best practices for using these platforms to facilitate multidisciplinary collaboration. • Setting up common data environments (CDE) and assigning roles and permissions for project stakeholders. **BIM-based Project Management and Lifecycle Information Management** • Managing project timelines, risks, and resources using BIM. • Techniques for tracking progress, managing changes, and maintaining data consistency across the project lifecycle. • Handover and lifecycle information management: ensuring the smooth transition of BIM data from construction to facility management. **Legal and Contractual Aspects of BIM Collaboration** • Understanding the legal implications of BIM-based collaboration. • Contractual frameworks for BIM projects and liability issues in multidisciplinary environments. • Best practices for ensuring data ownership, intellectual property, and stakeholder accountability.

Course 3 - Construction operator for structures (3 EQF LEVEL)[4]

Since the ***Construction Operator for Structures*** course prepares a multipurpose operational profile, the experts consider that this course provides the essential knowledge base required for on-site work. However, to upskill the profile of the *Construction Operator*, several modules can be integrated into the program, as described below:

Title of the course	**Modular Construction and Assembly Techniques** EQF Level 3
Target Audience **Duration:** **Prerequisites**	Construction workers (EQF Level 3) 60 hours **Prerequisites:** Basic construction knowledge
Expected results	Is able to: • to interpret plans and technical drawings for modular construction projects. • To install connections and assembling modular building components in a construction site environment. • introduce the use of BIM (Building Information Modelling) in modular construction
Indicators	• interpretation and analysis of technical plans and drawings specific to modular components. • Ability to correctly assemble modular units, ensuring proper alignment and sequencing.

[4] For the current structure of the course see Annex 3.

	• Effective installation of mechanical, electrical, and structural connections with a focus on watertightness, stability, and safety. • BIM Utilization in Assembly, extracting relevant data from BIM models to coordinate the installation process. • Conducting safety assessments and quality control measures throughout the installation and assembly process.
Capacity	• to understand and interpret modular construction plans, focusing on connection points, dimensions, and assembly tolerances. They will identify critical elements like load-bearing components, joints, and sequencing. • to assemble prefabricated modular units, including aligning and positioning modules on-site, installing connections, and adjusting components to meet design specifications. • to install secure mechanical, electrical, and structural connections, ensuring the integrity and efficiency of the modular system. This includes ensuring structural stability and watertight connections. • to navigate BIM models, extract key details, and use the information to coordinate installation work, improving efficiency and reducing errors during the assembly process. • to implement safety protocols, handle large prefabricated elements, and carry out quality checks during and after assembly to ensure compliance with design standards and safety regulations.
Knowledge	• Understanding of the fundamentals of modular construction, including the advantages (e.g., faster build times, less waste), challenges, and materials commonly used in prefabrication. • Proficiency in reading and interpreting construction drawings and technical plans related to modular construction, recognizing key features such as connection points, load paths, and dimensions.

	• Knowledge of the different types of connections (mechanical, electrical, structural) and the tools and materials needed for ensuring secure and durable installations between modular units. • Familiarity with BIM software and its application in modular construction, focusing on extracting relevant data, coordinating installation, and sequencing tasks based on digital models. • In-depth understanding of safety protocols in handling large modules, installing heavy components, and conducting thorough quality control to ensure compliance with construction and safety standards.
Contents	**Introduction to Modular Construction** • Definition, advantages, and challenges of modular construction. • Overview of modular building components and materials **Interpreting Modular Construction Plans** • Reading and interpreting technical drawings for modular components. • Recognizing key elements such as connection points, dimensions, and t tolerances. **Installing Connections in Modular Construction** • Installing and securing mechanical, electrical, and structural connections. • Insuring watertight and structurally sound connections between units. **BIM in Modular Construction** • Introduction to BIM and its application in modular construction. • Extracting relevant information from BIM models for on-site assembly. **Safety and Quality Control in Modular Assembly**

	• Safe handling and assembly of large prefabricated modules. • Conducting quality checks during and after installation to ensure compliance with design and safety standards.

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Title of the course	**Sustainable Material Management and Life Cycle Analysis** **(EQF Level 3-4)**
Target Audience **Duration** **Prerequisites**	Construction workers, site managers, and procurement professionals 60 hours Basic knowledge of construction processes and materials
Expected results	Is able to: • provide participants with an understanding of sustainable material management practices. • train workers in assessing the environmental impact of materials throughout their life cycle. • introduce circular economy concepts and how to integrate them into construction projects. • enhance skills in waste reduction, recycling, and sustainable sourcing practices. • encourage the use of Life Cycle Analysis (LCA) in construction decisions.

Indicators	• Development and presentation of an LCA for a selected construction material. • Practical application of waste reduction and recycling techniques during project simulations. • Identification and sourcing of sustainable materials aligned with environmental certifications. • Application of circular economy principles in material procurement and site management.
Capacity	• Ability to evaluate materials based on their environmental footprint. • Competence in conducting LCA and making data-driven material choices. • Skills in reducing material waste, promoting reuse, and applying recycling methods. • Knowledge of circular economy concepts and the ability to integrate them into construction practices. • Practical understanding of sustainable sourcing and procurement in construction projects.
Knowledge	• Concepts of sustainable sourcing, procurement, and waste management. • Life Cycle Analysis, methodology, tools, and software used to assess the environmental impact of construction materials. • Circular Economy Principles, concepts and practical approaches for applying the circular economy in construction projects. • Familiarity with certifications such as LEED, BREEAM, and FSC, and how to incorporate them into project planning. • Waste Reduction and Recycling Techniques, hands-on strategies to minimize construction waste and promote material reuse and recycling.

Contents	**Introduction to Sustainable Material Management** • Overview of sustainable material management in construction. • Introduction to circular economy principles. • Importance of reducing environmental impact through material choices. **Life Cycle Analysis (LCA) in Construction** • Principles of Life Cycle Analysis and its application to construction materials. • Steps involved in conducting an LCA (goal setting, inventory analysis, impact assessment). • Tools and software used in LCA for evaluating the environmental impact of construction materials. **Waste Reduction and Recycling in Construction** • Waste management strategies in construction. • Techniques for minimizing waste during procurement, design, and construction stages. • Practical methods for reusing and recycling construction materials on-site. **Sustainable Sourcing and Procurement** • Criteria for selecting sustainable materials and suppliers. • Environmental certifications and standards (e.g., FSC, LEED, BREEAM). • Case studies on sustainable procurement practices in construction projects. **Circular Economy in Construction**

	• Overview of the circular economy and its application in the construction industry. • Designing for deconstruction and material recovery. • Using Building Information Modelling (BIM) to facilitate circular material flows.

Course 4 - Construction Technician (4 EQF LEVEL)[5]

Based on the considerations developed by the experts, the ***Construction Technician*** profile can also be integrated with various modules, similarly to the building operator profile, as indicated below:

Title of the course	**Modular Construction and Assembly Techniques** EQF Level 3
Target Audience **Duration:** **Prerequisites**	Construction workers (EQF Level 3) 60 hours **Prerequisites:** Basic construction knowledge
Expected results	Is able to: • to interpret plans and technical drawings for modular construction projects. • To install connections and assembling modular building components in a construction site environment. • introduce the use of BIM (Building Information Modelling) in modular construction
Indicators	• interpretation and analysis of technical plans and drawings specific to modular components. • Ability to correctly assemble modular units, ensuring proper alignment and sequencing. • Effective installation of mechanical, electrical, and structural connections with a focus on watertightness, stability, and safety.

[5] For the current structure of the course see Annex 4.

	• BIM Utilization in Assembly, extracting relevant data from BIM models to coordinate the installation process. • Conducting safety assessments and quality control measures throughout the installation and assembly process.
Capacity	• to understand and interpret modular construction plans, focusing on connection points, dimensions, and assembly tolerances. They will identify critical elements like load-bearing components, joints, and sequencing. • to assemble prefabricated modular units, including aligning and positioning modules on-site, installing connections, and adjusting components to meet design specifications. • to install secure mechanical, electrical, and structural connections, ensuring the integrity and efficiency of the modular system. This includes ensuring structural stability and watertight connections. • to navigate BIM models, extract key details, and use the information to coordinate installation work, improving efficiency and reducing errors during the assembly process. • to implement safety protocols, handle large prefabricated elements, and carry out quality checks during and after assembly to ensure compliance with design standards and safety regulations.
Knowledge	• Understanding of the fundamentals of modular construction, including the advantages (e.g., faster build times, less waste), challenges, and materials commonly used in prefabrication. • Proficiency in reading and interpreting construction drawings and technical plans related to modular construction, recognizing key features such as connection points, load paths, and dimensions. • Knowledge of the different types of connections (mechanical, electrical, structural) and the tools and materials needed for ensuring secure and durable installations between modular units.

	• Familiarity with BIM software and its application in modular construction, focusing on extracting relevant data, coordinating installation, and sequencing tasks based on digital models. • In-depth understanding of safety protocols in handling large modules, installing heavy components, and conducting thorough quality control to ensure compliance with construction and safety standards.
Contents	**Introduction to Modular Construction** • Definition, advantages, and challenges of modular construction. • Overview of modular building components and materials **Interpreting Modular Construction Plans** • Reading and interpreting technical drawings for modular components. • Recognizing key elements such as connection points, dimensions, and tolerances. **Installing Connections in Modular Construction** • Installing and securing mechanical, electrical, and structural connections. • Insuring watertight and structurally sound connections between units. **BIM in Modular Construction** • Introduction to BIM and its application in modular construction.

	• Extracting relevant information from BIM models for on-site assembly. **Safety and Quality Control in Modular Assembly** • Safe handling and assembly of large prefabricated modules. • Conducting quality checks during and after installation to ensure compliance with design and safety standards.

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Title of the course	**Sustainable Material Management and Life Cycle Analysis** (EQF Level 3-4)
Target Audience **Duration** **Prerequisites**	Construction workers, site managers, and procurement professionals 60 hours Basic knowledge of construction processes and materials
Expected results	Is able to: • provide participants with an understanding of sustainable material management practices. • train workers in assessing the environmental impact of materials throughout their life cycle. • introduce circular economy concepts and how to integrate them into construction projects. • enhance skills in waste reduction, recycling, and sustainable sourcing practices.

	• encourage the use of Life Cycle Analysis (LCA) in construction decisions.
Indicators	• Development and presentation of an LCA for a selected construction material. • Practical application of waste reduction and recycling techniques during project simulations. • Identification and sourcing of sustainable materials aligned with environmental certifications. • Application of circular economy principles in material procurement and site management.
Capacity	• Ability to evaluate materials based on their environmental footprint. • Competence in conducting LCA and making data-driven material choices. • Skills in reducing material waste, promoting reuse, and applying recycling methods. • Knowledge of circular economy concepts and the ability to integrate them into construction practices. • Practical understanding of sustainable sourcing and procurement in construction projects.
Knowledge	• Concepts of sustainable sourcing, procurement, and waste management. • Life Cycle Analysis, methodology, tools, and software used to assess the environmental impact of construction materials. • Circular Economy Principles, concepts and practical approaches for applying the circular economy in construction projects. • Familiarity with certifications such as LEED, BREEAM, and FSC, and how to incorporate them into project planning.

	• Waste Reduction and Recycling Techniques, hands-on strategies to minimize construction waste and promote material reuse and recycling.
Contents	**Introduction to Sustainable Material Management** • Overview of sustainable material management in construction. • Introduction to circular economy principles. • Importance of reducing environmental impact through material choices. **Life Cycle Analysis (LCA) in Construction** • Principles of Life Cycle Analysis and its application to construction materials. • Steps involved in conducting an LCA (goal setting, inventory analysis, impact assessment). • Tools and software used in LCA for evaluating the environmental impact of construction materials. **Waste Reduction and Recycling in Construction** • Waste management strategies in construction. • Techniques for minimizing waste during procurement, design, and construction stages. • Practical methods for reusing and recycling construction materials on-site. **Sustainable Sourcing and Procurement** • Criteria for selecting sustainable materials and suppliers. • Environmental certifications and standards (e.g., FSC, LEED, BREEAM).

	- Case studies on sustainable procurement practices in construction projects. **Circular Economy in Construction** - Overview of the circular economy and its application in the construction industry. - Designing for deconstruction and material recovery. - Using Building Information Modelling (BIM) to facilitate circular material flows.

Experts highlight the need to enhance the existing training with two new pathways, such as: ***Solar Panel Orientation and Installation*** and ***Leadership and Team Management for HVAC Technicians*** which would make the training offer more comprehensive.

The duration of these new courses can be adjusted based on the participants' prior knowledge. These courses can be offered as independent training programs or as modules integrated into current courses.

Course Title: Solar Panel Orientation and Installation

Title of the course	**Solar Panel Orientation and Installation** EQF Level 4
Target Audience **Duration** **Prerequisites**	Electrical installers, Energy Efficiency Technician 40 hours Basic electrical knowledge and experience with solar technology
Expected results	Is able to: • enable electrical installers to calculate the optimal orientation and tilt of solar panels for maximum energy efficiency. • familiarize them with geographic, seasonal, and technical factors influencing solar panel performance. • provide hands-on experience with software tools used for simulation and analysis.
Indicators	• Development of Solar Panel Orientation Plan that includes orientation and tilt angles for maximum efficiency. • Shading and Obstruction Analysis, perform a thorough analysis of potential shading and obstructions using tools like PVsyst or SketchUp. • Simulation Report, generation of energy yield forecasts using simulation software based on specific site conditions. • Installation Assessment, which includes practical assessment of panel installation, with adjustments based on real-time conditions and compliance with safety standards.

Capacity	• to assess geographic locations, analyse local weather conditions, and adjust tilt and orientation based on latitude, season, and solar path. • how to identify and mitigate the effects of shading and obstructions on panel efficiency, optimizing energy capture. • To gain proficiency in using simulation software to model solar panel performance, taking into account azimuth, tilt, and site-specific conditions. • To develop hands-on skills in installing solar panels, ensuring compliance with technical and safety regulations, and fine-tuning installations for optimal performance.
Knowledge	• Understanding solar radiation, geographic coordinates, and solar declination to assess the best orientation for solar panels. • Calculation of azimuth and tilt angles, considering latitude, longitude, and seasonal sun paths. • Knowledge of how trees, buildings, and other obstructions affect solar panel output, and methods to counteract these effects. • Knowledge in using specialized software for modeling the efficiency and energy yield of solar panels based on site-specific data. • Familiarity with electrical safety protocols, installation standards, and building regulations applicable to solar panel installations, including the integration of solar inverters and battery systems.
Contents	**1: Fundamentals of Solar Energy** Overview of solar radiation and how it varies with location and time. Basics of photovoltaic (PV) technology and energy conversion. **2: Geographic and Seasonal Factors** Determining solar angles based on geographic location (latitude, longitude).

	Seasonal variations and their impact on energy production. **3: Panel Orientation and Tilt Calculations** Azimuth and tilt: definitions, importance, and calculations. Optimal panel orientation for different regions. **4: Shading Analysis** Identifying potential shading obstacles (buildings, trees) and their impact. Using shading analysis tools to optimize positioning. **5: Simulation and Optimization Tools** Introduction to software tools. Conducting simulations and interpreting results for design improvements. **6: Installation and Compliance** Practical installation of panels based on calculated orientation. Compliance with local and international standards for solar installations.

Course Title: Leadership and Team Management for HVAC Technicians

Title of the course	**Leadership and Team Management for HVAC Technicians** EQF Level 5
Target Audience **Duration** **Prerequisites**	HVAC engineering technicians, maintenance supervisors, and team leaders 40 hours Basic knowledge and experience in HVAC system installation, maintenance, and troubleshooting.
Expected results	Is able to: • equip HVAC technicians with the leadership and team management skills necessary to oversee maintenance teams. • improve communication and coordination among team members during complex HVAC maintenance projects. • develop strategies for ensuring quality control, safety compliance, and efficient workflow in HVAC maintenance. • lead teams with a focus on maintaining high-performance standards and optimizing team output.
Indicators	• Demonstrated ability to lead a maintenance team through a complex HVAC project, ensuring safety, quality, and efficiency. • Successful coordination of team roles and responsibilities in practical exercises. • Application of leadership techniques to resolve conflicts and maintain team morale during challenging scenarios. • Implementation of quality control and safety procedures in simulated HVAC maintenance tasks.

	• Development of a communication plan for managing team interactions and client expectations during HVAC maintenance.
Capacity	• to lead HVAC maintenance teams effectively, ensuring all tasks are completed to high standards. • Expertise in resolving conflicts within teams, managing risks, and maintaining team productivity. • to communicate project goals and progress to team members and stakeholders, ensuring alignment and smooth execution. • to ensure HVAC maintenance tasks meet quality standards and comply with safety regulations. • to manage time, resources, and team dynamics, particularly in complex and large-scale HVAC maintenance projects.
Knowledge	• In-depth understanding of leadership styles and how to apply them in HVAC maintenance teams. • Strategies for organizing, scheduling, and managing HVAC maintenance teams. • knowledge of ensuring quality control and mitigating risks in HVAC maintenance operations. • Understanding of safety regulations and protocols related to HVAC maintenance. • in effective communication, reporting, and stakeholder management during maintenance projects.
Contents	**Fundamentals of Team Leadership** • Introduction to leadership styles and principles relevant to HVAC maintenance teams. • The role of the HVAC team leader: responsibilities and key challenges.

	• Developing leadership qualities, including decision-making, delegation, and motivation. **Team Management in HVAC Projects** • Techniques for organizing and managing maintenance teams for optimal efficiency. • Planning and scheduling tasks to ensure timely completion of HVAC maintenance projects. • Managing team dynamics: conflict resolution, teamwork, and performance management. • Practical exercises in managing team roles and responsibilities on-site. **Quality Control and Safety Leadership** • Implementing quality control measures to ensure high standards in HVAC maintenance. • Techniques for inspecting and assessing team output, ensuring it meets client and regulatory expectations. • Risk management: Identifying potential risks in HVAC projects and leading teams to mitigate them. • Ensuring compliance with safety standards and protocols during maintenance operations. **Communication and Stakeholder Management** • Strategies for effective communication with team members, clients, and project managers. • Conducting team meetings and briefings to align project goals and expectations.

	• Reporting progress and handling client feedback during HVAC maintenance projects. **Leadership in Complex Maintenance Projects** • Leading teams during large-scale or complex HVAC maintenance projects. • Managing resources, time constraints, and unexpected challenges. • Best practices for overseeing the maintenance of HVAC systems in critical environments (e.g., hospitals, data centers). Case studies on successful team leadership in demanding maintenance scenarios

4 – The experts' validation

Experts' Validation and Recommendations for New Modules

The experts provided valuable insights during the validation process, confirming the relevance of the proposed training programs and identifying areas where new modules could enhance the existing curriculum. Their feedback played a critical role in ensuring the training paths address current industry needs and fill skills gaps. Based on their validation, the following recommendations were made:

- **maintain core curriculum:** experts confirmed that the training for *Technician in the Management of Smart Technological Systems* adequately prepare participants with foundational skills. They recommended that these core curricula remain unchanged due to their up-to-date content and alignment with industry standards.

- **Introduce Specialized Modules for Upskilling.** To address the evolving needs of the industry and ensure workers are equipped with advanced skills, experts emphasized the importance of introducing specialized modules tailored to specific areas of expertise. These modules would provide upskilling opportunities for participants, enabling them to deepen their knowledge and acquire advanced capabilities in areas such as: **Advanced BIM Integration for Multidisciplinary Collaboration, Modular Construction and Assembly Techniques, and Sustainable Material Management and Life Cycle Analysis.**

  Experts noted that the existing *Building Information Modeling (BIM) Technician* course is sufficient for introducing learners to BIM at a foundational level. However, to further enhance this profile, an advanced module focused on BIM Integration for Multidisciplinary Collaboration is recommended. This addition would allow participants to coordinate across different disciplines, managing complex construction projects more effectively.
  Similarly, the *Construction Operator for Structures* course, which prepares workers for a versatile operational role, was recognized as providing a solid base of essential knowledge required for on-site work. However, to upskill construction operators, experts recommended integrating specialized modules such as Modular Construction and Assembly Techniques, which would provide specific competencies in the assembly and connection of prefabricated building

components. Additionally, Sustainable Material Management and Life Cycle Analysis would equip workers with the skills to assess environmental impact throughout the construction lifecycle, aligning their work with circular economy goals.

Furthermore, experts suggested enhancing *the Construction Technician* profile by incorporating similar specialized modules, allowing this role to evolve in line with the industry's shift towards sustainability and modular construction.

- **Introduce two new training pathway.** Experts emphasized the importance of introducing two new training pathways to address significant gaps in current offerings:

1. *Solar Panel Orientation and Installation*, designed to provide electrical installers with skills to optimize solar panel positioning for energy efficiency.
2. *Leadership and Team Management for HVAC Technicians*, which would equip technicians with the leadership and team management skills necessary to oversee maintenance teams and ensure quality control in HVAC system management.

These additional pathways would make the training offer more comprehensive, supporting the industry's ongoing transformation towards more sustainable and technologically integrated construction practices.

- **Flexible delivery options**. Experts highlighted the benefit of offering flexibility in course delivery. The new modules could either be taken as stand-alone courses for professionals seeking specific skills or integrated into existing training programs to provide a more holistic learning experience. This flexibility ensures that both new entrants and experienced workers can benefit from the training, adapting the content to their knowledge level.

- **Emphasize practical application**. A strong recommendation was made to focus on practical, hands-on learning in the new modules. Experts noted that while theory is important, the ability to apply knowledge in real-world scenarios is essential. Therefore, each module should include significant practical components, such as on-site workshops, simulation exercises, and interactive case studies.

- **Continuous review and adaptation**. Experts advised that the newly introduced modules and the overall training offer undergo regular updates to keep pace with technological advancements and industry trends. They suggested establishing a feedback loop with industry professionals to ensure that the training remains relevant and up-to-date.

- **Emphasis on Sustainability:** Sustainability should be a core component of all new and existing courses, reflecting the industry's shift towards energy-efficient and environmentally friendly construction practices. The inclusion of circular economy principles in all training modules would be beneficial.

Conclusion

In summary, the validation process proved to be a critical step in refining the proposed training paths, ensuring they meet the evolving needs of the construction industry while addressing identified skills gaps. Throughout the process, experts provided invaluable feedback, confirming the relevance of the core curricula and highlighting areas where enhancements were necessary. They emphasized that the foundational training programs, such as the Technician in the Management of Smart Technological Systems, are well-aligned with current industry standards and adequately prepare workers with the essential skills needed for their roles. This confirmation reinforced the decision to maintain the core content of these programs without significant changes.

However, to better equip the workforce for the industry's ongoing transformation, experts strongly recommended the introduction of specialized modules aimed at upskilling participants. These modules are designed to provide advanced competencies in key areas such as Building Information Modeling (BIM) integration, modular construction, and sustainable material management. Such additions will allow workers to deepen their knowledge and skills, preparing them to take on more complex tasks and meet the growing demand for environmentally friendly and technologically advanced construction practices.

In addition to improving the existing training paths, experts also identified notable gaps in the current offerings, prompting the proposal of two new training pathways. The first focuses on solar panel orientation and installation, a crucial skill set as the industry moves towards more sustainable energy solutions. The second pathway is designed to equip HVAC technicians with leadership and team management skills, enabling them to oversee maintenance teams more effectively and ensure the quality of HVAC system management. These pathways would not only address current skill shortages but also align with broader industry trends toward sustainability and efficiency.

Flexibility emerged as a key consideration in the validation process. Experts emphasized the importance of offering these new modules as both stand-alone courses and integrated parts of existing training programs. This flexibility ensures that both new entrants and experienced professionals can benefit from the training, adapting it to their specific needs and prior knowledge.

Another important recommendation from the experts was the need for a strong emphasis on practical application within the new modules. While theoretical knowledge remains important, the ability to apply skills in real-world scenarios is seen as essential for worker development. Therefore, each module should include hands-on components such as on-site workshops, simulations, and interactive case studies, ensuring that learners can translate what they have learned into practical, on-the-job performance.

Finally, the process underscored the importance of keeping the training offer dynamic and adaptable. Experts recommended regular reviews and updates to ensure the training remains aligned with the latest technological advancements and industry needs. Establishing a continuous feedback loop with industry professionals will help maintain the relevance and effectiveness of the training programs over time.

Sustainability emerged as a central theme throughout the validation process. Experts highlighted the need to embed sustainable practices across all modules, both new and existing. By integrating circular economy principles into the curriculum, the training can help drive the industry's shift towards greener, more energy-efficient practices, preparing workers to contribute to the industry's environmental goals.

By incorporating advanced skills, practical application, and sustainability, the training paths are well-positioned to support the construction sector's transition towards more sustainable, technologically integrated practices.

Annex 1

Title of the course *<Unit of competence>*	**Technician in the Management of Smart Technological System (4 EQF Level)**
Expected results	Develop skills in the design, installation and management of automated systems in various contexts, ensuring energy saving, comfort and safety. The technician will be able to create solutions consistent with the customer's needs, define all the essential components, and ensure that the systems function optimally while respecting safety standards.
Indicators	▪ Development of the automation system scheme ▪ Installation and startup of the automated system ▪ Verification and testing of the installed system ▪ Periodic maintenance and adjustment of the automated system ▪ Verification of safety standard compliance and energy efficiency control ▪ Report processing according to legal regulations.
Capacity	▪ Understand the client's needs and evaluate the structural and functional characteristics of the intervention context, both residential and non-residential. ▪ Outline and design plant solutions for automation, also integrating pre-existing systems and identifying potentially automatable areas. ▪ Recognize the main technologies and innovative solutions, define the system layout and select the most suitable devices for sizing the systems.

	▪ Apply techniques and procedures for the installation, testing and start-up of automated systems, identifying any anomalies and possible corrective interventions. ▪ Carry out periodic maintenance, reprogramming, identification and resolution of malfunctions, and propose improvements to optimize performance and reduce energy consumption.
Knowledge	▪ main technologies, products and integration systems for automated systems (centralized, distributed, etc.). ▪ types and techniques of technical drawing, as well as principles of components for automated systems. ▪ control technologies (safety, thermoregulation, lighting, etc.) and types of wiring (control unit, bus, wireless, powerline, mixed). ▪ main regulatory and legislative references regarding building automation, electrical systems and workplace safety. ▪ Fundamentals of applied computer science, diagnostic and fault detection techniques, including industry-specific English-language technical terminology.

Annex 2

Title of the course *<Unit of competence>*	**Building information modeling technician** **(5 EQF Level)**
Expected results	Be able to use BIM technology in the design, construction and maintenance process of building and infrastructure works, with particular reference to the three-dimensional description, the extraction of graphic data and the specific technical attributes of the building or infrastructure object.
Indicators	▪ Examination and analysis of existing models and spatial study of the work. ▪ Creation and verification of the BIM model according to standards, with proprietary and open formats (IFC). ▪ Extraction of graphics and data from the BIM model for calculations and programming. ▪ Interoperability programming and continuous updating of the BIM model.
Capacity	▪ Acquire and interpret data to create BIM models of structural and infrastructural works. ▪ Adopt BIM technologies and applications, defining libraries of supporting objects. ▪ Apply extraction and virtualization techniques for project representation and management. ▪ Verify the correctness and consistency of the BIM model, using analysis and clash detection tools.

	▪ Manage the archiving, integration and updating of the BIM model over time.
Knowledge	▪ Materials technology and technological systems related to construction. ▪ Structural elements and building survey and tracing techniques. ▪ Digitalization of the construction process and application of BIM tools. ▪ Main drawing techniques, BIM modeling, rendering and virtualization (VR and AR). ▪ Workplace safety regulations, management of construction site works and legislative references.

Annex 3

Title of the course *<Unit of competence>*	**Construction operator for structures** **(3 EQF LEVEL)**
Expected results	Be able to: Construction site preparation, Carry out masonry works, Carry out treatment of internal and external surfaces, Carry out processing and finishing of accessory building components.
Indicators	▪ Set up and decommissioning of construction site logistics spaces, supply and control of tools, and implementation of safety measures. ▪ Reading of the technical project, execution of the main masonry works and waterproofing works, management of resulting materials. ▪ Treatment and installation of materials for thermal/acoustic insulation, plaster application, completion of finishes and maintenance of surfaces. ▪ Carrying out painting, retouching and finishing operations, applying insulating products, assembling wooden elements.
Capacity	▪ Assembly and safe use of temporary structures, equipment control and maintenance, space management and site safety. ▪ Construction and waterproofing techniques, understanding and application of the technical project, choice and management of materials. ▪ Surface treatment, plaster application, preparation of guides and semi-finished products, laying of floors and coverings.

	▪ Painting techniques, assembly of wooden elements, understanding of the work phases, application of insulating materials.
Knowledge	▪ Phases of the construction process, construction site organization techniques, workplace safety, waste management regulations. ▪ Technical drawing, English terminology, materials and construction technology, principles of building construction technology. ▪ Material technology, plastering and installation techniques, main types of covering, workplace safety. ▪ Painting preparation and application, plasterboard installation, wooden carpentry assembly, workplace safety.

Annex 4

Title of the course *<Unit of competence>*	**Construction Technician** **4 EQF LEVEL**
Expected results	Is able to: manage the various phases of the construction process, ensuring that projects are completed according to established technical specifications, timescales and budgets; identify and select the necessary materials and tools, prepare detailed work plans, coordinate the delivery of materials and take care of the operational organization of construction site activities; implement continuous improvement procedures to optimize work processes by evaluating the results to guarantee quality and effectiveness.
Indicators	▪ Organization and coordination of workers, companies and subcontractors, periodic verification of the progress of the works, and management of technical documentation according to company standards. ▪ Installation of the main building systems and finishing of wooden elements, setting up and dismantling of construction site logistics spaces, and movement of waste materials. ▪ Quality control of the construction work carried out and verification of compliance with safety standards, implementing the measures and procedures set out in the safety plans.
Capacity	▪ Plan and manage economic and administrative documentation, organizing staff work and coordinating workers and subcontractors. ▪ Carry out construction and wood carpentry work, using consolidation and recovery techniques.

	▪ Set up and decommission the construction site safely, managing materials and equipment according to supply plans. ▪ Monitor compliance with quality and safety standards, detecting and documenting consumption and requirement levels. ▪ Promote safe behavior, preventing risks and verifying compliance with workplace safety regulations.
Knowledge	▪ Understand the principles of architectural and structural technical drawing, as well as calculation techniques for slopes, heights and volumes. ▪ Know the characteristics of building materials and traditional and modern construction techniques. ▪ Familiarity with the main legislative and regulatory references regarding workplace safety, waste management and public procurement accounting. ▪ Ability to use methodologies for the preparation of accounting books and for the metric calculation of building products. ▪ Understand workplace safety regulations, environmental risks