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Professional Qualifications

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NS4nZEBs New Skills for nearly Zero Energy Buildings

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1. Summary

The qualification profiles are developed on the basis of extensive research of the National Education Standards and curricula of the universities, vocational high schools and vocational training centres in Belgium, Bulgaria, Greece, Italy, Spain and Ukraine, where such specialists are qualified.

Job description and key activities are identified for architects, electrical and mechanical engineers, HVAC engineers, electricians and HVAC technicians.

On the basis of these job and key activities descriptions are identified the required new, or update of already acquired knowledge, skills and abilities of these specialists for implementing NZEBs.

The identified required knowledge, skills and abilities for implementing NZEBs are divided into groups according to the themes covered. Some of these themes are common for all qualification profiles of specialists, other are specific for the different profiles.

The themes are divided in topics, in such way common themes can be easily adapted to the qualification level of the different specialists.

The common themes are dedicated to:

- EU and National legislations related to energy efficiency and RES in buildings
- Understanding the integrated concept of NZEBs and Zero Emission Buildings
- Organisational and financial issues
- Working with clients
- Soft skills
- Media and Information Literacy; Digital Skills

Specific themes:

- PV systems in buildings
- Energy management
- Heat pumps
- Ventilation
- Storage systems
- Application of RES systems for cooling and heating of buildings
- Solar thermal systems in buildings
- Geothermal heating and cooling

Qualification profiles are developed for:

- Architects – level 5-7
- Electrical and mechanical engineers – level 5-7
  - New skills
  - Up-skills
- HVAC engineers - level 5-7
  - New skills
  - Up-skills
- Electricians – level 3
- Electricians – level 4
- HVAC technicians – level 3

- HVAC technicians – level 4

The identified themes will serve as basis for the development of the curricula. Each theme will present a module divided in sub-modules.

Such approach will ensure the necessary flexibility of the training programmes and content, and can be adapted to the different needs of new skills and up-skills.

2. Purpose and Scope

The use of renewable energy and digital technologies in the building sector is heavily emphasized in the relevant EU Directives and Regulations. These technologies are a key factor in achieving a fully decarbonized building stock by 2050, as well as in addressing the energy crisis in Europe.

However, there is a gap between the skills currently possessed by specialists involved in the building sector and the ones already in demand, and definitely indispensable in the future, in the field of PVs, smart electrical systems, heat pumps and hydrogen technologies in buildings, at all levels of building design, operation and maintenance. We have carried out extensive surveys in the partner countries, and have identified competences that need to be developed or improved in order to boost the application of new energy efficient and RES technologies for the successful uptake of (nearly) Zero Energy Buildings, the upscaling of ambitious renovation interventions, the roll out of efficient renewable-based heating and cooling, thus contributing to phasing out EU dependence on fossil fuel imports.

This cannot be achieved without creating synergies between all professionals involved in the building value chain ("blue collars" and "white collars").

So, one of our first tasks is to develop respective professional qualification profiles, focusing on what has to be improved and/or upskilled in order to tackle the skills mismatch identified in the surveys.

The qualification profiles are developed on the basis of extensive research of the National Education Standards and curricula of the universities, vocational high schools and vocational training centres in Belgium, Bulgaria, Greece, Italy, Spain and Ukraine, where such specialists are qualified.

The training programme will be in modules, so trainees will be able to choose the modules applicable and relevant to them.

In this document are developed qualification profiles for:

- Architects – level 5-7
- Electrical and mechanical engineers – level 5-7
    - New skills
    - Up-skills
- HVAC engineers - level 5-7
    - New skills
    - Up-skills
- Electricians – level 3
- Electricians – level 4
- HVAC technicians – level 3
- HVAC technicians – level 4

3. Qualification Profile for Architects

As stated in the curricula of the university offering such qualifications, architects contribute to building the cities of the future and improving people's quality of life. It is a versatile profession that provides students with a general view of the construction cycle and allows them to choose a specialisation ranging from energy efficiency and 3D design to business administration and works management. Students also become experts in materials, structures and facilities.
To achieve this, universities provide students with a Europe-focused, generalist education on the theory, techniques and technology of the building construction sector. They emphasise going beyond lectures, fostering practical and transversal education and incorporating new teaching methods and activities that increase students' active participation in the learning process.

This Professional Qualifications Profile defines the required knowledge, skills and competences of Architects so that they could be adequate to the new reality and objectives related to the implementation of Nearly Zero Energy Buildings with a horizon to Zero Emissions Buildings.

Job description and key activities

In accordance with the Directive 85/384 CEE, the architects should have acquired the following knowledge, competence and skills:

(a) ability to create architectural designs that satisfy both aesthetic and technical requirements;
(b) adequate knowledge of the history and theories of architecture and the related arts, technologies and human sciences;
(c) knowledge of the fine arts as an influence on the quality of architectural design;
(d) adequate knowledge of urban design, planning and the skills involved in the planning process;
(e) understanding of the relationship between people and buildings, and between buildings and their environment, and of the need to relate buildings and the spaces between them to human needs and scale;
(f) understanding of the profession of architecture and the role of the architect in society, in particular in preparing briefs that take account of social factors;
(g) understanding of the methods of investigation and preparation of the brief for a design project;
(h) understanding of the structural design, construction and engineering problems associated with building design;
(i) adequate knowledge of physical problems and technologies and of the function of buildings so as to provide them with internal conditions of comfort and protection against the climate;
(j) the necessary design skills to meet building users' requirements within the constraints imposed by cost factors and building regulations;
(k) adequate knowledge of the industries, organizations, regulations and procedures involved in translating design concepts into buildings and integrating plans into overall planning.

The architects perform the following activities related to the implementation of NZEBs:

- Develop urban planning solutions and situate the buildings in such a way as to create optimal conditions for the energy performance of buildings and for the installation of systems for the use of RES in buildings;

- Develop project solutions that allow the achievement of high indicators of energy efficiency of the building envelope;
- Together with the engineers, they select the most suitable systems for the production, storage and management of the necessary energy resources for the building;
- Develop design solutions that integrate RES use systems in the building;
- When discussing the project solutions with the clients, they point out the benefits of the NZEBs;
- Give advice to the users of the building for better consumer behaviour and the most efficient use of energy resources.

Required knowledge, skills and abilities of the architects for implementing NZEBs:

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (In Chapter 6, 'horizontal provision', the directive explicitly suggests to set up a network ensuring the appropriate level of competencies for energy efficiency-related professions);
- DIRECTIVE (EU) 2023/2413 of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652;
- DIRECTIVE (EU) 2024/1275 of 24 April 2024 on the energy performance of buildings;
- National legislation

Understanding the integrated concept of NZEBs and Zero Emission Buildings

- Energy transition and building's role
- Energy efficiency – the building envelope
- Energy efficiency – energy efficiency of building's systems
  - energy management
  - ventilation
  - heat pumps
- RES in buildings:
  - Solar-related issues (solar irradiance, geometry, solar potential, modelling, irradiance measurements, and analysis)
  - biomass
  - wind
- Urban planning and energy performance
- Energy, sustainability and health impacts
- Voluntary schemes overview (Low Carbon Building Initiative, Passivhaus, BREEAM, DGNB, LEED, VERDE (in Spain), other)

PV systems in buildings

- Types of PV modules, grid-connected and off-grid systems
- Mounting and building integration options for PV systems in buildings
- Design Parameters and Performance Factors, Examples
- Elements in a PV installation

Heat pumps

- Type of heat pumps and their applications
- Requirements for the installation of heat pumps

Ventilation

- Natural and mechanical ventilation – design, opportunities, and limitations
- New smart ventilation systems
- Requirements for the installation of smart ventilation systems

Storage systems

- Batteries
- Small–scale applications for the production of hydrogen from PV systems

Solar thermal systems in buildings

- Types of solar thermal systems and their components
- General configuration of solar thermal systems
- Types of solar thermal collectors and applications

Organisational and financial issues

- The process of building's refurbishment – step by step
- Green procurement and LCC assessment

Working with clients

- Give advices for energy efficiency and RES systems
- Analysis of user behaviour

Soft skills

- Communicative skills, emotional intelligence and networking
- Critical thinking and decision-making
- Entrepreneurship Competence
- Diversity, inclusiveness and social responsibility

Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

4. Qualification Profile for electrical, mechanical engineers

There is no European legislation, such as Directive 85/384/EEC, that regulates the engineering profession in the same way as it does the profession of architects. Directive 2005/36/EC, on the other hand, establishes rules according to which, a Member State, which makes access to or pursuit of a regulated profession in its territory contingent upon possession of specific professional qualifications, shall recognise professional qualifications obtained in one or more other Member States. In the absence of a general mechanism for professional qualifications, Directive 2005/36/EC indicates that Member States should continue to set the minimum level of qualification necessary to ensure the quality of services provided on their territory. In this regard, Directive 2013/55/EU establishes that: as a result of the Bologna Process and in order to apply the recognition mechanism under the general system, it is necessary to group the various national education and training systems into different levels. These levels, established solely for the purposes of the operation of the general system, should not have any effect on national education and training structures or on the competencies of Member States in this area, including national policy for the implementation of the European Qualifications Framework (EQF). The EQF is a tool designed to promote transparency and comparability of professional qualifications, as well as to provide a useful source of additional information for the authorities responsible for examining professional qualifications issued in other Member States. As can be seen from the map that monitors the situation, EQF systems are still in the process of being implemented in several countries. Despite other encouraging initiatives taken at European level, such as the European Skills Agenda and STEM, the main regulatory reference for defining the qualification of the engineering profession remains at the national level.

Here below is a brief description of skills for some of engineering degrees in Spain-Barcelona, which are very similar to the ones in the other partner-countries:

The bachelor's degree in Electrical Engineering covers the technological fundamentals of the generation and distribution of electrical energy and the control and protection of electrical systems. You will acquire the skills needed to supervise and manage engineering projects related to electrical systems, high-, medium- and low-power installations, machine and industrial production line automation, and the generation and distribution of electrical energy. You will also become familiar with emerging fields such as electric traction and the development of renewable energies. (example from UPC university in Catalonia for 4 years degree with 240 ECTS)

The bachelor's degree in Mechanical Engineering provides a solid grounding in the design, development and use of machinery; mechanical processes and systems; criteria for the selection of materials; and the structural design of production systems and processes. You will acquire the knowledge needed to analyse, calculate, design and test machines, industrial installations, hydraulic and thermal engines, industrial structures and constructions, and production systems. You will also receive multidisciplinary training in fluid mechanics, thermal technology, electricity, automation, the design and construction of industrial HVAC systems, and graphic engineering techniques. (example from UPC university in Catalonia for 4 years degree with 240 ECTS)

On the bachelor's degree in Industrial Electronics and Automatic Control Engineering, students acquire the knowledge needed to supervise and manage engineering projects in the fields of industrial electronics and automatic control: design and development of analogue, digital and power electronic systems and industrial control and automation systems. They receive multidisciplinary training in the fields of analogue, digital and power electronics, systems modelling and simulation,

automatic regulation and control techniques and their application in industrial automation, and the principles and applications of robotic systems, industrial informatics and communications. (example from UPC university in Catalonia for 4 years degree with 240 ECTS)

The bachelor's degree in Industrial Technology Engineering provides knowledge of the range of industrial technologies and offers a multidisciplinary, unifying view of the field of industrial engineering. You will be trained in basic scientific and technological disciplines that will equip you to learn about new methods and theories and gain in-depth knowledge of industrial fields, including technological and business aspects such as project planning, supervision and management, whilst observing social and environmental requirements. Upon completion of your studies, you will have developed the versatility to adapt to changing working environments and to future technological developments that will improve products and processes in the sector. (example from UPC university in Catalonia for 4 years degree with 240 ECTS)

The bachelor's degree in Energy Engineering provides a clear vision of the energy field, focusing on aspects such as efficiency, saving, management, generation, elements and the energy market. Students are trained in energy resources; energy storage; energy management; energy sector planning; energy integration; the generation, transport and distribution of energy; and the control of energy systems. They learn to analyse the criteria of sustainability, general efficiency and professional ethics that enable individuals, businesses and institutions to implement energy saving policies. In addition to studying conventional energies, they also gain in-depth knowledge of renewable energies such as wind, solar, thermal, photovoltaic, biomass, geothermal, micro hydro, biogas, biofuel, hydrogen and fuel cells. (example from UPC university in Catalonia for 4 years degree with 240 ECTS)

This Professional Qualifications Profile defines the required knowledge, skills and competences of electrical different engineering degrees related to energy and buildings so that they could be adequate to the new reality and objectives related to the implementation of Nearly Zero Energy Buildings with a horizon to Zero Emissions Buildings.

In view of the varied existing competences, trainees will be able to choose the specialist modules they will have to cover.

Job description and key activities

Engineering profiles for different EU countries are defined by each University study plans aligned with state regulations and with recognition among countries (2013/55/EU Directive).

It appears that electrical engineers, mechanical engineers, industrial and energy engineers have competences in energy efficiency, HVAC, electricity and renewable energy, in different ways.

The above-mentioned engineers are expected to be able to usually perform the following activities related to the implementation of NZEBs:

- Develop electricity and thermal energy projects that include usual electric and thermal uses, HVAC, PV, Electric Vehicles, energy storage systems, building management systems
- They assess alternative energy solutions in terms of feasibility, energy efficiency, sustainable impact, health impact and economic payback

- Together with the architects, they select the most suitable solutions and systems integrating passive and active strategies and their integration to maximise building energy performance;
- When discussing the project solutions with the clients, they point out the benefits of the NZEBs; and renewable energy
- Advise the users of the building for better consumer behaviour and the most efficient use of energy resources.

4.1 Required knowledge, skills and abilities connected with PV installations and energy management for implementing NZEBs:

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955;
- DIRECTIVE (EU) 2023/2413 of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652;
- DIRECTIVE (EU) 2024/1275 of 24 April 2024 on the energy performance of buildings;
- National legislation

Understanding the integrated concept of NZEBs and Zero Emission Buildings

- Energy transition and building's role
- Energy efficiency – the building envelope
- Energy efficiency – energy efficiency of building's systems
  - energy management
  - ventilation
  - heat pumps
- RES in buildings:
  - solar related issues (solar irradiance, geometry, solar potential, modelling, irradiance measurements and analysis)
  - biomass
- Urban planning and energy performance
- Energy, sustainability and health impacts
- Voluntary schemes overview (Zero Carbon Building standards, Passivhaus, BREEAM, DGNB, LEED, VERDE (in Spain), other)

PV systems in buildings

- Solar engineering
  - Solar Photovoltaic (PV) Energy
  - Elements of PV systems
  - PV technologies

- Types of PV technologies and their application (off-grid, grid connected and hybrid)

- Design principles
  - On-site visit: customer needs, climate conditions, shading, array orientation and tilt, mounting methods, load description, performance ratio
  - System sizing and design: basics (I-V curve, effect of temperature, interconnecting PV modules, inverters, strings, sizing of cables, blocking diodes, earthing, lightning protection, sizing of stand-alone PV system
- Simulation software
  - PV analysis and planning software
  - Software tools for site analysis
- Installation, sitework
  - Working safely with PV
  - Installation plan
  - Installation of electrical components
  - Installation of equipment
  - Installation of mechanical components
  - Completing the PV installation
- Maintenance and troubleshooting

Storage systems

- Design parameters of batteries and other storage systems for electricity
- Small–scale applications for the production of hydrogen from PV systems

Energy management

- Energy management parameters, indicators, protocols and current integration of products
- Hardware and software for energy management systems
- Programming and automation

Organizational Management of Work Activities

- Defining Tasks, Time, and Operating Modes
- Conducting Work Phases Based on Project Specifications
- Document Management of Procurement and Activities
- Budget management

Organisational and financial issues

- The process of building's refurbishment – step by step
- Green procurement and LCC assessment

Working with clients

- Give advices for energy efficiency and RES systems
- Analysis of user behaviour

Soft skills

- Communicative skills, emotional intelligence and networking
- Critical thinking and decision-making
- Entrepreneurship Competence
- Diversity, inclusiveness and social responsibility

Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

4.2 Required knowledge, skills and abilities for up-skilling trained engineers connected with PV installations and energy management for implementing NZEBs:

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955;
- DIRECTIVE (EU) 2023/2413 of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652;
- DIRECTIVE (EU) 2024/1275 of 24 April 2024 on the energy performance of buildings;
- National legislation

PV systems in buildings

- Types of PV modules, grid-connected and off-grid systems
- Mounting and building integration options for PV systems in buildings
- Design Parameters and Performance Factors, Examples

Storage systems

- Design parameters of batteries and other storage systems for electricity
- Small–scale applications for the production of hydrogen from PV systems

Energy management

- Energy management parameters, indicators, protocols and current integration of products
- Hardware and software for energy management systems
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- Analysis of user behaviour

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- Entrepreneurship Competence
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Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

5. Qualification Profile for HVAC engineers

This Professional Qualifications Profile defines the required knowledge, skills and competences of HVAC engineers so that they could be adequate to the new reality and objectives related to the implementation of Nearly Zero Energy Buildings with a horizon to Zero Emissions Buildings.

Job description and key activities

In accordance with the ESG policies and ISCED the HVAC engineers should have acquired the following knowledge, competence and skills:

- ✓ To know, understand and apply key concepts in practical activities, modern knowledge and best practices in the heat energy industry, technologies production, transmission, distribution and use of energy
- ✓ To apply knowledge in practical situations.
- ✓ Ability to design and operate thermal power equipment.
- ✓ Ability to identify, classify and evaluate the effectiveness of systems and components based on the use of analytical methods and modelling methods in the thermal energy industry.
- ✓ Ability to investigate and solve problems in the field of thermal energy, as well as identify constraints, including those related to engineering aspects and issues of nature protection, sustainable development, health and safety and risk assessments in the thermal energy industry.
- ✓ Ability to take into account knowledge and understanding of the commercial and economic context when making decisions in the heat energy industry.
- ✓ Ability to take into account the wider interdisciplinary engineering context in the professional activity in the field of thermal power engineering.
- ✓ Ability to develop plans and projects to ensure the achievement of a specific goal, taking into account all aspects of the problem to be solved, including production, operation, maintenance and disposal of thermal power equipment.

HVAC engineers are expected to perform the following actions related to the implementation of NZEB:

- Develop and implement projects for HVAC solutions in the field of implementation of NZEB: taking into account goals, forecasts, limitations and risks and taking into account technological, legislative, social, economic, environmental and other aspects
- Make effective decisions using modern methods and alternative comparison, risk assessment and forecasting tools
- Justify the choice and use of materials, equipment and tools, engineering technologies and processes taking into account their characteristics and properties, requirements for the final product, as well as non-technical aspects
- Plan and implement measures to improve the energy efficiency of buildings, taking into account existing restrictions, including those related to the problems of nature protection,

sustainable development, health and security, focusing on active measures, in collaboration with architects to find the appropriate balance between passive and active measures

- Analyse and evaluate the problems of thermal energy related to the development of new technologies, science, society and economy
- Assess in terms of thermal comfort, air quality and health conditions, the design and implementation of NZEB

5.1 Required knowledge, skills and abilities of HVAC engineers for implementing NZEBs:

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955;
- DIRECTIVE (EU) 2023/2413 of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652;
- DIRECTIVE (EU) 2024/1275 of 24 April 2024 on the energy performance of buildings;
- National legislation

Understanding the integrated concept of NZEBs and Zero Emission Buildings

- Energy transition and building's role
- Energy efficiency – increasing the heat-shielding properties of the building's enclosing structures
- Energy efficiency – improvement of engineering systems of the building
  - energy management
  - ventilation
  - heat pumps
- RES in buildings - Energy transition and buildings' role
  - solar related issues (solar irradiance, geometry, solar potential, modelling, irradiance measurements and analysis)
  - direct combustion of solid biomass

Application of RES systems for cooling and heating of buildings

- solar thermal systems, biomass and geothermal
- Installation and dismantling operations of HVAC equipment for RES systems
- Applies methods for calculation and selection of a suitable RES-based HVAC system
- Heat pumps
  - the principle of operation and modes of operation of the heat pump.
  - selection of the optimal source of low-potential heat for TPU
  - ensuring the appropriate energy conversion factor of the heat pump
- Ventilation
  - optimal microclimate parameters in the room
  - types of ventilation systems and basic equipment
  - devices for utilization of the heat of ventilation emissions

Solar thermal systems in buildings

- Solar thermal basics
  - Solar thermal energy
  - types of solar heating systems and their components
  - general schemes of active solar thermal systems
  - types of solar collectors and areas of their application
- Heating water with solar energy
  - Collection
  - Energy transfer and storage
  - Auxiliary heating
- Preliminary studies
  - The needs for domestic hot water: domestic hot water temperature, analysis of the needs
  - On-site visit: climate conditions, solar radiation
  - Collector layout
  - Collector connections
  - Storage volume and back-up
- Knowledge of equipment and materials in the plumbing,
- Thermal energy storage systems
  - types and features of constructions of water accumulators and accumulators with a phase transition
- Simulation software
  - Software for analysis and planning of solar thermal systems
  - Software tools for site analysis
- Maintenance and troubleshooting

Geothermal heating and cooling

- Low surface geological principles and earth exchange basics
  - Fundamental hydrogeological & geological and physical principles
  - Fundamentals of heat transfer and its effects
  - Ability to analyse basic hydrogeological & geological conditions
  - Different design techniques and tools
  - Knowledge of how design techniques are used for planning geothermal installation and their limitations
  - Ability to understand and use tools for planning
- Geothermal Heating – Structure of the heat pump and types of geothermal heat pumps
  - Working principles and components; Types of heat pumps
  - Ability to install, bring into service and maintain heat pumps
- Knowledge of the worldwide state of the art in geothermal applications and legislation
  - Regulations and legislation concerning geothermal systems
  - State of the art and future trends of geothermal applications
- Installation of geothermal systems
  - Drilling techniques
  - Techniques for optimizing efficiency
  - Supervision and maintenance of geothermal systems

Organizational Management of Work Activities

- Defining Tasks, Time, and Operating Modes
- Conducting Work Phases Based on Project Specifications
- Document Management of Procurement and Activities
- Budget management

Organisational and financial issues

- The process of building's refurbishment – step by step
- Green procurement and LCC assessment

Working with clients

- Give advices for energy efficiency and RES systems
- Analysis of user behaviour

Soft skills

- Communicative skills, emotional intelligence and networking
- Critical thinking and decision-making
- Entrepreneurship Competence
- Diversity, inclusiveness and social responsibility

Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

5.2 Required knowledge, skills and abilities for up-skilling trained HVAC engineers for implementing NZEBs:

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955;
- DIRECTIVE (EU) 2023/2413 of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652;
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Understanding the integrated concept of NZEBs and Zero Emission Buildings

- Energy transition and building's role
- Energy efficiency – increasing the heat-shielding properties of the building's enclosing structures
- Energy efficiency – improvement of engineering systems of the building
  - energy management
  - ventilation
  - heat pumps

Application of RES systems for cooling and heating of buildings

- solar thermal systems, biomass and geothermal
- Applies methods for calculation and selection of a suitable RES-based HVAC system
- Heat pumps
  - the principle of operation and modes of operation of the heat pump.
  - selection of the optimal source of low-potential heat for TPU
  - ensuring the appropriate energy conversion factor of the heat pump
- Ventilation
  - optimal microclimate parameters in the room
  - types of ventilation systems and basic equipment
  - devices for utilization of the heat of ventilation emissions

Organizational Management of Work Activities

- Defining Tasks, Time, and Operating Modes
- Conducting Work Phases Based on Project Specifications
- Document Management of Procurement and Activities
- Budget management

Organisational and financial issues

- The process of building's refurbishment – step by step
- Green procurement and LCC assessment

Working with clients

- Give advices for energy efficiency and RES systems
- Analysis of user behaviour

Soft skills

- Communicative skills, emotional intelligence and networking
- Critical thinking and decision-making
- Entrepreneurship Competence
- Diversity, inclusiveness and social responsibility

Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

6. Qualification Profile for Electricians/Installers (EQF Level 3 and 4)

This Professional Qualifications Profile defines the required knowledge, skills and competences of electrician/Installers/ so that they could be adequate to the new reality and objectives related to the implementation of Nearly Zero Energy Buildings with a horizon to Zero Emissions Buildings.

Job description and key activities

In accordance with the State Educational Standard, electricians should have acquired the following knowledge, competence and skills:

- ✓ Ability to make/assemble, install, deinstall, perform diagnostics, testing and repair of electrical equipment;
- ✓ Knowledge and competence to measure electrical and non-electrical values. Trace electrical circuits and read electrical schematics;
- ✓ Make decisions concerning the operability of electrical plant and equipment;
- ✓ Ability to perform fitting and electrical installation works;
- ✓ Ability to strictly apply the methodologies for construction, installation, maintenance, dismantling and repair of electrical machinery and equipment;
- ✓ Ability to use modern IT technology and use a computer, as well as specialized computer equipment and software for the design and monitoring of electrical systems;
- ✓ Complies with the regulatory requirements for operation and safety of the equipment and of the workplace;
- ✓ Sets and assigns tasks and supervises their performance;
- ✓ Knowledge of administrative procedures, competent authorities, procedures and rules for awarding, coordinating and approving layout schemes and plans and investment projects, permits, execution and commissioning of constructions;
- ✓ Ability to work with clients and in a team.

The electricians perform the following activities related to the implementation of NZEBs:

- Installation of systems for the use of RES;
- Propose project solutions that allow the achievement of high indicators of energy efficiency of the building;
- Operation, maintenance & repair of different kinds of PV systems in buildings;
- Maintenance & repair of battery storage;
- When discussing the project solutions with the clients, they point out the benefits of the NZEBs;
- Give advice to the users of the building for better consumer behaviour and the most efficient use of energy resources.

Required knowledge, skills and abilities of electricians for implementing NZEBs:

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2024/1275 of 24 April 2024 on the energy performance of buildings;
- National legislation

Understanding the integrated concept of NZEBs and Zero Emission Buildings

- Energy efficiency – energy efficiency of building's systems & energy management;
- RES in buildings:
  - solar related issues (solar irradiance, geometry, solar potential, modelling, irradiance measurements and analysis)
  - biomass

PV systems in buildings

- Types of PV modules, grid-connected and off-grid systems
- Mounting and building integration options for PV systems in buildings
- Design Parameters and Performance Factors, Examples

Storage systems

- Batteries
- Small – scale applications for production of hydrogen form PV systems

Solar thermal systems in buildings

- Types of solar thermal systems and their components
- General configuration of solar thermal systems

Working with clients

- Give advice on energy efficiency and RES systems
- Analysis of user behaviour

Soft skills

- Communicative skills, emotional intelligence and networking
- Critical thinking and decision-making
- Entrepreneurship Competence
- Diversity, inclusiveness and social responsibility

Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

7. Qualification Profile for HVAC Installers (EQF Level 3 and 4)

This Professional Qualifications Profile defines the required knowledge, skills and competences of HVAC installers (HVAC installers to be upskilled to installers of HVAC systems based on RES) so that they could be adequate to the new reality and objectives related to the implementation of Nearly Zero Energy Buildings with a horizon to Zero Emissions Buildings.

Job description and key activities

In accordance with the State Educational Standard, HVAC installers should have acquired the following knowledge, competence and skills:

- ✓ Ability to make/assemble, install, deinstall, perform diagnostics, testing and repair of technical equipment;
- ✓ Knowledge of HVAC and building distribution systems
- ✓ Knowledge and competence to measure respective values and read respective drawings;
- ✓ Knowledge of the technology and requirements for cost-efficiency of the production process;
- ✓ Ability to act in changing environments;
- ✓ Knowledge of the organization of the work process, materials and tools used, the technology of the production process
- ✓ Make decisions concerning the respective equipment;
- ✓ Ability to perform fitting and installation works;
- ✓ Ability to strictly apply the methodologies for construction, installation, maintenance, dismantling and repair of the respective equipment;
- ✓ Ability to use modern IT technology and use a computer, as well as specialized computer equipment and software for the design and monitoring of systems;
- ✓ Complies with the regulatory requirements for operation and safety of the equipment and of the workplace;
- ✓ Sets and assigns tasks and supervises their performance;
- ✓ Knowledge of administrative procedures, competent authorities, procedures and rules for awarding, coordinating and approving layout schemes and plans and investment projects, permits, execution and commissioning of constructions;
- ✓ Ability to work with clients and in a team.

The HVAC and geothermal installers perform the following activities related to the implementation of NZEBs:

- They design, install and maintain geothermal systems, which circulate a water-based solution through a buried loop system to take advantage of the relatively constant temperature of the ground and are used in residential, commercial or industrial facilities;
- Produce precise technical plans and blueprints
- The Geothermal Installers calculate the thermal energy balance and total needs of the facility, select the suitable geothermal system according to the given conditions, install all the components of the geothermal system, supervise its operation, proceed to necessary adjustments or repairs and maintain the whole system.
- Propose project solutions that allow the achievement of high indicators of energy efficiency of the building;
- Operation, maintenance & repair of different kinds of HVAC and geothermal systems in buildings;
- Operation, maintenance & repair of RES-based HVAC systems;
- Maintenance & repair of battery storage;
- When discussing the project solutions with the clients, they point out the benefits of the NZEBs;
- Give advice to the users of the building for better consumer behaviour and the most efficient use of energy resources.

Required knowledge, skills and abilities of HVAC/geothermal installers for implementing NZEBs (including up-skills):

EU and National legislations related to energy efficiency and RES in buildings

- DIRECTIVE (EU) 2024/1275 of 24 April 2024 on the energy performance of buildings
- National legislation

Understanding the integrated concept of NZEBs and Zero Emission Buildings

- Energy efficiency – energy efficiency of building's systems & energy management;
- RES in buildings:
  - solar related issues (solar irradiance, geometry, solar potential, modelling, irradiance measurements and analysis)
  - biomass

Low surface geological principles and earth exchange basics

- Fundamental hydrogeological & geological and physical principles
- Fundamentals of heat transfer and its effects
- Ability to analyse basic hydrogeological & geological conditions

- Different design techniques and tools
- Knowledge of how design techniques are used for planning geothermal installation and their limitations
- Ability to understand and use tools for planning

Geothermal Heating – Structure of the heat pump and types of geothermal heat pumps

- Working principles and components; Types of heat pumps
- Ability to install, bring into service and maintain heat pumps

Knowledge of the worldwide state of the art in geothermal applications and legislation

- Regulations and legislation concerning geothermal systems
- State of the art and future trends of geothermal applications

Installation of geothermal systems

- Drilling techniques
- Techniques for optimizing efficiency
- Supervision and maintenance of geothermal systems

Application of RES systems for cooling and heating of buildings

- PV systems, biomass and geothermal
- Installation and dismantling operations of HVAC equipment for RES systems
- Applies methods for calculation and selection of a suitable RES-based HVAC system

Working with clients

- Give advices for energy efficiency and RES systems
- Analysis of user behaviour

Soft skills

- Communicative skills, emotional intelligence and networking
- Critical thinking and decision-making
- Entrepreneurship Competence
- Diversity, inclusiveness and social responsibility

Media and Information Literacy; Digital Skills

- Ability to access and analyse media messages as well as create, reflect and take action, using the power of information and communication;
- Digital Skills – DigComp2.2, software used in the profession.

Conclusion:

The developed professional qualification profiles will serve as a basis for designing the curriculum and preparing the training materials.

As stated at the beginning, the training programme will be structured in modules. The transversal-skills modules will be common for all specialists, whereas the modules focused on the profession-specific skills will be elective. In other words, trainees will choose which modules they need to do in view of their current qualifications and experience.