NEWCOM New qualification schemes to build high quality

Summary report on national certification strategies for blue collar workers

D3.2

08.05.2019

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Summary report on national certification strategies for flat roofs D3.2.

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Executive summary

The aim of this report is to define the certification strategy related to the trainings developed in the NEWCOM project for blue-collar workers in the field of flat roofing and roof waterproofing in the project partner countries. The report describes the strategies for establishing the needed course schemes for flat roofing in the national markets and the method of involving relevant stakeholders, educational institutions, important administrative bodies and authorities.

All partners summarize the country-specific existing trainings on flat roofing and identify the training insitutions and training providers who can actively participate in the further implementation of the developed trainings. It is clear that countries with longer and stronger roofing craft tradition and federal systems based on local and central governments, such as Austria and Netherlands, are more advanced in this field with more training opportunities and available training institutions. In contrast, Hungary and Slovakia are in a transition stage and have less tradition with regard to craft roofing and a less clear demand. However, both countries finished Pillar I and Pillar II of their Build Up Skills projects, which provided and also increased demand from the clients side. This provides a good base for further development and, thus, represents a special technology transfer opportunity from West to East as well.

The report also analyzes how the modules defined for flat roof training developed in NEWCOM can be integrated into existing trainings. Austria and the Netherlands have higher interest in innovative solutions, such as failure detection systems, cross-cutting activities and innovative solar panels installing opportunities; in Slovakia and Hungary there is a much higher demand related to almost all basic course items.

In order to build up demand and attract trainees for the developed courses, this report also includes a promotion strategy to reach as many stakeholders and participants as possible.

The existing training institutions and the Build Up Skills networks provide a good platform for the implementation. Stronger connection of the project partners with the national roofing

federations and with the main industrial actors also offers a wide range of opportunities for the implementation of the intended training activities.

The figure below demonstrates the defined steps related to the implementation of the flat roof training. This deliverable focuses on the first three elements and, based on the results, the last two steps will be performed and documented in the upcoming public deliverables.

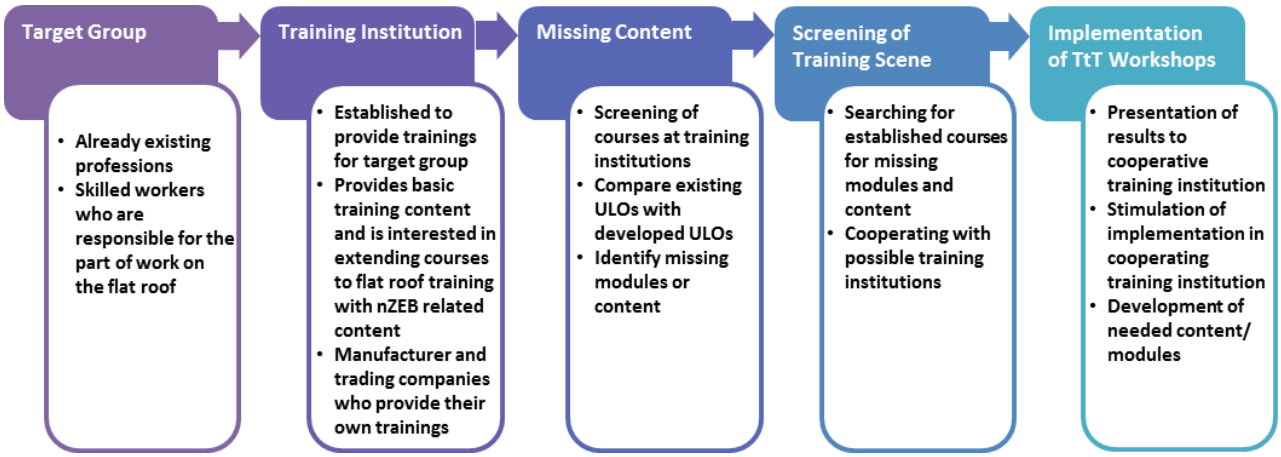

Figure 1: Steps for the implementation of flat roof training

Contents

1 Introduction of the flat roof trainings

Generally, three actors are defined in the construction/renovation process of flat roofs in the partner countries: **project manager, foremen, skilled worker**, but not all countries differentiate between project manager and foremen. Therefore, in the example of Austria the project manager is excluded.

Colour key of the tables of analysis of existing and needed training tasks:

Existing modules	
New elements	

1.1 Austria

There is no mandatory apprenticeship for flat roofing. Although the roofing of flat roofs is formally part of the profession of roofer and tinsmith, in practice there are hardly any skilled workers in the field of flat roof manufacturing. The knowledge and skills required here are usually acquired in-house or in short training courses. Professional experience in the construction sector is a good prerequisite for entering the profession. Short training is offered by various adult education institutions as illustrated in the next chapter.

1.1.1 Summary of existing trainings

The Institute of Flat roofing and Waterproofing (IFB) is the leading training centre for flat roofing in Austria, most of the trainings are organized and run by (or at least coordinated with) the IFB. The IFB and associated institutions offer modular training and continuing education courses. As proof of training, graduates receive the official certificate: Flat roofer and waterproofer with basic training.

In the case of additional higher qualification, graduates receive the commissioned certificate as proof of further training: Flat roofer and waterproofer with higher qualification.

The IFB maintains a personal database with the registration and archiving of all qualification, further education and training data of certified flat roofers and waterproofers.

1.1.2 Existing and missing modules

In Austria three types of trainings are offered: basic training, higher qualification and personal certification. The trainings consist of theoretical and practical modules.

Table 1: Summary of existing flat roof trainings in Austria

Basic training in theory and practice	
Theory technology	• Roof waterproofing or waterproofing of components in contact with the ground incl. testing
Craft practice	• Bitumen or plastic sheeting or liquid plastics incl. testing
Higher qualification in theory and practice	
Theory technology	• Roof sealing • Roof waterproofing, quality assurance • Waterproofing of building protection, waterproofing of components in contact with the ground, waterproofing of wet rooms
Craft practice	• Bitumen sheets • Plastic sheets • Liquid plastics
Industry-specific verifications	
Personal qualification in theory and practice	
Theory technology	• Roof sealing • Waterproofing • Wet room and tank sealing • Sealing of components in contact with the ground • Sealing of drivable components • Building damage analysis

	• Quality assurance, monitoring • Occupational safety • Fire protection • Rescue, first responder • Building laws
Craft practice	• Bitumen sheets • Plastic sheets • Liquid plastics

Industry-specific verifications

After the training offers had been investigated, the content and the Unit of Learning Outcomes (ULOs) of the trainings required for the nZEB buildings were identified in the table below.

Two main actors are defined in the construction/renovation process of flat roofs in Austria: **foreman and skilled worker**.

Table 2: Analysis of existing and needed training tasks in Austria

AT				
Tasks	**Subtasks**	**ULO number**	**Foreman**	**Skilled worker**
Assist in diagnostic of existing roof	Open the layers for diagnostics & repair	2.2.1		
	Height control for increased outskirting need	3.2.2		
	Demolish/maintain part of the existing roof construction	2.1.2; 3.1.2.; 3.1.5		
Layers of nZEB renovation +	Normal roof layers	3.1.2; 3.1.4; 3.1.5		
	Inverted roof layers	3.1.2; 3.1.4; 3.1.5		
	Duo roof layers	3.1.2; 3.1.4; 3.1.5		

fixing technology + building physics	Mechanical fixing	3.1.2; 3.1.4; 3.1.5		
	Glued technology fixing	3.1.2; 3.1.4; 3.1.5		
	Coat loading	3.1.2; 3.1.4; 3.1.5		
	Evaporation layers and vent openings of captured water	2.2.2		
	Transportation of demolished materials and new thermal insulation	1.4.1; 5.1.3		
	Temporary fixing and waterproofing technology	4.3.1; 4.3.2		
Slope correction and new outlet design and implementation	Suction based outlet systems	2.1.2; 3.2.1		
	Consignation of insulation in slope	3.3.1; 4.3.3		
	Local site cast insulation correction at height areas	3.2.2		
	Local site cast insulation correction at low areas	3.2.1		
	Minimize thermal bridge	3.3.1; 3.3.2		
Proactive design and installation of joints at height areas	New height of perimeter walls	3.2.2		
	New outskirting height at abutment wall and threshold	3.2.3		
	Fill up unnecessary different height level areas	3.1.2		
	Measurement of minimized thermal brides at the vertical joints	3.2.2; 3.2.3		
	Diminish unnecessary penetration	3.1.2		

	Clear the valley from penetration	2.1.2		
Health and Safety (H & S)	Temporary protection against fall at inner openings	1.1.1		
	New hooks against fall at perimeter of the roofs	1.1.2		
	H & S in transportation during demolition	1.1.2; 5.1.2		
	H & S in maintenance works	5.1.1		
Secure the failure proof implementation of the solar systems	Penetration and fixing opportunities on existing roof	3.4.2; 4.3.2; 5.2.2		
	Fixing opportunities on new roof with penetration	3.4.2; 5.2.2		
	Fixing opportunities without penetration	3.4.1; 3.4.2		
	Hybrid fixing with penetration and loading	3.4.1; 3.4.2		
	Safe access for the active systems	5.1.1		
Intelligent failure detection systems for roof with covered waterproofing	Principle and operation	3.1.6; 4.4.2		
	Installation	3.1.5		
	Control and actions at failure detection	5.2.1		
Cross-craft activities, maintenance and repair	Penetrations for ventilation	4.1.1; 4.1.3		
	Non-destructive diagnostic of thermal performance	4.4.3		
	Roof diary and administration of access	4.5.4		

	New penetrations on existing roof: sky flights, fixing points	5.2.2		
Extensive green roof	Layers	3.1.7; 3.3.2; 4.4.4		
	Water route and outlets	3.2.1; 3.2.4		
	Joints at height	3.2.2; 3.2.4		
	Irrigation system and maintenance	4.1.3		

The function “project manager” is not applied to this profession regarding nZEB standards in Austria, therefore has not been integrated into the table above, as mentioned before.

Within the project the development of two modules (which are particularly relevant to nZEB), namely "Green roofs and water retention roofs as a contribution to climate change adaptation", and "Requirements of the new standard ÖNORM B3691 with special focus on energy efficiency", were identified as two missing important courses to be addressed in the “Train the Trainer” courses in Austria.

1.2 Hungary

In Hungary trainings were available in the National Qualifications Framework (NQF) system and currently are organized by trading and manufacturing companies. The existing trainings contain different modules; however, none of them cover the whole process of the construction or renovation of roofs.

1.2.1 Summary of existing trainings

Table 3: Summary of competencies and modules of building insulation training in Hungary

Building insulation technician training content	
Competences to be obtained after the completion of the trainings	• Work preparation • Preparation of waterproofing • Waterproofing according to moisture effects • Layers for roof insulation • Subsequent drying and waterproofing • Drainage

	• Thermal insulation and soundproofing • Subsequent façade insulation
Modules of the training	1. Common construction tasks I 2. Thermal insulation, water- and sound-proofing I 3. Special insulation tasks 4. Thermal insulation, water- and sound-proofing II 5. Thermal insulation, water- and sound-proofing III 6. General business tasks 7. Subsequent thermal insulation

The training consists of 50% theoretical and 50% practical modules. Thermal insulation, soundproofing and waterproofing trainings are available as sub-qualifications (40% theoretical and 60% practical training).

Table 4: Summary of competences and modules of waterproofing training in Hungary

Waterproofing and floor layer technician training content	
Competences to be obtained after the completion of the trainings	• Work preparation • Preparation of insulation • Make and repair waterproofing • Coverage for indoor walls and floors
Modules of the training	1. Common construction tasks I 2. Insulation of substructures 3. Industrial waterproofing 4. Rainwater insulation/proofing 5. Preparation of floor laying 6. Floor laying techniques 7. Employment I 8. Employment II 9. Health and safety

Directives of the design and implementation of flat roof renovations

The project partner ÉMI is involved in the development of the Directive in the subject of the principles related to the renovation of flat roofs or structures with waterproof insulation (not walkable only in case of maintenance, repairing or Photovoltaic (PV) check). The Directive has not been finalized yet, drafting is still in progress. It contains the main reasons for flat roof renovation and the most common failures such as incorrect construction technology as well as flooding due to inadequate or old insulation. Other reasons for renovation of flat roofs can be preventive maintenance or energy efficiency.

The Directive also defines the common basic standards of roof insulation, waterproofing, technical, building physics, structural, acoustic, slope, wind, fire safety and energy-related requirements. General principles of planning and design are included with detailed description with respect to renovation. The Directive can be an important and relevant base for the harmonized training material developed in NEWCOM.

1.2.2 Existing and missing modules

The strategy of implementing the training developed in NEWCOM depends on the available trainings and training institutions of each partner country. In Hungary flat roof trainings are not available on their own, but other trainings (especially those organized by companies) include modules and content related to the topic. The NQR (National Qualification Register) system changed in the past few years in Hungary and a number of trainings were terminated and others were integrated into other trainings.

Based on the training materials available and the Units of Learning Outcomes developed in the "*D3.1. Units of learning outcomes and descriptors*" report, we defined the most important modules for the flat roof training. The following table contains these main modules and the information related to their availability. Three main actors are defined in the construction/renovation process of flat roofs: **project manager, foremen, skilled worker**.

In Hungary the three actors have different skills, competences and level of training/qualification. The modules defined are categorized as follows:

- existing modules
- new elements

Table 5: Analysis of existing and needed training tasks in Hungary

HU					
Task	Subtasks	ULO number	Project manager	Foreman	Skilled worker
Assist in diagnostic of existing roof	Open the layers for diagnostic & repair	2.2.1			
	Height control for increased outskirting need	3.2.2			
	Demolish/maintain part of the existing roof construction	2.1.2; 3.1.2; 3.1.5			
Layers of nZEB renovation + fixing technology + building physics	Normal roof layers	3.1.2; 3.1.4; 3.1.5			
	Inverted roof layers	3.1.2; 3.1.4; 3.1.5			
	Duo roof layers	3.1.2; 3.1.4; 3.1.5			
	Mechanical fixing	3.1.2; 3.1.4; 3.1.5			
	Glued technology fixing	3.1.2; 3.1.4; 3.1.5			
	Coat loading	3.1.2; 3.1.4; 3.1.5			
	Evaporation layers and vent openings of captured water	2.2.2			
	Transportation of demolished materials and new thermal insulation	1.4.1; 5.1.3			

	Temporary fixing and waterproofing technology	4.3.1; 4.3.2			
Slope correction and new outlet design and implementation	Suction based outlet systems	2.1.2; 3.2.1;			
	Consignation of insulation in slope	3.3.1; 4.3.3			
	Local site cast insulation correction at height areas	3.2.2			
	Local site cast insulation correction at low areas	3.2.1			
	Minimize thermal bridge	3.3.1; 3.3.2			
Proactive design and installation of joints at height areas	New height of perimeter walls	3.2.2			
	New outskirting height at abutment wall and threshold	3.2.3			
	Fill up unnecessary different height level areas	3.1.2			
	Measurement of minimized thermal brides at the vertical joints	3.2.2; 3.2.3			
	Diminish unnecessary penetration	3.1.2			
	Clear the valley from penetration	2.1.2			
Health and Safety	Temporary protection against fall at inner openings	1.1.1			
	New hooks against fall at perimeter of the roofs	1.1.2			

	H & S in transportation during demolition	1.1.2; 5.1.2			
	H & S in maintenance works	5.1.1			
Secure the failure proof implementation of the solar systems	Penetration and fixing opportunities on existing roof	3.4.2; 4.3.2; 5.2.2			
	Fixing opportunities on new roof with penetration	3.4.2; 5.2.2			
	Fixing opportunities without penetration	3.4.1; 3.4.2			
	Hybrid fixing with penetration and loading	3.4.1; 3.4.2			
	Safe access for the active systems	5.1.1			
Intelligent failure detection systems for roof with covered waterproofing	Principle and operation	3.1.6; 4.4.2			
	Installation	3.1.5			
	Control and actions at failure detection	5.2.1			
Cross-craft activities, maintenance and repair	Penetrations for ventilation	4.1.1; 4.1.3			
	Non-destructive diagnostic of thermal performance	4.4.3			
	Roof diary and administration of access	4.5.4			
	New penetrations on existing roof: sky lights, fixing points	5.2.2			
Extensive green roof	Layers	3.1.7; 3.3.2; 4.4.4			
	Water route and outlets	3.2.1; 3.2.4			
	Joints at height	3.2.2; 3.2.4			
	Irrigation system and maintenance	4.1.3			

1.3 Netherlands

1.3.1 Summary of existing trainings

There are several trainings for the flat roofer available at Tectum (organizer and provider of training for roofing industry).

Table 6: Summary of existing flat roof trainings in the Netherlands

Type of training	Modules
General trainings	1. Level 1: Entrée level training 2. Level 2: Basic training roofer 3. Level 3: Basic training roofer all-round 4. Level 4: Basic training staff 5. Practical education for less advanced roofers 6. Introduction course bitumen 7. Introduction course non bitumen (Ethylene Propylene Diene Monomer or EPDM, Polyvinylchlorid or PVC, etc.)
Specific trainings	1. Practical course for advanced roofers 2. Roof details 3. Building mistakes 4. Basic courses focused on material (metal, EPDM, PVC, etc.) 5. Basic course supervisor
Safety courses	1. Safety on the roof 2. First aid and reanimation 3. Prevention of accidents 4. Scaffolding
Courses on quality	1. Quality course roofer 2. Organisation of the room, beginner team leader 3. Custom orientation
Courses on education of staff	1. Entrepreneurship 2. New types of maintenance 3. Typical roof damages and consultancy
Special courses	1. Installation of PV solar systems for roofers 2. Maintenance and inspection of roofs

Also, BDA opleidingen has a technical course on flat roofs and sustainable flat roofs.	1. Flat roofs 2. Maintenance and management of flat roofs 3. Maintenance inspector flat roofs 4. Maintenance and management of tiled roofs 5. Practical training: processing of lead sheet
Safety	1. Performing a Roof Risk Inventarisation and Evaluation (RI & E) 2. Safe working at altitude / use Personal Protection Equipment (PPE)
Sustainable roofing	1. Green roofs 2. Sustainable roofs

1.3.2 Existing and missing modules

Three main actors are defined in the construction/renovation process of flat roofs: **project manager, foremen, skilled worker**. Based on the inventory of available courses the table is filled in. Its content will be validated in the stakeholder workshop concerning sustainable flat roofs:

Table 7: Analysis of availability of Train the Trainer materials in the Netherlands

NL					
Task	**Subtasks**	**ULO number**	**Project manager**	**Foreman**	**Skilled worker**
Assist in diagnostic of existing roof	Open the layers for diagnostic & repair	2.2.1			
	Height control for increased outskirting need	3.2.2			
	Demolish/maintain part of the existing roof construction	2.1.2; 3.1.2; 3.1.5			
Layers of nZEB renovation +	Normal roof layers	3.1.2; 3.1.4; 3.1.5			
	Inverted roof layers	3.1.2; 3.1.4; 3.1.5			
	Duo roof layers	3.1.2; 3.1.4; 3.1.5			

fixing technology + building physics	Mechanical fixing	3.1.2; 3.1.4; 3.1.5			
	Glued technology fixing	3.1.2; 3.1.4; 3.1.5			
	Coat loading	3.1.2; 3.1.4; 3.1.5			
	Evaporation layers and vent openings of captured water	2.2.2			
	Transportation of demolished materials and new thermal insulation	1.4.1; 5.1.3			
	Temporary fixing and waterproofing technology	4.3.1; 4.3.2			
Slope correction and new outlet design and implementation	Suction based outlet systems	2.1.2; 3.2.1;			
	Consignation of insulation in slope	3.3.1; 4.3.3			
	Local site cast insulation correction at height areas	3.2.2			
	Local site cast insulation correction at low areas	3.2.1			
	Minimize thermal bridge	3.3.1; 3.3.2			
Proactive design and installation of joints at height areas	New height of perimeter walls	3.2.2			
	New outskirting height at abutment wall and threshold	3.2.3			
	Fill up unnecessary different height level areas	3.1.2			
	Measurement of minimised thermal brides at the vertical joints	3.2.2; 3.2.3			

	Diminish unnecessary penetration	3.1.2			
	Clear the valley from penetration	2.1.2			
Health and Safety	Temporary protection against fall at inner openings	1.1.1			
	New hooks against fall at perimeter of the roofs	1.1.2			
	H & S in transportation during demolition	1.1.2; 5.1.2			
	H & S in maintenance works	5.1.1			
Secure the failure proof implementation of the solar systems	Penetration and fixing opportunities on existing roof	3.4.2; 4.3.2; 5.2.2			
	Fixing opportunities on new roof with penetration	3.4.2; 5.2.2			
	Fixing opportunities without penetration	3.4.1; 3.4.2			
	Hybrid fixing with penetration and loading	3.4.1; 3.4.2			
	Safe access for the active systems	5.1.1			
Intelligent failure detection systems for roof with covered waterproofing	Principle and operation	3.1.6; 4.4.2			
	Installation	3.1.5			
	Control and actions at failure detection	5.2.1			
Cross-craft activities, maintenance and repair	Penetrations for ventilation	4.1.1; 4.1.3			
	Non-destructive diagnostic of thermal performance	4.4.3			
	Roof diary and administration of access	4.5.4			

	New penetrations on existing roof: sky lights, fixing points	5.2.2			
Extensive green roof	Layers	3.1.7; 3.3.2; 4.4.4			
	Water route and outlets	3.2.1; 3.2.4			
	Joints at height	3.2.2; 3.2.4			
	Irrigation system and maintenance	4.1.3			

1.4 Slovakia

In 2012 and 2013, Slovakia participated in the Build Up Skills (BUS) Pillar I project managed by EACI (now EASME) to analyse the status quo in the level of competencies available in the sector of buildings, future needs and obstacles for improvement and investments in the skills and knowledge of human resource in the sector of buildings. Although the Pillar I project was aimed at craftsmen and on-site workers in the sector of buildings, the Slovak BUS team used this opportunity to address also middle and senior level professionals, as the needs in this area are of the same urgency and need to be focused on should the objectives in the energy efficiency of buildings and in the use of renewable energy sources be delivered. Moreover, taking into account the specific situation in Slovakia, not meeting the needs in middle and senior level professions in the sector of buildings would undermine the effectiveness of achieving the expected impact of the action focused on craftsmen and on-site workers.

The agreed and endorsed BUS National Roadmap has anticipated leadership of employers in the process, with support of universities, accreditation bodies (ministries in charge of education), responsible officials of relevant governmental policies (ministries in charge of energy policies, including achievement of EU 2020 targets, ministries in charge of the construction sector, etc.), social partners, and suppliers of services related to preparing and delivering construction works, construction materials, machinery, technology and equipment that is essential for achieving the set objectives.

In implementing the Roadmap, **StavEdu** - National Qualification and Training Scheme was

set up for craftsmen and on-site workers on energy efficiency and use of renewable energy sources in buildings (resulting from the BUS StavEdu project supported by Intelligent Energy Europe).

1.4.1 Summary of existing trainings

The StavEdu scheme offers ten cross-trade training programs of further education and training of craftsmen and on-site workers in the field of buildings on energy efficiency and use of renewables in buildings. The key objective of the cross-trade training programs is developing the key competencies of craftsmen and on-site workers in the field of buildings needed for energy renovation of buildings and construction of new buildings to the standard of near zero energy buildings. The training envisages three phases:

- Inception training focused on main issues of compliance (standards, technology requirements, legislation) identified by company experts;
- Theoretical part of the training;
- Practical training.

The further training programs are offered for the following crafts and on-site professions:

Table 8: Overview of further training programs in Slovakia

NR	TARGETED PROFESSIONS
SC1	Bricklayer, insulator, plasterer, concrete worker, scaffolding assembler
SC2	Auxiliary production bricklayer (including dry mounting and wooden structures, assembler and installer of fillings for building openings), chimney-sweeper, carpenter/joiner, electrician and plasterboard fitter
SC3	Assembler of concrete and steel structures, assembler of building envelope, steel structure specialist
SC4	Roofer, hydro-insulator, carpenter, tinsmith and slater
SC5	Painter, paperhanger, tile setter, floorer, paver and mason
SC6	Installer/plumber, installer of sanitary equipment, installer of heating, cooling and water equipment and construction locksmith

SC7	Crane and construction machinery operator
SC8	On-site training on key energy-saving measures for craftsmen and on-site workers
SE1	Lighting systems in buildings
SE2	Technical energy equipment in buildings

The training programs SC1 to SC7 and SE1 provide 40 hours of training, including practical education in the working environment.

Within the training program SE2, the following modules are available:

- Module 1 for on-site workers with primary education (3 hours);
- Module 2 – an intermediate module for on-site workers with completed secondary technical education (8 hours);
- Module 3 for advanced on-site workers with completed secondary electro-technical education (24 hours).

Training programs offer assessment of the learning outcomes and certification of the qualification in energy efficiency and use of renewable energy resources in buildings.

Flat roofs are the responsibility of the hydro insulator. This profession includes:

- Installing flat roofs;
- Building insulation.

The suppliers of building materials, technology and structural elements for flat roofs provide training to instruct craftsmen how to use their own products and how to avoid failures in installing the flat roofs. This training however is not covering the full subject matter and focuses only on professional hydro insulators.

Young people interested in this profession can take up vocational education and training (VET) at several VET schools that offer high school training and practical vocational training for construction crafts.

As regards further education and training, the first course for roofers and hydro insulators was prepared and launched by the BUS StavEdu project and is offered within the National Qualification and Further Training Scheme of the same name. This course includes all types of roofs that are used in Slovakia.

1.4.2 Existing and missing modules

The table below provides overview of the available and missing modules. Review of the available training has shown that flat roofs are not covered satisfactorily, and additional efforts are needed to fill the gap on the further training market.

Table 9: Analysis of availability of Train the Trainer materials in Slovakia

SK					
Tasks	Subtasks	ULO number	Project manager	Foreman	Skilled worker
Assist in diagnostic of existing roof	Open the layers for diagnostics & repair	2.2.1			
	Height control for increased outskirting need	3.2.2			
	Demolish/maintain part of the existing roof construction	2.1.2; 3.1.2; 3.1.5			
Layers of nZEB renovation + fixing technology + building physics	Normal roof layers	3.1.2; 3.1.4; 3.1.5			
	Inverted roof layers	3.1.2; 3.1.4; 3.1.5			
	Duo roof layers	3.1.2; 3.1.4; 3.1.5			
	Mechanical fixing	3.1.2; 3.1.4; 3.1.5			
	Glued technology fixing	3.1.2; 3.1.4; 3.1.5			
	Coat loading	3.1.2; 3.1.4; 3.1.5			
	Evaporation layers and vent openings of captured water	2.2.2			
	Transportation of demolished materials and new thermal insulation	1.4.1; 5.1.3			
	Temporary fixing and waterproofing technology	4.3.1; 4.3.2			

Slope correction and new outlet design and implementation	Suction based outlet systems	2.1.2; 3.2.1			
	Consignation of insulation in slope	3.3.1; 4.3.3			
	Local site cast insulation correction at height areas	3.2.2			
	Local site cast insulation correction at low areas	3.2.1			
	Minimalize thermal bridge	3.3.1; 3.3.2			
Proactive design and installation of joints at height areas	New height of perimeter walls	3.2.2			
	New outskirting height at abutment wall and threshold	3.2.3			
	Fill up unnecessary different height level areas	3.1.2			
	Measurement of minimized thermal brides at the vertical joints	3.2.2; 3.2.3			
	Diminish unnecessary penetration	3.1.2			
	Clear the valley from penetration	2.1.2			
Health and Safety	Temporary protection against fall at inner openings	1.1.1			
	New hooks against fall at perimeter of the roofs	1.1.2			
	H & S in transportation during demolition	1.1.2; 5.1.2			
	H & S in maintenance works	5.1.1			
Secure the failure proof implementation	Penetration and fixing opportunities on existing roof	3.4.2; 4.3.2; 5.2.2			

of the solar systems	Fixing opportunities on new roof with penetration	3.4.2; 5.2.2			
	Fixing opportunities without penetration	3.4.1; 3.4.2			
	Hybrid fixing with penetration and loading	3.4.1; 3.4.2			
	Safe access for the active systems	5.1.1			
Intelligent failure detection systems for roof with covered waterproofing	Principle and operation	3.1.6; 4.4.2			
	Installation	3.1.5			
	Control and actions at failure detection	5.2.1			
Cross-craft activities, maintenance and repair	Penetrations for ventilation	4.1.1; 4.1.3			
	Non-destructive diagnostic of thermal performance	4.4.3			
	Roof diary and administration of access	4.5.4			
	New penetrations on existing roof: sky lights, fixing points	5.2.2			
Extensive green roof	Layers	3.1.7; 3.3.2; 4.4.4			
	Water route and outlets	3.2.1; 3.2.4			
	Joints at height	3.2.2; 3.2.4			
	Irrigation system and maintenance	4.1.3			

1.5 Overview of the existing and missing modules in the partner countries

The table below shows the overview of both existing trainings and new education needs of each partner country. According to the table, the following conclusion can be stated:

- Austria is well advanced in flat roof trainings, however needs extension mainly on solar systems, intelligent failure detection systems, cross-cutting issues and green roof.
- The Netherlands are also well positioned in most of the basic trainings, however, they are interested in advanced solutions, such as minimizing thermal bridges, proactive design, innovative fixing of solar elements, intelligent failure detection systems and cross-cutting issues.
- Hungary and Slovakia have new elements in each module that is due to the younger structural training system of flat roof areas, the weaker position of the roofing activity as a profession, the lack of or short history of the master exam system, and the shorter tradition and widespread influences of the roofing federation and its local organisations.

Table 10: Overview of the analysis of availability of Train the Trainer materials in each partner country

Tasks		Subtasks	ULO number	HU			AT		NL			SK		
				Project manager	Foreman	Skilled worker	Foreman	Skilled worker	Project manager	Foreman	Skilled worker	Project manager	Foreman	Skilled worker
A	Assist in diagnostic of existing roof	Open the layers for diagnostic & repair	2.2.1											
		Height control for increased outskirting need	3.2.2											
		Demolish/maintain part of the existing roof construction	2.1.2; 3.1.2; 3.1.5											
B	Layers of nZEB renovation + fixing technology + building physics	Normal roof layers	3.1.2; 3.1.4; 3.1.5											
		Inverted roof layers	3.1.2; 3.1.4; 3.1.5											
		Duo roof layers	3.1.2; 3.1.4; 3.1.5											
		Mechanical fixing	3.1.2; 3.1.4; 3.1.5											
		Glued technology fixing	3.1.2; 3.1.4; 3.1.5											
		Coat loading	3.1.2; 3.1.4; 3.1.5											
		Evaporation layers and vent openings of captured water	2.2.2.											
		Transportation of demolished materials and new thermal insulation	1.4.1; 5.1.3											
		Temporary fixing and waterproofing technology	4.3.1; 4.3.2											
C	Slope correction	Suction based outlet systems	2.1.2; 3.2.1;											

	and new outlet design and implementation	Consignation of insulation in slope	3.3.1; 4.3.3												
		Local site cast insulation correction at height areas	3.2.2												
		Local site cast insulation correction at low areas	3.2.1												
		Minimize thermal bridge	3.3.1; 3.3.2												
D	Proactive design and installation of joints at height areas	New height of perimeter walls	3.2.2												
		New outskirting height at abutment wall and threshold	3.2.3												
		Fill up unnecessary different height level areas	3.1.2												
		Measurement of minimized thermal brides at the vertical joints	3.2.2; 3.2.3												
		Diminish unnecessary penetration	3.1.2												
		Clear the valley from penetration	2.1.2												
E	Health and Safety	Temporary protection against fall at inner openings	1.1.1												
		New hooks against fall at perimeter of the roofs	1.1.2												
		H & S in transportation during demolition	1.1.2; 5.1.2												
		H & S in maintenance works	5.1.1												
F	Secure the failure proof	Penetration and fixing opportunities on existing roof	3.4.2; 4.3.2; 5.2.2												

	implementation of the solar systems	Fixing opportunities on new roof with penetration	3.4.2; 5.2.2												
		Fixing opportunities without penetration	3.4.1; 3.4.2												
		Hybrid fixing with penetration and loading	3.4.1; 3.4.2												
		Safe access for the active systems	5.1.1												
G	Intelligent failure detection systems for roof with covered waterproofing	Principle and operation	3.1.6; 4.4.2												
		Installation	3.1.5												
		Control and actions at failure detection	5.2.1												
H	Cross-craft activities, maintenance and repair	Penetrations for ventilation	4.1.1; 4.1.3												
		Non-destructive diagnostic of thermal performance	4.4.3												
		Roof diary and administration of access	4.5.4												
		New penetrations on existing roof: sky lights, fixing points	5.2.2												
I	Extensive green roof	Layers	3.1.7; 3.3.2; 4.4.4												
		Water route and outlets	3.2.1; 3.2.4												
		Joints at height	3.2.2; 3.2.4												
		Irrigation system and maintenance	4.1.3												

2 Key stakeholders

2.1 Austria

The development and implementation of trainings for flat roofers in Austria is executed in close cooperation with the Institute of Flat Roofing and Waterproofing (IFB). This institute is the leading training centre for flat roofing in Austria, most of the trainings are organized and run by (or at least coordinated with) the IFB.

The following table contains the Board members of the IFB who are key stakeholders from chambers and experts in flat roofing.

Table 11: Key stakeholders in relation to flat roofs in Austria

Institute of Flat Roofing and Waterproofing (IFB) – key stakeholders	
Board members	• President • President Deputy • Chairman of the Technical Guidelines Division • 1st Deputy Chairman of the Technical Guidelines Division • 2nd Deputy Chairman of the Technical Guidelines Division • Chairman of the Education and Training Division • 1st deputy chairman of the division education and training • 2nd Deputy Chairman of the Education and Training Division • Chairman of the Evaluation Commission and Quality Seal • Deputy Chairman of the Evaluation Commission and Quality Mark • 2nd Deputy Chairman of the Evaluation Commission and Quality Mark • Presidential Advisory Board • Auditors

2.2 Hungary

Building on the previous BUILD UP Skills projects ÉMI has strong partnership with several training and education institutions as well as trading and manufacturing companies. During the implementation of the BUILD UP Skills TRAINBUD project the consortium established a Sustainable Construction Skills Alliance which contributed to reaching the project targets.

3.2.1 Training institutions

ÉMI is in partnership with 18 vocational training institutions throughout Hungary.

Table 12: Key training institutions in Hungary

no.	Organisation
1.	Simonyi Károly Technical and Vocational School
2.	Arany János Technical Vocational School
3.	Povolny Ferenc Vocational and Special Secondary school
4.	Békéscsaba Central Vocational School and Student Dormitory
5.	Szily Kálmán Technical Vocational Secondary School
6.	Budapest University of Technology and Economics, Faculty of Architecture, Department of Building Energetics and Building Service Engineering
7.	Budapest University of Technology and Economics, Faculty of Architecture, Department of Building Constructions
8.	Szent István University Ybl Miklós Faculty of Architecture and Civil Engineering
9.	Szeged Vocational Centrum, Szeged Móraváros Vocational School
10.	ZalaegerszegVocational Centrum, Széchenyi István Vocational School
11.	Villox-vs Kft.
12.	BGSzC Öveges József Vocational School
13.	Székesfehérvár SZC Vörösmarty Mihály Vocational School
14.	Debrecen SZC Péchy Mihály Vocational School

15.	Debrecen SZC Povolny Ferenc Vocational School
16.	Szombathely SZC Vocational school
17.	Veszprém SZC Vocational school
18.	Miskolc SZC Vocational school

These training institutions provide education mainly for Heating, Ventilation and Air conditioning (HVAC) skilled workers, therefore, the curricula of the students include ventilation modules also. However, these trainings still focus merely on the basics.

Épületszigetelők Tetőfedők és Bádogosok Magyarországi Szövetsége (ÉMSZ) - Hungarian Roofing Association

The Hungarian Roofing Association is a key stakeholder in the development of flat roof training. The mission of ÉMSZ is to establish and efficiently apply those tools which support the development and value protection of building insulation and the roofing profession.

The Association also takes part in trainings and has many expert members in the field of the roofing profession and in education as well, making it a key stakeholder.

3.2.2 Trading and manufacturing companies

The Sustainable Construction Skills Alliance (established on BUS TRAINBUD) has members from the construction industry as well. ÉMI has connections with relevant trading and manufacturing companies who also provide trainings. These companies mostly organize one- to two-day long trainings for blue-collar workers. The aim of the trainings is not only to promote their materials, but also to update the knowledge of the participants and teach about the most common errors and adequate solutions. The trainings provided by these companies differ in content, length and aim; however they usually all include practical parts as well.

Some of them even provide their own certificate for the participants who successfully complete the course.

Table 13: Key companies in relation to flat roofs in Hungary

Company / Training provider	Short description of the training content
PREFA Hungary Ltd.	Provides training in knowledge restoration and introduction of new technologies in order to use PREFA products better; different trainings for the installation and maintenance of gutter, techniques of fold roofing, aluminium elongation, facade insulation. The trainings are available for basic and advanced level.
BRAMAC	Bramac and Villas as part of the BMI group provide high quality trainings (for one or two days, master courses, in different special topics) several times a year in different locations country-wide. The trainings address the following topics: ventilation and system elements, curved tiling, underlaid and bound gambrel, Bramac Therm and internal vapor barrier. These are voluntary trainings organized by the company, which not only includes the promotion of its products, but technical information and up-to-date solutions also.
TECTUM Ltd.	The company focuses on the insulation of buildings and building structures (construction, maintenance and repair). It also provides trainings in relation to insulation techniques.
SIKA	With regard to sustainability topics, Sika trainings give a clear understanding of which sustainability issues are relevant for the specific tasks and which is a priority for the specific market.
MAPEI	Mapei provides trainings, seminars, conferences, webinars and training videos also.
BAUDER	Bauder provides trainings (both theoretical and practical) in collaboration with ÉMI TÜV SÜD Ltd. At the end of the training, participants receive a certificate.

2.3 Netherlands

The stakeholders for high quality and sustainable roofing have been identified. As a next step one or more stakeholder meetings will be organized with regard to the defined ULOs and "train the trainer" approach. Based on the outcomes of these meetings[1] the national strategy will be updated. The stakeholders involved are: training institutions (BDA opleidingen, Tectum Bouwradius training & advice), trading and manufacturing companies (Solatube), Brache organizations (VEBIdak, NDA – Nederlandse Dakdekkers Associatie), quality assurance (Dakmerk, DIAC dakadvies: daughter organization of the NDA).

2.4 Slovakia

The Build Up Skills Pilot I project reviewed available training for 32 crafts that were identified as relevant to energy efficiency and the use of renewable energy sources in buildings. This analysis was the basis for drafting the national roadmap including specific objectives and measures to support their implementation.

The follow-up project BUS StavEdu succeeded to set up the National Qualification and Further Training Scheme of the same name for craftsmen on energy efficiency and the use of renewable energy sources in buildings. This scheme is implemented with the help of 32 organizations that include VET schools and producers of building materials, structural elements and technologies.

The StavEdu scheme is coordinated by Ústav vzdelávania a služieb (UVS) that is supporting the Association of Construction Entrepreneurs of Slovakia (ZSPS) in ensuring the needed skills in the construction sector in Slovakia.

UVS has been established in 1970 as an independent organization of the Ministry of Construction Industry and was transformed into a limited company on 1 June 2002.

UVS as a commercial and independent institution offers a wide range of educational activities, such as training and re-training courses, and programs accredited by the

[1] As preparation for the Train the Trainer workshop.

Ministry of Education of SR and by the Office of Work Safety of SR. UVS also hosts seminars, workshops, negotiations, company presentations and international conferences.

The key objective of UVS is to provide lifelong learning of adults in the following areas: the building sector and construction industry, European integration and regional policy, and technology.

UVS has long-time experiences with publication activities with more than 600 published specialized information materials dealing mostly with the themes of construction, building sector, regional development, etc. UVS has been processing and publishing special teaching texts for secondary schools in the building sector for more than 20 years. With respect to the education process, UVS has expertise in creating teaching aids, special publications, video programs etc.

Another key stakeholder in further education and training of craftsmen is the Association of Construction Entrepreneurs of Slovakia (ZSPS).

ZSPS was established in 1990 as an independent, voluntary, non-political interest group of construction entrepreneurs/companies associating entrepreneurs and companies specialized in delivering works and services in the area of civil engineering. ZSPS is represented in many international, European and national institutions and organizations.

ZSPS promotes common and specific interests of its members and joint projects to create transparent and fair market conditions vis-à-vis European and national authorities and institutions, European and national legislators, professional bodies and organizations. It also provides platforms for facilitating dialogue among stakeholders, decision makers and rule makers. Other tasks of the interest group include the promotion of projects and actions aimed at supporting investments in the skills, the cooperation with professional and certification bodies to push quality management systems and the advancing of research, technical development and innovations in the construction industry. Moreover, ZSPS provides information, consultancy, and educational and training services: it also heads the

National Sector Skills Council in the construction sector.

ZSPS led the StavEdu project and is “owner” of the National Qualification and Further Training Scheme for Craftsmen on Energy Efficiency and Use of Renewable Energy Sources in Buildings established by this project.

ZSPS works closely with the Slovak Innovation and Energy Agency (SIEA) that is focused on energy-related crafts (energy equipment of buildings, renewable energy installers, etc.).

SIEA was established in 1999 as executive agency of the Ministry of Economy. It is the competence center for energy efficiency, energy innovations and renewable energies. SIEA also acts as implementation agency for the EU Structural Funds and other funding mechanisms.

SIEA functions as the national energy agency and has a thorough knowledge of the Slovak energy market and its participants, the decision makers, companies, professionals, associations and all those who are involved in the area of energy as well as energy efficiency and renewable energy sources. Special emphasis is laid on the area of trainings and information seminars for professionals as well as on awareness-raising measures towards the general public dealing with the rational energy use and wider exploitation of renewable energy sources. Fulfilling the tasks of the Slovak Ministry of Economy, SIEA takes part in the preparation of energy policy, energy acts and decrees, and follows and monitors development in the energy sector both on the demand and supply sides.

The key training institute of ZSPS is UVS, as mentioned earlier.

The training for construction professionals is delivered with support of many organizations that help to provide the content of the training, instructors to conduct the trainings, necessary teaching aids, models and equipment for practical training, as well as infrastructure and access to real working environment. The network is open for new organizations and currently includes:

Table 14: Key organizations in Slovakia

No.	Name of the organisation	City
1	Stredná odborná škola stavebná, Nitra	Nitra
2	Innovia, s.r.o.	Trnava
3	Stavoinvesta Dunajská Streda, s.r.o.	Dunajská Streda
4	Ipeľské tehelne, a.s.	Lučenec
5	STU BA, Stavebná fakulta	Bratislava
6	Slovenergookno, n.o.	Bratislava
7	SCHIEDEL Slovensko, s.r.o	Zamarovce
8	STRABAG Pozemné a inžinierske staviteľstvo, s.r.o.	Bratislava
9	Chemostav, a.s.	Poprad
10	Stredná odborná škola stavebná - ÉSzKI	Nové Zámky
11	Cech strechárov Slovenska	Bratislava
12	Kerkotherm, a.s.	Košice
13	STU BA, Stavebná fakulta	Bratislava
14	IMOS – Systemair, a.s.	Kalinkovo
15	HERZ, spol. s.r.o.	Bernolákovo
16	Ústav vzdelávania a služieb, s.r.o.	Bratislava
17	VIEGA, s.r.o.	Praha
18	ZEUS PB, s.r.o.	Dunajská Streda
19	Beztech, s.r.o.	Miloslavov
20	TERRASTROJ spol. s.r.o.	Bratislava
21	KUHN – SLOVAKIA, s.r.o.	Senec
22	MTS – com, s.r.o.	Stupava

These organizations will be the supporting stakeholders for delivering the needed training, including training of trainers within the NEWCOM project. These stakeholders were successfully tested by the StavEdu scheme and are therefore foundation of the success of

NEWCOM training and certification.

The further training has been implemented with the support of other stakeholders, such as:

- Ministry of Education, Science, Research and Sport of the Slovak Republic (responsible for lifelong learning, including further education and training);
- Ministry of Economy of the Slovak Republic (responsible for energy efficiency targets, including energy performance of buildings and renovation roadmaps);
- Platform “Buildings of the Future” (supporting energy renovations of existing buildings);
- Slovak Green Building Council (global stakeholder in energy efficiency and use of renewable energy sources in buildings supporting development of strategies in this area);
- Association for Supporting Renovation of Residential Housing (national stakeholder in promoting energy renovations of existing residential housing and supporting owners in implementing their objectives in this area);
- Institute for Passive Houses (national stakeholder providing advice on passive house concept implementation);
- Greenpeace Slovakia (global stakeholder in promoting environmental approaches in all sectors of society and actions for combating climate change);
- National Qualification Platform (national platform set up by the Build Up Skills Pillar I project providing advice on training policies and supporting implementation of the measures agreed in the BUS National Roadmap);
- Technický a skúšobný ústav stavebný, n.o. (national stakeholder providing expertise in energy performance of buildings and relevant regulatory framework);

- Ekofond, n.f. (national stakeholder established by key energy providers to support actions aimed at increasing energy efficiency, including energy efficiency of buildings).

These stakeholders also provide their experts for delivering training and facilitate contacts to professional sponsors for these further training programs.

3 Strategy of implementation

3.1 Austria

3.1.1 Creating demand and promoting trainings

The IFB is the leading training centre for flat roofing in Austria, most of the trainings are organized and run by (or at least coordinated with) the IFB. Also, manufacturers of flat roofing materials are involved in the training activities, esp. during the practical parts. The IFB and associated institutions offer modular training and continuing education courses. As proof of training graduates receive the official certificate: Flat roofer and water proofer with basic training. The quality of the planning and processing steps of flat roofs, terraces and balconies as well as of building components in contact with the ground is decisive for the long-term functional suitability of a waterproofing system. The IFB has set itself the goal, on the one hand through targeted continuing education and training activities and on the other hand through quality assurance measures, to significantly reduce the risk of defects. Executing companies have the possibility to use the IFB quality mark for their company as proof of quality. On the IFB's virtual presentation platform and in the quality label database all evaluated companies that receive a valid IFB quality label will be published. Planners, building owners, tendering bodies and other decision-makers thus have the opportunity to select "companies with a quality mark".

3.1.2 Implementation of new modules

Within the project two modules (which are particularly relevant to nZEB), namely "Green roofs and water retention roofs as a contribution to climate change adaptation", and "Requirements of the new standard ÖNORM B3691 with special focus on energy efficiency", will be developed.

3.2 Hungary

3.2.1 Creating demand and promoting trainings

Blue-collar workers usually lack time to participate especially in long trainings. It is important to build up the demand among workers to update their knowledge and develop their skills further. As nZEB requirements are part of the mandatory requirements in the partner countries, the need to obtain related knowledge in Hungary should grow as well.

In order to promote a qualified workforce, it is crucial to build up demand among building owners, contractors, and site managers also.

On the other hand, blue-collar workers need to be informed about the benefit of participating in trainings and continuously improving their skills and updating their knowledge.

Manufacturing and trading companies are key actors in this process, since they have ties with numerous actors of the construction field, including contractors, building owners and skilled workers as well. At the same time, they are stakeholders who will also benefit from a more skilled workforce, which will ensure that their products will be installed correctly.

Professional associations are also relevant and significant actors in promoting the benefit of skilled craftsmen and high quality trainings. In Hungary ÉMSZ is the leading association in the roofing profession, involving many experts, organizing regular events (Roof of the year contest, conferences and trainings in collaboration with Chambers) and actively working in collaboration with other related associations and companies.

3.2.2 Implementation of new modules

In Hungary the new modules will be included in existing trainings for flat roofers in collaboration with the professional associations such as ÉMSZ.

The most demanding and “popular” way to implement the modules are the two-day seminars offered by ÉMSZ in cooperation with Veszprém Szakképzési Centrum. The Centrum is equipped with relevant flat roof simulation models which give opportunity to demonstrate and

even partly implement the special structures as fixing opportunities, inner and outer corners, outlets, skylights, solar panel mounts, etc. The necessary materials for the trainings are normally donated by the technology providers, e.g. manufacturers of waterproofing, thermal insulations, fixing systems, solar panels, etc.

During the two-day courses all modules take two hours with basically one hour of theoretical frontal teaching (with presentations) and one hour of practical training on flat roof models. The trainers will be provided jointly by the Vocational centre, the Hungarian Roofing Federation and main suppliers such as Bramac or Sika. The theoretical and practical trainings could be consecutive or consist of shorter blocks depending on the availability of the trainers and the needs of the trainees.

Some companies or group of companies would require special one-week courses related to the nZEB issue. In these cases a four-hour extended training could be provided for each of the modules, which means a weekly training with 36 hours. The most popular period of time for these trainings is during winter season from mid-January till the end of February, when work opportunity on roofs is very limited.

If only one-day trainings are possible, ÉMI suggests choosing four modules with an exam at the end, while the remaining modules could be held at other occasions. In this case the training certificate should clearly state the name of the modules.

ÉMI has started to have discussions with the technology providers to integrate some modules into their existing courses (SIKA, BRAMAC, MAPEI, KEMPER SYSTEM). That would help to change the mind-set of the waterproofing or thermal insulation suppliers to move forward to a systemic approach rather than holding on to the point of view of a simple special technology provider. As clients require safer and more complex systems, this trend should be encouraged by authorities as well by imposing certified competencies as mandatory requirements in public tenders.

3.3 Netherlands

3.3.1 Creating demand and promoting trainings

Due to the economic growth, there is a lack of capacity on the market. Blue-collar workers usually lack time to participate especially in longer trainings. Within the previous BUILD UP Skills project, BUStoB ISSO developed together with Bouwradius an e-learning platform on several nZEB-related roofing subjects for blue-collar workers. Part of the strategy will be to use this free e-learning tool to motivate blue-collar workers to focus more on further professional development.

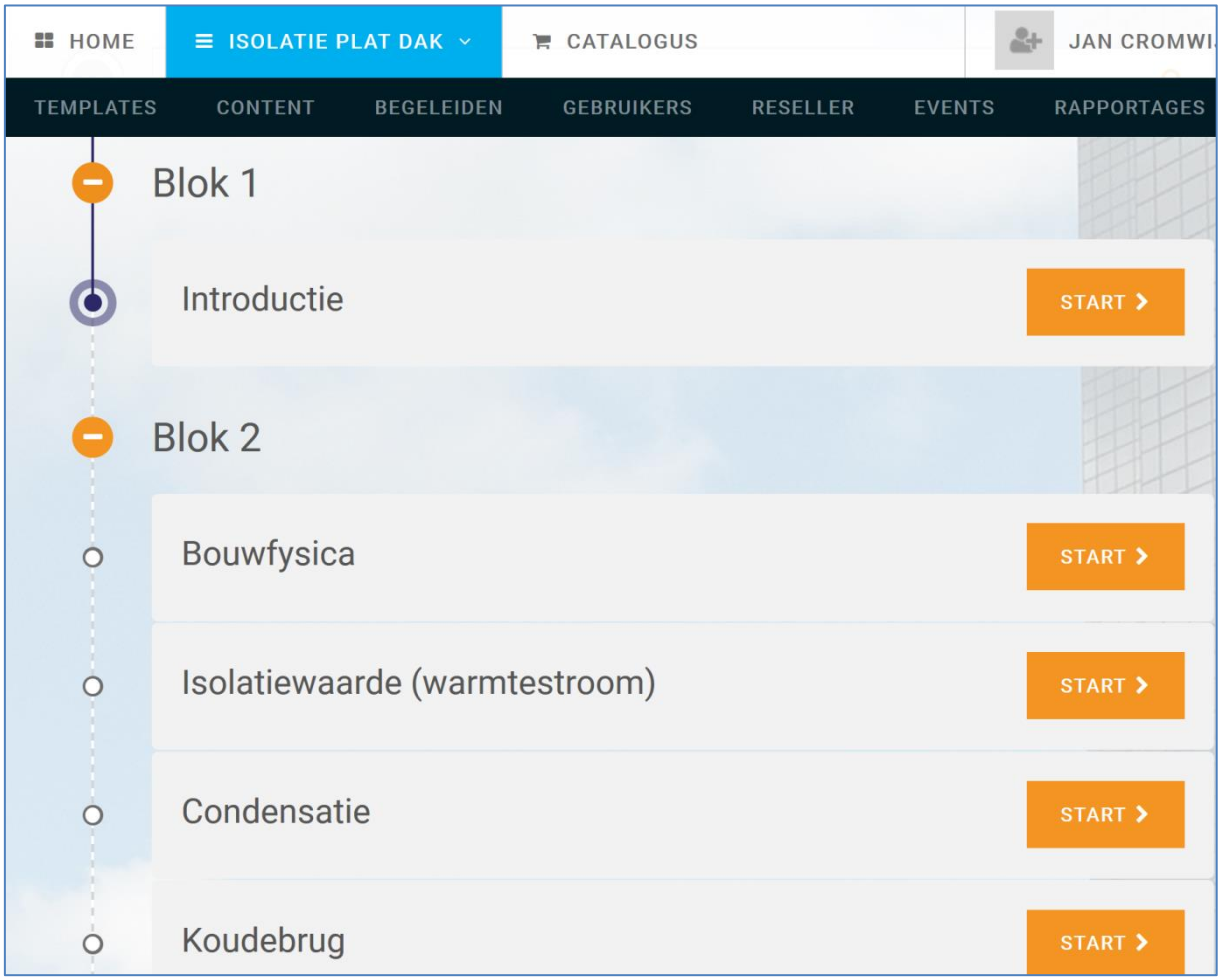

Figure 2: Screenshot of the Dutch e-learning platform

As a part of this approach the BUILD UP Skills advisor app will be used to provide interested craftsmen with an actual overview of available courses and several learning interactions in

which the user can learn from actual situations. The following screenshots represent a small overview of roofer-associated training content:

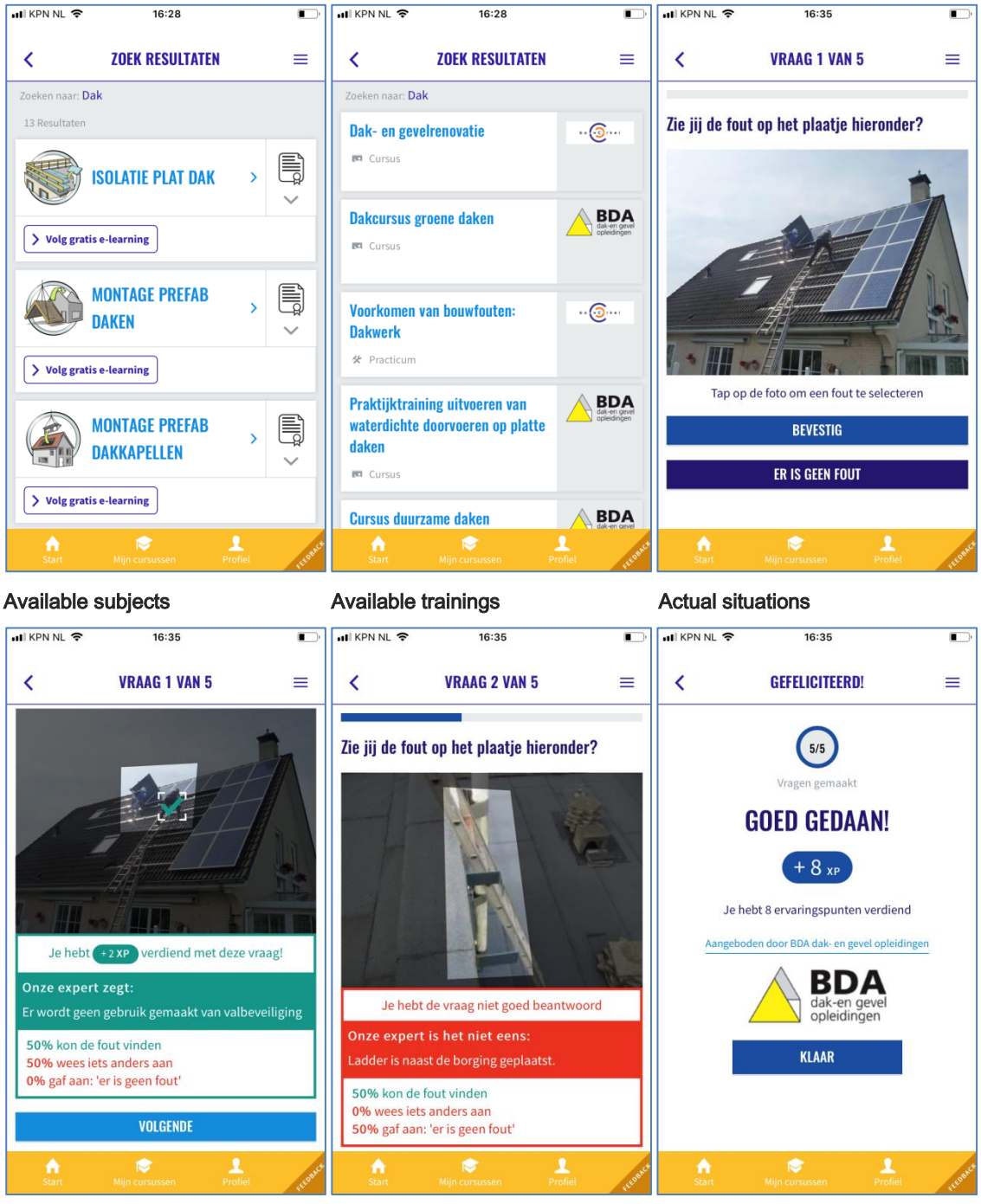

Figure 3: Screenshots of the advisor app

Additionally, blue-collar workers need to be informed about the benefit of participating in trainings and continuously improving their skills and updating their knowledge. Manufacturing

and trading companies are key actors in this process, since they have ties with numerous actors of the construction field, including contractors, building owners and skilled workers also. At the same time, they are stakeholders who will benefit from a more skilled workforce, which will ensure that their products will be installed correctly. One or more stakeholder meetings will be organized during the further preparation of the “train the trainer” event with the objective to explore the possibilities for cooperation.

Professional associations are also relevant and significant actors in promoting the benefit of skilled craftsmen and high quality trainings. Collaboration possibilities will be explored with NDA and VEBIdak, especially on the guidelines that VEBIdak provides to roofers.

Cooperation with special interest magazines for craftsmen

In the Netherlands several special interest magazines for craftsmen are on the market. Part of ISSO (project partner) strategy is to explore possibilities to cooperate with them. The most suitable ones are Dakenraad (https://www.dakenraad.nl/) and Dakweb (http://www.dakweb.nl/).

3.3.2 Implementation of new modules

Implementation of the new modules will be prepared together with Tectum and BDA opleidingen. At Tectum the Train the Trainer course will be part of its ”summer school” for Tectum trainers. Both Tectum and BDA have excellent practical training facilities.

Tectum BDA

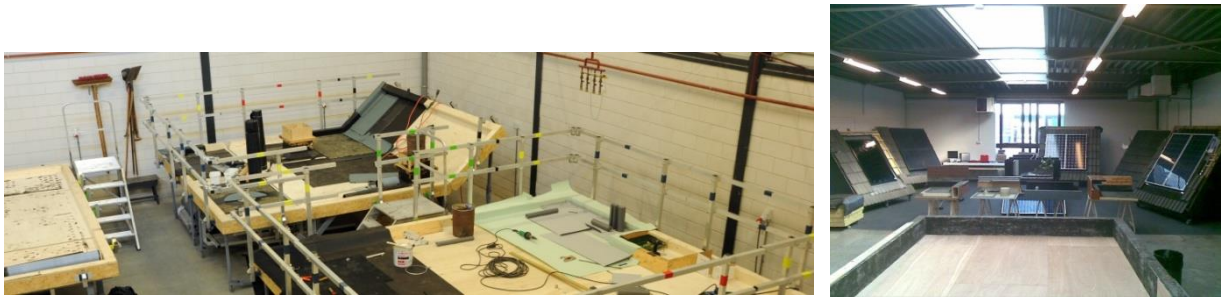

Figure 4: Facilities of Tectum and BDA

If possible, some experiments will be done with Bouwradius by using the gamified learning

platform Atrivity (https://www.atrivity.com/en/), a mobile-based Trivia game that works quite well in balancing the learning load and challenging competitions. In these experiments ISSO will split the BUILD UP Skills modules into small sets of questions that can be used to prepare for an exam or performance on-site.

Below are some examples from a game recently developed for training in safe scaffolding:

Start screen **Challenge someone** **A question**

Another question **Feedback** **Result of the challenge**

Figure 5: Screenshot of the gamified training in safe scaffolding

3.4 Slovakia

As regards flat roofs in Slovakia, they have expanded to a high degree through extensive construction of multi-family apartment housing using prefabricated elements. In the 1970s and 1980s flat roofs started to be used also in the construction of single family houses. In the case of public administrative buildings, it is the most used type of roof. During the 1990s flat roofs have almost not been constructed, but since then they are re-emerging due to more stringent energy efficiency requirements and the consequent implementation of passive house concepts.

However, lack of quality in flat roofing led to low trust towards flat roofs, and the leaking roofs were named as one of the most frequent problems in Slovakia during the survey carried out among experts in WP2 of the project.

3.4.1 Creating demand and promoting trainings

The implementing organisation will be Ústav vzdelávania a služieb (UVS) that is supporting the Association of Construction Entrepreneurs of Slovakia (ZSPS) in ensuring the needed skills in the construction sector in Slovakia.

The main stakeholder is the Roofers Guild of Slovakia that is already cooperating with UVS and ZSPS in providing the needed training within the StavEdu scheme.

The supporting organizations for the StavEdu qualification and training scheme cover all key regions of Slovakia:

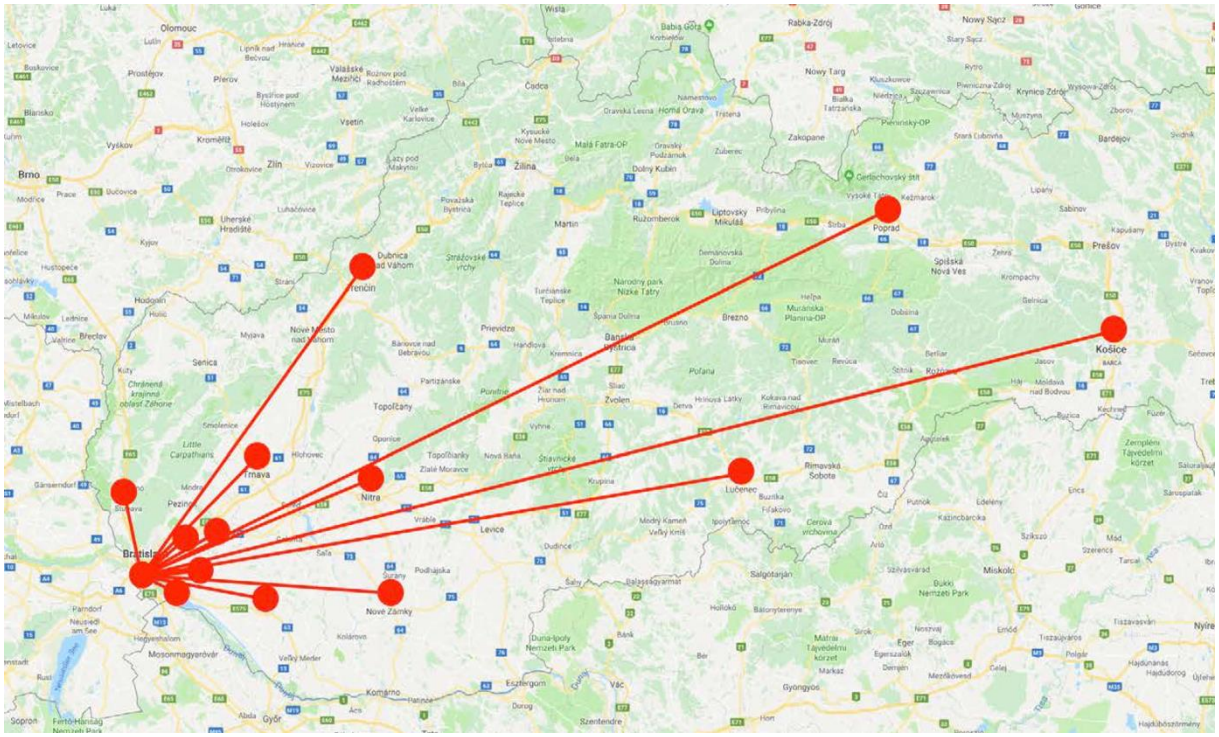

Figure 6: Map of the location of supporting organizations (StavEdu Final Project Report (public), Bratislava, 15 September 2017)

The target groups will be reached through the network of members of ZSPS that are the key employers in the Slovak construction sector, members of the Slovak Roofing Association that is the key association of the targeted craftsmen, and through the portal education.sk that is a marketing tool available for offering training for all craftsmen and professionals in Slovakia.

The drivers of the demand will be the two following:

- Requirements for energy performance of buildings in Slovakia and the relevant requirements on quality of public works;
- Regulation of the construction trade requiring relevant qualification for receiving license (bill pending in the Slovak parliament).

3.4.2 Implementation of new modules

The new modules for flat roofs will be implemented as a new further training program, that is as SC9 of the StavEdu scheme. It will complement the existing program SC4 that is mainly focused on pitch roofs. The SC4 program also covers flat roofs and its content will be maintained in its current form. The new SC9 program will complement the SC4 program by

providing more details that relate to nZEB and energy renovations towards nZEB standards.

To identify trainers eligible for the trainer course, the network of instructors established by StavEdu has been used. UVS and ZSPS have already started recruitment of targeted craftsmen for the training by contacting employers and craftsmen through the above-mentioned networks.

Table 15: Key implementing organizations in Slovakia

no.	Organization
1.	Ústav vzdelávania a služieb s.r.o. Bratislava
2.	Stredná odborná škola stavebná and školiace stredisko Nitra
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NEWCOM sets up large-scale professional qualification and certification schemes for of blue-collar workers and building professionals. The special focus is on the mutual recognition between different European Member States. These schemes will enable the building workforce to be qualified for the construction, renovation and inspection of the nearly zero-energy buildings 2020.

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NEWCOM New qualification schemes to build high quality

Summary report on national certification strategies for Ventilation in nZEB

Deliverable 3.2

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Abstract

This report provides an analysis of how the modules defined for nZEB ventilation developed in NEWCOM can be integrated into the existing training infrastructure and training supply of the partner countries. All partners summarized the existing country-specific training supply and identified the training institutions and training providers who can actively participate in the further implementation of the designed trainings. Based on this overview, a clear picture is sketched for the additional train-the-trainer materials on nZEB ventilation to be developed in NEWCOM. These materials will be generated and delivered in public deliverable ”D3.4: Set of harmonized training material for the selected trades regarding blue-collar workers”.

Contents

1 Introduction

The NEWCOM project has set itself the task of ”upgrading” existing training offers for the correct execution of the building envelope and building services in nearly zero energy buildings (nZEBs) by focusing especially on total quality control accompanying the planning and construction process of new construction and renovation of nZEBs in Austria, Hungary, the Netherlands and Slovakia.

In work package 2, based on desk research and surveys, the need for missing training offers and/or modules, and underlying qualification schemes, has been determined. The greatest similarities and thus prospects of success in the partner countries Austria, Hungary, the Netherlands and Slovakia have been found in the following areas and trades involved:

- Flat roof construction and building waterproofing (blue collars)
- Installation of ventilation systems (blue collars)
- Building inspection: modules for quality assurance and quality control for several existing training courses (mix of white and blue collars)

Based on these findings in work package 3 qualification schemes for occupations involved have been developed. Together with a database of common descriptors for skills, knowledge and competences, a platform of available existing training material and an overview on relevant trainings and training needs has been set up. The next step includes the setting-up of pilot train-the-trainer courses for three topics identified within the project. This will be done on the basis of an analysis of available courses and train-the-trainer materials.

The content of this report is furthermore used by the partners involved to define certification strategies related to the trainings developed for blue-collar workers working on ventilation systems in nZEBs. It describes the designed strategies for establishing the created course scheme in the national markets and the method of involving relevant stakeholders, educational institutions, important administrative bodies and authorities. The strategy of

implementing the training established in NEWCOM depends on the available trainings and training institutions of each partner country.

Strategies which provide answers to the question of why people should attend an nZEB ventilation course and what the benefits are must be shaped to create market demand for the promotion of the new training supply. In order to build up demand and attract trainees for the developed courses, this report also includes deliberations on the promotion strategy to reach as many stakeholders and participants as possible. This will be introduced into work package 6, where the strategies are further elaborated and brought into practice in an advertising and marketing campaign.

2 Implementation of nZEB Ventilation upskilling

Ventilation is starting to get very significant attention all around Europe. In the European western and northern countries ventilation systems are installed due to improved air tightness of the building envelope. However, in other countries, such as Hungary and Slovakia, ventilation systems are not as common as they should be. In addition, ventilation in nZEBs requires profound skills of the craftsmen regarding air flow distribution, air tightness, and acoustic and noise reduction.

2.1.1 nZEB requirements in relation with ventilation

For the nZEB level a ventilation system with demand control and/or heat recovery is almost always necessary in the four season climate of the partner countries. The air tightness of the building and a controlled air flow distribution is very important regarding the heating, ventilation and air conditioning (HVAC) system to ensure that the flow patterns are not disturbed by, for instance, cross ventilation. In this respect, smart demand-controlled systems have many advantages. Moreover, noise reduction of ventilation systems will become increasingly important as insulation and air tightness of buildings are enhanced and, as a result, the noise from the outside is reduced.

Ventilation systems can be divided in systems with heat recovery – for single family homes (SFH) or building units, multifamily homes (MFH), single room or a combination of rooms – or without heat recovery (exhaust air, window ventilation), central or decentralized units and in combination with other systems (heating and domestic hot water).

2.1.2 Composition of the NEWCOM train-the-trainer course on nZEB ventilation

The implementation strategy for the nZEB ventilation upskilling follows a modular approach. That means the complete course does not necessarily have to be taught by just one training

institution. Instead, a training institution can grant a voluntary certification based on Units of Learning Outcomes (ULOs) from previously completed courses. An overall exam has to be taken at the training institution, which then issues the voluntary certificate.

Therefore, mandatory for the implementation of the new nZEB ventilation course in the partner countries is a close contact or collaboration with one or more educational institution(s). They ideally provide most of the teaching content and are interested in providing additional modules and the recognition of courses taken elsewhere. If there are still modules missing, those will be created in the form of train-the-trainer materials within the NEWCOM project so that nothing would bar the way to a modular implementation of the nZEB ventilation course in each partner country. In the train-the-trainer education tutors will be taught to design their own course program based on the NEWCOM qualification and developed additional training components.

2.2 Identification of cooperating training institution and missing modules

In every partner country a least one training institution or a similar organization was identified for cooperating talks and actions to implement the nZEB ventilation qualification in the national education systems. NEWCOM sees this as the only sustainable way to ensure and support an implementation. A very important step from this perspective is the realization of a “train-the-trainer course” in each partner country, which is a core product of the NEWCOM project.

The advantages when cooperating with established training institution(s) are:

- Existing stock of customers (trainees)
- Availability of course materials
- Availability of training infrastructure and sometimes also practicum models
- Existing stock of experienced trainers (also relevant for the realization of a train-the-trainer course in every partner country)
- Reliable established brand(s)

- Already educated trainees with the potential to be “upgraded” to the Building Inspector education

In the following paragraphs all partner countries describe the national situation, their cooperation with training institutions, available and missing training content in relation to the qualification, and their draft individual implementation strategies.

2.3 Austria

In Austria ventilation technology has been identified to be a key technology not only for nearly zero-energy buildings but also in modern residential and non-residential buildings. In order to combat errors occurring in installing ventilation systems, many educational institutions and system providers started offering special courses. Among those, the “Certified comfort ventilation technician” course offered by AIT (Austrian Institute of Technology) has to be highlighted. This course provides an (product-independent) overview of the systems commonly used in the market and is intended to provide reliability for the initial consultation as well as for the planning, commissioning and servicing of comfort ventilation systems.

Unfortunately, at present there is nearly no market demand for new further education courses with regard to ventilation systems in Austria. The market is saturated with the currently available trainings. Therefore, the development of new courses on this topic is not considered in Austria within NEWCOM. Instead, Austria will focus on formulating and testing new strategies for accelerating market demand.

2.3.1 Summary of existing trainings

During the survey carried out within the project BUILD Up Skills Austria, in the category “heating, ventilation, air conditioning” the largest offer of courses (also certified courses) was identified among courses regarding further education of professionals, also involving the largest number of participants. The increased demand for ventilation systems require highly skilled staff for the assembling, operating and maintaining of these systems in the future. Providers, such as the Austrian construction academies (BAUAkademie), Energieinstitut

Vorarlberg, Oberösterreichischer Energiesparverband (Upper Austrian Energy-saving Association), Energie Tirol, Austrian Institute of Technology (AIT) and Wirtschaftsförderungsinstitut (WIFI), offer courses in this area.

Till 2014, around 100 “Certified comfort ventilation technicians” were trained in Austria. Unfortunately, the market demand for comprehensive and non-product related trainings dropped down since then. Also, intensive advertising did not achieve the reversal of this situation. At present, Austrian ventilation installers are of the opinion that they need, at most, a product-related training by the manufacturer (one-day training) to be trained adequately in their business.

To raise market demand, AIT, Comfort Ventilation Systems Austria (KLA) and komfortlüftung.at developed a further compact modular course scheme. This course scheme consisted of a basic course, an advanced training module and one practical day on site (4 days, 8 hours each). However, this compact modular course scheme could not boost market demand either and the training providers decided to stop the offer because of lack of registrations in 2019.

Currently, further education on the topic of ventilation is offered in cooperation with the energy consultants of the energy agencies of the Austrian federal provinces. Some federal provinces (e.g. Tirol) implement, in addition, annual information workshops in this field for planers, building developers and installers to spread information on new subsidies, standards or R&D projects.

Also, the Akademie für Recht, Steuern und Wirtschaft (ARS) provided training courses on the topic of ventilation, which were implemented twice a year from 2016 to 2018. Unfortunately, the first planned course in 2019 had to be cancelled too due to lack of registrations.

2.3.2 Analysis of ULOs and needed modules

Based on the training materials available and the Units of Learning Outcomes developed in NEWCOM, the project partners defined the most important modules for the nZEB ventilation

training. The following table contains these main modules and information related to their availability. Three main actors are defined in the construction/renovation process of ventilation systems: **project manager, foremen, skilled worker**. The three actors have different skills, competences and level of training/qualification.

Table 1: Analysis of availability of train–the-trainer materials in Austria

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
Check schedule of requirements				
	Check type of ventilation system	UP[1]	UP	UP
	Explain demands for energy efficiency			
	Determine supply air flow rate			
	Determine minimum discharge flow			
	Check requirements regarding air tightness of ducts	UP	UP	
	Check the type(s) of ventilation regulation system(s)			
	Verify location of the control unit			
	Check necessary safety device depending on the fireplace			
	Provide assistance with selection of recirculation or exhaust air kitchen hoods			
In case of renovation: check the list of additional requirements				
	Judge the existing situation / technical state of the installation			
Check location of ventilation unit(s)				
	Determine optimal location of the ventilation unit(s)	UP	UP	UP
	Prevent noise pollution			
Check location of air supply and discharge in each room				
	Ensure air circulation in the room			
	Prevent draft complaints			
	Check location of the external air intake			
	Check location of the air exhaust			
Check the global layout of air ducts				
	Check ventilation duct dimensions based on rule of thumb			

[1] The topic is part of an existing training module which needs to be updated (UP).

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Check zones where ducts cannot be placed	VT[2]	VT	VT
	In collective systems: control fire safety and check if valves in the wall(s)/floor are needed	VT	VT	VT
	Check the need for coordination with other trades with regard to cable routing, breakthroughs and overflow areas	VT	VT	VT
In case of renovation: assess functional and technical state of the ventilation system				
	Determine which parts are reusable and which parts/systems need to be replaced	VT	VT	VT
Check design of the central mechanical ventilation unit				
	Check the use of silencers			
	Check drainage facility for heat recovery (if needed)	UP	UP	UP
Check design of mechanical exhaust unit				
	Check the use of silencers			
Determine special needs in case of collective ventilation systems				
	Apply sealing between fire damper and wall	VT	VT	VT
Make holes in wall(s) and/or floor(s)				
	Check/mark position and dimensions of the recess(es)	VT	VT	VT
	Make the recess(es) or correct the sizes if necessary	VT	VT	VT
	Make airtight seals at the location of MVHR (Mechanical Ventilation with Heat Recovery) unit and penetration of the thermal envelope	VT	VT	VT
Work safety				
	Ensure a safe working platform	VT	VT	VT
	Observe occupational safety and health protection	VT	VT	VT

[2] This topic is adequately integrated in the vocational training (VT) of Austrian plumbers.

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Use dangerous substances in safe and environmentally friendly way	VT	VT	VT
Install air ducts				
	Ensure clean and proper storage of ducts, registers and other components	VT	VT	VT
	Optimize position of supply and extract register(s)	VT	VT	VT
	Construct the duct system (supply and discharge)	VT	VT	VT
	Fix air ducts with structure-borne noise decoupling	VT	VT	VT
	Fix ducts in floors against flooding	VT	VT	VT
	Seal all breakthroughs (as long as that is not taken over by other trades)	VT	VT	VT
	Install supply valves with preset flow rates	VT	VT	VT
	Install exhaust valves with preset flow rates	VT	VT	VT
	Insulate both channels from the outside to the unit in systems with heat recovery	VT	VT	VT
	Install sound attenuators	VT	VT	VT
	Document air ducts and corrections in the installation plan (if changes were made)	VT	VT	VT
Mount central ventilation unit				
	Locate position of the central ventilation unit			
	Mount the central ventilation unit			
	Assemble silencers between unit and duct system	VT	VT	VT
	Connect the ventilation unit to the duct system	VT	VT	VT
	Connect the ventilation unit to the discharge water system	VT	VT	VT
	Construct facilities such as electricity and data cables	VT	VT	VT
Mount decentral ventilation unit				

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Locate position of the decentral ventilation unit			
	Make needed passage(s) through the wall			
	Mount the decentral ventilation unit			
	Construct facilities such as electricity and data cables	VT	VT	VT
Mount supports for ducts				
	Drill fixing holes for duct supports	VT	VT	VT
	Mount suspension brackets	VT	VT	VT
	Fix support profiles	VT	VT	VT
	Fasten threaded rods / mounting brackets	VT	VT	VT
Apply safety measures in collective systems				
	Mount check valves	VT	VT	VT
	Mount fire damper(s)			
	Seal space between fire damper and wall/floor			
Mount and connect sensors and controllers				
	Install smart detection and control system	VT	VT	VT
	Insert and connect sensors	VT	VT	VT
	Construct facilities such as electricity and data cables	VT	VT	VT
	Connect the controller	VT	VT	VT
Apply overflow measures				
	Install overflow openings (if not included by other trades)			
Balance the ventilation system				
	Check the ventilation system for common installation errors	UP	UP	UP
	Adjust the fan capacity of the supply with the dip switches (if mechanical supply is present)			
	Adjust fan capacity of the supply valves	VT	VT	VT

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Adjust fan capacity of the exhaust with the dip switches (if mechanical exhaust is present)			
	Check and, if necessary, correct air exhaust	VT	VT	VT
	Carry out all other settings (frost protection, time program, filter monitoring, ...)	VT	VT	VT
Commission the ventilation system				
	Explain importance of commissioning of the ventilation system	UP	UP	UP
	Check the ventilation system for common installation errors	UP	UP	UP
	Control and document sound load for the operating stages	UP	UP	UP
	Control and document external pressure losses for the operating stages	UP	UP	UP
	Carry out all other settings (frost protection, time program, filter monitoring, ...)	UP	UP	UP
Handover ventilation system				
	Compile documentation	UP	UP	UP
	Create user manual	UP	UP	UP
	Add adjustment state to the manual	UP	UP	UP
	Add maintenance schedule to the manual	UP	UP	UP
	Transfer installation to the user	UP	UP	UP
	Raise awareness for regular maintenance need	UP	UP	UP
Test ventilation system				
	Test air tightness of the building			
	Test and evaluate air tightness of the ventilation system	VT	VT	VT
	Test and evaluate noise protection of the ventilation system	VT	VT	VT
Maintain ventilation system				

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Check annual operation	VT	VT	VT
	Check hygiene annually	VT	VT	VT
	Clean valves annually	VT	VT	VT
	Clean ducts if necessary (in general every 10 years)	VT	VT	VT
	Clean fans when needed	VT	VT	VT
	Clean or replace filters according to maintenance schedule	VT	VT	VT

Legend:

VT vocational training

UP needs to be updated

Note: The basic assembling of ventilation systems is not part of existing further education courses in Austria because this topic is adequately integrated in the vocational training of Austrian plumbers. Due to that fact, existing modules are marked with “VT” for vocational training. For the topics “initial operating, adjustment and handover” a practical module (implementation in a specific lab) is available.

2.4 Hungary

2.4.1 Summary of existing trainings

The current education and continuing training system for the HVAC crafts is rather complex in Hungary. There are primary, secondary and tertiary education streams, both school-based and non-school trainings.

Regarding the continuing vocational training for workers including on-the-job practice, an increasing number of market-based education programs are available in order to meet the demand for vocational trainings not covered by the formal education system. These courses are accredited based on specific requirements (technical and human resources) and are registered in the National Registry of Qualifications. The currently available building-related accredited trainings are:

- Building engineering and technician
- Central heating and plumbing
- Climatization technician
- Air-conditioning mechanic
- Electro-technician
- Renewable energy technician

In terms of numbers there are 115,000 people working in the building sector In Hungary, out of which 35,000 people are working in the HVAC sub-sector, according their qualifications:

- 2,000 have tertiary qualifications (engineers)
- 7,000 have secondary qualifications (technicians)
- 25,000 have some qualifications registered in the National Qualification Registry (NQR)
- 1,000 have no formal qualifications

Thus, the major bulk of all HVAC professionals working in the building industry have National Qualification Registry qualifications. Although the curricula for these qualifications have been upgraded in 2011 to include up-to-date information on renewable energy use and energy-efficient products and equipment, nZEB-related requirements are not yet met. Therefore,

there is a significant need among practitioners to upgrade their knowledge with energy-related information and skills.

The **trainings provided by vocational schools** are mainly aimed at students (learning in the school-based system). These trainings provide the basis, but rarely include energy efficiency topics. In the project BUILD UP Skills TRAINBUD the project consortium targeted the HVAC skilled workers and provided them with up-to-date energy efficiency-related knowledge. The trainings and the material were mainly developed with regard to active HVAC skilled workers. However, it was very successful, so much so that the vocational schools integrated it in their own curricula.

The **trainings provided by manufacturers and trading companies**, indeed, provide general knowledge, but mainly focus on the adequate installation of their own products. In addition, nZEB-related information is not covered.

2.4.2 Analysis of ULOs and needed modules

Based on the training materials available and the Units of Learning Outcomes developed in the *D3.1 Units of learning outcomes and descriptors* report, the project partners defined the most important modules for the nZEB ventilation training. The following table contains these main modules and the information related to their availability. Three main actors are defined in the construction/renovation process of flat roofs: **project manager, foremen, skilled worker**. The three actors have different skills, competences and level of training/qualification.

Table 2: Analysis of availability of train-the-trainer materials in Hungary

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
Check schedule of requirements				
	Check type of ventilation system			
	Explain demands for energy efficiency			
	Determine supply air flow rate			
	Determine minimum discharge flow			
	Check requirements regarding air tightness of ducts			
	Check the type(s) of ventilation regulation system(s)			
	Verify location of the control unit			
	Check necessary safety device depending on the fireplace			
	Provide assistance with selection of recirculation or exhaust air kitchen hoods			
In case of renovation: check the list of additional requirements				
	Judge the existing situation / technical state of the installation			
Check location of ventilation unit(s)				
	Determine optimal location of the ventilation unit(s)			
	Prevent noise pollution			
Check location of air supply and discharge in each room				
	Ensure air circulation in the room			
	Prevent draft complaints			
	Check location of the external air intake			
	Check location of the air exhaust			
Check the global layout of air ducts				
	Check ventilation duct dimensions based on rule of thumb			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Check zones where ducts cannot be placed			
	In collective systems: control fire safety and check if valves in the wall(s)/floor are needed			
	Check the need for coordination with other trades with regard to cable routing, breakthroughs and overflow areas			
In case of renovation: assess functional and technical state of the ventilation system				
	Determine which parts are reusable and which parts/systems need to be replaced			
Check design of the central mechanical ventilation unit				
	Check the use of silencers			
	Check drainage facility for heat recovery (if needed)			
Check design of mechanical exhaust unit				
	Check the use of silencers			
Determine special needs in case of collective ventilation systems				
	Apply sealing between fire damper and wall			
Make holes in wall(s) and/or floor(s)				
	Check/mark position and dimensions of the recess(es)			
	Make the recess(es) or correct the sizes if necessary			
	Make airtight seals at the location of MVHR unit and penetration of the thermal envelope			
Work safely				
	Ensure a safe working platform			
	Observe occupational safety and health protection			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Use dangerous substances in safe and environmentally friendly way			
Install air ducts				
	Ensure clean and proper storage of ducts, registers and other components			
	Optimize position of supply and extract register(s)			
	Construct the duct system (supply and discharge)			
	Fix air ducts with structure-borne noise decoupling			
	Fix ducts in floors against flooding			
	Seal all breakthroughs (as long as that is not taken over by other trades)			
	Install supply valves with preset flow rates			
	Install exhaust valves with preset flow rates			
	Insulate both channels from the outside to the unit in systems with heat recovery			
	Install sound attenuators			
	Document air ducts and corrections in the installation plan (if changes were made)			
Mount central ventilation unit				
	Locate position of the central ventilation unit			
	Mount the central ventilation unit			
	Assemble silencers between unit and duct system			
	Connect the ventilation unit to the duct system			
	Connect the ventilation unit to the discharge water system			
	Construct facilities such as electricity and data cables			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
Mount decentral ventilation unit				
	Locate position of the decentral ventilation unit			
	Make needed passage(s) through the wall			
	Mount the decentral ventilation unit			
	Construct facilities such as electricity and data cables			
Mount supports for ducts				
	Drill fixing holes for duct supports			
	Mount suspension brackets			
	Fix support profiles			
	Fasten threaded rods / mounting brackets			
Apply safety measures in collective systems				
	Mount check valves			
	Mount fire damper(s)			
	Seal space between fire damper and wall/floor			
Mount and connect sensors and controllers				
	Install smart detection and control system			
	Insert and connect sensors			
	Construct facilities such as electricity and data cables			
	Connect the controller			
Apply overflow measures				
	Install overflow openings (if not included by other trades)			
Balance the ventilation system				
	Check the ventilation system for common installation errors			
	Adjust the fan capacity of the supply with the dip switches (if			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	mechanical supply is present)			
	Adjust fan capacity of the supply valves			
	Adjust fan capacity of the exhaust with the dip switches (if mechanical exhaust is present)			
	Check and, if necessary, correct air exhaust			
	Carry out all other settings (frost protection, time program, filter monitoring, ...)			
Commission the ventilation system				
	Explain importance of commissioning of the ventilation system			
	Check the ventilation system for common installation errors			
	Control and document sound load for the operating stages			
	Control and document external pressure losses for the operating stages			
	Carry out all other settings (frost protection, time program, filter monitoring, ...)			
Handover ventilation system				
	Compile documentation			
	Create user manual			
	Add adjustment state to the manual			
	Add maintenance schedule to the manual			
	Transfer installation to the user			
	Raise awareness for regular maintenance need			
Test ventilation system				
	Test air tightness of the building			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Test and evaluate air tightness of the ventilation system			
	Test and evaluate noise protection of the ventilation system			
Maintain ventilation system				
	Check annual operation			
	Check hygiene annually			
	Clean valves annually			
	Clean ducts if necessary (in general every 10 years)			
	Clean fans when needed			
	Clean or replace filters according to maintenance schedule			

2.5 The Netherlands

2.5.1 Summary of existing trainings

For ventilation currently no trainings are being organized. The most recent training materials were developed in 2011. Editor of these materials was ISSO and these were realized with the support of and in collaboration with other organizations:

- RVO.nl (formerly known as Agentschap NL, agency of the Ministry of Economic Affairs);
- OTIB, educational and development fund for installation companies;
- Stichting Promotie Installatietechniek (PIT);
- Techniek Nederland, association of the HVAC installation sector;
- VLA, association of ventilation manufacturers.

The training materials consist of multiple instruction books. Together, these books constitute a complete track on ventilation, from the know-how for designers to that for mechanic installers. Each instruction book is a sort of module and covers certain aspects of ventilation systems.

The four modules are:

1. Basics of ventilation systems;
2. Design of ventilation systems;
3. Installation and produce of ventilation systems;
4. Management and maintenance of ventilation systems.

For all modules formal theoretical exams are available. A practical exam is not available.

All craftsmen that succeed in passing the exam are registered in a national register currently maintained by QBIS-NL[3]. In the nearby future this will become a branch register for recognized craftsmen organised by the association of HVAC installers. As there are no active course institutes in this field, the number of recognized workers is very low.

[3] https://www.qbisnl.nl/

Since 1 July 2018 an updated personal certification has been available for design, installation and maintenance of ventilation systems in houses and residential buildings.

2.5.2 Analysis of ULOs and needed modules

Based on the training materials available and the Units of Learning Outcomes developed in the *D3.1 Units of learning outcomes and descriptors* report, the project partners defined the most important modules for the nZEB ventilation training. The following table contains these main modules and the information related to their availability. Three main actors are defined in the construction/renovation process of flat roofs: **project manager, foremen, skilled worker**. The three actors have different skills, competences and level of training/qualification.

Table 3: Analysis of availability of train-the-trainer materials in the Netherlands

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
Check schedule of requirements				
	Check type of ventilation system			
	Explain demands for energy efficiency			
	Determine supply air flow rate			
	Determine minimum discharge flow			
	Check requirements regarding air tightness of ducts			
	Check the type(s) of ventilation regulation system(s)			
	Verify location of the control unit			
	Check necessary safety device depending on the fireplace			
	Provide assistance with selection of recirculation or exhaust air kitchen hoods			
In case of renovation: check the list of additional requirements				
	Judge the existing situation / technical state of the installation			
Check location of ventilation unit(s)				
	Determine optimal location of the ventilation unit(s)			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Prevent noise pollution			
Check location of air supply and discharge in each room				
	Ensure air circulation in the room			
	Prevent draft complaints			
	Check location of the external air intake			
	Check location of the air exhaust			
Check the global layout of air ducts				
	Check ventilation duct dimensions based on rule of thumb			
	Check zones where ducts cannot be placed			
	In collective systems: control fire safety and check if valves in the wall(s)/floor are needed			
	Check the need for coordination with other trades with regard to cable routing, breakthroughs and overflow areas			
In case of renovation: assess functional and technical state of the ventilation system				
	Determine which parts are reusable and which parts/systems need to be replaced			
Check design of the central mechanical ventilation unit				
	Check the use of silencers			
	Check drainage facility for heat recovery (if needed)			
Check design of mechanical exhaust unit				
	Check the use of silencers			
Determine special needs in case of collective ventilation systems				
	Apply sealing between fire damper and wall			
Make holes in wall(s) and/or floor(s)				

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Check/mark position and dimensions of the recess(es)			
	Make the recess(es) or correct the sizes if necessary			
	Make airtight seals at the location of MVHR unit and penetration of the thermal envelope			
Work safely				
	Ensure a safe working platform			
	Observe occupational safety and health protection			
	Use dangerous substances in safe and environmentally friendly way			
Install air ducts				
	Ensure clean and proper storage of ducts, registers and other components			
	Optimize position of supply and extract register(s)			
	Construct the duct system (supply and discharge)			
	Fix air ducts with structure-borne noise decoupling			
	Fix ducts in floors against flooding			
	Seal all breakthroughs (as long as that is not taken over by other trades)			
	Install supply valves with preset flow rates			
	Install exhaust valves with preset flow rates			
	Insulate both channels from the outside to the unit in systems with heat recovery			
	Install sound attenuators			
	Document air ducts and corrections in the installation plan (if changes were made)			
Mount central ventilation unit				

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Locate position of the central ventilation unit			
	Mount the central ventilation unit			
	Assemble silencers between unit and duct system			
	Connect the ventilation unit to the duct system			
	Connect the ventilation unit to the discharge water system			
	Construct facilities such as electricity and data cables			
Mount decentral ventilation unit				
	Locate position of the decentral ventilation unit			
	Make needed passage(s) through the wall			
	Mount the decentral ventilation unit			
	Construct facilities such as electricity and data cables			
Mount supports for ducts				
	Drill fixing holes for duct supports			
	Mount suspension brackets			
	Fix support profiles			
	Fasten threaded rods / mounting brackets			
Apply safety measures in collective systems				
	Mount check valves			
	Mount fire damper(s)			
	Seal space between fire damper and wall/floor			
Mount and connect sensors and controllers				
	Install smart detection and control system			
	Insert and connect sensors			
	Construct facilities such as electricity and data cables			
	Connect the controller			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
Apply overflow measures				
	Install overflow openings (if not included by other trades)			
Balance the ventilation system				
	Check the ventilation system for common installation errors			
	Adjust the fan capacity of the supply with the dip switches (if mechanical supply is present)			
	Adjust fan capacity of the supply valves			
	Adjust fan capacity of the exhaust with the dip switches (if mechanical exhaust is present)			
	Check and, if necessary, correct air exhaust			
	Carry out all other settings (frost protection, time program, filter monitoring, ...)			
Commission the ventilation system				
	Explain importance of commissioning of the ventilation system			
	Check the ventilation system for common installation errors			
	Control and document sound load for the operating stages			
	Control and document external pressure losses for the operating stages			
	Carry out all other settings (frost protection, time program, filter monitoring, ...)			
Handover ventilation system				
	Compile documentation			
	Create user manual			
	Add adjustment state to the manual			
	Add maintenance schedule to the manual			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Transfer installation to the user			
	Raise awareness for regular maintenance need			
Test ventilation system				
	Test air tightness of the building			
	Test and evaluate air tightness of the ventilation system			
	Test and evaluate noise protection of the ventilation system			
Maintain ventilation system				
	Check annual operation			
	Check hygiene annually			
	Clean valves annually			
	Clean ducts if necessary (in general every 10 years)			
	Clean fans when needed			
	Clean or replace filters according to maintenance schedule			

2.6 Slovakia

In 2012 and 2013, Slovakia participated in the Build Up Skills Pillar I project managed by EACI (now EASME) to analyze a status quo in the level of competencies available in the sector of buildings, future needs as well as obstacles for improvement and investments in the skills and knowledge of human resource in the construction sector. Although the Pillar I project was aimed at craftsmen and on-site workers in the sector of buildings, Slovak BUILD UP Skills team used this opportunity to address also several middle and senior level professionals, as the needs in this area are of the same urgency and need to be tackled should the objectives in the energy efficiency of buildings and in the use of renewable energy sources be delivered. Moreover, taking into account the specific situation in Slovakia, not addressing the needs in middle and senior level professions in the sector of buildings would undermine the effectiveness of achieving the expected impact of the action focused on craftsmen and on-site workers.

The agreed and endorsed BUS National Roadmap places the leadership of employers at the focus of the process, with the support of universities, accreditation bodies (ministries in charge of education), and file managers of relevant governmental policies (ministries in charge of energy policies, including achievement of EU 2020 targets, ministries in charge of the construction sector, etc.). Other backing players include social partners and suppliers of services related to preparing and delivering construction works, construction materials, machinery, technology and equipment that is essential for achieving the set objectives.

In implementing the Roadmap, **StavEdu** – National Qualification and Training Scheme was set up for craftsmen and on-site workers on energy efficiency and use of renewable energy sources in buildings (resulting from the BUS StavEdu project supported by Intelligent Energy Europe).

2.6.1 Summary of existing trainings

The StavEdu scheme offers ten cross-trade training programs of further education and training of craftsmen and on-site workers in the field of buildings on energy efficiency and

use of renewables in buildings. The objective of the cross-trade training programs is developing the key competencies of craftsmen and on-site workers in the field of buildings needed for energy renovation of buildings and construction of new buildings towards the standard of nearly zero energy buildings. The training has three phases:

- Inception training focused on main issues of compliance (standards, technology requirements, legislation) identified by company experts;
- Theoretical part of the training;
- Practical training.

The further training programs are offered for the following crafts and on-site professions:

Table 4: Overview of further training programs in Slovakia

NR	TARGETED PROFESSIONS
SC1	Bricklayer, insulator, plasterer, concrete worker, scaffolding assembler
SC2	Auxiliary production bricklayer (including dry mounting and wooden structures, assemblers and installer of fillings for building openings), chimney-sweeper, carpenter/joiner, electrician and plasterboard fitter
SC3	Assemblers of concrete and steel structures, assembler of building envelope, steel structure specialist
SC4	Roofer, hydro-insulators, carpenter, tinsmith and slater
SC5	Painter, paperhanger, tile setter, floorer, paver and mason
SC6	Installer/plumber, installer of sanitary equipment, installer of heating, cooling and water equipment and construction locksmith
SC7	Crane and construction machinery operators
SC8	On-site training on key energy-saving measures for craftsmen and on-site workers
SE1	Lighting systems in buildings
SE2	Technical energy equipment in buildings

The training programs SC1 to SC7 and SE1 provide 40 hours of training, including practical training in the working environment.

Within the training program SE2, the following modules are available:

- Module 1 for on-site workers with primary education (3 hours);
- Module 2 – an intermediate module for on-site workers with completed secondary technical education (8 hours);
- Module 3 for advanced on-site workers with completed secondary electro-technical education (24 hours).

Training programs offer assessment of the learning outcomes and certification of the qualification in energy efficiency and use of renewable energy resources in buildings.

2.6.2 Analysis of ULOs and needed modules

Based on the training materials available and the Units of Learning Outcomes developed in the *D3.1 Units of learning outcomes and descriptors* report, the project partners defined the most important modules for the nZEB ventilation training. The following table contains these main modules and the information related to their availability. Three main actors are defined in the construction/renovation process of flat roofs: **project manager, foremen, skilled worker**. The three actors have different skills, competences and level of training/qualification.

Table 5: Analysis of availability of train-the-trainer materials in Slovakia

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
Check schedule of requirements				
	Check type of ventilation system			
	Explain demands for energy efficiency			
	Determine supply air flow rate			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Determine minimum discharge flow			
	Check requirements regarding air tightness of ducts			
	Check the type(s) of ventilation regulation system(s)			
	Verify location of the control unit			
	Check necessary safety device depending on the fireplace			
	Provide assistance with selection of recirculation or exhaust air kitchen hoods			
In case of renovation: check the list of additional requirements				
	Judge the existing situation / technical state of the installation			
Check location of ventilation unit(s)				
	Determine optimal location of the ventilation unit(s)			
	Prevent noise pollution			
Check location of air supply and discharge in each room				
	Ensure air circulation in the room			
	Prevent draft complaints			
	Check location of the external air intake			
	Check location of the air exhaust			
Check the global layout of air ducts				
	Check ventilation duct dimensions based on rule of thumb			
	Check zones where ducts cannot be placed			
	In collective systems: control fire safety and check if valves in the wall(s)/floor are needed			
	Check the need for coordination with other trades with regard to cable routing, breakthroughs and overflow areas			
In case of renovation: assess functional and technical state of the ventilation				

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
system				
	Determine which parts are reusable and which parts/systems need to be replaced			
Check design of the central mechanical ventilation unit				
	Check the use of silencers			
	Check drainage facility for heat recovery (if needed)			
Check design of mechanical exhaust unit				
	Check the use of silencers			
Determine special needs in case of collective ventilation systems				
	Apply sealing between fire damper and wall			
Make holes in wall(s) and/or floor(s)				
	Check/mark position and dimensions of the recess(es)			
	Make the recess(es) or correct the sizes if necessary			
	Make airtight seals at the location of MVHR unit and penetration of the thermal envelope			
Work safely				
	Ensure a safe working platform			
	Observe occupational safety and health protection			
	Use dangerous substances in safe and environmentally friendly way			
Install air ducts				
	Ensure clean and proper storage of ducts, registers and other components			
	Optimize position of supply and extract register(s)			
	Construct the duct system (supply and discharge)			
	Fix air ducts with structure-borne noise decoupling			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Fix ducts in floors against flooding			
	Seal all breakthroughs (as long as that is not taken over by other trades)			
	Install supply valves with preset flow rates			
	Install exhaust valves with preset flow rates			
	Insulate both channels from the outside to the unit in systems with heat recovery			
	Install sound attenuators			
	Document air ducts and corrections in the installation plan (if changes were made)			
Mount central ventilation unit				
	Locate position of the central ventilation-unit			
	Mount the central ventilation unit			
	Assemble silencers between unit and duct system			
	Connect the ventilation unit to the duct system			
	Connect the ventilation unit to the discharge water system			
	Construct facilities such as electricity and data cables			
Mount decentral ventilation unit				
	Locate position of the decentral ventilation unit			
	Make needed passage(s) through the wall			
	Mount the decentral ventilation unit			
	Construct facilities such as electricity and data cables			
Mount supports for ducts				
	Drill fixing holes for duct supports			
	Mount suspension brackets			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Fix support profiles			
	Fasten threaded rods / mounting brackets			
Apply safety measures in collective systems				
	Mount check valves			
	Mount fire damper(s)			
	Seal space between fire damper and wall/floor			
Mount and connect sensors and controllers				
	Install smart detection and control system			
	Insert and connect sensors			
	Construct facilities such as electricity and data cables			
	Connect the controller			
Apply overflow measures				
	Install overflow openings (if not included by other trades)			
Balance the ventilation system				
	Check the ventilation system for common installation errors			
	Adjust the fan capacity of the supply with the dip switches (if mechanical supply is present)			
	Adjust fan capacity of the supply valves			
	Adjust fan capacity of the exhaust with the dip switches (if mechanical exhaust is present)			
	Check and if necessary correct air exhaust			
	Carry out all other settings (frost protection, time program, filter monitoring, ...)			
Commission the ventilation system				
	Explain importance of commissioning of the ventilation system			

TASKS	SUB-TASKS	Project manager	Foreman	Skilled worker
	Existing modules			
	New elements			
	Check the ventilation system for common installation errors			
	Control and document sound load for the operating stages			
	Control and document external pressure losses for the operating stages			
	Carry out all other settings (frost protection, time program, filter monitoring, ...)			
Handover ventilation system				
	Compile documentation			
	Create user manual			
	Add adjustment state to the manual			
	Add maintenance schedule to the manual			
	Transfer installation to the user			
	Raise awareness for regular maintenance need			
Test ventilation system				
	Test air tightness of the building			
	Test and evaluate air tightness of the ventilation system			
	Test and evaluate noise protection of the ventilation system			
Maintain ventilation system				
	Check annual operation			
	Check hygiene annually			
	Clean valves annually			
	Clean ducts if necessary (in general every 10 years)			
	Clean fans when needed			
	Clean or replace filters according to maintenance schedule			

3 Training institutions

3.1 Austria

3.1.1 Training institutions

There are several training institutions in Austria which offer courses in the field of ventilation systems:

BAUAkademie (Austrian construction academy): The Austrian construction academies are certified as educational institutions, which guarantees quality assurance of all essential procedural steps in connection with the development and implementation of qualification measures in the building industry. The construction academies (in different regions) rely on the jointly developed "BAUAkademie certificate".

Energieinstitut Vorarlberg: Energieinstitut Vorarlberg, among other activities, offers a comprehensive information and further education program. In evening lectures, day trainings or longer training courses (several days), they offer interested individuals, entrepreneurs or communities practical knowledge on the subjects concerning energy. Among the courses there are also “comfort Ventilation” which is an evening course for interested stakeholders[4].

OÖ Energiesparverband: OÖ Energiesparverband (Upper Austrian Energy Saving Association) is the central contact point for independent energy information in the province of Upper Austria. Its purpose is to promote the efficient use of energy with a focus on environmental friendliness and the use of new technologies, in particular in connection with the use of domestic renewable energy. The OÖ Energiesparverband is organized as an independent association. During the preparation period of this report there were no courses on ventilation offered by this organization.

[4] The upcoming course can be found at: https://www.energieinstitut.at/events/komfortlueftung-komfortabel-energieeffizient-gesund/

The Austrian Institute of Technology (AIT): AIT is Austria's largest Research and Technology Organization (RTO) and offers courses in many areas of the building technologies.

WIFI Austria: WIFI is one of the largest vocational education and training provider in Austria. It offers more than 32,000 courses and seminars per year in all nine federal states of Austria.

ARS: The ARS academy for law, tax and business offers training courses on the topic of ventilation for planers, building developers and public organizations.

3.1.2 Trading and manufacturer companies

KLA: The association KLA – Komfortlüftungssysteme Austria (Comfort Ventilation Systems Austria) has set itself the goal of providing information and education on the subject of ventilation in buildings on a broad basis. The manufacturer companies represented in Austria are members of this platform.

komfortlüftung.at: This is a non-profit association for providing information and boosting the market dissemination of comfort ventilations by especially increasing awareness of healthy indoor air and energy efficiency in ventilation systems. Many Austrian federal states' energy consultancy offices, research institutions (e.g. AIT) and engineers are members of this association. Together with AIT and KLA, komfortlüftung.at offers courses on ventilation.

3.2 Hungary

Building on the previous BUILD UP Skills projects ÉMI has a strong partnership with several training, education institutions and trading and manufacturer companies. During the implementation of the BUILD UP Skills TRAINBUD project the consortium established a Sustainable Construction Skills Alliance which contributed to reaching the project targets.

3.2.1 Training institutions

ÉMI is in a partnership with 18 vocational training institutions throughout Hungary:

Table 6: Partnership with vocational training institutions which provide education mainly for HVAC skilled workers throughout Hungary

NR	ORGANIZATION
1.	Simonyi Károly Technical and vocational school
2.	Arany János technical vocational school
3.	Povolny Ferenc Vocational and Special Secondary school
4.	Békéscsaba Central Vocational School and Student Dormitory
5.	Szily Kálmán Technical Vocational Secondary School
6.	Budapest University of Technology and Economics, Faculty of Architecture, Department of Building Energetics and Building Service Engineering
7.	Budapest University of Technology and Economics, Faculty of Architecture, Department of Building Constructions

These training institutions provide education mainly for HVAC skilled workers, therefore, the curricula of the students include ventilation modules also. However, these trainings still focus merely on the basics.

3.2.2 Trading and manufacturer companies

The Sustainable Construction Skills Alliance (established in BUS TRAINBUD) has members from the construction industry as well. ÉMI has connections with relevant trading and

manufacturer companies who also provide trainings. These companies mostly organize one to two-day trainings for blue-collar workers. The aim of the trainings is not only to promote their materials but to update the knowledge of the participants and teach about the most common errors and adequate solutions. The trainings provided by these companies differ in content, length and aim; however, they all usually include practical parts as well.

Some of them even provide their own certificate for the participants who successfully complete the course.

Table 7: Overview of companies as involved training providers in Hungary

COMPANY/TRAINING PROVIDER	SHORT DESCRIPTION OF THE TRAINING CONTENT
AERECO	Aereco develops innovative ventilation solutions for residential and office buildings with a key concept: the modulation of air flow rates according to the needs. Aereco provides one to two-day trainings with theoretical sections and some practical demonstration.
DAIKIN	Daikin offers products and system solutions to ensure comfortable and sustainable living environments in relation to ventilation. The company has its own one to two-day training (theoretical and practical sections also).
ROSENBERG	Rosenberg Hungary Ltd. is part of the German Rosenberg Group. The company is a leading organization in the training of HVAC skilled workers. They provide demonstration equipment also for trainings in laboratories and have their own training related to energy efficiency and the installation of ventilation systems.

3.3 Netherlands

3.3.1 Training institutions and vocational training (VET) providers

In the Netherlands, there are currently no training institutions involved in ventilation trainings. Further education in the form of a half-day course is offered by manufacturers. Some VET providers (such as ROC Tilburg, ROC Friese Poort and InstallatieWerk) have curriculum elements on the installation of ventilation systems implemented, mostly targeting the mounting aspects.

One site of InstallatieWerk, the site in Amersfoort, has plans to create a new practice environment on ventilation in combination with air tightness. This is of special interest for ISSO.

Training institution ROVC

ROVC is interested to join the development of the NEWCOM ventilation modules in cooperation with Installatiewerk. This is due to a recent success in working together on the repositioning of the practical courses for installing heat pumps.

ROVC is one of the most important training institutes for secondary vocational education in the building services sector. It organizes regular education programs, but also specialized trainings and courses for professionals who are already employed. ROVC has 13,000 students each year, who follow a multitude of different technical courses, ranging from air-conditioning to process engineering. Its target group are mostly installers and (service) mechanics. ROVC's main principle is practical learning; the institution wants its students to work with real installations and systems as soon as possible. To enable this, it provides several practice centers with all different kinds of test installations.

3.3.2 Trading and manufacturer companies

There are manufacturers and suppliers who give courses to mostly beginning installers, fresh from school. Some of the large manufacturers and suppliers of heat recovery ventilation systems providing courses are:

Table 8: Overview of involved manufacturers and trading companies

NR	ORGANIZATION
1.	Brink Climate Systems
2.	Zehnder
3.	Itho Daalderop
4.	Technische Unie
5.	Rensa

About eight years ago the manufacturers cooperated in the VLA (trade association) and have, together with Techniek Nederland, designed a one-day training on mounting and quality aspects. Unfortunately, due to organizational issues this training has never left the drawing board.

3.4 Slovakia

3.4.1 Training institutions

Build Up Skills Pilot I project reviewed available training for 32 crafts that were identified as relevant to energy efficiency and the use of renewable energy sources in buildings. This analysis was the basis for drafting the national roadmap with specific objectives and measures to support implementation of the agreed objectives.

The follow-up project BUS StavEdu succeeded to set up the National Qualification and Further Training Scheme of the same name for craftsmen on energy efficiency and use of

renewable energy sources in buildings. This scheme is implemented with the help of 32 organizations that include VET schools and producers of building materials, structural elements and technologies.

The StavEdu scheme is coordinated by Ústav vzdelávania a služieb (UVS) that is supporting the Association of Construction Entrepreneurs of Slovakia (ZSPS) in ensuring the needed skills in the construction sector.

UVS had been established in 1970 as an independent organization of the Ministry of Construction Industry and was transformed into a limited liability company on 1 June 2002.

UVS as a commercial and independent institution offers a wide range of educational activities, such as training and re-training courses and programs accredited by the Slovak Ministry of Education and the Office of Work Safety. UVS also hosts seminars, workshops, company presentations, and international conferences.

The key objective of UVS is to provide lifelong learning of adults in the following areas: building sector and construction industry, European integration and regional policy, and technology.

UVS has long-time experiences with publication activities with more than 600 published specialized information materials dealing mostly with the themes of construction, building sector, regional development, etc. UVS has been processing and publishing special teaching texts for secondary schools in the building sector for more than 20 years. With regard to the education process, UVS has expertise in creating teaching aids, special publications, video programs etc.

Another key stakeholder in further education and training of craftsmen is the Association of Construction Entrepreneurs of Slovakia (ZSPS).

ZSPS was established in 1990 as an independent, voluntary, non-political interest group of construction entrepreneurs/companies associating entrepreneurs and companies specialized in delivering works and services in the area of civil engineering. ZSPS is represented in many international, European and national institutions and organizations.

ZSPS promotes common and specific interests of its members and joint projects to create transparent and fair market conditions vis-à-vis European and national authorities and institutions, European and national legislators, professional bodies and organizations. It also provides platforms for facilitating dialogue among stakeholders, decision makers and rule makers. Other tasks of the interest group include the promotion of projects and actions aimed at supporting investments in the skills, the cooperation with professional and certification bodies to push quality management systems, and the advancing of research, technical development and innovations in the construction industry. Moreover, ZSPS provides information, consultancy, and educational and training services: it also heads the National Sector Skills Council in the construction sector.

ZSPS led the StavEdu project and is “owner” of the National Qualification and Further Training Scheme for Craftsmen on Energy Efficiency and Use of Renewable Energy Sources in Buildings established by this project.

ZSPS work closely with the Slovak Innovation and Energy Agency (SIEA) that is focused on energy-related crafts (energy equipment of buildings, renewable energy installers, etc.).

SIEA was established in 1999 as executive agency of the Ministry of Economy. It is the competence center for energy efficiency, energy innovations and renewable energies. SIEA also acts as implementation agency for the EU Structural Funds and other funding mechanisms.

SIEA functions as the national energy agency and has a thorough knowledge of the Slovak energy market and its participants, the decision makers, companies, professionals, associations and all those who are involved in the area of energy as well as energy efficiency and renewable energy sources. Special emphasis is laid on the area of trainings and information seminars for professionals as well as on awareness-raising measures towards the general public dealing with the rational energy use and wider exploitation of renewable energy sources. Fulfiling the tasks of the Slovak Ministry of Economy, SIEA takes part in the preparation of energy policy, energy acts and decrees, and follows and monitors development in the energy sector both on the demand and supply sides.

The key training institute of ZSPS is UVS, as mentioned earlier.

The training for construction professionals is delivered with support of many organizations that help to provide the content of the training, instructors to conduct the trainings, necessary teaching aids, models and equipment for practical training, as well as infrastructure and access to real working environment. The network is open for new organizations and currently includes:

Table 9: Overview of involved training providers in Slovakia

NR	ORGANIZATION	CITY
1	Stredná odborná škola stavebná, Nitra	Nitra
2	Innovia, s.r.o.	Trnava
3	Stavoinvesta Dunajská Streda, s.r.o.	Dunajská Streda
4	Ipeľské tehelne, a.s.	Lučenec
5	STU BA, Stavebná fakulta	Bratislava
6	Slovenergookno, n.o.	Bratislava
7	SCHIEDEL Slovensko, s.r.o	Zamarovce
8	STRABAG Pozemné a inžinierske staviteľstvo, s.r.o.	Bratislava
9	Chemostav, a.s.	Poprad
10	Stredná odborná škola stavebná - ÉSzKI	Nové Zámky
11	Cech strechárov Slovenska	Bratislava
12	Kerkotherm, a.s.	Košice
13	STU BA, Stavebná fakulta	Bratislava
14	IMOS – Systemair, a.s.	Kalinkovo
15	HERZ, spol. s.r.o.	Bernolákovo
16	Ústav vzdelávania a služieb, s.r.o.	Bratislava
17	VIEGA, s.r.o.	Praha
18	ZEUS PB, s.r.o.	Dunajská Streda
19	Beztech, s.r.o.	Miloslavov
20	TERRASTROJ spol. s.r.o.	Bratislava
21	KUHN – SLOVAKIA, s.r.o.	Senec
22	MTS – com, s.r.o.	Stupava

These organizations will be the supporting stakeholders for delivering the needed training, including training of trainers within the NEWCOM project. These stakeholders were successfully tested by the StavEdu scheme and are therefore foundation of the success of NEWCOM training and certification.

The further training has been implemented with the support of other stakeholders, such as:

- Ministry of Education, Science, Research and Sport of the Slovak Republic (responsible for lifelong learning, including further education and training);
- Ministry of Economy of the Slovak Republic (responsible for energy efficiency targets, including energy performance of buildings and renovation roadmaps);
- Platform “Buildings of the Future” (supporting energy renovations of existing buildings);
- Slovak Green Building Council (global stakeholder in energy efficiency and use of renewable energy sources in buildings supporting development of strategies in this area);
- Association for Supporting Renovation of Residential Housing (national stakeholder in promoting energy renovations of existing residential housing and supporting owners in implementing their objectives in this area);
- Institute for Passive Houses (national stakeholder providing advice on passive house concept implementation);
- Greenpeace Slovakia (global stakeholder in promoting environmental approaches in all sectors of society and actions for combating climate change);
- National Qualification Platform (national platform set up by the Build Up Skills Pillar I project providing advice on training policies and supporting implementation of the measures agreed in the BUS National Roadmap);
- Technický a skúšobný ústav stavebný, n.o. (national stakeholder providing expertise in energy performance of buildings and relevant regulatory framework);

- Ekofond, n.f. (national stakeholder established by key energy providers to support actions aimed at increasing energy efficiency, including energy efficiency of buildings).

These stakeholders also provide their experts for delivering training and facilitate contacts to professional sponsors for these further training programs.

3.4.2 Trading and manufacturer companies

The suppliers of building materials, technology and structural elements for flat roofs provide training to instruct craftsmen how to use their products and how to avoid failures in the installing of flat roofs. This training however does not cover the entire training needs in Slovakia and focuses on professional installers.

Young people interested in this profession can take up vocational education and training (VET) at several VET schools that offer high school training and practical vocational training for construction crafts at the same time.

The producers on the Slovak market include Bramac, Lindab, Elektrodesign ventilatory, Colt, Hagard, IKO and others.

4 Creating demand and promoting trainings

As the nZEB ventilation craftsman certification is not yet recognized in the partner countries, a relevant strategy is required to create the need and to promote its launch on the market. In the following paragraphs the networks of stakeholders and ingredients for successful strategies are explored.

The training providers have to be addressed because they act as multipliers for the spreading of the education program. Also, existing networks with already educated experts can be a target group as the potential trainees of the education. Business associations are also important multipliers as well as economic clusters that are mostly innovative and well-organized.

4.1 Austria

The main reasons for the reduced market demand for comprehensive non-product related further education on the topic of ventilation systems in Austria are:

- Free and short product-related trainings are widely available.
- Design and initial operation of ventilation systems are mostly not implemented by plumbers.
- At present, Austrian plumber companies operate at full capacity.

Product-related trainings consist mostly of very few general topics and concentrate on concrete information with regard to the specific product (training duration: max. one or two days). At present, these free, short and product-related trainings are more attractive for plumber companies than comprehensive, non-product related courses liable to costs.

Moreover, some manufacturers execute the design and initial operation of ventilation systems in smaller residential buildings (e.g. single family houses). Consequently, the task of

the plumber is reduced to an assembler, and the basic assembling of ventilation systems is adequately integrated in the vocational training of Austrian plumbers. In the case of apartment or office buildings the design of ventilation systems is done by building service companies and the initial operation by the manufacturer. Again, the task of the plumber is reduced to an assembler.

Furthermore, presently Austrian plumber companies operate at full capacity, which reduces their interest in further educations.

In a nutshell, at present there is nearly no market demand for new comprehensive product-neutral further education courses on the topic of ventilation systems in Austria. The market is saturated with already available trainings. Therefore, the development of new courses in this field is not considered in Austria within NEWCOM.

4.2 Hungary

Blue-collar workers usually lack time to participate especially in long trainings. It is important to build up the demand among workers to update their knowledge and develop their skills further. As nZEB requirements are part of the mandatory requirements in the partner countries, the need to obtain related knowledge in Hungary should grow as well.

In order to promote a qualified workforce, it is essential to build up demand among building owners, contractors, and also site managers.

On the other hand, blue-collar workers need to be informed about the benefit of participating in trainings and continuously improving their skills and updating their knowledge.

Manufacturer and trading companies are key actors in this process, since they have ties with numerous actors of the construction field, including contractors, building owners and skilled workers as well. At the same time, they are stakeholders who will benefit from a more skilled workforce which will ensure that their products will be installed correctly. EMI intends to start collaboration with Aereco, Daikin and Rosenberg since they provide high quality trainings.

Professional associations are also relevant and significant actors in promoting the benefit of skilled craftsmen and high quality trainings. The most important association to collaborate with in relation to the training of HVAC is the Hungarian Coordination Association for Building Engineering (Magyar Épületgépészeti Koordinációs Szövetség).

4.3 Netherlands

Due to the economic growth, there is a lack of capacity on the market. Blue-collar workers usually lack time to participate especially in longer trainings. Within the previous BUILD UP Skills project, BUStoB ISSO developed an e-learning platform on nZEB ventilation for blue-collar workers. Part of the strategy will be to use this free e-learning tool to motivate those workers to focus more on further professional development.

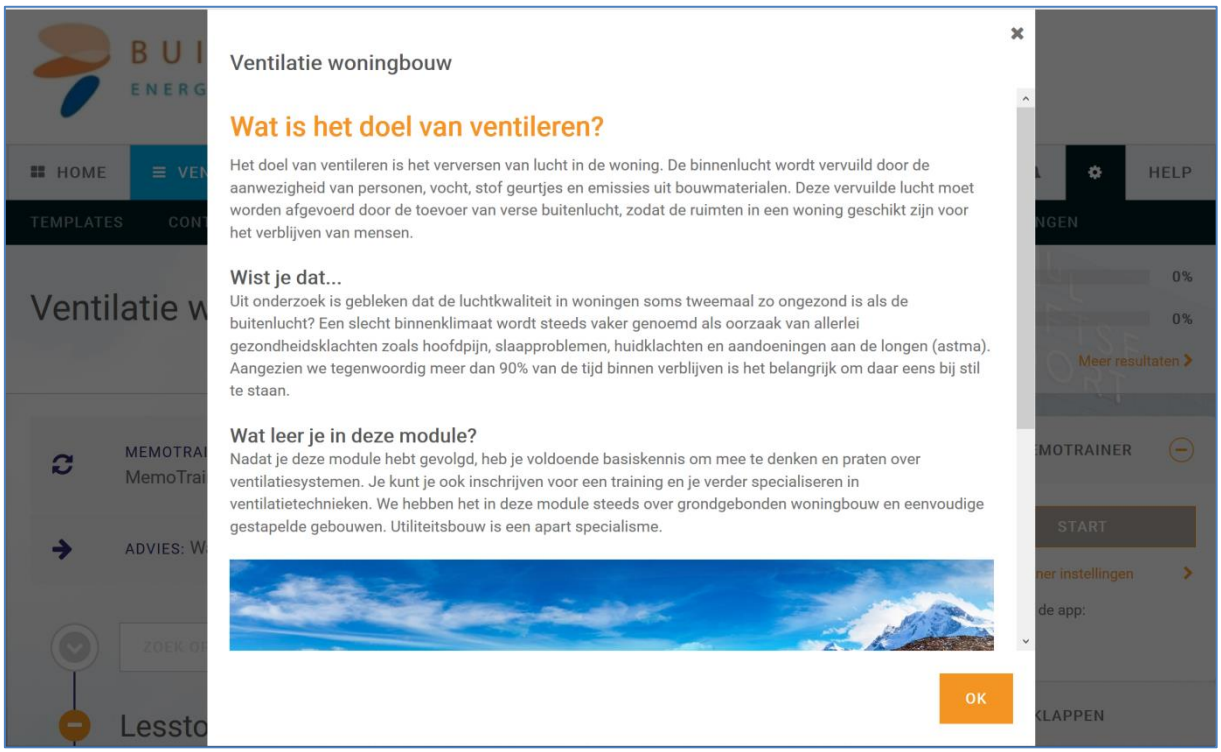

Figure 1: Introduction to the BUILD UP Skills e-learning module on ventilation

As a part of this approach the BUILD UP Skills advisor app will be used to provide interested craftsmen with an actual overview of available courses and several learning interactions in which the user can learn from actual situations. The following screenshots represent a small overview.

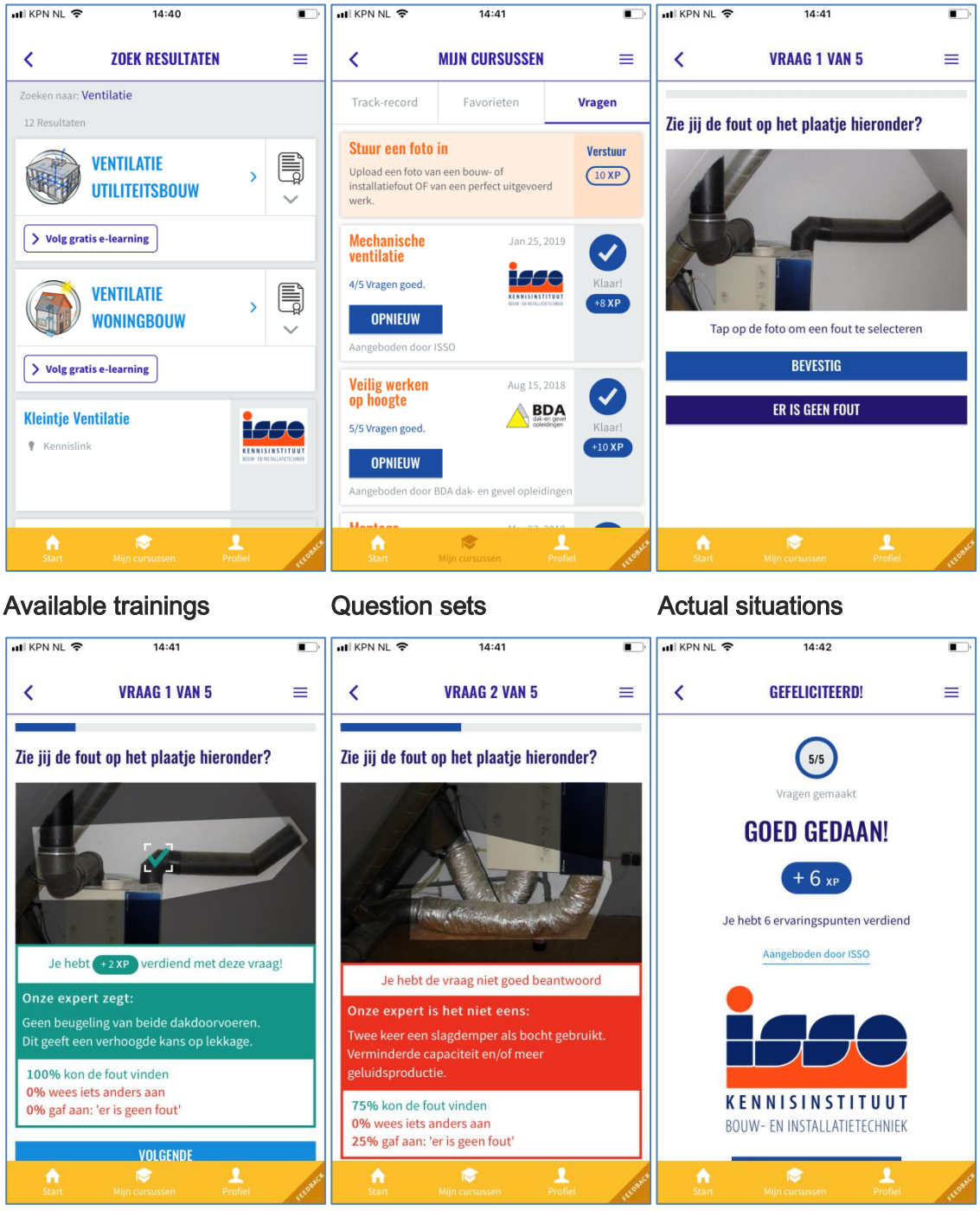

Figure 2: Overview of the BUILD UP Skills advisor app functionality

Additionally, blue-collar workers need to be informed about the benefit of participating in trainings and continuously improving their skills and updating their knowledge.

Manufacturer and trading companies are key actors in this process, since they have ties with numerous actors of the construction field, including contractors, building owners and also skilled workers. At the same time, they are stakeholders who will benefit from a more skilled workforce which will ensure that their products will be installed correctly. One or more stakeholder meetings will be organized during the further preparation of the train-the-trainer event with the objective to explore the possibilities to cooperate. In the Netherlands, there is an increasing demand in performance contracting. For a fixed fee per month the manufacturer guarantees the operating of the installation for ten to twenty years. There is an even a new law that enables housing corporation to ask for a fixed fee for heating, ventilation and cooling, and electricity. Quality of works then becomes much more important and could be an interesting driver for training.

Professional associations are also relevant and significant actors in promoting the benefit of skilled craftsmen and high quality trainings. Collaboration possibilities will be explored with Techniek Nederland (branch organization for HVAC installers) and the VLA (branch organization for manufacturers and suppliers). Together with these two large networks the Dutch team will further explore the possibilities to strengthen the new recognition of design, installation and maintenance of ventilation systems in houses and residential buildings.

Practical demonstrations

In Heerhugowaard a consortium of which TNO[5] was a partner developed a demonstration building ("NeroZero") to demonstrate and evaluate new ventilation concepts and total quality in residential buildings. Results from this project will be used to create further awareness and attractive user stories.

[5] https://www.tno.nl/en/

Figure 3: Demonstration site NeroZero in Heerhugowaard (Source: ISSO)

The project will be upscaled to a 42-dwelling project in June. Performance contracting is planned to be part of the contract. Adequate training will then be an important topic for this project.

Cooperation with special interest magazines for craftsmen

In the Netherlands several special interest magazines for craftsmen are on the market. Part of the strategy in the Netherlands is to explore possibilities to cooperate with them. The most suitable ones are Installatiezaken, Gawalo, Intech K&S and Henk & Fred.

4.4 Slovakia

The BUS StavEdu project has shown that there is considerable demand for the training of installers of ventilation in nZEB buildings and in energy renovations aimed at nZEB standard (as it soon will required by law also for private dwellings). This demand was triggered by complaints of customers and negative image of energy renovations due to considerable problems with moisture accumulation and consequent indoor air quality and impact on health. These were caused by lack of quality delivered in energy renovations. With stricter regulatory requirements on the energy performance of buildings, the pressure of customers is increasing. This is the market opportunity for the project to market the needed training.

The training demand has been noticed both from self-employed craftsmen and construction companies. The key to success is to offer the training during off-peak periods in the construction cycle (for example during winter time).

The general course on ventilation (as part of the HVAC training program) provided by the BUS StavEdu project helped UVS and ZSPS to build contacts to reach the target group of the craftsmen.

The implementing organization will be Ústav vzdelávania a služieb (UVS) that is supporting the Association of Construction Entrepreneurs of Slovakia (ZSPS) in ensuring the needed skills in the construction sector in Slovakia.

The supporting organizations for the StavEdu qualification and training scheme cover all key regions of Slovakia:

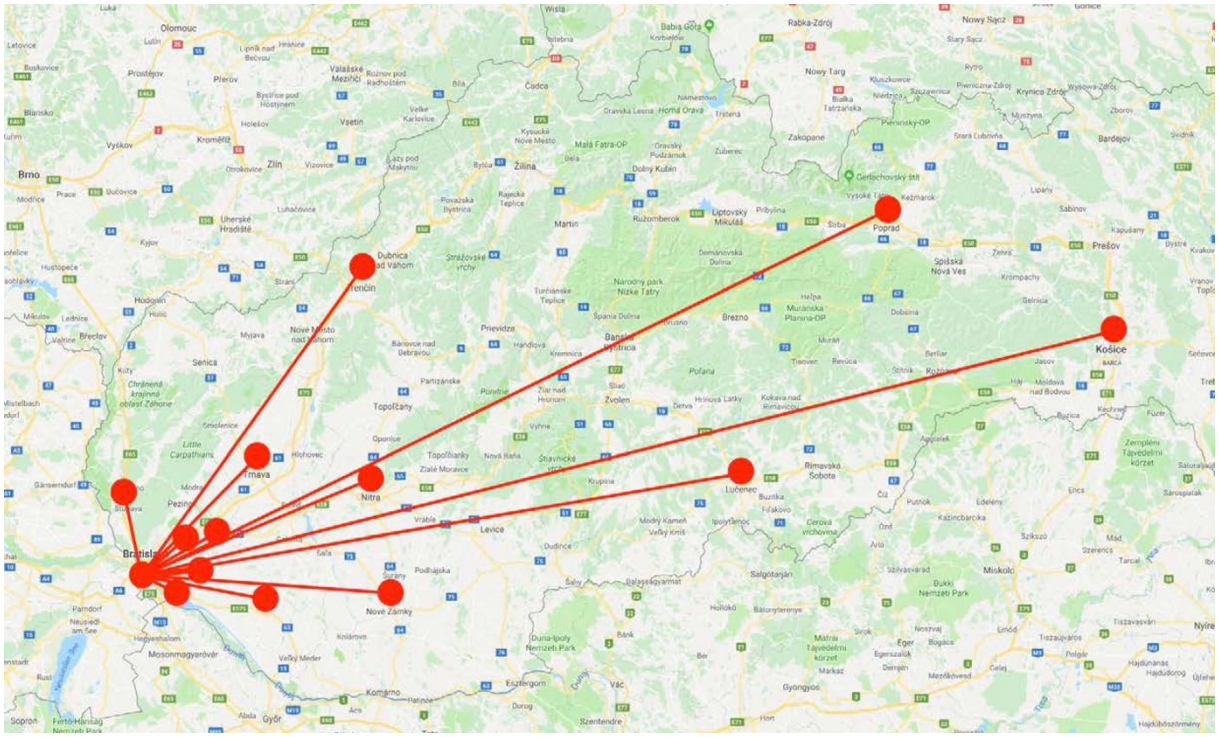

Figure 4: Map of the location of supporting organizations

The target groups will be reached through the network of members of ZSPS, which are the key employers in the Slovak construction sector, and through the portal education.sk that is a marketing tool available for offering training for all craftsmen and professionals in Slovakia.

The drivers of the demand will be the two following:

- Requirements for energy performance of buildings in Slovakia and the relevant requirements on quality of public works;
- Regulation of the construction trade requiring relevant qualification for receiving license (bill pending in the Slovak parliament).

The new modules for ventilation will be implemented as a new further training program, as SC10 of the StavEdu scheme. It will complement the existing program SC6 that already covers the topic to a large extent by providing more details that relate to nZEB and energy renovations towards nZEB standards.

To identify trainers eligible for the trainer course, the network of instructors established by StavEdu has been used. UVS and ZSPS have already started recruitment of targeted

craftsmen for the training by contacting employers and craftsmen through the above-mentioned networks.

Table 10: Key implementing organizations in Slovakia

NR	ORGANIZATION
1.	Ústav vzdelávania a služieb s.r.o. Bratislava
2.	Stredná odborná škola stavebná and školiace stredisko Nitra
3.	Stredná odborná škola stavebná Nové Zámky

ABOUT NEWCOM

NEWCOM sets up large-scale professional qualification and certification schemes for of blue-collar workers and building professionals. The special focus is on the mutual recognition between different European Member States. These schemes will enable the building workforce to be qualified for the construction, renovation and inspection of the nearly zero-energy buildings 2020.

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