



Dedicated to stimulate demand for sustainable
energy skills in the construction sector

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Report:	D2.4 Qualification for the recognition of energy efficiency skills
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Partners involved:	UT, IRI-UL, PF, EnE, BCC, IVE, LIT, IGBC, AEA



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CHANGE RECORDS

Version	Date	Author	Changes
Version 0.1	30-11-2020	Jan Cromwijk	First draft to get started
Version 0.2	7-1-2021	Jan Cromwijk	Added insights based on analysis of competence examples in NL
Version 0.3	15-2-2021	Jan Cromwijk Leticia O	Adopted planning to reality Added first Spanish results
Version 0.4	29-3-2021	Lis O'Brien Benny McDonagh	Added Irish results
Version 0.5	23-4-2021	Jan Cromwijk	Added ethnographic insights from D2.3 Drafted the underpinning of the EE-skills qualification
Version 0.6	27-04-2021	Lis O'Brien	Reviewed Irish section and Structural choices
Version 0.7	28-04-2021	Georg Trnka and Naghmeh Altmann	Added input from Austria
Version 0.8	3-05-2021	Jan Cromwijk	Reviewed input from Austria and Ireland. Started composing the Summary as input for T2.4
Version 0.81	06-05-2021	Jan Cromwijk	Added the definitions section
Version 0.82	31-05-2021	Jan Cromwijk	Processed changes proposed by Ireland
Version 0.9	21-06-2021	Jan Cromwijk	Final edition and proofreading
Version 0.91	30-06-2021	Domen Bančič	Proofreading
Version 0.92	14-07-2021	Loes de Jong	Proofreading
Version I	16-07-2021	Jan Cromwijk	Processed feedback from the proofreaders, published version I

SUMMARY

BUSLeague is dedicated to stimulate demand for sustainable energy skills in the construction sector. In order to stimulate demand the BUSLeague project designs a qualification on Energy Skills that is fit for Recognition of Energy Skills. On the one hand, to use this recognition in order to stimulate the demand for properly skilled nZEB and retrofitting teams; for example in asking those recognitions in legislation, procurement procedures and financing schemes. On the other hand, to facilitate upskilling providers such as training institutes to deliver practical and effective upskilling that counts. This in order to adequately fill in the stimulated demand and to prove the effectiveness of structured and pro-active upskilling.



Fig 1: The BUSLeague approach to stimulate demand for upskilling

For effective improvement of the built environment (both new and existing buildings) to nZEB standards all actors in the value chain need to have a proper, transparent and up-to-date set of knowledge, skills and competences. Goal of the BUSLeague qualification for recognition of Energy Skills is to provide this.

In this document the BUSLeague team working on the qualification for recognition of Energy Skills has documented their quest on finding out the right approach, scope and its contents. Our quest starts with a desk research into the actual state of play and a study of (lighthouse) examples found both at national and EU-level. In addition, the team retrieved lessons learned, perceptions and expectations on the recognition of Energy Skills from the ethnographic research done in another important task of BUSLeague.

Based on the input from the desk research, this document elaborates and illustrates a methodical approach as well as the outline and scope for composing the Energy Skills qualification. It also includes an overview of the main tasks defined as part of the Energy Skills qualification. The detailed BUSLeague Energy Skills qualification itself is provided in Excel and as a database within the BUILD UP Skills advisor maintenance environment (the Unit of Learning Outcomes database).

Definitions

Term	Meaning
Energy Skills	A high quality up-to-date set of knowledge, skills, and competences that enables effective improvement of the built environment (both newbuilds and renovations) to nZEB, this as part of the energy transition.
Recognition	Acknowledgement of the existence, validity, or legality of something When a person receives recognition for the things that they have done, people acknowledge the value or skill of their work (www.collinsdictionary.com)
Accreditation	If an educational qualification or institution is accredited, it is officially declared to be of an approved standard (www.collinsdictionary.com). <i>In the context of this deliverable accreditation means that a training provider can be accredited in order to give trained persons a form of recognition that counts (that is widely and objectively recognized as valid and valuable). How much it will count and how formal it will be, will vary from country to country as governance structures and appreciation of recognition differ substantially. For personal certification independent Certification bodies can accredit personnel certification bodies (such as exam/assessment providers) to ISO/IEC Standard 17024.</i>
European Qualification Framework (EQF)	Common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems. (COUNCIL RECOMMENDATION of 22 May 2017 (2017/C 189/03))
Certification	The act of certifying or state of being certified (www.collinsdictionary.com) <i>In the context of this deliverable certification means a formal certificate following a ISO/IEC Standard 17024 accredited process.</i>
ISO/IEC 17024	Conformity assessment - General requirements for bodies operating certification of persons is an International Standard which specifies criteria for the operation of a Personnel Certification Body (also known as a certification body for persons). The standard includes requirements for the development and maintenance of the certification scheme for persons upon which the certification is based (https://en.wikipedia.org/wiki/ISO/IEC_17024).
Unit of Learning Outcome	The 2008 EQF recommendation defines learning outcomes as ‘...statements of what an individual should know, understand and/or be able to do at the end of a learning process’. ULO’s are statements regarding what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and attitude (reflected in responsibility and autonomy).
Competence	The ability of an individual/organisation to do something effectively. It consists of a cluster of attitude, related abilities, commitments, knowledge, and skills that enable a person (or an organization) to act effectively in a job or situation.

	The competence description is always worded as a result somebody can take responsibility for. Competence addresses 'responsibility and autonomy' it is the ability of the learner to apply knowledge and skills autonomously and with responsibility.	
Skill	<p>Something a person needs to be able to do/perform in order to reach a certain result.</p> <p>To have a 'skill' or to be 'skillful' signifies the ability to use know-how to complete tasks and solve problems. These can be cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).</p> <p>Ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).</p>	
Knowledge	<p>'Knowledge' is the body of facts, principles, theories, and practices that is related to a field of work or study.</p> <p>Know-how you need to know by 'head' in order to perform a task as efficient and effective as possible.</p> <p>In the context of the EQF, knowledge is described as theoretical and/or factual.</p>	
Skill-level (PROF/TRAC)	0	Not applicable / no knowledge and skills required
	1	Has little knowledge and skills with respect to the relevant field / technology (mostly <i>outside</i> the own field of expertise). Understands basic principles and is able to take part in project team discussions.
	2	Understands basic knowledge and has practical skills within the field / technology, is able to solve simple problems by selecting and applying basic methods, tools, materials and information (mostly <i>outside</i> the own field of expertise).
	3	Has comprehensive, factual and theoretical knowledge and skills within the field / technology, is capable of solving standard problems within the field.
	4	Has advanced knowledge involving a critical understanding of theories and principles and skills, required to solve complex and unpredictable problems in the field and is aware of the boundaries.
	5	Has specialized knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields.
Multilayered qualification	A multilayered qualification is a description of tasks that have to be performed to be effective. It consists of a layer with basic tasks and one or more layers of context specific layers. Examples of context specific layers can be: nZEB related tasks, BIM-related tasks or Indoor air quality (IAQ) tasks.	
Occupation	An occupation is a job or profession.	
Profession	A profession is a specialized occupation characterized by profession specific education and training.	
Qualification	A pass of an examination or an official completion of a course, especially one conferring status as a recognized practitioner of a profession or activity.	

Qualification document	<p>A qualification file describes what a participant in education should know and master at the end of a (intermediate vocational training) course.</p> <p>A qualification file describes the level of starting professional workers (school leavers).</p>
Qualification structure	<p>A formal system describing qualifications.</p> <p>It makes visible which qualifications or sets of competences are sought by the labour market, education and society to secure a job, start further studies or participate in society.</p>
Building stages & RIBA	<p>A building life-cycle consists of several stages. The RIBA Plan of Work is the definitive UK model for the building design and construction process.</p> <p>https://www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work</p>
Task	<p>A piece of work / an activity to be done or undertaken.</p>
Subtask	<p>An activity that is part of a certain task at a subordinate level. Individual subtasks can be linked to multiple tasks.</p>

I Task descriptions & related projects

In order to get a clear view and a common understanding hereby an overview from the BUSLeague grant agreement of the tasks related to the compilation and validation of a qualification for recognition of energy skills. This deliverable covers the results of Task 2.3; which results will be validated in T2.4 and serves as content in T2.5.

I.1 Task 2.3 Compile qualification for recognition of energy skills

Task leader: ISSO (2)

Partners involved: UT(0,5), IRI-UL(0,5), PF(1), EnE(0,5), BCC(0,5), IVE(1), LIT(0,5), IGBC(0,5), AEA(0,5)

1. Based on initial results from Ireland and gathered experience in the other countries involved, a qualification for recognition of energy skills will be composed.
2. The methodology co-developed in NEWCOM and BIMplement, and Unit of Learning Outcomes (ULO) database will be used to do so. This means that for each relevant aspect on 'Energy Skills', tasks will be inventoried and allocated to specific professions.
3. After approval by the consortium, descriptors will be further worked out into ULO's, including competence, skills and knowledge.
4. IRI-UL will internally review the developed qualification to ensure it matches with the outcomes of the ethnographical research. UT and LIT will assess the didactical quality of the qualification.

The result will be a flexible recognition based on a task-based qualification, digitally available and mutually recognizable. In this deliverable (D2.4) the process followed the scope and the tasks addressed are compiled. The Digital available EE-skills qualification including detailed Unit of Learning Outcomes will become available after processing the stakeholder feedback and input gathered in T2.4.

I.2 Task 2.4 Market validation of the compiled qualification for recognized energy efficiency skills

Task leader: IVE (1)

Partners involved: ISSO(0,5), AVE(0,5), BCC(0,5), BH(0,25), IGBC(0,5), AEA(0,5)

The compiled qualification mechanisms will be presented and discussed in at least 3 small focus group sessions (2-10 persons) per country by M9, where all key stakeholders should be represented E.g. homeowners, public sector, financial entities and suppliers. The focus group will carry out qualitative research consisting of interviews about their perceptions, opinions, beliefs, and attitudes towards a product, service, concept, advertisement, idea, or packaging. Results gathered will be discussed in an online round table working session with all consortium partners involved at M12 and the final qualification will be published. The final deliverable on Market Validation will include: activities and outputs including design of participation incentives, focus groups guidelines, focus groups discussions, round table presentations and functioning design, and round table minutes.

The result will be 'D2.5 Recommendations and adapted qualification Report'

I.3 Task 2.5 Preparing for Personal and Mutual Recognition

Task leader: LIT (1)

Partners involved: ISSO(0,5), AVE(0,5), BCC(0,5), IVE(0,5), AEA(0,5)

This task is to prepare the implementation of personal and mutual recognition between member states on energy skills. The practical implementation processes, governance structures, GDPR compliance and IT requirements for implementation of the developed recognition in each member state, will be inventoried and assessed on their usability. For the IT-element our aim is to build upon the systems delivered by the ongoing H2020 project NEWCOM and the BUILD UP Skills advisor-app. This includes a mobile application to locate and recognize the "skilled" workforce for the demand side. In order to establish personal recognition in each country based on the outcomes of the inventory, a draft process for assigning and storing personal recognition will be developed at M12 as preparation for implementation in Task 4.6.

The result will be 'D2.6 Report on defining personal recognition for each country'

2 Development of the qualification for recognition of energy skills

For development of the qualification for recognition of energy skills the following activities have been performed. Gathering and assessing existing experience and qualification examples from EU [paragraph 2.1] and national contexts [paragraph **Fout! Verwijzingsbron niet gevonden.**]. Selecting and outlining relevant recommendations from the BUSLeague ethnographic research, both at national and generalized at EU level [paragraph 2.3]. Application of methods to compose qualifications building upon PROF/TRAC, BIMplement and NEWCOM leading to conclusions for scope and format of BUSLeague QF [paragraph 2.4]. And closing task 2.3 and this deliverable with an overview of the main tasks and key subtasks of the EE-skills qualification in [paragraph **Fout! Verwijzingsbron niet gevonden.**].

2.1 Existing experience and qualification examples at EU level

As a first step the BUSLeague consortium gathered and assessed existing experience and qualification examples. For investigating synergy with other projects connections have been made to:

Project Title	Connection
Train4Sustain	connection by Jan Cromwijk
Circle Economy NL-EU	7 Key Elements
PROF/TRAC	connection by Jan Cromwijk
NEWCOM	connection by Jan Cromwijk and Georg Trnka
Instruct	connection provided by Dragomir Tzanev
nZEB roadshow	connection by Dragomir Tzanev, nZEB roadshow will review all drafts
CraftEdu	connection by Dragomir Tzanev
Fit-to-NZEB	connection by Dragomir Tzanev
BIMCert	connection by Lis O'Brien
BIMzeED	connection by Lis O'Brien
Construction Blueprint	connection by Lis O'Brien
Health and Safety Blueprint	connection by Lis O'Brien
Heatpump4All	connection by Lis O'Brien
NSS Ireland	connection by Lis O'Brien
BUNRs Ireland A first analysis is done on the basis of 'KeyRenovationSkills_V2.0.xlsx'	connection by Marion Jammet, Alice Ryan, and Lis O'Brien

2.1.1 Train4Sustain

The Train4Sustain project works on establishing future-oriented training and qualification quality standards for fostering a broad uptake of sustainable energy skills in the European construction sector. They delivered a Competence Quality Standard (CQS) for a common understanding of sustainable energy skills (D2.2). The CQS allows the evaluation, scoring and reporting the level of competence of professionals, workers with regards to specific Areas of Expertise related to sustainability at building and urban scale. The main reference for the methodology development has been the European Qualification Scheme developed by the H2020 PROF/TRAC project and it is being expanded in TRAIN4SUSTAIN project to include new topics and new professions. The CQS has been structured in modules and hierarchic levels, reflecting the structure of the most relevant sustainability certification systems at building and urban scale and in relation to the recent Level(s) framework of core sustainability indicators issued by European Commission in October 2020. It allows to map existing qualifications and trainings in relation to building constructions, building energy efficiency and sustainability at national and transnational level and to integrate them in the system through the identification of the Learning Outcomes provided.



The CQS works with a framework of 4 Dimensions (hierarchic level 1) and a set of Thematic Fields (hierarchic level 2).

Environment	Society	Economy	Process
E – Energy	C – Comfort and well being	Q – Economical Quality	D - Building Design
W – Water	S – Safety		Z - Urban Design
M – Materials	A – Accessibility		I – Innovative digital solutions
H - Habitat	O – Mobility		T – Sustainable construction
	F – Services		U – Maintenance and operating
	R – Adaptation to climate change		N - Commissioning
			P – Sustainability Certification Systems
			K – Interdisciplinary Skills

Fig 2: Train4Sustain CQS Dimensions and Thematic Fields

The third hierarchic level are the Macro-Areas of Expertise that represent a particular aspect pertaining to the Thematic Fields. An example of Macro Areas of Expertise in the Energy Thematic Field:

Dimension	Environment
Thematic Field	E - Energy
Macro-Area of Expertise	EM - Energy Management EP - Energy Production ER - Energy Reduction
Thematic Field	W - Water
Macro-Area of Expertise	WE - Water Efficiency WM - Effluents Management WS - Sustainable Drainage
Thematic Field	M - Materials
Macro-Area of Expertise	MD - Design for Deconstruction, reuse and recycling MS - Sustainable Materials MW - Construction Waste
Thematic Field	H - Habitat
Macro-Area of Expertise	HL - Land Use HB - Biodiversity

Fig 3: Train4Sustain Macro-Areas of Expertise

The fourth hierarchic level of the framework are the Areas of Expertise that represents the specific topics contained in each Macro Area of Expertise. An example of Areas of Expertise in the Macro Area “Quality of Air”:

Dimension	Society
Thematic Field	C - Comfort
Macro Area of Expertise	CQ - Quality of Air
Area of Expertise	CQ1 - Low Emitting Materials CQ2 - Natural Ventilation CQ3 - Mechanical Ventilation CQ4 - Radon

Fig 4: Train4Sustain Macro-Area of Expertise

The fifth and lowest hierarchic level of the CQS are the Learning Outcomes (LO). An example of Learning Outcomes in the Area of Expertise “CQ3 - Mechanical Ventilation”:

Dimension	Society
Thematic Field	C - Comfort
Macro Area of Expertise	CQ - Quality of Air
Area of Expertise	CQ3 - Mechanical Ventilation
Learning Outcome	CQ3.1 - Understand ventilation systems in relation to energy performance
	CQ 3.2 - Understand basic design principles of ventilation and IAQ systems.
	CQ 3.3 - Advise on required IAQ
	CQ 3.4 - Investigate and select fitted ventilation systems
	CQ 3.5 - Perform energy calculation of ventilation systems
	CQ 3.6 - Advise on natural ventilation for (summer) night cooling
	CQ 3.7 - Engineer a ventilation system
	CQ 3.8 - Specify a ventilation system in tender contracts
	CQ 3.9 - Quality assurance of a ventilation system according to tender contract

Fig 5: Train4Sustain Learning Outcomes

In TRAIN4SUSTAIN Competence Quality Standard, Learning Outcomes are described in terms of knowledge and skills. An example of “Knowledge” and “Skill” describing the Learning Outcomes of the Area of Expertise “ERI - Insulation”:

Dimension	Environment	
Thematic Field	Energy	
Macro area of Expertise	ER - Energy Reduction	
Area of Expertise	ER1 - Insulation	
Learning Outcome	Knowledge	Skill
Understand the importance of thermal insulation.	Has general knowledge on thermal insulation. Understands the basic concept of energy conservation.	Is able to take part in discussions within a project team. Is able to keep in consideration constraints and boundary conditions related to thermal insulation.
Understand the importance of health and safety issues regarding the installation of thermal insulation	Has knowledge on concepts of health and safety issues regarding the installation of thermal insulation.	Is able to keep in consideration health and safety issues regarding the installation of thermal insulation.
Select the suitable material for thermal insulation	Has knowledge on the insulating materials and their properties. Has general overview of insulation products available on the market, their requirements and possibilities, including advantages and disadvantages.	Is able to select the most suitable material for thermal insulation in relation to constraints and boundary conditions (regulations, type of building, type of insulation technique, etc.)
Perform the installation of thermal insulation on different types of building elements, using different types of techniques and different materials available on the market	Has knowledge on different techniques/ systems for correct installation of insulation materials.	Is able to select the most suitable system/technique for thermal insulation in relation to constraints and boundary conditions (regulations, type of building elements, etc.). Is able to install thermal insulation material using different types of systems/techniques and material available on the market.

Fig 6: Train4Sustain Learning Outcomes of the Area of Expertise “ER1 - Insulation”

Besides this, the Train4Sustain projects adopted and optimized the PROF/TRAC skill-levels. The levels of competence used in the TRAIN4SUSTAIN CQS are.

1	Has little knowledge and skills with respect to the thematic area. Understands basic principles and is able to take part in project team discussions
2	Understands basic knowledge and has practical skills within the thematic area, is able to solve simple problems by selecting and applying basic methods, tools, materials and information.
3	Has comprehensive, factual and theoretical knowledge and skills within the thematic area, is capable of solving standard problems within the field
4	Has advanced knowledge involving a critical understanding of theories and principles and skills, required to solve complex and unpredictable problems in the field and is aware of the boundaries
5	Has specialized knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields

Fig 7: Train4Sustain optimized PROF/TRAC skill-levels

Each Learning Outcome in the Areas of Expertise is associated to a competence level. This information specifies for which levels of competence each Learning Outcome is needed. The value associated to each Learning Outcome will depend on its degree of specialisation.

Dimension	Environment		
Thematic Field	Energy		
Macro area of Expertise	ER - Energy Reduction		
Area of Expertise	Insulation		
Learning Outcome	Knowledge	Skill	Level of competence
Understand the importance of thermal insulation.	Has general knowledge on thermal insulation. Understands the basic concept of energy conservation.	Is able to take part in discussions within a project team. Is able to keep in consideration constraints and boundary conditions related to thermal insulation.	1
Understand the importance of health and safety issues regarding the installation of thermal insulation	Has knowledge on concepts of health and safety issues regarding the installation of thermal insulation.	Is able to keep in consideration health and safety issues regarding the installation of thermal insulation.	2
Select the suitable material for thermal insulation	Has knowledge on the insulating materials and their properties. Has general overview of insulation products available on the market, their requirements and possibilities, including advantages and disadvantages.	Is able to select the most suitable material for thermal insulation in relation to constraints and boundary conditions (regulations, type of building, type of insulation technique, etc.)	3
Perform the installation of thermal insulation on different types of building elements, using different types of techniques and different materials available on the market	Has knowledge on different techniques/ systems for correct installation of insulation materials.	Is able to select the most suitable system/technique for thermal insulation in relation to constraints and boundary conditions (regulations, type of building elements, etc.). Is able to install thermal insulation material using different types of systems/techniques and material available on the market.	4

Fig 8: Train4Sustain Learning Outcomes linked to skill-levels

In the TRAIN4SUSTAIN CQS, each Learning Outcome is associated to one or more professions.

Dimension	Environment
Thematic Field	Energy
Macro area of Expertise	ER - Energy Reduction
Area of Expertise	Insulation
Learning Outcome	Profession
Understand the importance of thermal insulation.	All
Understand the importance of health and safety issues regarding the installation of thermal insulation	AR - Architect ME - Mechanical Engineer, Energy Engineer EN - Building Energy Consultant SB - Sustainability Consultant C - Manager of building process II - Insulation Installer
Is able to install a thermal coat according to best practice	II - Insulation Installer

Fig 9: Train4Sustain Learning Outcomes linked to professions

With as a final result the following overview including the ULO, project stages, knowledge, skill, level of competence, scale and professions involved.

Area of Expertise	Learning outcome (LO)	Stage of the project	Knowledge	Skill	Requested for the levels of competence					Scale	Profession
					1	2	3	4	5		
CV1	Understand the importance of daylight to contribute to the comfort and well-being of building occupants	Conceptual design	Has a general knowledge of the benefits of daylight and the main design strategies applicable at the building level	Can take part to the discussion in a project team being able to discuss basic principles and design strategies for daylight spaces	1	2	3	4	5	B	SC
		Detailed design			1	2	3	4	5		AR
											BEC
CV1	Learn recognized metrics to assess the daylight availability inside a building	Conceptual design	Has a basic knowledge of recognized standards, criteria and methods to assess and verify the daylight availability and glare probability inside a building	Can take part to the discussion with design team and Daylight specialist to guide strategies and documentation submission in compliance with LEED requirements	-	-	3	4	5	B	SC
		Detailed design									AR
		In Use									CE
PL1	Learn advanced strategies to guarantee connection to the natural outdoor environment	Conceptual design	Has a basic knowledge of strategies and assessment criteria to guarantee connection to outdoor environments by providing quality views	Can take part to the discussion with design team and space planning specialist about strategies to guarantee quality views for occupants as recognized by LEED	-	-	3	4	5	B	SC
		Detailed design									AR
		In Use									

Fig 10: Train4Sustain overview of the full model

2.1.2 Circle Economy: 7 Key Elements

A Dutch organisation that works worldwide has crafted an overview of [7 Key Elements for the circular economy](#) and elaborated each Key Element into several general key competences.



Several of these key elements and key competences are focusing on Energy Efficiency Skills. Besides that also several key elements and key competences can be translated one-on-one from circularity to energy skills. This is done by adding the 'Energy'-elements in blue.

A few examples:



Prioritise regenerative resources

Ensure renewable, reusable, non-toxic resources are utilised as materials and energy in an efficient way.

- Replace energy sources with less impactful alternatives and enact energy efficiency measures
 - o Convert fossil-fuel based operations to electric (electrification)
 - o Enact measures that optimise energy use (energy efficiency)
 - o Use renewable energy like solar, wind, etc. or renewable fuels like biomass, etc.



Use waste as a resource

Utilise waste streams as a source of secondary resources and recover waste for reuse and recycling.



Rethink the business model

Consider opportunities to create greater value and align incentives through business models that build on the interaction between products and services.



Design for the future

Account for the systems perspective during the design process, to use the right materials, to design for appropriate lifetime and to design for extended future use.



Collaborate to create joint value

Work together throughout the supply chain, internally within organisations and with the public sector to increase transparency and create joint value.

- Industry peers to industry peer collaboration to create joint value and identify synergies.
 - Put in place purchasing guidelines for procurement departments and evaluating suppliers on [sustaining the built environment](#) principles
 - Work together with stakeholders and parties in other unrelated industries to implement [sustaining the built environment](#) strategies and opportunities
 - Engage in discussions with industry stakeholders to share [sustaining the built environment](#) best practices and push the industry towards greater [impact in sustaining the built environment](#)
 - Work together with industry peers to engage in business activities or exploratory projects that advance [the state of art in sustaining the built environment](#)
- Engage and guide customers and consumers to ensure circular use of products.
 - Work together with customers to jointly create *concepts, products and services* fit for them
 - Engage in discussions with customers to educate and raise awareness on [sustaining the built environment](#) and explore [sustaining](#) opportunities together
 - Create or participate in specific programmes or initiatives to help customers become more [involved in sustaining the built environment](#)
 - Allowing customers to alter and modify certain features of the [sustaining offer](#)



Incorporate digital technology

Track and optimise resource use and strengthen connections between supply chain actors through digital, online platforms and technologies that provide insights.

- Employ technologies to gather and analyse data to provide insights on resource use
 - Install sensors to gather data from products and services to identify, enable and/or implement [sustaining measures](#)
 - Utilise data and models to identify, enable and/or implement [sustaining measures](#)
 - Connect products and services into the internet of things to identify, enable and/or implement [sustaining measures](#)
 - Employ artificial algorithms and robotics to identify, enable and/or implement [sustaining measures](#)

2.1.3 Health and Safety Blueprint

The [Health and Safety Blueprint](#) project aimed at addressing the training gap on health and safety (H&S) regarding energy efficiency and sustainable materials. From December 2018, the twelve countries involved in Construction Blueprint (Germany, Belgium, Slovenia, Spain, Finland, France, Greece, Ireland, Italy, Lithuania, Poland and Portugal) worked on this line.

The created modules focus on the most common materials and operations, as well as those that workers are most exposed to. The training takes into account materials and operations with higher risks or those that workers are less aware of.

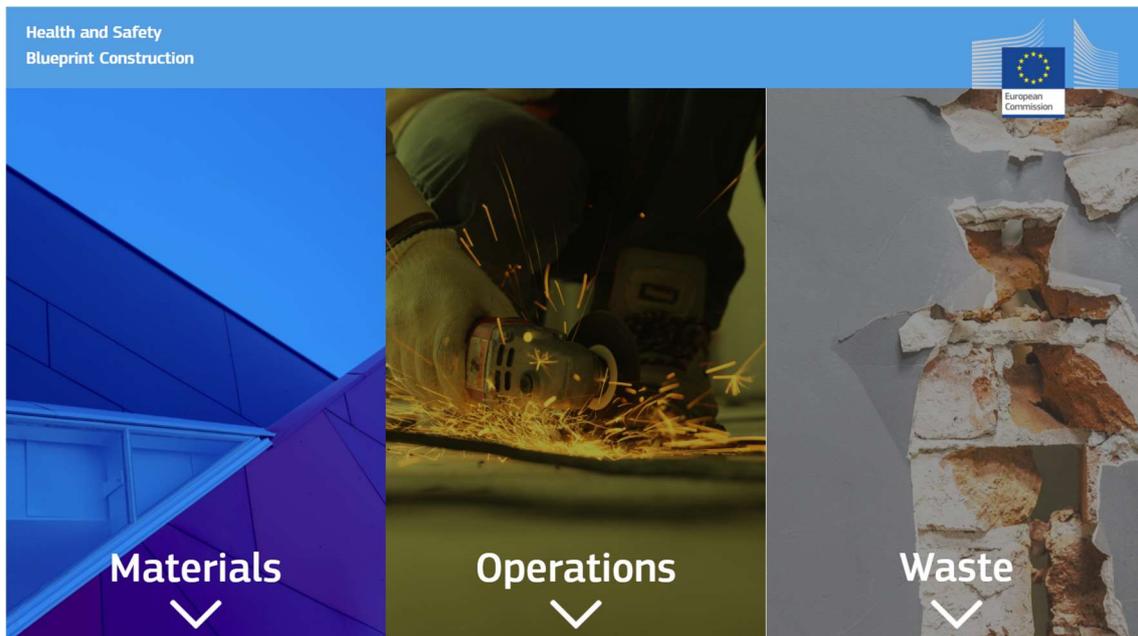


Fig 11: Health and Safety Blueprint Construction

2.1.4 Input from Fit-to-nZEB

Deliverable 2.3 of the Fit-to-nZEB project “[Catalogue of Learning Outcomes](#)” includes compendium of knowledge, skills and responsibilities that the learner is supposed to possess after finishing a Deep Energy Retrofit (DER) training programme at different EQF levels. The catalogue is structured according to 17 topics, chosen by Fit-to-nZEB project partners. The order of the topics in the Catalogue is not connected with their importance or relevance to the field of DER.

In the report were used the following definitions, introduced in the Council recommendation¹:

- “knowledge” means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the EQF, knowledge is described as theoretical and/or factual;
- “skills” means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);
- ”responsibility” and autonomy’ means the ability of the learner to apply knowledge and skills autonomously and with responsibility.

The project partners have included in the catalogue possibly fullest collection of learning outcomes related to DER, a selection of which is to be applied in newly developed training

¹ COUNCIL RECOMMENDATION of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03)

programmes according to the educational plans and specialization of the specific education or training provider. The topics are the following:

Topic 1: Basics of building physics

Sub-Topic 1.1 : Passive house principles

Topic 2: Optimal solar gains

Topic 3: Building Envelope

Sub-Topic 3.1 Thermal insulation

Sub-Topic 3.2 Minimizing thermal bridges

Sub-Topic 3.3 Highly efficient window

Topic 4: NZEB Neighborhoods

Sub-Topic 4.1 Distributed energy production systems and energy management

Sub-Topic 4.2 Energy cooperatives

2.5. Topic 5: Airtightness, vapour and moisture movement, wind tightness

2.6. Topic 6: Building Services

Sub-Topic 6.1 Mechanical Ventilation with Heat Recovery

Sub-Topic 6.2 Heating and Cooling

Sub-Topic 6.3 DHW

Sub-Topic 6.4 Automation – Regulation

Sub-Topic 6.5 Lighting

2.7. Topic 7: Conservation of historic building fabric

2.8. Topic 8: RES in building renovation

Sub-Topic 8.1 Long and short term energy storage

2.9. Topic 9: Cost effectiveness

2.10. Topic 10: Planning and design instruments

2.13. Topic 11: Comfort, health and safety requirements in buildings, incl. indoor air quality

Sub-Topic 11.1 Summer comfort/ passive cooling strategies

Sub-Topic 11.2 Fire protection

2.12. Topic 12: Step-by-step retrofit plans

2.13. Topic 13: Energy efficiency and building renovation policies

2.14. Topic 14: Achieving measurable results

2.15. Topic 15: Engaging stakeholders

2.16. Topic 16: Project management

Sub-Topic 16.1 Quality assurance

2.17. Topic 17: Ecology and Sustainability

Based on the set of learning outcomes and the feedback from the international train-the-trainer activities, model training programmes on deep energy building renovation were developed for:

- higher education establishments specializing in architecture and civil engineering (EQF level 6-7),
- professional high schools for architecture, construction and mechanical engineering (EQF level 4-5), and
- specialized vocational training centers with a focus on hands-on training (EQF level 3).

The programmes are outlined according the project team evaluation of educational gaps and skills needed on the emerging NZEB market and integrate available and newly designed e-learning tools, facilities for practical demonstration and training, and examination programmes, available from the practice of the partner organizations and a set of selected EU projects.

Just as the set of learning outcomes, the model programmes are not a requirement for training and educational institutions, but on the contrary – a reference and even an invitation for re-design by any interested Vocational Education and Training (VET) provider, according to its own training plan and agenda. Thus, encouraging cooperation in the sector by providing a shared and open knowledge base, the project paves the way for future action, targeting mutual recognition of NZEB-related skills and competences among an increasing number of countries.

2.1.5 CraftEdu

The CraftEdu's [Catalogue of Learning Outcomes](#) includes compendium of knowledge, skills and responsibilities that the learner is supposed to possess after finishing CraftEdu training programme. All contents relate to EQF level 3. The catalogue includes 8 Units of Learning Outcomes (ULOs) each for a different construction vocation set in the project documentation and modified by consortium members in the course of workshops and other project meetings of WP2. The occupations are:

- 1) HVAC installer
- 2) Carpenter
- 3) Electrician (High-voltage)
- 4) Installer of windows and doors
- 5) Hydro-insulator (roofs and foundations)
- 6) Electrician (Low-voltage)
- 7) Chimney sweeper – Installation of chimneys and chimney liners
- 8) Chimney sweeper – Inspection technician

Based on the units of learning outcomes, particular training programmes are defined and their parameters set – what is to be learnt, which methods are to be used, how much time is to be spent for each topic and who would sponsor each programme. The developed [curricula for training programmes](#) are relevant to the expected learning outcomes to be acquired by the targeted craftsmen and on-site workers participating in the training relevant in the field energy efficiency (EE) and use of renewable energy sources (RES) of buildings.

As a next result, full documentation for the training programs for targeted craftsmen and on-site workers is developed, using the experience and materials from previous projects (StavEdu, Train-to-NZEB, CrossCraft, Newcom and Fit-to-nZEB). It includes training materials, pedagogical concept, methods and tools that will be used in actual training courses. The documentation is used for developing specialized training courses, including online training courses (e-learnings) using the [CraftEdu electronic database](#).

2.1.6 Erasmus+ BIMzeED

Extensive research and surveys established a number of priority learnings required within the industry in Ireland, Croatia, Hungary and Spain. The developed Learning Units (LUs) can be used as stand-alone online learning, grouped together as a course or integrated into existing curricula at HEI or VET organisations. Competences were defined in the description of the courses. In the BIMzeED project each Learning Unit (LU) provides knowledge and skills competences, as general and also specific to the learning topic. The LUs range from EQF levels 4 to 7 with 8-10 contact hours and 30-40 hours self-directed online learning aimed at the majority of the construction workforce.

LU icons

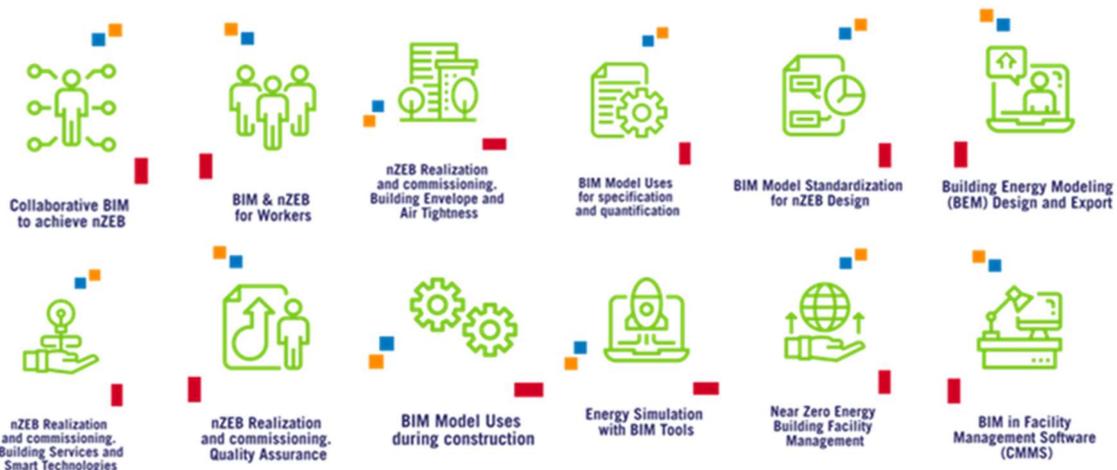


Fig 12: BIMzeED icons of the Learning Units

Learning Unit 1 – Collaborative BIM to achieve NZEB

- Topic 1.1: Introductions
- Topic 1.2: NZEB Fundamentals
- Topic 1.3: BIM Fundamentals
- Topic 1.4: NZEB and BIM
- Topic 1.5: BIM Collaboration

Learning Unit 2 – BIM and NZEB for Workers

- Topic 2.1 - Introductions
- Topic 2.2 - Navigate BIM
- Topic 2.3 - BIM and NZEB Procedures
- Topic 2.4 - Communication and Responsibilities
- Topic 2.5 - Digitalisation on Site
- Topic 2.6 - Personal Development

Learning Unit 3 – NZEB Realization and commissioning: Building Envelope and Air Tightness

- Topic 3.1 – Introductions, required software for LU3
- Topic 3.2 – Basics of building physics, Building envelope & comfort
- Topic 3.3 – Installation of thermal insulation, Windows, Construction damage-failure, Facades in fire, Creating suitable BIM objects
- Topic 3.4 – Thermal bridges & calculation, minimizing thermal bridges
- Topic 3.5 – Airtightness and moisture transport

Learning Unit 4 – NZEB Realization and commissioning: Building Services and Smart Technologies

- Topic 4.1 - Lighting Systems
- Topic 4.2 - Cooling Ventilation Systems
- Topic 4.3 - Heat Pumps and Heating Systems
- Topic 4.4 - Safety Systems
- Topic 4.5 Energy Performance

Learning Unit 5 – NZEB Realization and commissioning: Quality Assurance

- Topic 5.1 - Introduction
- Topic 5.2 - Achieving NZEB Compliance
- Topic 5.3 - Quality controls and Checks
- Topic 5.4 - Certification of Products and Materials

- Topic 5.5 - Coordination of Quality in Construction
- Topic 5.6 - Personal Development

Learning Unit 6 – BIM Model Uses during construction

- Topic 6.1 - Introduction
- Topic 6.2 - BEP on Site
- Topic 6.3 - 3D Coordination
- Topic 6.4 - Deliverables and As-Built

Learning Unit 7 – BIM Model Uses for specification and quantification

- Topic 7.1 - Project Time and Cost Planning
- Topic 7.2 - Structuring BIM project
- Topic 7.3 - Specification, quantification and quality check
- Topic 7.4 - Developing 4D and 5D model

Learning Unit 8 – BIM Model Standardization for NZEB Design

- Topic 8.1 - Project delivery models
- Topic 8.2 - Integrated project delivery
- Topic 8.3 - Effects of BIM on project lifecycle phases
- Topic 8.4 - International standards
- Topic 8.5 - Standardizing data
- Topic 8.6 - Project and office standards
- Topic 8.7 - BIM project deliverables – EIR
- Topic 8.8 - BIM project deliverables – BEP

Learning Unit 9 – Building Energy Modelling (BEM) Design and Export

- Topic 9.1 - Introduction
- Topic 9.2 - Energy Analysis Workflow within a project
- Topic 9.3 - Information within the BIM Model (Autodesk Revit)
- Topic 9.4 - Export to GBXML
- Topic 9.5 - Export to IFC

Learning Unit 10 – Energy Simulation with BIM Tools

- Topic 10.1 - Introductions
- Topic 10.2 - Basics of Simulation features with CAD Systems
- Topic 10.3 - Energy Balance Simulation
- Topic 10.4 - Energy saving option Simulation
- Topic 10.5 - Complex simulation and data-exchange between BIM-capable CAAD systems

Learning Unit 11 – Nearly Zero Energy Building Facility Management

- Topic 11.1 - Introductions
- Topic 11.2 - Facilities Management
- Topic 11.3 - BIM and Facilities Management Integration
- Topic 11.4 - Implementation of BIM for FM
- Topic 11.5 - Digitalised Facilities Management
- Topic 11.6 - Personal Development

Learning Unit 12 – BIM in Facility Management Software (CMMS)

- Topic 12.1 - Introductions
- Topic 12.2 - From As Built to FM Model
- Topic 12.3 - Data Storage of BIM Models
- Topic 12.4 - Data Structure of CMMS
- Topic 12.5 - Relationships Between Databases

2.1.7 VET4LEC

The Vocational Energy Training for Low Energy Construction (VET4LEC) project determined what requirements for Vocational Education & Training VET providers in construction and what Knowledge Skills & Competencies are required in Low Energy Construction (LEC) across 10 countries in Europe. It was also researched to see how these different VET systems could be integrated into initial (IVET) and continuing (CVET) requirements. The Knowledge Skills Competencies, KSC required to implement Low Energy Construction (LEC) was reviewed and recommendations were provided on how to integrate these into initial (IVET) and continuing (CVET)

Table 1: Table 6: LEC KSC covered in VET for envelope occupations: based on examples from Belgium, Germany, Ireland and UK

Knowledge and understanding
<p>Climate change:</p> <ul style="list-style-type: none"> • energy costs and use • environmental protection • building protection
<p>Low carbon building/Energy efficiency and Building physics:</p> <ul style="list-style-type: none"> • principles of energy performance • building envelope • heat retention and loss (season, heat exchange, properties of materials) • air tightness and insulation (types of insulation, consequences of poor insulation, thermal imaging) • thermal bridging (bridge types, measures against thermal bridges) • moisture and ventilation (condensation risks, consequences of poor installation) • window quality and positioning
<p>Low carbon building</p> <ul style="list-style-type: none"> • understanding principles of renewable energy systems and technologies • understanding how heating technologies can be integrated • understand effect that control systems have on heating
<p>Retrofitting: Understanding effect upon building fabric of remedial or new installation work</p>
<p>Whole LEC process: Understanding sequence of works and roles of occupation/dependent occupations and in achieving energy performance required</p>
<p>Efficient resource use and sustainable products</p> <ul style="list-style-type: none"> • understanding water efficiency on site • knowledge of responsibly sourced products and justification for using them • understand principles of materials storage, recycling and re-use opportunities
<p>Legal requirements:</p> <ul style="list-style-type: none"> • knowledge of regulations, rules and standards in low energy construction • EPBD and NZEB • national policies and building Regulations
<p>The example of waste management</p> <ul style="list-style-type: none"> • distinguishing dangerous and non-dangerous products, triage categories, recyclables and disposable materials • categories of disposables and/or disposal procedures with particular reference to asbestos; • importance of role of enterprise in triage and disposal of certain disposables and advantages of doing this;

understanding handling risks and rules for removal of disposables containing asbestos and other dangerous materials
Skills/know-how
Quality awareness: Keeping labels and markings of materials used
<p>The example of waste management</p> <ul style="list-style-type: none"> • protecting environment and oneself and colleagues from harmful materials and substances; • organising sorting methods through trays and containers; • sorting disposables; • identifying and separating from other disposables those containing asbestos and other dangerous materials packing and removing them in secure manner
Efficient resource use and sustainable products: Identify and use sustainable products
Competences (Personal & social)
Displaying conduct, way of thinking and behaviour necessary to practise occupation (e.g., precision, care)
Able to coordinate the sequence of works and occupational roles to achieve necessary energy performance
Able to anticipate the consequences of each intervention for internal climate and overall energy performance
<p>Quality awareness</p> <ul style="list-style-type: none"> • working with care, diligence, precision, attention to detail, with the patience necessary to execute detailed work; • economic attitude in using materials, tools and time; • waste avoidance; • having aesthetic sense and taking into account, where possible, aesthetic aspects of the work; • spirit of autonomy and care for quality; • professional conscience; • clarifying when others carry out poor quality work
<p>Waste management</p> <ul style="list-style-type: none"> • having ecological awareness and awareness of financial consequences of poor management of disposables; • prudence; • being systematic in gathering disposables; • determination to sort disposables; • in case of doubt, to determine destination of disposables; • care; • acting when container full

2.1.8 Erasmus+ Sector Skills Alliance Construction Blueprint

Curricula to be developed which will be mutually recognised across Europe yet provide specialisms to each particular countries' need. Competences will cover sustaining the built environment competences and are worked out in Knowledge, Skills, and Ability. Three curricula will be developed addressing the categories energy efficiency, circular economy and digitalisation and is aimed at EQF levels 3-5.

Online trainings are also to be collected and made available on an Open Educational Resource OER platform for all target groups to carry out self-directed online trainings. On completing these training badges will be issued to be used for CPD or acknowledgement of completion.

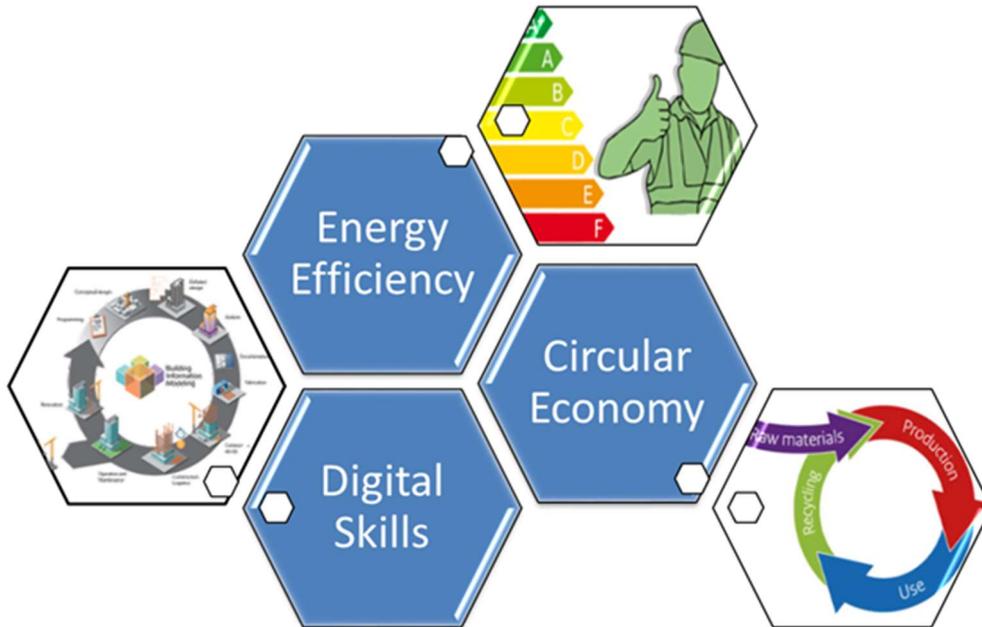


Fig 13: Erasmus+ Sector Skills Alliance Construction Blueprint

2.1.9 Horizon 2020 BIMCert

The BIMCert project developed an e-learning framework and associated learning material based upon a system thinking approach, delivering better results in energy efficiency than traditional methods. In this Framework, competences are defined in process phases and roles of persons involved in these phases, competences are worked out in Knowledge, Skills and Ability, for example:

- Enable learners to develop a fundamental understanding of the use of digital skills for construction sites and office/design role. They should gain:
 - Skills required to ensure they remain relevant and skilled to continue roles, by knowing how to use digital tools and devices.
 - An overview of BIM and digital tools that can improve roles on Site and office-based work too.
 - An overview of BIM workflow that can be used to implement or improve BIM processes within your organisation or business while performance or organising site related work.

Furthermore:

- Understand the use of Digital Skills, including devices, in the construction context, which includes: Explaining the use of digital skills and devices to improve construction project management and delivery; Demonstration of structured file management; Summary of Health & Safety guide using digital devices on site.
- Understand the use of Digital Skills and devices to access information, which includes: Demonstration of ICT file management; using cloud based storage and portable devices to access and exchange information.
- Understand how to implement BIM across the supply chain, which includes: the use of BIM and digital skills to improve coordination across the construction supply chain and for construction project management.
- Understand the use of digital tools to perform design reviews and assess construction feasibility, which includes: Demonstration of digital design review tools to access and evaluate a BIM model

2.1.10 HP4ALL

This project is tasked with determining what are the drivers and barriers that stimulate or restrict the demand for skills related to heat pump system design, installation, commissioning, and ongoing maintenance.

Through through interviews significant, significant challenges were identified for heat pump roll out and the most important actions that can be taken to dramatically scale up the heat pump markets around Europe. Competences to be delivered are:

1. Explain to clients the use of Heat Pump Technology as a sustainable energy solution and its contribution to the reduction of greenhouse gases.
2. Outline the use of safe work practices concerning the installation of domestic heat pump systems.
3. Appraise the relationship between low temperature floor heating systems, wall heating systems and thermal comfort, including controlled building ventilation.
4. Assess the thermodynamic cycle of heat pumps and the components within including their function.
5. Have the ability to calculate the coefficient of performance (COP) and seasonal performance factor (SPF) of a domestic heat pump system.
6. Provide advice to potential customers on the ecological and economic issues relating to domestic heat pump technologies.
7. Apply relevant scientific and mathematical concepts to the specification and design of an efficient domestic heat pump installation with regard to the site, collector heat source, boiler and heat distribution system.
8. Install a domestic heat pump including planning of a system and with regard for Health & Safety, compliance with standards and national building regulations and take overall responsibility for the co-ordination of all aspects of the domestic heat pump installation.
9. Manage the commissioning of a domestic heat pump system, including balancing the mass flow within the heat source and the heat sink and complete the handover of the completed system to the client.
10. Understand the energy principles and the law of thermodynamics, the modes of heat transfer in buildings and benefits of thermal mass and solar gain.

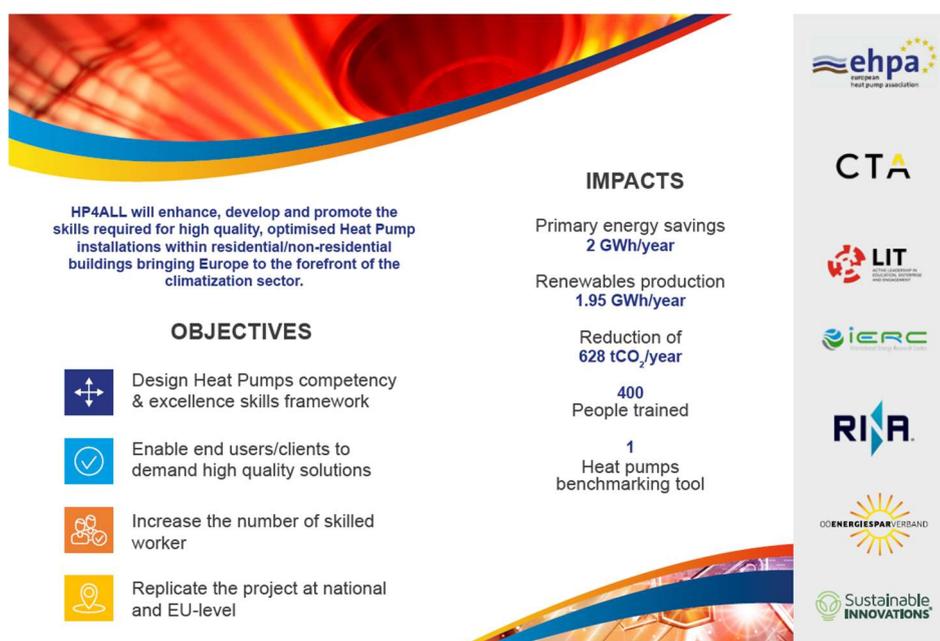


Fig 14: HP4ALL objectives

2.1.11 NEWCOM

The European Union project NEWCOM emerged from the BUILD UP Skills initiative provides solutions to improve and maintain energy efficiency in the building sector. NEWCOM supports the professional execution of nearly zero-energy buildings (nZEB), on the one hand, by developing new training modules for professionals, and on the other hand, by preparing a basis for (European-wide) mutual recognition of competencies via a database that allows describing and comparing expert qualifications.

In order to support the quality of sustainable buildings, NEWCOM developed several nZEB training schemes. To ensure maximum flexibility, the trainings are designed in modules so that they can be used both as stand-alone units and as a complement to already established courses. Based on the current needs of the partner countries for professionals in the fields of flat roof and structural waterproofing, comfort ventilation and quality assurance of near zero-energy buildings, specific training modules have been prepared.

A competence database was created with the aim of making acquired skills comparable across Europe. This database provides a basis for mutual recognition of skills of professionals throughout Europe. The competence database links the description of competencies gained by attending a relevant course with the expert. Furthermore, a professional card can be issued on the basis of the acquired skills. The developed system can be expanded to almost any field of work and used throughout Europe.

Moreover, identification of market barriers to the implementation of (European-wide) mutually recognised training schemes for professionals in the building sector and ways of overcoming these barriers to create the needed market demand was a priority topic that was worked on during the whole project.

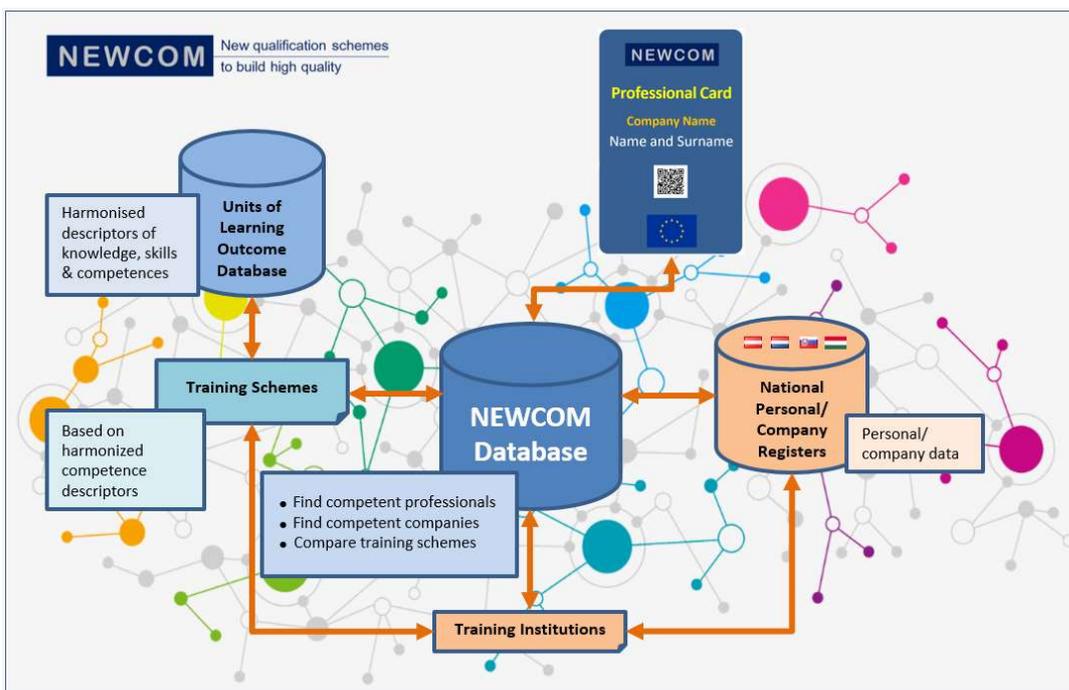


Fig 15: The environment of the NEWCOM database (source: © AEA)

2.2 Existing experience and qualification examples on national levels

In this paragraph an overview of relevant experience and qualification examples on national levels.

2.2.1 Gathering and analysis of examples from the Netherlands

In the Netherlands several initiatives on competence definition in the field of sustaining and retrofitting existing buildings are found:

- 1 There is already a quite substantive set of competences and Unit of Learning Outcomes developed for specific EE-technologies.
- 2 Bouwend Nederland and Techniek Nederland have collaborated together as part of 'The Bouwagenda' a competence catalogue for the Construction sector with a focus on sustaining the built environment.
- 3 Bouwend Nederland, Techniek Nederland and OnderhoudNL developed together with BouwInBalans and Building Changes a guide on how the construction sector can unburden private customers with a consortia to deliver a safe, healthy and comfortable home with low living costs and an energy bill that can go (almost) to zero, all at once or in steps. This under the name 'Duurzame Aanbieder' / 'sustainable provider'.
- 4 Techniek Nederland and Wij Techniek are observing the so called 'Wijkaanpak' / neighborhood approach for sustaining neighborhoods in order to infer competences from new EE practices in the field.

In the following paragraphs examples from the sources mentioned are given and input for the EE-skills qualification is distilled.

From existing technology specific qualifications

In most technology specific qualifications generic EE-competences are highlighted. They are always filled-in in relation to a specific technology context. In these qualifications often the phases of the construction process are also applied. Some of the qualifications are also cross craft.

Inbedrijfstellen van de WP-installatie/ WP-systeem
In bedrijf stellen installatie.
Controleren installatie volgens de specificaties en juiste werking.
Rapporteren inbedrijfstelling en eventueel invullen werkbonnen.
Toelichten werkzaamheden, adviseren over de werking en opleveren installatie aan de klant.
Service en onderhoud / beheer van de WP-installatie/ WP-systeem
Verrichten (periodiek) onderhoud volgens fabrikantspecificaties (of fabrikant modificaties) en wettelijke voorschriften.
Bevragen klant naar de (goede) werking van het warmtepompsysteem of eventuele bijzonderheden.

Fig 16: Example from a qualification on heatpumps with attention to interact with the client

Uitwerken advies aan klant	
	Vertalen van doelstelling klant naar advies gebruik IR verwarming
	Optimaliseren compartimentering indien nodig
	Addresseren koudestraling van glasoppervlakken indien nodig
	Rekening houden met massa van muren, wanden, vloer en plafond
	Adviseren optimalisatie luchtdichtheid indien nodig
	Opstellen indicatie van het benodigde vermogen
	Rekening houden met effecten inrichting en materiaalgebruik bij inrichting

Fig 17: Example form a qualification on Infrared heating with attention to cross-craft interaction

From the construction sector competence catalogue

In the competence catalogue for the construction sector competences needed 'in general' for sustaining the built environment are worked out in competences are worked out in Knowledge, Skills and Behavior/attitude.

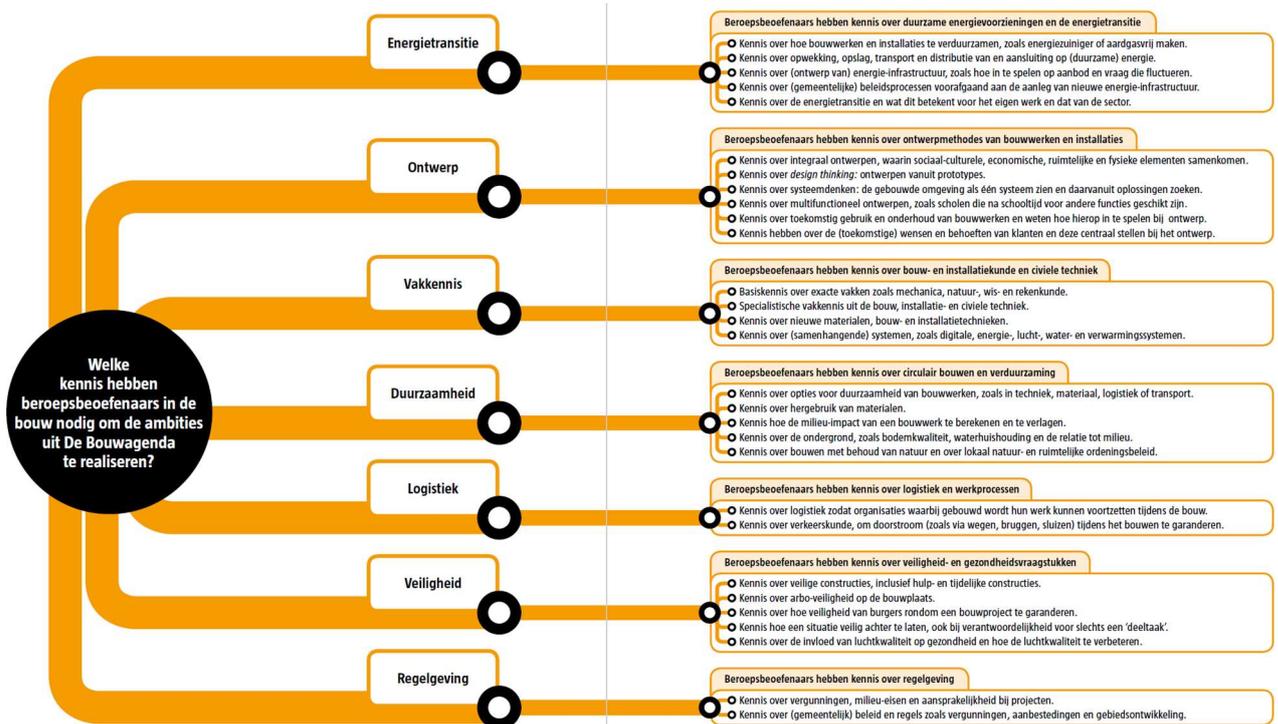


Fig 18: Generic EE Knowledge construction sector workforce

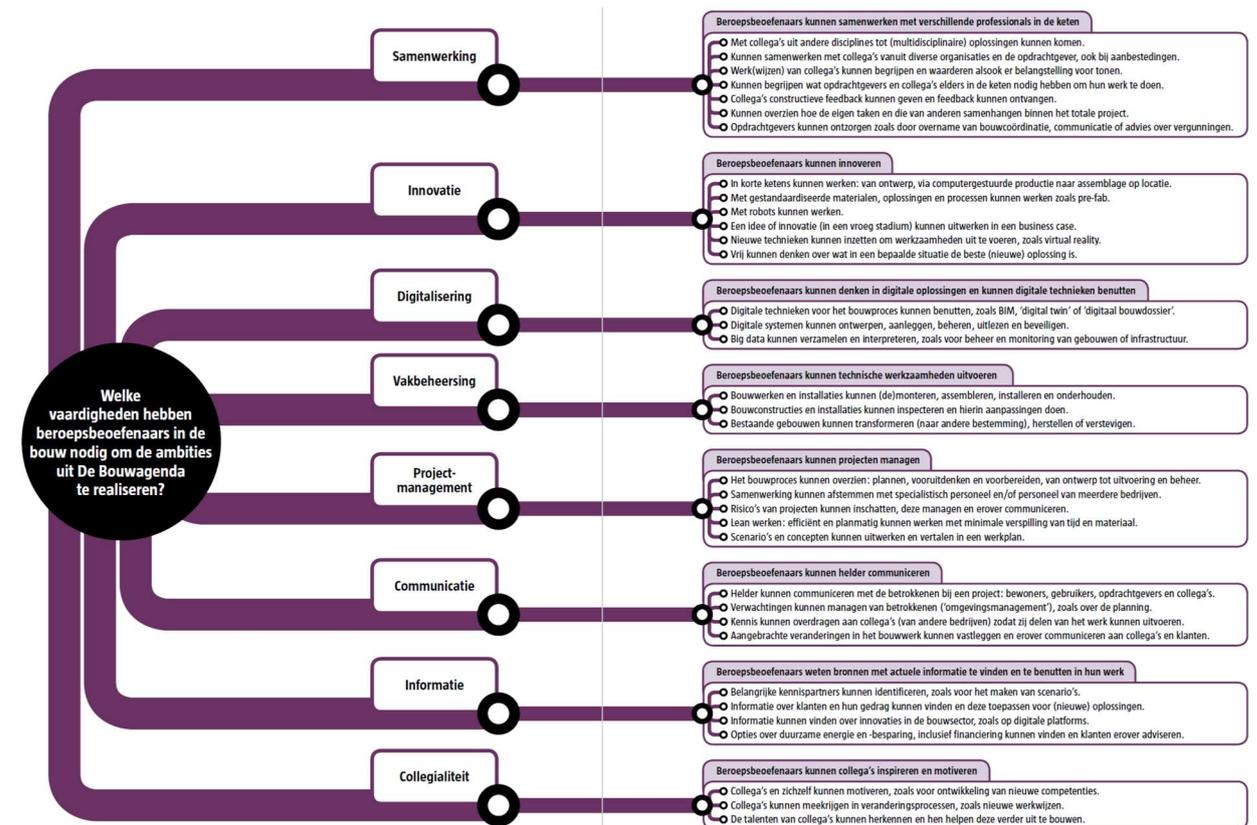


Fig 19: Generic EE Skills construction sector workforce

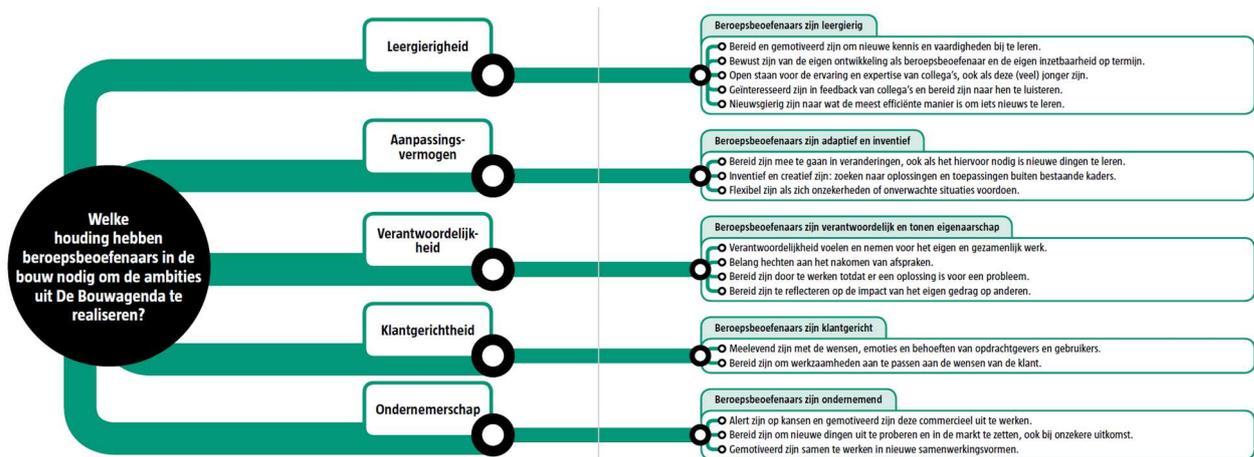


Fig 20: Generic EE Attitude construction sector workforce

From the 'Sustainable provider' (One Stop Shop formula)

Central question from 'Sustainable provider' is how can unburden private customers with a consortia to arrive at a safe, healthy and comfortable home with low living costs and an energy bill that can go (almost) to zero, all at once or in steps.

In this guide from 'Sustainable provider' first step taken to come to a set of competences is definition of process phases and roles of persons involved in these phases. Needed competences are worked out in Knowledge, Skills and Behaviour/attitude.



Fig 21: Examples from 'Sustainable provider' - working with roles & phases

		Projectleider	Calculator	Werkvoorbereider	Teamleider	Vakman bouw	Vakman installatie	Servicemedewerker
Kennis	De consortium medewerker heeft kennis van:							
	een voorstel helder offrenen							
	de functionele spec's vertalen naar technische spec's							
	het aanbod vertalen naar een projectmatige aanpak							
	de schil van een woning isoleren							
	ventilatie aanbrengen in de schil van een woning							
	duurzame energiesystemen installeren							
	omgaan met de particuliere klant							
	effectief samenwerken met collega's en leveranciers							
Vaardigheden	De consortium medewerker kan:							
	een voorstel helder offrenen							
	het aanbod functioneel specificeren							
	de functionele spec's vertalen naar technische spec's							
	het aanbod vertalen naar een projectmatige aanpak							
	de schil van een woning isoleren							
	ventilatie aanbrengen in de schil van een woning							
	duurzame energiesystemen installeren							
	omgaan met de particuliere klant							
	effectief samenwerken met collega's en leveranciers							
	de kwaliteit van de prestaties borgen							
	omgaan met digitalisering							
Houding	De consortium medewerker:							
	gedraagt zich klantgericht							
	gedraagt zich verantwoordelijk ten aanzien van het eigen werk en het totaal							
	is leergierig (blijft zichzelf steeds ontwikkelen)							
	treedt op als ambassadeur voor het bedrijf/consortium							
	evalueert en reflecteert samen met anderen							
	is trots op zijn werk en dat van het consortium							
	luistert actief (niet aannemen maar doorvragen)							

Basic

For performing (needed to do your own part of the 'work')

Transcendent (needed to understand the 'whole' / holistic)

Fig 22: Overview of competences from 'Sustainable provider'

The writers of the Guide (Building Changes and BouwInBalans) advise to elaborate the competences for the 3 levels distinguished.

Niv. 1	Weten welke maatregelen er genomen kunnen worden om energie te kunnen besparen in een woning en globaal weten hoe deze maatregelen er in de praktijk uitzien, bv het kunnen lezen van een energiescan.
Niv. 2	+ het kunnen vertalen van de wensen van de klant in een werkbaar technisch aanbod
Niv. 3	+ de klant kunnen meenemen in een aanbod wat maakbaar, haalbaar en te garanderen is

Fig 23: Example of elaborated competences

From the Neighborhood approach

In the Neighborhood approach a distinction is made between competences for workers and competences for company owners / executives. This initiative makes a distinction between new roles, new knowledge, and new competences.

Doelen	Doelgroepen	
	Vakmensen	Leidinggevenden
Nieuwe rol	Aan het eind van dit traject hebben deelnemende vakmensen voldoende kennis van de verduurzamingsopgave en de nieuwe rol van de installateur die uit deze opgave kan voortvloeien.	Aan het eind van dit traject hebben deelnemende leidinggevenden voldoende kennis van de verduurzamingsopgave en de nieuwe markt-eisen en kansen die uit deze opgave voortvloeien, zodat zij een goed geïnformeerde strategische keuze kunnen maken in de rol die het installatiebedrijf in deze verduurzamingsopgave wil nemen.
Nieuwe kennis	Aan het eind van dit traject hebben deelnemende vakmensen voldoende kennis van de diverse verduurzamingstechnieken om deze op basis van geldende normen en leveranciersdocumentatie toe te passen.	Aan het eind van dit traject hebben deelnemende leidinggevenden voldoende kennis van verduurzamingstechnieken en bijbehorende nieuwe modellen voor ontwerp, financiering, aanbesteding, contractering, uitvoering, onderhoud en beheer om deze op een succesvolle en verantwoorde manier te kunnen aanbieden en realiseren.
Nieuwe competenties	Aan het eind van dit traject beschikken deelnemende vakmensen over alle benodigde vaardigheden om diverse verduurzamingstechnieken om deze op basis van geldende normen en leveranciersdocumentatie toe te passen.	Aan het eind van dit traject beschikken deelnemende installatie-leidinggevenden over alle benodigde vaardigheden om verduurzamingstechnieken en bijbehorende nieuwe modellen voor ontwerp, financiering, aanbesteding, contractering, uitvoering, onderhoud en beheer om deze op een succesvolle en verantwoorde manier te kunnen aanbieden en realiseren.

Fig 24: Example from the Neighborhood approach addressing role, knowledge and competences

From the Circular Skills Community of Practice

In the Netherlands, several initiatives both in regular education and continuing professional development are working on elaboration of a set of Circular skills. In this model there are three types of skill-sets distinguished.

1. Skills addressing the Why – in order to understand the overarching goal and the need to reach it.
2. Skills addressing the How – in order to be able to co-work with general principles, methods and models.
3. Skills addressing the What – in order to be able to apply principles methods and models in a specific context and work-field.

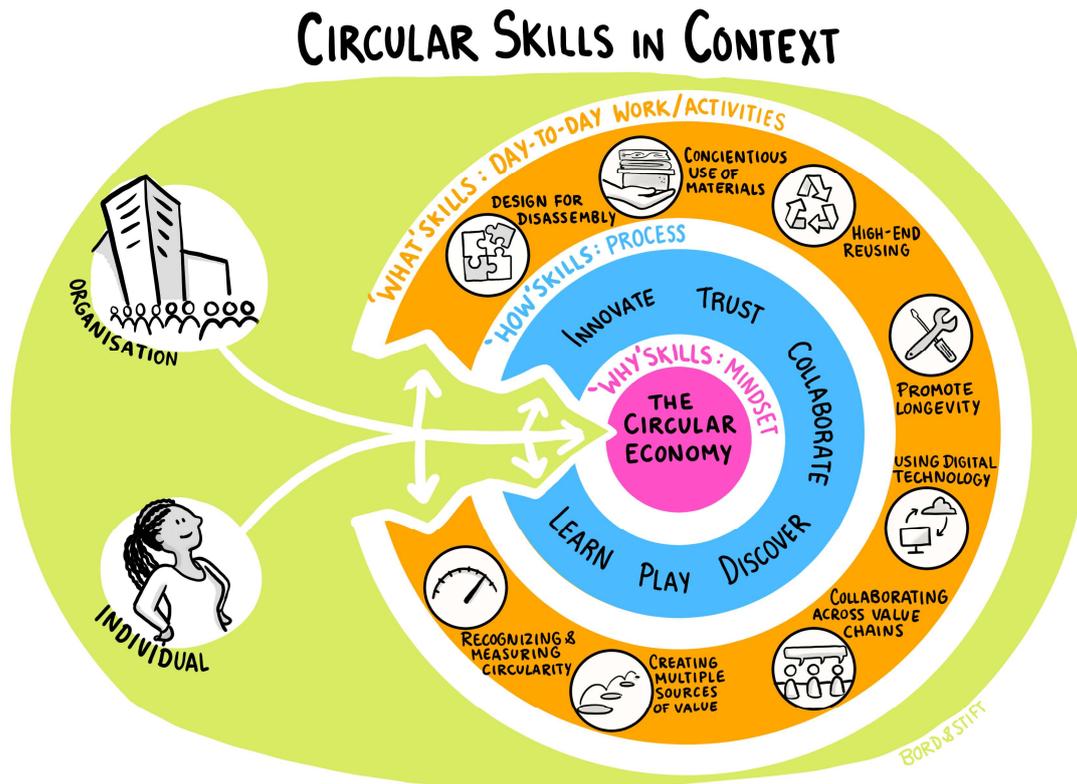


Fig 25: Circular Skills work-model (draft 1)

These can also be translated into:

- WHY – Direction
- HOW – Design
- WHAT – Operation

2.2.2 Gathering and analysis of examples from the Spain

In Spain there are a few examples on competence definition in the field of energy efficiency developed in quite different context:

The National Institute of Qualifications establishes the competences for the vocational training Spanish system. The national regulation on thermal installations (heating, cooling and DHW) sets the minimum competences for professionals on this field to be able to work.

The BUS project Construte2020+ developed an "eco badge" which consists of the recognition of the 'eco' skills. In the field of private certification of people, there are examples as the certification of technicians for the energy certification of homes where the necessary competences are detailed. In the following paragraphs examples from the sources mentioned are given and input for the EE-skills qualification is distilled.

Vocational training defined competences

The National Institute of Qualifications establishes the competences for the vocational training Spanish system. Competences are defined for the different sectors covered by the vocational training as a base for the vocational training courses. It also allows professionals to certify each separate competences by demonstrating experience and knowledge in such competence. The area of "Energy and Water" describe 5 competences related to renewable energies (solar thermal and photovoltaic) and 1 in energy efficiency in buildings.

CUALIFICACIÓN PROFESIONAL:

Eficiencia energética de edificios

<i>Familia Profesional:</i>	<i>Energía y Agua</i>
<i>Nivel:</i>	<i>3</i>
<i>Código:</i>	<i>ENA358_3</i>
<i>Estado:</i>	<i>BOE</i>
<i>Publicación:</i>	<i>Orden PRE/1615/2015</i>
<i>Referencia Normativa:</i>	<i>RD 1698/2007</i>

Competencia general

Gestionar el uso eficiente de la energía, evaluando la eficiencia de las instalaciones de energía y agua en edificios, colaborando en el proceso de certificación energética de edificios, determinando la viabilidad de implantación de instalaciones solares, promocionando el uso eficiente de la energía y realizando propuestas de mejora, con la calidad exigida, y cumpliendo la normativa aplicable.

Unidades de competencia

- UC1194_3:** Evaluar la eficiencia energética de las instalaciones de edificios
- UC1195_3:** Colaborar en el proceso de certificación energética de edificios
- UC1196_3:** Gestionar el uso eficiente del agua en edificación
- UC0842_3:** Determinar la viabilidad de proyectos de instalaciones solares
- UC1197_3:** Promover el uso eficiente de la energía

Fig 26: Example from the vocational training competences for energy efficiency of buildings

Spanish national regulation of thermal installations in buildings

The Regulation of Thermal Installations in Buildings establishes basic competences for the installers or maintainers of heating, cooling or domestic hot water systems, which they must accredit in order to obtain the professional license that allows them to exercise.

BUS project Construte2020+

The BUS project Construte2020+ developed an "eco badge" which consists of the recognition of the 'eco' skills of the professionals who have been trained in the Construye 2020+ courses. Competences are defined in the description of the courses.

	Cód	Competencias básicas
Conocimientos	C1	Reconocer los conceptos básicos que identifican el edificio como un sistema que consume energía para proporcionar confort térmico en su interior.
	C2	Valorar la importancia de las condiciones exteriores, el uso del edificio y su orientación en el consumo energético
	C3	Reconocer la asociación de cada solución constructiva a las necesidades del edificio.
	C4	Contextualizar la normativa actual, para comprender los motivos de la evolución normativa.

Fig 27: Example from the competences included as part of the eco badge courses of the Construye2020+ project

Likewise, within the framework of this project a new qualification of Energy Auditor will be developed for the vocational training system where competences will be described.

In 2016, Royal Decree 56/2016, of February 12 was approved in Spain. It transposes the Directive 2012/27 / EU of the European Parliament and of the Council, of October 25, 2012, which is related to energy efficiency, into the Spanish national policy regarding energy audits, accreditation of energy service providers and auditors, and promotion of energy supply efficiency. This standard created the need in the training field to develop a new Energy Auditor qualification.

Construye 2020+ has as a partner the National Institute of Qualifications, which is the technical body that supports the General Council of Vocational Training responsible for defining, preparing and keeping updated the National Catalog of Professional Qualifications.

In this context, the Construye 2020+ project contemplates the design and development of the Energy Auditor qualification - a professional framework at the national level where competences will be included, and the basis for designing a professional training qualification or a certificate of professionalism.

People certification

In Spain, there is a growing market of the so-called “**voluntary certification of people**” schemes. They are available to professionals who wish to reinforce confidence in their services. The certification of people can be carried out based on the international standard **UNE EN-ISO 17024**. There are examples of certifications in the energy efficiency field mainly focused on energy efficiency certification and energy auditing. There are also examples of people’s certifications mainly linked to the supply of sustainable certification of buildings.



Fig 28: Competences to be fulfilled by TECHNICIANS IN ENERGY CERTIFICATION IN HOUSING to obtain the certificate as an example of a certification system for people in the field of Energy Efficiency

2.2.3 Gathering and analysis of examples from Ireland

Ireland is committed through the national policy to reduce its energy usage by 20%, provide 70% of total primary energy from renewable sources and to achieve total reduction of 51% emissions over the period to 2030, in line with the Programme for Government commitment. The strategic goals include:

- Actions to promote the sustainability of energy supply and use;
- Addressing climate change by reducing greenhouse gas emissions;
- Accelerating the growth of renewable energy sources;
- Maximising energy efficiency and conservation;
- Ensuring affordable energy for everyone;
- Creating jobs, growth and innovation in the energy sector.

The National Centre for Guidance in Education (NCGE)

This National Skill's Strategy: Ireland's Future builds on the progress made under the previous strategy Towards Tomorrow's Skills I. Over the next ten years, it will advance towards the ambitious vision to address a number of objectives. Lifelong learning as defined by Eurostat includes 'all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence'. Formal Education covers the regular education and training system.

A Competency Framework for Guidance Practitioners OECD – Vocational Education and Training in Ireland through the Department of Education – VTOS

Vocational Training Opportunities Scheme (VTOS) is operated through 16 local Education and Training Boards, ETBs and is aimed in particular at unemployed people who are early school-leavers. The scheme includes the following goals for the students:

- To continue education and training;
- To develop new skills;
- To gain certification at a range of levels;
- To find a good employment.

The Expert Group on Future Skills Needs, EGFSN

Has identified Key Competences for Lifelong Learning as:

- Literacy
- Multilingual; Mathematical, science, technology and engineering;
- Digital
- Personal, social and learning to learn
- Citizenship
- Entrepreneurship
- Cultural awareness and expression

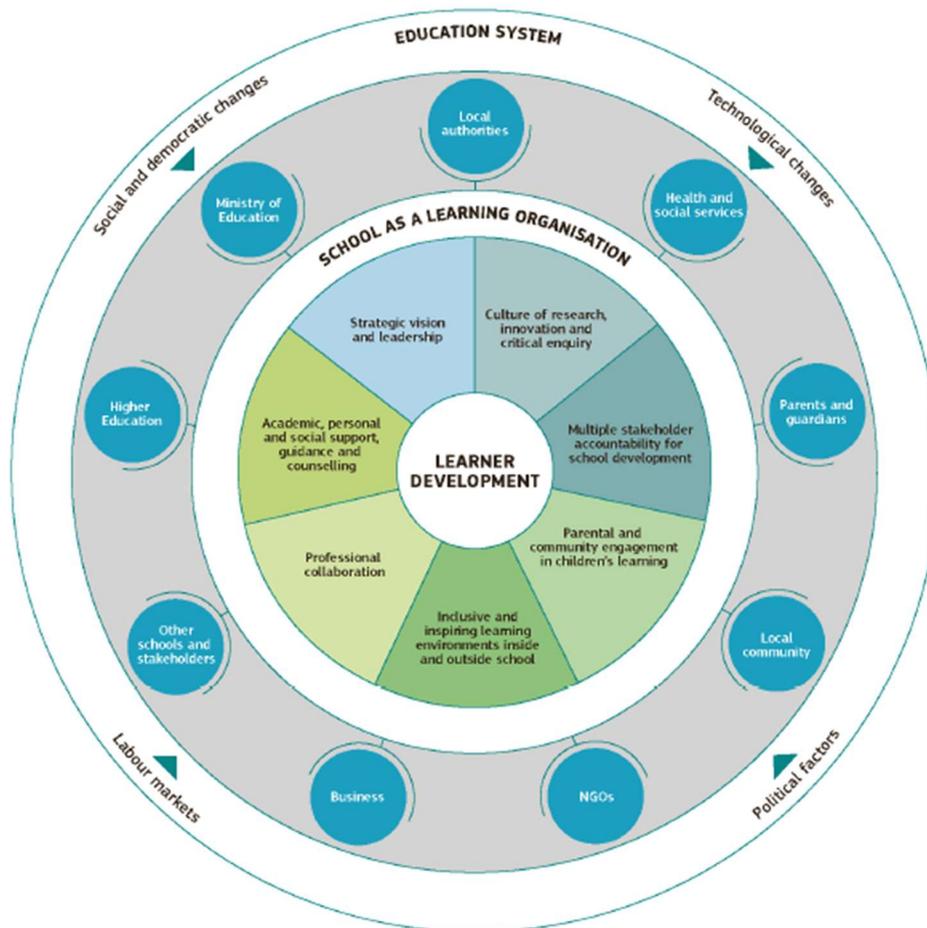
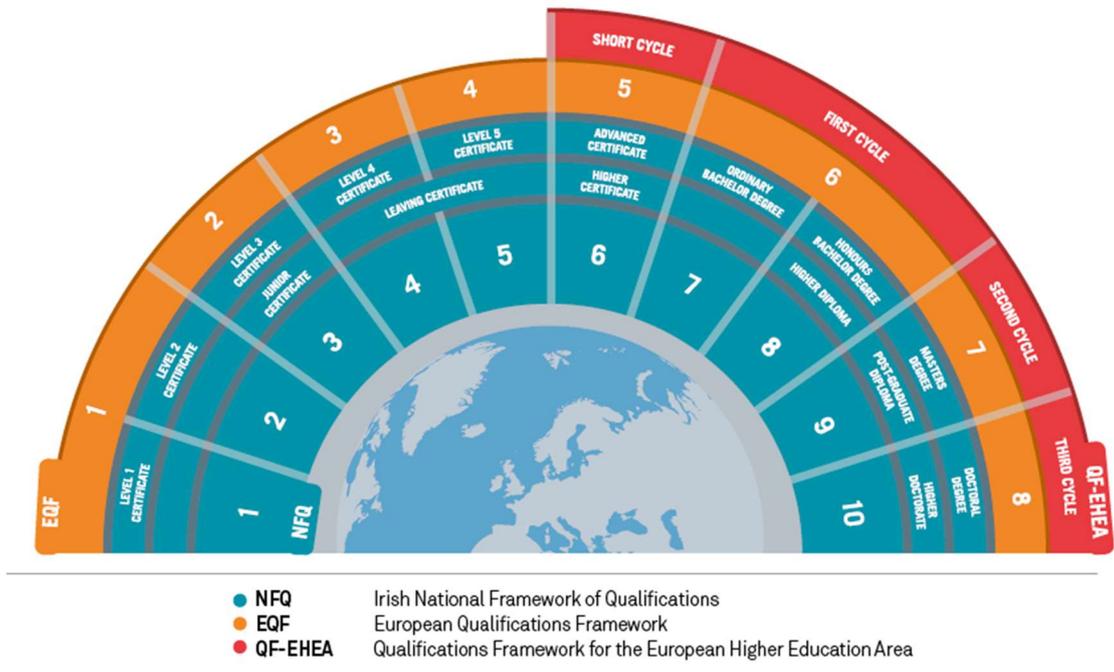


Fig 29: Supporting Key Competence Development: Learning approaches and environments in school education (Publications Office of the European Union, 2020)

The European Higher Education Area (EHEA) aims to facilitate cooperation between systems, institutions, and individuals in its 48 member countries. Member states also hope to raise the international profile and status of European higher education.

The Irish and UK qualifications authorities promote the transparency, recognition and mobility of qualifications between our respective jurisdictions. The qualifications authorities in the UK and Ireland have agreed the correspondence between qualifications frameworks in operation across the five jurisdictions. Quality and Qualifications Ireland (QQI) is responsible for developing, promoting and maintaining the Irish NFQ and also facilitates the recognition of foreign qualifications.



Source: <https://nfq.qqi.ie/qualifications-frameworks.html>

Fig 30: Comparative view of Irish NFQ and EQF

Training defined competences in Ireland

BUILD Up Skills QualiBuild Low Energy Training for Construction Workers

In 2011, the EU funded project Build UP Skills Ireland (BUSI) was tasked with establishing the extent of the skills gap in the building sector for achieving 2020 energy saving targets. This resulted in the development of a National BUSI Roadmap of actions to address the issue.

The BUSI project concluded that the pace of change in building construction and renovation standard has not been matched by the availability of compatible training provision for the construction workforce. As a consequence, two training programmes were developed for the construction workforce but also for the construction trainers.

The QualiBuild Train the Trainer programme was identified in the BUSI Roadmap (2012) as one of the key training actions necessary to address skills and knowledge deficits in the construction sector. Additionally, the QualiBuild Foundation Energy Skills (FES) Programme was also classified as a major upskilling need especially for those already in construction employment. Both programmes were designed to adopt a blended learning format incorporating a ‘flipped classroom’ approach where participants were provided with course content upfront in the form of comprehensive learner manuals for each module. Activities were then designed to engage learners with each manual ahead of workshops and site visits where active learning and group work were emphasised.

Course Structure of QualiBuild Train the Trainer Programme

Module 1: Building for Energy performance

On completion of this module the learner will/should be able to:

1. Discuss the implications of European and International energy policy on building construction and renovation activity in Ireland.
2. Outline the profile of energy use in residential and non-residential buildings.

3. List and describe the main changes to Irish Building Regulations for energy performance and ventilation since 2002.
4. Outline the main drivers for deployment of energy efficient and renewable energy technologies in new and existing buildings.
5. Identify and input appropriate information to a relevant Energy performance Modelling Software e.g. Dwelling Energy Assessment Procedure (DEAP) for estimating the energy consumption and CO₂ emissions of a residential building.
6. Identify gaps in the knowledge and skills of construction workers in light of technologies being adopted onsite for energy performance of buildings.

Module 2: Building Fabric

On completion of this module the learner will/should be able to:

1. List and describe the modes of heat transfer, laws of thermodynamics and control of heat loss and gains in buildings.
2. Outline the principles of air tight construction and identify common air leakage pathways in buildings.
3. Explain the impact of thermal bridging on energy performance in buildings and illustrate good practice examples of detailing to mitigate its effect.
4. Outline the methods for calculating the energy performance of the external fabric of a dwelling as described in the current Building Regulations.
5. Compare the properties of commonly used building insulation materials/systems and relate to the criteria to be considered in determining their suitability for selection.
6. Describe the relationship between ventilation, vapour control, thermal mass and surface /interstitial condensation in building fabric.

Module 3: Building Services

On completion of this module the learner will/should be able to:

1. Describe the factors affecting energy use for heating, lighting and small power in buildings and describe their impact on energy consumption.
2. Outline the main features of common space and water heating systems and list possible measures to improve their energy performance.
3. Describe the principles of energy efficient lighting and the relative efficiencies of lamps currently available in the market.
4. Outline the principles of renewable energy systems deployed for heating and microgeneration of electricity in buildings.
5. Describe techniques for the integration and optimisation of multiple heating systems in dwellings including renewable technologies.
6. Outline the main design principles of ventilation system options for dwellings.

Module 4: Pedagogical Approaches

On completion of this module the learner will/should be able to.

1. Describe a range of learning styles and outline the factors that affect learner motivation.
2. Apply instructional design theory and techniques to develop a lesson plan.
3. Describe the stages of group development and their impact on performance.

4. Design, implement and manage group learning activities.
5. Select the appropriate training methods to achieve different learning objectives.
6. Describe the principles and applications of modern learning technologies including computer presentations, computer-based training, mobile learning (M-learning), multimedia.
7. List and describe the principles of and methods of assessment appropriate for different types of learning outcomes.

QualiBuild Foundation Energy Skills Course (FES)

The Certificate in Low Energy Building Construction Programme is focused on developing the knowledge of building construction workers (crafts people and operatives) on Low and Near Zero Energy Buildings. The aim of the programme is to increase the learner's knowledge of principles and practices applied to the construction/retrofitting of low energy/near zero buildings. This improved knowledge will allow such workers apply their existing skills so that relevant energy efficient standards are achieved.



Learning Outcomes (LO):	
At the end of this programme the participants will be able to:	
1	List and describe the key policy and legislative drivers, relevant to construction workers, behind the move to low energy buildings.
2	Explain the key energy terms and measurement units associated with low energy buildings.
3	List and describe the key principles of low energy techniques for newbuild and renovation works, including insulation, airtightness, ventilation etc.
At the end of this programme the participants will be able to:	
4	Identify best practice relevant to low energy/near zero energy construction methods and details.
5	Communicate the need to engage with other crafts to meet specific design demands.
6	Describe the challenges of low energy quality building projects and how to apply specific solutions.

After the successful roll out of both the QualiBuild programmes, they have been adopted and updated with reference to the NZEB and Building Regulations (enforced in Ireland in 2019). The programme also helped to pave the way to develop the National Specifications for NZEB.

Irish National Specifications for NZEB

The National Specifications for NZEB have been developed setting out **six critical objectives**. This means that upon completion of the training programme the participant should be able to:

1. Understand the Principles relevant to nZEB, Building Regulations and Product Standards
2. Understand Building Physics – Key energy terms and units

3. Understand Building Fabric – Continuous Insulation, Thermal Bridging, Air Permeability, Windows and Doors.
4. Understand Building Services – Space heating and Domestic Hot Water, Controlled Ventilation, Lighting, ICT and Smart Technology
5. Understand Renewable Energy, Photo-Voltaics, Smart Metering and Electric Vehicles relevant to nZEB
6. Demonstrate the required knowledge to facilitate high quality Communication and Best Practice User Information

NZEB Programmes for the Vocational Educational Training Boards

Waterford Wexford Educational Training Board, WWETB along with LIT developed a number of training courses which are designed to provide learners with knowledge of the principles and practices that help in achieving the NZEB standard.



Fig 31: WWETB NZEB Training Courses

The courses are City and Guilds Assured to an equivalent of EQF level 5 and a Certificate and a Digital Badge is issued to participants on successful completion of the programme. which delivers the following courses:

7. NZEB – Basic Awareness
8. NZEB for Electricians for new dwellings
9. NZEB for Carpenters for new dwellings
10. NZEB for Plumbers for new dwellings
11. NZEB for Plasterers for new dwellings
12. NZEB for (Site Foreman/Supervisor) for new dwellings
13. NZEB for Bricklayers for new dwellings
14. NZEB for Construction Workers
15. NZEB – Ventilation
16. NZEB – Retrofit

Competences are defined for the various courses covered by the approved vocational training, demonstrating experience and knowledge.

The NZEB Retrofit module describes 6 competencies related to energy efficiency in buildings.

Retrofit Competences

On successful completion of the training programme learners have:

- Basic understanding of NZEB Principles.
- Basic understanding of Building Physics.
- Basic understanding of Building Fabric – Continuous Insulation, Thermal Bridging, Air Permeability, Windows and Doors.
- Basic understanding of Building Services – Space heating and Domestic Hot Water, Controlled Ventilation, Lighting, ICT and Smart Technology.
- Basic understanding of Renewable Energy, Photo-Voltaics, Smart Metering and Electric Vehicles.
- Understand the required knowledge for Communication and Best Practice User Information.

A number of programmes listed above include these generic competences but also specific competences relevant to the trade. For example, nZEB training for Plumbers for new dwellings will give specific competency to:

1. Describe the concept of 'friction losses' in relation to energy required to pump and circulate water around a dwelling.
2. Explain the impact of bends, kinks, elbows, tees, valves and fittings on friction losses and energy efficiency of fluid and air circulation systems.
3. Explain the concept of 'equivalent pipe or duct length' in relation to the pressure losses created by bends, elbows and tees in fluid and air circulation systems.
4. Describe the relationship between flow rate, velocity and pipe / duct diameter and their impact on pressure losses.
5. Describe the consequences of a poorly designed hot water circulation systems in terms of overall energy use in dwellings.
6. Describe the difference in heat carrying capacity of water versus air.
7. Explain in outline how a heat pump works including reference to the four key elements of evaporator, compressor, condenser and expansion valve.

Also, NZEB for Site Foreman/Supervisor for new dwellings will give specific competency to:

1. Describe the relevance of the Code of Practice for Inspecting and Certifying Buildings and Works to trades in relation to meeting the nZEB standard.
2. Describe 'BCAR' (Building Control Assessment Regulations) and explain the role in the BCAR process, including requirements to signing off work completed by others.
3. Describe the role of the Assigned Certifier ("AC") and Design Certifier ("DC") in the BCAR process.
4. Describe in outline the relevance of Standard Recommendation (SR) 325 to nZEB in consideration of matters such as cavity barriers and closers, exposure zones and accepted wall types, wall ties, and cavity widths and openings, durability, exclusion of moisture (render specification/ application), specification of masonry unit, and certification.

5. Describe in outline the relevance of Irish Standard (I.S.) 440 (2009) in consideration of such matters as requirements for timber frame materials, design, manufacture, construction details, site work and quality control.
6. Describe in outline the relevance of Standard Recommendation (SR) 50 to nZEB in relation to ventilation design for dwellings.
7. Describe in outline the relevance of Standard Recommendation (SR) 50-1 to nZEB in relation to heat pump systems for dwellings.
8. Describe in outline the relevance of Standard Recommendation (SR) 50-2 to nZEB in relation to solar thermal systems for dwellings.

Irish National Regulation of Ventilation in Buildings NSAI

NSAI has established a registration scheme that certifies an individual as a competent independent third party to validate that a ventilation system has been installed, balanced and commissioned to meet the minimum requirements of Technical Guidance Document F - Ventilation (2019) to the Irish Building Regulations. Checks and measurement methods broadly follow the guidance given in I.S. EN 14134:2019, Ventilation for buildings – Performance testing and installation checks of residential ventilation systems.



I.S. EN 14134:2019

Ventilation for buildings - Performance measurement and checks for residential ventilation systems

National Standards Authority of Ireland

Irish Heat Pump Consultation and Regulations

In Ireland, the Standard Recommendation (S.R.) 50-4:2021 - Building Services – Part 4: Heat pump systems for dwellings is available since May 2021. This document provides guidelines for the design, installation, commissioning and maintenance of heat pump systems with an effective rated output up to 70 kW in new and existing dwellings.

This document is applicable to:

- heat pump systems that are intended to serve as the principal source of space heating of a dwelling and/or domestic hot water demand of a dwelling,
- heat pump systems which use the following sources for heat,
- air,
- water,
- ground,
- air being expelled from the same dwelling by a ventilation system,
- packaged heat pumps, split and multi-split heat pumps,
- heat pumps which are driven by electricity or heat, including absorption heat pumps, and
- distribution systems suitable for heat pump systems.

The document does not give guidance on heat pumps used for the purposes of cooling and it does not apply to heat pumps used in district heating or group heating schemes.

HCI Pillar DASBE

A digital learning platform for Ireland is established known as the Digital Academy for Sustainable Built Environment (DASBE). This digital hub is to provide upskilling, capacity building and education to the building sector on energy efficient construction, green and circular economy and digital skills. DASBE provides programmes from Level 6 to Level 9 on the National Qualification Framework, NFQ, and responds to the recognised need to upskill the building sector on a range of topics ranging from low energy buildings design to the application of VR in building surveying. There are numerous programmes available and will be updated further with the collaboration of all the higher education institutes by sharing and mutually developing training and education together specifically addressing the needs and gaps in the construction industry.



Digital Academy for the Sustainable Built Environment

Home Performance Index

The Home Performance Index, HPI, is a voluntary framework for designing, assessing and certifying new residential design and construction. It addresses performance criteria, to facilitate all sectors of the housing chain to evaluate performance from their individual perspective. House-buyers can assess the performance data for the house they are purchasing which will encourage the demand to seek exemplar performance. This is assisted by financial institutions to assess the quality of assets on which they are lending, therefore enabling the introduction of green mortgages.



THE HOME PERFORMANCE INDEX (HPI)[®]
Know that your house is a home.

A Certified HPI Assessor is qualified to advise clients and submit assessments for HPI, Ireland's first national quality and sustainability assessment system for new housing associations, which will:

- reward contractors and developers for their conscientious approach, and
- encourages design teams to set targets early at the design stage and work together as a team to achieve them.

HPI considers the quality of residential development under three categories:

- **Our Planet** considers how homes help reduce the ecological footprint of occupants.
- **Wellbeing** considers the impact on occupants wellbeing, such as comfort, indoor air quality, the levels of daylight, and other issues
- **Costs** considers the costs associated with living in the home, including energy, water and transport.

Sustainability and the Build Environment



This webinar series covers eight themes:

1. Sustainability Principles
2. Climate Change and the Built Environment
3. Energy and Carbon Efficiency in Buildings
4. Buildings and Human Health
5. Sustainable Use of Natural Resources in Construction
6. The Building Lifecycle
7. Sustainability at the Neighborhood and Urban Scale
8. Creating a Better Built Environment

By completing the knowledge tests after each module, 2 CPD hours will be awarded and Certificates will be issued after successful completion of the tests

2.2.4 *Gathering and analysis of examples from France*

The French Ministry of ecologic transition supported the development of various initiatives that have been implemented by public and private stakeholders, in order to prepare the building sector to the overall increase of energy renovation and the installation of equipment using renewable energies.

A. The creation of Qualit'EnR in 2006

The Qualit'EnR association was created in 2006 by actors of the professional sector to develop the quality of installation in the field of renewable energies. The objective was to increase the competencies of professionals and to promote their know-how alongside private clients, organize and control professional's training, companies' qualifications of the audits of installations. The creation of Qualit'EnR was also in response to the very many unfortunate experiences, defects, and disputes that occurred between customers and installers in this field of renewable energy.

B. The creation in 2007 of the Building Energy Savings Training Program (FEEBat):

In 2007, EDF, along with the FFB and the CAPEB, created [FEEBAT “Energy saving training for construction craftsmen and enterprises”](#), a training program (initial and continuous training) to train and upskill several kinds of professionals in the building sector with the purpose of encouraging the decrease of energy consumption. The program benefited from advantageous financial conditions thanks to a financial contribution from Electricity of France (EDF), via the energy savings certificates.

Promoters: FFB, CAPEB (Professional Federation of Craft Companies), EDF (Electricity of France), ADEME (Agency for Environment and Energy Management)

Other partners: Ministry of Energy and Solidarity Transition, Ministry of Territorial Cohesion, Ministry of Culture, Ministry of National Education.

[FEEBAT “Energy saving training for construction craftsmen and enterprises”](#) was established to train several kinds of professionals in the building sector with the purpose of encouraging reduction in energy consumption. The initiative is set up in the framework of “Grenelle Environnement” with the financial support of “Electricité de France” (EDF), the main French electric utility company, which participates in the Energy Saving Certificates scheme. Public authorities, trade unions, and employers' organisations were brought together in order to define the programmes dedicated to vocational training. Up to now, close to 60,000 construction workers and craftsmen have been trained. Also in France, eco-conditionality rules for have fostered upskilling, training and the quality of audited works.

The introduction of eco-conditionality of government aid for energy efficiency improvements in the building sector required that as many companies and craftsmen as possible be able to follow training courses that would enable them to access the market concerned by government aid and the CEE mechanism (Energy efficiency certificates). Achieving energy performance objectives in renovation requires building professionals to understand the global nature of a building's energy performance and to integrate its implications in terms of implementation, quality, and control. Since 2007, the FEEBAT programme on energy efficiency and energetic renovation of buildings helps professionals in the building sector to improve their skills (via initial and continuous training). With the energy renovation market in full expansion, the program, formerly dedicated to contractors (builders), it is now also opened to apprentices, trainers, project designers, and construction supervisors. These new targets have made it possible to involve the Ministry of Education and the Ministry of Culture in the 2018-2020 agreement, alongside the professional organizations that have been present since the program was launched. In this new agreement, emphasis is also placed on innovation in teaching methods in order to offer each professional,

whether they are aspiring or working, an individualized and innovative skills development program, combining both face-to-face and distance learning.

The FEEBAT training is divided into modules for the Team coordinators and crafts people in modules for electricity, heating, ventilation, carpentry, and opaque walls. While for the other professionals involved they are offered modules on project management and the audit process. Both of them pretend to teach the participants about the most recent manners and materials for energy renovation. These competences are finally evaluated through a multiple-choice test that, if approved, can bring a certificate or serve as one of the requirements for getting the formal recognition on the RGE label (Recognised Environmental Guarantor certification).

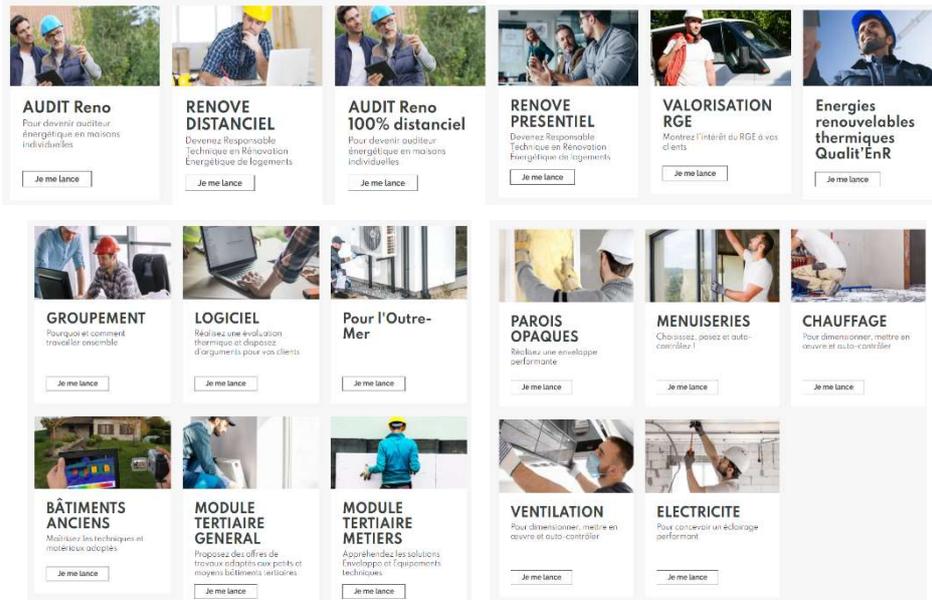


Fig 32: FEEBAT training modules

C. The creation of quality brands by professional organizations in 2008 and 2009

In 2008, the CAPEB created the "[Eco-artisan®](#)" brand:

- to offer a global thermal assessment of the existing building,
- to provide the customer with global advice on thermal renovation,
- and to carry out the work and control its quality.

On the other hand, the FFB created in 2009 its own brand "[Les Pros de la performance énergétique®](#)", which included a mandatory on-site audit of at least one work reference. These two brands rely on the FEEBat system to provide training for certified professionals. "Eco-artisan®" and "Les Pros de la performance énergétique®" were entrusted in 2009 and 2010, respectively, to Qualibat, a pre-existing professional qualification organization for building companies, which afterward managed the awarding of the RGE label to these two brands as well as to its own trade qualifications. In 2013, the two brands will be integrated into Qualibat's nomenclature and issued in the same way as traditional trade qualifications.

D. QUALIBAT

[QUALIBAT](#) is an association gathering the main professional organizations of the construction sector in France (companies, craftsmen, project owners, technical controllers...). Through its qualifications and certifications, QUALIBAT promotes a selection of craftsmen and companies who have demonstrated their skills and know-how. QUALIBAT covers all sectors of the building industry, with the exception of electricity. Nearly 61,000 companies are now qualified, including more than 49,000 RGE professionals.

The professional qualification of a company refers to the recognition of the capacity of a company or a craftsman to carry out work in a given activity. It is valid for four years. At the end of this period, it is put back into play through a thorough review.

QUALIBAT has also developed **trade certifications**, based on specific reference systems. The company or the craftsman must not only satisfy all the criteria of the qualification, but also provide the operating procedures, ensure the complete traceability of the work carried out and regularly undergo expert audits intended to control his mastery of the execution processes.

The awarding of a qualification or certification involves a rigorous procedure, based on precise standards. After revising the application in terms of reference system requirements, it is submitted to a departmental or national commission, depending on the speciality or degree of technicality. These commissions are formed by professionals from the building sector, all of whom are volunteers and independent: architects, public and private project owners, inspection offices, and companies. The "RGE" label is issued in conjunction with certain qualifications attesting to the competence of companies to carry out work in the activities of the nomenclature concerned by the [QUALIBAT scheme](#).

E. Reconnu Garant de l'Environnement RGE label, Recognized as an Environmental Guarantor

The Recognised Environmental Guarantor (Reconnu Garant de l'Environnement, RGE) certification and labelling system was launched in 2011 to certify the quality of energy efficiency renovation work carried out by construction service providers in the residential sector.

The RGE scheme addresses several types of professionals: installers of renewable energy equipment; energy efficiency installers and consulting work related to energy efficiency. The scheme involves mandatory training of a technical manager, evaluation of the skills and on-site audit within 2 years of qualification. This examination and the subsequent issuance of the quality sign are carried out by qualification bodies (Qualibat, Qualit'EnR and Qualifelec) or certification bodies (Certibat and Cerqual) that have signed an agreement with the State and are accredited by the French Accreditation Committee (COFRAC).

The RGE system targets three main objectives:

- To help building professionals acquire new skills;
- To enable individuals and contracting authorities to identify the most competent professionals;
- To establish environmental quality eligibility criteria as a pre-condition for all grant applications for public financial support.

Two principal RGE certificates/labels are offered:

- The RGE Work (RGE Travaux) certificate/label is intended for companies that carry out energy performance improvement work for individuals;
- The RGE Study (RGE Études) certificate/label is intended for companies that conduct studies or provide project management services to large-scale renewable energy buildings or installations (biomass boilers, tertiary buildings, multi-apartment buildings, etc.).

The RGE certification enables companies and tradespeople that carry out energy efficient renovation work to gain official recognition for their professional competency and the quality of their services. The use of RGE certified contractors is also a mandatory requirement for construction customers that wish to benefit from public funding support.

F. Reform of RGE 2021

The RGE qualification showed many weaknesses highlighted by various reports and investigations: UFC-Que-Choisir (2016), DGCCR (2018), CGEDD (2018), as well as by complaints opposing private clients against RGE companies. As mentioned earlier, the RGE label is issued for a period of 4 years with an annual follow-up. In 2018, a reform has been undertaken to increase the trust of households in the RGE system and thus facilitate their decision to start energy renovation works.

The first measures of this reform came into effect on January 1, 2021. These measures focus on two main areas: the **fight against fraud** and **the strengthening of qualification criteria**. This first axis translates into the implementation of targeted controls on companies that carry out poor quality work or that use misleading commercial practices, as well as expanded means of sanctioning qualification and certification bodies. The strengthening of controls is based on two principles: the random selection of audited sites (for all companies) and the organization two audits instead of one (only for critical work categories).

The strengthening of qualification criteria is reflected, on the one hand, by the random selection of worksite audits, which are now carried out using harmonized audit grids. These grids define control points and are the result of a consensus between professional organizations, qualification bodies, auditors, and the administration. On the other hand, in certain areas identified as critical, because they are sensitive to bad practices, the audit system is reinforced (increase in the number of audits). This concerns the installation of wood and other biomass boilers, wood and other biomass stoves or inserts, heat pumps for heating or for the production of domestic hot water, and the installation of insulation of lost attics or low floors. This consultation has also allowed regulatory changes of the nomenclature of RGE work areas for greater consistency with the associated professional qualifications.

2.2.5 *Gathering and analysis of examples from Austria*

Looking at building construction in Austria, it becomes apparent that highly complex construction tasks are performed by semi-skilled workers. Even though the market offers a number of certification and education schemes, a lack of skills and knowledge is noticed when it comes to the implementation of the nearly zero-energy building standard. In general, further education offer in the areas of energy consulting, energy efficiency and renewable energies seems comprehensive at first sight in Austria. However, considered more closely and with respect to the target group of blue-collar workers, it becomes clear that the number of courses focusing on energy efficiency is rather limited. Moreover, objective trans-national recognition is hardly possible because clear descriptions of earned competences are missing in the field of further education. Furthermore, further education modules often do not require an entry qualification or do not end with a certificate of earned competencies on an international, comparable standard.

The already mentioned finalized project NEWCOM focused on the one hand on the development of new training modules for professionals, and on the other hand, on the preparation of a basis for (European-wide) mutual recognition of competencies. NEWCOM developed several nZEB training schemes based on the current needs of European countries. To ensure maximum flexibility, the trainings were designed in modules so that they can be used both as stand-alone units and as a complement to already established courses. Moreover, a competence database was created with the aim of making acquired skills comparable across Europe. The aim was to link the description of competencies gained by attending a relevant course with the expert.

Especially the methodology behind the developed competence database in the NEWCOM project is perfectly in line with the target of the BUSLeague project to make acquired skills

comparable and to link the description of competencies gained by attending a relevant course with the expert.

After relevant available content for micro learning in the field of energy efficiency has been identified, the methodology for the description of competences from the NEWCOM competence database will be used to enable a clear and mutable recognizable competence description.

2.2.6 *Gathering and analysis of examples from Bulgaria*

The Bulgarian EE market is characterized by insufficient supply of qualified construction specialists for execution of deed renovation and nZEB projects. The supply and demand of trainings for EE specialists is limited, which reflects the low market demand for energy efficient renovation. There is a recent positive trend – the launch of the Masters’ programme “Energy Efficiency in Construction” and the discipline “Management of energy efficient renovation of buildings” (EQF level 6 and 7) and the discipline “Ecological and energy efficient construction” (EQF level 3); however, this is not enough to boost the skills in the sector. In general, the training programmes in the VET schools and the universities are not aligned with the contemporary technologies and solutions in the field of energy efficiency. Therefore, the implementation of new training programmes for the key professions and specialties needs to be accelerated, in collaboration with the Ministry of Education and Youth and the National Agency for Vocational Education and Training (NAVET).

Currently, there are a few examples on competence definition in the field of energy efficiency. Despite the strong demand for qualified construction workers in the field of nZEB and the intensive activities for continuous improvement of the State Educational Standards for the related professions in Bulgaria, there is no significant progress in this direction. There is two recently adopted state educational standards, which are partially adapted to the current needs of the construction sector and includes the nZEB relevant skills, knowledge and competences. However, there is no full-time course for profession related to nZEB construction, regulated by the State Educational Standards. The market relies on private training service providers and EU funded training courses. These examples for the EE-skills qualification are presented below.

Competences defined by the State Educational Standards

The National Agency for Vocational Education and Training (NAVET) establishes the requirements and the units of learning outcomes for different professions, which should be covered by the vocational training system. The two recently adopted state educational standards, partially including nZEB relevant skills, knowledge and competences are for the following professions:

- **Profession 522030 "Electrical equipment and installations technician"**, in force since 15.02.2019. It is valid for specialties 5220301 „Heating Energy”, 5220302 „Nuclear Energy”, 5220303 „Hydro-energy”, 5220306 „Gas Installations”, 5220308 „Renewable Energy Sources” and 5220309 „Heat, air conditioning, ventilation and refrigeration”, targeting 4th EQF level. These are fully or partially applicable to HVAC installer, Low-voltage electrician, High-voltage electrician, however, the nZEB-related specifics are not fully reflected. The specific references to energy efficiency/RES/nZEB are related to ULOs 25: “Assembly and disassembly of equipment and installations for systems with RES”, 26: “Diagnosis and repair of equipment and installations for production of electricity and heat from RES, 27: “Operation of facilities and installations for renewable energy systems”, and 28: “Principles of the "Passive House" standard”
- **Profession 582010 "Construction Technician" (IV EQF level)**, in force since 11.03.2020, valid for specialty 5820101 "Construction and Architecture". The specific references to energy efficiency/nZEB are concentrated in ULOs 9: “Earthworks and construction works for rough construction (formwork, reinforcement, concrete,

masonry, roofing works)”and 10: “Finishing works - plasters, ground coats, screeds, floorings, painting and tinsmithing, insulation works, construction carpentry”. Although these references are by themselves relevant for achievement of LOs sufficient for application in real-life practice, they are too generic and do not emphasize on important aspects as the cross-craft understanding. The deficiencies are however overcome in a significant extent by the introduction of a specific discipline in the training plan “Ecological and energy efficient construction”.

- Within the profession - 582010 "Construction Technician", the discipline “**Ecological and energy efficient construction**” uses newly designed training materials. The subject provides basic knowledge related to energy efficient construction. The program has sections to get students acquainted with modern materials for the implementation of thermal insulation systems, including environmental aspects. The basic principles in thermal insulation systems design are also studied. The training under the program also clarifies the main characteristics of passive buildings and the requirements and standards for sustainable construction. This knowledge builds on the knowledge and skills acquired in the subjects such as construction technology, training practice in construction process technology, and training practice in construction and installation work. An example of the learning outcomes of this special discipline is provided below:

At the end of the training, students must have the following knowledge, skills and competencies:

Knowledge of:

- basic concepts related to energy efficiency of buildings;
- modern thermal insulation materials;
- ecological materials;
- modern trends for energy efficient and environmentally friendly construction.

Skills:

- to calculate the coefficient of thermal conductivity of an envelope in the building;
- to analyze the degree of energy efficiency of enclosing elements;
- to choose a suitable thermal insulation material for a specific thermal insulation system.

Competences:

- responsibility in performing the assigned tasks;
- logical thinking and creativity;
- shows a desire for professional development and career development.

Competences defined by EU funded projects

The deficiencies in the National VET system are partially overcome through implementation of various EU funded initiatives. Some of these are BUILD UP Skills EnerPro, CraftEdu and Fit-to-nZEB.

BUILD UP Skills EnerPro, project developed 10 new training programmes for acquisition of competences on energy efficiency construction for part of profession. The modules on building envelope (Low energy and passive buildings, Thermal Bridges, Airtightness, Thermal insulation of the foundations, Thermal insulation of facade walls, Thermal insulation of roofs, Joinery: windows, doors and other transparent external components, and Building renovation) are

designed for professions of vocational direction “Construction”, professions “Construction technician”, “Builder”, “Builders-installers”, specialization “Construction and architecture”, “External cladding and flooring”, “Roofing”, “Dry construction”, “Joinery and glazing”, “Building Insulation” from the List of professions for vocational education and training and Art. 6 of the Law on Vocational Education and Training.

The remaining modules are focused on RES and include the following trainings: Air-conditioning, ventilation and heating, Boilers and Biomass Installations, Heat pumps, Hybrid heating systems, Mini-wind systems and installations, PV Installations, and Solar thermal installations.

The theoretical training is thematically consistent with the practice sessions during the course in order to be able to form sufficient professional knowledge and skills. The training on the modules is organized through active involvement of the trainees in the learning process, by creating problematic tasks and clarifying the learning content through data analyses and justification of the requirements, procedures and methods for provision of airtightness of the buildings. An example of the expected learning outcomes of Module 2: Thermal bridges is provided below.

At the end of the training on the subject, the students must know:

- What is a thermal bridge, what damages are inflicted on buildings as a result of thermal bridging;
- Basic rules to prevent thermal bridges;
- Solutions for: foundation, roofs, eaves, edges projecting from the façade, openings in the insulation layer;
- Technological process (consistency) of the assembly of thermal insulation when eliminating thermal bridges;
- The basic requirements for labour safety, hygiene and fire safety.

Students should be able to:

- Read technical documentation;
- Rationally organize the workplace;
- Implement the technological sequence of thermal insulation assembly when eliminating thermal bridges;
- Describe the structure of the layers of insulation for the elimination of thermal bridges.

[CraftEdu](#) project has developed full training documentation for acquiring nZEB-related competencies on 8 professions for craftsmen and on-site workers in the field of energy efficiency and use of renewable energy sources in buildings. The training activities are facilitated by a recently launched e-learning platform. The project supports the EU policies for introduction of nearly zero-energy buildings and deep energy building renovation within a vision for a decarbonized building stock in 2050. In Bulgaria, the training scheme supports the vocational training EQF level 3 for the following specializations within profession 582040 Builder-Installer (EQF3): Installer of windows and doors and Hydro-insulator. The project aims to overcome the training deficiencies in this field, as the current state educational standards do not focus on the requirement for achieving of airtightness and the cross-craft understanding related to the operation of the mechanical and electrical installations. An example presenting the approach to the description of the learning outcomes for the training “Installer of windows and doors” is provided below:

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p><i>knowledge</i> on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness .</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p><i>knowledge</i> on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p><i>knowledge</i> on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p><i>cognitive and practical skills</i> required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p><i>cognitive and practical skills</i> required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p><i>cognitive and practical skills</i> required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p><i>cognitive and practical skills</i> required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p><i>cognitive and practical skills</i> required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p><i>cognitive and practical skills</i> required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p><i>cognitive and practical skills</i> required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p><i>cognitive and practical skills</i> required to seal elements such as wooden joists which penetrate</p>	<p><i>responsibility</i> for formulating a logical procedure/sequence of work with reference to airtightness</p> <p><i>responsibility</i> for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p><i>responsibility</i> for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p><i>responsibility</i> for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p><i>responsibility</i> for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p><i>responsibility</i> for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p><i>responsibility</i> for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p><i>responsibility</i> for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>
<p>diffuse layers from inside to outside (“drying-out”)</p> <p><i>knowledge</i> on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p><i>knowledge</i> on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p><i>cognitive and practical skills</i> required to explain the importance of the q50 value in large buildings</p> <p><i>cognitive, practical and communication skills</i> required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>

Fit-to-nZEB project developed Training courses on Deep Energy Renovation of Building Systems for all EQF levels, conducted in partnership with the University of Architecture, Civil Engineering and Geodesy, the Professional High School for Architecture and Construction in Pazardzhik and the Bulgarian Association for Insulation in Construction. The training programme “Deep energy retrofit: retrofitting to nZEB levels” is designed for professional high schools Levels 3-5 under the EQF “Construction” professional direction, an example of which is provided below (full materials are available [here](#)).

<i>Subject</i>	DEEP ENERGY RETROFIT: RETROFITTING TO NZEB LEVELS
<i>Academic hours</i>	1-2 hours lecture + 1-2 hours practical lessons per week Total: 60 hours - 24 hrs lectures and 36 hrs practical lessons
<i>Type of discipline</i>	Elective (facultative)
<i>EQF level</i>	3 - 5
<i>Control and evaluation - ongoing assessment and examination</i>	
<i>Credits ECTS</i>	
<i>Acquired knowledge</i>	Comprehensive, specialised, factual and theoretical knowledge on: (a) deep energy retrofit process (b) principles and practices of the deep energy retrofit (c) overview of the basic deep energy retrofit details and their implementation during building renovation
<i>Acquired skills</i>	Comprehensive range of cognitive and practical skills on: (a) overall organization of building renovation design process (b) implementation of some basic tasks during renovation with regard to the: thermal bridges insulation, air tightness, fixing of thermal insulation, windows assembling etc.
<i>Targeted responsibility and autonomy</i>	Responsibility for: (a) read and process the planning documents of the main stages of the design and construction process in deep energy retrofit (b) reading the necessary drawings regarding the retrofit
<i>Preliminary requirements</i>	The students are expected to have general knowledge on: building physics & building materials, building construction basics.
<i>Exam procedure</i>	Midterm test and final written exam (incl. drawings done on site) and an oral examination.
<i>Technical secure (hardware and software)</i>	<ul style="list-style-type: none"> • White board; • Multimedia facility; • Demonstration models; • Practical training models; • Samples of components and materials, suitable for deep renovation; • Demonstration videos.

The training programme “Management of Deep Energy Building Retrofit” for 6-7 EQF level was piloted for last-year students. An example of one of the training programme is provided below (full materials are available [here](#)):

<i>Subject</i>	Deliverable 4.1 of the FIT-TO-NZEB Development of the educational programme
<i>Academic hours</i>	1-2 hours lecture + 1-2 hours seminar Total: 60 hours - 30 hrs lectures and 30 hrs seminars
<i>Type of discipline</i>	e-learning tools, facilities for practical demonstration and training, and examination programmes
<i>EQF level</i>	6 - 7
<i>Control and evaluation - ongoing assessment and examination</i>	
<i>Acquired knowledge</i>	advanced and highly specialised knowledge on: <ul style="list-style-type: none"> (a) The physical properties of the object; (b) Thermal gains and losses of the building; (c) Properties of the building envelope; (d) Passive standards, nZEB; (e) Requirements for the operation and maintenance of buildings; (f) Proposals for energy-saving building measures; (g) The economic efficiency of the design, construction and operation of the building; (h) Principles of building ecology and sustainability.
<i>Acquired skills</i>	General and specific skills: <ul style="list-style-type: none"> (a) To explain the main building physics principles; (b) To carry out a fine tuning to optimize the building envelope, and the building services depending on the climate conditions; (c) To understand passive solar design in different climates – cold, warm, continental; (d) To generate solutions to specific problems related to risks and construction damage; (e) To integrate knowledge from different field; (f) To apply basic methods, tools, materials and information.
<i>Acquired responsibility and autonomy</i>	Self-management and/or management and supervision in: <ul style="list-style-type: none"> (a) Within the guidelines of work related to the design process of energy saving buildings;

	<p>(b) Manage complex technical or professional activities or projects;</p> <p>(c) For decision-making contributing to professional knowledge and practice in unpredictable work;</p> <p>(d) In recommending measures/actions to optimize the functionality of a defined system;</p> <p>(e) For the proposed/promised benefits;</p> <p>(f) For completion of tasks related to preparation of construction project.</p>
<i>Preliminary requirements</i>	<p>Participants are expected to have basic knowledge of:</p> <ul style="list-style-type: none"> • Building physics; • Building materials; • Building insulation; • Energy measures; • Energy economy; • Project planning and management.
<i>Exam procedure</i>	Final test and regular practical testing during the seminars.
<i>Technical secure (hardware and software)</i>	<ul style="list-style-type: none"> • White board; • Multimedia facility; • Laptop; • Demonstration models; • Practical training models; • Samples of components and materials, suitable for deep renovation; • Demonstration videos.

Training programmes for vocational training centers are designed for the two streams of construction workers involved in the deep retrofitting of buildings: building envelope and mechanical systems. These training programmes can be delivered at vocational training schools or at the construction site. An example of one of the training programmes is provided below (the full materials are available [here](#)):

<i>Subject</i>	Deep energy renovation of the building envelope
<i>Academic hours</i>	10 hours weekly (theory + practice) Total: 40 hours - 20 hours lectures and 20 hours practical hands-on workshop training
<i>Type of course</i>	Elective
<i>Course field</i>	Construction (foremen, carpenters, block-layers, plasterers, general operatives)
<i>Control and evaluation</i>	Continuous assessment and examination
<i>Term in which the evaluation takes place</i>	After completion of the course
<i>Credits ECTS / Certification</i>	Yes
<i>Acquired knowledge</i>	Knowledge on: <ul style="list-style-type: none"> (a) Deep energy retrofit process (b) Principles and practices of deep energy retrofits (c) Overview of key aspects of deep energy retrofit and their implementation during building renovation, including continuous insulation, airtightness, thermal bridges and high-performance windows (d) Principles of moisture movement and risks associated with interior insulation (e) Qualities of different insulation and airtightness product types and their suitability to different application settings
<i>Acquired skills</i>	Cognitive and practical skills on: <ul style="list-style-type: none"> (a) Overall organization of the building renovation process (b) Implementation of some of the key renovation tasks with regards to affixing of insulation, application of airtightness materials, reducing thermal bridges and installation of high performance windows and doors
<i>Acquired responsibility and autonomy</i>	Responsibility for: <ul style="list-style-type: none"> (a) Interpreting the deep retrofit drawings and schematics and understanding the planning of the main stages of the design and construction (b) Adaptation of own behaviour to circumstances in solving problems (c) Taking responsibility to ensure continuity of the insulated and airtight thermal envelope (where assessable)

	(d) Taking responsibility to ensure that all products used in deep energy retrofits are fit for purpose with respect to ensuring insulation and air-sealing of the thermal envelope for the life of the building
<i>Preliminary requirements</i>	The students are expected to have an overall understanding of building systems, construction, processes and materials.
<i>Terms for certification of lectures and seminars</i>	An application for accreditation of the training programme will be made by WWETB, most likely to the internationally renowned City and Guilds [insert relevant details for each country].
<i>Exam procedure</i>	Final theoretical and practical examination.
<i>Technical equipment (hardware and software)</i>	<ul style="list-style-type: none"> - White board - Multimedia facility - Laptop - Health and safety equipment, including first-aid box - Envelope demonstration models illustrating the classic construction types found in the region of the VTC and including the key junctions of wall to floor, wall to window, wall to intermediate floor and wall to roof - The envelope demonstration models should illustrate both interior and well as exterior insulation strategies and should include typical service penetrations found on high performance retrofits required for ventilation ducts - Multiple samples of the different kinds of insulation, air-sealing and thermal bridge products which can be used for deep energy retrofits - Sample triple-glazed windows available in the region - Blower door equipment used for airtightness testing - Tools and applicators typically used in deep energy retrofits, including smoke-pens used for finding leaks in the building envelope <p>Appreciation of DER mechanical services strategies:</p> <ul style="list-style-type: none"> - Demonstration model for MVHR system, including ducts, registers and simulated wall penetrations - Demonstration model for renewable energy systems including roof mounting fixings, inverter and battery - Demonstration model for exterior air to water heat pump with interior low temperature radiators and / or mini-split wall-mounted cooling evaporator - Demonstration model for insulation of DHW pipes with multiple awkward connections, bends and fittings - Demonstration model for drain waste water heat recovery - Demonstration model of typical deep energy retrofit of the thermal envelope illustrating solutions for insulation, airtightness, thermal bridging and high-performance windows

	- Tools and applicators typically used in deep energy mechanical services retrofits
<i>Trainer qualifications and experience</i>	- Construction related qualification minimum EQF Level 4 to 5 - Nationally recognised 'Train the Trainer' accreditation - Certified Passive House Designer or equivalent - Demonstrable project experience with deep energy retrofit practice

People Certification and Mutual Recognition

Unfortunately, in Bulgaria there is no system for continuous professional development in the construction sector yet, which is one of the major gaps which BUSLeague will try to address. Within the national VET, certification is most commonly provided by “qualification courses on part of profession”, as exemplified by the courses developed and piloted BUS EnerPro. The most common international voluntary certification schemes in Bulgaria for construction workers is the Passive House Certified Tradesperson, as promoted by Train-to-NZEB. For designers, besides the Certified Passive House Designer and Certified Passive House Consultant courses offered by Passive House Bulgaria, there is a growing market for LEED and BREEAM certification. The only attempts for mutual recognition of qualification among countries in the region are initiated by the Building Knowledge Hubs network started by Train-to-NZEB. Activities under these two initiatives have, however, been hampered by the COVID pandemic as they are mostly based on hands-on training. New attempts are being done on CraftEdu, and the work will be continued within INSTRUCT, where a regional cluster will be supported. On the other hand, there are many initiatives of VET establishments on the Erasmus+ programme, but they are usually limited to exchange of trainers and students and haven't resulted in common educational programmes and mutual recognition.

2.3 Recommendations from the BUSLeague ethnographic research

In this paragraph the BUSLeague consortium selected and outlined relevant recommendations from the BUSLeague ethnographic research, both at national and generalized at EU level.

2.3.1 General elements derived from D2.3

Lack of knowledge and awareness proved to be one of the most frequently reported barriers and challenges for the existing and future EE Skills market. Reasons for and forms of “lack of awareness” are very diverse, including everything from ignorance to lack access to information. Several aspects regarding lack of awareness and knowledge with regard to demand side have been identified:

- **EE Skills in “the bigger picture”** – Lack of general awareness regarding importance and benefits of existence of EE Skills, knowledge and certification/qualifications has been widely reported. In addition, it has been reported in close relation to **inefficient communication** (lack of promotion and marketing) on the side of EE Skills suppliers and responsible public authorities. A particularly important aspect in this regard is **lack of access to reliable information**, which has been pointed out in several countries.
- **Lack of understanding of the (basic/key) concepts and notions** – Concepts, such as nearly zero-energy buildings (nZEB), Plus energy buildings, Passive house, etc. have been reported as poorly understood.
- **EE Skills as a benefit** – Lack of understanding regarding the importance and benefits of skilled workforce for investors (individual or institutional), such as to minimize construction errors, or ensure long term savings.

“What I would like to see is more emphasis put on the benefits of energy efficiency so that I can motivate others to make their home healthier and more energy efficient.” (Representative of a professional org., Bulgaria)

Also identified is skepticism with regard to EE Skills:

- **Gap between theory and practice** – Skepticism that emerges in transition from belief in theory to disbelief in practice.
- **Doubt & denial in feasibility and efficacy of EE** - Skepticism regarding the efficacy and financial feasibility of EE measures and/or technologies (examples of failed investments, myths and misconceptions). This diminishes objective relevance of EE Skills, making them subject to misconception and prejudice, baseless beliefs and averse attitudes.

Several aspects with regards to Skills (availability) and Policy have been identified

- **Increasing gap between regulatory (theoretical) requirements and available skills** – In some countries, policy makers already tend towards more ambitious policies which are in conflict with capacities of the sector. This is a specific aspect of the issue of supply and demand in general, closely related to lack of skilled workforce, continuous change, inertia of the market etc.
- **Lack of experience (practice) with implementation of nZEB** – In contrast to the point above, some countries lag behind with implementation of policies. Lack of capacity of the system(s) to implement requirements for EE Skills in the whole value chain of the sector can be a key factor with regard to recognition of EE Skills.

Another widely reported aspect is **lack of quality training opportunities**. Some of the most commonly reported aspects in this regard include:

- **Poor transfer of knowledge and experiences** (lack of thereof, poor adaptation to local specifics, etc.),

- **Not enough stress on cross-trade collaboration on the building site,** and
- **Training contents are either overly generalized or overly specialized.**

Reports indicate that **overcoming low recognition of (and trust in) the value of certification and qualifications of EE Skills** is one of the central challenges of the future of upskilling efforts. Some of the most commonly reported reasons are:

- **Lack of knowledge and awareness,**
- **High numbers of (available) qualifications on the market,**
- **High numbers of (qualified) workforce on the market,**
- **Lack of appropriate regulation (standards and enforcement).**

With regard to **lack of knowledge and awareness among stakeholders** (workers, professionals and other stakeholders that co-create the market) that form part of the construction and renovation value chain, reports have been made with regard to lack of understanding of the importance of EE, nZEB, IEQ, etc.

- **Poor commissioning** – Failing to ensure effective functioning of building systems can significantly negatively impact not only energy performance of buildings, but also the uptake of new technologies and general perception regarding EE policies and industries.

Other aspects mentioned are

- **Target the entire construction and renovation value chain** – The need to reach *all* key stakeholder groups has been particularly stressed.
- **Clients (demand side) thinks in terms of concrete solutions & products** rather than holistically (an aspect of driving demand for EE Skills).

2.3.2 NL

General

- An attitude of continuing to develop and take up new things.
- Relieving the customer or referring specifically to someone who takes care of it.
- Explain the practical value of alternative techniques to the client and colleagues.
- Respects in his own work the importance of airtightness in relation to nZEB.
- Working on EE can be completed at various levels:
 1. individual measures,
 2. measures without obstructing other measures or existing systems
 3. measures in conjunction
 4. integrated systems
(with digitization and prefabrication as an additional complicating factor).
- Feeling for the customer relationship and knows how to communicate substantively.
- Imbued with safety and certifications and can communicate about the added value of this and that the company or people have it.

Several key roles

- Technician on-site (with the customer) who knows the context of nZEB.
- Installer and builder who masters the integration of techniques from nZEB.
- Understanding of the new techniques, in order to attune your own work to them or to perform it in conjunction with them.
- Identify and indicate when something is not going well in the individual measure / installation part or in relation to the larger whole (installation / building).
- Installation knowledge among builders and construction knowledge among installers.
- Take the residents' questions seriously and submit them to the manager if the technician does not know what to do with them.

- Advisor that can take the resident with him in the transition to nZEB
- How do you get the building owner along and unburden them.
- Insight into what happens in a building and what the role and function of sustainable installations has to be in terms of energy and climate technology.

The energy transition advisor (ETA) for the Owners Association must have additional knowledge and skills about support formation, group dynamics, collective decision-making, financial plans, operation and organization of an Owners Association, etc.

- An ETA has financial knowledge of financial instruments (subsidies, etc.), financial situations of residents and capacity, as well as project costs and tax reductions.
- An ETA has a feeling for its target group, among other things not drowning in an overload of information, but guiding people to a choice that they can oversee. He can also deal with justified and unjustified resistance and complicated questions.
- An ETA can understand and advise integrated energy concepts. He can also make the planning for each measure of the integrated concept with a technically justified sequence. In other words: take it by hand. He knows how to plan and implement "no-regret" measures.
- An ETA can record a home, estimate which separate and integrated measures are appropriate for the home and whether they are technically and physically fit. So he has technical and energetic knowledge.
- An ETA can transfer its work to a subsequent party in the chain, so that without having to do work again, it can offer and implement the realization.
- The ETA is able to act as a guiding advisor for the resident or owner, for example to carry out a final check upon completion or to support the resident with questions or complaints.
- In collective activities, the ETA can make a communicative connection between the residents and the implementing parties, so that the residents have and keep confidence in the project. The ETA has a feeling for the wishes and interests of the residents.
- An ETA (but also others in the ET) have a sense of what is politically sensitive.
- An ETA is able to select, guide and review implementing parties professionally, without favoritism or the like.
- An ETA or other supervisor can estimate what certificates and recognitions represent for value.
- An ETA (this skill fits a profile that is also called an energy coach): advising residents about energy use, i.e. behavior, quick wins, simple steps, etc.
- Everyone who works on the ET is aware of safety and certifications and can communicate about the added value of this and that the company or people have it.

Contractor

- Have an eye for what I have to ask subcontractors in terms of craftsmanship and how to organize / test this.
- Participate in new tender and contract procedures.
- Able to work in a more horizontally organized chain.

Clients

- How to select a skilled craftsman
- ET craftsmanship requires the ability to deal with prefab: is sustainability delivered or will it be realized in / on the building? This influences the process and therefore also the information to the resident / owner. What is prefab? What is the added value? What does this mean in the realization and preparation thereof in the process for the various professionals?

- Being able to deal with the ever-new developments surrounding digitization. This affects both the process and the way in which systems are controlled.

2.3.3 Spain

In Spain, vocational training offers very complete but excessively rigid training itineraries. On the one hand, it is a slow mechanism to include new skills demanded in the sector. On the other hand, most of students are young people who dedicate all their time to study, as a first step before entering the labour market.

Heads of the Department of Education of the Regional Government of Valencia have commented to IVE in recent meetings their interest in some change approaches to training so that it is more flexible and better adapted to the needs of professionals and the demand of the sector:

- **Micro-training:** the current training offer is of very long duration and this implies, on the one hand, that it is very general, and on the other hand, that it is not easy to combine with work. It is necessary to carry out a thorough analysis of what training is already available, in order to offer smaller and more specialized units.
- **Micro-accreditation:** the new skills demanded by the sector are increasingly specific and specialized. Often companies in the construction sector look for a very specific worker profile. In parallel to the micro-training, the accreditation that already exists should evolve to certify more specific skills. It is very important to certify or support the current professionals working in the construction sector as the most part of them were not able to study and acquired their skills through working experience.
- **Skills Passport:** it is a priority to share the different databases of the regional government with information related to skills acquired through training, skills recognized by experience, working life, qualifying titles, etc. The next step is to advance in the recognition of all this through professional listings, passports, virtual cards, etc.

There are professional profiles that are very difficult to find because the available workforce is not qualified. There is a gap between supply and demand. Acquiring trendy and highly demanded skills are key to increasing the employability of blue-collar workers.

Young people are not attracted to the construction sector because it is a sector perceived as outdated, sexist, and with very demanding working conditions.

Many of the workers are untrained and their work is of poor quality, leading to poor repair and customer dissatisfaction. These bad experiences and the lack of transparency outline an unreliable sector for the consumer.

Small home repairs accumulate numerous claims in consumer and user offices.

Clients feel lost when hiring a professional and, in most cases, are guided by the recommendation of friends and family.

Several of the interviewees miss an online list, web or application where clients can find qualified professionals in energy efficiency easily and quickly. They imagine an online platform, supported by official bodies (Government, non-profit associations, professional associations, etc.) for greater confidence, and periodically reviewed to update the information of professionals.

2.3.4 Ireland

In Ireland there is a huge commitment through national policy and the Climate Action Amendment bill, to reduce energy usage by 20%, provide 70% of Total Primary Energy, TPE from renewable sources and to achieve total reduction of 51% carbon emissions over the period to 2030, in line with the Programme for Government commitment.

The strategic goals include:

- Actions to promote the sustainability of energy supply and use;
- Addressing climate change by reducing greenhouse gas emissions;
- Accelerating the growth of renewable energy sources;
- Maximising energy efficiency and conservation;
- Ensuring affordable energy for everyone;
- Creating jobs, growth and innovation in the energy sector.

Barriers and solutions to the uptake of energy skills training previously identified were raised in the ethnographic research outlined below:

- A lack of awareness amongst homeowners about skills. A general awareness campaign similar to the campaign for the “RECI” certification for electricians has been recommended.
- There is a lack of awareness in the workforce as well as unwillingness to make changes, which is well illustrated in a commonly used phrase:

“This is the way we have always done it.”

- There are issues with time constraints. Even if SMEs could pay for their employees to do the training, SMEs and contractors reported that they couldn’t afford to take time off work due to work commitments on site. Flexible micro-training online and onsite is an option to progress.
- There is a need for clarity. There should be **one standard and one specification** that everyone needs to meet. Part of the issue is knowing what training to do as there are so many different courses and do not know where to go for training advice. A huge number of trainings are available but these are all fragmented and difficult for the industry and workers to progress or find a suitable pathway effectively.
- Professionals are more likely to sign up to training than construction workers, even if the training is designed for construction workers as professionals are required to complete Continuous Professional Development CPD annually and any course of interest is undertaken. Additionally, it is easier for professionals to complete online trainings as they are generally located in the office.
- Practical training was recommended as the best format. Generally, construction workers don’t like classrooms listening and looking at powerpoints, they like to be hands-on operating in the open. Blended learning has been identified as preferential to online learning, if support is given for digitalisation and IT aspects.
- Providing micro-training on site or at the hardware store should increase uptake.
- There is a shortage of skilled workers in the industry, especially in wet trades (plastering, bricklayers, tiling etc.) but also in green and retrofitting skills due to the recent high demand from the construction industry.

Ireland’s Future builds on the progress made under the previous strategy Towards Tomorrow’s Skills I. Over the next ten years, it will address the objectives of Lifelong learning; an all-purposeful learning activity, formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence.

Vocational Training Opportunities Scheme (VTOS) is operated through 16 local Education and Training Boards, ETBs and is aimed in particular at unemployed people who are early school-leavers. Its competencies include:

- continue education and training.
- develop new skills.
- gain certification at a range of levels.
- find good employment.

The Expert Group on Future Skills Needs, EGFSN has identified key competences for Lifelong Learning as:

- Literacy
- Multilingual; Mathematical, science, technology and engineering;
- Digital
- Personal, social and learning to learn
- Citizenship
- Entrepreneurship
- Cultural awareness and expression

The European Higher Education Area (EHEA) facilitates cooperation between systems, institutions, and individuals in its 48 member countries. member states also hope to raise the international profile and status of European higher education.

The Irish and UK qualifications authorities promote the transparency, recognition and mobility of qualifications between each respective jurisdiction. The qualifications authorities in the UK and Ireland have agreed the correspondence between qualifications frameworks in operation across the five jurisdictions. Quality and Qualifications Ireland (QQI) is responsible for developing, promoting and maintaining the Irish NFQ and also facilitates the recognition of foreign qualifications.

This Energy efficiency and circular economy objectives will be further advanced by the publication, at the end of June 2021, of updated guidelines for Green Public Procurement by the Environmental Protection Agency. LIT are developing training for green public procurement in the Erasmus+ funded [GUPP project](#), which is expected to influence policy and procedures, with the roll out of training across the entire construction sector and local authorities establishing the requirement for energy efficiency and green skills as a remit in the GPP.

2.3.5 France

In France, the ethnographic research identified that some stakeholders of the energy renovations are particularly worried about the lack of professionals enrolled in the sector, one of the main issues in the market nowadays. This explains the difficulty for finding qualified enterprises available to achieve energy renovation projects. And backwards, this is a consequence of lack of interest of the school seniors and of the labour demanders of other sectors on the construction sector.

In this sense, process of certification and as so the educational offer should respond to increase the offer of qualified professionals . As such, the process should be simple enough for it to be accessible to all kind of organization or independent professional concerned but also create spaces or exploratory certificated in which professionals from other fields to familiarize with techniques and methods of this kind of works and, motivated by the market growing demand, use their engage in more detailed trainings without damaging strongly their revenues.

The permanent improvement in the materials and techniques also makes the continual education an important axis of the certification process. However, it was highlighted in the research that even when its relevance is recognized by most of the state holders and that the government and other agencies encourages it through financial aids that cover most of the trainings cost (Constructys in the French case), the entrepreneurs still hesitate to enroll their employees considering the monetary losses derived from the absence of their collaborators in the work site towards the training spaces and the impossibility to note instantaneous increases in the productivity.

The conclusion drawn from this notion goes along with what private sector and public agencies had identified years ago: the practical and mobile skilling up programs. As so, projects like PRAXIBAT and FIT had innovated not only in the way of teaching, an empiric method, and facilitating the access of the candidates to the training spaces decreases the time and monetary cost of transportation. The facility for enrolling in these programs in as well an unavoidable advantage for both entrepreneurs and individual professionals.

Given that this is the only certification available, the RGE label is also one of the topics highlighted in the research. It is a powerful signal to facilitate the matching between project owner, project manager and professional team. Nevertheless, it is remarked that the complexity of this process discourages the enterprises, especially the small employers, for seeking to achieve this label. As well, it is agreed that it is not infallible: as the firms are not obliged to train all their collaborators but at least one of them.

Reading this context, a recommendation would be to simplify the administrative labelling process in order to increase the incentives for the small and independent professionals to label. Alternatively, given the utility of this kind of tools for matching the project stake holders, the possibility to provide recognised certificates from the training would serve as a transitory solution for emptying the market.

2.3.6 Austria

In Austria there is a very clear and well-developed initial training for craftspeople. However, there are currently numerous barriers to overcome in terms of further education. On the one hand, the range of further education courses to improve energy skills is very limited and, on the other hand, objective trans-national recognition is hardly possible. In Austria, further education modules often do not require an entry qualification or do not end with a certificate of earned competencies on an international, comparable standard.

Within the survey carried out during the first phase of the project, which included the experiences from the previous projects carried out under Build Up Skills program, it could be observed that unfortunately the Austrian construction companies show little willingness in sending their employees to further education courses. This is because the workers and professionals are needed on construction site. Furthermore, the benefits of the trainings are not clear enough for both, employee and employer. The most successful trainings were the ones carried out on site or practical ones. Moreover, it is very difficult to motivate blue-collar workers to participate in courses. A main reason for the demotivation of craftspeople is that attending further education is voluntary in Austria and is not required by the market.

In the framework of BUSLeague, in order to push the further education of the blue-collar workers and professionals forward, interviews with different relevant stakeholders were carried out. During the interviews, all the barriers and challenges in context with further education already observed were confirmed and more insights could be gained:

- The travel distance to possible training locations should be short.
- The more experiences professionals are more willing to take part in further or deepening trainings.
- The market (end user) doesn't ask for skilled workers.
- The regulations and tailor made subsidies can contribute to the market growth of the skills.
- Energy consulting especially as a tool to support the building owners can raise awareness of the end user / building owner regarding quality and therefore, indirectly promote the skilled workers.
- The motivation to participate in a training changes when it comes to the location of the SME: rural areas more than the ones close to the bigger cities concerning the reputation of SME.
- The micro-learnings (such as learning via app or short clips) could be added to the existing trainings in order to support the main contents of the courses/trainings, e.g. installing the components of a heating system or tuning the settings.
- The professionals (mainly involved in planning) are more willing to participate in training courses. They are also more motivated to learn outside of the daily working hours.

- The best way to apply EE in the building is by providing advice for the building owner and accompanying him through the planning and construction of the building.

If the technology is new, or a certification is needed to carry out the job, the professionals are willing to get trained.

2.3.7 Bulgaria

The conclusions from the ethnographic research in Bulgaria confirmed the initial hypothesis that the market for training and educational services on NZEB-related issues is fragmented and dispersed, focus around individual DC nuclei that are not sufficient to streamline the training offer and stimulate mass market demand. The need for a national **continuous professional development system** is reappearing in many of the conducted interviews, although it is still not unequivocally accepted or even identically interpreted by the various stakeholders.

In this regard, there is **no evidence for broad market acceptance of neither national nor international certification schemes**, especially as regards highly qualified professionals. The situation is looking more positive in consideration of blue-collar workers, where specialized training and certification are deemed as a positive sign for the overall attitude of the worker.

Interventions by public authorities – either as legislation, support programmes or within procurement – are (still) deemed decisive in shaping the demand. The interest towards vocational education and training is often related to either the legal requirements for qualification of the workers or to the existence of financial support programmes for building renovation.

There is a need for policy support for both building renovation as such, and specifically for skills development, therefore, the overall BUS League approach in Bulgaria should be based on **active policy advocacy and promotion campaigns** regarding the design and implementation of the national renovation support programmes.

The awareness level of the benefits of energy efficient buildings and the importance of skilled labour is low. This is why BUS League and other initiatives in Bulgaria are focused on the **development of the real estate market in general and stimulating the demand for quality nZEBs** through improved understanding of the benefits of sustainable construction among different end-user groups.

The **upskilling courses provided by product suppliers** are considered as the main carrier of market-relevant skills and knowledge. However, there is no suitable system which can integrate these training into a coherent certification scheme – a gap that could potentially be filled through BUS League-supported actions.

The **lack of qualification register and deployment of skills passports** represent an outstanding barrier for the development of the continuous professional development system.

The **architects and designers** are recognized as the leading actors for implementation of new features in the buildings in general – not only in the area of energy efficiency, but within the broader aspects of sustainability, circularity and smart technologies. Thus, the expectations towards their qualification, knowledge and continuous professional development become higher and well outlined, which makes them one of the **key target groups** for BUSLeague.

2.4 Conclusions for scope and format of BUSLeague QF

Based on examples from EU projects and national projects the following scopes for qualification elements are distinguished:

1. Fundamental knowledge and skills with a focus on the ‘Why’ of sustaining the built environment.

Example qualifications are: NSS Basic Awareness, PROF/TRAC basic skill level in its skills gap analysis.

Proposed format: skill-levels for involved occupations as used in PROF/TRAC:
TECHNOLOGY AND INTERDISCIPLINARY SKILLS PER WORK FIELD

WORK FIELD	ARCHITECTURE	CIVIL ENGINEERING	ELECTRICAL ENGINEERING	MECHANICAL ENGINEERING	BUILDING MANAGEMENT	CONSTRUCTION MANAGEMENT	FINANCING & PROCUREMENT	
Reference professions	Architect	Civil Engineer	Electrical Engineer	Mechanical Engineer	Facility Manager	Project Manager	Procurer	
		Construction Engineer	ICT Engineer	Building Automation Engineer	Technical Energy Engineer	Cost Engineer	Project Developer	
		Structural Engineer		Energy Engineer	Operator	Quality Assurance		
EM	ENERGY MANAGEMENT							
EM1	Smart grid systems	2	1	5	3	3	2	1
EM2	Domotic systems	2	1	4	4	3	2	1
EM3	Building management systems	2	1	4	5	3	2	1

Fig 33: PROF/TRAC Skill levels linked with workfields of professions

Train4Sustain has extended the PROF/TRAC skillsmapping with blue collar workers. For this reason BUSLeague will assess and, if needed, adapt these outcomes in T2.4 Stakeholder validation for scope I.

2. Cross-craft addressing:
 - a. Shared knowledge, skills and responsibility
With a focus on integral quality of nZEB and retrofitting towards nZEB
 - b. Including the use of digital means and innovative measurement technologies
 - c. Extendable on the impact of circularity

Example qualification: NEWCOM Building Inspection Modules

Proposed Format: task based such as applied in BIMplement & NEWCOM:

Tasks	Sub-tasks	ULO Nr.	Task Type
Give guidance to a comprehensive project development			Core
	Assess feasibility of the energy concept	2.1;2.2	Core
	Evaluate an economic profitability analysis	19.2	Core
	Optimize and interpret the energy balance forecast	17.1;17.2	Core
	Roughly evaluate feasibility for a building certification	17.3	Optional
	Review renovation concept in a proactive approach following nZEB standards/guidelines	18.1	Core
	Analyze the concept design according to change in use aspects	1.3	Optional
Assess the concept design by regarding energy related infrastructural aspects			Optional
	Evaluate the availability of local energy-infrastructure	1.1	Optional
	Evaluate sustainable mobility aspects in concept design stage	1.2	Optional
Control comfort in inner spaces in planning phase			Core
	Control thermal comfort in winter	3.1;3.2;3.4;3.5;6.1;8.1;11	Core
	Control thermal comfort in summer	3.1;3.2;3.4;3.5;6.1;8.2;12	Core

Fig 34: NEWCOM task based competences

3. Occupation specific knowledge, skills, competence needed for professional practice with a focus on a specific occupation
Example qualifications: NSS Plastering from Ireland, Craft-Edu Windows installer

Out of scope for BUSLeague EE-skills qualification
4. Technology specific knowledge, skills, competence needed to install/realise...
With a focus on application on a specific technology
Example qualifications: NSS NZEB Ventilation assured, Heatpumps-RES,-NL SolarPV-RES-NL

Out of scope for BUSLeague EE-skills qualification

Summarised in one picture

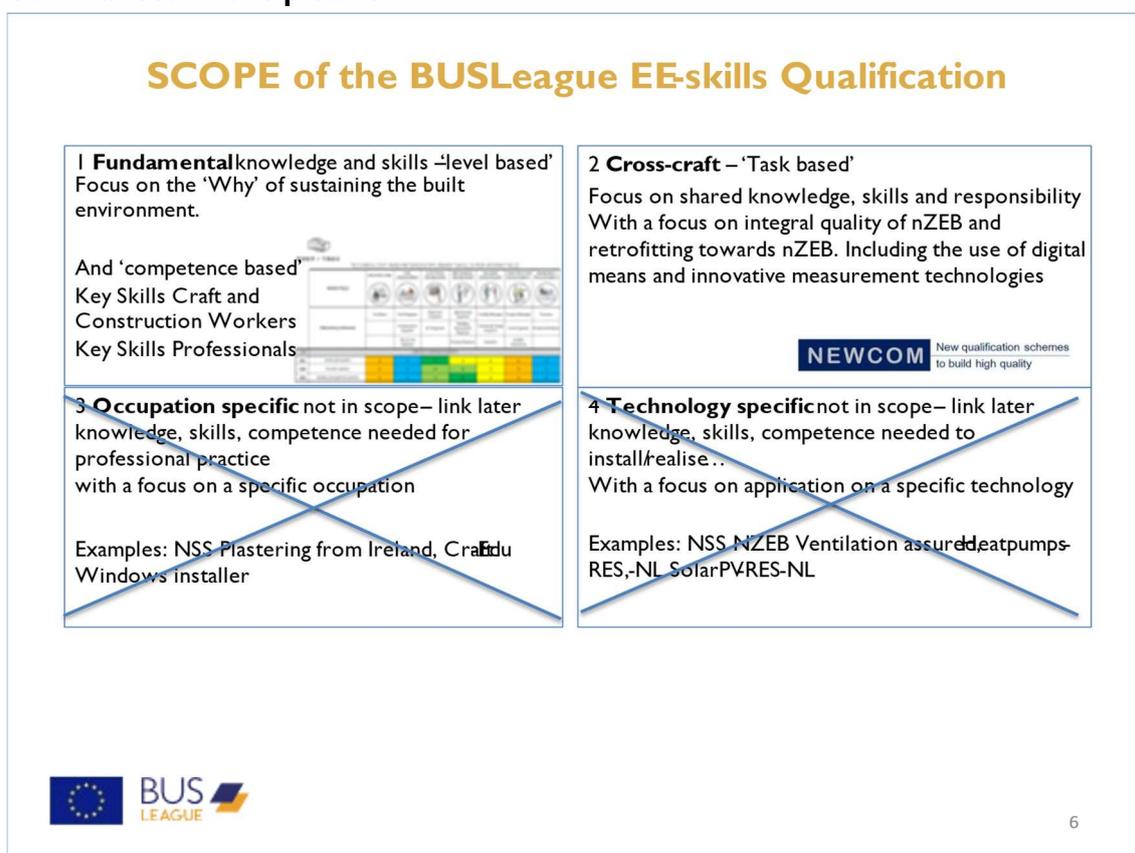


Fig 35: Scope of the BUSLeague EE-Skills qualification

The second scope - Cross-craft shared knowledge, skills and responsibility – is the primary focus of the BUSLeague EE-skills qualification. As part of the cross-craft element, relevant occupation specific elements will be highlighted in order to create a better understanding of each other’s work and to become aware of certain quality requirements. In order to elaborate the BUSLeague EE-skills qualification on the second scope - Cross-craft shared knowledge, skills and responsibility; we gather useful elements from the examples at both EU (2.1) and national level (2.2).

One of the outcomes of the ethnographic research and analysis of the examples at EU and national level is that ‘Training contents are either overly generalized or overly specialized’. Particular focus will therefore be given to shared responsibilities for specific activities, specifically

by using a task-based format. Based on recommendations from BUSLeague ethnographic research, the BUSLeague EE-skills qualification has to address the following:

- Take into account that Clients (demand side) thinks in terms of concrete solutions & products rather than holistically,
- Place EE Skills in “the bigger picture”,
- Doubt & denial in feasibility and efficacy of EE,
- The lack of understanding of the (basic/key) concepts and notions,
- The lack of experience (practice) with implementation of nZEB,
- The entire construction and renovation value chain, such as:
 - Communication and collaboration between stakeholders
 - Potential existing loose ends or missing links in the chain
 - Awareness and motivation
- Stress on cross-trade collaboration on the building site,
- The gap between theory and practice,
- Better transfer of knowledge and experiences by cross trade awareness,
- Decrease of the gap between regulatory (theoretical) requirements and available skills, and
- Integrated commissioning.

Working with skill-levels and a task based qualification enables micro-training, micro-accreditation, and a user-friendly approach for ‘work’ skills passports (a certification index understandable for an average person (end user)).

2.5 Overview of maintasks and some subtasks BUSLeague QF

The methodology to developed task based qualification co-developed in NEWCOM and BIMplement is used to do develop the EE-skills qualification and its Unit of Learning Outcomes. (ULO). This in order to deliver qualification content that is fit for use in the ULO database that is part the BUILD UP Skills advisor-app maintenance environment. This means that for relevant aspects on ‘Energy Skills’, tasks will be inventoried and allocated to specific professions. The tasks will cover the whole ‘work process’ and all actors involved. From orientation, setting ambitions to building in use (and when needed / available after use). We have used the RIBA phases (RIBA Plan of Work see 2020RIBAPlanofWork-template.pdf).

The tasks have been inventoried in the Excel-format provided from BIMplement.

The Qualification			P	P	P	Specialisms involved
Tasks	Sub-tasks	NOTES area for jotting down knowledge and context	r	r	r	
			o	o	o	
			f	f	f	
			e	e	e	
			s	s	s	
			s	s	s	
			i	i	i	
			o	o	o	
			n	n	n	
			1	2	3	
Example maintask						
	Example subtask		x			Example specialism
				x		
					x	

Fig 36: BUSLeague task based qualification inventory format

To give an impression of the scope and content of the BUSLeague EE-skills qualification, here is an overview of the 27 main tasks and seven key subtasks. These subtasks are linked to multiple main tasks and therefor seen as Key subtasks.

Why [economy, project management, importance]

1. Explain the impact of EU climate change and energy policy on sustaining the built environment.
2. Explain the characteristics of energy use in existing buildings.
3. Explain in general how to improve the energy efficiency of a building.
4. Explain the value of energy renovation in relation with the building users' needs.
5. Provide adequate information to building occupants in achieving adequate levels of ventilation, lighting, acoustic and thermal comfort.
6. Explain the consequences of having poorly insulated pipes, vessels and ducts which transport or store heated water or air.

How [Generic Cross-craft skills]

7. Perform a careful inventory as input for an integrated improvement process.
8. Design and apply step-by-step retrofit plans.
9. Ensure achievement of ecology and sustainability criteria.
10. Ensure comfort, health and safety requirements in buildings.
11. Analyse cost effectiveness of energy efficiency improvements.
12. Engage with other crafts to meet design demands – Work together onsite to achieve quality low energy buildings.
13. Ensure quality of work with regards to airtightness and vapour control.
(needs to be made generic)
14. Interpret thermographic images (both for building and installation issues).
15. Provide the homeowner with information needed to ensure that the building is operated and maintained to its optimum.

What [Building envelope - from cross-craft point of view]

16. Reduce heat loss through the building envelope (as a responsibility, not the actual isolation activity).
17. Identify and prevent common air leakage points.
18. Address potential thermal bridges during construction / maintenance / retrofit.
19. Address potential airtightness issues.

What [Building services - from cross-craft point of view]

20. Identify when adjustment on the type of ventilation system is needed.
21. Install necessary electrical services without compromising the effectiveness and continuity of the insulation layer.
22. Install necessary plumbing / ventilation services required without compromising the effectiveness and continuity of the insulation, airtightness and vapour control layer.
23. Minimise heat losses from the heat source and distribution pipes.
24. Identify and prevent poor hot water circulation systems.
25. Ensure proper functioning of the heating system.
26. Keep an eye on the importance of windows in relation to thermal protection, solar gains and ventilation.
27. Keep an eye on the need for or effectiveness of shading systems and passive solar systems.

Key BUSLeague subtasks [Linked to several of the Main tasks]

1. Subtask: Identify key information presented on both a CE label and in the associated Declaration of Performance.
2. Subtask: Identify if insulation materials are fit for purpose.
3. Subtask: Identify and label insulation layer(s) in construction details.
4. Subtask: Identify and label airtightness layer(s) in construction details.
5. Subtask: Repair and / or reinstate of insulation where it has been damaged or removed.
6. Subtask: Apply techniques and types of materials that are commonly used to create the airtight layer.
7. Subtask: Apply correct taping approaches and materials to create a permanent airtight connection.

2.6 Working out Unit of Learning Outcomes

After approval by the consortium and validation of stakeholders at national level (in Task 2.4), descriptors will be further worked out into ULO's, including competence, skills and knowledge.



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