



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

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Report:	D4.5 Strategies to improve the energy skills of blue-collar workers
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TABLE OF CONTENTS

SUMMARY	4
I INTRODUCTION.....	5
2 ENERGY RENOVATION AT SMALL WORKSITES.....	6
2.1 Austria.....	6
2.2 Bulgaria	8
2.3 France.....	10
2.4 Ireland.....	16
2.5 Netherlands	21
2.6 Spain	25
3 EXPERIENCES WITH SKILLS DEVELOPMENT AND EVALUATION ON WORKSITES	29
3.1 Austria.....	29
3.2 Bulgaria	30
3.3 France.....	31
3.4 Ireland.....	33
3.5 Spain	35
4 STRATEGIES FOR SKILLS DEVELOPMENT AND EVALUATION ON SMALL WORKSITES.....	37
4.1 Austria.....	37
4.2 Bulgaria	38
4.3 Ireland.....	41
4.4 Spain	43
Prerequisites	44
5 MARKET RECOGNITION POSSIBILITIES	46
5.1 Austria.....	46
5.2 Bulgaria	47
5.3 France.....	48
5.4 Ireland.....	49
5.5 Spain	50
6 CONCLUSION	52
7 ANNEX	53
7.1 Bulgaria	53
7.2 Spain	56
7.3 Ireland.....	66
8 REFERENCES.....	71

CHANGE RECORDS

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SUMMARY

The report “Strategies to improve the energy skills of blue-collar workers” is the result of the activities of the BUSLeague project related to the challenge of proving and validating the practical skills of construction workers. This process is considered very important in the overall efforts within the BUILD UP Skills initiative to support the progress towards mutual recognition of the competences of the construction workforce, which is often obstructed by outdated and time- and cost-intensive evaluation methods.

The report studies the development of methodologies and tools to evaluate the energy skills of blue-collar workers adapted to small construction businesses around Europe, including worksites related to small and medium-sized residential projects. It starts with a review of the construction sector dynamics in the participating countries, focusing on the role of small and medium enterprises which shape the entrepreneurial landscape in the construction sector throughout the EU. Further on, various examples for tested, proven and, as in the case of France and Ireland, already established practices for proving and evaluating the practical skills are described. An example is examination programmes based on mobile training equipment, which are designed for testing the energy-related skills of the workforce directly at the worksite.

These methodologies are based on both pre-evaluations training modules, refreshing the theoretical insight and practical skills and proficiency of the trainees, and post-training evaluation exercises, resulting in on-site certification of the workers. To be able to adjust the training contents to the needs of the workforce, the training modules are designed in a short and attractive manner with a strong prevalence of practical training components; however, they can cover key issues related to the current trends of energy efficiency in buildings as airtightness, thermal bridge minimisation, and ventilation with heat recovery.

To contribute to the recognition of the energy skills of the workers, a variety of tools for supporting the on-site training and evaluation methodologies are discussed. These tools show a great extent of diversity, ranging from the above-mentioned mobile training and evaluation units, through dedicated training centres with practical training equipment operational in Bulgaria and Ireland (with the support of international projects such as Train-to-nZEB and Fit-to-nZEB and based on national financing), airtightness testing-related on-site training practices in Austria, demonstration mock-ups from Practee Formation in France, to gamification equipment in various EU countries developed under the more recent nZEB Roadshow project.

Based on the current situation, the available methodologies and tools, and the training traditions in the project countries, strategies for skills development and evaluation on small worksites are defined, outlining the opportunities for market recognition and integration in the national qualification system and practices. As operational examples of the above-described process, the report discusses in detail the establishment of a validation training scheme in Ireland, a practical training scheme in the Bauhaus chain of stores in Spain, and a training scheme developed to support skills-based procurement in Bulgaria. They all demonstrate the added value of the described methodologies in various circumstances and the potential for their upscaling throughout the national qualification frameworks and educational systems.

I INTRODUCTION

The construction sector throughout Europe faces multiple challenges regarding the need to update the knowledge, skills and competences of the workforce for the application of energy efficiency and renewable energy solutions. This issue is further exacerbated by the ageing of the working force, the declining reputation of the construction sector and its failure to attract young talent in competition with more attractive IT-related industries, and the internal migration of workers leaving parts of Europe in extreme shortage of construction specialists and workers. At the same time, the increase in EU energy and climate targets and the recently proposed recast Directive on Energy Performance of Buildings, confirm the need not only to update the competences of the workforce regarding basic onsite activities such as thermal insulation, window installation and maintenance of traditional heating systems, but also to focus on less known aspects as airtightness, thermal bridge minimisation, integration of mechanical ventilation systems with heat recovery. Moreover, the astonishingly fast market invasion of modern heat pump technologies, often supported by on-site renewable electricity, requires mass-scale reskilling of the installers, which is difficult to operate through the traditional educational systems and qualification frameworks. The imminent introduction of innovative concepts such as demand-side energy management based on building automation and smart building assessment and certification, on their side, poses requirements for integrated design approaches and on-site construction activities performed by professionals with different qualifications but shared knowledge and understanding of the general principles of energy efficiency.

While the recast of the Energy Performance of Buildings Directive mentioned above explicitly requires a quantification of the skills needs and a set of specific measures for addressing the identified issues, and with a series of BUILD UP Skills national projects developing roadmaps for upskilling of construction professionals to deliver on the building sector energy transition, the change on the local markets is expected right away - without any space for delays and compromises. This is why private initiatives for the provision of short upskilling courses and evaluation schemes appear around Europe, applying targeted methodologies and designing specific learning tools and aids to provide an immediate increase of the onsite competences needed to deliver quality at the construction site, avoid mistakes and overcome performance gaps often associated with zero-energy targets. Many of these initiatives stem from various international collaboration projects developed under the BUILD UP Skills and Construction Skills initiatives financed by the Horizon 2020 programme of the EU, such as Train-to-nZEB, Fit-to-nZEB, NEWCOM, nZEB Roadshow and many others. There are also purely market realisations as e.g., the Practee Formation training approach in France. They provide both practical certification schemes based on methodologies tested in real-life conditions, and specialized equipment, which is currently lacking from the mainstream educational practice, attracting the attention of trainers from the full spectrum of professions in the sector.

These methodologies and tools are precisely the focus of the current report, describing the variety of options for upskilling of the working force while taking into consideration the cost and time limitations in the sector in the challenging market circumstances. What is even more important, however, is the resulting possibility to relate these methods and tools to the already established BUSLeague qualification framework. That way, potential replicators can integrate them directly into their training and certification activities, thus directly influencing the capacity of the construction sector (and specifically the ultra-important but difficult-to-engage segment of SMEs) to deliver on the European clean energy transition.

2 ENERGY RENOVATION AT SMALL WORKSITES

2.1 Austria

More than 60% of the Austrian residential buildings – mostly in suburbs or small towns – are single- or two-family houses. The total housing stock has increased by about 40% to nearly 4.8 million units in the nearly thirty years between 1991 and 2018. According to the survey of Statistic Austria, from 2004 to 2018, 30,000 to 35,000 major renovations and 110,000 to 120,000 single renovation measures per year have been carried out in residential buildings (main residences). For many years, the federal government and provinces provide subsidies for renovation work. Right now, the replacement of old fossil heating systems is particularly targeted by these subsidies. For example, by the actual subsidy initiative “banning fossil fuel” the replacement of the heating systems by environmental-friendly systems is pushed strongly. Furthermore, the Austrian provinces subsidise energy consulting to provide information and renovation recommendations onsite. Recently a tool was prepared to support the stepwise renovation of older buildings (individual renovation roadmap). According to the ARGE-Eba (the umbrella organisation of energy consultants), the number of consultancies in 2021 has grown more than 50% compared to 2020.

According to the report, “Definition and monitoring of thermal-energy renovation rate in Austria”¹, the share of subsidised renovations around 2010 (10 to 12 years ago) were significantly higher than today.

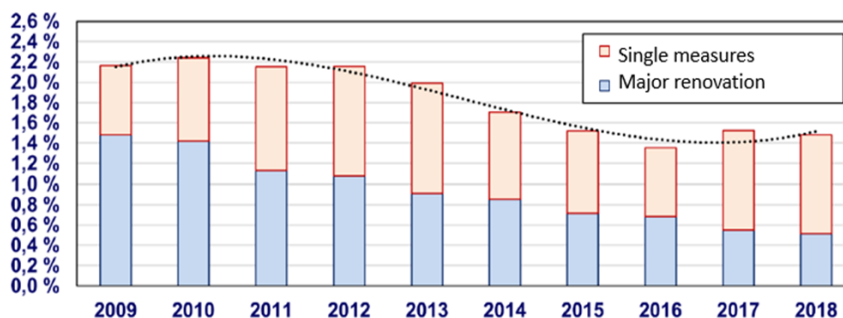


Figure 1: Renovation rate for residential buildings 2009-2018; Source: UBA/IIBW 2020

During the 1990s and early 2000s, the overall renovation rate was constant at 0.8-1.0% but rose rapidly to 2.1% between 2005 and 2009. It then remained at this level for four years until 2012, after which it decreased again to 1.4%. In order to achieve a complete thermal-energy upgrade of the housing stock by 2040, the renovation rate (comprehensive renovations and cumulative individual measures) must be increased to 2.6% in the short term and to 3.2% from 2025.

This means that in the coming years, the importance of high-quality renovation on small worksites will increase and with it, the need for qualified blue-collar workers. Since the Austrian government decided its total phase-out from fossil-based heating systems until 2040, the need for qualified personnel will especially increase in this field. The most important thermal renovation measures include the replacement of windows, insulation of the roof, insulation of exterior walls and replacement or upgrading the heating system (installing biomass, heat pump and photovoltaic systems). This means that most of the professionals in the energy renovation

¹ UBA & IIBW April 2020

of the buildings are among roof and façade builders (mainly ETICS), window installers, heat pump or biomass and PV installers. This statement can be underlined by the following figures, which show the massive increased yearly installation of heat pumps and photovoltaic systems in the last few years.

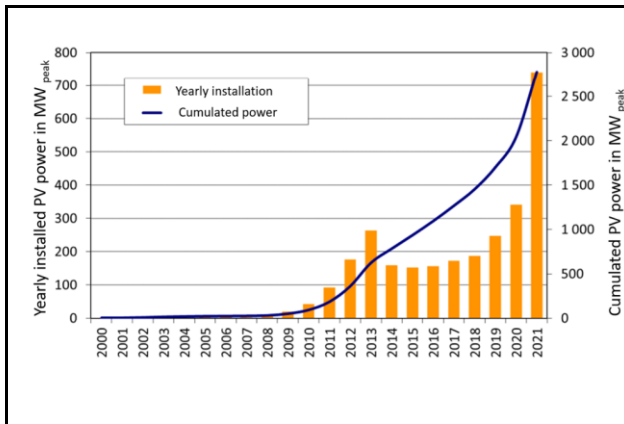


Figure 2: The market development of photovoltaics in Austria until 2021; Source: Technikum Wien (2022)

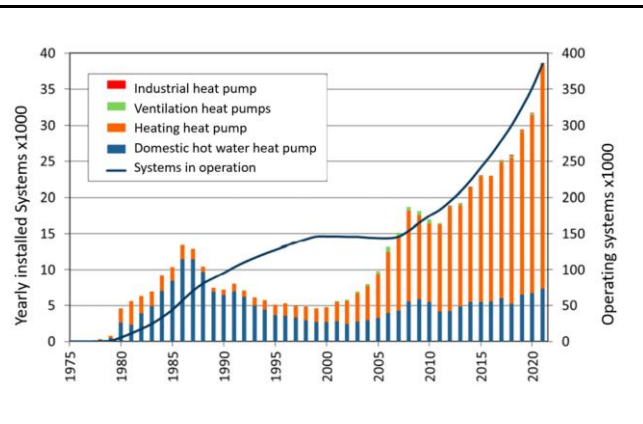


Figure 3: Market development of heat pumps in Austria until 2020 Source: ENFOS (2022)

The frequent mistakes are deficient installation of windows (airtightness, thermal bridge), poor installation of insulation on the façade², especially where there is a penetration of pipes or other installations (e.g., electricity), waterproofing on the roof (e.g. installation of PV on roofs)³ and applying the wrong insulation materials and fine-tuning of the heating system to the size of the building and the tenants needs (hydraulic balancing). Furthermore, the lack of an appropriate ventilation strategy adds to the problems of growing market demand because of overheating in summer due to climate change.

Most of these mistakes happen because of lack of time (too many job orders or commissions) and lack of training of the blue-collar workers. Due to these aspects, the role of the energy consultant becomes more vital to ensure the quality of work during the construction and renovation to minimise the risk of having an inefficient building.

This means that the well-sealed flat roof must be penetrated for the necessary fastening points. Once the PV system is completely installed, these "holes" must be 100 per cent sealed again. Otherwise, damaging water ingress into the roof will occur at these points during rain or snowmelt.

² 4. Austrian construction errors report 2011

³ A particular weak point in the installation of PV modules on a flat roof are the penetration points. To prevent the substructures from shifting or lifting off during storm gusts, anchoring in the subsoil of the roof is one solution option. This means that the well-sealed flat roof must be penetrated for the necessary fastening points. Once the PV system is completely installed, these "holes" must be 100 percent sealed again. Otherwise, damaging water ingress into the roof will occur at these points during rain or snowmelt.

2.2 Bulgaria

The following numbers and facts are based on information from 2021 since the final reports on the economic development of the construction sector in Bulgaria for 2022 are not yet published. Reports are written and presented by the Bulgarian Construction Chamber.

There is, unfortunately, no distinction made in the analysis between construction works - i.e., if they are about new or existing buildings (renovation or new construction) or if works are about increasing energy efficiency. At this point in time, the National Statistics Institute in Bulgaria is not analysing such information, probably because there are no supported mechanisms for collecting it.

Nevertheless, there is information about the division of construction works between the types of operating entities in terms of their size and capacity- there are construction companies and there are consortiums. Construction companies are further divided into small (1-49 employees), medium (50-249 employees) and large (over 250 employees). And what the presented data for 2021 shows is that during that year- there has been a sensible increase in the number of construction projects assigned to small and medium-sized companies in comparison to 2020. In total of 91.6% were the contracted works for SMEs in 2021 with an increase of whole 40% for the small ones alone in comparison to 2020. Of those projects, 45.5% are related to buildings (the others are infrastructure and electrical engineering) of which 85% are given to SMEs.

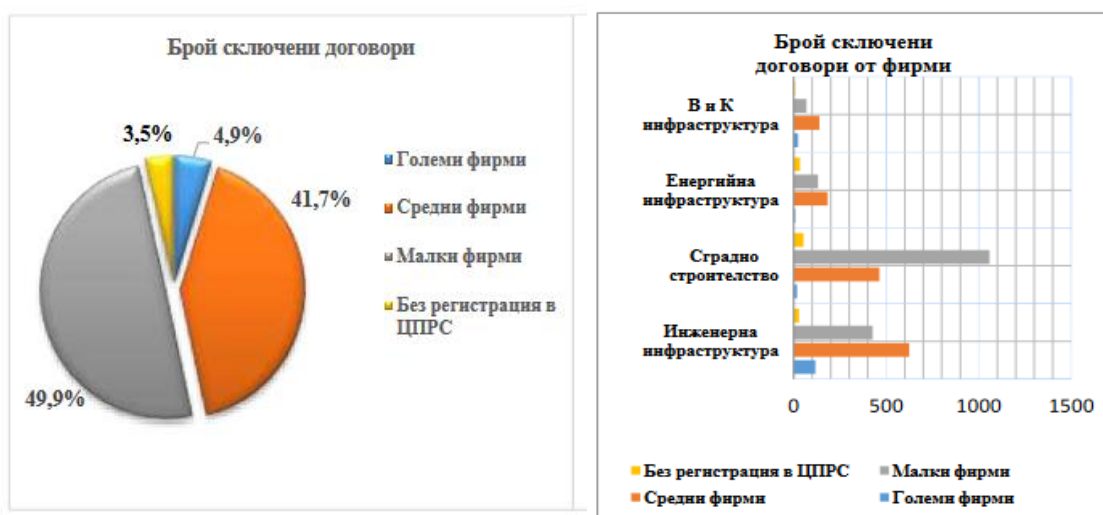


Fig.4 Showing on the left in orange medium-sized companies and in grey- small construction companies and their part from the total number of projects; to the right the figure shows the distribution of type of companies to the number of projects related to buildings (colour distribution as to the left)

Another type of information shows that the out of all construction companies, the small ones are representing 87,13% of the total employed people in the sector and contribute to almost 98% of the net profit from the total income for 2021. Those are considerable numbers, showing the impact and importance of the activity of the SMEs on the Bulgarian construction market. This points to a huge potential when it comes to having an effect on the whole construction process.

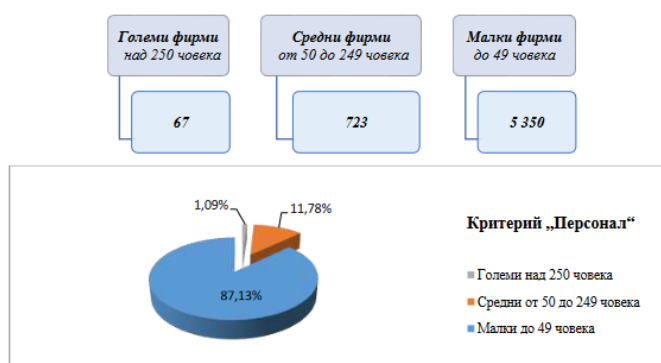


Fig. 5 Shows the proportion of construction specialists working in small companies (blue) and medium ones (orange); big ones (grey)

There is, unfortunately, no information as to how many of those SMEs have their workers trained, or how many possess the necessary qualifications to perform energy-efficient construction works. It can only be assumed that, judging from the visibly fragmented, individual renovation works done (photo below) around the country, there is a high chance that a big part of them is done by small to medium-sized construction companies.



At the same time, the most recurrent professions normatively regulated in the vocational education and training system, involved in energy renovations in Bulgaria include builder installers, construction assistants, constructors, energy efficiency consultants, construction engineers and architects, electricians, plumbing, gas, ventilation and heating technicians.

The greater share of these professions requires secondary education, which in Bulgaria is acquired in profiled vocational high schools and/or in Vocational Training Centres for persons over 16, according to published by the Ministry of Labour and Social Policy report “Mid-term and long-term forecasts for the development of the labour market in Bulgaria”, forecasts for the Top 3 professions in construction (number of employed persons, in thousand) as follows:

	2022	2023	Employment share of the sector, 2032
Mining and construction workers	57	58.1	23.2%
Constructors of buildings and related	18,9	19.2	7.7%
Truck and bus drivers	14,8	15.1	6%

Table 1. Share growth of construction workers compared to other parts of the labour market

For the construction sector, the number of persons employed by the end of June 2022 is 124.4 thousand, or 5.4% of the total number of persons employed in the country. On an annual basis, the data show a drop of 5.3 thousand units, or 4.1% Persons employed June 2011 - June 2022 according to preliminary data from the National Statistical Institute.

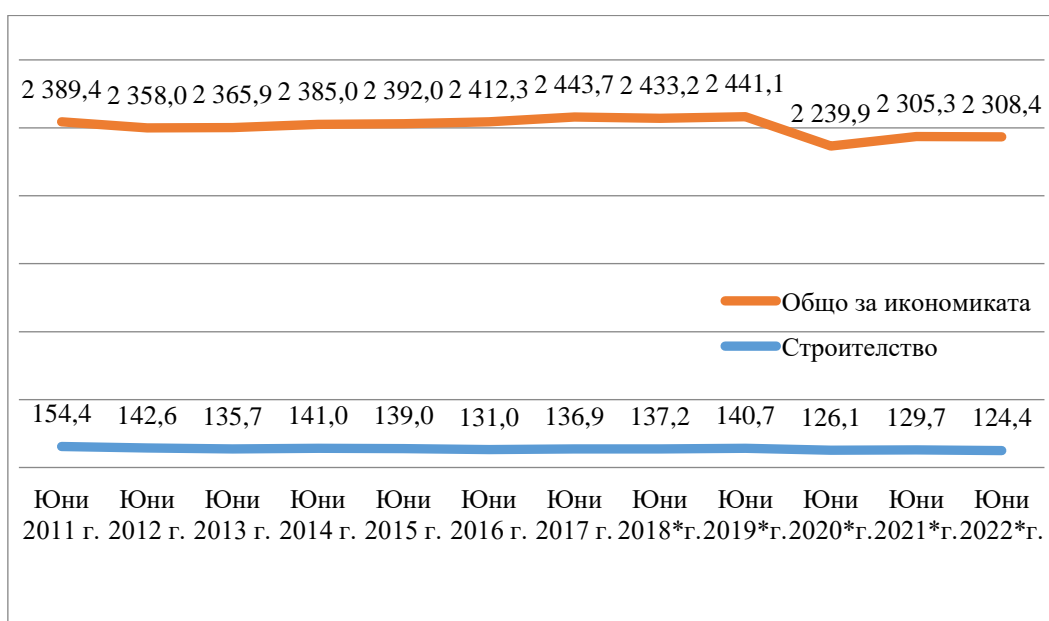


Fig. 6 Shows the portion of construction workers employed in comparison to the total employment rate in Bulgaria for the last 10 years

There is also no publicly available information on what type of professional training construction specialists go through, there are however around 3,389 people from the construction sector that have had some kind of professional training. This is 2.7% out of 120 thousand workers for 2021. So, there is little doubt left that there is an urgent need to provide more, and concrete training offers to construction specialists, to promote the benefits of upskilling and to create methods for collecting this information.

2.3 France

According to the Energy Transition Agency of France (ADEME on its French acronym) (Michel & Rivaton, 2021), the building sector is characterised by a low rate of innovation derived from an atomised sector. This is to say that the construction is mainly done by small enterprises operating in limited geographical zones, implying an absence of economies of scale. In this context, France counts 392,000 operative enterprises competing with independent workers which executed 20% of the work in 2014. This trend is confirmed by the CAPEB (2020), which

enlists that 98% of all enterprises are formed by less than 20 employees, a relation that deepens each year, and 46% of them are one-individual organisations.

Nombre d'entreprises du bâtiment par taille

Entreprises de 0 salarié	374 977
dont micro-entreprises ¹	151 783
de 1 à 9 salariés	167 061
de 10 à 19 salariés	15 268
Moins de 20 salariés	557 306
de 20 à 49 salariés	6 709
de 50 à 99 salariés	981
de 100 à 499 salariés	562
de 500 à 999 salariés	40
de 1000 salariés et plus	32
Plus de 20 salariés	8 324
Total	565 630

1. Les micro-entreprises ont 8 trimestres pour déclarer du chiffre d'affaires sous peine d'être radiées

Figure 7: Building enterprises by size. Source: Michel & Rivaton, 2021

In concordance, the labour market presents high frictions: 60% of the employers claim recruitment difficulties, even when the market already absorbed an important amount of foreign workforce (around 74,000 Portuguese workers, 61,000 Polish, 45,000 German and 44,000 Romanian, among others). Additionally, 24% of the 516,000 floating employees in France, are interims work in the building (Michel & Rivaton, 2021).

This workforce does not present major gaps between age classes; however, it is important to notice that 72% of the individuals have left the professional official education at least 10 years ago, amassing 20 or 30 years of experience while only 28% have less than 30 years (CAPEB, 2020). In this sense, the atomisation and low presence of scale economies also impact the workforce profiles. While in the industry sector the rate of continuous training rounds to 45%, in construction it is 35%, a lag that has held during the last 40 years. As well, the share of non-qualified workers decreases slower than in other sectors (26% in 1980 and 17% in 2015) (Michel & Rivaton, 2021).

While monitoring self-employed workers remains difficult, some clues can be drawn from the statistics related to the enterprises of less than 20 workers compiled by the CAPEB (2020). This organisation shows that the first phase of building - this is to say, the structural and base components of the building-, is mainly executed by enterprises while 81% of the closing works - highly specialised- are done by micro-enterprises. Regarding the professions, the enterprises operating in masonry-tiling and metalworks represent less than 40% among both the individual craftsmen and micro-enterprises but still have the highest share. For the rest of them, the shares surround a fair distribution - including the insulation and plaster works - with the notorious exception of the paint-glazing-coatings, which total only 41% of medium and big enterprises.

	Entreprises ²	Soit en %	Micro-entreprises	Soit en %
Gros œuvre ¹	122 598	30 %	29 246	19 %
Second œuvre	282 925	70 %	122 537	81 %

Source : SIRENE au 1^{er} janvier 2018 et ACOSS 2018
1. Codes APE 4120A, 4120B, 4399B, 4399C, et 4311Z
2. Hors micro-entreprises

	Personnes morales (en%)	Personnes physiques (y compris micro-entrepreneurs) (en%)
Maçonnerie Carrelage	66 %	34 %
Couverture Plomberie Chauffage	56 %	44 %
Charpente Menuiserie Agencement	51 %	49 %
Serrurerie Métallerie	63 %	37 %
Équipement Électrique et Électrodomotique	51 %	49 %
Métiers et Techniques du Plâtre et de l'isolation	49 %	51 %
Peinture Vitrerie Revêtements	41 %	59 %
Total Bâtiment	54 %	46 %

Source : SIRENE au 1^{er} janvier 2018

Figure 8: Share of building stages between Small enterprises (less than 20 employees).

Figure 9: Share of legal status within small enterprises (less than 20 employees).

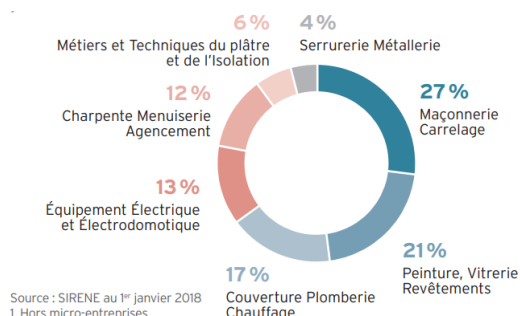


Figure 10: Share of activities between Small enterprises (less than 20 employees). Source: CAPEB, 2020. <https://www.capeb.fr/www/capeb/media/chiffres-clefs-2020-version-finale-8-juillet-2020.pdf>

From the total, almost half of the enterprises work in *Masonry - Tiling* (27%) and in *Painting, Glazing and Coatings* (21%), while the *Insulation, Plumbing and heating* related enterprises represented 17% as well as the *electric* branch did so in 13%. The enterprises related to *plasterwork and insulation* represented only 6% of the companies registered.

The report also presents the data for each one of these professional blocs as can be seen in Figure 7. It can be seen that in most professions; the number of enterprises is more representative than one of self-employed workers. Then block *Covering, Plumbing, Heating*, for example, accumulated 47% of the enterprises, while 49% of the self-employed and 54% of the micro-enterprises were working in the installation of electricity or water utilities, which ranked first. Consequently, only 6%, 3% and 3%, respectively, were classified as works on air and water tightness. In the case of *Insulation and plasterworks*, 21% of the enterprises and 15% of the self-employed and 6% of the micro-enterprises are dedicated to insulation-specific activities (CAPEB, 2020).

The CERC Hauts-de-France (2021) presents in detail the shares of the professions among the construction workers employed in building companies in the north of France, a region in which BUSLeague takes place. It can be seen that the labour supply in the sector is heavily oriented towards the ending phases of construction - those which serve the renovation works - ,

representing 71% of the total. Within this group, the installation of heating systems (9,349 empl.) and of wooden components (7,459 empl.) lead as second and third in the rank of specialised employees. Nevertheless, the number of employees decreases significantly in the insulation works (2,012 empl.) This suggests an excess of demand for specialised workers when it is seen that the renovations are highly invested in this activity as the CERC Hauts-de-France (2021) data suggest.

The research on energy renovations' punctual activities can be approached by analysing the motives for asking for subventions. The ADEME (2018), for example, identified a focus on the reforms to the *doors and windows*, representing 27% of the work and the highest number of investments. This was followed by the *roof* related ones and the *wall insulation* works (19% and 18%, respectively). Following this logic, the Regional Economic Cells for Construction sector (CERC on its French acronyms), draw the status of the energy renovation through a descriptive analysis of the allocation of resources under aid dispositive like MaPrimeRénov' and CITE. In order to illustrate the national trends, here, a sample of the results is presented:

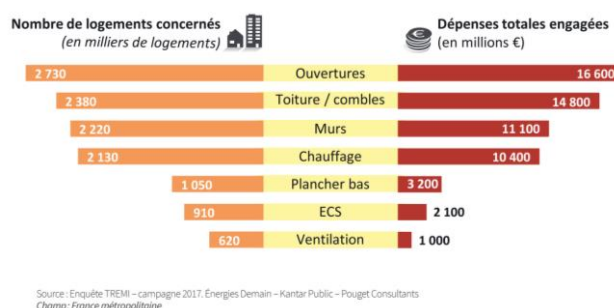


Figure 11: Expense assignment of the housing renovation projects. Source: ADEME, 2018.

In the **Provence-Alpes-Côte d'Azur** région (southeast of the country), for example, MaPrimeRénov' shows that the expenses in equipment, 52% of the renovation projects (and showing a 22% of the annual increase in February of 2022), detailing the *Pellet boilers*, ranked the higher, only followed by *Heating or water pumps* and *Geothermal heating pumps*. Regarding the insulation (20% of the renovation subvention), the *External wall insulation* and the *Insulation of terrace roofs* were the highest, followed by similar shares in the *Insulation of windows and door frames*, of *Internal walls* and of *Sloping roofs*. (CERC Provence-Alpes-CoteD'Azur, 2022)

In the **Ile-de-France** region (Parisian region), the CITE dispositive reported that 76% of the subventions demand for renovations were related to Thermal Insulation, while 16% of them were focused on energy savings and 6% on equipment installation. In detail, 2017 was led by the works of *Glass component insulations*, followed by *windows cover insulation*. The equipment was led by the *Boilers with high energetic performance* which position at the third. Finally, the *Insulation of roofs and the frames for outdoor entrances* ranked fourth (CERC Ile-de-France, 2019).

In the **Hauts-de-France** region (Northwest part of the country), for which MaPrimeRénov' accounts for in 2020- the *gas boilers*, the *pellet stove* and the *heating pump for water and air* summed 69.4% of the total interventions that asked for the subvention. Finally, the *external insulation of the walls* represented 8.4% of the total works (CERC Hauts-de-France, 2021). The TREMI (ADEME, 2020) survey confirms this fact showing that almost 30% of the renovations made in 2019 were related to the intervention of *Windows, doors and frame components* and 32.9% of them in the *renovation and insulation of components like the walls and the roofs*. when the specific

activities belonging to each group are detailed, the survey enlists the Installation or replacement of windows, French windows, bay windows and openings, the Exterior renovation of walls facing the exterior and the Replacement or installation of a main heating production system (including renewable energy) as the most recurrent activities with the renovations registered in the region with 29.6% la 15.1% and 14.7% of the total in 2019.

Tableau 11 : Les modes de réalisation des travaux

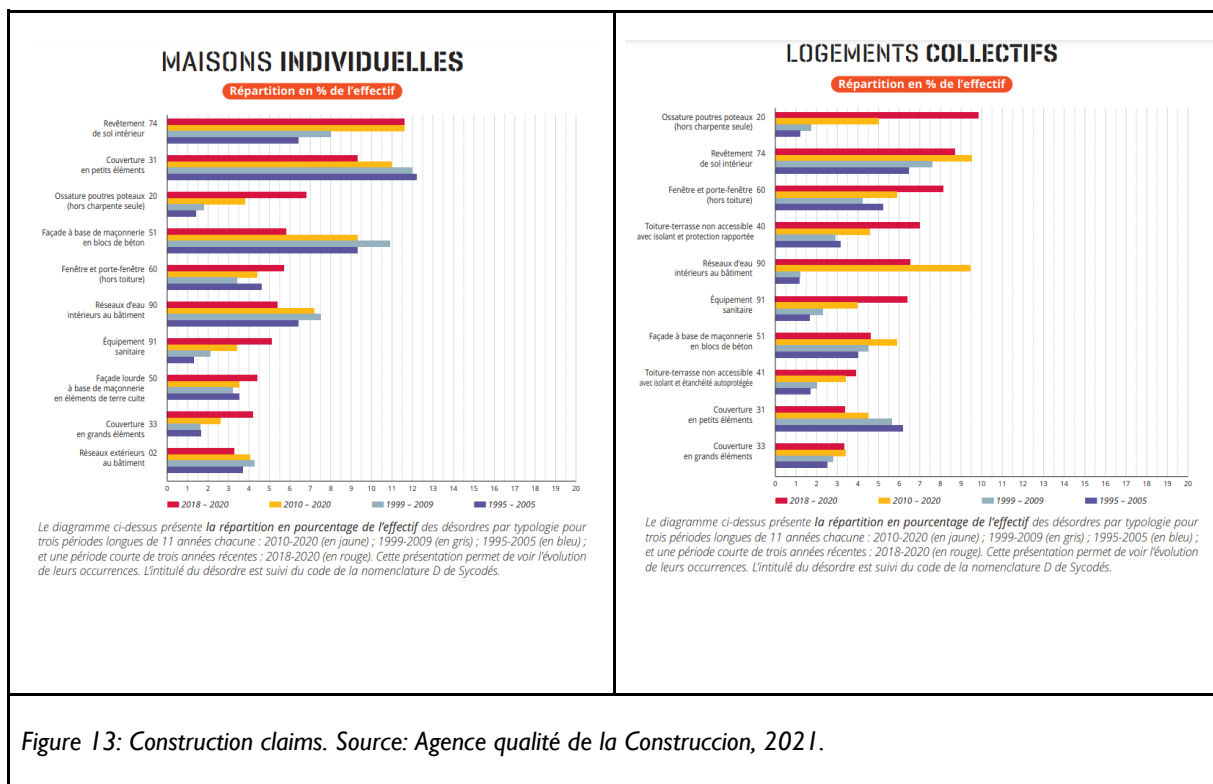
	Professionnels uniquement	Mixte	Auto-rénovation avec savoir	Auto-rénovation sans savoir
Tous travaux	66%	2%	15%	17%
Toiture / Combles	69%	2%	14%	14%
Ouvertures	80%	2%	10%	8%
Chauffage	79%	1%	11%	8%
Murs	39%	3%	21%	37%
ECS	69%	1%	16%	15%
Ventilation	44%	0%	23%	32%
Plancher bas	33%	3%	32%	32%
Confort d'été	60%	0%	3%	37%

Champ : Haut de France, maisons individuelles ayant fait l'objet de travaux (gestes recensés dans le questionnaire TF
Source : enquête Tremi 2020, exploitation Energies Demain

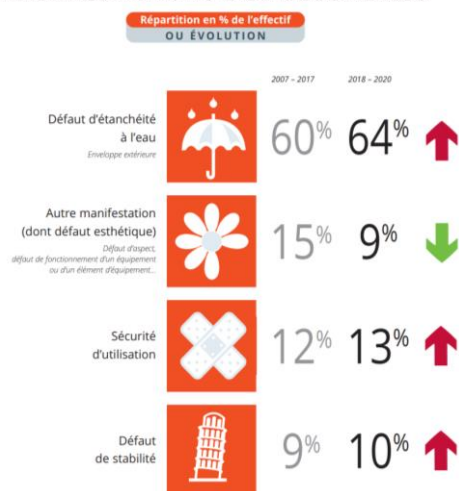
This survey also permits us to characterise the labour force at e Hauts-de-France by their academic part. There, the professionals rounded 66% of the workforce of the renovations, being particularly relevant to the activities related to *heating systems* installation and the *doors and windows* installation, where they represent around 80% of the labour disposal. In contrast, components like the *floor* and the *walls* witnessed a high share of unskilled individuals deploying the interventions (64% and 58%).

The *Agence qualité de la Construccon* (2021), reports data concerning the construction claims in individual and collective housing during the last 25 years. This data reports that the highest rate of reparation was seen in *indoor soil flooring* (11.5% of the individual unity houses) and almost 7% of the *frame beams columns* (around 10% for collective housings, the biggest one). Some other remarked items are the *masonry over concrete blocks* and in the *windows installation*, reaching 6% (the most important reduction since when compared to the first 10 years of the 2000 decade), and less than 6% in the second case (8% in the collective housing building). The report also suggests that the claims linked to *water air tightness* increased by 4% during 2018 and 2020, leading to 64% of the repairs for this reason.

This data, however, is examined considering that the latest measures can present a high distortion given the fact that were taken during the crisis derived from the COVID19 Pandemic. The sudden stop in the activity forced a high restart rate of the projects and a reduction of the time to compensate for the financial losses suffered during the lockdowns and the health restrictions. The effect of this rush seems to be a rise in the number of defects in the building components in the project recently finished.



MANIFESTATIONS DES DÉSORDRES



Considering this context, the development of strategies for easing verification and certification of skills in worksites considered as “small”, necessarily starts by defining these kinds of projects. According to the *president of Practee Formations*, in France, a work deployment with no more than 6 workers involved in the site during the whole period of the running (as so, less than 10 workers can be considered as medium and more than 15 is often classified as big) is usually considered as a “small worksite”. This implies that an energy renovation scenery is most likely composed of 2 craftsmen working on the insulation and plasterwork, 2 on the wood-framing installations and 2 on the converting works.

As pointed out, the criteria are set in terms of human resources. Therefore, a small worksite can take place in an individual household with a global renovation implying a medium budget and intervening not more than 100 m². As well, it can also be the covering of a collective housing



building, which demands a high budget (mainly because of the raw materials) and a big external surface (even more than 100m²) but a small number of workers.

For the project leader for buildings of Cambresis Employment house, another way of defining it - the way that has been used for the SDP project in Cambresis territory -, follows a housing criterion: Regarding the Energy efficiency renovations, is a work deployment happening in an individual housing or a collective one with no more than 8 housing - this is a small collective building. This implies that in the smallest cases, the project can be run with 5 employees distributed in roof insulation, walls, wood components replacement, heating and ventilation system. As such, the limit of this definition is never having more than 2 professional teams at the same time on the work site.

Departing from these possible definitions, one last question can be done: what is the share of this kind of worksite among all the renovations taking part in France? Some light on this question can be drawn from the TREMI survey in 2019 (ADEME, 2021), which presents data for energy renovations accounting for subventions for funding the projects. There, it is presented a total of 2,066,519 aids including 1,397,297 specifically for individual logins. As so 67% of the aids were assigned to individual housings (and therefore to small worksites). Unfortunately, there is not enough information for distinguishing among the sizes of collective housing renovation and therefore it cannot be known precisely how many of these have less than 8 housing units. Even when the aids may be biased towards the individual logins and this share may not be a trustable statistic, some conclusions can be seen from them. For example, among the individual housing, 54.9% of them were works on the roof, walls or platform surfaces, 34% in plumbing and heating systems and 25.7% in windows and doors (the remainder corresponds to ventilation systems and climatization).

2.4 Ireland

In Ireland, buildings make up over a third of all energy usage (construction and operation) and so have a major contribution to Greenhouse/CO₂ emissions. To reduce these emissions, a reduction in the energy demand of buildings and a change in energy sources to renewables is required. In addition, other less CO₂ emitting measures such as heat pumps can be designed into buildings that are currently not feasible due to building energy load or the stability of our grid to supply the import capacity required by a new heat pump (see figure 14).

<p>% share final energy by sector 2020</p>  <p>● Transport ● Residential ● Industry ● Services ● Agriculture & Fisheries</p>	
<p>Figure 14: % of energy use by Sector- Ireland https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/energy-use-overview</p>	<p>Figure 15: Wheel of Key Words for Quality http://www.qualibuild.ie/fes-training/useful</p>

The introduction of the Nearly Zero Energy Buildings (NZEB) standard in Ireland for new builds and the minimum B2 for retrofitting has led to a raising of the in-use performance standard for buildings. This principle is now moving towards the definition of Nearly to Net annually (as the Energy Performance of Buildings Directive (EPBD) is currently recast where the energy use of a building over a year is expected to reach net zero due to reduced energy use and on-site generated and self-consumed renewable energy is prioritised.

The NZEB standard and fundamental training in Ireland has these high level and introductory principles which help to deliver the high quality in use-post occupancy buildings possible where:

- All stakeholders in the construction value chain have the same understanding of what is involved in providing a quality nearly zero-energy building
- A general understanding of the contribution that can be made to buildings (retrofit)
- All construction professionals and craftsmen understand the impact of their work on everyone else, who is trying to provide a quality nearly zero energy building.

The professions we believe, in Ireland, involved in retrofitting are all those involved in the construction sector from design to build, to operate, where required. A classic example is public housing which is sometimes managed by local authorities or contracted out to housing associations who supply and facilities companies who manage the housing.

Below are the basic NZEB courses available in Ireland which deliver the collaborative and team effort. The main objectives are outlined in the NZEB fundamentals 1-day training course which we believe in Ireland should be taken by all roles in the construction sector.

- Part L Retrofit Requirements for 'Major Renovations'
 - Thermal Envelope and Building Physics
 - Thermal Insulation
 - Thermal Bridging

- Airtightness, Vapour Control and Wind-tightness
- Windows
- Ventilation
- Heating
- Renewable Energy
 - Smart Metering & Electric Vehicles
- Building Services
 - Space Heating & Domestic Hot Water
 - Controlled Ventilation
 - Lighting, ICT & Smart Technology
- Communication and User Information
 - Collaborative Teamwork
 - Systems Thinking

There are more trade-specific courses which can then be taken and added to the Fundamental and retrofitting courses (See figure 16). All courses can be found on the BUS (Build Up Skills) App. More advanced - Special Purpose Awards, Degrees and Master programmes are also loaded on the App.



Figure 16: NZEB Training courses. Source: <http://nzeb.wwetbtraining.ie/>



Figure 17: Airtightness strategies. <https://www.ecologicalbuildingsystems.com/product/tescon-vana#installation-guide>

Building mistakes – most are related to airtightness

The majority of mistakes found in buildings are related to a lack of knowledge of building physics, airtightness and ventilation. This information is now acknowledged to be the most crucial in any building renovation project. If designed, communicated, and delivered right, airtight and well-insulated homes are warm, comfortable and free from both draughts and condensation. They are also future proofed against extreme weather events which will likely become commonplace due to climate change, such as overheating in the summers and excessive cold during winter and cold days and fluctuations in energy costs related to fossil fuels.

It is important to remember that an airtight building does not mean it is hermetically sealed, it means that unintended air leakage has been reduced to a minimum. Below are examples of high-quality airtightness measures:

1. Airtightness membrane at the underside of a ceiling with taping around web joists and other junctions.
2. Airtightness taping around joist ends.
3. Taping of membrane overlaps to the underside of the ceiling, with service cavity beneath.
4. Specialised seals around penetration for wires and ductwork.
5. Airtight membranes installed prior to the installation of internal studwork.

The correct sequencing of installations is made easier by the appropriate training.

If the prospect of making an old building airtight can be overwhelming, it's worth noting that a Galway contractor in Ireland produced a retrofit with a leakage rate of just 0.37 ACH - lower than the Passive standard of 0.6 ACH on a Passive House retrofit, designed and modelled by Simon McGuinness. Also, the contractors were novices to airtightness but completed training prior to the project which demonstrates training can improve workers' skills and project deliverables.

Small worksites in Ireland: In the first 3 months of 2022 there were 5,669 new dwelling completions. This was a 44.5% increase from 3,923 completions in the same period in 2021 - and 15.1% higher than the 4,926 completions in 2020 prior to the pandemic. This is the most completions seen in any first quarter since data collection began in 2011. In this period there was a 148.5% increase in apartments completed compared with 2021, up from 701 to 1,742.

Development schemes of combined dwelling construction dwellings rose by 25.0% from 2,256 in 2021 to 2,821 in 2022. There was a rise of 14.5% in single dwellings from 966 in 2021 to 1,106 in the 2022 period.

Scheme dwellings accounted for 49.8% of new dwelling completions in Q1 2022 with 30.7% apartments and 19.5% single dwellings. This compares with 57.5% scheme, 17.9% apartments and 24.6% single. This year there is planned to be a step change to 30,000 homes per year and another step up to 50,000 homes per year in 2024.

The National Residential Retrofit Plan aims to achieve the equivalent of 500,000 homes retrofitted to a Building Energy Rating of B2 (cost optimal or carbon equivalent) and the installation of 400,000 heat pumps in existing premises to replace older, less efficient heating systems by end-2030. A total of 18,400 home retrofits were completed in 2020. However, just 4,000 were to a B2 standard and 1,600 installed a heat pump.

The quality BER (Building Energy Rating) and volume numbers need to be increased. Likewise, the number of heat pumps and low carbon heating systems such as sustainable biomass installed to deliver the required emissions reductions.

Currently in Ireland the construction industry for both retrofitting and new builds is in a state of flux due to the consequences of the COVID19-lockdowns on the labour market and the rise in energy prices from the conflict in Ukraine. This has resulted in the rise in prices of materials, equipment and labour in addition to supply chain issues. Therefore, the shortage of workers and materials has destabilised the market, which means the short-term data may be slightly inaccurate in the future.

The Irish government has also recently announced that the deep retrofit grants will be raised to 50% were possible. This will reduce the cost to the householder and improve the energy efficiency and comfort of the houses. If a house is to get a deep retrofit a *One-Stop-Shop (OSS) consultation and project management* is a requirement to qualify for the grant.

This has many advantages such as: managing the home energy upgrade from start to finish. Providing all the contractors and specialists to guide from an initial home assessment and design through to project completion. The best solutions will be selected for the house, a quote for the whole works will be provided, the OSS will organise and manage works to the completion stage, present finance options, apply for the grants on the householder's behalf and discount all available grant supports from the overall upgrade cost invoiced to the householder. An energy survey and audit of the house are required prior to any works or grants being applied for.

If the householder or building owner cannot afford all measures to obtain the other remaining 50% of the cost through a low-interest rate loan. A building renovation passport can be generated as part of the energy audit to allow the householder to have a long-term plan.

Building Renovation Passports are master plans for retrofit and include a record of works done and to be done in the future. They ensure that any renovation works are planned and implemented in a holistic and technically sound manner and facilitate a step-by-step approach to deep renovation. The passports could be extremely useful in addressing the barriers to consumer decision-making and allow a new owner to take up where a previous owner left off. Finally, by improving the availability of data for valuers and lenders, passports should de-risk investments in that area and facilitate phased deep retrofit.

Building Renovation Passports are more and more considered a key solution in Europe to encourage phased ambitious quality retrofit. Voluntary passports are actually mentioned in the 2018 Recast of the Energy Performance of Buildings Directive (EPBD).

2.5 Netherlands

The Dutch government has the ambition to build 900,000 new homes and to make 1,500,000 existing homes natural gas-free by 2030. In the period from 2022 to 2030, this will require growth in employment of 1.8% per year and growth in labour productivity of 1.6% per year. These are robust growth rates, which may be achievable without major scale-ups or technological breakthroughs. The robust growth in employment and productivity fits the picture of incremental progress. For employment, the inflow from training and structural growth of foreign labour can provide the bulk of the required labour capacity in the period 2022-2030.

Although growth is, numerically, possible, it does not mean that no bottlenecks can arise in certain professions. 1.500.000 homes to be off gas means that more than 200,000 gas boilers per year will need to be replaced for a more sustainable system. Usually, that is a more complicated system that requires training. Deploying auxiliary workers and technological means that relieve the skilled workers can provide a solution.

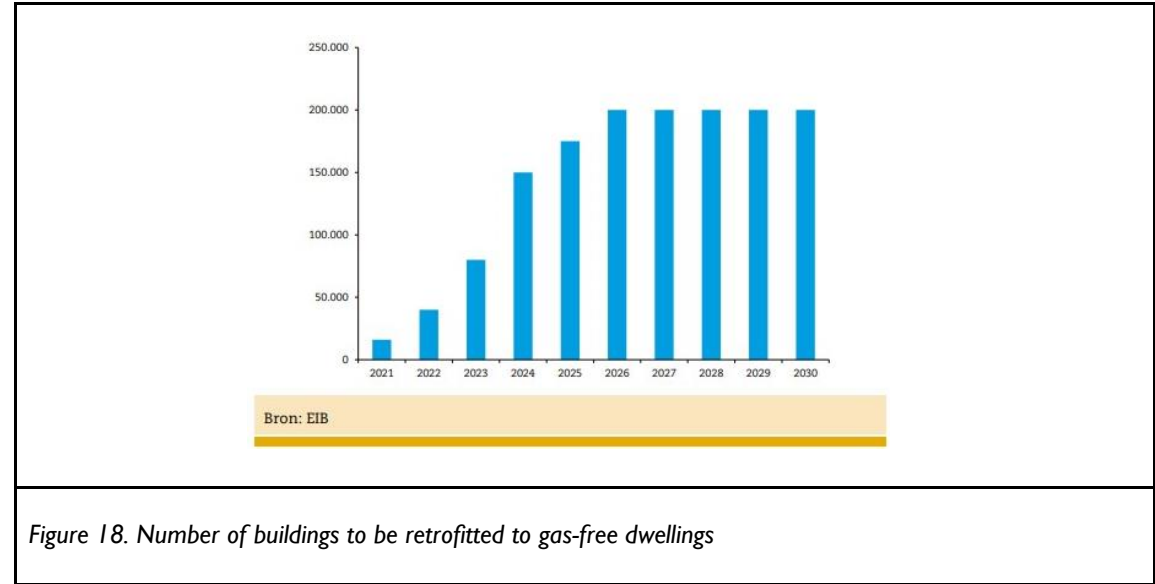


Figure 18. Number of buildings to be retrofitted to gas-free dwellings

Especially in the short term, the total additional demand for a new labour force is large, reaching nearly 30,000 in both 2022 and 2023. In the medium term, the required inflow decreases to around 20,000 additional labour force per year. In the period 2027-2030, the inflow requirement then decreases further to 16,000 workers per year. 34% of employers think that there will still be a shortage of staff in 5-year time because there are not enough trained people.

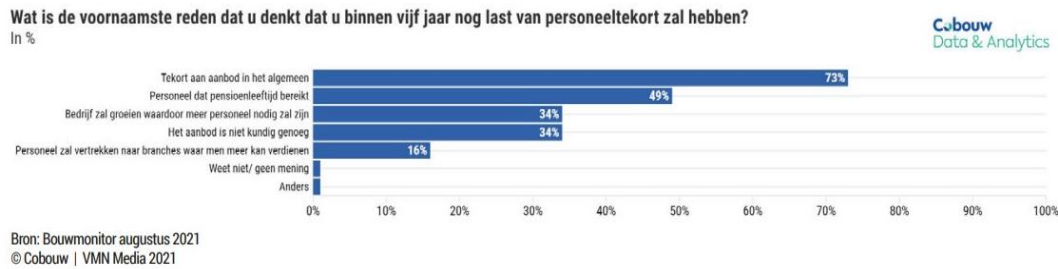


Fig. 19 Results of the survey among construction employers

This year the government announced that it would become mandatory to choose a hybrid heat pump, a full electric heat pump or a heat network when replacing a heat pump⁴. More heat pumps also mean a heavier burden on the electricity grid. In some places, a choice has been made to install a heat network. These developments together mean that the number of jobs in the civil engineering sector (GWW) is also increasing.

The envelope of the building needs to be upgraded to make new heating systems like heat pumps more efficient. This means more work for carpenters who can make a building airtight, insulators who can fill the cavity with insulation material and glaziers who can fit homes with triple glazing. This is work that can be done by the existing workforce; further education and training are needed for this. The training fund for the construction industry no longer exists. 15 years ago, almost 50,000 training days were provided. The increase in the number of self-employed workers without personnel also makes it more difficult to train professionals using collective means.

Tabel 1 Ontwikkeling bouwproductie bij behalen van ambities rond woningbouw en aardgasvrij maken van woningen, 2021-2030

	Miljoen €	Mutaties gemiddeld per jaar in %			
	2021	'22	'23	'24-26	'27-30
Woningbouw	35.100	10	12½	4	1
- nieuwbouw	15.975	14½	18	1½	1
- herstel en verbouw	11.775	9	10½	8	½
- onderhoud	7.350	2	1½	2	2
Utiliteitsbouw	24.475	5½	3	2	2
- nieuwbouw	11.975	6	2	1	2
- herstel en verbouw	7.150	7½	5½	2½	2½
- onderhoud	5.350	2½	2½	3	2½
GWW	17.750	4½	4½	4½	2½
- nieuwbouw en herstel	11.525	4½	4½	4½	3
- onderhoud	6.225	4	4	4	2
Externe onderaanneming	4.300	7½	7½	3½	1½
Totaal bouw	81.625	7½	7½	3½	1½

Bron: EIB

Fig.20 New professions

⁴ <https://www.technieknederland.nl/stream/actieplan-hybride-warmtepompen>

There is no data yet on what this means for new occupations in the factory. To gain insight into the new developments, we interviewed an advisor who works for RcPanels and VolkerWessels. He is specialised in improving cooperation between organisations and people in the construction environment. Aim of the interview was to investigate the current situation regarding craftsmen working in the field of energy transition and what skills craftsmen need to realise energy transition in the Netherlands.

Conclusions from the interview with the advisor of RcPanels and VolkerWessels

- He sees new disciplines emerging in the field of construction workforces. The construction is slowly moving towards industrialisation and digitalisation. Therefore, new disciplines and jobs emerge. Such as a BIM specialist. Moreover, a trend is seen in a different way of construction, called prefab. When using prefab, construction parts are assembled in the factory instead of on the construction site. The focus in factories is therefore placed on plugging parts together. Consequently, this way of working calls for different skills. Since everyone is allowed to plug parts, traditional craftsmen's skills are not needed.
- A construction factory consists of different stations. Every station has its own tasks. The craftsmen rotate after a few months to a different station. Therefore, the craftsmen in a construction factory have to be versatile, they do not need a traditional set of construction skills. The feedback from the craftsmen regarding this work is often positive; the craftsmen enjoy the variety and are eager to learn.
- The craftsmen who do this work are likely to have different backgrounds, for example, a supermarket manager or a conveyor belt operator. This brings in different skills, which can still benefit the tasks, but also need upskilling.
- It has been found that traditional craftsmen do not want to work in construction factories, since they perceive the work not as craftsmen.
- A shift is seen from working on a construction site to working in a factory. Traditionally, construction was not highly industrialised and automated. Productivity per worker is low. Now, more and more investments are being made in factories to increase productivity and thus profitability. Currently, this shift results in a dynamic environment. Therefore, employees must keep learning. Dynamic manuals are for example key to keeping the employees up to date.
- To realise the energy transition by 2050 in The Netherlands, 7 million gas boilers need to be replaced. Currently, there are not enough craftsmen to do this. For the future, the advisor foresees that two types of craftsmen realise the energy transition. First, one type of craftsmen will work in factories. These craftsmen will free up capacity from the traditional craftsmen. The other type, which are the traditional craftsmen, is needed to execute new tasks. For example, installing a heat pump.



- To summarise, on the one hand, there will be craftsmen who perform tasks that require a low amount of construction expertise. While other craftsmen specialise in specific tasks that are needed to install sustainable components. Hans foresees that the traditional craftsmen will not exist in the future.

The advisor also shared some extra information on courses, craftsmen and profile

- The construction sites are internationally oriented. It is important to take this into account when communicating with craftsmen. It would for example be an improvement if the text on technical drawings is stated in normal sentences (instead of jargon and keywords). This will enable craftsmen to easily translate the text with Google Translate. Moreover, double negative clauses and 'if...then' sentences should be avoided to increase readability.
- Knowledge will be one of the most important aspects of making the transition. The following aspects are crucial:
 - The knowledge should be accessible (e.g., accessible through a phone).
 - The knowledge should be easily updatable.
 - The acquainted knowledge and skills should be saved into a skill passport[i].
- Craftsmen enjoy sharing their knowledge. It is for example possible to ask them for a vlog to explain how to assemble a certain part.
- On the construction site the craftsmen have instruction guides. In the future videos in IKEA-style would be beneficial to disseminate knowledge. The videos should be a maximum of 2 minutes.
- Craftsmen are searching for security (professional growth is not their goal). Craftsmen attach value to seeing the end result. The feeling of making something together and seeing that they are good at something is important to them.
- In the UK it is made mandatory that buildings are 3D modelled. This has resulted in an increase in prefabricated bathrooms built in factories in Europe. There is no more room for deviations and the craftsmen's own solutions.
- Training providers do not offer exactly what companies need. Because there is no uniform description of competences, it is also difficult for training organisations to develop training- and educational programmes. Now, the competences are often provisionally recorded in spreadsheets with crosses. These spreadsheets are for internal use and are not exchanged. There is still much room for improvement here.

[i] These people change from sector to sector. For example, from the construction factory to the beer factory. Consequently, the skill passport cannot/may not be managed by one sector.

The market for renovation, transformation and maintenance is much larger than that for new construction alone. This applies to residential construction, non-residential construction, and civil engineering. the growth in renovation is substantial at around 10% per year. how this translates to large and small construction sites is not clear.

Although no figures are available, it is to be expected that most errors occur in places where communication is required between different professions. As far as we are concerned, the greatest concern is in regular construction. Because installation technology has a training fund and sets of requirements for professional skills, the chances of preventing errors through training are the highest. Professional skills are recorded in a register, which also makes professional skills

visible. To description of the state of play in The Netherlands is closed off with an overview of topics for which high-quality upskilling is available, for both new builds and renovation.

- Airtightness
- watertightness
- insulation
- lead-throughs
- ventilation
- heat pumps

2.6 Spain

According to the Labour Force Survey⁵ conducted by the National Statistics Institute, the number of people employed in the construction sector in 2021 was 1,291,539, which represents 6.7% of the total number of people employed in the Spanish economy as a whole.

With regards to the occupations with the highest number of contracts in 2021, below is a list of the ten occupations with the highest number of contracts, which account for 70.5% of the total number of contracts. These occupations include bricklayers, electricians, painters, concrete installers, and metal structure installers.

CONTRATOS POR OCUPACIÓN REGISTRADOS EN OFICINAS DE EMPLEO POR EMPRESAS DE CONSTRUCCIÓN

OCUPACIONES (CNO-2011)	2021	% SOBRE EL TOTAL	2020	VARIACIÓN INTERANUAL 2021-2020	2019	VARIACIÓN INTERANUAL 2021-2019
Albañiles	334.589	29,3	341.157	-1,9%	373.723	-10,5%
Peones de la construcción de edificios	188.906	16,5	178.942	5,6%	201.190	-6,1%
Peones de obras públicas	47.265	4,1	42.444	11,4%	45.902	3,0%
Electricistas de la construcción y afines	45.392	4,0	41.641	9,0%	46.943	-3,3%
Otros trabajadores de las obras estructurales de construcción no clasificados bajo otros epígrafes ¹	45.029	3,9	40.851	10,2%	46.783	-3,7%
Pintores y empapeladores	37.530	3,3	37.860	-0,9%	43.530	-13,8%
Encofradores y operarios de puesta en obra de hormigón	34.399	3,0	34.437	-0,1%	37.033	-7,1%
Oficiales, operarios y artesanos de otros oficios no clasificados bajo otros epígrafes	27.396	2,4	26.007	5,3%	29.414	-6,9%
Montadores de estructuras metálicas	23.561	2,1	21.977	7,2%	27.675	-14,9%
Peones de las industrias manufactureras	22.238	1,9	18.865	17,9%	23.838	-6,7%

¹ Este epígrafe comprende las ocupaciones de Apuntaladores de edificios, Colocadores de prefabricados ligeros, Demoledores de edificios, Montadores de andamios, Poceros en redes de saneamiento y Trabajadores de la construcción a grandes alturas.

FUENTE: Elaboración del Observatorio Industrial de la Construcción con datos del Servicio Público de Empleo Estatal.

Figure 20: List of occupants with the highest number of contracts in the construction sector

⁵ <https://www.observatoriodelaconstruccion.com/uploads/media/HKQvbb7Q4Z.pdf>

To tackle the challenges of sustainability, energy efficiency, circular economy and digital transformation, professionals with new skills and different abilities are needed. Training and the adaptation of the educational level of those employed in the sector is one of the key elements to provide the workforce with new trades that will implement the transformation of the construction sector.

According to the Habitissimo report, in 2021⁶, 28% of all registered requests were related to improving the energy efficiency of the home. If we compare this data with those obtained in 2020, we can observe an increase of 3 percentage points, as in that year only 25% of all requests were related to energy efficiency. This evolution corroborates the increase in concern for improving energy efficiency, a condition that is gaining prominence in Spanish households.

In terms of the evolution of the demand for requests by quarter, during the first three months of the year, work related to the installation of new heating systems and the repair of existing systems were the most in-demand, although, in February and more in March, there was a clear increase in demand for exterior carpentry work and the installation of awnings and blinds. During the second quarter, the most requested interventions to improve the energy efficiency of the home were the replacement of household appliances with more efficient ones. On the other hand, in the third quarter, the most demanded works related to energy efficiency were changes in exterior carpentry, carried out by 54% of the respondents. Finally, during the fourth quarter, work to improve the thermal comfort of homes once again gained importance, once again becoming the main protagonists.

In addition, many Spaniards have opted for renewable energies, especially photovoltaic solar energy for domestic energy supply. Specifically, during the year 2021, this trend was consolidated, increasing month by month in a sensitive way, growing by 61% compared to the data recorded from January to November 2021 and by 230% compared to 2019.

According to information provided by the Official Architects' Associations of Spain⁷, in 2021 there were a total of 138,775 licences enabling works on residential buildings which represents an increase of 1% compared to 2019. These official licences issued by the architects' associations for residential buildings in 2021 are broken down according to the type of work to be carried out into 108,318 for new construction, 3,268 for home extensions, and 27,189 for minor renovations to the interior of the dwelling. Considering that small worksites are inside the homes the share of them among the total is 19.6%.

On the other hand, according to the Spanish National Statistics Institute (2011), 66.2% of dwellings were more than 30 years old, with almost one million dwellings in a poor, bad or dilapidated state. The Plan for the Recovery, Transformation and Resilience of the Spanish Economy includes housing refurbishment as one of its strategies, as well as a modification of the Horizontal Property Law, focused on energy refurbishment. The aim is to carry out 510,000 housing renovation actions and to help multiply the rate of renovations in Spain by 10 times by the spring of 2026.

⁶ https://procenter.habitissimo.es/wp-content/uploads/2022/03/informe_anual_ES_2021.pdf

⁷ <https://www.observatoriodelaconstruccion.com/uploads/media/te-4Llxfu7.pdf>

According to the Habitissimo report in 2021, the majority of renovations include several types of work and there is a slight decrease in more ad hoc renovations. The following typology has been defined according to the scope of the intervention: deep renovation, partial renovation - this is considered to be those that affect less than three rooms - and renovation of only one room, which is usually the bathroom or kitchen.

In relation to the location of the deep renovations, 70% were carried out in main dwellings and 23% were carried out in second homes. Finally, 7% of those who carried out a deep renovation stated that they did so as an investment in properties that they wanted to rent or sell in the future.

In terms of the type of property where deep renovations were carried out in 2021, we can observe that 39% of the interventions were carried out in flats of more than 90m², 28% were carried out in flats of less than 90m², 10% in semi-detached houses and the same percentage in detached houses. Finally, 13% were carried out in family dwellings.

As for the year of construction of the dwelling where the deep renovation was carried out, 36% of the renovations being carried out in properties built between 1977 and 1990.

Regarding the reason that led Spaniards to renovate their homes, 50% stated that they carried out a deep renovation on a property they had just bought. Of these, 89% wanted to personalise the property they had just bought to their own style and 11% decided to renovate it to increase the value of the property and be able to sell or rent it at a higher price. On the other hand, 25% stated that they carried out a deep renovation of their main property because it had become outdated and needed to be updated, and 9% stated that they needed to repair major damage caused by use and the passage of time. Finally, 16% carried out a complete renovation on a property they had just inherited and needed to update it.

For an assessment process to be recognized among employees of construction specialists a suggestion would be to incorporate:

1. Implementation of plans and measures to bring companies closer to training centres, with a positive impact on the perception of students.
2. Commitment to training in collaboration with construction companies adapted to their needs and providing these studies with prestige and social recognition.
3. Design of a specific campaign to publicise and promote the certificates of professionalism among workers and companies in the sector.
4. Implementation of a specific plan for the assessment, recognition and accreditation of competencies acquired through experience. This is the quickest, most effective and most economical way to dignify the sector and give value to the non-official qualifications that exist in the sector.
5. Definition of a Training and Apprenticeship Contract model adapted to the needs of construction sites, to attract unemployed young people interested in a real job opportunity in the short term.
6. Launch of a specific plan to train unemployed young people to obtain certificates of professionalism.

According to a recent report by the “Fundación Laboral de la Construcción (FLC)”⁸ in Spain, the client is not demanding in terms of energy consumption/ efficiency. Environmental aspects increase construction costs, and the potential advantages are not perceived by the client. Although there is concern about climate change, the client does not act as a driver as he is not aware of the advantages of zero consumption.

⁸ <https://www.observatoriodelaconstruccion.com/uploads/media/2MqKkAlFHR.pdf>

3 EXPERIENCES WITH SKILLS DEVELOPMENT AND EVALUATION ON WORKSITES

3.1 Austria

Within the BUILD UP Skills projects carried out since 2011 in Austria, new training courses for building professionals were designed, tested, monitored, and evaluated in pilot training, in collaboration with key actors in the building sector as well as in educational institutions. The training courses developed in these previous BUILD UP Skills projects were based on a modular qualification scheme for professionals in the construction industry with an emphasis on crosscutting craftsmen understanding. Primarily, the following competencies had to be imparted in the developed courses:

- Understanding the importance of energy efficiency and nearly zero energy building standards.
- Understanding of the interplay of the trades.
- Avoiding the most common construction faults and errors and their impact on the building.

One of the most successful outputs of the previous BUILD UP Skills projects was short onsite training – 3-4 hours – with a blower-door test. All professions involved in the construction were invited to an onsite blower-door test, which was carried out by an energy consultant. Within this framework, the trainees were confronted with actual construction failures and received direct instructions from the energy consultant how the errors could be avoided or repaired.

The national focus within the BUSLeague project was to develop and implement short online trainings (micro-trainings) for energy consultants. These trainings deepen the knowledge of the trainees or provide insight into new subjects according to actual market demand:

- The construction site process in connection with the implementation of renovation roadmaps.
- Building materials management for ecological building materials.
- Interpretation of measurements for quality assurance in practice.

These trainings were very well received, and many energy advisors attended these short courses.

In cooperation with a DIY chain store in Austria, three short trainings for the sales employees were developed:

- Basic knowledge on the subject of energy efficiency in buildings.
- Detailed knowledge of the correct selection and installation of windows.
- Detailed knowledge on the correct selection and installation of shading systems.

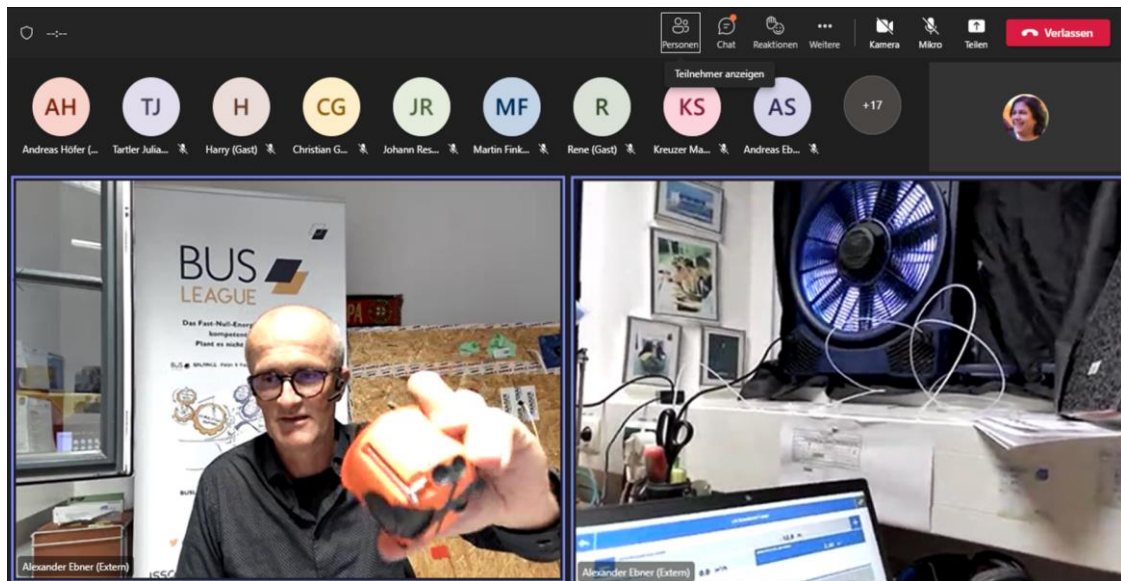


Fig 21: training in Austria; due to COVID10 held online

The training modules are offered via an e-learning platform for DIY employees and are 10-15 minutes long. The trainees can use the earned knowledge directly at the store in interaction with customers.

Considering the experiences with training activities in BUILD UP Skills projects, it can be stated that the most effective way to avoid construction mistakes and build energy-efficient buildings in Austria is actually training the energy advisors to bring the knowledge to the construction site and to the building owner.

3.2 Bulgaria

On-site

On-site training on NZEB is delivered on a specific building site. The latest example is in the town of Gabrovo, where the Municipality took this initiative for a building that they are constructing. In each case, the initiative for implementation of the course derives either from the construction company or from the building owner. This is due to the increased quality of construction after the implementation of the course.

The basic principles of NZEB are explained to all construction workers. During the theoretical part, the workers get to ask as many questions as possible to make sure that they get the essence of the topic. After that, the theoretical part is supplemented by on-site examples and construction techniques. The method is concluded by an evaluation of the candidate's progress and the new skills acquired.

Training Centre

The trainings are conducted in an Educational Training Centre, where the necessary building envelope and practice models are present. The participants in the course are predominantly construction workers and the company that they work for has decided to upskill their employees.

The programme consists of a theoretical part that follows the main NZEB principles and of hands-on experience on the practice models (scale 1:1). The participants are using the materials

that they will also use on-site and collaborate to stimulate the learning process. The final exam consists of theoretical questions and a practical exam on the practice models.

Professional High-School

The trainings are conducted in Professional High-schools, where the students major in Building construction or RES. The main principles of NZEB are explained to the students in the classroom. In each case, depending on the major that they are studying a different emphasis is given to the main topics. In some cases, even students from different majors take the course together, in order to stimulate interaction among different professions while upskilling.

After that, the course continues on-site, where a construction company has agreed to collaborate and provide a site. The students get to see the practical side of the educational material. Moreover, a public-private partnership is formed where the High-school and the construction company get to collaborate and form long-term working relations. On top of that later on some of the students might get a job opportunity at the construction company.

The final exam is conducted in a laboratory back in the High-school, where both the theoretical and the practical knowledge is tested.

3.3 France

FIT

The Work-integrated Training (FIT -its French acronym) was launched in 2017 for providing training to SME enterprises with theoretical and practical tools as the training platforms are brought directly to the work site, diminishing the transportation costs. Founded by the National Government, the regional government and the ADEME, the program, the implementation of FIT requires additionally the active enrolment of stakeholders, the selection of suitable worksites (among the different dimensions considered, the worksite should allow gathering of around 15 workers at the same time for the trainings), the inclusion of a “training clause” in the project acing contract, and the disposal of a mobile training platform and a trainer.

Following the initial deployment of this program, Constructys and the partners of the consortium did an evaluation for the Hats-de-France region in November 2019. The assessment was done based on interviews with trainers, training operators and different kinds of worksites involved, including project owners, managers, and supervisors. Despite the lack of initial motivation from the side of the participants, the results showed almost complete satisfaction with improvements in the quality of the tasks performed (less sinister in airtightness), an improvement in the communication among professional teams within the worksite, and the labialization process easing as a plus. Nevertheless, it was as well found a mean for the transfer of skills, a certain reticence for changing the methods on the part of the trainers, and the necessity to increase the efforts for rising the deployment logistics (this includes a yearly updating of the contents given the rapid evolution of the construction techniques) (C-Campus, 2019).

BTP

Build Up your project (BTP “Batis ton projet” in French) is a method conceived for the evaluation of the existing skills among the workers inscribed in a building project or for permitting job seekers to discover the construction professions. Its deployment was evaluated by Alliances Villes Emploi for the period March 2021 - February 2022 pour de execution on the Hauts-de-France region and with funding of the regional conseil. Following a round of interviews

with different stakeholders, including employment organisations, local government members and sector organisations,

Given the purpose of BTP as an orienting prelude for job seekers to build up a profession, the interviewed individual recognised its utility. They highlighted the possibility that the project offers for acknowledging the existence of these professions, and give a real impression about them, and awake the desire in the participants to join these careers. From the point of view of the professional advisors, the selection of appropriate candidates for trainings became easier, while from the point of view of the candidates, the interventions permitted the creation of groups that encouraged themselves for following a path in this sector while easing information exchange between the participants. Regarding the labour market of the construction sector, the interviewed individuals reported how the training process had registered an increase in enrolment, (as at the QPV de la Bourgogne neighbourhood, at Tourcoing) while its deployment has reinforced the links between employment organisations and gilt organisations.

Finally, the reported answers enlisted as conditions for success the involvement of the stakeholder of the sector, the right distribution of the task within the direct organisers of the interventions deployments and the track on the participant's carrier after their training or discovering sessions. Given this, the evaluation suggested the launching of specific craft (like heat pump installers, for example) or age-oriented interventions as well as new territorial distributions to capture as many candidates as possible for filling the precise labour necessities of the local market.



Figure 22 BTP interventions. Source: Archive

AFEST

The Work Situation-Based Training (AFEST, its French acronym) is a method launched in 2015 trying to respond to the necessity of professionalising the workforce in various sectors with the scarcity of skilled workers. Given that small enterprises hire less training for their workers than the big ones, the AFEST method offered a way to train the workers on the worksite with contents focused on specific abilities regarding the particular necessities of the running project. This is done with a simultaneous evaluation-assessment process based on learning by doing sessions and reflexive spaces in which the trainer (a colleague or supervisor) leads a group of partners that witnessed the process and results of the activity and can provide feedback about the work done.

This method was tested by ANACT et al. (2018), including 18 cases of organisations interested in improving their internal training structures in the building sector (one of them, specifically for

the Energy efficiency subsector) but also in other sectors such as retail purchase, health and management, among others. In the Experimentation run by the skill operator Constructys, for example, it was recognised the pertinence of the method for the sector -which is constantly demanding training- and the suitability of this methodology for its characteristics. In the trial, the complexity of the deployment highlighted the financial effort derived from it and suggest a complementarity with FIT-trainings⁹ as a plausible way to afford it. Seeking how to reduce this cost, it was proposed to standardise the contents and pedagogical methods and tools. Regarding the positive effects, the AFEST process has shown to reinforce the relationships within the work team, has improved the workers' perception of their work and its importance, and even the enterprise recognition of their skills.

The report also remarks two considerations for the AFEST deployment: 1. Distinguishing the reflection moments (feedback for improving the acquired skills) from the evaluation ones (as a judgement on the quality of the work done), 2. The training of the trainer is a complex problem (as (s)he has a main role: the interest awakening to the process, the observation of the pre, post-task and finals reflection scenes leading). And it enlists four main challenges: 1. Meeting in one place the qualified trainer and the unskilled worker given the dynamics in the sector, 2. The reflection session implies additional time from the work time, 3. The process for offering content that promotes the development of the desired skills, 4. The implementation cost is often higher than the one of the external trainings as the time invested in preparing it is also higher¹⁰ (ANACT et al., 2018).

3.4 Ireland

Currently, the assessment recognised is the NZEB and airtightness training delivered at the Education and Training Board (ETB) centres. There are some equipment suppliers with training rigs that are visiting sites, public authorities and hardware stores to deliver training and give those in the sector a hands-on view of their equipment and systems for both retrofitting and new builds.

⁹ The FIT program is a recognised program in terms of Energy Efficiency and is often financed by public entities or professional associations.

¹⁰ The report suggests that, if the local engineering or the trainer is already prepared, the cost may decrease.



Figure 23: Grants Heat pump training rig at a public authority county council office to deliver training facilitated under BUSLeague by TUS.

There are some ETBs considering the development of mobile training rigs, however some of the feedback TUS is currently receiving is that due to the small geographic layout of the country and the rollout of up to twelve centres delivering NZEB training, that going to these centres will not be overly far for construction workers to travel. Therefore, the use of mobile training rigs is not yet a priority as the Centres is developing their NZEB centres of excellence.



Figure 24: Unveiling of Eco centre at Chadwicks Hardware store; TUS were involved in design and development



Figure 25: Airtightness and NZEB Training for Hardware Store staff Mount Lucas NZEB Centre

3.5 Spain

On-site trainings



Figure 26: On-site training in a BAUHAUS store

One of BAUHAUS' regular activities is to organise on-site trainings in cooperation with product suppliers. These trainings are mainly aimed at the installer network but also at private customers. It is a win-win solution as both BAUHAUS and the partner company increase their sales and customer loyalty and the attendee appreciates the time spent learning and the human contact with the team behind the product to whom he/she can then turn to for after-sales service.

This on-site training takes place in BAUHAUS stores. They are short training sessions (2-3 hours) and start with a brief explanation of the product to introduce its benefits and are followed by an application demonstration.

These trainings are voluntary, and no exam or test is taken and no certification and/or recognition is obtained by the attendee.

On-site evaluation

In Spain, many blue-collar workers have no specific training but have learned by doing after many years in the profession. For this reason, there is an official system of "recognition" that validates professional experience through a bureaucratic system and provides the worker with a certificate.

In line with the BUSLeague project, and with the growing demand for *micro-training*, to acquire *micro-competences*, which can be recognised through *micro-credentials*, in Spain we decided to test an on-site evaluation scheme where the professional would perform real manual work in front of an assessor. To this end:

- We elaborated a certification scheme for people, in accordance with Spanish law.
- The micro-competence chosen was the “replacement of conventional windows with thermal break windows”.
- We selected an evaluator who considered the requirements of a competent worker to replace windows correctly.
- We tested 15 candidates on-site. The test was conducted individually, so it lasted about 2 hours per candidate.
- We disseminated the lessons learnt during this experience to regional key actors providing technical and economic data to make this assessment a reality with the support of official entities to give confidence to the scheme.

This action is described in detail in Annex I of this deliverable.



Figure 27: Example of onsite training and evaluation

4 STRATEGIES FOR SKILLS DEVELOPMENT AND EVALUATION ON SMALL WORKSITES

4.1 Austria

Klimaaktiv building standard Certificate Extension and Cooperation with Training Providers

Specific context identification

Based on the experience of the former BUILD UP Skills projects, Austria's strategy is to raise the competence of building professionals and to avoid frequent mistakes on the construction site in line with energy efficiency, based on the fact that some (well-known) building performance criteria are directly linked to the quality of work of craftsmen on the site. Among these building performance criteria, some are also easily verifiable or required for the commissioning or for the certification process of the building.

In this context, and to support the European path to greater sustainability and to live up to the exemplary role of the public sector, the Austrian federal government developed a new Action Plan for Sustainable Public Procurement.

Skill assessment

From 2021, new green public procurement criteria apply to federal public buildings in Austria. These require that new and refurbished federal buildings match the klimaaktiv building standard. The klimaaktiv building standard is a national-specific sustainability rating system for buildings published by the Federal Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology. The criteria set is transparent and freely accessible. The klimaaktiv building standard not only assesses and evaluates energy efficiency, but also the quality of work, the quality of construction materials and design, as well as aspects such as location, comfort and indoor air quality¹¹.

In line with the *klimaaktiv building standard*, a blower door test to prove airtightness has to be performed. The result of a blower door test relates directly to the quality of craftsmanship onsite. In case of non-achievement of the targeted performance, a detailed inspection reveals where mistakes were made, and which crafts are responsible.

General method

As a result, the mandatory use of the *klimaaktiv building standard* can become a cornerstone for raising the quality of craftsmanship, and lead to a higher demand for highly skilled building professionals in Austria. The strategy is that public buildings will act as best practice examples for the public and promote the realization of high sustainability standards.

To increase impact, it is suggested to extend the *klimaaktiv building* requirements to buildings of the federal provinces and communities of Austria in the near future. Moreover, the purpose

¹¹ <https://www.klimaaktiv.at/bauen-sanieren/gebaeuedeklaration/kriterienkatalog.html>

of blower door tests and the resulting benefits to raise the quality of the craftsmanship needs to be broadly disseminated.

Cooperation with training providers

The Austrian Energy Agency in cooperation with the further education provider Energy Agency Styria developed and implemented short training sessions for energy advisors to support the raise of the quality of craftsmanship and the use of quality controls within the BUSLeague project. Within the BUSLeague period, these trainings were offered online due to Covid.

In cooperation with an Austrian DIY chain store (with ca. 90 branches), three short trainings for the sales personnel were developed so that these employees can convey the importance of energy efficiency and the correct installation of building elements directly to the customers. This training is offered via an e-learning platform.

4.2 Bulgaria

Currently, no framework for upskilling construction specialists in energy efficient building methods exists in Bulgaria in line with the national qualification system. This naturally precludes a lack of current onsite training with the same focus. The lack of CPD adds to the low rate of educated individuals. While building site training has been neglected in Bulgaria, it is known that hands-on experience provides an opportunity for a relatively quick and efficient way of knowledge distribution as direct examples and practical training improve the learning experience. Therefore, the Bulgarian team would attempt to create the preconditions necessary for the establishment and development of an appropriate certification process related to upskilling SME workers on small building sites in energy efficient building methods. The approach is to propose training strategies suitable for a wide range of construction professionals in a variety of building projects in flexible conditions, and consistent with perceived methodologies for mutual recognition of acquired skills. Available training content and diverse learning opportunities have been developed through the initiatives of other international projects shared in D4.1, which could potentially be integrated. At this moment four strategies seem suitable to be used in the Bulgarian context.

4.2.1 Strategy I - Public procurement projects

Specific context identification

The missing coherent strategy in Bulgaria for raising qualifications in line with energy efficient ambitions as well as the lack of legal requirements for building nZEB synchronized with national building legislation leads to low demand for qualified workers. Therefore, given the context, requiring trained construction specialists in building performance optimization, could arise solely from awareness and acknowledgement of the advantages of building energy efficiency. An instance in Bulgaria of the existence of such specific context conditions is a public procurement project in the city of Gabrovo, upholding in the tender documents the requirement for all construction workers to pass a training course in nZEB building techniques. This case holds the potential to become a precedent for public projects with green building performance criteria and could stimulate the creation of a practice where a strategy for proper integration of energy efficient skills among construction workers would become inevitably necessary.

In some other cases in Bulgaria, investors decide for various reasons to validate their buildings against international green building certification programmes. In such situations, it is beneficial for the assessment part of the certification that construction works are completed with the appropriate application of energy efficient measures and according to requirements for sustainability. Therefore, competing construction companies, who have their workers trained in energy efficiency, would have the advantage of ensuring quality buildings through a qualified workforce.

General method

For construction companies participating in the tender process for green public buildings, there should be a requirement for the provision of documentation certifying knowledge and experience in energy-sustainable projects and/ or evidence for completed projects with proven energy efficient performance. In case such validated documentation cannot be submitted, other criteria for the selection of the construction workforce should be followed. Eventually, the process should guarantee that the chosen construction specialists will be able to conform to requirements for energy efficient building by receiving appropriate project-oriented training. This action should be organised in a timely manner, be discipline-specific and be aligned with the goals of the project. Training activities could be then arranged right before the planned construction works and in the vicinity of the building site (such as in the network of Building Knowledge Hubs set during the Train-to-nZEB-project) or on the building site itself, relying on mobile training stations (from the nZEB Roadshow-project).

Once training is completed, the learned material would be directly put into practice during construction, solidifying the gained knowledge, and supporting it with practical experience. In a further step, ensuring quality control and inspection would testify to the success of the training programme as a whole.

Skill assessment

Setting requirements for qualified construction workers in building nZEB in public procurement and/or internationally certified projects should be underlined by clearly defined criteria for achieving optimization of building energy performance. Against those criteria performance indicators should be determined to confirm whether a sustainable goal was achieved during construction or not. For international certification programmes, such as BREEAM, LEED, WELL, etc., clear methods exist for assessing construction works, compared to pre-defined standards for sustainable buildings. In such a way, the final evaluation mark is also an indication of the successful integration of energy efficient knowledge and skills among workers on the building site and is a rightful assessment of project parameters.

4.2.2 Strategy 2 - Voluntary training courses

Specific context identification

For projects where no strict requirements for qualified construction work have been put in place, a specific context could evolve from voluntary training courses. Without an official evaluation methodology, a preliminary assessment of the skills of construction workers could be done based on completed education, professional experience, and current position on the building site. As part of a proposed mixed learning programme in energy efficiency, theoretical

courses could be combined with practical experience directly applied to the building site during a particular project. By providing the opportunity to gain experience on the job, construction specialists would be able to connect individual building measures related to achieving energy efficient performance to real-life examples.

General method

For the current perceived strategy, it is necessary to establish a coherent training methodology for construction specialists and companies seeking to improve their skills on the building site. A proposal for an upskilling course would be to first cover learning materials on discipline-specific materials related to energy efficiency in theory. This could be done in a self-taught manner via provided online platforms, such as the CraftEdu one, described in D4.1. Then, in the second step, the training provider should arrange exercises to demonstrate nZEB principles in practice. If certain products and building components are chosen for the project, special training by the given product manufacturer or distributor could be additionally organized. As a last step, the trained construction workers should address issues related to energy efficiency directly on the building site. Results of the interventions could be assessed through the application of tests for airtightness and/or thermography to identify and evaluate newly acquired, special knowledge and skills.

Skill assessment

In the last step of the strategy for raising the qualification on small building sites, conducting blower door tests for airtightness and thermographic imaging could be used for evaluating the level of adopted skills. Results from the tests would serve at best as evidence and illustration of the importance of energy efficient skills on the building site and should add to the overall learning experience. The qualification experience in this case accounts for the skill level of a whole team and reflects on the company profile.

4.2.3 Strategy 3 - Training course on site

Specific context identification

The third strategy proposed could work as an alternative to the previously described one. In this case, construction specialists once again decide upon themselves to improve their knowledge and skills in energy efficiency, however in a more compact format in which theory is explained through direct examples and with the use of demonstration models, described in D4.3. For this purpose, a mobile training station is set up on-site to create an appropriate learning environment and testing ground at the same time.

General method

This third strategy is related to the building site - by organizing a travelling mobile training station, construction workers get to be trained directly in the working place. By doing so, the training provider ensures physical hands-on experience and creates tangible relationships for the construction workers with the expected results. Blower door tests and thermographic imaging should also be arranged to illustrate further potential mistakes and low-quality works typically occurring on the building site.

Skill assessment

Providing physical demonstration models on the building site, workers get to practise, experiment and research best building practices for achieving energy efficiency for the building project. Their success would be measured in a similar way described for Strategy 2. By organizing airtightness and thermal bridge tests, construction workers will be assessed in their skill to apply specific measures for avoiding the low performance of buildings.

4.2.4 Strategy 4 - High School Trainings

Specific context identification

There is currently the practice in Bulgaria that professional high schools connect students with partnering construction companies to provide conditions for gaining practical experience on the building site. Those internships are usually coordinated with the teaching material at High school, where the students should seek to cover certain topics in practice, along with gaining new knowledge and skills coming from real-life situations. At the end of this working experience, students are examined and potentially receive a job proposal.

The Bulgarian team identifies an opportunity for upskilling individuals from the construction industry in a similar way, where the high schools become the teaching ground for theory in energy efficiency, and the same construction companies conduct practical training on the topic.

General method

In this situation, construction workers, who wish to change their qualification or build on current skills, would have the opportunity to do so through an already-established training scheme. The teaching staff at the professional high school can pass on theoretical knowledge on nZEB, as a result of the BUS EnerPro initiative, described in D4.1. Construction companies on the other hand grant access to conditions for practical exercises. In such a way, all sides could potentially benefit from the exchange of knowledge and experience in the process.

Skill assessment

There is a common agreement between the teaching institution and the building company that the material covered in the classroom would be proactively applied to the building site during the internship. At the end of the learning process, the ones seeking recognition of their gained skills would be examined in a way, which testifies their capability of conducting construction works fit for nZEB buildings.

4.3 Ireland

For Ireland, all EE trainings were mapped and presented in D4.1. These have been developed for all-collar workers as, currently, off-site training. BIMzeED (Digitalisation & NZEB) training was developed within an ERASMUS KA European Union project. As a result, all the content is available in English, Spanish, Hungarian and Croatian on the website https://bimzeed.eu/user-account/?action=eb_register. This allows for these training modules to be used by the other project partners with any adaptations required pertinent to the specific country.

The NZEB trainings at NZEB centres fully correspond to the scope of the BUSLeague EE-skills qualification. It is under consideration how the available trainings can be shared internationally. This will entail trainings in English and online, which is currently an option for trainees in Ireland.

These training modules are suitable to be conducted in practical training centres or as on-site and digital/online training and also to be used by suppliers and product manufacturers to train their workers.

Currently in Ireland the method of delivering training to hardware stores staff is to visit the Training Centres to train in:

- NZEB Fundamentals
- NZEB Retrofit
- NZEB Ventilation
- Retrofit Insulation

Product suppliers of, for example, Heat Pumps, Airtightness Materials and Insulation visit the hardware stores to deliver training to staff. They also have developed training centres and online academies¹². HP4All has also developed a webinar series now live on TÚS Talk YouTube portal which gives short energy efficiency introductions to all aspects of the construction sector.¹³

A tool developed and under development is the BUILDUP Skills App which can direct all in the construction sector, and also homeowners, to training that will upskill them.

Additionally, this tool can assist householders, or those about to build, as the training will give an overview of energy efficiency and comfort in buildings. In Ireland we have been suggesting to all, if they are about to buy, build or retrofit a dwelling they do the NZEB Fundamentals course as a minimum. The feedback from those who have taken the 1-day course has been positive.

Our strategy is to raise the competence of building professionals and to avoid frequent mistakes on the construction site in line with energy efficiency. This is based on feedback from the renovation at St. Bricins which inserted an airtightness training clause into the tender and the delivery of a better build was evidenced.

Additionally, we are suggesting that a minimum qualification for all working in the construction industry for design to build to Facilities Management become mandatory in the future. The training is NZEB Fundamentals delivered at the Irish ETBs. The course is both at the training centres, 1 day, and online 2 days of 3-hour webinars. The course is free and fully funded.

This will give all in the industry an introduction to building physics, airtightness, insulation and building services such as heating and renewable energy systems. As knowledge of building performance criteria is directly linked to the quality of work of craftsmen on the site, we are in discussions with many stakeholders highlighted below, in the industry training and policy sectors, to roll out this minimum qualification such as:

- Simon Harris, Minister for Further and Higher Education.
- Eamon Ryan, Minister for Environment, Climate, Communications and Transport.
- Dr Fiona Maloney, Director of Further Education and Training Support Services.

¹² <https://www.ecologicalbuildingsystems.com/training-courses;>
<https://www.saint-gobain.ie/technical-academy>

¹³ [HP4ALL Homeowner Webinar Series-TÚS Talks; Comfort & Energy in Construction- TÚS Talks](#)

- Construction Industry Federation.
- Education and Training Boards Ireland.

Skill assessment

There is an assessment at the end of the course, both theoretical and practical. When completed and passed a City & Guilds Certificate is issued. This broad range of training will enable all involved in the construction industry to continue to be at the cutting edge in supporting Ireland & Europe's Low Carbon Transition and Mitigation Plan. TUS, in collaboration with training ETBs, looks forward to working with the construction industry and all our other partners in this area to ensure the provision of these most relevant training opportunities in NZEB can be made available anywhere globally.

4.4 Spain

Certification Scheme for the category of “Expert” in the replacement of conventional windows by the installation of windows with thermal break

Object

This section aims to establish the conditions and requirements that shape and regulate the operation of the Certification Scheme of persons for the category of "Expert in the replacement of conventional windows by the installation of windows with thermal break according to UNE 85219:2016".

Promoting entities and Working group

The scheme has been promoted by the Valencia Institute of Building (IVE) through the European BUSLeague project, funded by the European Union under the Horizon 2020 Programme.

A working group consisting of the following entities/persons was formed for the creation of the scheme:

- Valencian Federation of Construction Businesses, Federación Valenciana de Empresarios de la Construcción (FEVEC).
- Valencia Institute of Building, Instituto Valenciano de la Edificación (IVE).
- Masuno Soluciones S.L.
- Eugenio Corbatón Lacueva.

Scope of the certification

The candidate will demonstrate through certification his/her qualification for the correct replacement and installation of external joinery in accordance with the UNE 85219:2016 standard. The objective of the scheme is the recognition of the set of competences necessary to intervene in the building to improve its energy efficiency by acting on the enclosures, by installing or replacing existing windows with windows with thermal break. Correct execution in the installation of the window manages to maintain the performance with which it has been manufactured, being able to last throughout its useful life.

The window goes through a series of phases from its manufacture until it is delivered to the building, see Figure 28. The presented scheme concerns the construction and assembly phases.

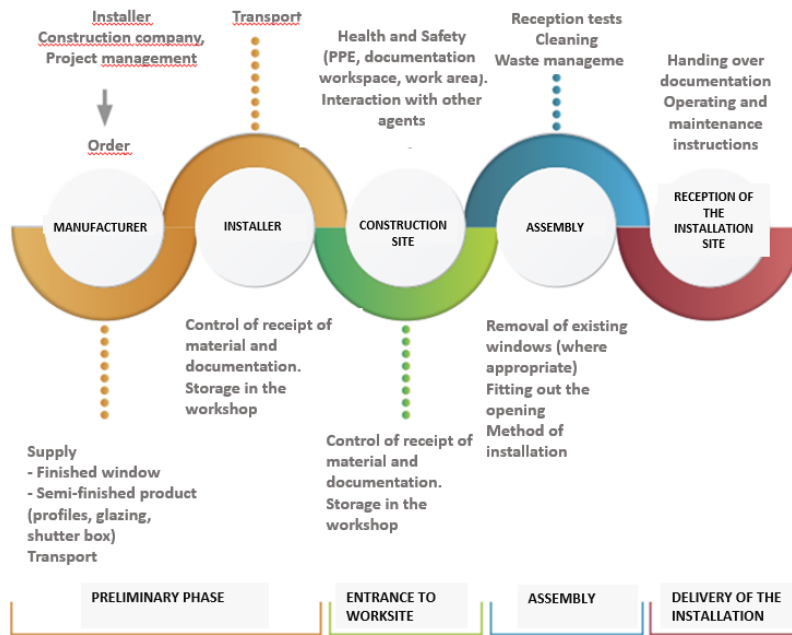


Figure 28: phases of installations of windows. (Source: Window installation guide. ASEFAVE)

Prerequisites

The candidate must be a professional who is dedicated to the replacement of windows with thermal break windows. In addition to having experience as a bricklayer, carpentry installer or metal and PVC carpenter who is dedicated to the installation.

To be eligible for the assessment phase, one of the following requirements must be fulfilled:

1. Experience of at least three years in the tasks related in the programme of the scheme to be demonstrated by:
 - a. Recent employment history report.
 - b. Certificate signed by their superior indicating the position and the tasks performed.
2. Minimum training of 200 hours in masonry or carpentry course(s).

Contents of the evaluation

The candidate shall demonstrate by certification their qualification to replace and install thermal break windows correctly according to UNE 85219:2016. Competence in the following concepts/practices shall be demonstrated:

Window requirements

- **CE marking:** The window is CE marked according to EN 14351-1 (Declaration of Performance, CE marking label and instructions for use and safety), and the corresponding documentation is handed over to the customer.
- **Voluntary quality label:** The window is voluntarily awarded the Quality Mark.
- **Energy Efficiency Label for Windows:**
 1. The window is voluntarily provided with the Energy Efficiency Label for windows.
 2. Correctly define what thermal break is in windows and doors, how it is useful and how it benefits them.
 3. Determine what energy certification is.

4. Correctly determine which types of windows improve energy certification.
5. Define what information is contained in the Energy Efficiency label.
 - **Technical Building Code:** The window complies with the design requirements of the CTE.

Details of the results of the evaluation and scheme content are described further in the Annex.

5 MARKET RECOGNITION POSSIBILITIES

5.1 Austria

Klimaaktiv Building Standard Certification in Austria

Market recognition

A classic approach to market recognition is to award a certificate to craftsmen who have completed a qualifying course or upskilling training. These certifications take the form of a certificate of attendance at a specific course or training (with or without a final knowledge test) or the form of a more global certification (e.g., the "passive house certification", which validates the ability of a craftsperson to know the typical issues related to passive house construction and the best practices to solve them). However, two aspects hinder the spread of such a recognition method. First, there are many similar certificates and only a few are known and acknowledged by construction companies. The second problem is that companies are often reluctant to hire or retain craftsmen who hold such certifications. This is due to the companies' reluctance to raise salaries because of certifications. Besides, there is no direct guarantee for companies of a positive impact of these certifications on compliance with building requirements.

However, another path to market recognition can be derived from the skills evaluation strategy presented in Chapter 4.1. Since it is the buildings themselves that are certified, according to criteria that imply a good quality of realisation (for example, by the implementation of the blower door test), the craftsmen who have worked on these sites can integrate his/her experience in a personal reference portfolio. When applying for the next company or the next job on a site, this portfolio can be presented as a list of references to the employer. Thus, a construction company that only hires craftsmen with such references has a much better chance of obtaining a building that meets the required quality criteria (in particular a positive result in the compulsory blower door test) without complications or additional work because their craftsmen have already done it correctly on another site. In contrast to the first method, companies might be more willing to pay such craftsmen a higher wage because their qualifications have a direct impact on the cost and duration of the construction work (efficient work, few defects to be repaired). The craftsmen thus indirectly receive market recognition of their skills.

How can the market recognise this assessment?

As mentioned in Chapter 3, only public buildings in Austria are currently required to meet the klimaaktiv quality criteria, which include criteria about construction quality. However, the positive effect on market recognition still needs time and is expected. Firstly, public buildings serve as examples of best practices and will promote demand and general implementation of high sustainability standards for all types of buildings, even for small or private sites. Secondly, this strategy also helps to improve the overall skills of craftsmen, as those who have acquired best practices through their work on public buildings can later work on another site and bring their practice back. Thus, though such quality criteria are not mandatory for all types of buildings, the upskilling of craftsmen will in the long run also go to private or smaller construction sites.

5.2 Bulgaria

Market recognition

For the Bulgarian building market, the role of energy efficient construction is still underappreciated. Since there are no definitive legal requirements and no strict control over the quality of construction works, investors and contractors often choose to build traditionally and cheaply. Respectively, there is a certain dose of scepticism in financial terms, as to what qualified workers could bring to a company or a building site, since hiring them inevitably means higher expenditures.

Unless the skill of building efficiently is understood by the industry, then the value of the certificate is almost insignificant. Therefore, a qualification certificate should have good marketing qualities, describing economic advantages for the hiring side. Additionally, the financing side should be well acquainted with the training institution and should trust their ability to educate and upskill accordingly. Even then, written evidence of a taken course, no matter how advanced, could still appear questionable in Bulgaria. What the market surely trusts are real-life examples of knowledge applied to practice. This leads to the conclusion that if an investor or hiring company are presented with valid evidence of completed works, which bring not only quality to the project but also saves time and money by utilizing learned knowledge at an upskilling course, they will surely recognize the respective skills. And since sustainable buildings by definition describe quality, precision and mindful work there is a good chance that through raising awareness of the benefits of building efficiently there will be greater appreciation for the upskilled workforce.

Having this in mind, it is essential to establish a clear and meaningful line of validation steps along a training course in energy efficiency. To begin with, it is crucial that the appropriate learning opportunities and methods are identified, based on the individual needs of construction workers, SMEs, and projects. Here, technological solutions could come in help - such as blended online platforms - serving as assistance for allocating suitable courses, connected to a database of training providers and learning material, based on personal profile, profession and interest. Important players are the training providers, who devise a coordinated scheme for certification together with other market participants - product manufacturers and construction companies to contribute to the overall effectiveness of the upskilling process. The inclusion of public and national institutions as the administrative and legal bodies to oversee and control the process is suggested, and most importantly to initiate and maintain a register of qualified construction professionals.

How can the market recognise this assessment?

Strategy I: Public procurement projects

For the first strategy, proposed in chapter 4.2 by the Bulgarian team, there is a potential that public buildings become a benchmark for quality construction once they adopt the requirement for upskilled workers in their projects and as a result achieve improved performance. This would not only increase the number of qualifications but would also introduce suitable processes on regional and local levels and establish a chain of validation among stakeholders. As a result, the promotion of energy efficiency and raising awareness of the benefits of sustainable buildings could further stimulate recognition and the need for qualification schemes.

Strategy 2: Voluntary training courses

In the second strategy, the ability to allocate convenient and relevant training courses quickly and efficiently would be essential for the motivation among construction specialists to upskill. Therefore, the use of an online service to identify a training course, suitable for learning energy efficiency in practice would be convenient and appreciated. The combination of theoretical and practical exercises would strengthen the effect of the learning process. Eventually, the outcome of construction works on a given project should be tested via blower door and thermographic tests to certify the quality of the taught and learned material as outlined in Chapter 4.2.

Strategy 3: On- site training

For this strategy, it is important to ensure that compatible mobile training stations are available, which could deliver necessary training skills at a given location and for a specific project. The aim would be to prepare the workers for the upcoming construction works as efficiently as possible via carefully selected training materials and practical exercises, which could be immediately applied to the project. Results would be once again validated via tests and would verify the effectiveness of the training method.

Strategy 4: High-school trainings

Considering that professional high schools operate in line with national education legislation adds credibility to the suggested training opportunity in this constellation. What needs to be coordinated is the recognition of such training methods as an official format for raising qualifications among construction practitioners.

5.3 France

Market recognition

In a general context, a certification can be useful for signalling the jobseekers in the labour market, representing an incentive for them in terms of gaining an advantage for competing for projects. In France, however, the scarcity of qualified craftsmen for the enterprises to hire non-qualified workers and train them on-site for achieving production goals on time. As so, the certifications, and even the diplomas, have a low value. Given this, according to the project leader from the Cambr sis Employment house, some lessons can be drawn from existing certifications and programs.

Lessons from the point of view of project owners:

1. A certification is a plus when it is associated with economic incentives, as happens with the RGE. In this case, the certified enterprises give access to their clients to subventions programs like MaPrimeR nov' (FranceRenov' from 2022). Nevertheless, the certification presents problems in terms of credibility given the possibility of choosing the employees that attend the training and the election of the simple control.
2. The FIT training, a training provided in the works, while comfortable is followed by the enterprises only when it is mandatory due to a training clause. Given the costs of the hour/labour and the rush with the time planning, it is very unlikely that the enterprises join the training voluntarily.

Lessons from the point of view of project managers:

3. The AFEST program, which upskills workers to train their colleagues in the work site, during the project running, is highlighted because of its adaptability to the enterprise's

needs. In this sense, it is well received because it can import the precise skills that are needed for the current worksite, bringing high profitability.

4. The BTP method, which implies a “discovering mechanism” and an “assessment mechanism”. Often supported by the employment houses, the assessment mechanism serves to emit a judgement on the candidate's level of competency that employers can consider for hiring them or for considering which kind of training offering for them. Even when neither the employment house nor the training centre is authorised to certify, the judgement emitted is accepted for two reasons:
 - a. The skills assessed are detailed and specific,
 - b. The assessments depart from the public national catalogues of skills (referencing techniques),
 - c. The assessment process is open to the public, it can be directly surveyed by the employers.

Additionally, some common agreements in the field, useful for this task, are:

- The workers are easier to train during their first years, once they finished school, than later, once they have advanced their careers.
- The requirements for mandatory training implied constraints in terms of labour or time. However, enterprises always seek to reduce the constraints and make time.
- The skills can only be tested practically. Nevertheless, there are not enough worksites for testing as the rate of actual PERFORMING energy renovations is not representative.

5.4 Ireland

Market recognition

In Ireland we are currently developing a system that we hope will recognise all NZEB training and mandate the NZEB 1-day Fundamentals training to be a requirement for all professions and trades that work in the construction sector from energy assessors, surveyors, designers, builders and operators. The CIRI (Construction Industry Register of Ireland) will be a legal requirement for all builders and many trades by 2024. Established in 2014, the Construction Industry Register Ireland (CIRI) is an online register of competent trade professionals who carry out construction across Ireland.

Currently the requirements appear to be as follows¹⁴:

VCR MEMBER REQUIREMENTS

- Competence & Experience
- Technical Capability
- Continuous Professional Development
- Industry Code of Conduct
- Tax Compliant
- Health & Safety Statement
- Insured
- VAT Registered
- Environmental Assurance
- Quality Assurance

¹⁴ [Search register » Voluntary Construction Register Ireland](#)

- Knowledge of Building Regulations
- Regulatory & Statutory Compliance

Through the BUSLeague project, in Ireland training clauses have been piloted which will allow public procurers and contracting bodies such as housing associations tendering for renovation and new build projects to require companies winning NZEB projects train their staff in energy efficiency.

This type of training clause is currently in use in the Hauts-de-France region (France), where the companies winning these projects must train staff working on a project (construction workers and site supervisors) in energy efficiency. And has been trialled in a retrofit in Ireland through Dublin City Council.

In Ireland, the route we appear to be going down for recognition is the current certified and recognised NZEB training. Through conversations with Educational Training Boards (ETBs), it is expected that the training will be added to the craft apprenticeships. To keep it uncomplicated and ensure it can be amalgamated into the training easily it will be added onto the craft training not inserted into the current curricula as this will take some time and create changes in the craft training programme. We have also received a letter of summary to date through the BUSLeague project, we have created a collaborative effect between hardware stores' training centres and hope to continue to stimulate upskilling training. We have also run various events with local authorities which have expressed interest in training their building departments in NZEB.

How can the market recognise this assessment?

This NZEB Strategy gives an overview of building physics and energy efficiency to all in the sector, from design to build to maintenance and facilities management. Additionally, life cycle analysis and embodied carbon of construction is now being recorded and we believe it will become an industry norm in the future. So, all the training will deliver lower emissions and healthier buildings with lower environmental and cost impacts. The market we believe will require a minimum level of training in the future which will be NZEB.

5.5 Spain

Market recognition

In recent years, several initiatives have been undertaken, both in Spain and Europe, aimed at highlighting the skills of professionals. Many of these initiatives have taken the form of "skills passports" or "professional cards" and some of their advantages are:

- The professional has information about him/herself in a friendly and attractive format that he/she can show to others physically (if there is a card or similar) or through digital media, publishing it on his/her curriculum vitae, website, blog, or social media.
- The information is authenticated and validated by the issuing bodies and should therefore be hosted on an official website, which lends credibility and transparency to the system. To this end, the card or passport must include an electronic verification code or QR code.
- With the prior authorisation of the professional, the data is published for free consultation, so that companies and users can hire the services of a professional according to the competences he or she holds.

- It motivates the professional to continue training and recycling, which results in better professional performance and a higher quality in the services offered.
- It increases visibility and highlights the qualification of professionals, favouring their recruitment and giving them a competitive advantage over others who are not included in recognition systems.
- It is the key element that connects supply and demand, becoming the needed link that connects the professional offering his or her services with the client that needs his or her services. As such, it must be publicised both among professionals and among companies in the sector.

How can the market recognise this assessment?

In Spain our goal is to involve the government in the onsite recognition of micro-competences for several reasons:

- We should not work in parallel as the government has a very advanced qualifications framework with which it associates training and accreditation. Therefore, the objective is to coexist with the existing official system but to work on a smaller scale (micro-competences).
- By focusing on micro-competences, we can give a quicker response to the innovative construction market, introducing new micro-competences to be recognised when needed.
- Government-supported initiatives are more powerful and trusted by the sector as they are not for profit.
- Having an official system of recognition in place will facilitate the introduction of “skilled professional clauses” in both tenders and financial mechanisms.

Our plan is to present a scalable strategy, giving the government technical and economic data on the feasibility of certification on "window replacement" actually implemented in BUSLeague and already tested with 15 participants. This procedure will be fine-tuned with the input and suggestions of the key actors consulted, will grow with other micro-competences, and will be complemented by micro-training (if there is a gap) to prepare professionals to acquire micro-competences.

6 CONCLUSION

While it is clear that the construction sector needs to address multiple challenges related to the energy efficiency and renewable energy skills of the construction workforce, the current report convincingly demonstrates that not only there are tested opportunities to deliver upskilling courses according to the needs of the industry (and especially of the SMEs), but also that practical realisations are proving the interest of the key target groups of the training. The described examples of different training methodologies provide evidence of an established culture of addressing the needs of the construction companies for short, practical, and cost-efficient training, assessment and certification of the workforce. At the same time, the experiences show that the quality is not necessarily compromised with the decreasing of the duration and the scope of the training activities; on the contrary, the proposed approaches demonstrate excellent results, which are proven by the market uptake and continued demand for the described training services. In this respect, the examples from the BAUHAUS chain of DIY stores in Spain and Practee Formations in France are extremely convincing, showing that the private markets are well in advance of the mainstream educational practices.

On the other hand, certain experiences closely related to the national qualification frameworks also gain pace. The most obvious examples are the Irish nZEB Fundamentals training expected to be adopted by the Educational Training Boards, and the Austrian training for energy advisers based on airtightness testing, delivered in close connections with the responsible authorities, which have the potential for immediate integration in the national qualification frameworks. Somewhere in the middle, the flexible training schemes delivered by the Building Knowledge Hub in Bulgaria and via the BUILD UP Skills Advisor App in The Netherlands, provide a direct link to the market but are constructed in a way to provide coherence with the national training and education specifics.

In this regard, with the strive towards mutual recognition of energy competences being one of the key features of the BUSLeague project in general, the collected examples for methodologies and tools for on-site upskilling are the perfect addition to the BUSLeague qualification framework. They provide not only direct reference to the tasks defined in this cornerstone document of the project but also support for the achievement of the learning outcomes for the different professional occupations in an attractive, straightforward and cost-efficient manner. At the same time, they also guarantee coherence with the national qualification discussed above and the quality needed for the sustainable market uptake of innovative training services. Thus, it is believed that the report and the included examples should be of interest to any vocational training institution and authority considering energy efficiency and renewable energy technologies as a strategic priority and developing its training services in this direction.

7 ANNEX

This annex contains a detailed description of some of the trainings mentioned in this report. Based on this description, others (training institutions, VET centres, companies, etc.) can develop their own trainings, adapted to their own situation.

7.1 Bulgaria

TRAINING REQUIREMENTS FOR PUBLIC PROCUREMENT PROJECTS

Introduction

The Bulgarian team has chosen to describe the assessment strategy applied during a pilot case in the city of Gabrovo (Bulgaria), in which EnEffect together with the Municipality of Gabrovo developed and implemented a model for public procurement for building renovation requiring on-site training of the contractor's team. The reason and idea for the initiative are provoked by the lack of ambition by the government to introduce specific requirements in the national legislation to apply green public procurement and by a missing coherent framework for upskilling construction specialists in energy-efficient building methods in the national qualification system.

Detailed below are the chosen method for the introduction of training activities on energy efficiency measures for construction specialists, the organization and administration of the course, and results from the training, as well as plans for exploitation and future expectations.

Approach

The contracting entity, in this case Municipality of Gabrovo, seeks to ensure quality construction works for a planned renovation of a public building. The project foresees complete retrofit and improved energy performance of the building envelope and systems, which requires specific knowledge in the installation of materials and components. By entering a clause in a separate section to the technical specification for construction and installation contracts, the municipality binds the bidding contractor to compulsory training on energy efficient specifics. It consists of a 2-day training programme delivered by an expert consultant on the expenses of the procurer, together with a set of obligations for the contractor to carry out the construction works with the workers who have undergone the training. By doing this, public procurement officers are not only able to guarantee quality construction, but they also provide a service by training and upskilling construction workers and setting a trend on the market for energy sustainable trainings and practices.

These specific requirements and clauses have been developed in line with EU policies to promote socially responsible and sustainable public procurement.

The training course

- Participants

As it has been outlined in the contract, the construction workers who were sent out to receive the necessary training in the Building Knowledge Hub in Sofia (set during the Train-to-nZEB project) were the ones who would be working on the building envelope. The chosen dates for the course were arranged in advance and before the commencement of construction work. A total of 5 builders and 2 technical assistants attended the course. They all have had practice with the installation of insulation systems and windows during renovation works, however, with little to no experience with advanced techniques on airtightness and/or alternative, innovative

solutions to the prevention of thermal bridging and applying insulation on the inside of external walls.

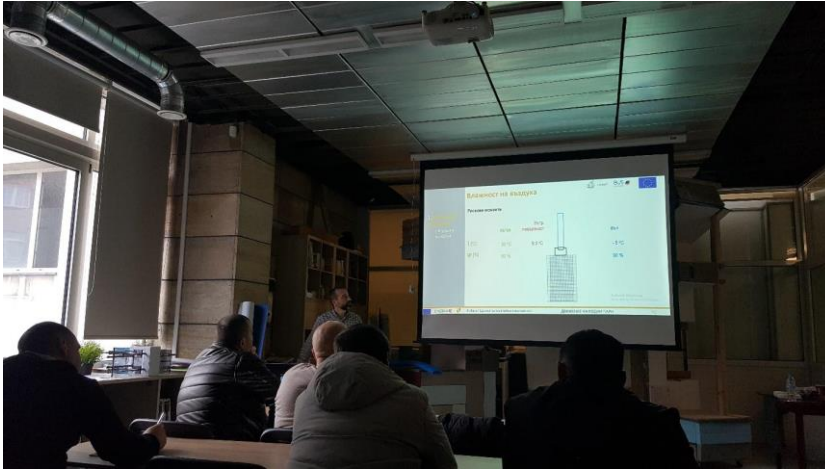


Figure A1a & A1b - Photos from the two-day training of construction specialists at the beginning of January 2023

- Training provider

EnEffect was the chosen training institution for the given case, with consideration of the extensive and rich experience in the development of course materials on Passive House and nZEB buildings, and respectively organization and collaboration with various construction stakeholders for increasing knowledge and capacity on energy-efficient buildings and renovation techniques across the construction value- chain in Bulgaria. The chosen trainers were specifically selected, because of their professional background, training experience and proven knowledge of practical solutions on the building site in relation to the application of energy efficient measures during renovation and deep retrofit projects.

- Materials (practical + theoretical)

The teaching materials for the 2-day intensive course were carefully selected, with regard to the planned construction works, specifics of the building site and profile of the construction specialists. The training course began with a theoretical explanation of Passive House and nZEB concepts, with a concrete focus on a highly efficient building envelope as part of achieving desired energy efficiency parameters during renovation. An official distributor of passive house products and materials presented the latest solutions to airtightness and vapour retention with a display

of proper installation and guidelines for systems' application. The training was accompanied by another product distributor, this time working with window and glazing systems with high energy performance and a rich portfolio of product and construction solutions.

- Results

The Building Knowledge Hub in Sofia is equipped with demonstration models (Described in D4.3) of building sections, representing nZEB construction principles. They were used to describe the taught content of the course and to show in practice the application of airtightness and vapour control membranes on wooden frame models. There were proactive discussions where the builders shared personal experiences and impressions, compared to the solutions offered by the training course. This led to a better understanding of both sides of recurring issues on building sites and common problems encountered during retrofit projects.

- Assessment

The trainees in this course had shown interest in the presented topics and concepts and had displayed an understanding of the newly gained knowledge in isolating an external wall from the inside. The construction workers were asked to demonstrate their understanding of the techniques necessary to properly select and apply vapour control layers in relation to other components of an external wall, by installing a product on a wall model.

They were additionally able to answer oral questions related to different cases of exchanging windows, applying insulation on the outside, types of materials used in practice and others. All of this formed an overall impression of the success of the course and the potential for improvements.



Figure A2 Photo from the assessment part of the training course

Evaluation

The new approach to public procurement is a way to provide quality training to construction specialists across Bulgaria. It is one of the tested strategies described in D4.5 of the BUSLeague project. Efforts will be put towards developing a consistent way of assessing the newly acquired knowledge and skills, to guarantee that after a completed training the construction works will be done accordingly.

The conducted pilot course acts as a precedent in Bulgaria for public procurement and required training in the energy efficiency of construction specialists. Upcoming results from the reconstruction of the given project could serve as an example to promote furthermore the need for raising qualifications among construction specialists in energy efficient measures and to stimulate the demand for quality construction.

Exploitation and future expectations

The described approach to public procurement has shown to be a promising alternative to ensuring quality construction works on public building sites. As previously mentioned, there are no examples of applied Green Public Procurement in Bulgaria. Since public procurement law is subject to national legislation, it is often tied to strict rules in defining and selecting contractors. Additionally, adapting national legislation requires a long and thorough process of reformation, which without necessary political will, may take a long time before it comes into action. Therefore, the offered procurement form with a clause to train contracted companies in the application of energy-efficient measures is an alternative to a burdensome national reform.

Due to the nature of their work, conducted mainly with civil finances, public administration is in a position to require high performance for the buildings they operate in, so they in return can provide high-quality services to the citizens. In that sense, public procurement can and should be demanded when public buildings are being renovated that this is done to the latest standards.

Future steps are to promote the pilot case and the results from the construction project via networks of municipalities across Bulgaria. The expectation is that eventually more and more public procurement offices would be able to recognize and successfully develop and apply appropriate requirements for the fulfilment of energy efficient renovations of public buildings. In parallel, alternative models to training courses should be collaborated and tested (planned strategies described in this report), to explore efficient methods of transferring knowledge and skills to construction specialists.

7.2 Spain

CERTIFICATION SCHEME FOR WINDOW REPLACEMENT

Introduction

This section aims to describe the actions carried out in order to establish the conditions and requirements that make up and regulate the operation of the Certification Scheme for the category of "Expert in the replacement of conventional windows for the installation of windows with thermal break according to standard UNE 85219:2016", the conclusions of the pilot test and the proposal of future actions for its definitive implementation.

The scheme has been promoted by the Valencian Building Institute, Instituto Valenciano de la Edificación (IVE) through the European BUSLEAGUE Project, funded by the European Union under the Horizon 2020 Programme.

A working group consisting of the following entities/persons was formed for the creation of the scheme:

- Valencian Federation of Construction Businesses, Federación Valenciana de Empresarios de la Construcción (FEVEC)
- Valencian Building Institute, Instituto Valenciano de la Edificación (IVE).
- Masuno Soluciones S.L.
- Eugenio Corbatón Lacueva.

Works carried out

The following actions were carried out:

1. Selection and definition of the certification scheme to be developed.
2. Creation and implementation in FEVEC of a certification system based on the UNE-EN ISO/IEC 17024 **General requirements for bodies carrying out certification of persons.**
3. Development of the Expert **Certification Scheme model for the replacement of conventional windows for the installation of windows with thermal bridge break according to standard une 85219:2016.**
4. Theoretical and practical development of the first pilot test for the evaluation of the scheme. Acquisition of materials for the practical test.
5. Implementation and promotion of the first pilot evaluation test of the certification scheme. Recruitment and enrolment of students.
6. Performance of the test. Evaluation and award of diplomas.
7. Conclusions and adjustments to the certification scheme.
8. Information and/or awareness-raising campaign aimed at professionals in the sector (construction companies and their workers) on the importance of having skills, knowledge or competences in energy efficiency and their public recognition. So far, this campaign has already reached 200 companies that receive FEVEC's information circulars, and more than 750 followers of FEVEC's social networks (Twitter, LinkedIn, Facebook and Instagram). Future actions have been planned (conferences, workshops and meetings) to disseminate the results obtained, so the reach will increase substantially.

Work phase

Reception control:

- Examine the goods to confirm that the windows and glass are in good condition and that the goods coincide with those established in the original documentation.
- Visual control of the goods, control of the documentation (CE marking) and control by means of quality marks (if any).
- The window has a Declaration of Performance, CE marking label and instructions for use and maintenance (use, assembly, installation, conservation and safety warnings and precautions).
- The unloading of material and storage is carried out with the necessary precautions to avoid damage to the material.
- The units are identified to facilitate the reception of the material.

Entrance to the construction site

- The documentation of the construction site, the workers and the licences are in order.
- All the minimum health and safety provisions to be applied on site, both at the general and workstation level, are known and taken into account.
- All the guidelines established in the Health and Safety Plan for the site are followed.

Storage

- Storage is in a vertical position, with a clean, dry and smooth standing surface.
- The windows are protected from sun and rain.
- No more than five windows are supported in a row and pieces of non-abrasive material are used between the individual stacked units.

Workplaces

- The workplace is in optimal conditions for use without health and safety risks.
- The workspace has the appropriate constructive characteristics, is clean and tidy and has the appropriate environmental and safety conditions for working.

Interaction with other actors

- The necessary means of coordination have been established to avoid interference with the different works.
- The appropriate safety measures and rules have been established to avoid harm to persons not involved in the work.

Window installation

Installation methods

- At any point along the perimeter, between the frame and the pre-frame, the total clearance is between 5 mm and 15 mm.
- Shims of different thicknesses are used to adjust the perimeter gaps as much as possible.
- Fixing elements are used that do not deform or uneven the window.
- The fastening screws used to go through the frame to avoid deformation of the profiles. The screws are threaded into expanding dowels suitable for the type of wall to which the window is fixed.
- The minimum number of anchors for each perimeter section is two.
- The maximum distance to corners or T-junctions must not exceed 200 mm.
- The maximum distance between anchorages must be 600 mm. If the existing frame is used, its condition is adequate, and it maintains the characteristics required for the pre-fence.
- In the case of using pre-fence, the fixing is done using mechanical fastenings, it is placed plumb, level and squared.
- Placement of braces, braces or beams to prevent deformation of the pre-fence during handling, transport and placement of the pre-fence on site.
- In the event of a difference in materials between the frame and the window, compatibility between the two materials is ensured.
- The difference in length between the two diagonals (D) must not exceed the following values: $D \leq 2$ m: maximum difference of 3 mm $2 < D \leq 3$ m: maximum difference of 5

mm $3 < D \leq 5$ m: maximum difference of 8 mm $D > 5$ m: maximum difference of 12 mm.

Sealing

- The water tightness and insulation of the connection joint between the joinery and the building work is guaranteed with the use of three levels of sealing (exterior, intermediate and interior).
- The sealants used are CE marked in accordance with the harmonised standards UNE-EN 15651-1 for façade elements and UNE-EN 15651-2 for glazing sealants.
- For the selection of the self-expanding tapes, the width of the window frame, the size of the compressed tape and the size of the tape after decompression were taken into account.
- To avoid condensation on the inside of the seal, sealants with different water vapour transmissions have been used for the inside and outside seal (the one on the inside has a lower water vapour transmission than the one on the outside).
- In the case of expansive sealing tapes, they are of class BGI and water tightness $P > 600$ Pa according to DIN 18542.
- If polyurethane foam is used, it is of controlled expansion.

Window glazing

- There is no direct contact between the glazing, as well as glass-to-glass, glass-to-concrete and glass-to-metal contacts.
- UV-sensitive components are protected against direct and indirect sunlight (according to UNE EN 1279-1).
- The edges shall not be modified to avoid contact with elements of the joinery. "Biting into the edge of the glass or any of its corners will cause subsequent breakage. Edges and corners must be continuous and free of nicks.
- Before installing the shims and glazing, clean the rebate, removing any shavings, sealants, or glass splinters and check that no element could damage the edge of the glazing.
- Support shims: the minimum distance between the corner of the frame and the nearest edge of the shim is equal to the length of a support shim and not less than 50 mm.
- Perimeter shims: the minimum distance between the corner of the frame and the nearest edge of the shim shall be the length of a positioning shim and not less than 50 mm, to prevent excessive stresses on the corners of the glass.
- Lateral shims: the maximum distance between the centre of two successive shims is 200 mm. The spacers shall be fitted in pairs, opposite each other, except where the glazing method allows them to be used on one side only.

Copings

- A waterproof flashing should be chosen to avoid the need for waterproofing.
- It is placed with a minimum slope of 10° , and expansion joints are provided on both sides to avoid expansion problems.
- In the case of embedding the flashing laterally in the brickwork, joints are also placed on the sides.
- A joint is left between the flashing and the window frame to avoid thermal bridging.
- The joinery is joined to the flashing to allow water to flow outwards.

- Both the side joints and the overlap between the window frame and the flashing are sealed with flexible material.

Fittings

The fittings are adjusted and checked for correct operation.

Shutter boxes and slats

- The connection between the window and the box has been made to ensure that the whole unit works together (mechanical connection).
- The appropriate anchoring elements for the roller shutter have been used and it has been checked that the screws do not invade the interior winding space of the box.
- In the case of the installation of a box with a central end panel, the box is to be fixed directly to the building site.
- In the case of motorised blinds, the electrical connection of the motor is carried out by qualified personnel, verifying that the installation has an earth connection, respecting electrical safety regulations at all times.
- In the case of roller shutter panels with high-security slats, the slat plugs are screwed on the side following the manufacturer's instructions.

Roof windows

- The sealing frame is used in accordance with the roofing material, window type and composition.
- The roof window (frame, sash and glazing) and the sealing frame are received on-site.
- An insulating pre-frame was pre-installed to match the size of the roof window.

Domotics

- The manufacturer's installation instructions for home automation, motorisation and digitalisation systems have been followed.
- The appropriate levels of system controls have been established.

On-site tests

- Acceptance criteria for water tightness according to the procedure of the UNE 85247 standard.
- Verification of airborne sound insulation of façades in accordance with the UNE-EN ISO 16283-3 standard.
- Verification of the installation using thermography and watertightness tests.

Waste

The waste generated has been separated at the source, and the disposal of each type of waste has been controlled at the appropriate points.

Risk prevention

- Safety of the workspace, materials and equipment used.
- Conditioning and signposting of the workspace.
- Order and cleanliness of the work site.
- Appropriate selection of PPE (Personal Protective Equipment).

Evaluation

The evaluation process will consist of two parts: a theoretical and a practical one.

Theoretical part

- There will be a theoretical exam consisting of a ten-question multiple-choice test.
- The duration of the exam is thirty minutes.
- Each question will have three answer options, of which only one will be valid. Questions answered incorrectly or left blank will not be marked.
- To pass the test, you must have answered at least 5 questions correctly.

Practical part

- A mock installation of a window with thermal break will be carried out, after removal of the conventional window.
- The candidate will be presented with several conditions during the assessment that he/she will have to solve. These conditions will be related to the type of window to be removed, the most convenient method to use for its removal, the measurement of the opening for the order to the carpentry company for its manufacture, the necessary materials, the existence or not of a pre-frame, the plumbing and levelling, the margins, the tolerances, the forms of fixing, the interior finishes, the interior finishes, the placement of the flashing, the joints, the order and cleanliness, the prevention of occupational hazards, etc.
- The duration of the test will be approximately two hours.

The design of the practical test and the development of the theoretical questions shall be the responsibility of the assessor selected for each particular examination session.

The theoretical test shall be worth 30% of the examination marks and the practical test shall be worth 70%

Period of validity - Renewal of certification

Renewal of the certificate shall not be requested and therefore has no expiry date.

Criteria for suspension or withdrawal of certification

If the withdrawal or suspension of the certificate is recommended, this shall be done in accordance with the procedures of the FEVEC management system.

Changes to the scope or level of the certification/revisions

Revisions to the scheme may be made, based on the development of:

- New applicable legislation.
- New window materials or certifications.
- Improved application techniques on site.

These revisions may lead to variations in the scope of the certificate, and it may be the case that an aptitude test referring exclusively to these variations may be necessary for those professionals who already have the certificate. In this case, FEVEC will design a specific test for the relevant changes between the scheme and its revision, convening an assessment test if necessary and

communicating it as far as possible to the certified professionals and publicly on its website www.construccion2030.es.

Evaluator requirements

The personnel in charge of the evaluation of the scheme shall meet at least one of the following requirements:

- Graduate in Technical Architecture or higher with professional or teaching experience in the assembly of external joinery with thermal bridge break.
- First class bricklayer for 5 years (with company certificate in the assembly of external joinery with thermal bridge break).
- Window fitter with thermal break for 5 years (with company certificate in the installation of external joinery with thermal break).

The evaluating staff may be a unique person with sufficient theoretical and practical experience or may be composed of several evaluators, with the practical part being covered by one of them and the theoretical part by another. In this case, it must be determined who is in charge of the evaluation team.

Results of the pilot evaluation test

Participants

A total of 15 participants took part in the pilot test, all of whom were men. The selection of participants was made according to the requirements set out in the Certification Scheme. Four of the participants are unemployed and the rest work as bricklayers, metal carpenters or fitters. Only one of the participants has a higher education, being a Technical Architect. The age range of the participants was between 34 and 58 years old.

Place and date of testing

The tests were held at the FEVEC facilities located at Street Arzobispo Fabián y Fuero, 1, Valencia. The tests were held from 21 March to 7 April 2022, with the first shift at 16.00 hours and the second at 18.30 hours. The evaluator was Eugenio Corbatón Lacueva. The curriculum of the evaluator is attached.

Evaluation

Each test consisted of two parts: theoretical and practical. The total duration of the tests was 2.5 hours per student. The theoretical part was 30% of the total mark and the practical part was 70%. All participants started the test with the practical part and finished it with the theoretical part.

Practical part

Practical simulation of the replacement of conventional carpentry and the correct installation of carpentry with thermal bridge break, developing all the steps to be followed for the correct development of the activity, safely and efficiently.

The aspects of the objective assessment of the practical test were:

- Identification of the different window elements. Appropriate naming and positioning of PPE and compliance with safety regulations.

- Occupational Risk Prevention, signalling and protection of the area affected by the activity of removal and replacement of carpentry with thermal bridge break.
- Recognise the standardised geometric parameters or those established by specific technical regulations, to be respected when taking data from the opening for the measurement of the carpentry.
- Carrying out the handling and transport of loads and the shaping of stockpiles, lifting loads manually, and applying procedures to prevent injuries due to overexertion. Stockpiling materials and equipment complying with the requested requirements of location, layout, maximum size and configuration of stockpiles.
- Correct setting out and correct positioning of sights, canvases, levelling, plumbing, etc.
- Correct temporary fixing for the subsequent fixing of the carpentry.
- Correct choice of fixing system for this type of thermally broken joinery.
- Correct protection of the carpentry so that the foam does not impregnate the carpentry and the correct application of polyurethane foam.
- Correct application using the corresponding mechanical fixing of the joinery to the facing, and correct removal of the excess foam overflow.
- Correct preparation of the external and internal joints of the carpentry with the walls, including the installation of ceramic guttering.

Theoretical part

Test of ten questions related to the correct execution of the activity of removing conventional carpentry and subsequent installation of carpentry with thermal bridge break in compliance with the regulations.

Maximum score: 10

Minimum required: 5

The final result of the assessment is PASS/FAIL.

Evaluation results

Of the 15 students who took part, only 4 obtained a pass result. The marks given as a pass result were, from lowest to highest: 5.05; 5.24; 5.87; 6.5. As can be seen, these are very low scores (out of 10), which provide information on the degree of experience and knowledge of the candidates, most of whom are specialised workers in the sector.

Conclusions

The pilot test was aimed at adjusting both the scheme and its management process, in order to complete it and finally carry out a series of validations described below. Furthermore, the pilot test aimed to draw conclusions on the suitability of this type of certification, its possible implementation in the future and its economic, technical and practical feasibility.

Adjustments and validation

I. Validation of FEVEC's management system based on the UNE-EN ISO/IEC 17024 people certification standard.

During the process, the methodologies developed in the various procedures of the management system were monitored. Some small adjustments were made to the definition of roles and responsibilities.

It is concluded that the management system is complete, the management system is VALIDATED.

2. Validation of the FEVEC Person Certification System. Determination of test times and costs. During the pilot test, the methodology indicated in the developed Certification Scheme was applied. It was possible to determine the time needed to carry out the test. In this sense, it was possible to verify the need for the assessment tests to be individual, both practical and theoretical, which implies a high number of assessment hours, as 2.5 hours per student are needed, and students cannot overlap.

- The practical test using a simulation of the installation of the window was found to be adequate and could be used to test the skill and knowledge of the professional as required.
- The need for the theoretical test as an indispensable part of the assessment was confirmed.
- The costs of carrying out the test were calculated and estimated as follows:

CONCEPT	COST (VAT NOT INCLUDED)
Materials	553,00 €
Evaluator	2.227,00 €
Promotion – dissemination of the test	300,00€
Installations	0 €
Indirect costs of FEVEC	1.500,00€
TOTAL	4.580,00 €

After minor modifications and final costs, **the certification scheme is VALIDATED.**

Technical and economic viability and conclusions.

The main conclusions drawn from the pilot tests are:

- **Economic viability:** due to the costs necessary to carry out the test, it would have an individual cost per student of **305,33 €**. We consider that this is not a high cost for accreditation of this level so that economic viability is guaranteed.
- **Technical viability:** the pilot test has served to prove that it is possible to carry out a test of these characteristics, with the means and facilities available. The test carried out ratifies the suitability of having the certification scheme developed, as it has been shown that this type of window is not installed in the same way as conventional windows and, if they are not installed correctly, it makes no sense for a customer to invest in the purchase of windows with thermal breaks to improve energy efficiency in their home, as the energy efficiency for which they were designed is not achieved. However, during the development of the test, several factors have been identified which should be addressed for the Scheme to be truly useful and for candidates to pass the test. The factors identified are set out below.
- **Lack of knowledge about the accreditation of competences through experience:** although a campaign has been carried out to obtain an expert certificate through the accreditation of experience and it has been explained individually to each of the interested parties, there is a fairly generalised lack of knowledge about the accreditation of competences through experience. It would be necessary to promote

this type of accreditation using information campaigns so that the concept is known in society.

- **Lack of preparation (knowledge) of the workers:** while the tests were being carried out, it was the participants themselves who realised their lack of preparation and lack of skills to install this type of window.
- **Lack of experience:** Thermal break windows have not been on the market long enough for professionals to be able to demonstrate sufficient experience in their installation.
- **Need for training:** Most participants requested training for this type of installation. This training is not currently available to professionals.

Planning

Once the management system for the accreditation of people has been created, the specific Scheme that has been worked on and the pilot test has been successfully carried out, a planning of activities is proposed to give continuity to the project and guarantee its viability.

Promotion of the Scheme

The promotion of the Scheme developed is and will continue to be aimed at:

- Metal enclosure installers.
- Manufacturers of metal enclosures.
- Construction and masonry companies.
- Professional associations.
- Students of the construction sector (training entities).

The following actions have been carried out for the promotion until June 2022:

- In March, a campaign to attract participants was carried out. The following activities were carried out for this purpose:
- Two e-mails were sent (a few days apart) to more than 500 recipients each time: FEVEC members, window installation companies, professional associations, companies not associated with FEVEC, etc. (See model e-mail in APPENDIX III).
- Also in March, the information poster was uploaded on the FEVEC website www.construccion2030.es (See the publication of the website in Annex III). The FEVEC website has more than 100 visits per month.
- It was published on FEVEC's social networks (Facebook, Twitter and LinkedIn) reaching more than 750 followers (see publications in Annex III).
- Once the tests were completed, two press releases were issued in May 2022. One by the Generalitat Valenciana and the other by FEVEC. (See both in Annex III). These press releases were published in electronic media: www.elperiodic.com; www.20minutos.es (the GVA press release) and www.lasprovincias.es www.interdiario.es www.valencia.elperiodicodeaqui.com (the FEVEC press release). They were also published on FEVEC's website, sent by mailing to more than 200 contacts and posted on Twitter, Facebook and LinkedIn (see publications in Annex III).

Future actions are planned:

- Presentation of the Scheme. The conferences will be face-to-face, with the possibility of streaming.

- Creation of a brochure presenting the Scheme, indicating the need for it, the advantages and the methodology for obtaining accreditation.
- Dissemination mailing addressed to companies, sending the informative leaflet.
- Promotion of the accreditations awarded, through the creation of a public database on the portal www.construccion2030.es so that companies can select professionals with the accreditation.
- Dissemination on social networks.
- Meetings with training centres to promote training in this area, aimed at passing the Scheme test.
- Article in CNC magazine, promotion on social networks and website.

Exploitation of the Scheme

The second step is to ensure the cost-effectiveness of the accreditation process. To this end, it is proposed to carry out 2 annual assessments, one per semester.

The cost of taking the test will be 330 Euros, including evaluation and emission of the certificate. To take the evaluation test, the full amount must have been paid in advance.

To ensure the viability of the whole management system of accreditation of persons, the creation of new accreditation schemes is necessary. It is proposed to create one new scheme per year, mainly related to sustainability and energy efficiency. Once FEVEC has at least three operational accreditation schemes available to professionals, it will apply to ENAC for accreditation.

Coordination with institutions and social agents.

The success of the accreditation of competences by experience depends to a large extent on the promotion of this type of accreditation. To this end, collaboration with a series of institutions and social agents is envisaged. Some of them are listed below:

- Regional Government of Education, Culture and Sport.
- Regional Government of Housing, Public Works and Territorial Planning.
- Regional Government of Agriculture, Environment, Climate Change and Rural Development.
- IVE Valencian Institute of Building.
- AIDIMME.
- Professional associations.
- IVACE.
- Avaesen.
- Energy Association of the Valencian Community.
- Trade unions.
- Business associations.

7.3 Ireland

To make clear what participants in the NZEB Training learn, are below per topic the learning outcomes outlined. These are the skills a trainee must have to do a proper job in working on the NZEB build environment.

NZEB PRINCIPLES

Understand the Principles relevant to NZEB, Building Regulations and Product Standards.

Learning Outcomes

- Explain why it is important to reduce the energy demand and consumption in buildings.
- Define the acronym 'NZEB'.
- Briefly outline the EPBD and EED drivers relevant to building regulations and NZEB.
- Explain the importance of energy efficiency combined with the need for the production and use of renewable energy.
- Define the timeframe deadlines that all new/existing dwellings to comply with the NZEB standard.
- Describe how the NZEB standard relates to existing buildings, extensions, changes of use and major renovations which affect more than 25% of the surface area of the building (deep retrofitting).
- Explain the importance of minimising heat loss through the building envelope.
- Describe the key renewable energy technologies most relevant to NZEB in Ireland.
- Explain the importance to building occupants in achieving adequate levels of ventilation, lighting and thermal comfort.
- Describe the key roles of adequate ventilation in meeting the fresh air needs of the occupants of the building, as well as preventing excessive levels of relative humidity and the associated risks of mould and condensation.
- Describe the key information presented in the acceptable construction details (ACDs), namely insulation placement, airtightness detailing and avoiding thermal bridging.

BUILDING PHYSICS

Understand Building Physics – Key energy terms and units

Learning Outcomes

- Describe the different means by which heat flow occurs in a building.
- Describe the terms “U-value” and “R-value”, including their units, and explain their practical relevance with regard to the energy efficiency of dwellings and achieving NZEB compliance.
- Describe the consequences of poorly insulated dwellings.
- Describe the potential adverse effects arising from penetrations in the building envelope considering both thermal and moisture movement.
- Explain the importance of minimising heat loss through the building envelope
- Outline the benefit of maximising heat gains in buildings through the windows whilst ensuring that buildings do not overheat.
- Describe key factors that affect occupant comfort in a building, including temperature, relative humidity, air speed and indoor air quality.

BUILDING FABRIC

Understand Building Fabric: Continuous Insulation, Thermal Bridging, Air Permeability and Windows and Doors.

CONTINUOUS INSULATION

Learning Outcomes

- Describe the importance of creating a continuously insulated thermal envelope to reduce heat loss through the building fabric.
- Describe the risks associated with poor workmanship relating to the continuity of the insulation layer by considering reducing the number and size of service penetrations.
- List those parts of the building envelope where special attention must be directed towards ensuring unbroken continuity of insulation.
- Identify and label the key insulation-related measures presented on the acceptable construction details (ACDs) for cavity walls and timber frames.
- Describe the most commonly used interventions to prevent or reduce thermal bridging.
- Identify thermal bridging in thermographic images.

THERMAL BRIDGING

Learning Outcomes

- Identify where thermal bridges are commonly found in dwellings.
- Explain why thermal bridging typically occurs at such locations.
- Describe the potential risks associated with poor workmanship relating to thermal bridging.
- Describe the potential adverse structural impacts to the building when thermal bridging occurs, with regard to the risk of mould and condensation.

AIR PERMEABILITY

Learning Outcomes

- Describe how the air permeability of a building influences heat loss.
- Describe the multiplicity of benefits that airtightness brings to dwellings.
- Describe the multiplicity of benefits that wind tightness brings to dwellings.
- List common leakage points in both masonry and timber frame construction types.
- Describe the key concept of “unbroken continuity” as it relates to the formation of an airtight building.
- State the maximum level of air permeability allowed in Part L of the Building Regulations for compliance with NZEB, including its units.
- State the level of air permeability below which mechanical ventilation is required.
- Describe the techniques and types of materials that are commonly used to create the airtight layer.
- Describe the most critical locations (including junctions) where meeting the airtightness targets presents the greatest challenge.
- Explain the importance of not reducing the effectiveness of the installed airtightness and vapour control layer through removal or damage.
- Describe the risks associated with poor workmanship relating to air tightness.

- Describe the importance of the sequence of tasks that should be followed in an airtightness strategy to ensure that the most optimal result is obtained.
- Describe the benefit of completing an early initial airtightness test.
- Explain the importance of providing adequate ventilation to a dwelling with increased levels of air tightness.

WINDOWS & DOORS

Learning Outcomes

- Describe the energy efficiency and comfort-related function of windows, highlighting their role in relation to thermal protection, solar gains and ventilation.
- Describe the importance of connecting the windows and doors to the insulation layer and the airtight layer.

BUILDING SERVICES

Understand Building Services: Space Heating and Domestic Hot Water, Controlled Ventilation, Lighting ICT and Smart Technology.

SPACE HEATING & DOMESTIC HOT WATER

Learning Outcomes

- Explain in outline why space heating and domestic hot water provision is typically one of the highest sources of carbon emissions from a dwelling.
- Explain in outline why all hot water storage vessels, pipes and ducts associated with the provision of heating and hot water should be fully insulated.

CONTROLLED VENTILATION

Learning Outcomes

- Describe in outline the differences between natural/background/combined/ mechanical ventilation.
- Explain why the importance of controlled ventilation increases with decreasing air permeability.
- Describe the different kinds of controlled ventilation systems that can be used for different types of dwellings (continuous, intermittent, whole-house individual room, with and without heat recovery, demand-controlled and others).
- Explain the importance of having a ventilation system designed, installed, balanced and commissioned by competent installers.
- Explain the importance of regularly changing the filters on an MVHR system.

LIGHTING, ICT & SMART TECHNOLOGY

Learning Outcomes

- Explain in outline why lighting constitutes significant regulated electrical loads in dwellings.
- Describe the energy labelling used for light bulbs and appliances.

RENEWABLE ENERGY, PHOTO-VOLTAICS, SMART METERING & ELECTRIC VEHICLES

- Understand Renewable Energy, Photo-Voltaics, Smart Metering and Electric Vehicles.

Learning Outcomes

- Define the minimum level of energy provision required from renewable energy technologies to comply with NZEB requirements.
- Describe in outline “renewable energy technologies” and cite examples of the different types of technology that qualify as providing renewable energy.

COMMUNICATION & USER INFORMATION

Understand communication and user information.

Learning Outcomes

- Explain the importance of ensuring good communication between all trades on the site as part of an overall ‘system-thinking’ approach to achieve NZEB-compliant dwellings. In particular, communication with those trades which regularly make penetrations through the airtight and insulation layers (including electricians and plumbers) is especially critical.
- Apply collaborative teamwork and “system thinking” on-site with all trades.
- List key aspects that require excellent communication on-site, especially the strategies being used for airtightness, vapour control, continuous insulation and thermal bridging to achieve NZEB-compliant dwellings.
- Outline the key sequences that must be followed to meet the airtightness targets and communicate these to the site/supervisor and all relevant trades.
- Understand the details specified in construction drawings concerning thermal bridging, air tightness and window positioning and how not to reduce their effectiveness.
- Describe what information needs to be provided to the homeowner to ensure that the building is operated and maintained to its optimum, including special emphasis on energy efficiency.
- Explain the importance of continuing professional development CPD, (continuous training) and association with relevant national quality assurance standards.
- Understand where CPD and future accredited training can be obtained in relation to the NZEB standards.

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