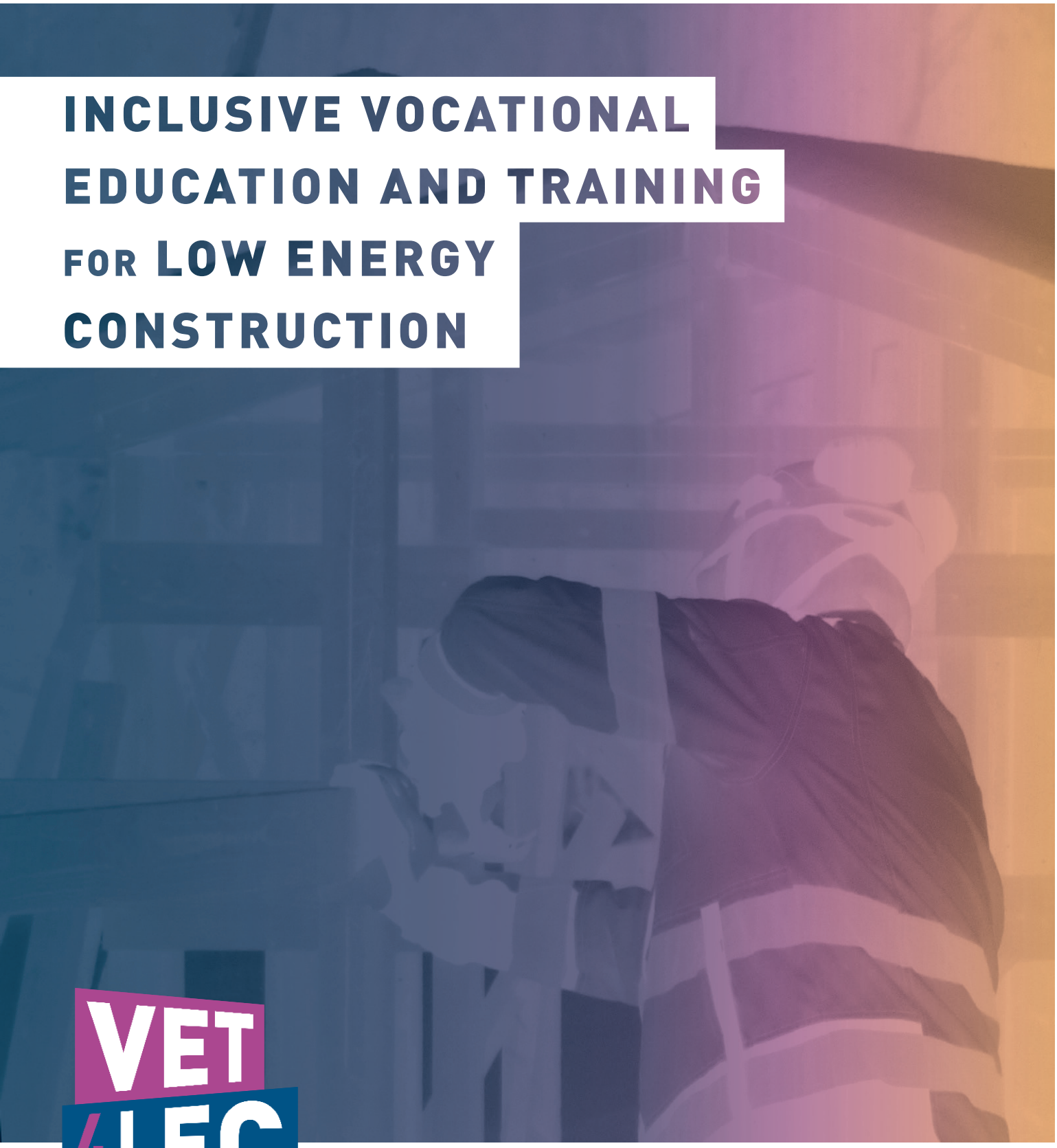

# INCLUSIVE VOCATIONAL EDUCATION AND TRAINING FOR LOW ENERGY CONSTRUCTION

VET 4LEC

COUNTRY SUMMARIES
FEBRUARY 2019

European Federation
of Building
and Woodworkers

**COUNTRY SUMMARIES** were prepared by the research team
based on the national reports produced by the partner organisation in each country.


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DESIGN: Beryl Natalie Janssen
COVER PHOTO: Carpentry trainee at Vantaa Vocational College/Finland

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# INCLUSIVE VOCATIONAL EDUCATION AND TRAINING FOR LOW ENERGY CONSTRUCTION

COUNTRY SUMMARIES
FEBRUARY 2019

# BELGIUM

## Construction Industry[1]

The gross value added (GVA) by the construction industry is around 5%, which remained stable between 2012 and 2016). In 2016, there were a total of 24,331 companies.

- o Small (<20): 93%
- o Medium (20-99): 6%
- o Large (>100): 1%

Between 2012 and 2016, the number of construction employers decreased by about 8% (26,564 in 2012). The drop was 8.6% in NSSO 24, 7.4% in NSSO 26, 14.5% in NSSO 44, and 7.1% in NSSO 54. Looking at the drop in the number of companies by size, it appears that small and medium size firms are more likely to have closed in the economic downturn; while the number of small (<20) and medium size (20-99) firms declined by over 8%, the number of large firms dropped by only 1.8%.

## Construction workforce[2]

In 2016, the total number of construction workers in the four NSSO activity categories was 251,360. This included the following groups of workers:

- o FTE regular workers (blue collar): 117,475
- o FTE employees (white collar): 39,364
- o Temporary workers: 3481
- o Self-employed: 62,000
- o Posted workers: 29,040

Between 2012 and 2016, the total level of employment appears to have remained stable, but there has been fluctuation in some types of employment. In the last four years, the number of temporary workers and posted workers more than doubled. At the same time, there was a small drop in the number of full time equivalent (FTE) blue collar workers (down from 118,343). There has also been a slight increase in the number of FTE white collar workers from 31,660. The number of self-employed also increased slightly, from 58,667. The characteristics of the workforce are:

- *Migrant workers* (2016): Among blue-collar workers, over 85% are of Belgian nationality and the remaining 15% are from other European nationalities.
- *Age* (2016): Among blue collar workers, three quarters are between the ages of 25 and 54 and 12% are over the age of 55. This is an ageing workforce with few young people entering the sector; only 12.7% are aged 15-24.
- *Training levels of regular blue-collar workers:* This description of construction workers' education levels uses the collective labour agreement (CLA) classification of salary levels, which are based on workers' professional aptitudes (p.11). It is estimated that:
  - o 16% of workers are unskilled ( salary levels I, IA)
  - o 24% hold a construction diploma from full-time education (salary levels II, IIA)
  - o 25% have expert knowledge with a minimum of three years experience (Salary III)
  - o 37% are considered to have superior professional competence (Salary level IV).

1 The overview of the construction sector presented in this section is based on data about four categories of NSSO (Belgian National Social Security Office Index):
24 – construction of buildings, road construction, levelling work, dredging
26 – painting, installations, joinery, business and rental
44 – floor coverings, plasterers
54 – roofing, pointing

2 "Information in this section refers to workers who are included in the DMFA declarations in JC 124, with the worker codes 015, 027 and 035, without any selection on the basis of the service codes, therefore, including long-term illness.
015: workers and apprentices in this category starting from the year of their 19th birthday
027: apprentices, workers and interns in the normal category
035: apprentices and equivalent – manual workers up to 31 December of the year of their 18th birthday (e.g. apprentices from the middle-income bracket, industrial apprenticeship contract, interns)" (From footnote on p. 3 of report)

## Vocational Education and Training (VET) system

The social partners govern VET and the state's role is limited to the development of education policy with advice from expert third parties, coordinated by the Department of Education and Training. Funding is through a combination of state funds and employer contributions. Initial VET (IVET) is a hybrid of college based and dual systems, with responsibility assigned in construction to Constructiv, a joint body formed by trade union and employer representatives, supported by technical and regional advisory groups, in which representatives of the sector and of training providers participate. Constructiv leads the development of occupational profiles used to draw up educational profiles and indicate the underpinning knowledge required for each training path. Educational programmes and curricula are drawn up by schools and training organisations who are responsible for ensuring that learning objectives are met through the training delivered. Regional steering groups in Flanders, Brussels and Wallonia are responsible for implementing sectoral frameworks and play a role in the development of courses. The key characteristic of the system is the involvement of all stakeholders: employer organisations, trade unions, training providers, regional authorities, and other experts. Pathways to obtain a qualification in construction include: Vocational Secondary Education, Technical Secondary Education, Day Release Training, Special Secondary Education (for students with special needs) and adult education. 40% of participants follow the Vocational and Technical Secondary Education paths.

*CONTINUING VET:* Further training, or training for adults, tends to be organised by employers and employer organisations. Since the 1990s, *Constructiv* has also been involved in further training and training for job seekers and career changers.

## Belgian Build Up Skills – LEC training needs

In relation to the development of VET for low energy construction (LEC), the national Status Quo Analysis (SQA) noted that: low levels of formal training and qualification among the workforce, including the low levels of general education among young entrants and the high staff turnover rates, present a challenge. Without employer support, for many workers, participating in CVET for LEC would be too expensive and not fit into work schedules. Although there are several courses in energy efficiency (EE) and renewable energy sources (RES) for different construction occupations, in Flemish and French, delivered across all regions and in varying modes of study, awareness of and participation in these are very low. In 2011, less than five per cent of all VET participation was LEC related. The Roadmap recommended improving knowledge and awareness of LEC, reorienting VET to better integrate EE and RES, redefining occupational competence profiles, expanding practical training, catering for workers with different levels of existing training and developing systems to accredit worker qualifications in LEC related areas.

## VET for LEC development

The development of VET for low energy construction (LEC), in keeping with the broad occupational training approach to IVET, has been within mainstream IVET, rather than through revising the occupational structure of the sector. As opposed to creating new occupations based on specific competences, the strategy is to introduce and integrate LEC knowledge and competences into existing occupational profiles, between which there are also considerable overlaps. The social partnership model means that all stakeholders, including employer organisations, trade unions, education experts and training organisations, have been involved in this revision of occupational profiles, led by *Constructiv*. Occupational profiles are used as guidelines for the development of curricula, which are developed by colleges and training organisations. The content of LEC training is likely to be uniform across the country though the range of courses available may vary between the regions. Profiles can be very detailed, with clear indications of where LEC specific elements in the qualification occur. A premium is placed on workers' independence and responsibility through detailed specification of *savoir être* (attitude, similar to German *Fähigkeiten*) competences, for instance in the *couvreur-étancheur* or roofer profile, thus assuming a high degree of independence on the part of the construction worker. Construction continuing VET (CVET) tends to be organised by employers and employer organisations and is more fragmented.

## Initiatives related to VET for LEC

*Stepping-stone construction jobs* is a government led initiative to encourage the integration of young people into the labour market and increase their recruitment into construction. Young people are considered to be an 'at risk' group and employers are required to invest 0.1% of their total salary outlay on the integration of such groups. The sectors can themselves determine 'at risk' groups, provided that they spend 0.025 per cent of their investment on young people under 26

BELGIUM – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | In official document |
| RESIDENTIAL/ NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | ✔ |
| APARTMENT BLOCKS | ✔ |
| OFFICES | ✔ |
| EDUCATIONAL BUILDINGS | - |
| HOSPITALS | - |
| HOTELS/RESTAURANTS | - |
| SPORT FACILITIES | - |
| WHOLESALE AND RETAIL | - |
| BUILDING TYPOLOGY | New/retrofit |
| BUILDING CLASS | Private/public |
| BALANCE | - |
| PHYSICAL BOUNDARY | Single building |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ✖ |
| CENTRAL SERVICES | ✖ |
| ELECTRIC VEHICLES | - |
| EMBODIED ENERGY | ✖ |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | ✔ |
| CREDITING | - |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

years of age. Sectors can benefit from extra resources if they double their contributions. Specific sectors can also determine the 'at risk' groups in a collective labour agreement (CLA). Stepping-stone construction jobs (*ETC - Emploi Tremplin Construction*) is a result of the CLA on the 'Sustainable integration, reintegration and vocational training of at risk groups' (25 June 2015). The CLA of 10 March 2016 explains what an ETC means and what conditions it must satisfy: a young person with less than one year's experience is taken on by a firm that provides mentoring and training suited to the young person's needs. After six months, the company carries out a performance interview. The scheme is funded by employer contributions and firms receive practical and financial support in drawing up the training plan, its organisation and administration. *Constructiv* provides sector-based support in delivering the training and a bonus of 1,000 Euros if a company meets these conditions.

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), NZEB definitions have been included in an official document in Belgium's three regions.

In their definitions, Belgium's three regions define NZEB for both residential and non-residential buildings and includes three specific subcategories: single family houses, apartment blocks, and offices (ibid: 16: Table 4).
In terms of building typology, classification, balance type, and physical boundary, Belgium's three regions refer to new buildings and renovations, private and public buildings, and single buildings respectively (ibid: 17-18: Figure 3).
The three definitions include four types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; and lighting. In addition, plug loads, appliances, IT, and central services may be possible to add in Belgium Flemish Region though the latter are not considered in Belgium Walloon region (ibid: 18-19: Table 5).
With regard to the specification of generation boundaries in the definition, Belgian regions' definitions consider on-site, off-site, and external generation. In the Belgium Flemish Region, crediting is foreseen on law (ibid: 20-21: Table 6).

The numeric indicators of energy performance below, expressed as primary energy (kWh/m²/y) have been specified in the Belgian regions' definitions (EC, 2016a: 23-26, Table 7).

BELGIUM – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| 45 + max (0; 30- 7.5*C) + 15*max (0; 192/VEPR-1) kWh/m²/y (Brussels region) E 30 (Flemish region) Ew45 and Espec85 (equal to 85 kWhEP/m²/y)(Walloon region) | ~ 54 | 95-2.5*C Or (95- 2.5*C)+(1.2*(x15) kWh/m²/y (Brussels region) E 40 (Flemish region) Ew45 (Walloon region) | ~ 108 | Included energy use: Heating, DHW, appliances in Brussels and Walloon regions. Flemish and Walloon region: Maximum E defined as a percentage of a reference primary energy consumption |

BELGIUM – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| BE Brussels: From 1 January 2015, requirement on final/ primary energy demand close to Passive House standard (for housing, office, service buildings and schools) | BE Brussels: n/a | BE Brussels: The target is deeper defined in line with the Passivhaus requirements (e.g. net heating need below 15 kWh/m²/y). | BE Brussels: Requirement on final/ primary energy demand close to Passive House standard (for housing, office, service buildings and schools). | BE Brussels: n/a | BE Brussels: The target is deeper defined in line with the Passivhaus requirements (e.g. net heating need below 15 kWh/m²/y). |
| BE Flanders: Requirement on primary energy demand for new and non-residential buildings: 45 KWh/m²/y | BE Flanders: n/a | BE Flanders: For residential and office buildings and buildings for education, E-level requirements have to comply with E60 since 2014. U-values have to be tightened. Next tightening is in 2016 (E 50) as follows: residential buildings and office buildings of public organisations: E50. Office buildings and buildings for education: E55. | BE Flanders: As other new buildings 2015: K 40, E 60, U-values tightened. | BE Flanders: n/a | BE Flanders: NZEB U-value requirements are the 2016 requirements. E level is sharpen to E 50 in 2016. |
| BE Wallonia: All new buildings have to comply with a "very low energy standard" from 2014 onwards (Ew< 80 and, for residential buildings, Espec130 kWh/m²/y, K< 35). | BE Wallonia: n/a | BE Wallonia: Next tightening is in 2017 (E65 and, for residential buildings, Espec115). | BE Wallonia: As other new buildings | BE Wallonia: n/a | BE Wallonia: n/a |

## Intermediate energy targets

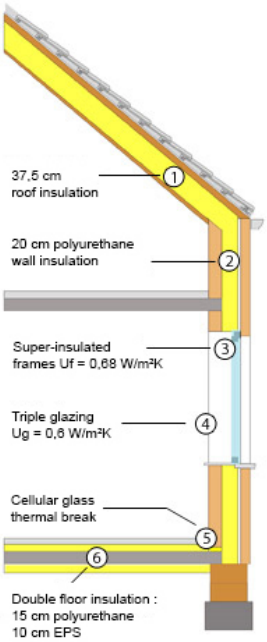
The three Belgian regions have set the intermediate targets above for all new buildings, and all new buildings occupied and owned by public authorities.

## Case study

The case study refers to a single-family residential new built in Auderghem, Brussels region. The following observations complement, and should be read in conjunction with, the information contained in the National Report.

Brussels Centre NZEB standard appears to be essentially Passivhaus (PH) with variations in the Flanders and Wallonia regions. It is not possible to assess NZEB Primary Energy (PE) due to the use of PHPP data (PH design software known as 'Passivhaus planning package' – PHPP) which includes appliances.

FIGURES – 'Max.isol K19 pack'





Sources: https://www.teamconstruct.be/en/maxisol-k19-pack and https://www.teamconstruct.be/en/passive-house

The Auderghem case study uses a package system variously described as 'Max.isol K19 pack' or 'Pack Max.isol K19'. The specification does not include renewables and is very similar to the Passivhaus design approach. The figures show 'Max.isol K19 pack' at 35 kWh/m²/y versus Passivhaus at 15 kWh/m²/y. The manufacturer claims this represents a reduction to 30% of Belgian 2010 building regulations. Note also, the 'Max.isol K19 pack' K19 value (35 kWh/m²/y) is below the 2015 qualitative target of K40 established for the Flanders region.

The Building Regulations for Flanders and Wallonia refer to various measures including an 'E' standard between 50 and 60, a K ratio of 40, a Be ratio of 450 and 'k values' for building elements such as walls:

- E-level is the Energy Performance expressed as the fraction of primary energy consumption (for heating, hot water production, auxiliary equipment and cooling, plus lighting in the case of offices, from which the production from the cogeneration and solar panels, if any, is subtracted), by an expression including the area of the building envelope with thermal losses, the volume, the ventilation rate and, in the case of offices, the usable floor area and a variable for lighting (http://www.buildup.eu/sites/default/files/content/CA3-National-2012-Belgium-Brussels-ei.pdf).
- The K ratio concerns the total level of thermal insulation calculated on the basis of a technical standard established by the Belgian Institute for Standardisation (IBN). It takes into account mainly the insulation of the various shells but neither solar heat, occupant behaviour or the efficiency of heating. The lower the K factor the better the total insulation of a dwelling.
- The Be ratio concerns the calculation of the net needs for energy for heating, which means taking into account the free inputs of solar heat. The calculation of the Be ratio is published in the "Arrêtés" of the Walloon Government of 15 February 1996, "Moniteur belge" of 30 April 1996 and 9 May 1996.
- A "k value" designates a heat loss coefficient of a wall system of a building. It allows the calculation of the specific heat loss of a wall while the K65 or K55 (note the capital K) is the heat loss value of a whole building (https://www.iea.org/policiesandmeasures/pams/belgium/name-21669-en.php).

Control units, EFB VET College workshop, Brussels

Mock-up of roofing insulation: CDR Training Centre, Brussels

## VET for LEC visit to Belgium: Summary Report

The visit to Belgium took place on 4-5 December 2017, involving interviews at:

- EFP vocational training college, Brussels
- CDR training centre, *Centres de Référence* in the Brussels-Capital Region
- Belgian Construction Confederation
- *Constructiv*, the Belgian paritarian construction organisation

## VET for LEC

Occupational profiles are drawn up through consultation between union, employer and educational representatives. With low energy construction (LEC), the *chapiste* (concrete layer/screeder) needs to know much more about what others are doing and the appropriate mix of cement for ground source heating. For *étancher des parois* (wall waterproofing) the abilities to close thermal bridges, achieve air tightness, and effectively communicate are necessary, whilst drilling operatives need to know the operational environment (e.g. not damaging insulation or creating thermal bridges, using insulation materials such as foil and being aware of damp screens). Occupational overlapping is well-established for hybrid unclassified occupations like the roofer/installer of photo-voltaic panels, though electricians belonging to a different sector, are just as likely as a roofer to install solar panels. Insulation does not have a particular profile though the *étancheur* (insulator) is envisaged to concern insulation and industrial heating vents etc. Constructiv considers that the *coffreur* (shutterer), *plafonneur* (partitioner), *maçon and electrician* are suitable to further adaptation to meet LEC and renovation needs. Given that most construction occupations are broad-based and encompass overlaps with other occupations, the general principle holds that existing occupational classifications should remain but boundaries can shift as necessary without the need for new LEC occupations.

*Constructiv* has a legal obligation to build LEC houses and ensure that professional competence profiles are drawn up but has no control over actual qualifications. It creates the occupational standards to be followed up in the vocational training colleges, so that industry indirectly says what should be included. Performance standards have to be complied with (e.g. for damp screens) and are made available by SFMQ *(Service Francophone des Métiers et des Qualifications)*, which translates professional profiles into the qualification profiles used by the colleges to devise curricula. All profiles are organised according to *savoir faire* (know-how), *savoir* (know-that) and attitudes. The state has no involvement, though innovation is ultimately driven by compliance requirements.

## Training Colleges and Centres

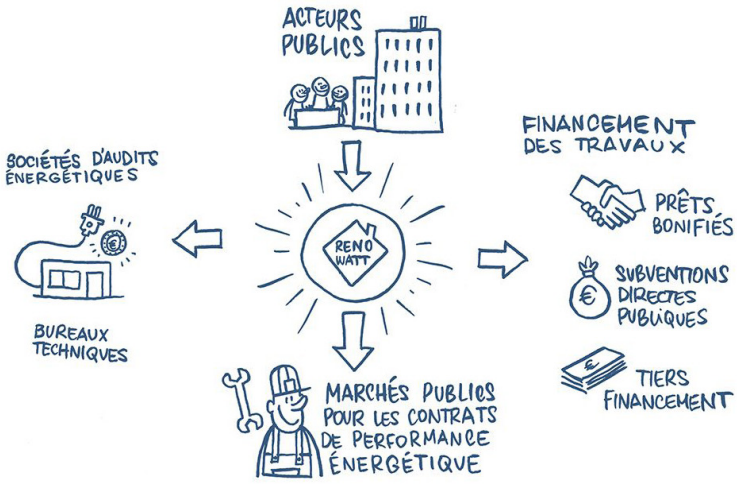
Construction was well represented in the vocational training college visited, which encompassed 70 occupations *(métiers)* and associated workshops and classrooms for more theoretical work. The college is funded by the region and community. Levy money goes to *Constructiv*, whose role is to promote training, and only part finances training. Only 1% of school leavers choose construction and training varies between two and five years. College construction students spend 3 days per week in the company (e.g. on site) and 2 in college. Vocational trainers are entitled to six and a

half days training per year and have a personal responsibility to ensure their own professional updating.

The Centres de Référence in the Brussels-Capital Region, built with government support on a partnership between employment and training providers and employer representatives, work to improve training opportunities to better meet employer needs and to get the inhabitants of Brussels into work by providing complementary training or a chance to retrain and learn new skills. The one visited was co-founded seven years ago and is concerned mainly with greater sustainability and safer construction, running courses on safety, insulation, airtightness, working at heights, and waterproofing. The centre is responsible for green construction training of 3-9 months duration for the workless, with trainers trained in insulation and airtightness.

## Labour market issues

The workforce ten years ago was 160,000, but is now 140,000, with a decline in direct employment and a rise in self-employment (now 60,000) and the use of posted workers (30,000). The union has had a campaign to recruit posted workers, for instance from Poland. Though a Belgian construction worker is paid about €30-35 per hour, posted workers' pay can be as low as €12-13. Union membership is over 90% and the unions are concerned with promoting the economic and employment benefits of LEC and renovation, life cycle analysis (grey energy) and recycling. However, their core role is to negotiate conditions of work. Collective agreements for skilled labour are mandatory and wage levels are tied to them and to relevant qualifications. Workers are employed for 40 hours a week, and social benefits are good. The *Construbadge* and the *Bouwbadge* are forms of social ID for the construction sector, though a licence to practise only applies to self-employed.




Renowatt activity chart

Large French, Dutch and Danish contractors with their management in Belgium all belong to the Belgian Construction Confederation (BCC) as do small enterprises, of which the membership is 40,000 to 50,000. The self-employed can still be considered an employer and there is a special association for the self-employed. The BCC is involved in training at all levels, including responsibility for the self-employed (non-unionised) sector of the industry. BCC supports a dual system of VET but there is a general decline in apprenticeships. BCC is not keen on the creation of new occupations for energy efficiency, although recognising the need for some, for instance cladding and external insulation. Employers have programmes to encourage women but these are more successful at the 'white collar' end of the construction industry.

## NZEB

NZEB definitions differ in different regions and, whilst there is little problem for new build, this is not the case with renovation; no basic standards are applied to deep retrofit. In general, there is a shortage of enterprises able or willing to carry out LEC work. An incentive scheme called ESCO (energy service company) exists where an owner pays for a deep retrofit through rent to the builder. Since 2011, EPC certification, stipulating the energy class and annual $CO_2$ emissions, is required if an apartment or a house is sold or rented. Building regulations are one route to enforce new standards and introduce LEC training and the way forward is to raise the bar. BCC argues that buildings older than 20 years should reach the standard of new build, as in electrical installation. There is no discussion concerning the carbon intensity of materials, though wood is gaining in popularity and has many advantages, for instance for prefabrication. 90% of building materials are recycled. There is a non-mandatory but costly LEC quality framework in Flanders; the Brussels regional authority also has a subsidy per square metre for Exemplary Buildings high in energy efficiency.

There are various initiatives, including Renowatt, a pilot project of energy renovation of public buildings in the province of Liège supported by the EU. It has involved: fiveEnergy Performance Contracts for the renovation and the performance maintenance of 136 buildings, particularly insulation, with savings of 34% of energy consumption guaranteed; 322 direct jobs and 780 indirect jobs; 16,450 hours of training and/or use of social economy enterprises; and 12 public authorities.

# BULGARIA

## Construction Industry

The construction industry contributes about 5% to the GDP (2015). Its output was 3 million EUR in 2016, a drop from 4.5 million in 2015. A similar decrease was observed in engineering construction. Following the recession of 2008, output had started increasing again in 2013, but this drop suggests that the economy has still not stabilised. Overall unemployment has also dropped from over 10% in 2014 to under 7% in 2016. The size of the *black economy* is estimated to be around 7-10%. The construction sector[1] (2017) is dominated by small firms. In total, there are 4,862 firms, and 87% employ under 50 workers, 11% has up to 250 employees and a tiny percentage (72 in total) are large firms with over 250 employees. At 5%, self-employment is very low.

## Construction workforce[2]

There are 216,400 (2016) construction workers in Bulgaria. The construction workforce makes up 7% of the entire labour force. There is a growing shortage of qualified workers and Bulgarian workers tend to emigrate. Generally, pay is low and, as construction is not seen as an attractive career, it is difficult to attract young people. Women make up about 7% of the construction workforce, decreasing from 10% in 2014. This contrasts sharply with the representation of women in the entire labour force (46%).

## Vocational Education and Training (VET) system

Bulgaria operates a centralised, school-based IVET system, although legislation passed in 2014 allows for the setting up of Dual System routes. The Minister of Education, Youth and Science coordinates national policy on VET. Sports and Culture Ministries are in charge of VET schools in their respective fields. The Framework Programmes provide the regulatory framework, determining age and entry level, content and duration of training, and setting out the State Educational Standards (SERs) for each training programme. SERs specify the entry requirements, learning objectives and outcomes, theoretical and practical training content, and required competences for qualifications including the activities, responsibilities and personal qualities of the profession. The curriculum includes a schedule of training, distribution of subjects, classes for general education and for compulsory vocational training. Vocational Training Colleges develop curricula, evaluated by the National Agency for VET (NAVET) and approved annually by the Ministry of Education, Youth and Science.

Since 2015, the responsibilities of local and regional authorities have increased. Social partners have a role in VET at several levels, participating in the economic and social council, as well as other national councils to help shape VET policy. Employers are actively involved in designing and updating SERs, a process coordinated by NAVET. Representatives from employer organisations and trade unions are members of examination boards set up by VET providers (CEDEFOP, 2018). With the 2016 amendments to the VET Act, employer organisations are becoming more actively involved in implementing VET and can propose changes to the list of VET qualifications.

*IVET* is mainly school based and the main IVET providers are VET secondary schools, art schools, sports schools, VET colleges and other licensed private and public continuing vocational training centres. The majority of VET providers are state owned, funded by the municipalities and the relevant state agencies. Vocational colleges and training centres, regulated by NAVET, need a licence to operate. The law specifies six types of initial and continuing VET, differentiated

1 Company information for specific NACE activity areas is not available.

2 No data available on migrant workers, the age profile or the qualification levels of the workforce. BUS SQA estimated that about one third had no qualifications and majority operate without any formal training. The 2015 Annual Report of the Bulgarian Construction Federation notes an ageing workforce, lack of interest in construction from young people.

by age and level of entry and duration. Young people can enrol from age 13. Vocational secondary schools provide training at EQF levels 2 and 3. VET programmes for school-age learners result in both a general education certificate and a VET qualification (EQF Level 3). VET programmes by training centres and colleges do not include a general education part. By law, practical learning comprises a substantial part of vocational studies (50-70 %), conducted for the most part in workshops rather than through work placements. However, the introduction of dual VET since 2014 has the aim of increasing periods of learning based in the workplace. IVET refers only to programmes leading to a first qualification at EQF Level 2; EQF Level 3 and higher are described as continuing VET. Since 2016/17, it is also possible to enter VET at the second stage of secondary education, aged 16. With the implementation of the Bulgarian qualifications framework, this system of validation will become operational. In accordance with the European credit system for VET (ECVET), all VET qualifications at Levels 2-5 are learning outcomes based, though the credit system has not been fully developed.

*CVET*: The main providers of further training are vocational schools, vocational colleges and vocational training centres. CVET programmes are available to those completing their secondary education. In addition, ministries, municipalities, employer and employee organisations and individual employers provide training for their employees. CVET provision can therefore be more informal. Other training by ministries and municipalities may target the unemployed and be part of a labour market programme. Since 2015, procedures and quality assurance criteria have been in place to facilitate the validation of informal learning in VET.

## Bulgarian Build Up Skills – LEC training needs

The Build Up Skills (BUS) status quo analysis estimated that only around one third of construction workers have qualifications and large numbers work without much formal training, a significant barrier to further training in low energy construction. It also highlighted that young people are not attracted to construction as a career and the number of trainees is decreasing. Despite recent improvements in the availability of training opportunities particularly by manufacturers of EE and RES related products, the number of workers trained in LEC related specialisms is low. Shortage of LEC trained workers is coupled with a severe shortage of trainers who do not have access to training themselves. The existing vocational training schools lack sufficient funding, facilities and equipment. There is a general lack of awareness and interest in LEC. The Roadmap recommended that: the VET system and curricula are completely overhauled, upgraded and better resourced to develop the training capacity needed; the training of teachers is prioritised with opportunities for requalification; a dual system of VET with a more substantial practical element is developed; and systems for monitoring and certifying training needs, worker qualifications and quality standards in low energy construction are established.

## VET for LEC development

The introduction of LEC training into national IVET was triggered by the Build Up Skills investigation. As part of the BUS Pillar II project EnerPro, a review of SERs for the professions relevant to the implementation of measures for energy efficiency and use of renewable energy in buildings was conducted. On the basis of the findings, the National Agency for VET (NAVET), also a partner in BUS EnerPro, developed recommendations to change the learning content of SERs for seven training programmes to introduce EE and RES. These recommendations are expected to be approved and formalised in 2017-18, once qualifications are updated and published by the Minister of Education, Youth and Science. The updating of training content and qualification requirements is taking longer than usual as the new VET Act of 2016 requires that all qualifications are re-written in terms of units of learning outcomes. NAVET also informed all Vocational Training Centres (licensed by the Ministry) to update and improve their training plans and programmes to include the newly developed modules in EE and RES in the two relevant professional directions:

- Electrical Engineering and Energy Sector (Electrician, Power Installer, Installer of energy equipment and systems)
- Construction (Builder Technician including civil engineering, architecture, hydro engineering, Builder, Building Assembler)

VET schools, which provide training in 'Architecture/ Construction' and 'Electrical/ Engineering Studies' professional pathways, teach these courses as part of IVET. The training programmes take 4-5 years to complete, lead to EQF 3 or 4 and are offered nation-wide in 22 Bulgarian districts (out of 27). The new programmes are expected to include about nine hours of training related to energy efficiency over the course term. The coverage of LEC knowledge and competences is specific to the specialisation in question. For example, Building Assembler training specialises in door and window frames and glazing and covers insulation of different types of joinery and glazing including PVC windows and doors.

CVET programmes for LEC are dependent on market demand, and shortages have been identified in, for example, heating and air-con systems. According to

the national report, three EQF Level 3 LEC related courses are offered by three VET centres in the two largest cities, Sofia and Varna, at the time of writing: 'Insulations in construction', 'External coating and plastering' and 'Joinery and glazing'. Other further training courses have been developed as part of EnerPro, for trainers and other building professionals. Initially designed as a comprehensive course, due to lack of demand the structure of the course changed to provide short modules that can be taken individually.

As outlined above, Bulgaria's participation in Train-to-NZEB and Fit-to-NZEB, both EU projects, will contribute to building training capacity in low energy construction both in new build and renovations.

## Initiatives related to VET for LEC

Bulgaria has taken part in several European projects since 2011, starting with *Build Up Skills* Pillar I (BUS), which culminated in the production of a Status Quo Analysis and the Roadmap (2011-2013), all co-ordinated by EnEffect, the Centre for Energy Efficiency based in Sofia.

- *EnerPro* (2014-16) was developed as part of BUS Pillar II and included: a 5-day 'train the future trainer of trainers' course in Dublin, conducted by MosArt/ Passive House Academy; two training programmes and an online training module for trainers, developed by the Passive House Institute, Germany; 10 new curricula; short forms of training (40-60 hours), together with all necessary supporting materials; and 29 courses delivered by the project co-ordinator, Centre for Energy Efficiency EnEffect, in different schools and locations. The project developed regional trainer capacity and trained more than 300 construction specialists[3].
- *Train-to-NZEB* (2015-2018) was funded under Horizon 2020 and created a network of training centres (Building Knowledge Hubs – BKHs) in four countries including one in Bulgaria, extending the target group of trainees to non-specialists such as journalists, decision makers, real estate agents. BKHs, in addition to providing training, will be used to demonstrate and exhibit innovative NZEB technologies and materials and promote the advantages of LEC. Partner countries include Bulgaria, Czech Republic, Germany, Ireland, Romania, Turkey and Ukraine. The advisers are Passive House Institute, Darmstadt and Passive House Academy, Dublin[4].
- *Fit-to-NZEB* (2017-2020), funded under Horizon 2020, aims to build on Train-to-NZEB and to introduce educational content on deep energy

3 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-enerpro

4 http://www.train-to-nzeb.com

BULGARIA – NZEB definition

| OFFICIAL STATUS | To be approved |
|---|---|
| RESIDENTIAL/ NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | ✔ |
| APARTMENT BLOCKS | ✔ |
| OFFICES | ✔ |
| EDUCATIONAL BUILDINGS | ✔ |
| HOSPITALS | ✔ |
| HOTELS/RESTAURANTS | ✔ |
| SPORT FACILITIES | ✔ |
| WHOLESALE AND RETAIL | ✔ |
| BUILDING TYPOLOGY | New/retrofit |
| BUILDING CLASS | Private/public |
| BALANCE | - |
| PHYSICAL BOUNDARY | Building unit |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ✔ |
| CENTRAL SERVICES | ✔ |
| ELECTRIC VEHICLES | ✖ |
| EMBODIED ENERGY | ✖ |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | ✔ |
| CREDITING | ✖ |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

BULGARIA – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| ~30-50 | ~40-60 | ~30-50 | ~40-60 | Buildings need to comply with class A. The definitive definition still to be approved. |

BULGARIA – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| ZEVI set a 2015 target of at least 15% of the total amount of heat and cooling energy needed must be produced from renewable sources. The National NZEB Plan will be actualized to set NZEB intermediate targets. | n/a | It is foreseen to revise the national legislation, including building codes, in order to define NZEB requirements (BG161PO001/5-01/2008/076 "Analyses, studies and actualization of legal acts" project). | As other new buildings | 2015 estimated NZEB target: 1÷1.5% share of the total floor area of new buildings occupied by central and local government | As other new buildings |

renovation of buildings in the curricula at all levels of the system of VET in South Eastern Europe, including in universities, professional high schools, vocational colleges and training centres. Partner countries are Bulgaria, the Czech Republic, Romania, Italy, Croatia, Ireland, Austria and Greece[5].

In addition, the construction sector trade union FCIW PODKREPA has developed a training programme for the unemployed, delivered through its Vocational Training Centres, which have been running for 2 years. In the *'Training in Park Construction and Landscaping'* course, 750 people have taken part over the last two years, of whom 60 per cent were women and 15 per cent under 35 years old. Forty per cent of successful candidates are guaranteed a job with a real employer for a minimum of 3 months. In the *'Construction Assistant – Basic and Finishing Works'* course, 264 people participated over two years, of whom 30 per cent were women and 15 per cent were under 35 years old.

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Bulgaria's NZEB definition is yet to be approved.

In its applied definition, Bulgaria defines NZEB for both residential and non-residential buildings and includes eight specific subcategories: single family houses, apartment blocks, offices, educational buildings, hospitals, hotels and restaurants, sport facilities, and wholesale and retail (ibid: 16: Table 4). In terms of building typology, classification, balance type, and physical boundary, Bulgaria refers to new buildings and renovations, private and public buildings, (does not specify), and building unit respectively (ibid: 17-18: Figure 3). Bulgaria's definition includes six types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; lighting; plug loads, appliances, and IT; and central services (ibid: 18-19: Table 5). With regard to the specification of generation boundaries in the definition, Bulgaria's definition considers on-site, off-site, and external generation. Crediting has not been considered (ibid: 20-21: Table 6).

The numeric indicators of energy performance above, expressed as primary energy (kWh/m²/y) have been specified in Bulgaria's definition (EC, 2016a: 23-26, Table 7).

## Intermediate targets

Bulgaria has set the intermediate targets above for all new buildings, and all new buildings occupied and owned by public authorities.

5 http://www.fit-to-nzeb.com

## Case studies

The case studies refer to two retrofits: Military social housing 'MAY' in Sofia and Multifamily residential building in Silistra. The following observations complement, and should be read in conjunction with, the information contained in the National Report.

The two retrofits 'meet all the requirements for energy saving and heat preservation in accordance with the requirements of Ordinance No. 7 of 2004' (Partner Report, page 10). Little technical information is provided regarding MAY, where no information is available for pre or post fabric changes (insulation and windows) apart from the boiler replacement new dual-fuel De Dietrich boiler with a potential efficiency increase of from 50-60 to 80-90%.

Case study 2 was retrofitted following the introduction of the National Programme for Energy Efficiency of Multi-Family Residential Buildings. The retrofitted envelope has new insulation ranging from 50 to 120mm at a 'k' or 'λ' value (thermal conductivity) ranging from 0.044 to 0.036 W/mK, thus a significant reduction in fabric heat loss. Since the pre and post retrofitted overall 'U values' (thermal transmittance coefficient) for structural elements are not given, energy savings cannot be calculated. However if, for example, we assume 1986 solid concrete wall panels of 150mm (15 cm) with 50mm (5 cm) insulation, the retrofitted addition of 120mm of insulation provides a U value percentage reduction of about 46%. No information is given for window replacement, or for any new heating systems although feedback from occupants reports that: "the living comfort is much higher and the heating costs have been reduced by at least 50%".

It is not possible to determine the extent to which Ordinance 7 or the National Programme for Energy Efficiency reflects the Bulgarian NZEB standard for cost optimal retrofit, partly because the Partner Report does not provide primary energy classification as defined in 'Implementation of the EPBD in Bulgaria December 2015' (https://www.epbd-ca.eu/outcomes/2011-2015/CA3-2016-National-BULGARIA-web.pdf).

CASE STUDY 1: Military social housing 'MAY' (Sofia) – Before and after renovation

CASE STUDY 2: Multifamily residential building (Silistra) – Before and after renovation

## VET for LEC visit to Bulgaria: Summary Report

The visit to Bulgaria took place on 13-14 December 2017 and involved interviews with:

- Podkrepa, the Confederation of Labour, representing 62 unions including the Construction, Industry and Water Supply Federation
- Bulgarian Construction Chamber
- EnEffect Training Centre at the University of Sofia
- The contractor and owners of a retrofitting project in Mazdra

## VET for LEC

VET for LEC in Bulgaria is at an early stage of development. A CVET type training programme in LEC was developed as part of the Build Up skills (BUS) project, and delivered by EnEffect, an NGO actively engaged with the EU energy efficiency agenda and representing Bulgaria in a number of EU funded projects. The BUS training programme was open to blue collar workers but mainly targeted construction professionals and trainers/teachers. EnEffect also collaborates with the Passive House Institute and facilitates its training course for designers. Prior to the BUS investigation, energy efficiency was not included in any IVET programme and there was very limited CVET type training, usually provided by manufacturers of relevant products. There are many private providers and some offer short courses in RES installations. The BUS investigation had an impact, albeit limited, on the national VET system: the IVET curriculum for the Construction and Architecture High School Diploma has been revised to include 9-11 hours of teaching in energy efficiency topics, though the precise details of this addition have not yet been developed.

Barriers to delivering effective LEC training include: the theoretical nature of existing initial VET; lack of work placements; lack of funding to set up training facilities, particularly in RES installations; and difficulties in engaging a workforce with low levels of general education in further training. A dual system is being introduced but the process is slow. Interest in VET for LEC is low, including among construction professionals, as evident from enrolment on the BUS training project despite the course offered being very affordable; the long course developed was as a result redesigned as standalone modules to attract more trainees.

## NZEB implementation

Interviews with the Bulgarian Construction Chamber (BCC) and the trade union Podkrepa similarly highlighted the generally low levels of LEC awareness among policy makers and the general public. Whilst some energy efficiency measures, such as external insulation, have become more widespread and a recently completed project funded by the EU supported more extensive retrofitting of apartment blocks, market demand for LEC remains low. Although the NZEB legislation has been transposed with some policy instruments in place to stimulate activity, implementation remains limited. The union representative interviewed emphasised the role of building materials in improving energy efficiency and the contribution of renewable energy sources to meeting emission reduction targets. He suggested that the dependence on coal-generated energy created a dilemma for the government and for the union in fully embracing the transition to renewable energy because of the job losses entailed. A green transition in energy production would have to be accompanied by training and alternative employment programmes; though a major retrofitting programme would create jobs, this would need sustained government investment.

The union is involved in the NZEB implementation process at the policy level and in an advisory capacity. Since 2013, it has sole responsibility for the Centre for Traditional Training set up in 2004 initially in collaboration with the Employers Chamber, though there are no plans at present to integrate low energy topics into its programmes. Only 20% of the workforce is unionised and the union faces challenges in recruiting from a mobile workforce, in a sector characterised by small firms and unregistered employment.

## Labour market challenges

The BCC noted the lack of skilled workers, the poor standards of work in the construction sector and the large grey economy. Migration of Bulgarian workers, attracted by higher wages in other European countries, was mentioned as a major issue by the trade union Podkrepa. Labour shortages are at such high levels that Bulgaria is considering importing construction workers from other countries, such as Moldova, Ukraine and Vietnam, though this presents its own challenges as these workers would need to be issued with a white card allowing them to work anywhere in Europe. Podkrepa suggested that, without a revision to European wage policies, migratory flows from Eastern Europe would be difficult to control.

## Low energy building example

The building scheme visited, a block of six apartments refurbished as part of the EU funded 2-year scheme administered by the municipal government, was one of several in the same town. The scheme began with an energy audit to establish the gains to be made post-refurbishment and to make specific recommendations and was managed by a consortium, including an architectural firm, an engineering firm, and a building contractor. The application for the subsidy was described as complicated and bureaucratic and off putting to many homeowners. The energy efficiency measures implemented included external rendering, replacement of single glaze windows with double-glazing, and repairs and insulation to the roof; the source of energy remained gas. The energy efficiency standard of the building improved from E to C and it was expected that energy bills would be reduced by around 40%. The project manager had received training in external insulation ten years earlier in Sofia and his company had completed other similar renovations. Other workers were also said to have had experience of working on similar projects and acquired skills on the job.

Retrofitting project in Mazdra

## Conclusions

The development of VET for LEC in Bulgaria has received an impetus from participation in EU initiatives such as Build Up Skills and a subsequent Horizon 2020 project, prompting a revision of the existing IVET, including a review of curriculum, the gradual introduction of a dual system of VET, and the introduction of a national qualifications framework modelled after EQF. However, the VET for LEC development process remains dependent on a dedicated but small specialist organisation and on EU initiatives. This is underscored by the fact that NZEB implementation is not high on the political agenda and national funds are very limited. A construction labour market with high external migration, unregistered employment and large numbers of workers with no formal training adds to the challenges of equipping the workforce with the necessary LEC knowledge, skills and competences.

# FINLAND

## Construction Industry

The construction industry produces 5.9% of the GDP, with 80% from building construction and 20% from civil engineering. Construction activity comprises building construction (45%, half renovation, half new building), specialised construction work (40%) and civil engineering (15%) (a quarter maintenance, two thirds investment). The *black economy* is estimated to equal 5.5-7.5% of GNP (10-14 billion Euros a year).

There are (2015) 41,616, companies in the broad construction sector (NACE F)[1]. The great majority are SMEs (99%) both in the 'building construction' and 'specialised construction activities' sub-sectors, and there are only 207 large companies. In 'civil engineering' the proportion of SMEs drops to 96.5%. There is no information on sole traders, but 18,693 companies in 'specialised construction activities' (84% of all companies in this sub-sector) have fewer than 5 employees. In terms of output, however, large enterprises' revenue is comparable to SMEs – 12.1 billion compared to 18.1 billion. In 'building construction', both types of enterprises make almost equal amounts of revenue. In 'civil engineering', large enterprises make 69% of the revenues, while in 'specialised construction activities', SMEs make 79% of the revenue and tend to work as sub-contractors.

## Construction workforce

In 2016, the Finnish construction sector employed 176,800 people[2]. The largest occupational groups are, in order of size, 'house builders', 'building caretakers' 'carpenters and joiners', 'building and related technicians' and 'plumbers and pipe fitters'. Most work full-time with only about 15% working part-time. Similarly, most have continuous type employment with about 7% (13,000) on temporary contracts. The characteristics of the workforce are:

- *Women* make up 7.9% of the construction workforce, and this has been stable over the last few years.
- *Migrants* constitute 25% of the workforce in the capital area, and 5% in the rest of Finland. 17%, or around 20,000, of the total construction workforce are foreign workers[3].
- *Age:* Most construction workers are between the ages of 25-54. The largest group is 25-34, and 15-24 is the smallest (under 20,000, 11%) group. Around 16% are over 55.
- *Qualification levels (2015):* General education levels are higher than many other European countries. In narrow construction activities, only 17.4% of workers hold qualifications below lower secondary level, and 19.6% participate in training and education.

## Vocational Education and Training (VET) system

The government is responsible for determining the objectives and structure of VET, which is nationally implemented. The Ministry of Education and Culture leads on its development and strategic direction. The ministry grants authorisation to provide VET, supporting and monitoring providers. VET providers are responsible for developing qualifications, deciding the size of their intake, language of instruction, locations and special needs. They are responsible for organising training in their areas, matching provision with labour market needs, devising curricula based on national qualification requirements. They also decide independently on the type of VET provided. A VET provider maybe a local authority, municipal training consortium, foundation or other registered association or state company. The Finnish National Board of Education draws up national qualifications in the context of broad cooperation with stakeholders; employers' organisations, trade unions, the Trade Union of Education and student unions. National qualification requirements are the basis for evaluating

1 The broad construction sector includes: construction, civil engineering and specialised construction companies.
2 This includes all those in infrastructure, real estate, building construction, construction product industry and related services.
3 'Foreign workers' refers to workers who don't have Finnish citizenship

learning outcomes. Representatives from enterprises also contribute to curricula development at the local level, organise and plan training and skills demonstrations and are part of regional committees. They also assess both skills demonstrations in upper secondary qualifications and competence tests in competence-based qualifications.

Finland operates a school-based IVET system. The workforce generally has a high level of education and nearly 20% participate in some form of VET. School-based VET is at the upper secondary level and can be entered after completing basic education (16+). This route involves at least six months work-based learning. Upper Secondary VET is accepted as equal to general upper secondary education and allows for transfer to higher education. Other routes are apprenticeships or competence-based qualifications. Apprenticeships include courses at vocational institutions with 70-80% of learning taking place at work. Most apprentices are adults.

*CVET:* Competence-based qualifications are usually completed by adults. There are around 300 further education courses that lead to specialist qualifications. All construction sector related vocational qualifications can also be earned with skills examinations.

## Finnish Build Up Skills – LEC training needs

The Finish Status Quo Analysis report that, despite the high levels of general education, large numbers of construction workers have no formal training. Not only is energy literacy lacking, but basic skills and knowledge need to be improved as the competence levels are not up to meeting the standards needed for energy efficient construction. Skills are found to be particularly lacking in managing the overall process of construction and coordination between occupations. In addition, training of trainers is inadequate, as are training materials – with incomplete or obsolete information and certain themes completely missing. The Roadmap recommended that LEC related knowledge and understanding, particularly in structural physics, thermal insulation, air tightness, moisture control, building technology, installation of heat pumps and air conditioning are developed and included in updated curricula and learning and teaching materials, alongside providing further training opportunities for teachers. It also identified the barriers to tackling the shortage of a LEC trained workforce: VET admissions are likely to drop as the population is declining; the workforce has no incentives to retrain; the number of migrant workers are increasing rapidly with implications for training provision and on-site management of differences in training and LEC related competences. Finally, it called for supporting measures to be introduced: the development and enforcement of quality criteria incorporating energy efficiency; increasing incentives for training; and improving communication on site and information provision to keep all stakeholders up-to-date with developments in LEC requirements.

## VET for LEC developments

Finland has a long tradition of building well-insulated houses and awareness of energy use in buildings is high. Teaching energy efficiency pre-dates the Build Up skills investigation and is addressed in IVET, which also covers understanding of material science and building physics in the three basic qualifications relating to construction. However, as outlined above, the BUS Status Quo Analysis found this training to be inadequate for operatives and recommended that existing training is upgraded. The need to update LEC training content was further underlined with changes in EU legislation and LEC requirements including the use of an E ratio to evaluate buildings. According to the VET for LEC National Report, low energy related topics are included in the 'Building Construction' and 'Building Services' pathways of mainstream IVET, but the content in the former is limited and provides only basic understanding of energy efficiency and environmental concerns. For the existing operative level workforce, the only CVET course available is a toolbox of training materials developed as part of BEEP, the Build Up Skills project, and intended to be suitable for those with mixed levels of training and qualifications. *Rateko,* the training arm of the Confederation of Finnish Industries runs a number of further training courses in energy efficiency. Many are accredited and successful participants are eligible to be included on the online registry of qualified experts. However, most of these target construction professionals and the content is of a high level with most specifying a degree level qualification as a pre-requisite.

## Initiatives related to VET for LEC

Finland participated in Build Up Skills Pillar II with the project BEEP, *Best Energy Efficient Construction and Training Practices (BEEP, 2013-2016)*, which aimed to increase the number of skilled construction workers on the basis of a practice-oriented approach, focusing on on-site training. A toolbox of publicly available training materials was prepared in different formats including PPT-slides, instruction cards, booklets and videos in five languages (Finnish, Swedish, English, Russian, Estonian) and distributed extensively through online downloads. Recommendations on practical energy efficient implementation on construction sites,

FINLAND – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | Under development |
| RESIDENTIAL/ NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | ✔ |
| APARTMENT BLOCKS | ✔ |
| OFFICES | ✔ |
| EDUCATIONAL BUILDINGS | ✔ |
| HOSPITALS | ✔ |
| HOTELS/RESTAURANTS | ✔ |
| SPORT FACILITIES | ✔ |
| WHOLESALE AND RETAIL | ✔ |
| BUILDING TYPOLOGY | New/retrofit |
| BUILDING CLASS | Private/public |
| BALANCE | - |
| PHYSICAL BOUNDARY | Building unit |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ✔ |
| CENTRAL SERVICES | ? |
| ELECTRIC VEHICLES | - |
| EMBODIED ENERGY | - |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | - |
| CREDITING | ✖ |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

using practical examples and relating to heat and moisture physics and building technology were presented through accessible materials. Hundreds of booklets were distributed and seven videos are available for use in workers' break rooms. It is estimated that over 48,000 workers have been exposed to these materials. In addition, 35 teachers were trained during a pilot teacher training scheme, 58 workers were trained as designated 'change agents' to support training on site, and a collaborative platform involving 240 stakeholders emerged .

*Build Upon (2015-2017):* Green Building Council (GBC) Finland participated in this Horizon 2020 funded project along with 12 Green Building Councils, under the coordination of GBC Spain and support from the World Green Building Council. The project sought to create a collaborative community, establishing innovative platforms for cross-sector partnership. Through 80 connected events, it aimed to help countries design and implement national renovation strategies.

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (2016), Finland's NZEB definition is currently under development.

In its applied definition, Finland defines NZEB for both residential and non-residential buildings and includes eight specific subcategories: single family houses, apartment blocks, offices, educational buildings, hospitals, hotels and restaurants, sport facilities, and wholesale and retail (JRC, 2016: 16: Table 4).

In terms of building typology, classification, balance type, and physical boundary, Finland refers to new buildings and renovations, private and public buildings, and building unit respectively (JRC, 2016: 17-18: Figure 3).

Finland's definition includes five types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; lighting; and plug loads, appliances, and IT; with central services possible to add (JRC, 2016: 18-19: Table 5).

With regard to the specification of generation boundaries in the definition, Finland's definition considers on-site and off-site generation. External generation has not been defined. Crediting has not been considered (JRC, 2016: 20-21: Table 6).

No numeric indicators of energy performance below, expressed as primary energy (kWh/m²/y) have been specified in Finland's definition (JRC, 2016: 23-26, Table 7).

FINLAND – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| n/a | n/a | n/a | n/a | |

FINLAND – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| n/a | A share of 15% NZEB single-family houses is expected by 2015. | The Ministry of the Environment will issue technical descriptions of NZEBs as recommendations. | New public buildings for public administration built after 2015 shall follow the "Passive House" standard. | n/a | New public buildings built after 2017 shall be NZEBs. |

## Intermediate targets

Finland has set the intermediate targets above for all new buildings, and all new buildings occupied and owned by public authorities.

The NZEB implementation plan (Finland National Report: page 7), suggests a definition by 2017: https://www.epbd-ca.eu/outcomes/2011-2015/CA3-2016-National-FINLAND-web.pdf. Correspondence with the Finnish partner (email received 16 February 2018 at 07:59) confirms compliance with the EPBD through: "cost optimal with the payback period of 20 -30 years" of improvement of energy performance of each building type, compared to existing level of performance (according to regulation 2012)":

> *As an alternative for apartment buildings and for other types of housing in general, we have in the regulation clause 33 "structural energy efficiency", in which the building is the NZEB building without any calculations [what is known as the] (simplified way), when: it is fulfilling the limit values for the U-values and the air tightness of the building envelope; it is having a mechanical (in/out) ventilation system with the required energy recovery level; and the heating energy of the building is coming from a district heating, ground heat pump or air-to-water heat pump system.*

## Case studies

Five case studies are supplied, two new build from circa 2011 (Järvenpää House and Kuopio House) and three retrofits (Innova, RenZero and ReBuilt). The following observations complement, and should be read in conjunction with, the information contained in the National Report. All appear to have significantly low or reduced u values and a high airtightness specification. There is no further detail in the reports that would allow a deeper analysis since there is no link to the NZEB definition or directly to Passivhaus certification. However, an internet search reveals limited further information on some of the case studies:

1. JÄRVENPÄÄ (2011) APARTMENT HOUSE
2124 m²

*[The] "measured air tightness of the building and it is the most airtight building in Finland. The airtightness values were in the range 0.18 – 0.35." (v3.3 p 17).*

More information is given at: https://www.rehva.eu/fileadmin/events/eventspdf/REHVA_Seminar_-_Zero_energy_buildings/Finnish_experiences_on_very_low_and_zero_energy_buildings.pdf

14 kW Photovoltaics
Solar thermal 126m²
Energy supplied to neighboring buildings
Solar shading by exterior shading structures, e.g., PV panels
Preliminary total cost estimate:
NZEB ~2900 €/m²

## Vet for LEC visit to Finland: Summary Report

The visit to Finland took place on 12-13 February 2018, and involved interviews at:

- Central Organisation of Finnish Trade Unions (SAK)
- Rakennusliitto, the construction sector union
- Confederation of Finnish Construction Industry and its training body RATEKO
- Vantaa Vocational College in Varia
- A large, low energy housing development in Metsatammi.

## VET for LEC

Interviews at the Vantaa Vocational College suggest that, whilst the principle of energy efficiency is familiar to students and they learn to build insulated structures, initial VET for building envelope occupations does not provide a theoretical understanding of LEC or climate change. Those training in these occupations are also taught separately from the building service occupations and thus there is little scope for interdisciplinary learning. About two thirds of the three- year course is spent on site and only the first year is dedicated to full-time learning at college. The general theoretical content of the course is described as 'very simple' and demand is weak; the number of students has fallen by around 40-50% since 2007 and the attrition rate is high. This decline reflects lack of interest in the construction sector; young people are put off by what they see as hard, physical and low paid work. Recruitment into plumbing and electrics, offering indoor working and better pay, is easier.

RATEKO organises short training courses for construction professionals. LEC training for the workforce (CVET) was developed as part of Build Up skills Pillar II project BEEP. Learning materials in

CASE STUDIES: Järvenpää House and ReBuilt retrofit

several formats were disseminated widely and are still available online. RATEKO courses lead to certification in, for example, thermographic surveying of buildings, air-tightness measurement, and building health. Some of these courses were developed in response to the requirements of EU legislation and are emerging as new areas of expertise. The duration of courses varies, ranging from 6 to 53 days over 18 months, and they are usually funded by participants' employers. Employees of municipalities are also found among course participants, often with the aim of qualifying as inspectors. Successful completion of training entitles participants to enrol on a register of certified experts.

## NZEB implementation

Due to its climate, there is already a tradition of highly insulated buildings in Finland. Implementing NZEB involves revising current energy efficiency standards, particularly in ventilation and moisture control, and developing cost-optimal improvements in refurbishments. Interviewees also considered that there is room for further improvements, including:

(i) The development of standards for infrastructural buildings;
(ii) Tighter and compulsory standards for commercial and industrial buildings;
(iii) Taking into account the lifetime of a building, including the materials used, in energy efficiency measures;
(iv) Better quality standards in energy efficient construction, largely dependent on a well-trained and qualified workforce.

According to the trade union organisations, SAK and Rakennusliitto, the new standards associated with the implementation of energy efficiency targets in construction are expected to create new jobs. The targets are therefore received positively by the construction sector union, in contrast with the situation in sectors such as energy production, where the green transition can result in job losses. In the construction sector, an increase in employment is expected both for new build and refurbishment. At the local level, workers' representatives are involved in numerous municipality-led initiatives to improve energy efficiency in social housing and public buildings and to save on energy costs.

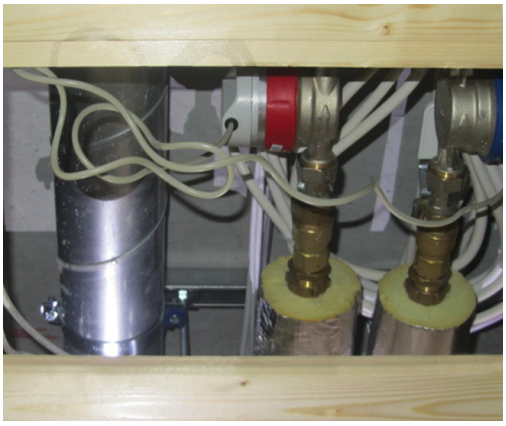
## Labour market conditions

The unions emphasised extended subcontracting chains and the employment of large numbers of foreign workers without training or language facilitation as a challenge to developing a more integrated construction process and achieving high standards in LEC. The unregulated construction labour market and the devaluing of VET qualifications undermine efforts to improve standards. The unions themselves face challenges; union membership in the construction sector stands at 60%, but is declining and foreign workers are particularly difficult to reach. On the policy front, the changing political environment is less receptive to unions' contribution to the green transition policies; they were not consulted on the EU2030 strategy and are of the view that assessment of employment effects was not carried out for all the sectors affected.

Carpentry trainee at Vantaa Vocational College

Bricklaying trainee at Vantaa Vocational College

LEC apartment visited in Metsatammi



Metsatammi heat recovery and mechanical ventilation system

## Low energy construction example

The low energy scheme visited is a block consisting of 102 apartments, built for the private sector to energy efficiency class C by a large Finnish construction company, with mechanical automation sub-contracted. Walls are manufactured off-site, with in-built insulation. The block will be served by a high specification, automated heat recovery and mechanical ventilation system that the occupants will be able to adjust but not turn off completely. The workforce is a combination of directly employed workers (plumbers, electricians, site supervisors and engineers) and Estonian migrant workers employed on temporary contracts. The site engineers interviewed claimed that the Estonian workers had no prior experience or training in LEC but were trained on site, by way of illustration, particularly in view of the language barrier. To ensure standards were met, their work was supervised closely, with further quality checks put in place.

## Conclusions

Our findings suggest that IVET and CVET provision for LEC are inadequate for building envelope workers. IVET has very limited LEC content, whilst organised, structured and funded CVET does not exist beyond the freely available BEEP learning materials. The building scheme visited indicated that, in the absence of comprehensive and funded training, building envelope workers are likely to be introduced to energy efficiency on site and in a fragmented fashion. By contrast, an extensive range of training courses is available for supervisors and professionals, often funded by employers. Our interviews and observations suggested that comprehensive VET for LEC for building workers is not regarded as necessary and supervisors are relied on to ensure that standards are met. Finland has a long tradition of energy efficient construction and the government has embraced NZEB implementation as a means to further improve on standards and remedy problems associated with the existing housing stock. Both employers and trade unions are involved in policy development and implementation, although the unions observe a change in the extent to which they are consulted.

# GERMANY

## Construction Industry

Generally, the economy is in good shape; employment is increasing and unemployment (including youth unemployment) is below EU average. Since 2005, the sector has contributed about 4% to gross value added (GVA). The economy is growing and this trend is expected to continue in the coming years. Between 2008 and 2017, the turnover in the construction sector increased from €85.640 to €112.814 (forecast) or 24%. The informal economy is estimated to be about 11% of the official economy.

There are 74,223 companies (2016), distributed by NACE[1] activity categories as follows:
- o Construction of buildings: 26%
- o Civil engineering: 11%
- o Demolition works and site preparations: 6%
- o Specialised construction activities: 57%

The majority are small companies, employing less than 10 workers. In contrast to most EU countries, medium size companies employing 10-49 workers, at nearly 24%, constitute a substantial part of the sector. The breakdown of companies by size is follows:
- o 1-9 workers: 73% (54,181)
- o 10-19 workers: 16% (11,849)
- o 20-49 workers: 7.9% (5,863)
- o 50-99 workers (1,538) + over 100 (792): 3.1%

The self-employed constitute 11% of the total workforce in the mainstream construction industry (NACE F 41.2, 42, 43.1). The figure for the finishing trades (NACE F.43.2-3) is 10%.

Prior to 2009, the number of small companies was increasing, but since then an opposite trend can be observed, though this is a small change. Since 2009, the number of medium size companies has increased by nearly 3%, and the number of small companies dropped by 3%. The number of companies involved in the shell construction of buildings fell by more than 2,400, their share of the total number of companies also dropping from 30% to 26%. The number of companies involved in renovation-related trades increased. For example, companies providing carpentry, roofing and other specialist work increased from 54% to 57% (more than 2,000 companies). Development of the refurbishment market is bringing more companies into this segment of the sector.

Between 1995 and 2005, mainstream construction lost around half of its workers. This was a re-adjustment following the boom years of reunification. The number of workers stabilised at 715,000 by 2010. The number of workers increased and in 2017 stands at 790,000 (forecast) due to increased activity in housing, stimulus packages targeting the public construction sector and the recovery in the commercial construction sector. The old and new federal states differ in that the number of workers continued to increase in the former and to decline in the latter.

## Construction Workforce

In the broad construction sector, the number of workers employed in 2016 was 2,272,627. About 58% work in narrow construction activities, 15% in architecture and engineering and 11% in manufacturing. In 2016, the number of workers in the mainstream construction industry[2] and structural engineering was 797,674 and 1.040,326 workers were found in finishing occupations. A total of 1,838.000 workers were employed in NACE F. The characteristics of the workforce are:
- *Part-time working:* Full-time working is more common than part-time but this varies by type of activity. Whilst 85%-88% in 'finishing trades' and demolition work are full-time, 90%-95% in 'mainstream construction activities' work full-time.

1 NACE is the statistical classification of economic activities in the European Community, Code F refers to construction.

2 Mainstream construction industry' refers to 'construction of buildings', 'civil engineering' , 'demolition of work and preparatory construction site work and other specialised construction work'.

- *Gender:* Women make up 12% of the construction workforce. They are better represented in 'structural engineering' (14%), 'building completion', 'building installation' and in 'finishing' (15%-16%), but less so in 'civil engineering' (9%) and 'demolition work and preparatory construction site work' and 'building construction' (10%-11%).
- *Foreign workers*[3] make up 14% of the construction workforce. They are more likely to work in 'demolition work and preparatory construction site work' (20%), 'construction of buildings' (17%) and in 'structural engineering' (16%). Their numbers are lower in 'building installation' (12%) and 'finishing occupations' (13%).
- *Age:* The majority are between the ages of 25-55 (around 70%), but there are some differences between activity types. 13% in the finishing trades are under 25 and this goes up to 16% in 'construction of buildings' and 20% in 'demolition work and preparatory construction site work'.
- *Qualifications:* 67%-72% hold a recognised vocational education qualification. This drops to 61% for those in 'demolition work' and is 72% for workers in 'building installation' and 71% for those in 'underground duct construction and sewage treatment plant construction'. 10%-14% in all activity categories do not have a vocational qualification and for 11%-16% of the workforce qualification levels are unknown.
- *Apprenticeships/Traineeships:* The recruitment of a junior workforce takes place in the 'crafts and trades' sector. 80% of apprenticeship contracts are concluded by SMEs. In the adjustment period of 1995-2005, disproportionately few apprenticeships/ traineeships were concluded and this is now contributing to a shortage of qualified workers at a time of increasing demand and further demographic challenges. Another reason for the shortage of apprentices is the decreasing rate of applications. There is a general trend to greater participation in higher education and increasing competition between sectors for the diminishing number of school leavers interested in VET. The total number of apprenticeships in *'Handwerk'* in the last 20 years declined from 68,162 to 26,621 by 2017 (forecast), and from 29,566 to 7,110 (forecast) in *'Industrie'*. Currently the number of apprenticeships is again rising. The number of skilled workers for each vacancy fell by half, and the construction engineering vacancies can no longer be filled from the existing pool of workers.

## Vocational Education and Training (VET) system

The institutional and legal framework that governs the development and regulation of VET, qualifications and skills follows the approach of a social partnership model. VET is regulated by social partners, with the state responsible for setting the legislative framework and supervision. Within the German Federal Government, the Federal Ministry of Education and Research has responsibility for general policy issues, including The Vocational Training Act and the legal supervision and funding of the Federal Institute for Vocational Education and Training (BIBB). However, the Federal Ministry for Economic Affairs and Energy is the lead body with responsibility, in consultation with the Ministry of Education and Research, for coordinating and steering the statutory framework that defines standards and the responsibilities of all stakeholders. Depending on the occupational field, individual ministries are also involved (e.g. Federal ministry of Agriculture). VET for the construction sector is funded by a combination of employer levy and state funding and is a national system with a federal/ regional element with regard to the VET schools. Responsibility for defining qualifications lies with social partners and BIBB. The head organisations of employers and employees assign VET experts to develop and modernise training regulations, mediated by the Ministry for Economic Affairs and the Ministry of Education and Research in a process governed by the Vocational Training Act. The law makes provision for wide-ranging trade union involvement in the design and implementation of VET. Trade unions and employer organisations are involved formally in training and education bodies at all levels; at the national level they are members of the Board of the Federal Institute for Vocational Education and Training, at the regional level they are on Regional Committees for Vocational Training, and at the local level they are on Vocational Training Committees of the 'Competent Bodies'.

VET is linked to occupational profiles and there are around 320 recognised professions or *Berufe*. In construction, there is an organisational division between *Handwerk* and *Industrie*, but the occupations covered in each are more or less the same and training for electricians and plumbers is organised separately, within the *Metall* sector. Germany operates a dual system of Initial Vocational Education and Training (IVET) in construction for over 20 construction occupations or *Berufe*. Half of all school leavers apply for vocational training in a company/dual vocational training. VET in the construction sector takes place in

3 Refers to all without German citizenship, including posted-workers.

a company (practical), in a training centre (workshop, simulated learning) funded through the levy, and at a vocational school or *Berufsschule* (theory). All construction trainees have a broad introduction to the sector and the relevant branch through what is known as *Stufenausbildung*, whereby trainees begin with a broad introduction to all the different construction occupations, then specialising in the second year into finishing, building or civil engineering, and only concentrate on a particular construction occupation in the third and final year.

*Further training and qualifications (CVET)* are also provided for under federal law, on the basis of the Vocational Education Law and the Craft and Trade Regulations. The federal CVET regulations are developed jointly by the experts from the social partners and economic organisations. Advanced CVET has three levels, building on the comprehensive IVET, and leads to qualifications that are highly recognised and partly seen as equal to university and master level studies. Within the construction sector, CVET means added depth and breadth of knowledge and understanding in a specific aspect of construction (e.g. construction machinery, maintenance and repair, building operations technology) and qualifies participants for specialist or management roles. In addition to the nationally-regulated CVET qualifications, there are hundreds of others provided by individual states and individual chambers such as the Chambers of Industry and Commerce and of Crafts and Trades or the Social Partners (collectively agreed).

## German Build Up Skills – LEC training needs

The Build Up national Status Quo Analysis stated that in terms of quality and content, the existing VET system provides a good framework for incorporating energy efficiency and for its future upgrading. However, it found that understanding of the interfaces between occupations and the building as a whole system needed improvement, with greater standardisation across the VET offered, particularly in CVET programmes. The Roadmap recommended the development of cross-trade CVET programmes to teach systems thinking and address the problems that arise at the interfaces. The recruitment challenges facing the German construction industry were found to be significant and a number of measures were recommended to address the issue. The drop in the number of trainees was attributed, in part, to population decline and the increasing popularity of university education. The report stated that the supply of trained construction workers is likely to be sufficient in the short term, but labour shortages should be expected beyond 2020. Measures are recommended to improve the recruitment of young people and to target the unemployed, women and those who did not finish their training in the construction sector, or did not enter it having completed their VET. A similar exercise to attract the existing workforce to LEC-related CVET is needed, as well as increasing awareness of this by creating an easily accessible database of course offerings. Improving career opportunities to incentivise participation in CVET and support for small and medium companies are recommended.

## VET for LEC developments

VET for LEC is part of mainstream IVET, with topics integrated into existing courses. As in Belgium, social partners are involved in this process at the national, regional/federal and local levels. The responsibility for defining qualifications lies with social partners and the Federal Institute for Vocational Education and Training (BiBB). Low energy skills and qualifications are established in the VET and examination regulations of the relevant occupations, with the relevant technologies and processes covered extensively. As CVET builds on IVET, LEC is also an integral part of *Meister* VET programmes that are nationally regulated. The introduction of LEC into the curriculum predates the Build Up skills investigation and Germany therefore has more experience and expertise in providing initial and further VET for LEC. In 2001, for instance, in the *Handwerk* and *Industrie* sectors, there were 315 further training programmes available in energy efficiency and renewable energies. Following Build Up Skills, a new nationwide CVET programme (involving 200 hours of learning and ending in a recognised qualification upon successful completion of a public examination) for the qualification as 'Certified Renewable Energy Specialist' was introduced. Detailed curricula for the construction occupations are available and, although LEC elements are not explicitly marked, it is not difficult to see where they occur.

## Initiatives related to VET for LEC

- *QUALITRAIN (2013-2016)*, a Build Up Skills Pillar II project, aimed to develop large-scale training and qualification schemes to ensure a life-long learning system for blue-collar workers in the building sector. As part of this plan:
  - o a skill and training needs forecasting system was developed
  - o a pilot course was tested to address interfaces and cooperation between trades
  - o a transferable Train-the-Trainer seminar was developed

GERMANY – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | Under development |
| RESIDENTIAL/ NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | |
| APARTMENT BLOCKS | |
| OFFICES | |
| EDUCATIONAL BUILDINGS | |
| HOSPITALS | |
| HOTELS/RESTAURANTS | |
| SPORT FACILITIES | |
| WHOLESALE AND RETAIL | |
| BUILDING TYPOLOGY | New build |
| BUILDING CLASS | Private/public |
| BALANCE | E demand/ E generation |
| PHYSICAL BOUNDARY | Single building |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ✖ |
| CENTRAL SERVICES | ✖ |
| ELECTRIC VEHICLES | ✖ |
| EMBODIED ENERGY | ✖ |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | ✔ |
| CREDITING | ✖ |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

  - attempts were made to engage SMEs, chambers of *Handwerk* organisations and CVET providers with life-long learning and to develop structures and materials to support this[4].
- *Vocational Education for Sustainable Development*, programme to support green skills development leading to action protecting natural resources, funded by Federal Ministry of Environment, Nature Conservation, Construction and Reactor Safety, and European Social Fund[5].
- *Pilot projects for sustainable development* were developed by BIBB[6].

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Germany's NZEB definition is currently under development.
In its applied definition, Germany defines NZEB for both residential and non-residential buildings but does not include specific subcategories (ibid: 16: Table 4). In terms of building typology, classification, balance type, and physical boundary, Germany refers to new buildings, private and public buildings, energy demand versus energy generation, and single building respectively (ibid: 17-18: Figure 3). Germany's definition includes four types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; and lighting (ibid: 18-19: Table 5). With regard to the specification of generation boundaries, Germany's definition considers on-site, off-site, and external generation. Crediting has not been considered (ibid: 20-21: Table 6).

The numeric indicators of energy performance below, expressed as primary energy (kWh/m²/y) have been specified in Germany's definition (EC, 2016a: 23-26, Table 7).

Germany has not yet finalised a specific NZEB definition for new dwellings although Passivhaus is likely to come close to the final criteria – perhaps with the addition of some onsite renewables.

## Intermediate targets

Germany has set the intermediate targets below for all new buildings, and all new buildings occupied and owned by public authorities.

4 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-qualitrain
5 http://www.gold-gruen.de
6 https://www.komzet-netzwerk-bau.de/ http://www.energiebildung.info/ http://www.uni-oldenburg.de/fee/

GERMANY – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| 40% PE | 55% PE | n/a | n/a | Maximum PEC defined as a percentage of the primary energy consumption (PE) of a reference building |

GERMANY – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| By 2016, the Energy Saving Ordinance (EnEV) aims at increasing minimum requirements for new buildings (residential and non-residential) by 25% (12.5% per year). | According to the Federal Government, it is neither possible nor necessary to establish numerical guidelines for intermediate targets as far as the number of NZEB will be achieved in future. | The energetic minimum standards are gradually tighten towards NZEBs (i.e. having the effect of an intermediate target). | As other new buildings | As other new buildings | As other new buildings |

## Case study

The German case study is a Passivhaus project. The following observations complement, and should be read in conjunction with, the information contained in the National Report. This project is partially prefabricated and constructed by a company claiming 20 'years of building healthy wooden houses' (https://www.lebensraumholz.de/ueber-uns.html).
The project is PH Institute registered (https://passivhausprojekte.de/index.php?lang=en#k_5176).

The construction company website, 'about us', shows two master carpenters and one carpenter among the project planners and managers. Although the Partner Report refers to photos and drawings (which are not attached), the architect, Dipl.-Ing Eva Bodner has posted descriptors, images, plans and sections: http://www.passivhausplaner.eu/MusterPH _Projektdoku_Bild/ph_Zimmermann_Muenchen_5176.pdf.

Because the building is a certificated PH, the quality of work would have been documented throughout to ensure meeting PH standards. The construction company is mature, the prefabricated timber frame design is in-house, and one of the directors is a master carpenter.

CASE STUDY: Detached single-family house in Munich

The construction company is part of a programme called *Gemeinwohl–Ökonomie* – Economy for the Common Good (ECG), which, inter alia, supports 'Human dignity in the supply chain and the work place' with 'self-determined working arrangements'.

## VET for LEC visit to Germany: Summary Report

The visit to Germany took place 14-15 May 2018, involving interviews at:

- *Bildungszentrum für Stuckateur Ausbildung* (Plasterers' Training College), Stuttgart
- *Max Bögl Fertigwerk*, (*Max Bögl* modular factory), near Nuremburg

## The Training College

The College encompasses both the *Berufschule* or Vocational College and the *Überbertriebliche Ausbildungsgstätte* or Training Centre, though elsewhere in Germany both may be in different locations. The *Stukkateur* (plasterer) is a broad occupation, including plastering, screeding, rendering, decorative work and dry and wet wall construction. In southern Germany, gypsum has a long tradition; in other regions plastering is more specialised. The plasterer is a *Handwerk* occupation, one of the *Bauhauptgewerbe* (principal construction occupations) alongside the carpenter, mason and plasterer, which come together in the Training Centre. Vocational education and training (VET) is completed over three years, with theoretical elements covering: knowledge of the subject, including materials and technique; and general education, including technical maths, organisation, contract conditions, and teamwork. The theory-practice link is relatively weak as firms cover different activities. There has been a steady decline in recruitment as more young people wish to pursue an academic route. In 1980 there were 1,400 recruits, falling to 500 by 2010 and now numbering only 400 for the whole of Germany. Fewer firms actively look for apprentices. Wage rates in *Handwerk* are not as good as in *Industrie*. Placements are mainly obtained through local networks; firms need to cover a broad range of operations, but this is not always possible so the gaps are made up at the Centre.

Plasterers' Training College, Stuttgart

For refugee candidates there is special language support plus maths and other instruction if needed in order to be ready for training, and perhaps leading to a contract with one of the 900 firms in the area. The *Meister* (master) and also shorter courses are run through the Centre, often by firms themselves, with participants paying a fee. In addition, there is *Geselle/ Meister Ausbildungsmodell*, a special three and a half year programme taking candidates either with an *Abitur*-level school leaving certificate or recognised training *(Ausbildung)* and leading to a master qualification. Further training also exists for workers to update skills or knowledge, on their initiative or the firm's.

Firms supply new materials cost free and up to date equipment. For instance, this Centre has a modern automated gypsum cutter, one of only five in Germany, costing €80,000 euros. In future, trainees will need to learn how to do computer-aided design (CAD). Technical drawing is learned only in the Berufschule, but as the occupation becomes more technical so firm, training centre and college will have to work together more closely. Trainers in workshops and the Berufschule go on updating courses to widen expertise. There is a levy in operation for the non-Berufschule element but because of the reduction in trainee numbers not all of the levy is used.

SOKA-BAU is the umbrella organisation of the Holiday and Wage Balancing Fund of the Construction Industry, the *Zusatzversorgungskasse des Baugewerbes AG*, which as a service provider is responsible for the holiday provision and additional old-age provision for the construction industry, as well as the financing of vocational training.

## VET for LEC

All trainees learn to apply building physics and to understand the main energy standards, though in some courses only pipes are covered, not pumps. Eventually Passive House (PH) will become the minimum. All the work is organised through *Lernfelder* (leaning fields), including the theoretical elements

concerning for example, thermal bridging, which are then followed by practical elements, in this case the means of preventing bridges. Not all trainees are able to comprehend the mathematics relating to heat loss and to interpret complex formulae so use tables instead in order to insert the right values and then calculate. Renewal and restoration are treated as distinct activities. The curriculum is written by stakeholders and updated every 4 years. Cross-occupational LEC guidelines exist.

## Labour Market issues

Plastering employers are organised in a guild-like structure, with the *Fachverband der Stuckateure* (plasterers' association) involving 900 firms grouping the plasterers in an association for the advancement of the occupation, which lobbies and contributes to the *Kompetenzzentrum* (Competence Centre) for building supervisors. There is also an interesting Energy Advice Handbook that includes 'diplomatic' circumlocutions for advising clients.

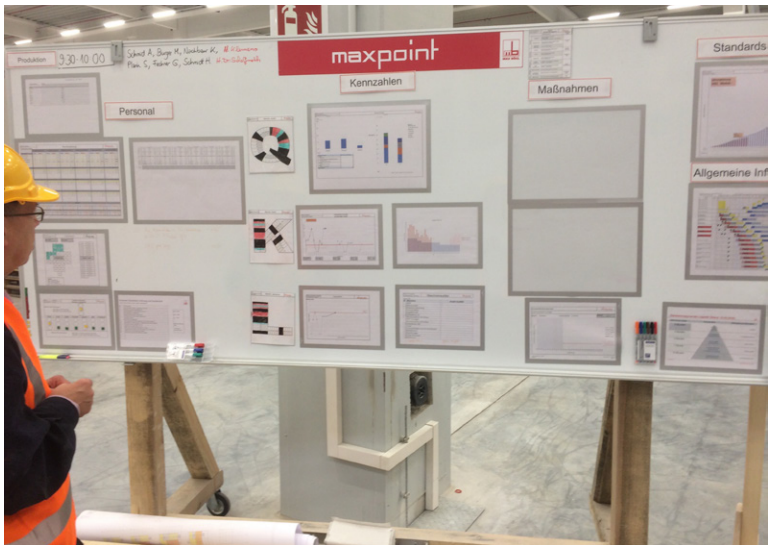
## Modular housing Factory

The CEO of the factory considered that Passive House is no longer a distinctive standard and KFE is better. The prefabricated method used by *Max Bögl* since 2015 is capable of meeting any energy standard required. Up to 80% of building costs can be in the pre-construction stage *(Vorbau)*, so preplanning and enabling prefabrication can drastically reduce the cost of putting up a building. Energy saving can be managed through prefabrication as there are a lot of workers who do not need to be brought to the site. The CEO was formerly a Master Concreter *(Betonbaumeister)* and has been with *Bögl* since 2000. He mastered UNIX programming quickly, enabling him to computerise the pre-building process. There are 6,000 workers employed by the firm in total, including 40 planning staff, 120 assembly workers and 12 trainees in the factory; 3-4 subcontractors are also used. In addition to modular production, 1,500 skilled people, including electricians, are employed on wind turbine production. There are about 29 different *Berufe* covered in the firm, including tilers, and three of those employed have a doctorate (engineers, *Statik*). There used to be 30-40 concrete trainees per year but this has fallen to 3-5.

Skilled workers need a formal training *(Ausbildung)* and most who are successful have then undertaken further study. There is, however, a shortage of people with appropriate qualifications so they must recruit and run courses for people outside the building trades. There is no unemployment locally, so workers are also recruited from Poland, where the firm has a subsidiary.

Workers need the foundations, but can then learn through experience so it is possible to use semi-skilled labour in prefabrication, as in the car industry. Workers must be diligent and reliable but need not have qualifications. The CEO saw the *Beruf* concept as in decline as well as identification with a firm, explaining that: "I have a *Beruf*, the workers here have a job".

On the planning side, it is no longer necessary to have people who can engage with an actual building. Architects have also changed; they were always on the client's side but now need to work with a team who can plan together. The engineering qualification is also too theoretical. Preplanning for the modules is required and all modules must have very fine tolerances (e.g. for plumbing, electricity etc.). Workers can assemble, however, without reading plans. One module is 20 square metres and the firm can make 4,000 modules per annum, with on average three needed per house; to make a robot pay, 40,000 modules would need to be produced per annum. The firm has invested over €20 million in plant, designed its own machinery and uses lean management. Continuous quality improvement techniques are applied. There are also plans for different configurations of the workforce. Team managers are important; there are three in the building, each managing between 10 to 15 workers. Workers work 38 hours per week and are paid over the collective agreement rate. There are two shifts, between 5.30am and 22.30pm. Building services are challenging as poor planning and fitting can lead to a significant loss of space in the building.




Instruction board:
Modular housing factory

# HUNGARY

## Construction Industry

The Construction industry contributes 4.2% to GDP, which is less than half the European average. There has been a decline in investment from 2006 due to austerity policies implemented following the financial crisis of 2008. During the recession (2007-2013), 85,000 workers left the sector, many moved abroad. The industry started recovering slowly in 2014-2015 due, primarily, to road, railroad and infrastructure projects financed largely from EU sources. There are other signs of recovery: the number of new completed dwellings increased to 10,00 in 2016, although this is still too low compared to the replacement rate of 40,000 required a year. Further expansion of the housing construction market is expected. There are 85,000 companies and 90% have no more than 5 employees. The sector is not considered to be profitable compared to infrastructure and civil engineering, and the number of loss-making and disappearing companies is high. Most companies have no financial reserves and no resources to contribute to training, innovation or other social initiatives.

## Construction workforce

Depending on the definition, the construction workforce in 2016 was between 277, 800 and 317,500, while the number of self-employed stood at 39,700. Bogus companies using labour leasing and agency workers are widespread. Interest in training, retention and quality is very low. There are full time employed workers, 'hired' labourers in subcontracting chains, and those who are undeclared or partially declared. All occupations in the construction industry face skills shortages. An estimated 30,000 skilled workers are needed. A lot of workers do not have any qualifications. Working overtime is common practice. The quality of work produced and health and safety are big problems. Low wages are standard. Productivity is below EU average.

## Vocational Education and Training (VET) system

*Initial Vocational Education and Training (IVET)* is the responsibility of the Economy Ministry and other ministries are responsible for specific vocational qualifications in their fields; the Human Resources Ministry designs learning outcomes and framework curricula. Social partners are involved in developing VET policy; they participate in advisory bodies such as the National Council for Vocational and Adult Training. The council consults on proposals and draft legislation. Business and industry participate in the consultation process as well as organising training. Apprenticeships, introduced in 2012, are coordinated by the Chamber of Commerce and Industry, whose role further expanded with the introduction of a guaranteed work placement scheme for learners in 2015.

Hungary operates a school based IVET system, although recent legislative changes have devolved more responsibility on to employers and a dual system form of IVET was launched in 2014, albeit on a very small scale. However, it is still difficult to find placements as the majority of employers in the construction sector are small enterprises with an irregular supply of work and unable to sign student contracts. Young people can enter VET from the age of 14. VET is available at Upper Secondary, post-Secondary and tertiary levels. At Upper Secondary level, it is a four–year programme and combines VET and general education. Learners can continue on to post-secondary VET or higher education. The other route is to complete a three-year practice oriented programme, followed by a two-year course to obtain the upper secondary school leaving certificate, and continue on to higher education. The completion of upper and post-secondary VET programmes involves passing a practice-oriented exam. A National Qualifications Register (NQR) was first published in 1993. Major changes were made to it in 2007 when modular, competence based qualifications were developed. The latest review of the register was completed in 2012 with the objective of eliminating overlaps and professional/content-related duplication

between qualifications. The modular principle and a competence-based approach were kept, vocational qualifications, partial qualifications and specialisations were retained, but the total number of qualifications decreased by half. The Hungarian Chamber of Commerce and Industry coordinated the development of the new NQR. The Government Decree of 2016 on NQR links VET qualifications to the Hungarian Qualifications Framework (HuQF).

*Continuing VET (CVET)* courses at all levels (secondary, post-secondary and tertiary) are also open to adults. Outside the formal school system, there are courses for adults run by economic chambers, which prepare for master craftsperson exams, mandatory CVET programmes for a given occupation, vocational programmes leading to NQR qualifications and courses for the unemployed and other vulnerable groups.

## Hungarian Build Up Skills – LEC training needs

The Build Up Skills Status Quo Analysis (SQA) was restricted in evaluating the training needs of the workforce as detailed data on the training and qualification levels of the workforce, existing LEC-related training provision, and workers trained and employed in energy efficiency (EE) and renewable energy systems (RES) installations were not available. Based on interviews with a non-representative sample of construction companies, the SQA stated that there is a shortage of LEC trained building workers in all construction occupations, including building technicians, central heating and plumbing installers and insulation installers. As the sample was dominated by HVAC specialist companies, very few commented on carpenters, building frame, door and window installers, roofers or plasterers. The report concluded that for some specialisations there is no LEC related VET at all, and that existing VET provision is in need of a general upgrade including: a review of training materials, development of advanced training for teachers, standardisation and accreditation of adult learning, and promotion of practical training in collaboration with construction companies. Other recommendations include raising awareness of energy efficiency in the construction sector as well as among the general public, promoting the benefits of CVET, and developing cooperation between vocational schools, professional institutions and the industry.

## VET for LEC developments

In Hungary, LEC topics have not yet been introduced into mainstream IVET. The report suggests that there are short, CVET courses in renewable energy though information about providers or course content is not available. Employers play an important role in providing CVET courses in general as well as energy efficiency related short courses, though these are likely to be in-house and not accredited. In Hungary, the Build Up Skills investigation provided the impetus for developing capacity for VET for LEC. As part of Trainbud, the BUS Pillar II project, CVET courses were developed for HVAC workers who had already had some initial training in order to support and consolidate the emergence of a trained workforce. Trainbud facilitated the establishment of the Sustainable Construction Skills Alliance to support the long-term continuation of training schemes developed and further enhance the validity of VET qualifications.

## Initiatives related to VET for LEC

Following on from Build Up Skills Status Quo Analysis and the Roadmap (BUSH), Hungary developed *Trainbud (2014-2017)*, a voluntary qualification scheme (quality labelling) for HVAC skilled workers. It created a database of qualified workers and sought to raise awareness of energy efficiency measures and the importance of installation and maintenance by appropriately qualified personnel, and to encourage workers to invest in training in EE and RES. The project was jointly developed and run by the Sustainable Construction Skill Alliance (SCSA) with representatives from professional organisations, manufacturers and training institutions. 400 trainees took part in training of varying length and intensity, depending on existing training and qualification levels. Partners of the SCSA were enthusiastic contributors to VET development and VET institutions plan to continue to run courses. A register of qualified HVAC professionals can be found on the Trainbud website[1].

*Hungary Green Building Council,* affiliated to the World Green Building Council, a not-for-profit organisation, campaigns for radical transformation of the built environment, provides information on sustainable practices, facilitates learning and communication, and organises training courses for professionals and stakeholders engaged in the construction industry.

1 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-trainbud

HUNGARY – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | Under development |
| RESIDENTIAL/ NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | ✔ |
| APARTMENT BLOCKS | ✔ |
| OFFICES | ✔ |
| EDUCATIONAL BUILDINGS | ✔ |
| HOSPITALS | ✔ |
| HOTELS/RESTAURANTS | ✔ |
| SPORT FACILITIES | ✔ |
| WHOLESALE AND RETAIL | ✔ |
| BUILDING TYPOLOGY | New build |
| BUILDING CLASS | Private/public |
| BALANCE | E demand/E generation |
| PHYSICAL BOUNDARY | Single building |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ? |
| CENTRAL SERVICES | - |
| ELECTRIC VEHICLES | - |
| EMBODIED ENERGY | - |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | ✔ |
| CREDITING | ✖ |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Hungary's NZEB definition is currently under development.
In its applied definition, Hungary defines NZEB for both residential and non-residential buildings, including 8 subcategories: single family houses, apartment blocks, offices, educational buildings, hospitals, hotels and restaurants, sport facilities, and wholesale and retail (ibid: 16: Table 4).
In terms of building typology, classification, balance type, and physical boundary, Hungary refers to new buildings, private and public buildings, energy demand versus energy generation, and single building respectively (ibid: 17-18: Figure 3).
Hungary's definition includes four types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; and lighting; with plug loads, appliances and IT possible to add (ibid: 18-19: Table 5).
With regard to the specification of generation boundaries in the definition, Hungary's definition considers on-site, off-site, and external generation, but not crediting (ibid: 20-21: Table 6).

## Intermediate targets

Hungary has set the intermediate targets below for all new buildings, and all new buildings occupied and owned by public authorities.

## Case study

The Hungarian case study is a Wienerberger e4 brick house with external render, known as E4. The following observations complement, and should be read in conjunction with, the information contained in the National Report.

It is not been possible to identify the exact specification for E4 in order to compare to Passivhaus, although there is general information on it such as a description of the E4 house at the UK BRE Innovation Park: https://wienerberger.co.uk/inspiration/e4-bre-innovation-park. An e4 terrace houses in Belgium provides a primary energy for heating of 38 kWh/m²/y: https://clay-wienerberger.com/expertise/e4-terrace-houses-in-belgium

Wienerburger E4 is described as having a Fabric Energy Efficiency of 46 kWh/m²/y: https://issuu.com/wienerberger/docs/131007132824-6c333d30c4ab41198f675845a32a7de0/22. Current Hungarian NZEB refers to 50-72 kWh/m²/y Primary Energy. It is therefore possible that the Wienerberger falls within this requirement.

HUNGARY – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| Requirements strengthened in 2016; the targets are under discussion. Also direct requirements on solar systems included. | n/a | n/a | As other new buildings | n/a | n/a |

The case study refers to Renewables under:

> *There is no direct power generation unit (e.g. solar cell) on the building, but its technical preparation has been completed. The amount of renewable energy used in terms of total energy demand is approximately 50% (passive solar gain, heat from the heat pump, heat from the environment).*

Note that the case study uses heat pump and MVHR ('heat from the environment' both of which are classed as 'nearly zero carbon technologies') and relies on passive solar gains for winter heat (100% renewable – zero carbon), but there is no energy generation from PV. The monitoring data referred to at http://www.e4haz.hu/?id1=monitoring is not very helpful since it provides only energy used and not a comparison with the design energy use. Also January 2018 shows 21,390 Ft whereas November and December 2017 show 1,050 Ft and 1,271 Ft, indicating monitoring problems.

E4 is based on traditional build techniques, the manufacturer's claim low cost as well as energy efficiency.

A report (in Hungarian) on NZEB is available at the Wienberger website: http://e4haz.hu/files/1427991340.pdf. The title is: *Designing energy-conscious family house, architectural and mechanical optimisation: Wienerberger e4 house project*. This report states that the house is built:

> *according to the Government Decree on Certification of Energy Performance of Buildings cost-optimized or energy-efficient building, in which at least 25% of the annual energy demand expressed in primary energy is renewable from the source of energy that is generated in the building, comes from the real estate, or is perhaps produced nearby (our translation).*

The document states that: 'the official announcement of nearly zero requirements is expected by 31 December 2017' (A közel nulla követelmény hivatalos kihirdetése 2017 december 31-ig várható).

This Hungarian case study therefore provides a potential example of NZEB specification with on-site renewables, effectively the Hungarian definition of new build NZEB, and warrants further analysis of their IVET and CVET supported by in-use energy performance monitoring to assess the actual building performance.

CASE STUDY: Wienerberger e4
Source: https://wienerberger.hu/epitesteglabol/fel%C3%A9p%C3%BClt-magyarorsz%C3%A1g-els%C5%91-energiahat%C3%A9kony-e4-h%C3%A1za

# IRELAND

## Construction Industry

The construction industry in Ireland is emerging from a period of deep recession and in 2017 it is projected to contribute 10% to GDP. In the same year, it accounted for 7% of the employment market. The estimated size of the *shadow economy* is 12.8% of total GDP, and construction sector activity is likely to account for a significant share of this.

The recession had a dramatic effect on the sector. Prior to this, in 2006, the number of construction workers had increased to a quarter of a million (276,670). In 2013, it had dropped to 96,400. At 81%, the biggest drop was among bricklayers and masons, due to very low levels of house building and the transition from traditional concrete build to timber frame building. The number of self-employed increased from 25% to 37%.

Thousands of workers, both foreign and Irish nationals, left Ireland for the UK and Australia. During the recession, the number of apprentices dropped from 29,000 (2005-6) to 5,700 in 2013. During the recession, the number of those enrolling on apprenticeship programmes in the construction sector fell dramatically. Carpentry, for example, had 2,000 apprentices in 2005, and this had fallen to 90 in 2012.

The sector has been recovering steadily since 2013, which is partly due to government initiatives to redevelop schools and public offices. There has been a shortage of skilled workers in the context of increasing demand since 2013, as Ireland catches up with delayed investments particularly in infrastructure and housing. Since 2016, there has been an increase in the volume of all types of projects going on site, including residential, commercial, social, sport and leisure. There is an increase in planning applications granted. From 2016 to 2017, building construction output was up by over 19%. Output volumes in residential building increased by 30%, and in non-residential building, by 24%. The number of workers has been increasing steadily since 2012 and reached 142,500 in 2017. The number of apprentices is also on the up; they have climbed back up to 10,000. The forecast for future craft apprenticeships remains positive and registrations in the construction sector are forecast to more than double from approximately 1,700 in 2015 to over 3,600 by 2018.

The sector is dominated by very small firms and characterised by sub-contracting and self-employment. A large number of workers also engage with small, medium and large companies on a sub-contract basis. In 2008, there were 61,965 firms, of which over 95% were classified as micro-enterprises (firms that employ fewer than 10 people). In 2015, the number of firms totalled 50,546 and 49,192 of those were micro enterprises. The increase in the number of micro-companies could be due, in part, to the medium/larger companies successfully tendering for large government projects and then subcontracting the work.

## Construction workforce

The number of full-time construction workers employed by companies was 73,587 in 2015. This figure increases to 108, 720 if construction workers employed on a temporary basis, casual labour, part-time and sub-contracting and also those in administration are included. In 2017, the total number of workers engaged in the entire construction sector (NACE F[1]) was over 140,000. In 2016, there were approximately 68,000 persons employed in craft occupations. The characteristics of the workforce are:

- *Gender (2016)*: 9.2% of workers across all skilled trades are women. Among electricians, only 1% of the self-employed, and 4% of the employees are women. Among those working in the building trades, only 2% of the self-employed and 5% of employees are women. In 2016, women took up only 33 state funded apprenticeships. To put this into perspective, there were 10,000 apprenticeships available that year.

1 NACE is the statistical classification of economic activities in the European Community, Code F refers to construction.

- *Age (2016):* 66% are between the ages of 25-54. Between 2011 and 2016, the number of under 24 year olds and the 25-34 age group decreased while the number of older workers – 35 years old and up-increased. This reflects the collapse in recruitment following the recession, and tallies with the drop in the number of apprentices. The age profile of plasterers, bricklayers and other construction trade workers is the most mature, with almost one quarter aged 55 or older.
- *Type of employment:* 36.7% of construction workers are self-employed and the majority has no paid employees. Self-employment has increased since the recession, from an average of 25% between 2000 and 2007.
- *Migrant workers:* In 2014, migrants accounted for about 12% of the construction workforce, with the majority being from Eastern and Central European countries. This is a drop from 18% in 2007. In 2007-2008, 7% of electricians, 16% of carpenter and joiners, 25% of brick and stone layers, and 19% of plasterers were foreign nationals. Following the recession, many are thought to have left Ireland.
- *Levels of education* are generally low, with 20 per cent not having completed the final secondary level exit exam (Leaving Certificate). Only 17.6% possessed a third level (degree and non-degree) qualification, compared to 33.4% amongst the workforce in general. According to the National Skills Bulletin, this trend continues in 2016; compared to 11% of construction workers, 47% of the total workforce hold third level qualifications. Among apprentices, the level of education is higher than that for the general population.

All occupations in the construction industry face skills shortages. An estimated 30,000 skilled workers are needed, though it is likely that these forecasts underestimate the actual numbers in future years in view of the anticipated and significant expansion in new residential development. Many workers do not have any qualifications, although generally education levels are quite high.

## Vocational Education and Training (VET) system

Responsibility for training and education lies with the Department of Education and Skills (DES). The implementation and regulation of education policy is divided between a number of bodies funded by and operating under the remit of the DES. Social partners are not involved in the development or implementation of vocational education policy. Quality and Qualifications Ireland is responsible for maintaining the ten-level National Framework of Qualifications (NFQ), making awards and setting standards for Further Education and Training (FET) programmes and some tertiary level education programmes, reviewing the effectiveness of quality assurance in FET and higher education providers in Ireland. Vocational Education Committees (VECs) are responsible for the management and operation of second level schools, further education colleges, and a range of adult and further education centres.

Ireland has a well-developed Initial Vocational Education and Training (IVET) system, mainly college-based but with a substantial apprenticeship element. Most VET takes place at post-secondary level and in the state sector, after the completion of secondary education, and is delivered by the 16 Education and Training Boards (ETBs). At secondary level, the construction studies curriculum is part of the leaving certificate and covers the construction of buildings and the built environment. This is a QQI Level 5 course that provides a basic understanding of materials, techniques of application and energy efficiency topics in renewables and sustainable design. Post-secondary programmes include apprenticeships, post-leaving certificate courses (PLCs) and training by ETB colleges, private or sectoral providers. PLC courses, delivered in ETB colleges, may combine vocational and general education and lead to NFQ level 5 or 6 (EQF Level 4 or 5) awards. VET at tertiary level, provided mostly by Institutes of Technology, universities and other HE providers, leads to NFQ Level 6 or 7 awards. Apprenticeships are available in carpentry, brickwork, electrics and plasterwork, and combine theory and on-the-job training with an employer and lead to an NFQ Level 6 (EQF Level 5) award. They run over four years and are provided through collaboration between the employer, an education and training body and institutes of technology. There are currently 27 apprenticeship programmes.

*Provision of continuing (CVET) is more varied*. SOLAS is the Further Education and Training (FET) authority, responsible for planning, co-ordinating and funding FET in Ireland. Further Education and Training Courses (FETAC) range from one-day courses by private companies to comprehensive 3-year programmes. FETAC courses are generally QQI level 5-6 and can be awarded by SOLAS/ETBI and some education organisations. City and Guilds are also present in Ireland. The Higher Education Authority (HEA) is responsible for the effective governance and regulation of tertiary education institutions and the tertiary education system. For adults, a broad range of courses is available in the HE sector. The Institutes of Technology are HE providers, providing courses at Levels 6-10 as well as phases 4-6 of apprenticeships. There are also courses for the unemployed and for early school leavers aged 15-20.

## Irish Build Up Skills – LEC training needs

The Build Up Skills status quo analyses estimated that 65,000 workers need to be trained in energy efficiency at different occupational levels for Ireland to meet its targets. In relation VET for LEC, the main findings of the study are that the current training provision does not reflect the changes in building regulations or prepare workers for the requirements of energy efficient construction. There are some newly introduced training programmes, some by manufacturers and some nationally recognised, but these tend to be technology or product specific, too short and do not teach the principles of low energy buildings. The qualitative assessment of training needs suggests that the gap is one of knowledge, and recommends that all workers are given sufficient training to understand the science behind energy efficiency. While training needs to be differentiated for Operative, Craft and Supervisory levels and specialised by occupation, workers at all levels must develop a common knowledge base and understand their role within the construction process as a whole. About 100 trainers per year need to complete the foundation and specialist training needed at Operative and Craft levels alone to support estimated training needs. More technical aspects and installation of RES need to be supervised by appropriately trained contractors and technicians. The report recommends the establishment and maintenance of a framework of mandatory qualifications to motivate participation in further training and improve standards. Supporting measures called for include governmental funding, as the cost of further training tends to act as a significant barrier particularly for SMEs, and a campaign to raise awareness of energy efficient construction. Finally, conditions in the labour market were identified as a major barrier to achieving these ambitious training targets, given the labour shortage after the exodus of large numbers of skilled Irish and migrant workers following the recession. The number of apprentices also dropped sharply.

## VET for LEC developments

The development of VET for LEC for building operatives was initiated with the Build Up Skills investigation. QualiBuild, the BUS Pillar II project, involved the development and delivery of a short introductory course, Foundation Energy Skills (FES), which is the only QQI (Quality Qualifications Ireland) accredited LEC course available for tradespersons. Developed as a stand-alone short course, this is now being gradually rolled out across Ireland in a process that gained speed after the more active adoption of the EU NZEB agenda by the Irish government and as part of its investment plans in the construction sector and the economy still recovering from the 2008 crash. The course covers the basics of LEC and develops clear communication skills between occupations on site, so enabling efficient and quality building. It is a detailed, self-contained module, giving thorough coverage of LEC, and designed for self-study rather than as an integrated part of an IVET or CVET upgrade programme. This programme is currently part of a HETAC QQI level 6 accreditation project, requiring an additional on-site module. Workers completing FES can register with the Construction Workers Register. It is also anticipated that the course will be updated to account for the new building regulations Part L and to introduce criteria for NZEB, which was officially adopted in early 2017. Additional courses may also be developed to target specific areas such as renewables, NZEB or sustainable retrofitting. Further courses for professionals and site managers are being discussed, either as add-ons to the FES course or as Level 6-7 courses by Institutes of Technology.

There are also a number of further education courses (FETAC) available in renewable technologies at levels 5 or 6, provided by QQI, Institutes of Technology and some regional Education and Training Boards (ETBs). In addition, City and Guilds runs a number of courses, ranging from 2 to 14 weeks in duration, in energy efficiency and sustainable construction. *Ad hoc* programmes are also provided by the private sector, such as the passive house tradesperson course, LEED and BREEAM training, though not certified under QQI.

There is evidence at both IVET and CVET level that low energy requirements are being incorporated. This is borne out by the case studies. Two key areas to support the ongoing development of VET for LEC are the roles of: apprenticeships (IVET) in upskilling skilled occupations in construction as their numbers are forecast to more than double by 2018; and continuing VET (CVET) to achieve quality low energy building and NZEB certification. To support the needs identified, SOLAS updates skills forecasts and works with stakeholders to ensure that mainstream and targeted VET initiatives are attuned to the supply of skills required to deliver the Action Plan. New LEC occupations are recognised.

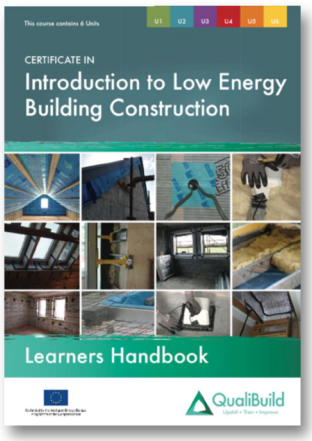
## Initiatives related to VET for LEC

*QualiBuild* (2014-2016) was developed as part of Build UP Skills Pillar II and aimed to stimulate the implementation of some of the recommendations of BUS Roadmap, including enhancing the capacity of the sector to build and retrofit to low energy standards, to develop trainer capacity, and to develop a registration system for workers who have enhanced competency in low energy building. As part of QualiBuild, the

Foundation Energy Skills (FES) course was developed, supported by a Train the Trainer Programme. FES was completed by 196 workers, through daytime and evening courses provided in four locations. The Train-the-Trainer programme was less attractive than expected (59 were trained, as against the target of 85), which is likely to be due to the downturn in construction training. The project was publicised and training promoted through a range of media, including a dedicated website[2]. The QualiBuild videos were viewed nearly 4,000 times, and the website was visited by 14,000 unique visitors. Workers completing the project were awarded a single subject certificate and can register on the Construction Workers Skills Register of workers trained in quality building. A Continuous Professional Development scheme for the construction sector trainers is also planned[3]. An e-book was created aimed at homeowners to raise awareness and understanding of the LEC principles. Financial issues and time restrictions were identified as important barriers to FES participation and need to be taken into consideration in the plans to roll out the course.

- *Meeting of Energy Professional Skills (MEnS):* Ireland is a partner in this Horizon2020 project which aims to design and deliver accredited training programmes for building professionals such as managers, engineers and architects[4].
- *Build Upon (2015-2017):* Green Building Council (GBC) Ireland participated in this Horizon 2020 funded project along with 12 Green Building Councils, under the coordination of GBC Spain and support from the World Green Building Council. The project sought to create a collaborative community, establishing innovative platforms for cross-sector partnership. Through 80 connected events, it aimed to help countries design and implement national renovation strategies.
- *NZEBRA*: Ireland is part of this international network established to promote NZEB[5]. The first World NZEB Conference was held in Ireland, Wexford, in November 2017.
- *Initiatives to encourage women into construction:* SOLAS/ETBs offers a bursary to employers in the public and private sectors to encourage the recruitment of women into apprenticeships. The Women in Trades Network Ireland (WITNI) provides consultancy services to support women in all trades.


QualiBuild Training Workshop, Dublin




Foundation Energy Skills, Course Handbook

2 http://www.qualibuild.ie/
3 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-qualibuild
4 http://www.mens-nzeb.eu/en/
5 https://www.nzebra.ie

IRELAND – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | In official document |
| RESIDENTIAL/ NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | |
| APARTMENT BLOCKS | |
| OFFICES | |
| EDUCATIONAL BUILDINGS | |
| HOSPITALS | |
| HOTELS/RESTAURANTS | |
| SPORT FACILITIES | |
| WHOLESALE AND RETAIL | |
| BUILDING TYPOLOGY | New build |
| BUILDING CLASS | Private/public |
| BALANCE | - |
| PHYSICAL BOUNDARY | Single building |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ✖ |
| CENTRAL SERVICES | ✖ |
| ELECTRIC VEHICLES | ✖ |
| EMBODIED ENERGY | ✖ |
| ON-SITE RES | - |
| OFF-SITE RES | - |
| EXTERNAL GENERATION | ✖ |
| CREDITING | - |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Ireland's NZEB definition has been included in an official document. In its definition, Ireland defines NZEB for both residential and non-residential buildings but does not include specific subcategories (ibid: 16: Table 4). In terms of building typology, classification, balance type, and physical boundary, Ireland refers to new buildings, private and public buildings, and single building respectively (ibid: 17-18: Figure 3). Ireland's definition includes four types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; and lighting (ibid: 18-19: Table 5). With regard to the specification of generation boundaries in the definition, Ireland's definition does not define on-site, external generation or crediting. Off-site generation has not been considered (ibid: 20-21: Table 6).

The numeric indicators of energy performance below, expressed as primary energy (kWh/m²/y) have been specified in Ireland's definition (EC, 2016a: 23-26, Table 7).

The following qualitative definition of NZEB was inserted into the Building Regulations (Amendment) Regulations 2017:

> *[a building] that has a very high energy performance where the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources including energy from renewable sources produced on-site or nearby: http://www.qualibuild.ie/what-is-nzeb-in-ireland/*

The quantitative calculation requires 'Dwelling Energy Assessment Procedure' (DEAP) software (published by Sustainable Energy Authority of Ireland) to ensure a Building Energy Rating (BER) of either A1 or A2. Additionally, Document L 2017, defines NZEB as having a 'Maximum Permitted Energy Performance Coefficient' (MPEPC) of 0.30 and a 'Maximum Permitted Carbon Performance Coefficient' (MPCPC) of 0.35 for dwellings completed after 31st Dec 2020 subject to regulatory process. These recommendations are numerically expressed as:

- Offices: 40-55 kWh/m²/y of net primary energy with, typically, 85-100 kWh/m²/y of primary energy use covered by 45 kWh/m²/y of on-site renewable sources.
- New single-family house: 15-30 kWh/m²/y of net primary energy with, typically, 50-65 kWh/m²/y of primary energy use covered by 35 kWh/m²/y of on-site renewables.

IRELAND – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| 45 – defined as energy load | 75-150 | ~60% PE | n/a | Included energy use: Heating, ventilation, DHW, lighting. |

IRELAND – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| The aim is to target 60% improvement by 2019 subject to cost-optimal calculations. An upgraded Energy Performance Standard for existing buildings undergoing renovation is foreseen. | No quantitative targets have been set for dwellings or for non-residential buildings to achieve nearly zero energy prior to 31 December 2020. | The 2011 step change at 60 kWh/m²/y is the intermediate step to advance towards 2020 performance levels of 45 kWh/m²/y. A draft standard will be produced in 2015 for dwellings; it will be passed into legislation in the timeframe between 2015 and 2020, but may be applied on a voluntary basis once published. An improvement of between 40% – 50% over the 2008 standard is proposed as an interim measure to be introduced in early 2015. A further review is expected to achieve an aggregate improvement of between 50% – 60% over the 2008 standard, to be completed by 2018. | The approach for buildings in the public sector will be largely similar to that for non-residential buildings. An improvement of between 40% – 50% over the current 2008 standard is proposed as an interim measure to be introduced in early 2015, with a further review to achieve an improvement of between 50% – 60% over the 2008 standard by 2018. This will facilitate the public sector in meeting the advanced deadline for NZEB by 31 December 2018. | No quantitative targets have been set for new public buildings to achieve NZEB prior to 31 December 2018. The Government foresees energy efficiency improvements of 20% by 2020, with the target of 33% set for the public sector. | The public sector will lead by example achieving defined nearly NZEB standard two years in advance of the private sector. It is envisaged that new regulations / technical guidance will be finalized by in early 2015. An improvement of at least 40% is proposed over the existing 2008 standard (primary energy demand of 67 kWh/m²/y for a naturally ventilated primary school rising to 220 kWh/m²/y for air-conditioned office). |

## Intermediate targets

Ireland has set the intermediate targets above for all new buildings, and all new buildings occupied and owned by public authorities.

## Case studies

Note that both of the Irish case studies appear on the QualiBuild's 'What is nzeb in Ireland?' (18 Jul 2017) website.

The Irish case studies refer to two new build residential developments. The following observations on the case studies complement, and should be read in conjunction with, the information contained in the Irish National Report.

CASE STUDIES 1 AND 2: Madeira Oaks (left) and Silken Park

CASE STUDY 1: Housing development 'Madeira Oaks' in Moyne, Enniscorthy, Wexford. Phase 2 of the project clearly meets current the NZEB definition at an A1 BER with low U-values, MVHR, on-site renewable heat (extract air heat pump) and renewable electricity (photovoltaics). For an excellent descriptive and technical analysis of the Enniscorthy project see the online video: https://phai.ie/info/passive-house-nzeb/7-steps-nzeb/

CASE STUDY 2: Durkan Residential's, Silken Park housing scheme in Dublin. Phase 2 has a BER of A2-3 and subsequently, the A3 housing will not meet NZEB. However, the Phase 3 development definitively meets NZEB with a BER of A1.

The Irish case studies therefore provide current examples of construction to Passivhaus specification with additional on-site renewables, effectively a cross-European definition of new build NZEB, and warrant further analysis of their IVET and CVET, supported by in-use energy performance monitoring.

## VET for LEC visit to Ireland: Summary Report

The visit to Ireland took place on 7-9 December 2017 and involved interviews at:

- Limerick Institute of Technology (LIT)
- SIPTU, the construction sector trade union
- Michael Bennett & Sons Building Contractors, including a visit to the firm's completed passive house scheme for Wexford County Council.

## VET for LEC

Lack of LEC training is being addressed, spurred by Ireland's participation in the Build Up skills project. The Irish project *QualiBuild*, led by LIT, involved the development and running of an introductory Foundation Energy Skills (FES) course for building operatives, open to both envelope and services occupations. Following its successful delivery as a BUS project, plans to roll out FES have been stalled by changes to the VET governance structure and by the sharp fall in the demand for training following the recession. Interviews at LIT highlighted the difficulty of winning national support for the FES initiative, as well as the generally low levels of awareness of NZEB legislation and its implications for construction VET. Currently, there are no plans to incorporate LEC training into existing IVET/ apprenticeship programmes[6].

Initial VET is not nationally co-ordinated. It was described as 'basic' and 'inadequate', including by the trade union, with limited government funding and no employer training levy. The culture of 'quick and cheap builds' conflicts with the precision and quality called for by LEC; the industry needs instead to develop a culture where high standards are the norm. Correspondingly, the approach to VET needs to change fundamentally so that skilled construction workers are valued, their training taken seriously and the importance of LEC knowledge appreciated. Interviewees agreed that without appropriately equipped workers, NZEB legislation, though perfect on paper, could not become a reality.

6 Since our visit, plans have been put in place to accredit FES by City and Guilds and deliver more widely under the leadership of ETBs. The first set of courses are expected to commence in Autumn 2018.

## NZEB implementation

The Irish construction sector was severely affected by the recession, with construction output and the number of workers and trainees dropping drastically. The implementation of NZEB in Ireland is gaining speed as the deadlines approach, particularly with the government's drive to stimulate the industry through investment in refurbishment and new building programmes in order to address the housing shortage and widespread fuel poverty, This investment is expected to create jobs and increase demand for LEC-trained workers There are serious barriers, however, to the participation of SIPTU, the sector trade union, in the energy efficiency agenda in terms of influencing policy, training development and responding to employment effects because there are no formal platforms to facilitate social dialogue.

## Low energy building example

The low energy scheme visited is a 12-unit passive house social housing development already occupied by tenants. The scheme was built by Michael Bennett (MB) & Sons Building Contractors, a medium size, local firm based in Wexford, which moved into 'green/ eco' construction gradually, starting with a single house in 2007 serving as a learning project for the company. The passive house trained company surveyor has been involved in all the Passive House certified projects: three single houses for private owners; another built without commission; followed by the 12-unit social housing scheme. The company seeks to build a 'basic passive house'; houses all meet passive house standards, are certified and built to the highest energy efficiency rating of A standard, yet they cost no more than traditional houses built for the council. The interviewees argued strongly that the image of green construction as expensive needs to be countered; savings can be made on wood, joinery, kitchens, doors, bathrooms and chimneys without compromising the passive house energy efficiency standard. They had used locally sourced timber frames and the houses are fitted with heat recovery and mechanical ventilation units.

The work was completed by local sub-contractors, with whom the company has a long-standing relationship and who were introduced to the principles of passive house construction and trained on site by the surveyor as there was no external training available. Particular attention was paid to communication with sub-contractors and prior planning of the works, including co-ordination between occupations. High quality training combining theory and hands-on practice for all workers and sub-contractors are seen as essential to achieving high energy efficiency standards. The company reported a lack of training opportunities and very low levels of awareness of green construction among the workforce, apart from small numbers involved in the niche but growing number of passive house projects. Nevertheless, with NZEB legislation coming into effect, the green construction market is expected to grow; the company has been commissioned to build 52 NZEB compliant houses for a housing cooperative and is highly supportive of the development of the European NZEB Centre of Excellence in Wexford, one of only three such training centres in the world.

## Labour market context

The construction sector, still recovering from a deep recession, is dominated by micro-firms, self-employment and the use of agency workers mainly by large companies. Though posted workers are not common, a number of construction workers are from Eastern Europe; some also join the union. Interviewees suggested that plans to regulate the construction industry through a register of companies and training requirements for workers would counter the current culture where qualifications and training are not valued in the labour market.

## Conclusions

VET for LEC provision for building operatives was initiated through involvement in the Build Up Skills project and wider provision is expected to gain speed with the government's increasing support for NZEB, also evidenced by the investment in the NZEB Centre of Excellence. Currently, contractors in the small LEC market rely on in-house training. Low levels of general education, lack of interest in and funding for further training for the existing workforce, many of whom are self-employed, the impact of recession on the demand for training and for energy efficient housing are seen as barriers to implementing NZEB. It is suggested that the transition calls for a fundamental shift in understanding of the roles of skilled construction workers and VET, as well as a culture change in the industry to prioritise the quality and the precision that LEC requires.

# ITALY[1]

## Construction Industry

The Construction industry contributed 6.2% of GDP in 2015, representing an increase from 4.3% in 2013, but nevertheless a decrease from 9.5% before the recession started in 2008. The recession had a dramatic impact. Between 2008 and 2016, the sector lost half its direct employees, production decreased by 41.5%, turnover by 35%, and employment by 25%. Signs of recovery are observable since the second half of 2015, after four years of a decrease in employee numbers. There has been a reduction in bankruptcies and an upturn due to tax incentive measures for building restoration and energy upgrading initiatives. The energy efficient renovation sector is booming thanks to Eco Bonus and Renovation Bonus. However, the situation remains critical. During the recession, installation work fared better than traditional construction activities. Wood construction has also been growing steadily since 2010. The construction sector includes the restoration of historical buildings and employed 1,163,255 direct employees between 2011 and 2016. In 2012, undeclared work was estimated to be 16% (compared to the average of 14.9% for all economic sectors). In 2016, inspections revealed that undeclared employment relations had increased, with irregularities found in 64% of cases investigated.

The construction sector is very fragmented with one of the highest number of small and medium size firms in Europe. The number of companies has decreased since 2008 (629,791) and was down to 529,103 in 2015, a drop of 16%. The recession had a bigger impact on companies that employed fewer than 50 workers. According to 2012 data, the great majority had 9 or fewer employees (96%) and nearly 4% had 10-49 employees. The average number of employees in firms is 2.7, which is the lowest in Europe. The share of *self-employment* increased from 36.6% of the sector to 43%.

## Construction workforce

According to 2015 statistics, the broad construction sector employed 1,444,700, down from 1,929,000 in 2008[2]. The sector accounts for 6.6% of all employment. According to 2017 FILLEA (the Italian Confederation of Labour) data, the number of workers in the narrow construction sector was 593,894. Within this, those with regular work and contracts numbered 508,162. There were also 16,875 apprentices and the remainder were white-collar office workers (67,723) and managers (1,134). The characteristics of the workforce are:

- *Gender (2016-17):* Male employment accounts for more than 90% of the total. In archaeology and restoration, women make up 20% of the workforce.
- *Migrant workers (2016-17)* tend to be employed at the lower levels of the occupational hierarchy and make up 30% of the workforce. This includes workers who are not Italian, but could be long-term resident, have irregular residence/employment status, or be posted.
- *Age (2016-17):* The average age of construction workers is 40, and an estimated 60% are over the age of 40. Migrant workers tend to be younger, 35 years old on average.

## Vocational Education and Training (VET) system

VET in Italy is characterised by multi-level governance and involves national, regional and local stakeholders. Ministries of Labour and Education define the general framework and policies. Regions and autonomous provinces are in charge of providing VET and apprenticeship schemes. Regions exercise their duties also by delegating and transferring functions and tasks to the Provinces (Local Authorities). The State remains responsible for setting minimum standards for training programmes. The Regions have the following

1 Not able to provide data on NACE activity categories, LEC related occupations, number of workers by occupation, casual employment or skill shortages.
2 Data from Eurostat 2016. Refers to the broad 'building' sector and includes all related occupations such as architects, plant engineers, metal workers, the self-employed and irregular workers.

responsibilities: the regulation of training profiles for apprenticeships, the local regulations governing VET, continuing VET (CVET) and access to the trade, the disbursal of loans to trainees. Some regions introduced specific laws governing apprenticeships, but not all. Social partners have a general advisory role on VET at all levels, in particular shaping and regulating professional apprenticeships. They also provide CVET, and promote company-level training programmes. In the construction sector, VET takes place through the building school system, which is financed with contributions deriving from the sector and managed on a paritarian basis by the sectoral social partners. FORMEDIL is the national joint body that coordinates the local building schools and has branches in different regions.

There is a national VET system for the construction industry with national standards, which the regions can in turn expand on according to the needs of the territory and must also comply with. The structure of qualifications and VET provision vary by region and there is no mechanism for mutual recognition. Currently the national qualifications framework and the attribution of EQF levels are applied at national level (with national and regional technical tables related to sector contributions). VET organisations are accredited by the Regions and the main criteria are administrative and logistical, not related to the standards of professional competence of training practitioners. There is no evaluation of training content or the resulting level of learning.

The performance of VET is varied in terms of effectiveness. Training providers are more closely regulated with the requirement to provide training in clearly defined path and at levels aligned to EQF. Upper secondary level VET includes: five-year programmes in technical schools and vocational schools that combine general and vocational education and lead to EQF Level 4 and 5 qualifications with access to higher education; four-year modular vocational training programmes organized by the regions, or education and training courses that include work learning and lead to qualifications at EQF levels 3 and 4; and four-year apprenticeship programmes.

*Continuing vocational education and training (CVET)* falls within the competence of regional authorities and private institutions and also includes higher education and technical training courses, non-academic training in strategic professional areas leading to EQF level 5 qualifications. Other courses of the regional authorities are targeted at those who are unemployed, migrants and disabled. VET for adults is offered by public and private providers and includes VET qualifications at upper secondary level to encourage re-entry into education. The social partners manage CVET that meets sectoral and regional needs and is supported by bilateral inter-professional funds (social partners)

## Italian Build Up Skills – LEC training needs

The Build UP Skills Status Quo Analysis estimated that nearly 100,000 workers would need to be trained in LEC-related competencies for EU2020 targets to be met. The report stated that the significant barriers to completing this challenging task are: no national system for qualification and accreditation at the time (though this is an ongoing process in relation to the national qualifications framework, aligning it with regional qualification systems and the EQF); lack of investment in training by private companies; and fragmented public VET system (national and regional). Recommendations include: development of new educational content and training materials; training of trainers by utilising e-learning technology and strengthening their career paths; setting up a system of certification of competences gained in informal or on the job training; establishing a national register of qualified trainers. The recommended measures aim to train operators in the sector by providing them with cross-cutting and 'transversal' skills bordering the various areas of professionalization.

## VET for LEC developments

In line with decentralisation of powers and functions, the Regions are responsible for VET for LEC development. All regions are reported to provide courses related to energy efficiency and renewable energy, developed and accredited according to regional qualification frameworks, though it is difficult to obtain detailed information about these. FORMEDIL, the social paritarian organisation responsible for training in the construction sector, trains the majority of construction workers and runs some LEC courses (e.g. in RES installations). Further information about these courses is not available. An introductory course for operatives was developed by FORMEDIL through I-Town, the Build Up Skills Pillar II project, targeting building operators, thermos-hydraulic operators, electricity operators, electronics operators, wood operators, teachers and other construction professionals. The training programme is modular and the training materials are publicly available. As a result of the positive experience in the I-Town project, FORMEDIL intends to propose to the social partners to make this training activity mandatory. The BRICKS project constructed five occupational profiles associated with LEC, for use by VET educators. However, problems with both CVET needs and provision have been identified. Irregular (undeclared) work makes CVET problematic in many situations. There is a lack of policy at national level and, in particular, the needs of small companies are not attended to. CVET needs to remedy: poor teamwork and co-ordination, lack of a 'big picture'

perspective, and lack of specific skills connected with LEC. Generally, however, the picture is fragmentary and uncoordinated.

## Initiatives related to VET for LEC

*I-Town*[3] *(2014-2017)* aimed to establish or upgrade training for skilled and other on-site workers in energy efficiency and renewable energy in buildings. The project involved a survey of building workers and established a lack of energy efficiency-related competences and also a lack of awareness of LEC. During the course of the project, through several training schemes, over 240 workers were trained and over 4,000 were reached through Youtube video lessons. Training developed for trainers also utilised e-learning platforms and 82 trainers participated in seminars and workshops. The objective is to achieve nationally recognised certification of the competences acquired and to ensure the long-term sustainability of the training developed. A large survey of construction workers conducted found lack of awareness of the importance of LEC competences. The cost of VET, for both workers and companies, was identified as a barrier to increasing participation[4].

*BRICKS (2014-2017) (Building Refurbishment with Increased Competence, Knowledge and Skills)* sought to help national VET systems to increase the knowledge, skills and competences of workers in the field of building refurbishment. The project engaged all regions, which began to update profiles to take into account EE related competences. A system has been developed to certify non-formal and informal learning, in alignment with the EQF. Guidelines for Assisted Training on the Job have been devised for three professional profiles: building automation, building envelope and geothermal pump installers. National standards and qualification profiles are being developed for occupations relevant to RES and a BRICKS label introduced to certify companies whose employees are qualified through the scheme. CVET barriers are: lack of job market recognition of the training undertaken and the associated costs[5].

*BROAD (2015-2017),* an EU funded project led by FILLEA CGIL (Federation of Wood, Building and Allied Industry Workers) of Italy, sought to develop social dialogue in the construction sector to support the green transformation of the European construction industry. The project involved a review of the development of green building in the partner countries of Italy, Poland, Spain, Belgium and Germany, focussed

3 http://www.bus-itown.eu/home

4 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-i-town

5 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-bricks

ITALY – NZEB definition

| OFFICIAL STATUS | In official document |
|---|---|
| RESIDENTIAL/NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | ✔ |
| APARTMENT BLOCKS | ✔ |
| OFFICES | ✔ |
| EDUCATIONAL BUILDINGS | ✔ |
| HOSPITALS | ✔ |
| HOTELS/RESTAURANTS | ✔ |
| SPORT FACILITIES | ✔ |
| WHOLESALE AND RETAIL | ✔ |
| BUILDING TYPOLOGY | New/retrofit |
| BUILDING CLASS | Private/public |
| BALANCE | E import/E export |
| PHYSICAL BOUNDARY | Building unit |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | ✖ |
| CENTRAL SERVICES | ✔ |
| ELECTRIC VEHICLES | ✖ |
| EMBODIED ENERGY | ✖ |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | ✔ |
| CREDITING | ✖ |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

ITALY – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| Class A1 | Class A1 | Class A1 | Class A1 | Energy requirements to be calculated; minimum requirements provided as U values divided per climatic zones. Lighting is included in nonresidential buildings. |

ITALY – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| The maximum U-values required to be lowered by 15% compared to their current value from 1 January 2016. A similar improvement will apply to the minimum performance of heating and conditioning systems. The obligation to include RES in new buildings and major renovations is equal to 20% of total consumption for heating, cooling and hot water. This latter share to be increased to 35% from the beginning of 2014 and to 50% from the beginning of 2017. | New obligations are to come into force from October 1st, 2015 for new and existing buildings. It is believed that on the basis of the current share of 1.6% of new buildings, 20% can be ranked as NZEB. | Verification of the requirements for nearly zero-energy buildings is planned to be applied starting from 2018. | As other new buildings | As other new buildings | n/a |

on similarities and divergences in regulatory aspects, policies, and economic and construction sector employment contexts and industrial relations experiences. It developed suggestions and recommendations for strengthening the role of social dialogue in the transition to a low-carbon economy[6].

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Italy's NZEB definition has been included in an official document. In its definition, Italy defines NZEB for both residential and non-residential buildings and includes eight specific subcategories: single family houses, apartment blocks, offices, educational buildings, hospitals, hotels and restaurants, sport facilities, and wholesale and retail (ibid: 16: Table 4). In terms of building typology, classification, balance type, and physical boundary, Italy refers to new buildings and renovations, private and public buildings, energy import versus energy export, and building unit respectively (ibid: 17-18: Figure 3). Italy's definition includes five types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; lighting; and central services (ibid: 18-19: Table 5). With regard to the specification of generation boundaries, Italy's definition considers on-site, off-site, and external generation. Crediting has not been considered (ibid: 20-21: Table 6).

The numeric indicators of energy performance above, expressed as primary energy (kWh/m²/y) have been specified in Italy's definition (EC, 2016a: 23-26, Table 7).

## Intermediate targets

Italy has set the intermediate targets above for all new buildings and all new buildings occupied and owned by public authorities.

6 http://www.broadproject.eu/

There is no single NZEB definition for Italy due to its widely ranging climatic zones where appropriate LEC design and renewable technologies varies for low energy thermal comfort. Geographically, insulation requirements vary from minimal (where mild-to-warm) through to maximum for cold winters in the north. For the hot south, low energy envelope design is based traditionally on heavyweight construction with exposed thermal mass. Similarly, the energy efficiency of renewable technologies such as heat pumps will vary depending whether predominantly operating for heating or cooling.

CASE STUDY 3: Porta Palazzo
http://www.luoghicomuni.org/portapalazzo/sites/default/files/file-allegati-articoli/LCPP_SCHEDA PROGETTO.pdf

## Case studies

The case studies, RCA RosAsetone, Teatro 1 and Porta Palazzo are taken from the COSTRUIRE IL FUTURO Report; pages 52, 59 and 63 respectively: https://greenhubblog.files.wordpress.com/2016/02/16206_rapporto-oise-20151.pdf. The following observations complement, and should be read in conjunction with, the information contained in the National Report.

The case studies represent LEC for the colder regions of the Italian north. There is insufficient technical information to check whether they meet the specifics of regional NZEB requirements expressed in primary energy units or cost-effective criteria, although case study 2, Teatro 1, meets Casaclima A+ classification for Udine based on 2003 EPBD compliance and is therefore highly energy efficient.

CASE STUDY 1 is an ARCA timber frame house (ARchitettura Comfort Ambiente) designed for earthquake resilience with a low energy specification. No description of the regional energy/NZEB standard has been identified, although there is reference to triple glazed windows, 16 cm of insulation, a heat pump, solar thermal, 6 kW of photovoltaics (a very big installation) and described by the architect as: 'an almost passive building, able to produce the energy it consumes' (http://www.luoghicomuni.org/portapalazzo/sites/default/files/file-allegati-articoli/LCPP_SCHEDA PROGETTO.pdf). Under these circumstances, it is certain it would meet NZEB primary energy requirements although perhaps not cost-effective criteria. ARCA New Construction Technical Regulations require certified detailed drawings and on-site quality assurance procedures and therefore reflect the Passivhaus approach. Bureau Veritas has verified the development process of the project.

CASE STUDY 2 is mass concrete block for retail and residential apartments with an energy classification of Casaclima A+ also known as a '3 litre house' equal to about 30 kWh/m²/y for heating and ventilation only (based on consumption of 3 litres of heating oil per m² per year with a calorific value of about 10 kWh/litre). This annual consumption is greater than the Passivhaus end-use maximum of 15 kWh/m²/y. Casaclima is classified as gold, A+ or B and ranges from 10 to 50 kWh/m²/y (1 to 5 litres). Casaclima certification requires detailed drawings and on-site quality assurance procedures, reflecting the Passivhaus approach. Casaclima may be compared to other low energy standards applied in the Alpine region: http://enerbuild.eu/publications/ENERBUILD-overview-certification-systems.pdf

For a detailed description of an Italian 2 litre house see: http://www.pvcconstruct.org/upload/documents/ 17-06-2011_Vinyl2010_Housing_PassiveHouse_Brochure.pdf. Alternatively, for the German 'Luwoge BASF' 3 litre

design see: http://www.energyefficiency.basf.com/ecp1/EnergyEfficiency/de/function/conversions:/publish/upload/pdf/3lh_e.pdf

CASE STUDY 3 Luoghicomuni Porta Palazzo, is a social housing residential block retrofitted with photovoltaics, solar thermal, insulation from natural materials 'ecolabel' recycled composites for bathrooms and utility rooms. No details are given for its energy performance. However, the architect, Matteo Fagnoni, provides a detailed description of the retrofit in Italian: http://www.luoghicomuni.org/portapalazzo/sites/default/files/file-allegati-articoli/LCPP_SCHEDAPROGETTO.pdf. The description refers to low-emissivity glazing, a condensing boiler and under-floor heating, solar thermal and photovoltaics, indicating that the building reflects the retrofit standards for EPBD compliance.

## VET for LEC visit to Italy: Summary Report

The visit to Italy took place on 17-18 October 2017 and involved interviews at:

- FILLEA/CGIL, the Italian Confederation of Labour
- FORMEDIL *(Ente per la Formazione e l'addestramento profesionale nell'edilizia)*, the national training body.
- CEFME CTP *(Organismo paritetico per la formazione e la sicurezza in edilizia di Roma e provincial)* training centre

## VET for LEC development

The provision of VET for LEC replicates the regional structuring of VET in Italy, whereby different regional authorities autonomously develop and deliver courses that are accredited according to Regional Qualification Frameworks. Currently, a National Qualifications Framework aligned with the EQF is being developed. Interviewees suggested that LEC training at both IVET and CVET levels is available in all regions though there is no centralised source of information about the type and content of courses. It was also suggested that manufacturers of energy efficient products, such as insulatio,n run short, practical courses.

FORMEDIL, the national training body jointly run by the social partners and funded by *Cassa Edile,* the social fund, has branches in every city and a total of 104 training centres. It provides initial VET, apprenticeships, CVET courses/refresher training, whilst also responding to regional demand and providing the mandatory health and safety training. FORMEDIL led the Build Up Skills Pillar II project I-Town, involving two elements: Train the Trainers, which sought to provide training for teachers; and an introduction to energy efficiency for traditional construction occupations, including bricklayers, carpenters and ironworkers. Both courses were received in the sector with enthusiasm and delivered successfully. FORMEDIL and the trade unions, CGIL, CSIL and UIL, have now called for 16-hour-long energy efficiency training to be included in National Collective Agreements. If successful, this would constitute the first step in developing uniform, short training in LEC for the existing workforce, which could be made available across Italy. The training is organised separately for building services occupations. Training in renewable energy sources is developed by ENEA (The National Agency for New Technologies, Energy and Sustainable Economic Development) and for electricians by ENAIP (Network of Services for Training and Work) and ASSISTAL (Nazionale Costruttori di Impianti).

## CEFME-CTP

CEFME-CTP is a FORMEDIL training centre with a long history of engagement with LEC and providing an example of locally organised and delivered training. It was formed in 2012 by the merger of two separate training centres, CEFME and CTP, following a drastic drop in employer contributions during the recession that began in 2008. The number of students also dropped with course closures and increasing specialisation. CEFME trains all construction occupations including plumbers and electricians. It also runs several courses in restoration and training for refugees and the unemployed, as well as providing health and safety training.

LEC training is provided for all occupations, with energy efficiency topics included in the curriculum. For example, bricklaying covers insulation, whilst training for electricians covers solar panel installation and building automation. The Centre itself has had solar panels installed since 2004, which serve as teaching tools and also save on electricity bills. An area of the garden is dedicated to experimenting with biomass. Currently, the Centre is also collaborating with the University of Sapienza in its bid for the Solar Decathlon Europe, involving the construction of an energy efficient house on the grounds of the training centre, which would be tested over a period of several months before being dismantled and then reassembled in Dubai for the final exhibition. In line with FILLEA-CGIL'S LEC strategy, the Centre has also been proactive in using more natural materials, such as hemp-based insulation and hemp-lime mixture as a cement replacement, and in developing techniques or reviving traditional methods to find solutions suited to historical

buildings, such as silicon-based insulation that can provide an alternative to standard cladding, being sprayed onto walls without obstructing the historical and aesthetic features of the building.

## NZEB implementation

NZEB is implemented by regional authorities, although Italy is now in the process of developing nationally uniform building regulations. As social partnership in Italy is limited, trade unions' influence on this process is indirect, through their participation in national and European networks and alliances as well as their position in regional and national governance structures. FILLEA/CGIL is involved in VET for LEC development through its role in FORMEDIL and is, along with other construction unions in Italy (FILCA-CISL and FENEAL-UIL), part of *Legambiante*, a broad network also including professional associations and environmental organisations. FILLEA takes an active part in environmental protection and climate change action, arguing for controls on speculative construction, radical reductions in the use of cement, and its eventual replacement by low emission and environmentally friendly materials such as hemp. The union was involved in a recent European project, BROAD, which aimed to develop social dialogue in green construction and put forward recommendations based on a detailed and informed analysis of the implications of the transition to sustainable construction for the sector.

## Labour market

The construction labour market is characterised by high levels of unregistered employment and micro firms. The sector is still recovering from the 2008 crash and was described by interviewees as "at a standstill". There are increasing numbers of migrant workers, some of whom are highly educated but lack Italian language skills and may have residency or work permit applications in process, so may be unable to take part in further training.

## Conclusions

The regional structure of governance in Italy defines the character of VET for LEC developments. VET is regionally organised, as is training in LEC, both initial and continuing. It is therefore difficult, if not impossible, to obtain detailed information about VET for LEC provision in Italy. The training centre visited suggests that pockets of specialised LEC training exist and FORMEDIL anyway provides a more connected structure of VET institutions that can facilitate the delivery of co-ordinated/homogenous LEC training. The development of a nationally co-ordinated IVET system and LEC curriculum requires close collaboration between regional authorities. The development of a national qualifications framework is a step in this direction. The energy efficient renovation of historical buildings is a major issue for retrofitting in Italy as any measures implemented need to ensure that the aesthetic features of the building are conserved.

Hemp and lime-based blockwork at CEFME-CTP training centre


Hemp and lime based green building component, experimented with in CEFME-CTP training centre

Photos: Linda Clarke/Melahat Sahin-Dikmen

# POLAND

## Construction Industry

The Construction industry generated 6.1% of GDP in 2016, a figure that has fluctuated in the last 10 years between 6% and 8%. The value of the market is €26 billion. Non-residential construction represents 43% of the value of construction works, engineering 33% and residential construction 24%. The estimated rate of undeclared work is very high. Construction companies number approximately 480,000 (2015), though this changes constantly as micro companies are not sustainable for long periods. Nearly 98% of companies employ fewer than nine people, only 1,300 employ over 49,200 over 250. There are no more than 10-12 companies able to coordinate the execution of large contracts.

## Construction workforce

According to 2016 figures, the construction sector employs 853,000 people, including 630,000 employed 'on the basis of an employment contract'. The characteristics of the workforce are:

- *Gender:* About 9% are women, found mostly in administration, finance, HR and middle and higher supervision positions. 88,700 workers are employed in finishing works[1].
- *Migrants:* There are 260,000 migrant workers, 98% of whom are from Ukraine. They are legally employed, usually on the basis of an employment contract. Ukrainians include highly qualified workers, but their qualifications are not recognised in Poland.
- *Skill shortages:* There is a chronic shortage of workers and 10,000 specialists are needed, a figure considered to be an underestimate. Around 200,000 Polish construction workers work in other European Union countries where wages are much higher and employment more stable. During periods of high activity, around 150,000 additional workers – both skilled and unskilled, Polish and Ukrainian – work in the industry with no regular employment relationship.
- *Qualification levels:* Those with qualifications acquired in vocational schools hold only an estimated 30% of jobs requiring Level 3 and 4 qualifications.

## Vocational Education and Training (VET) system

*Initial Vocational Education and Training (IVET)* is the responsibility of the Ministry of National Education, which sets out the policy. Other ministries are responsible for specific occupations in their field. The management and administration of VET operates at three levels: national (ministries), regional and district authorities. Social partners can be invited to give their opinion on planned changes but their involvement is limited. In 2017, the Sectoral Council for Competence in the Construction Industry, operational since 2017, represented 26 institutions including employer organisations and the trade union *Budowlani* and is expected to enhance joint working and develop a framework for improving VET in the sector as well as contribute to policy formation. The council led the development of a Sectoral Qualifications Framework (SQF) in Construction, focused mainly at level 4 and above, and aimed to strengthen project management and supervisory capacity in a way suitable for LEC. Currently this framework, developed by the social partners, awaits government recognition

Formal VET is provided at upper-secondary and post-secondary non-tertiary levels and is mainly school based, combining general and vocational education. There is a very small dual-apprenticeship stream. In 2016, only 2,085 graduates from vocational schools entered the industry. VET is not popular because it is a relatively long, theory based education with little financial returns (pay is low in the industry and no better for those with qualifications compared to those

1 Detailed data on all construction occupations are not available. A 2014 survey provides data on 'construction and related workers', which exclude electricians, and cover those involved in 'raw state works' and 'finishing'.

without), and employers, in turn, claim that VET schools do not prepare students for the construction site. There is permeability between pathways (VET and general education). VET schools have some autonomy to choose one of two optional curricula; a subject oriented or a modular one. A register of occupations classifies and defines separate qualifications for every occupation at upper secondary and post-secondary level. There is a need to increase employer engagement in organising practical training in VET. Since 2016, the VET system has undergone structural changes. Two different types of VET schools are being created: a two-stage industry school of 2/3 years and a five-year technical college. The number of EQF Level 3 and Level 4 qualifications will be limited and more higher level qualifications created. The small dual apprenticeship element will also be developed, to be provided by the Polish Craft Association.

*CVET* provision is fragmented and limited. Poland has one of the lowest rates of adult lifelong learning in the EU. IVET schools now also offer courses to adults. Other options include occupational skills courses for specific learning outcomes or courses organised in cooperation with labour offices. Introduced in 2015, the Integrated Qualifications System (IQS) enables the recognition of all types of learning, provided these non-formal courses meet the criteria in the Polish Qualifications Framework.

## Polish Build Up Skills – LEC training needs

The Build Up Skills Status Quo Analysis (SQA) estimated that over 60,000 workers need to be trained by 2018, 20,000 in energy efficiency and 43,400 in RES. There are some significant barriers to achieving these targets. Following the closure of vocational schools in the 1990s, the existing provision of vocational education provided in general profile schools is too fragmented to amount to a national VET system. In terms of content, the courses on offer and the materials used are out of date. Schools do not have the resources to keep up with developments in EE and RES. There is limited cooperation between schools and businesses with insufficient internship/practical placement opportunities. Further education opportunities are limited and the existing courses are not standardised. Short courses are popular with employers and employees, but these are difficult to monitor. The Roadmap recommends that quality standards should be introduced for the entire VET system that should be more interdisciplinary, include more practical training, and be better financed so that training in EE and RES can be developed or acquired abroad. Training of teachers should also be improved. These VET-related measures need to be supported by broader economic and institutional measures such as setting up a national registry of qualified workers and companies and systems for monitoring skills needs and quality standards, as well as institutionalising the enforcement of NZEB implementation.

## VET for LEC developments

The national report advises that two low energy related qualifications are currently available in Poland in the formal education pathway: Installation of Equipment and Systems for Renewable Energy; and Operation of Equipment and Systems of Renewable Energy Sources (EQF Level 3). The core curricula, introduced in 2012 and intended to be strengthened in the re-structured VET, take into account energy efficiency for bricklayers, plasterers, insulation fitters, metal workers, construction technicians, drywall system installers and chimney sweeps. The SQF in Construction under development will define qualifications related to energy efficiency in buildings, at Levels 2-8. There are short, further education courses that are popular with employers and employees, but these are difficult to monitor. Courses provided by other organisations can enter into the Integrated Qualifications System (IQS), provided they meet the criteria set out in the IQS Act. Examples include: Certified Passive House Construction Master, Installer of Insulation Systems, Modern technologies in Building Industry and Execution of External Wall Insulation. Not all courses by private companies will be eligible, for example, courses by manufacturers of construction products. Courses defined by the SQF will enter onto IQS, resulting in a more unified and transferable qualifications framework.

POLAND – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | In official document |
| RESIDENTIAL/NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | ✔ |
| APARTMENT BLOCKS | ✔ |
| OFFICES | ✔ |
| EDUCATIONAL BUILDINGS | ✔ |
| HOSPITALS | ✔ |
| HOTELS/RESTAURANTS | ✔ |
| SPORT FACILITIES | ✔ |
| WHOLESALE AND RETAIL | ✔ |
| BUILDING TYPOLOGY | New/retrofit |
| BUILDING CLASS | Private/public |
| BALANCE | - |
| PHYSICAL BOUNDARY | Building unit |
| HEATING DHW | ✔ |
| VENT, COOL, A/C | ✔ |
| AUXILIARY ENERGY | ✔ |
| LIGHTING | ✔ |
| PLUGS, IT, APPLIANCES | - |
| CENTRAL SERVICES | - |
| ELECTRIC VEHICLES | - |
| EMBODIED ENERGY | - |
| ON-SITE RES | ✔ |
| OFF-SITE RES | ✔ |
| EXTERNAL GENERATION | ✔ |
| CREDITING | - |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

## Initiatives related to VET for LEC

*BROAD (2015-2017)* is an EU funded project in which Poland participated. The project was led by FILLEA CGIL (Federation of Wood, Building and Allied Industry Workers) of Italy, which sought to develop social dialogue in the construction sector with a view to supporting the green transformation of the construction industry in Italy and Europe as a whole. The project involved a review of the development of green building in the partner countries of Italy, Poland, Spain, Belgium and Germany with a focus on similarities and divergences in regulatory aspects, policies and economic and construction sector employment contexts and industrial relations experiences. It also developed suggestions and recommendations for strengthening the role of social dialogue in the transition to a low-carbon economy.

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Poland's NZEB definition has been included in an official document.

In its definition, Poland defines NZEB for both residential and non-residential buildings and includes eight specific subcategories: single family houses, apartment blocks, offices, educational buildings, hospitals, hotels and restaurants, sport facilities, and wholesale and retail (ibid: 16: Table 4).

In terms of building typology, classification, balance type, and physical boundary, Poland refers to new buildings and renovations, private and public buildings, (does not specify), and building unit respectively (ibid: 17-18: Figure 3).

Poland's definition includes four types of energy use: heating DHW; ventilation, cooling and A/C; auxiliary energy; and lighting (ibid: 18-19: Table 5).

With regard to the specification of generation boundaries, Poland's definition considers on-site, off-site, and external generation. Crediting has not been considered (ibid: 20-21: Table 6).

The numeric indicators of energy performance below, expressed as primary energy (kWh/m²/y) have been specified in Poland's definition (EC, 2016a: 23-26, Table 7).

POLAND – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| 65-75 | n/a | 45-70-190 | n/a | Depending on building type. |

POLAND – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| On 1st of January 2017 the technical requirements (Uvalues) and the requirements related to primary energy demand (by building category) to be increased (e.g. to 85-95 kWh/m²/y for residential buildings). Intermediate targets are specified by dates. | n/a | Reference: Ministry of Infrastructure Ordinance of 12 April 2002. It did not lead to any official register concerning the number of NZEB. | At 1st of January 2017 the technical requirements (Uvalues) and the requirements on primary energy demand (by building category) to be increased (e.g. to 60-290 kWh/m²/y for public buildings) | n/a | As other new buildings |

## Intermediate targets

Poland has set the intermediate targets above for all new buildings, and all new buildings occupied and owned by public authorities.

## Case studies

The two Polish case studies are both non-residential, a school and an office block with ground floor retail. The following observations complement, and should be read in conjunction with, the information contained in the National Report. The report does not provide a definition for NZEB nor the primary energy performance but both case studies exhibit aspects of design expected of NZEB.

FOR CASE STUDY 1, Akademia High School, there are architect's photographs and reference to LEED Platinum. However, the High School does not appear in the LEED (Leadership in Energy and Environmental Design) database. The only reference to LEED that can be found is: 'The intention was also to obtain the highest level of certification in the LEED certification system': https://www.archdaily.com/889061/akademeia-high-school-in-warsaw-medusagroup-studio/.

CASE STUDY 2, Dominikański project Wroclaw, listed as Gold in the LEED database: https://www.usgbc.org/projects/skanska-office-dominikanski

Its LEED scores for 'Energy & Atmosphere' are shown below:

- Optimize energy performance – lighting power 0 / 5
- Optimize energy performance – lighting controls 0 / 3
- Optimize energy performance – HVAC 10 / 10
- Optimize energy performance – equipment and appliances 1 / 4
- Enhanced commissioning 5 / 5
- Measurement and verification 5 / 5
- Green power 0 / 5

The LEED scores show that the majority of 'Energy & Atmosphere' points were gained through a highly efficient HVAC system, enhanced commissioning and measurement/verification. The total score for 'Energy & Atmosphere' is just 57% of maximum points available. No information is available for fabric energy performance and no renewables (green power) were installed.

1000046233, Wroclaw, Wroclaw

# Skanska Office Dominikanski

## LEED ID+C: Commercial Interiors (v2009)

GOLD, AWARDED DEC 2016

### SUSTAINABLE SITES — AWARDED: 17 / 21

| | | |
|---|---|---|
| SSc1 | Site selection | 5 / 5 |
| SSc2 | Development density and community connectivity | 6 / 6 |
| SSc3.1 | Alternative transportation - public transportation access | 6 / 6 |
| SSc3.2 | Alternative transportation - bicycle storage and changing rooms | 0 / 2 |
| SSc3.3 | Alternative transportation - parking availability | 0 / 2 |

### WATER EFFICIENCY — AWARDED: 8 / 11

| | | |
|---|---|---|
| WEp1 | Water use reduction | REQUIRED |
| WEc1 | Water use reduction | 8 / 11 |

### ENERGY & ATMOSPHERE — AWARDED: 21 / 37

| | | |
|---|---|---|
| EAp1 | Fundamental commissioning of building energy systems | REQUIRED |
| EAp2 | Minimum energy performance | REQUIRED |
| EAp3 | Fundamental refrigerant Mgmt | REQUIRED |
| EAc1.1 | Optimize energy performance - lighting power | 0 / 5 |
| EAc1.2 | Optimize energy performance - lighting controls | 0 / 3 |
| EAc1.3 | Optimize energy performance - HVAC | 10 / 10 |
| EAc1.4 | Optimize energy performance - equipment and appliances | 1 / 4 |
| EAc2 | Enhanced commissioning | 5 / 5 |
| EAc3 | Measurement and verification | 5 / 5 |
| EAc4 | Green power | 0 / 5 |

### MATERIAL & RESOURCES — AWARDED: 5 / 14

| | | |
|---|---|---|
| MRp1 | Storage and collection of recyclables | REQUIRED |
| MRc1.1 | Tenant space - long-term commitment | 1 / 1 |
| MRc1.2 | Building reuse - maintain interior nonstructural elements | 0 / 2 |
| MRc2 | Construction waste Mgmt | 2 / 2 |
| MRc3.1 | Materials reuse | 0 / 2 |
| MRc3.2 | Materials reuse - furniture and furnishings | 0 / 1 |
| MRc4 | Recycled content | 1 / 2 |
| MRc5 | Regional materials | 1 / 2 |
| MRc6 | Rapidly renewable materials | 0 / 1 |
| MRc7 | Certified wood | 0 / 1 |

### INDOOR ENVIRONMENTAL QUALITY — AWARDED: 8 / 25

| | | |
|---|---|---|
| EQp1 | Minimum IAQ performance | REQUIRED |
| EQp2 | Environmental Tobacco Smoke (ETS) control | REQUIRED |
| EQc1 | Outdoor air delivery monitoring | 1 / 1 |
| EQc2 | Increased ventilation | 1 / 1 |
| EQc3.1 | Construction IAQ Mgmt plan - during construction | 1 / 1 |
| EQc3.2 | Construction IAQ Mgmt plan - before occupancy | 0 / 1 |
| EQc4.1 | Low-emitting materials - adhesives and sealants | 1 / 1 |
| EQc4.2 | Low-emitting materials - paints and coatings | 1 / 1 |
| EQc4.3 | Low-emitting materials - flooring systems | 1 / 1 |
| EQc4.4 | Low-emitting materials - composite wood and agrifiber products | 0 / 1 |
| EQc4.5 | Low-emitting materials - systems furniture and seating | 0 / 1 |
| EQc5 | Indoor chemical and pollutant source control | 0 / 1 |
| EQc6.1 | Controllability of systems - lighting | 0 / 1 |
| EQc6.2 | Controllability of systems - thermal comfort | 0 / 1 |
| EQc7.1 | Thermal comfort - design | 1 / 1 |
| EQc7.2 | Thermal comfort - verification | 1 / 1 |
| EQc8.1 | Daylight and views - daylight | 0 / 2 |
| EQc8.2 | Daylight and views - views | 0 / 1 |
| EQpc123 | Designing with Nature, Biophilic Design for the Indoor Environment | REQUIRED |
| EQpc124 | Performance-based IAQ design and assessment | REQUIRED |

### INNOVATION — AWARDED: 3 / 6

| | | |
|---|---|---|
| IDc1 | Innovation in design | 2 / 5 |
| IDc2 | LEED Accredited Professional | 1 / 1 |

### REGIONAL PRIORITY — AWARDED: 4 / 4

| | | |
|---|---|---|
| EAc1.2 | Optimize energy performance - lighting controls | 0 / 1 |
| EAc1.3 | Optimize energy performance - HVAC | 1 / 1 |
| EAc2 | Enhanced commissioning | 1 / 1 |
| EAc3 | Measurement and verification | 1 / 1 |
| WEc1 | Water use reduction | 1 / 1 |

| TOTAL | 66 / 110 |
|---|---|

| 40-49 Points | 50-59 Points | 60-79 Points | 80+ Points |
|---|---|---|---|
| CERTIFIED | SILVER | GOLD | PLATINUM |

CASE STUDY 2: LEED Scores
Source: https://www.usgbc.org/projects/skanska-office-dominikanski

CASE STUDY 2: Dominikanski
Source: https://group.skanska.com/projects/140284/Dominikanski

## VET for LEC visit to Poland: Summary Report

The visit to Poland took place 29-31 January 2018, involving interviews at:

- Budowlani, construction trade union
- Gypsum Employers Association
- Skanska HQ in Warsaw
- Institute for Renewable Energy
- Siniat Training Centre, outside Warsaw


Partitioning and insulation in Siniat training centre

## VET for LEC developments

The construction trade union Budowlani, which has 11,000 members and also organises workers in wood, forests and in environmental activities, leads the Construction Sectoral Qualification Framework (SQF). This is a project in partnership with the construction employers' association and through government contract, aiming to establish an integrated qualification system, formal and non-formal together, and ultimately an (occupational) labour market. Construction SQF is being constructed by a body of 26 members, including the Chamber of Civil Engineers, teachers, and private trainers, under the supervision of the ministry. Though focused on curricular requirements at EQF 4+ and going up to level 8, the SQF will provide a template for curriculum design throughout construction, with LEC requirements also embedded in levels 2- 3. The government has the authority to establish formal pathways for qualifications (14-15 in construction) from EQF levels 3-5. On the agenda are also the training of LEC competences and retraining (CVET) experienced workers to become energy building auditors, advising homeowners and preparing funding applications.

## VET Schools and Training Centres

Public VET schools tend to be organised around sectors and oriented to the local market, with obligatory practical training. VET is over 3 years, including 1,248 hours tuition time and 40% practical, which can take place in workshops. Though there is a national curriculum, the choice of the kind of training depends on schools and thus VET is organised locally to fit local labour markets rather than through formal profiles. Whilst the quality profile for LEC is broadly supported, companies want to raise standards themselves and so set up training centres to handle the issue on a firm-specific basis. There are over 300 companies in the Polish association of training companies. Skanska, for instance, has a training team to train its own workers in what they are responsible for, though no certification is issued. Subcontractors are responsible for training their own workers and every new subcontractor is inducted on site. Material producers are also leading trainers, for example Siniat, the result of the merger between the cement giants, Lafarge and Holzim, which produces gypsum products. Its training centre provides users with knowledge of its products and is chiefly aimed at builders, who do not pay for the course (typically two days, one day theory and one day practice). Both employers and employees attend the courses and altogether 2,500 have been trained here and elsewhere, including 300 teachers from vocational schools. Typical occupations

include: installers, dry wall fitters, insulators, interior design and suspended ceiling fitters, architects, project managers, quantity surveyors. There is also training for Passivhaus builders.

## Labour market issues

There is good collaboration between the three unions involved in construction – Budowlani, Solidarnosc and Solidarnosc 80, which cooperate with employers and government in tripartite structures, though it is difficult to get legally binding collective agreements and easier to discuss non-binding wage arrangements related to qualifications and outside the labour code framework. There are 14 regional structures in Poland, but wage negotiations take place at company level for employers with more than 10 employees and there is a diminishing number of collective agreements. There are approximately 200,000 (25% of the total) migrants in the construction workforce, mainly from Ukraine. No more than 30% of all Polish construction workers have received formal IVET, though in large companies about 40% have formal qualifications. The majority of workers are nevertheless qualified, often through company-based qualifications. There is an unlimited range of subcontractors, but all large projects are carried out by non-Polish firms; the aim of the unions is to cap the subcontracting chain to no more than 5 levels. Poland also has a lot of companies and about 20-30 factories engaged in modular construction, but this is mainly an export market.

## NZEB implementation

There are various barriers to the implementation of LEC, including local regulations, legal constraints, financial and technical barriers, and lack of investment know-how and productive capacity. There is currently a very small domestic market and the government is not touching the problem. In 2012 a National Certification Scheme for installers was introduced and in 2015 the Renewable Energy Act incorporated this requirement and made provision to certify trainers and companies responsible for the organisation of training through a course of 1-2 weeks. There are now about 2,500 heat pump installers as well as certificates for photovoltaic, heat storage and solar collector installers. However, installers find it more difficult to find work than in the past as LEC is not popular, especially in housing, and there is a need to support local producers through government subsidies for housing.

Skanska, which has both a property and a construction arm in Poland and employs a Sustainability Manager, is currently building a new headquarters in Warsaw according to LEC principles. It was the first western construction company, taking over the former state construction company and now employing 6,000 workers in Poland, mainly engineers but also some site operatives though no apprentices. Skanska is one of the few organisations with a 'green agenda', seeking to analyse how building contributes to carbon emissions and carrying out airtightness testing of prefabricated components. Skanska recycles the asphalt it produces, reuses excavated soil and excess concrete on site or elsewhere, provides induction into LEC on site, recycles component waste, and employs a designated person responsible for health and safety and the environment. Skanska initiated LEED and BREEAM standards in Poland, all offices are LEED and residential buildings BREEAM certified, assessors are employed and detailed emission data collected. Skanska is adapting EPBD standards compliant to BIM and also provides BIM training, though it is difficult to get subcontractors to use.

Heat pumps are available for water and space heating and there is now 5Gw solar capacity, though the government subsidy to extend solar capacity was discontinued in 2017. In 2015, tariffs were introduced for electricity generated through renewable methods but the government is now promoting district heating schemes, as well as coal. In 2013 35,000 people were employed in renewable energy but now only 13-17,000 because there is no market for its products.

Skanska office

# SLOVENIA

## Construction Industry

The construction industry contributed 3.85% to GDP in 2015. The value of construction output has been increasing since 2014, except for civil engineering where there has been more fluctuation. The *black economy* is estimated to be about 10% of GDP, but estimates vary between Slovenian and European statistics, which suggests that the figure could be as high as 24%. In the *recession* between 2008 and 2013 about 34,000 jobs were lost, around a third of construction sector employment, with many workers leaving the sector and the country all together. Between 2010 and 2017, the value of construction output decreased by 33%. 'Building construction' dropped by nearly half, and 'civil engineering' by over 22%. There are signs of modest improvement. The number of workers increased by 6.4% from 2014 to 2015, profit in 'civil engineering' by 10% and in 'specialised construction activities' by 17%. The number of building permits is increasing. In 2016, 57% more buildings and 7% more dwellings were completed than in 2015.

According to 2015 statistics, there are 17,757 construction companies and sole entrepreneurs. The great majority (96.5%) are 'micro' companies that employ less than 10 workers[1] and hold 17% of the market share. Companies that employ up to 50 workers make up only 2.63% of the sector and the number employing over 100 workers is only 120 (1.62%) (p.5). Out of all construction companies, 58.9% are *sole entrepreneurs* with no paid employees. In terms of the distribution of construction companies across NACE[2] activity categories, 64% are in 'specialised construction activities', 29% in 'construction of buildings' and nearly 6% are in 'civil engineering'. Sole entrepreneurs are more likely to be found in 'specialised building activities'; 90% of companies in this sub-sector have no paid employees. In 'construction of buildings', the proportion of sole traders is just over 8%, and, in 'civil engineering', a negligible 1%.

## Construction workforce

In 2015, 54,314 workers were employed in all NACE F activity categories. On average, 18% of all workers are self-employed. The share of *self-employed workers* is highest in 'specialised construction activities' (25%), followed by 'construction of buildings' (7%) and lowest in 'civil engineering' (1%). The characteristics of the workforce are:

- *Migrant workers* make up 32% of the workforce, which dropped from 40% in 2008. Most are from outside the European Union (EU).
- *Women* make up about 9% of construction workforce; among Slovenians, this figure is 12%, while among 'foreigners' it is only 2%.
- *Qualification levels:* The majority of construction workers hold Upper Secondary school qualifications (72%) and a further 10% has higher qualifications. One fifth has lower or no qualifications[3].
- *Age profile:* Under 5% of the workforce are aged 15-24, and 84% are 25-49 years old. The remaining 11% are over 50[4].

General educational levels in the workforce are high, although not necessarily relevant to the sector or the occupation in which the worker is engaged.

## Vocational Education and Training (VET) system

The Ministry of Education, Science and Sport has the responsibility for preparing legislation, financing and adopting programmes, standards and qualifications. The Institute of the Republic of Slovenia for VET (IRSVET or slov. CPI) is responsible for implementation, monitoring and guiding the development of VET, providing teacher training and maintaining standards. It also acts as a link between ministries, schools and

1 Company size definition also includes, in addition to number of employees, income, asset value.
2 NACE is the Industry Standard classification used in Europe, Code F refers to construction.
3 Own calculation from raw numbers in Table 9, p.20 of original report.
4 Own calculation from raw numbers in Table 10, p.21 of original report.

social partners. Social partners are involved in the governance of VET and are represented on the consulting body for the Ministry; employers contribute to the preparation of 'open curricula' and the training of students.

*Initial Vocational Education and Training (IVET)* is school based. The main training programmes are:

- a technical upper secondary programme of 4 years, combining general and vocational education, and with the possibility to continue to higher education;
- a vocational upper secondary programme, 3 years, labour market oriented, with a school path that is only 20% with an employer or an apprenticeship path that is 50% or more with an employer, with the possibility to complete to technical education with a further 2 years study;
- short, lower grade, vocational upper secondary programmes of 2 years.

The transition from/to general and vocational education is facilitated. In 2017, a dual system of VET was introduced for a small selected range of occupations, which also included construction. The legislation increased the autonomy of schools and teachers over curricula and 20% of the national programme is defined in response to local and economic (employers') needs. Since 2006, changes have taken place in school curriculum planning, the school-company cooperation culture, and assessment approaches. There is increased emphasis on company-based training, and investment in company training centres has increased. Local companies cooperate with VET schools to establish intercompany training centres.

There are continuing vocational programmes (CVET) for adults within the formal education system and these are identical to the ones for young people. CVET is also provided by private companies, manufacturers, craft chambers and public institutions. The NVQ based system, in place since 2000, enables individuals to obtain formal recognition for on the job learning and existing competences. A substantial part of CVET training is competence-based training, leading to NVQs obtained through competence-based accreditation of prior experiential learning (APEL), presumably organised on a similar conceptual basis to the English NVQ.

## Slovenian Build Up Skills – LEC training needs

The Build Up Skills findings from the Status Quo Analysis (SQA) estimate that from 2012 to 2020 between 4810 and 5770 workers need to be trained each year in NZEB relevant competencies. The qualitative assessment of existing VET shows that this is very much theory based, with only a small practical component, and interdisciplinary thinking is lacking. Further training opportunities for those already in the sector are very limited and there are no systems for facilitating the accreditation of on-the-job learning, exacerbated by a weak life-long learning culture. Barriers to meeting the anticipated shortage of LEC trained workers include the general labour shortages in the construction sector and declining rates of VET participation, with the recruitment of young people presenting a particular challenge. The Roadmap recommends that the existing VET system should be reviewed to embed energy literacy and training in LEC for all occupations related to EE and RES, including in master crafts and foreperson examinations, supported by a system of accreditation and certification of informal learning. New educational programmes and professional standards are recommended to be developed for emerging occupations in new technology installations. A broad reform programme with sufficient funding should also be pursued to upgrade VET more generally and to bolster the training of teachers.

## VET for LEC developments

Although it is known that there are LEC skills shortages – including in green skills, social abilities such as planning and co-ordination, literacy, health and safety, and ICT – LEC training is not yet properly included in IVET programmes. The Build Up skills investigation identified a skills gap in meeting the EU2020 targets. However, due to lack of resources, it has not been possible to implement the recommendations for upgrading VET. There are short further education type courses in RES installations provided by manufacturers of building materials and other private companies. However, this is not regulated or continuous training. Slovenia was also a partner in EMILIE, a project that supported SMEs in developing capacity in the field of energy efficiency, involving technical workshops for introducing new technology on regional pilot sites. Currently national SRIP networks (Strategic Development and Innovation Partnerships) appear to be the triggers of LEC developments, including in construction[5].

5 For more on this topic, see: http://www.svrk.gov.si/delovna_podrocja/strategija_pametne_specializacije/strateska_razvojno_inovacijska_partnerstva_srip/ or http://www.mgrt.gov.si/si/sripi/

## Initiatives related to VET for LEC

- *Build Upon (2015-2017):* Slovenia participated in this Horizon 2020 funded project along with 12 Green Building Councils (GBCs), under the coordination of GBC Spain and support from the World Green Building Council. The project sought to create a collaborative community, establish innovative platforms for cross-sector partnership. Through 80 connected events, it aimed to help countries design and implement national renovation strategies.
- *EMILIE (2013-2015)* was funded by the Mediterranean transnational cooperation programme and aimed to support SMEs in developing their capacity for innovation in the field of energy efficiency. The project supported the development of a network and involved organising technical workshops for introducing new technology that is tested on six regional pilot sites. These pilot operations are still open for public SMEs and regional and local administrations in charge of managing public buildings and contracts for building construction and renovation[6]. On-line monitoring of built in installation performance is available for interested public.
- *Initiative to recruit more young people and girls into construction:* The Ministry of the Environment and Spatial Planning calls for sectoral initiatives and in 2017 construction VET schools were successful in their campaign in elementary schools. Private construction companies offer competitive stipends for young people through VET schools in the region and accessible through a competition. There are also state scholarships for different occupations in short supply in Slovenia. There is a call every year, inviting young people/future pupils to apply for the public scholarship stipend, which is 100 EUR per school month. For construction VET programmes in 2016/2017 there were 5 occupational profiles identified as in short supply and pupils enrolled in the respective programmes were eligible to apply for the stipend. There were some initiatives to attract girls into construction. *Day for girls* was a very successful project, planned to be repeated every year, encouraging girls into technical VET programmes. To attract school pupils, construction VET schools organise 'Technical days' twice per school year in different elementary schools across Slovenia where information about training and employment opportunities are presented, also using past pupils as role models.
- *Skillco (2016-2019):* The main goal of the *Sector Skills Alliance project* is to define and identify four (one of them green) existing and anticipated sectoral, technical skill needs and to elaborate and define learning units, with the use of ECVET principles, which could be integrated into formal VET programmes or used as training courses. The intention is, on the one hand, to integrate the learning unit outcomes elaborated within the framework of the project into the existing sectoral curricula, corresponding the 4th EQF level, and, on the other, to include them (where possible, due to the differences in the various education systems, and where required with specific adaptations) in the national occupation standards and regular VET programmes. These goals therefore constitute the first attempts to elaborate and implement comparable curricula in different countries, with the aim to foster trainees' and workers' mobility.

6 http://www.emilieproject.eu/eng/home.aspx

SLOVENIA – NZEB definition

| | |
|---|---|
| OFFICIAL STATUS | In official document |
| RESIDENTIAL/NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | |
| APARTMENT BLOCKS | |
| OFFICES | |
| EDUCATIONAL BUILDINGS | |
| HOSPITALS | |
| HOTELS/RESTAURANTS | |
| SPORT FACILITIES | |
| WHOLESALE AND RETAIL | |
| BUILDING TYPOLOGY | |
| BUILDING CLASS | |
| BALANCE | |
| PHYSICAL BOUNDARY | |
| HEATING DHW | |
| VENT, COOL, A/C | |
| AUXILIARY ENERGY | |
| LIGHTING | |
| PLUGS, IT, APPLIANCES | |
| CENTRAL SERVICES | |
| ELECTRIC VEHICLES | |
| EMBODIED ENERGY | |
| ON-SITE RES | |
| OFF-SITE RES | |
| EXTERNAL GENERATION | |
| CREDITING | |
| PRIMARY ENERGY INDICATOR (kWh/m²/y) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Slovenia's NZEB definition has been included in an official document.
In its definition, Slovenia defines NZEB for both residential and non-residential buildings but does not include specific subcategories.
With regard to the specification of generation boundaries in Slovenia's definition, information is classified/defined/limited for three different building types: one-storey buildings; multi-dwelling buildings; and non-residential buildings and activities (new building, major renovation (reconstruction), and RER (the share of renewable resources in terms of total energy input, as defined by REHVA).[7]
The Energy Act (EC-1) defined in Article 330 the requirement that all new buildings must be almost zero-energy. The term 'virtually zero-energy building' in this law means a building with very high energy efficiency or a very small amount of energy needed for operation, whereby the required energy is largely produced from renewable sources on site or in the vicinity. The transitional provisions in Article 542 provide that the provision of Article 330 of this Act shall apply on 31 December 2020. For new buildings owned by the Republic of Slovenia or self-governing local communities and used by public sector entities, Article 330 of the law applies from 31 December 2018[8].

The numeric indicators of energy performance below, expressed as primary energy (kWh/m²/y) are specified in Slovenia's definition (EC, 2016a: 23-26, Table 7).

## Intermediate targets

Slovenia has set the intermediate targets below for all new buildings and all new buildings occupied and owned by public authorities.

At the moment in Slovenia in the field of NZEB construction, wooden buildings are at the forefront, being the most numerous and also considered the most suitable among the experts and most of the investors. The national sectoral NZEB development is also driven by many innovative construction products and installations developed by the Slovenian building materials industry. Some of these also received innovation awards by the Chamber of Commerce and Industry of Slovenia (GOSPODARSKA ZBORNICA SLOVENIJE) on National Innovation Day.

7 For a detailed overview of NZEB requirements, see the table at: http://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/akcijski-nacrt-za-skoraj-nic-energijske-stavbe/

8 Source: SLO energy act in EN: http://www.energetika-portal.si/fileadmin/dokumenti/zakonodaja/energetika/ez-1/ez-1_energy_act_proposal.pdf

SLOVENIA – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| 75 (single family), 80 (multi-family) | 95 (single family), 90 (multifamily) | 55 | 65 | Per unit of conditioned surface, depending on the reference building. |

SLOVENIA – Intermediate targets

| ALL NEW BUILDINGS | | | ALL NEW BUILDINGS OCCUPIED AND OWNED BY PUBLIC AUTHORITIES | | |
|---|---|---|---|---|---|
| QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES | QUALITATIVE 2015 TARGET | QUANTITATIVE 2015 TARGET | NOTES |
| Heating energy demand < 25 kWh/m²/y; fraction of RES > 50%. | 480 single-family houses, 8 apartment blocks, 26 other nonresidential buildings. | n/a | For the public sector, the requirements are tightened by 10%. | 41 public buildings. | n/a |

Source: AKROPOLA

CASE STUDY: Eco Silver House, http://www.ee-highrise.eu/

## Case studies

The three case studies are a high rise building and two pre-fabricated houses. The following observations complement, and should be read in conjunction with, the information contained in the National Report.

THE 'ECO SILVER HOUSE' HIGH RISE APARTMENT BLOCK was built to the Eco Silver House standard, meets PH design criteria and is registered in the PH database https://passivhausprojekte.de/index.php?lang=en#k_4522. The design: 'fulfilled minimal requirements of cost-optimal for apartment building with Net Present Value of 272 EUR/m² and primary energy use of 79 kWh/m²/y' in line with the 'Slovenian national cost optimal study of minimum energy performance requirements from the year 2014' which defines NZEB as 75 (single family), 80 (multi-family) kWh/m²/y primary energy: http://www.scirp.org/journal/PaperInformation.aspx?PaperID=59005. The 2015 Qualitative Intermediate targets of < 25 kWh/m²/y must be based on end-use or metered energy with a fraction of RES > 50% in final energy use. Currently the renewables aspect comprises district heating based on a mix of 9% of biomass, grid electricity, with 33.5% hydroelectricity and a photovoltaic array together comprising 44.3% of total PE. It is expected that the renewable component of the district heating will reach 39.3% by the year 2020, thus significantly superseding the NZEB requirement for >50% RES. An

analysis of Slovenian NZEB, including the Eco Silver House is available at:
https://file.scirp.org/pdf/GEP_2015082411220849.pdf

The Eco Silver House description provides a broad definition of renewables in that it includes 'off-site' carbon savings through the district heating with its biomass fuel mix and through the hydro-electric component of grid electricity supply. For those member states defining NZEB as meeting the EPBD 'cost optimal' requirement, the inclusion of off-site renewables could have a significant impact on the final low energy design. Large-scale renewables such as hydro-electric schemes are generally more cost effective than, for example, small scale photovoltaics, thus providing lower cost energy. This allows for enhanced envelope design at higher cost but within cost optimal provisions. It also moves the maintenance requirements from the individual installation (the responsibility of owners) to suppliers and, inter alia, achieves economies of scale. All the stakeholders learned a lot during the construction process and on the basis of the monitoring results of the building. Now they know what they could do differently and have, above all, acquired a valuable experience and the knowledge of which solutions, technologies and products can be used in following NZEB projects.

THE TWO CASE STUDY HOUSES ARE THE HOUSE PRIMUS D137D AND THE ACTIVE HOUSE LUMAR. A web search reveals the 'PLUS ENERGY HOUSE PRIMUS-D 137DD' with the same photograph as in the partner report stating the Primus D137DD is the first 'plus energy' house in Slovenia and certified at the Passivhaus Institute in Germany https://passivhausprojekte.de/index.php?lang=en#k_1840. The plus energy component is the 62.5 m² photovoltaic array (approximately 7 to 8 kW peak). The dwelling must therefore exceed Slovenian NZEB demands both for energy and RES.

THE ACTIVE HOUSE FROM LUMAR IG, Slovenia is described as a: 'highly energy-efficient structure [that] makes best use of solar energy and offers utmost living comfort'. http://www.swst.org/wp/meetings/AM14/pdfs/presentations/kuzman%20pdf.pdf.
The term 'Active house' implies more than nearly zero and represents a net positive concept and thus must exceed Slovenian NZEB requirements. Its specification is as follows:

- Location – Dragočajna; Year – 2013; Total floor area – 151 m²; 1 year construction time.
- Timber-frame wall element with I-studs and a fully insulated cavity.
- Energy efficiency – plus energy (PHPP 15 kWh/m²/y)
- U-value (W/(m²K)) – wall 0.1; roof 0.1; floor 0.12; window 0.87: glass 0.6; frame 0.86
  Services – air to water heat pump with underfloor heating; solar thermal collector; photovoltaic array; MVHR and a rainwater collector.

Source: LUMAR

CASE STUDIES: House Primus D137d (left) and Active House (right), both Lumar company www.lumar.si

# SPAIN

## The Construction Industry

The sector contributes 10% to the GDP (2016), down by half since 2008. Construction company data related to NACE[1] activity categories show that 'building construction' constitutes the biggest share, followed by 'specialised construction activities'.

- o Building Construction: 54.72%
- o Specialised construction activities: 42%
- o Civil engineering: 3.28%

The construction sector is extremely fragmented, with a total of 406,682 construction companies, of which 64% has no employees. Small companies employing under 10 workers make up nearly 97% of the sector. During the recession (2008-2016), the number of jobs and construction companies and the volume of construction activity declined. The number of workers dropped by nearly half and the number of permits for new dwellings dropped from 264,795 to 64,098. The number of companies increased by about 3 per cent in 'specialised construction activities' and decreased by a similar rate in 'building construction'.

## Construction workforce[2]

In 2017, there are just over 1 million workers in the construction sector. Of these, 71% (769,600) are wage earners and the rest (29%) are self-employed. In 2008, there were over two million wage earners and another half a million self-employed, which illustrates the dramatic shrinking of the sector over the last ten years. Of the wage earners, 59% have a permanent contract, 41% temporary. The characteristics of the workforce are:

- *Age:* Spain has an ageing workforce and a major difficulty in attracting young people to the sector. The proportion of workers in construction aged 29 years and under has decreased dramatically, from 27% to 8% between 2008 and 2017. Age distribution in 2017 compared to 2008 was:
  - o 16-24: 2% (was 12%)
  - o 25-29: 6% (was 15%)
  - o 30-54: 86% (was 70%)
  - o 60+: 6% (was 3%)
- *Migrant workers:* About 16% of the workers are foreign nationals, down from 25% in 2008. Among foreign nationals, 44% are from EU, 8% other Europe, 28% from South America, 20% are from the rest of the world or they are 'stateless'.

## Vocational Education and Training (VET) system

VET in Spain is organised by the state in close collaboration with social partners. The General Council for Vocational Training is the national government body leading on VET policy. It comprises representatives of national and regional public authorities as well as social partners, such as employers' organisations and trade unions. The National Institute of Qualifications (INCUAL) is in charge of designing all VET qualifications in the VET system in all sectors of the economy and creating a National Catalogue of Professional Qualifications along with the participation of stakeholders. As a result, the INCUAL through the National Qualification Framework (NQF) defines qualifications and related training content, which the Ministry of Employment and the Ministry of Education translates first into vocational certificates (vocational training) and second into vocational diplomas (vocational education).

In this way, vocational training also stems from the National Catalogue of Professional Qualifications. Vocational training has a higher workshop and work-based learning element, with classroom learning making up 43%, and completers are awarded certificates endorsing their professional skills, rather than diplomas. Vocational Certificates can be gained in all the professional families indicated below.

1 NACE is the Industry Standard classification used in Europe, Code F refers to construction.

2 No data available about women in the sector, qualification levels of the workforce, number of workers by occupation or about energy efficiency related occupations.

*Initial Vocational Education and Training (IVET)* is nationally organised and college-based, encompassing upper secondary to EQF level 5, with substantial work-based learning (up to 65%) elements within it. It is organised into Basic Vocational Education, Mid-Grade Vocational Education and High-Grade Vocational Education. Basic VET programmes are offered from age 15 and target students at risk of leaving education. After this 2-year training, they can continue onto mid-grade VET or take general school leaving examinations. Mid-grade programmes start at 16 years old and allow access to higher level VET. There are 26 strands ('professional families') in the VET system. The Ministry of Education and Vocational Training is in charge of the design and approval of the minimum training contents for each diploma of vocational education. VET at all three grades involves work-based learning (20%), together with practice in a workshop (32%) and theoretical learning in the classroom (48%). There are also recent initiatives to introduce a dual system.

Finally, *CVET* is provided by public and private organisations. All companies can have access to the CVET system, including micro companies, though not all appear to take advantage as in 2017 there were about 4 million participants out of a working population of 18 million. The State Foundation for Training in Employment (FUNDAE) funds and manages further education courses, acting on behalf of the Ministry of Employment, Migrations and Social Welfare. Funds for training come mainly from a quota paid by companies (0.6%) and employees (0.1%) on their salary payroll. These courses aim to support workers to train or re-train for jobs in growing sectors and respond to the needs of companies. Most of CVET is organised and provided by private companies, and FUNDAE provides a volume of information on this (See: https://www.fundae.es/Observatorio/Pages/default.aspx). There is a year on year increase in CVET activity and there is a considerable degree of in-company accreditation of CVET. The system also includes tailor-made, demanding and *ad hoc* programmes by companies.

## Spanish Build Up Skills – LEC training needs

According to the Build Up Skills Status Quo Analysis (SQA), the number of LEC trained workers needed is thought to be in the region of 21,000-53,000, although this estimate is undermined by lack of comprehensive data about different occupations. The report proposed that this estimate be paralleled by an increase in the number of trained teachers. The Roadmap recommended the development of VET on different aspects of EE and RES, incentives to further training, prioritisation of teachers' training, and the development of systems for the accreditation of LEC related skills.

There is also a need to engage employers and to raise awareness of energy efficient construction. More specifically in relation to VET for LEC and as part of the Status Quo Analysis, LEC relevant occupations and new courses were identified for inclusion in the National Permanent Training Plan for Employment. Significant challenges to meeting these targets were highlighted:

- qualification levels of construction workers are very low;
- little demand for and provision of continuing/further VET for those already in the sector;
- lack of coordinated thinking on VET and legislative gaps in the articulation of relevant policies and regulations;
- government spending is very low due to recession; and
- the construction sector is dominated by small companies, which find it difficult to access and fund training.

## VET for LEC developments

Most VET for LEC provision is at the higher levels of EQF (Levels 4-6), at technician and higher technician levels, and in RES installations. Three professional families are relevant to LEC and energy efficiency: 'Construction and Civil Work', 'Energy & Water' and 'Installation and Maintenance'. Two relevant courses within the 'Energy and Water' strand of Higher Grade VET are: 'Higher Technician on Energy Efficiency and Solar Thermal Energy' and 'Higher Technician on Renewable Energies'. There are several more practically-oriented courses at EQF Level 2&3 in energy efficiency and RES installations, for example in the installation of photovoltaics and solar thermal panels. These are also short courses leading to Vocational Certificates. Data on the number of workers undertaking EE or RES training in permanent training organisations or through permanently available courses are not available. There is also a large range of private and *ad hoc* training available related to EE and RES that responds to company demand. This is not regulated, although employers may issue their own certificates. Following the recommendations of the Build Up Skills investigation, EE and RES competencies have been developed and are to be included in the occupational qualifications related to 'Civil and Building Works', 'Energy and Water' and 'Installations and Maintenance'. CONSTRUYE 2020, the Build Up skills Pillar II project, developed a self-learning training tool for both trainers and workers, covering energy efficiency, renewable energies, placement of insulation, external carpentry and efficient installations. This project developed 9 new CVET courses to offer to building workers. Spain has participated in other EU-funded projects, BUS Trainers and BROAD, and is working to build training capacity and improve social partnership in implementing the green transition strategy in construction.

## Initiatives related to VET for LEC

*CONSTRUYE2020* (2013-2016) is a Build Up Skills Pillar II project that sought to implement some of the actions of the Spanish Roadmap. It developed a training tool useful for both trainers and for self-learning, covering energy efficiency, renewable energies, placement of insulation, external carpentry and efficient installations. This App was one of the most successful aspects of the project. The App was also assessed by trainees and trainers. An observatory consisting of two tools (an online survey, and a Statistics visor) has been established to forecast training needs and monitor labour market changes. A website specialised in providing information about training related to EE and RES was set up to guide users in the selection of VET courses. 25 pilot courses were carried out during project execution with some 400 trainees trained in different matters. A set of competencies has been elaborated on geothermal energy systems. The project highlighted the value of ICT as a tool and platform of learning, the importance of financing training, and the need to raise awareness of EE to stimulate training demand.[3]

*BROAD (2015-2017)* is an EU funded project in which Spain participated. The project was led by FILLEA CGIL (Federation of Wood, Building and Allied Industry Workers) of Italy, which sought to develop social dialogue in the construction sector with a view to supporting the green transformation of the construction industry in Italy and Europe. The project involved a review of the development of green building in the partner countries of Italy, Poland, Spain, Belgium and Germany, with a focus on similarities and divergences in regulatory aspects, policies and economic and construction sector employment contexts and industrial relations experiences. It also developed suggestions and recommendations for strengthening the role of social dialogue in the transition to a low-carbon economy.

The Sector Skills Alliances project *BUS Trainers* (2016-) aims to increase competitiveness in the construction industry, through promotion of energy efficiency skills (EE) and renewable energy systems (RES) within the expertise of Vocational Training (VT). The project will try to develop and deliver a training system for vocational trainers and to create a platform for exchanging good practices and opportunities for VET trainers. In accordance with EQF (European Qualifications Framework) methodology, ECVET (European credit system for VET), and EQAVET (European VET quality assurance system), it seeks to

3 https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-construye2020

SPAIN – NZEB definition

| OFFICIAL STATUS | Under development |
|---|---|
| RESIDENTIAL/NON-RESIDENTIAL | ✔ |
| SINGLE FAMILY HOUSES | |
| APARTMENT BLOCKS | |
| OFFICES | |
| EDUCATIONAL BUILDINGS | |
| HOSPITALS | |
| HOTELS/RESTAURANTS | |
| SPORT FACILITIES | |
| WHOLESALE AND RETAIL | |
| BUILDING TYPOLOGY | |
| BUILDING CLASS | |
| BALANCE | |
| PHYSICAL BOUNDARY | |
| HEATING DHW | |
| VENT, COOL, A/C | |
| AUXILIARY ENERGY | |
| LIGHTING | |
| PLUGS, IT, APPLIANCES | |
| CENTRAL SERVICES | |
| ELECTRIC VEHICLES | |
| EMBODIED ENERGY | |
| ON-SITE RES | |
| OFF-SITE RES | |
| EXTERNAL GENERATION | |
| CREDITING | |
| PRIMARY ENERGY INDICATOR ($kWh/m^2/y$) | ✔ |

Source: based on European Commission (2016a) *Synthesis Report on the National Plans for Nearly Zero Energy Buildings*, JRC Science for Policy Report

SPAIN – Energy performance expressed as primary energy (kWh/m²/y)

| RESIDENTIAL BUILDINGS (kWh/m²/y) | | NON-RESIDENTIAL BUILDINGS (kWh/m²/y) | | |
|---|---|---|---|---|
| NEW | EXISTING | NEW | EXISTING | NOTES |
| Class A | n/a | Class A | n/a | Buildings need to comply with class A. |

develop a new European sectoral qualification standard and, eventually, develop certification of competences through a "Green Tag accreditation". The target groups are teachers of house builders, civil engineering, construction work and trades[4].

## National NZEB definition

According to the European Commission's Joint Research Centre for Policy Report (EC 2016a), Spain's NZEB definition is currently under development[5].
In its applied definition, Spain defines NZEB for both residential and non-residential buildings but does not include specific subcategories (ibid: 16: Table 4).
In terms of building typology, classification, balance type, and physical boundary, information about Spain is not available (ibid: 17-18: Figure 3).
There is no information available on the types of energy use under consideration in Spain (ibid: 18-19: Table 5).
With regard to the specification of generation boundaries in Spain's definition, there is no information available (ibid: 20-21: Table 6).

The numeric indicators of energy performance above, expressed as primary energy (kWh/m²/y) are specified in Spain's definition (EC 2016a: 23-26, Table 7).

## Intermediate targets

These is no information available on Spain's intermediate targets for all new buildings and all new buildings occupied and owned by public authorities.

## Case studies

The Spanish National Report presents two case studies: a dwelling and a University Applied Research Center. The following observations complement, and should be read in conjunction with, the information contained in the Report.

CASE STUDY 1:
EL PLANTÍO 2014, CARRIÓN DE LOS CONDES, CASTILLA Y LEÓN.
A registered Passivhaus: http://passivhausprojekte.de/index.php?lang=en#d_2910.
Timber frame construction with MVHR (including 1 kW pre-heater, solar thermal and ASHP for domestic hot water). With its solar thermal and a heat pump, the dwelling may meet Spain's (as yet unspecified) NZEB criteria for the inclusion of renewables.

CASE STUDY 1: El Plantio
Source: http://www.plataforma-pep.org/estandar/ejemplos-ph/13

4 http://www.buildup.eu/sites/default/files/bus_document_eu_meeting/relevant_projects-bus.trainers_javiergonzalez.pdf
5 Note: Since the publication of JRC Science for Policy Report in 2016, new developments exist in this regard, the NZEB definition adopted by Real Decreto 564/2017 that modifies Real Decreto 235/2013.

CASE STUDY 2: LUCIA BUILDING 2014 IN VALLADOLID.

A multiple award winning 'A-rated' low energy building considered to be the most energy efficient in Europe and second in the world (https://www.energynews.es/en/the-building-lucia-in-valladolid-is-europes-most-sustainable-and-second-worldwide/) and with LEED platinum (Leadership in Energy and Environmental Design) and Green Building Council certification. For details on the project: http://lucia-building.blogspot.co.uk/. Monitoring is ongoing, although the results are not yet available. The building LEED scores are 98 points out of a total possible of 110, suggesting an exemplary platinum score (>80 points) although final LEED certification is still ongoing: https://www.usgbc.org/node/2591214?view=overview

Photo: Diego Tamayo

CASE STUDY 2: Lucia building (Valladolid)
Source: http://edificio-lucia.blogspot.com/#

## PROJECT PARTNERS

FIEC

European Federation of Building and Woodworkers

EFBWW

UNIVERSITY OF WESTMINSTER

KING'S College LONDON

CSC ACV
bouw - industrie & energie
bâtiment - industrie & énergie

КАМАРА НА СТРОИТЕЛИТЕ В БЪЛГАРИЯ
BULGARIAN CONSTRUCTION CHAMBER

CNC
Confederación Nacional de la Construcción

FACHVERBAND DER STUCKATEURE FÜR AUSBAU UND FASSADE

Rakennusliitto

Budowlani ZWIĄZEK ZAWODOWY

ÉPÍTŐK ÉFÉDOSZSZ

Gospodarska zbornica Slovenije

LIT
LIMERICK INSTITUTE OF TECHNOLOGY

CGIL FILLEA

OFFICIAL PARTNER
EUROPEAN VOCATIONAL SKILLS WEEK
2018

The final conference of this project has been an official event of the EU Vocational Skills Week 2018.