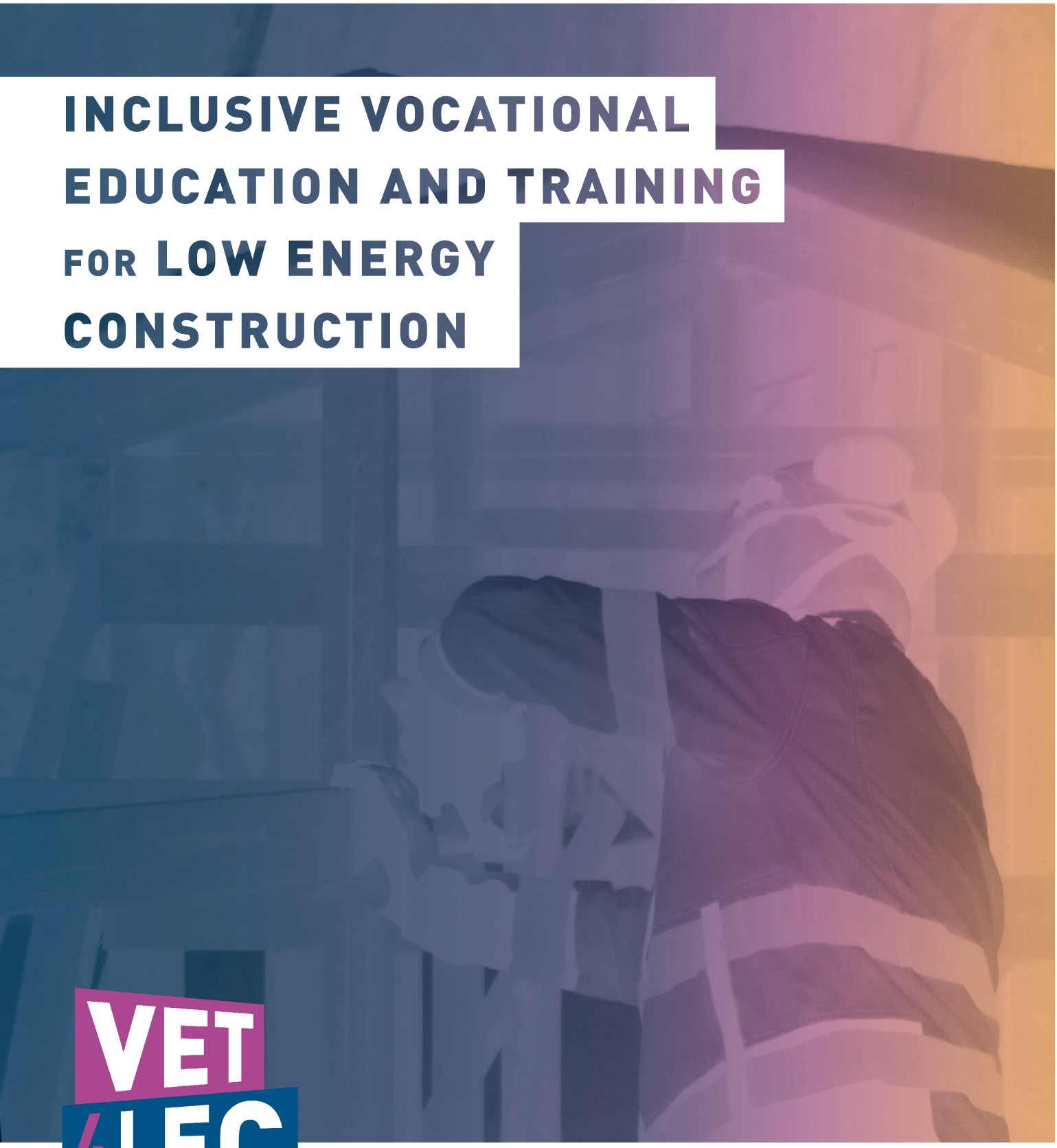
INCLUSIVE VOCATIONAL EDUCATION AND TRAINING FOR LOW ENERGY CONSTRUCTION



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COUNTRY SUMMARY FINLAND
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European Federation
of Building
and Woodworkers

EFBWW

FIEC

THIS SUMMARY was prepared by the research team,
based on the Finnish national report produced by Rakennusliitto.

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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.

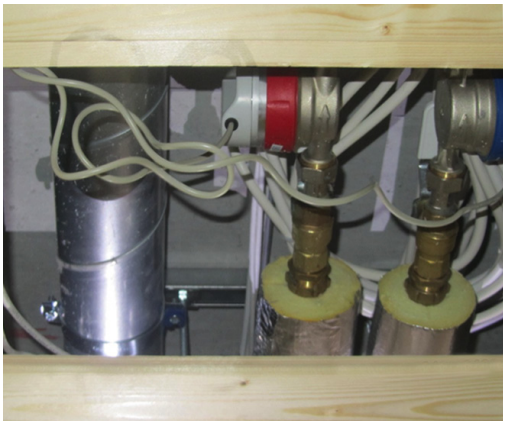
Labour market conditions

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.