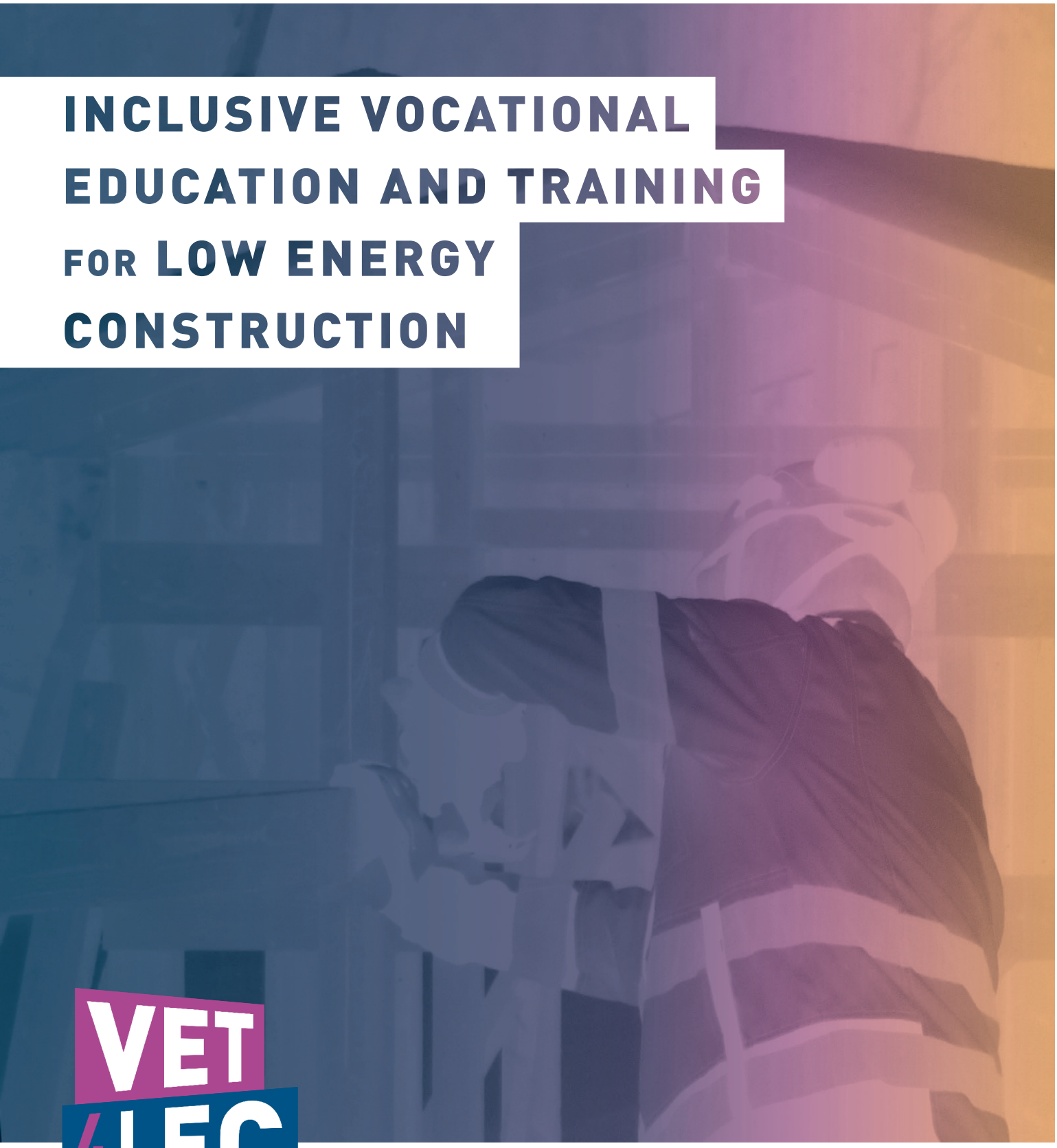

INCLUSIVE VOCATIONAL EDUCATION AND TRAINING FOR LOW ENERGY CONSTRUCTION

VET 4LEC

COUNTRY SUMMARY GERMANY
FEBRUARY 2019

European Federation
of Building
and Woodworkers

EFBWW

FIEC

THIS SUMMARY was prepared by the research team,
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COVER PHOTO: Carpentry trainee at Vantaa Vocational College/Finland

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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:

- Construction of buildings: 26%
- Civil engineering: 11%
- Demolition works and site preparations: 6%
- 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:

- 1-9 workers: 73% (54,181)
- 10-19 workers: 16% (11,849)
- 20-49 workers: 7.9% (5,863)
- 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

  - o 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.

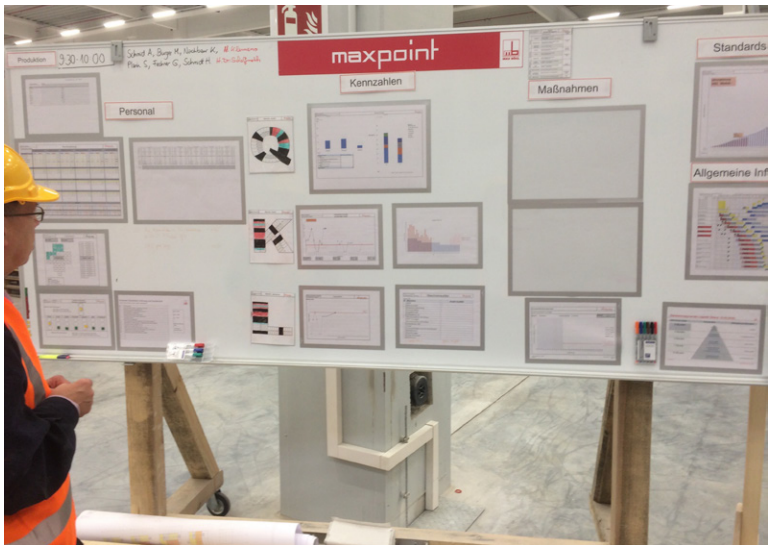
Modular housing Factory

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