NEWCOM New qualification schemes to build high quality

REPORT ON ANALYSIS OF MARKET BARRIERS TOWARDS CROSS-CRAFT SCHEMES

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Author: Jeanpaul van den Haspel

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Weena 505, 3013 AL Rotterdam, Postbus 577, 3000 AN Rotterdam, Phone +31 (0)10 206 59 69

E-mail: isso@isso.nl

Editor-in-chief: ISSO, Jeanpaul van den Haspel

Co-authors: Naghmeh Altmann-Mavaddat, Wouter Borsboom, Jan Cromwijk, Frantisek Doktor, Alexander Ebner, Johannes Fechner, Viola Kelemen, Frans Koene, Károly Matolcsy, Ronald Setznagel, Georg Trnka, Theresa Urbanz

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Abstract

Legislations towards nearly zero-energy building (nZEB) solutions are changing in most EU countries. This is accompanied by increased subsidies for energy-saving measures and the rise of national initiatives. This could be a great catalyst, however, the focus on quality control in relation with the ambitiousness of the stated goals could still be sharpened.

Unfortunately, most construction companies are slow to adapt and hardly embrace innovation, sustainable development, and high-quality execution. Cross-sectoral and cross-specialty cooperations among construction crafts are scarce and, additionally, investment in employee education is very low. For this reason, construction companies need to be convinced to invest in trainings for their employees. A direct engagement with leading companies, serving as best examples (ambassador approach), might increase the demand for a highly qualified workforce and emphasize the importance of skilled workers as well as of energy efficiency as a central quality aspect of the future.

At present, building owners do not ask for nZEBs or specific energy efficiency-related quality aspects. The reasons behind this are, on the one hand, lack of knowledge and, on the other hand, financial barriers. The creation and the promotion of informational platforms could be a way to close this knowledge gap.

Specific cross-craft qualification and certification schemes to guarantee the high quality of nZEBs are practically non-existent in all four partner countries involved in this project. To address this situation, training providers need assistance to overcome a multitude of barriers. At the same time, it is clear that the necessary cross-craft trainings can only be implemented in close collaboration with those providers. They need to be motivated to improve the transparency of offered trainings and to raise the quality of training content, trainers, and training material.

Above all, many blue collar workers show little interest in participating in voluntary further education. As a result, various strategies need to be developed to change their attitude

towards additional education. Moreover, craftsmen need to be given a way to show proof of completion (presentation of gained further education), for instance with a skills register.

Contents

4 LITERATURE 41

1 Introduction

The construction and renovation of nearly zero-energy buildings (nZEB) demand a large contribution from the building sector and pose a significant challenge to the construction industry to use innovative design processes and technologies.

To accomplish a successful design, construction and use of energy-efficient buildings, integrated design processes as well as multi-disciplinary teams are required. Therefore, the effective implementation of cross-craft knowledge is essential.

Professionals need to gain a mutual (basic) understanding of each other's disciplines and skill sets, and have to be able to operate outside their own are of expertise in order to achieve optimal nZEB constructions and retrofittings. This applies to both energy efficiency and cost effectiveness.

The focus of the project NEWCOM is to set up large-scale qualification schemes in order to implement missing professional qualifications and certifications of blue collar workers and building inspectors with a special focus on the possibility of mutual recognition of these diplomas between the participating member states. These schemes will enable the building workforce to be qualified for the construction and renovation of nZEB buildings.

The first step towards this goal is to identify the barriers concerning the implementation of cross-craft knowledge and to develop appropriate strategies to overcome these obstacles.

The results of this report will be used in further project communication and dissemination activities. Based on these analyses, strategies for an improved and sustainable market uptake for cross-craft training schemes in the participating countries will be elaborated on national and EU level. Representatives in each of the project's member countries, which are Austria, Hungary, the Netherlands, and Slovakia, will develop their own national strategies.

The findings of this report are therefore the first step to enable the sustainable development and implementation of presently unavailable cross-craft training schemes for nZEB.

2 Opportunities and barriers on a national level

This chapter will focus on identifying and analysing the opportunities and barriers which characterise the project NEWCOM in the four participating countries.

2.1 Opportunities and barriers in Austria

2.1.1 Opportunities in the market

Due to the step-wise tightening of maximum space heating demand in the Austrian building codes and to the requirements of national subsidy schemes, greenhouse gas emissions have been consequently reduced in the Austrian building sector. But there are still knowledge gaps in the industry which need to be overcome to avoid frequently made mistakes. As a result, it is crucial that building professionals have a thorough knowledge of interactions and interdependencies of the components required in the construction of nearly zero-energy buildings.

The analysis of the preliminary project BUILD UP Skills Austria shows that highly complex construction tasks are being performed by semi-skilled workers. However successful they might be in the completion of their routine work (for example, screed work, EIFS, drywall), they lack the skills and knowledge when it comes to the requirements to achieve the nearly zero-energy buildings standard. To address this problem, the market demand for high-quality execution of more energy-efficient buildings has to be raised.

The analysis shows that the following opportunities are favourable to boost this market demand:

- Raising awareness for the connection between quality of execution, low operating costs, and increased living comfort
- Enhancing the quality requirements (focus energy efficiency) of end consumers

- Increasing the control of executed construction work with focus on energy efficiency
- Promoting the importance of an heightened focus on energy efficiency in the building sector as a central point of a future-oriented, sustainable construction method
- Convincing construction companies of the benefits of well-skilled employees
- Promoting the benefits of collaboration between the crafts
- Further spreading of best practice projects
- Creating a better general view of relevant regulations and standards
- Adapting relevant subsidies
- Informing about the benefits of inspections and evaluations - e.g. as a chance for improvements and innovation, market benefits, etc.
- Promoting or creating national platforms with detailed and actual funding information (e.g. Public Consulting KPC)

2.1.2 Opportunities in education

In Austria, a broad offer of further education in energy efficiency and renewable energy is available but for the target audience the specific benefits of the trainings are often not really clear. According to the national status quo analysis report (developed in the previous project BUILD Up Skills Austria), the general further education offered in the areas of energy consulting, energy efficiency, and renewable energies can be characterised as extensive. However, if the offer is considered from a more differentiated point of view and if only the target group of blue collar workers is taken into account, the number of specialised courses is revealed as rather limited.

The opportunities concerning the education of workers in the building industry are:

- Promoting the benefits of evaluating the courses in order to improve their impact and raise their topicality
- Developing persuasion strategies for craftsmen to participate in further education trainings
- Explaining the trainings in detail (content, acquired qualification, etc.) and, thereby, improving the reliability of the courses
- Implementing collaborations and cooperations between small training providers to enable standards for mutual recognition of certificates

- Promoting cross-craft trainings as an effective method for more cost efficiency and quality enhancement
- Advancing the strict use of the ISCED[1] system (International Standard Classification of Education)

2.1.3 Barriers in the market

According to the statistics of the Chamber of Commerce in Austria, the number of workers in the building industry decreased about 16% (in 2016) compared to the year 2010[2]. Around 38% of the companies in the building industry are small enterprises with one to nine employees.

One of the main reasons for the decrease of the number of workers is the economic crisis of 2008, from which the industry has not fully recovered yet even though construction work has increased. For example, the number of apartments built in 2015 has grown by 11% compared to 2011[3]. Therefore, competition among companies is high. Consequently, SMEs can barely afford to send their staff to trainings since they are needed directly at the construction site.

The following barriers for the market implementation of energy efficiency measures and building of nZEB buildings have been identified:

- The end consumer does not demand quality in terms of energy efficiency because they are not aware of the parameters, systems, and implementation on site.
- Independent instruments of control for the high energy efficiency quality required for the construction of nZEBs are insufficient and rarely applied.
- The construction companies have little willingness to provide their employees with further education by sending them to courses. Among the reasons, these factors have been named: the distance to the training location is too far; well qualified employees ask for higher salary; companies are getting smaller and employees are needed on site; the long

[1] International Standard Classification of Education (ISCED)
[2] http://wko.at/statistik/BranchenFV/B_209.pdf, 22.12.2017
[3] https://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/wohnen wohnungs_und_gebaeudeerrichtung/fertigstellungen/index.html, 22.12.2017

and very cold winters, when working on site is impossible, are diminishing, resulting in continued work during the winter months.

- In the construction sector trainees are very difficult to motivate to participate in courses.
- Implementing the juridical requirements of new technologies is complicated in Austria (for example, nine different building regulations of nine independent provinces, around 8,000 different national building standards, etc.).
- Often the trades react slowly to new market requirements and only take action if specific procedures or system changes are prescribed.
- There are many different funding agencies, and a central application and information agency is missing. Therefore, the companies are not aware of the financial advantages they could receive.

2.1.4 Barriers in education

Regarding the education and further training of blue collar workers in the building industry, many activities concerning energy efficiency of the buildings are being implemented in Austria. The existing strategic plans already provide opportunities for improving the education and training schemes but they are not sufficient.

In detail, the following barriers for the implementation of energy efficiency measures to build nZEBs have been identified:

- Energy efficiency is only of secondary importance in the apprenticeship training.
- The offered courses are insufficient in terms of course content and, therefore, the benefits for the trainees are not clear.
- Comprehensive quality management is necessary for the certification of training institutions (e.g. following ISO 90001). Unfortunately, this is very complex and cost-intensive especially for small training providers. However, it is often a precondition for the Public Employment Service funding.
- Training providers are partly not willing to increase transparency with regard to the contents of their courses due to fear of competition.

- Only very limited financial support for further education is available in Austria.
- Cross-craft awareness is not part of the initial curricula. In the actual tendering process for the construction of buildings, each trade is considered individually and not in connection with other trades, which will affect or be affected by the trade in question.
- The gained competences of the employees trained in the courses cannot be demonstrated. That is the reason why companies and the market are less willing to pay for it.
- In Austria, a very broad offer of further education courses is available. Therefore, new courses are hard to establish in the market. One of the main competitors are the free trainings of the construction products' suppliers (although their trainings are in general more product-oriented).
- Divergent structure in apprenticeship and post-graduate schemes
- Lack of coordination with regard to the required education contents between Austrian provinces, training institutions of national organisations, guilds, and chambers
- The opportunity of course evaluations is partly rejected as providers are afraid to lose clients in case of poor results.
- Longer courses (more than one day) are not well accepted by the companies and workers.

2.2 Opportunities and barriers in Hungary

2.2.1 Opportunities in the market

In 2014, the Hungarian Ministry of Interior created a regulation related to building energetics (20/2014. (III. 7.) BM rendelet az épületek energetikai jellemzőinek meghatározásáról szóló 7/2006. (V. 24.) TNM rendelet módosításáról). The threshold limits became stricter than before, increasing the value of integrated planning and the role of costly expert skills, which aims at creating high performance buildings (environmentally and economically) by building on the harmonisation of different fields of expertise.

The regulation (stating that energy efficiency of walls and windows must increase by 40%) applies to renovations implemented from public funds from 2015 and to the construction of every new building from 2018. According to examples in Western Europe, this can lead to an increase of the market value of the buildings of 10 to 20%.

Currently regulations are only mandatory for renovations of public buildings. For the enterprises, applying the most energy-efficient systems is not only compulsory by law but is also beneficial from the aspect of cost-effectiveness because wasting energy might result in disadvantages related to the competition in the market. The potential in improving the energy efficiency of enterprises represents one third of the whole energy-saving potential of Hungary.

There is a possibility to finance the renovation from the savings of lower energy bills. An ESCO[4] performs the energy audit of the partner, implements the investment, and maintains the system. At the end of the contract, all advantages of the cost savings will return to the owner of the building.

There are tenders, procurements, and calls (EU and national) which support the renovation and building of energy-efficient buildings, especially nZEBs:

- EU funding
- National funding: KEHOP-5.2.5.; pilot projects of creating nZEB buildings (construction of nZEB public buildings)

National funding supports the renovation and construction of nZEB buildings and, due to the fact that after 2018 every new building must be constructed according to the mandatory regulations, intensifies the demand for skilled white collar workers who are qualified in integral planning.

[4] Energy service company

2.2.2 Opportunities in education

There are existing trainings pertaining to the technical challenges and implementation of nZEB buildings in Hungary, but these are voluntary, short trainings which aim to provide practical information related to planning. Compulsory or registered trainings do not exist currently. In higher education (for architects), the nZEB solutions are covered but not entirely, and, at present, there are no departments for specialisation.

Voluntary short trainings:

- The Chamber of Hungarian Architects organised 3-day long trainings for architects in order to provide information about the regulations, technical challenges, and possible solutions related to nZEB buildings.
- Passive house trainings are available, which also cover nZEB solutions but focus on passive houses which require a higher level of technical solutions.

The guidelines related to the planning of nZEB buildings are included in the national and EU regulations. There is a possibility in cooperating with professional associations who already organise voluntary trainings to also integrate cross-craft schemes.

2.2.3 Barriers in the market

In Hungary, as abovementioned, the nZEB regulations are only mandatory for the renovation of public buildings and the construction of new public buildings after 2018. After 2020, the regulations will be mandatory for every new building. Therefore, nZEB solutions are not that common currently. Also, applying these solutions results in the rising of renovation costs. In most cases, property owners are not familiar with these solutions and the payback time, therefore, they are less likely to use nZEB solutions for renovations.

2.2.4 Barriers in education

Although nZEB solutions are mentioned in higher education, they are not covered extensively and only short voluntary, informative trainings are available. On the one hand, white collar workers in Hungary are more likely to participate in voluntary trainings, but for

blue collar and construction workers it is hard to find the time to undertake training. On the other hand, many construction workers are not registered by their employers and work without a proper qualification, thus, they usually lack the motivation to participate in any training.

2.3 Opportunities and barriers in Slovakia

2.3.1 Opportunities in the market

Member State commitments to the implementation of the EPBD[5] targets are becoming the main driver for nZEB level energy renovations in Slovakia. The construction of new nZEB is not strong and it is expected to develop as additional driver after 2020, while nZEB level energy renovation will remain the key driver for at least the next 12 years.

The most immediate market opportunity will be the energy renovation of public buildings to nZEB standard as the relevant provisions of EPBD are to apply from 2018, together with the minimum annual renovation rate.

In Slovakia, the state and municipalities own over 15,000 public buildings. Almost half of them were built in the beginning of the 1950s and only a small percentage is built earlier than 25 years ago. The largest group of the public buildings are schools (45%, while one third are elementary schools), followed by administrative buildings (16.6%). The public buildings in Slovakia need to be renovated not only for energy performance reasons but also for reasons pertaining to the technical state and low quality of the internal environment.

Most of the public buildings have undergone only minor modifications in the past and have not been adequately maintained. At present, these buildings exhibit deficiencies and constructional faults in the building's envelope, which, in addition to normal wear and tear, are not providing sufficient thermal protection of the envelope and roof cladding. Waterproofing of roofing is also insufficient and the buildings openings (windows, doors) are not well protected against leaking. These buildings have also problems with heating, electricity, gas, water and sewerage systems.

The average energy consumption for heating all of non-residential buildings owned by the state and municipalities for the years 1994 to 2003 is 190.08 kWh/m^{2}a. The results of the energy audits of approximately 250 public buildings, executed in 2015 by the Slovak

[5] Energy Performance of the Building Directive

Innovation and Energy Agency, illustrate the possibilities for both energy and financial savings. The identified measures would, on average, lead to a reduction in energy consumption from almost 139 to less than 56 kWh/m^{2}a, i.e. 60% for administrative buildings, and less than 160 to 55.5 kWh/m^{2}a, i.e. 65% for nursery schools. This represents an average reduction of annual energy costs of more than €15,000 (more than 50% reduction compared to pre-renovation) in administrative buildings and nearly €7,900 (over 60% reduction) for nursery schools.

To achieve these results, it is essential to deliver on the quality of energy performance measures in the energy renovation that is directly dependent on the level of skills and knowledge of the craftsmen, workers on the construction sites, middle and senior level construction professionals in energy efficiency and use of renewable energy sources in buildings.

2.3.2 Opportunities in education

The above outlined market opportunity creates a labour market opportunity, as well as labour market pressure, on education and training of all relevant professionals. The market opportunities are:

- In short term in developing and deploying the further education and training programme to upskill the qualified workforce and provide the basic abilites and knowledge to untrained and inexperienced on-site workers (despite all measures in the vocational education and training and requirements of the guilds and professional associations, almost 50% of the on-site workers are unskilled);
- In medium term in embedding the energy efficiency and use of renewables in buildings in the current curricula at secondary and tertiary levels of education, and in developing vocational training at secondary and tertiary level to equip newcomers to the labour market with the adequate skills set;

- In long term in developing new curricula for the secondary and tertiary level of education to include the changes in the sector of buildings that are brought about by the 4th industrial revolution, including robotics, artificial intelligence, big data analysis, nanomaterials, and biotechnologies that already demonstrate their capacity in the construction sector and will change how buildings are built, used, and recycled.

Before the BUILD UP Skills Slovakia initiative, there was no national qualification and further training scheme for craftsmen and on-site workers in the sector of buildings in Slovakia. The only available courses were those provided by suppliers of certain construction products and technologies. These courses have been very brief and limited to presenting their product or service.

The BUILD UP Skills StavEdu project succeeded in setting up a national qualification and further training scheme for 31 craftsmen and on-site workers on energy efficiency and use of renewable energy sources in buildings. This scheme is focused on upskilling existing qualified workforce (skilled craftsmen and on-site workers in the sector of buildings) in the defined area of energy performance of buildings. This scheme is operated by ZSPS, the Association of Construction Entrepreneurs of Slovakia with the help of UVS, the Institute for Education and Services in Bratislava, and 22 organisation, institutions, and companies that signed up to create a network underpinning the StavEdu scheme.

Besides the StavEdu scheme, the training and licensing was developed in the follow-up of the BUILD UP Skills Pillar I project for ETICS and installers of windows.

The Horizon 2020 project ingREeS succeeded in setting up national qualification and further training scheme for middle and senior level professionals on energy efficiency and use of renewable energy sources in buildings. This scheme is operated by SKSI, the Slovak Chamber of Civil Engineers, and currently includes 16 modules for training:

- Architects/Planners;
- Site Managers;
- Sustainability/Energy Advisors;

- Site Supervisor;
- Assessor of the Achieved EE/Energy Specialists.

The ingREeS Scheme is built as an open modular system, new modules can be added and new training programmes can be built on the bases of existing and new modules for additional middle and senior level construction professionals.

The current efforts are focused on assuring financial support from ESF (Slovak Operational Programme “Human Resources”) for mass roll-out of the training for craftsmen and on-site workers (including unskilled workers with a more intensive and longer training built based on StavEdu modules). BUILD UP Skills SQA assessed that 13,000 craftsmen and on-site workers are needed in the StavEdu training. The number of unskilled workers to be covered in future training will depend on feasibility and availability of the financial support from the government as the priority remains the upskilling of craftsmen and skilled on-site workers.

Under Horizon 2020, the efforts are focused on increasing value of the training through mutual recognition of qualifications – the present H2020 NEWCOM Project – and on building up a qualification system for Building Information Modelling (BIM) focused on increasing the energy performance of buildings through use of BIM.

At present, the only drivers for developing skills in der construction sector on energy efficiency and use of renewable energy sources in buildings are: the BUILD UP Skills initiative, a Horizon 2020 construction skills programme, and the private initiative of ZSPS, the Association of Construction Entrepreneurs of Slovakia, and SKSI, the Slovak Chamber of Civil Engineers, as well as of other partners in the relevant consortia (UVS, ViaEuropa Competence Centre, Faculty of Civil Engineering of the Slovak University of Technology, Slovak Innovation and Energy Agency, and the National Institute for Lifelong Learning). This is because governmental support is currently very low and is declining in recent months as Slovakia can use the “escape roads” built in EPBD (Slovakia has almost 100% energy from non-carbon based sources).

2.3.3 Barriers in the market

The BUILD UP Skills Roadmap and the Pillar II projects provided the possibility of empirical research of the barriers in the market for the implementation of cross-craft schemes in nZEB. It should be noted that energy renovations of existing buildings did not trigger a growth in the construction sector in Slovakia to mitigate the effects of the financial crisis in 2009 and the follow-up economic crisis that led to collapse of the construction sector in Slovakia. The reason for this is the fact that the energy renovation market has not yet developped in Slovakia, which is the first general barrier to the adequate demand response for education and training in the construction sector. This provides a link to other barriers and factors that relate to the underdeveloped energy renovation market:

- **Lack of quality demand** from the side of owners, including private owners of residential units, the government and municipalities. Although the thermal insulation of multi-family apartment buildings (97% owned by residents) was in principle successful, the prime motivation of the residents has been the renovation of facades and removal of system faults of panelled buildings. The price of the insulation, not the quality, was the decisive decision making factor. The main drawbacks of the trend in thermal insulation has been the fact that the internal infrastructure of the buildings remained mainly untouched by these renovations and that insulation projects were focused mainly on the buildings built after 1970 where the energy savings are not that significant as these buildings already satisfied stricter energy standards. The stock of older buildings changed only marginally and the materialised renovations were not focused on energy efficiency and use of renewable energy sources but on making the old buildings functional and appealing for sale or rent. Lack of quality demand and control from the government and municipalities relevant to the energy renovations of public buildings crippled the development of the public buildings energy renovation market.

- **The way companies hire and/or sub-contract craftsmen and on-site workers:** In Slovakia, the construction companies hire most of their on-site workers locally (short-term employment and/or agency employment), and over 50% of craftsmen and on-site workers are sub-contracted self-employed persons and/or micro or small companies. This means that their possible investment into training has no direct return or any other benefit for the company. Consequently, construction companies are not the potential

"investors" in training. The "investment" needs to be done by professional guilds and associations, employers' associations, and training providers that do not have the necessary financial resources to develop nation-wide schemes that would bring substantial change to the market.

- The situation described above is amplified by a **lack of financial support to trainings** and efforts to impose on the construction sector industry models for vocational and further training, for example, from the car industry. The project recently implemented in Slovakia did not deliver its objectives in the construction sector due to disrespect to the specific situation in this sector.

- **Limited interest of construction workers and professionals to learn and undergo testing:** The construction sector in Slovakia is plagued by an aversion of the construction professionals at all levels to learn new information and acquire new skills. The choice of working in the construction sector is often motivated by the fact that one is not required to be "in a classroom" and learn. Moreover, the aversion includes taking written and/or oral examinations and tests.

- **The construction sector is inward-looking:** The construction sector in Slovakia is inward-looking and cooperations with other sectors and other professionals are limited. This stifles progress in the sector as innovations frequently happen at the cross sections of different sectors. This is amplified by the lack of interest to acquire new knowledge and skills.

- **Lack of market uptake of financial innovations:** Financial innovations, including energy performance contracting, are failing on the market in Slovakia. This impedes the private and institutional investments in energy renovations of existing buildings. Governmental support of financial innovations does not exist and there are unfounded concerns about their legality and integrity.

- **The complexity of regulation in the sector** will remain an important barrier intensified by a lack of interest to learn and a lack of political interest to pursue new regulatory instruments (Slovakia's Building Code is over 50 years old and all efforts to modernise it have failed so far).

- **Public procurement is still based on the lowest available price:** Despite all efforts towards green public procurement and multi-criteria public procurement, the Slovak public

procurement law provides legal certainty only to criteria of lowest price. The principles of "value for money", green public procurement, and multi-criteria public procurement are allowed but are only at the level of isolated experiments (recently also pursued by ZSPS, the Association of Construction Entrepreneurs of Slovakia). Consequently, the officials responsible for public procurement, including staff of municipal offices, choose the lowest-price principle that provides them legal certainty and prevent any legal, career, or financial consequences for them.

2.3.4 Barriers in education

The BUILD UP Skills StavEdu project succeeded in removing the barriers from the point of view of educational policies, recognition of the qualifications, and feasibility.

Nevertheless, some barriers remain:

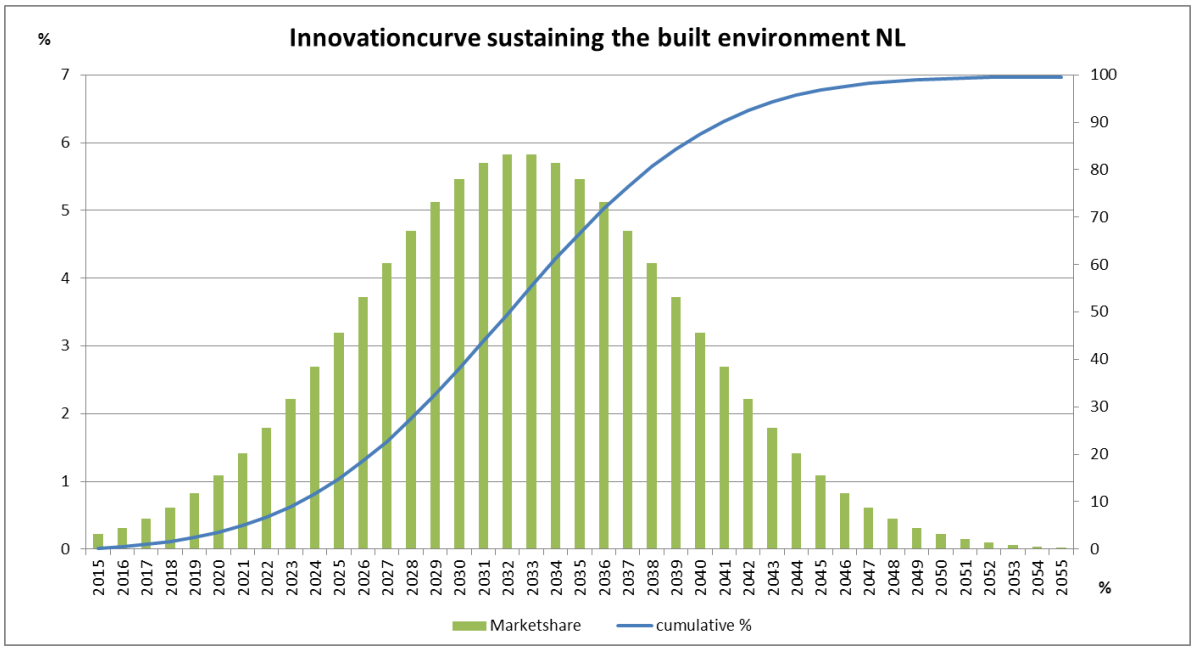
- **Cross-craft qualification**, a "nano-degree" or "partial qualification", **is very new** for Slovakia, and the StavEdu and ingREeS training programmes will undergo accreditation as cross-craft training programmes, leading to a cross-craft qualification for the first time in Slovakia. The use of the cross-craft approach in vocational education and training will develop as more comparable training programmes are introduced.
- Promoting **cross-craft understanding** from the point of view of learning what other crafts are doing on the construction site to ensure their concertation is developing very slowly in Slovakia and training schemes such as StavEdu will help to gradually overcome this barrier.

2.4 Opportunities and barriers in the Netherlands

2.4.1 Opportunities in the market

The demand for energy saving and renewable energy is on the rise. More and more building owners invest in sustainable measures. This transition is supported by new legislation and national initiatives.

The government is setting more ambitious goals. Even though these goals are not yet ambitious enough, unambiguous legislation and subsidies are helping to drive the transition. The impact of these goals is translated into an expected growth curve. Based on this curve, it is safe to state that the years of rapid acceleration are approaching with an expected peak around 2031.



One of the current subsidies is the ISDE[6] subsidy scheme for households, which stimulates domestic solar boilers, biomass stoves, and heat pumps. Another more holistic one is the EPV (Energie Prestatie Vergoeding) which enables social housing corporations to invest in

[6] Sustainable energy investment subsidy scheme (ISDE)

improvement of dwellings to a very good energy label for both new dwellings and retrofit in return for higher rent.[7] This measure also includes an extra of €25,000 when loaning money.

Also, until 2023 Dutch households are allowed to feed electricity from PV systems into the grid, namely up to 5,000 kWh per year at a tariff which is equal to the cost of electricity taken from the grid. The sum of demand and supply are calculated over a whole year. If demand and supply are the same, the energy bill will be 0 euros (so-called netting). This regulation will be reformed in 2020, most probably in a subsidy scheme.[8]

Because natural gas reserves are diminishing in the Netherlands, there is a transition to transform 7 million dwellings of gas heated houses in order to be able to disconnect them from the gas grid at 2030. This will create a need to adapt those houses so that they can be heated by heat pumps and low heat networks. It is important that these houses are renovated to make use of low temperature heating by improving airtightness and insulation level.

These factors will likely speed up the demand for nZEB buildings, and thus for related certifications. Especially the EPV will bring opportunities for cross-craft and integral nZEB qualifications.

Another opportunity is a proposal for legislation, whereby the quality assurance of building becomes a private matter instead that of local governments. New quality certification schemes are drafted, in combination with inspecting. These qualification schemes will be verified by a governmental body which will check a percentage of building. There will also be a change in liability; the contractor has to prove that they have provided the correct performance.

[7] PROF/TRAC Roadmap
[8] PROF/TRAC Roadmap

2.4.2 Opportunities in education

Concerning the building services sector, the Netherlands already have a well-developed system for personal certification schemes. KvINL[9] established voluntary schemes focused on specialisations concerning the RES Directive. These schemes are not cross-craft yet, but in several schemes cross-craft elements are added, for example, building physics and safety in the solar schemes.

There is one side note, though: since the schemes are voluntary, a very large number of companies do not put effort into earning them.

But there is a rising demand for cross-craft educated professionals (to eliminate boundaries between the specialisms of building, construction, energy, ICT). The same is true for professionals with certified skills in sustainability.[10]

In the proposal legislation about quality control, there is a possibility to replace part of the quality scheme by a certification scheme, for example, for installers. This enables the assessment of the education of the workers concerned because there is no need for an additional quality control. It is crucial that the cost involved which arises from this certification is reasonably limited. Performance checks because of the certification should be well targeted and effective. This is also important for the training of these installers.

Most of the innovations in terms of the energy performance of buildings do not require additional skills or additional needs for good workmanship. The existing training schemes for sustainable technologies can continue to exist with marginal updates. Of course, if there are already major quality concerns with the classic systems, this might be fixed with better training.[11]

With the developments in energy transition, it is essential that the education programmes are continuously updated. Teachers must be given the possibility to change the trainings so that

[9] Foundation Quality for Building Services Netherlands
[10] NEV2015, Technopolis 2016
[11] Qualicheck, 2016

these cover the newest developments in energy transition and sustainability. Lifelong learning will ensure that knowledge will stay up to date.[12]

2.4.3 Barriers in the market

Historically, the construction companies that build offices, homes, etc. generally do not work for the end users. Therefore, the specific needs and wishes of the users regarding comfort and energy are not taken into account during the design and building process.

Also, the average Dutch house owner moves every seven to ten years, which means they have little interest in long-term improvements in energy efficiency and sustainability.[13] This decision is influenced additionally by the relatively small added real estate value of an nZEB house. These means the demand for high-quality nZEB houses is rather low. Drivers are mostly comfort and health.

Morality and national habits can also be a barrier. Dutch people are known as “merchants”, which still means today that investments in renewable energy, energy reduction, etc. are only applied when they can be amortised within a short period of time or when obligatory. The average Dutch house owner does not invest in higher principles if they have nothing to gain from it (in financial or sustainable image). This may differ from other EU countries, e.g. German house owners happen to be much more proud of the technical standards of their house[14], while the Dutch consumer is not at all interested in the performance of the ventilation system.

The energy sector is heavily regulated, as a result, there is little room for innovation and problems are solved with proven technology. This slows down innovation (like new certification schemes) and leads to suboptimisation.[15]

Besides this, governmental institutes on all levels are very slow to set ambitious goals concerning nZEB and sustainability. Consequently, construction companies do not feel

[12] PROF/TRAC Roadmap
[13] PROF/TRAC Roadmap
[14] PROF/TRAC Roadmap
[15] PROF/TRAC Roadmap

compelled to fully invest in sustainable technology and in sustainable (cross-craft) training and skills.

With regard to some regulations, the government even wants to make a step back: for instance, the regulation on domestic solar electricity. If this is changed, it might decrease the installation of PV panels as they are not absolutely necessary to fulfil specific targets, such as nZEB. Training does not provide extra value to the installer; on the contrary, it causes an economic disadvantage because the costs involved cannot be passed on to the client.

Also, the question arises as to whether the market will automatically make use of voluntary certification schemes. Past experiences in the Netherlands have shown that only a very small percentage of the professionals are working according to such quality frameworks.[16] If certification were to be obligatory for performing particular activities, it would be an enormous boost for the uptake of quality frameworks.[17]

2.4.4 Barriers in education

Initial education in the Netherlands is provided by public schools and universities. Private universities are not common in the building sector. The post–initial education, however, is almost always organised by private training providers. Many professionals did not follow post-initial education in a systematic way after entering the labour market. Sometimes they took a course on a specific item. But when someone graduated as engineer in the ’70s, it is more likely that he/she learned about new systems and innovations from colleagues, by reading magazines, by personal experience, etc., than by post-initial trainings at a certified level. In this way, it is possible to keep using outdated premises and parameters without being aware.[18]

Concerning the construction sector, personal certification schemes are lacking. There exist very few, and the ones that do exist are acquired by a very small portion of the complete labour force. Personal certifications, in general, are mostly seen as a costly hindrance, let

[16] Qualicheck, 2016
[17] Marktgids Zonne-energie 2018
[18] BUSNL Roadmap

alone cross-craft schemes for nZEB buildings. Furthermore, there are gaps in knowledge and skills in the construction companies in the field of sustainability and energy efficiency of buildings.

Due to all these reasons, the available knowledge, technologies, and skills are not optimally employed, therefore, the end user is not being served in the most favourable way. This means that many construction companies are not able to deliver the required quality for sustainable buildings (nZEB), assuming that the demand keeps rising. Thus, the opportunities in education to reach full potential should be exploited. A building which is built according to minimum regulation is by definition not a healthy building. The challenges of constructing sustainable buildings can not be met by the installer alone but must be tackled with a cross-craft process which involves all building components (facade, window, roof, floor, etc.).

3 Conclusions and recommendations

The conclusions in this chapter are drawn according to the findings of the national chapters, the national barrier inventories, and the research results of other European projects. The national barrier inventory recognised the following categories: market, governmental policy and education (initial and post-initial). By harmonising the results in these categories, the analysis gives a good overview of which barriers and opportunities are similar in different countries.

The conclusions are mostly on general issues, with a focus on barriers for further education in the construction sector. Obviously, education in this context is understood as education in sustainable (and cross-craft) specialisations. The International Energy Agency (IEA) stated earlier that: *"Non-technical barriers are the single biggest challenge in the market – as they are the main reasons why energy efficiency technologies are not implemented. The IEA Market reports show that if all cost effective Best Available Technologies (BAT) were fully implemented, savings in excess of 80% could be achieved."*[19]
This chapter will show that indeed most of the found barriers are 'non-technical'.

The conclusions and recommendations will be viewed in two parts. First, the conclusions and recommendations for each country individually will be reviewed. Second, the harmonised conclusions and recommendations on a European level will be analysed and the research results of earlier European projects will be examined.

3.1 Conclusions and recommendations on a national level

It is conspicuous that numerous similarities regarding the implementation of cross-craft trainings between the different countries have been revealed. Most of the identified barriers and opportunities are not unique for a certain country but are mentioned in a similar scope or form in the inventories of the other countries.

[19] Evaluation of building projects under the Intelligent Energy Europe II Programme Final Report

3.1.1 Austria

Austria faces a growing shortage of skilled craftsmen. The result is that a considerable part of construction work is executed by semi-skilled workers. In addition, end consumers do not ask for quality and instruments of quality control in nZEB are lacking. Both construction companies and craftsmen are hard to motivate for employee trainings (especially for longer courses). As a result, the demand for knowledgeable workers and high-quality execution has to be raised. Much can be achieved by promoting the different aspects of quality execution on all levels; from end consumers to blue collar workers and construction companies. To accomplish this, quality requirements and control of executed works need to be enhanced.

In Austria, there are already many strategic plans that provide opportunities for improving education and training schemes. The problem is that these are not sufficient. Energy efficiency is a secondary goal in the courses. This reduces the benefits of available courses. Comprehensive quality management is needed, but this is costly and training providers are unwilling to be transparent and to participate in course evaluations. Furthermore, the further education market in Austria is really competitive and gained competences are hard to demonstrate for trainees. The amount of courses in the areas of energy consulting, energy efficiency, and renewable energies for blue collar workers is rather limited in Austria. The importance of further education and clear training descriptions need to be communicated to the market. To ensure high-quality trainings, the evaluation of available courses, the collaboration between training providers, and the dissemination of cross-craft knowledge are essential.

3.1.2 Hungary

High-quality nZEB solutions are not common yet in Hungary. At present, these are only mandatory for the renovation of public buildings. But since there is still no market demand, skills, trainings, and certifications are also lacking. Regulations concerning obligatory nZEB solutions will change in 2018 and 2020, which might trigger a shift in demand. Furthermore, more subsidies are created to support the funding of nZEB renovations.

In Hungary, only short voluntary, informative trainings concerning nZEB solutions are available. Blue collar workers are unlikely to participate in voluntary trainings. Consequently, many craftsmen work without proper qualification. To improve the uptake of trainings, national and European regulations are needed. Another opportunity is the cooperation with existing course providers in Hungary.

3.1.3 Slovakia

The energy renovation market has not developed yet in Slovakia. Therefore, this has caused the lack of quality demand from end consumers and government. The fact that over 50% of the on-site workers are sub-contracted and the companies and blue collar workers have limited interest for training only adds to this. The construction sector is inward-looking and not likely to take up innovations. Furthermore, the system of regulations is very complex and public procurement is still based on lowest-price policy. The earliest opportunity for the uptake of nZEB (solutions and certifications) in Slovakia is the renovation of public buildings. To achieve this, the control on quality of energy performance measures and the related skills and knowledge of craftsmen are essential.

Cross-craft qualification or partial qualification is very new for Slovakia. The first certifications are being realised, but the cross-craft approach and understanding will need continuous development and promotion. Until recently, Slovakia did not have any relevant certification schemes, the BUILD UP Skills and ingREeS projects are the first steps towards change. Still 50% of the workers are unskilled. More training needs to be developed, including increasingly ambitious curricula. To make these trainings a broad success, financial support (from ESF and government) is needed. Currently, governmental support is very low.

3.1.4 The Netherlands

Construction companies in the Netherlands generally do not work with a focus on the end user. Furthermore, end consumers have little interest in energy efficiency measures. The result is an nZEB market which is not very developed. Regulations slow down innovation and lead to sub-optimisation, while they could instead boost the uptake of quality frameworks.

Legislation and national initiatives are raising the demand for nZEB solutions in the Netherlands, though (even when quality control plays no part). The government also supports these measures with subsidies. Hopefully, the demand for energy-efficient buildings will raise the need for the required quality measures and qualifications of blue collar workers.

Post-initial education is organised by private training providers in the Netherlands. Most craftsmen do not follow this education in a systematic way after entering the labour market. This results in many companies and blue collar workers having knowledge gaps in nZEB solutions. Still, the Netherlands already have a well-developed system for personal certification schemes in the building services sector (as a result of RES and EPBD Directives). However, these schemes are voluntary, so many companies and craftsmen do not put any effort in earning them. Concerning the construction sector, personal certification schemes are severely lacking. Updating existing training schemes and enhancing cooperation between training providers could be a good opportunity.

3.2 Conclusions on a European level

In all partner countries, the government is steering towards a more sustainable focused policy. This is stimulated (or enforced) by new policy and subsidies. But also across all involved countries, current governmental policy seems to be not proactive enough. Legislation is not focused on quality and control, for example, existing nZEB schemes are almost always voluntary. Furthermore, the sustainability goals are still mostly concerned with new buildings. Governmental policy gives insufficient quality control and coordination on: executed construction work, training certification, unambiguous building regulations (innovations), and needed education. This is the case for all four partner countries and means that poor or missing regulation and standards (and also the enforcement of the existing laws) are still major barriers.[20]

There are also barriers in the market. The inventories showed that, at least, the construction companies in Austria, the Netherlands and Slovakia do not embrace innovation, sustainable

[20] Evaluation of building projects under the Intelligent Energy Europe II Programme Final Report

development, and high-quality execution and construction by themselves. Furthermore, most companies are inward-looking and cooperation with other sectors or professionals is limited.[21] The lack of a common sector strategy and the lack of appropriate coordination amongst stakeholders are mentioned as barriers for a large number of projects (namely in 33 of 61 projects).[22]

The decision for low cooperation is mostly risk related. The building sector is very competitive, so most barriers are connected with monetary or financing issues, time, or logistics. Some examples are: training location is too far away; well qualified employees ask for higher salaries; smaller companies need employees on-site; multi-day courses and trainings are not manageable for smaller enterprises. Also, a large part of the on-site workers are sub-contracted. Construction companies are not forced to adapt since governmental policy entails low obligation for high-quality nZEB solutions. The fact that there are no reputation mechanisms in place to stimulate best practice only adds to the issue. This means companies or clients do not consider certification as the main guarantee of work quality but prefer to rely on references.[23]

Not only construction companies are not setting the bar high enough; among building owners (consumers) the demand for high-quality sustainable construction is also lacking. Information barriers experienced by managers, occupants of buildings, and/or policy makers and advisors were the top obstacles according to the Intelligent Energy Europe II report (49 and 41 of 61 projects, respectively).[24] Also mentioned (albeit less often: 29 and 25 projects) were the information barriers faced by real estate agents and investors.[25]

Most consumers are not familiar with nZEB solutions, they miss critical information about sustainable solutions and funding possibilities and are not aware of the benefits. As a result, the higher investment costs become a barrier and consumers will not ask for high-quality

[21] This is also mentioned in the PROF/TRAC Roadmap and BUSNL Roadmap.
[22] Evaluation of building projects under the Intelligent Energy Europe II Programme Final Report
[23] BUILD UP Skills Technical working group 4 Market acceptance (incl. marketing and communication)
[24] Evaluation of building projects under the Intelligent Energy Europe II Programme Final Report
[25] Evaluation of building projects under the Intelligent Energy Europe II Programme Final Report

nZEB solutions. This obstacle is mentioned in the inventory of all four partner countries.[26] Consumers also do not ask for evidence of good performance.

Some of the most important barriers are in education. In all countries, there is a certain amount of available nZEB courses. The attainable certifications differ from country to country. However, for all partner countries the available schemes for nZEB solutions are not enough or suitable. Training does not provide extra value to the installer; instead it creates an economic disadvantage because the costs involved cannot be passed on to the client. In the Netherlands, most existing certifications are for building services specialisations (solar, ventilation); for construction, there are barely any. Hungary has two nZEB focused voluntary trainings: architect training and passive house training. Austria's further education possibilities are differentiated in the areas of energy consulting, energy efficiency, and renewable energies, but if this is narrowed down to blue collar workers as a target group, then the number of offered courses is rather limited. Furthermore, the cross-craft elements in most of the available courses are almost non-existent. Cross-craft understanding is developing very slowly in all four countries. Most available trainings still focus on one specific target group and on one technique or concept.[27] So, it can be stated that there are not enough suitable courses or schemes for (cross-craft) nZEB specialisations.

Most blue collar workers are not motivated to achieve voluntary certifications. This seems to be an issue for all partner countries.[28] The result is a very small percentage of the labour force with a certification in nZEB. An important question is if this will be any different for cross-craft certification. The concern is that blue collar workers from different specialisations might not feel addressed by a course because of its cross-craft nature. And even if a professional is motivated, in most cases, he or she lacks the right information on available qualifications and training materials to make a good choice.[29] The unwillingness to participate in trainings results in a mismatch between the presently available and needed skills, such as the managerial capacity of professionals, due to the lack in specific training and education.

[26] This barrier is also mentioned in BUILD UP Skills Technical working group 1 Finance (sustainability)
[27] PROF/TRAC Roadmap
[28] The barrier concerning incentive is also mentioned in BUILD UP Skills Technical working group 1 Finance (sustainability)
[29] PROF/TRAC Roadmap

Many professionals in the building sector have only limited training and skills in energy-efficient building design and nZEB principles.[30] Lack of skills, specific training, and education results in poor compliance with efficiency and construction standards.[31] Considering this, it will not be a surprise that lack of skilled architects, engineers, designers etc. (23 of 61 projects), lack of skilled craftsmen (15 of 61), and lack of skilled energy certification experts (10 of 61) are important barriers for achieving good nZEB quality.[32] Interestingly enough, the last but least encountered barrier (lack of skilled energy certification experts) was mentioned most often as 'not effectively addressed' during the project.

Apart from the available courses, there are some barriers for the course providers. The course providers have limited funds, consequently, they by themselves are not able to develop cross-craft courses. In the Netherlands, the structure of the education system is not flexible enough for cross-craft training or to make the link between initial and post-initial education or for reskilling/retraining.[33] At the same time, there is only limited willingness among the providers to increase transparency (by sharing course materials, for instance) and to perform course evaluations (they are afraid they will lose clients in case of poor results). Across all countries, there are also issues with the current curriculum of the offered courses: the content is not useful enough (especially, regarding energy efficiency of the buildings) to guarantee participation of trainees, the benefits are too small; also, sustainability and energy efficiency is of secondary importance in the trainings. Training materials are now created on an ad hoc basis without consensus on an underlying qualification framework. The result is that numerous available training materials are fragmented and developed on an unqualified basis.[34] The insight that a building which is built according the minimum requirements of the regulation is not necessarily a healthy building is not taught. Besides, inventories showed that free product trainings are a rival for paid courses in at least Hungary, Austria, and Slovakia. These trainings have the risk to be biased. The solution might be to involve

[30] PROF/TRAC Roadmap
[31] HERON Working paper
[32] Evaluation of building projects under the Intelligent Energy Europe II Programme Final Report
BUILD Up Skills: Evaluation of the BUILD UP Skills initiative under the Intelligent Energy Europe Programme, Final Report
[33] BUSNL Roadmap
[34] PROF/TRAC Roadmap

manufacturers in 'independent' trainings to improve training quality.[35] Still, this shows that the price of the certification of trainings (cost and affordability for company or employee) becomes another barrier.[36]

It is clear that course providers need to be stimulated and supported to overcome these barriers. At the same time, it is necessary to motivate course providers to implement the cross-craft schemes. The involvement of course providers in the design of the training could help to match the scheme with market needs/demands and to intensify its promotion (through social media).[37] The inventories and research results of other European projects also showed plenty of opportunities to increase demand and uptake for cross-craft nZEB skills and knowledge.

3.3 Recommendations on a European level

Legislation is changing in most countries, nZEB standards will be progressively enforced in the next couple of years. This creates possibilities of additional mandatory trainings related to nZEB skills and cross-craft schemes. Governments could effectively promote the quality of energy renovations through endorsing (or enforcing) certification schemes. Financial funding for nZEB buildings could also increase demand, and, thus, increase certification uptake. The enhancement of control and evaluations on executed works might improve the spreading of best practice. A good example is the upcoming Dutch legislation (private kwaliteitsborging), which will make the contractor responsible for the performance of the building. National initiatives could also stimulate the implementation of nZEB and energy-saving measures. Making connection with organisations that are active with nZEB solutions might improve the uptake of the cross-craft schemes.

Awareness should be raised concerning the context between quality of execution, low operating costs, and good living comfort of nZEB. In this way, quality requirements could also be established. Simultaneously, the awareness about ESCO's, funding opportunities, and

[35] E.g. Croatia, BUILD UP Skills Technical working group 4 Market acceptance (incl. marketing and communication)
[36] BUILD UP Skills Technical working group 1 Finance (sustainability)
[37] E.g. Lithuania, BUILD UP Skills Technical working group 4 Market acceptance (incl. marketing and communication)

payback time is instrumental to give nZEB solutions the much needed boost. The promotion or creation of informational platforms could be a means to reach this goal. Moreover, low costs sensors, meters, and Internet of Things (IoT) enable end users to become aware of and to benchmark performance of indoor air quality and energy performance. But not only end consumers are a target group for promotional activities, architects and engineers can also be encouraged to only work with companies who employ skilled and knowledgeable craftsmen. This will provide a higher quality of works for the client.[38] When energy and comfort in combination with nZEB dwellings (both retrofit and new) are delivered as a service, it will provide the need for qualified craftsmen and inspectors (Energyleap programme).

Companies (professional market parties) should be persuaded to invest in quality training for their employees. Staff policy should be focused on the structural improvement of skills, linked with common practice to ensure that the offered knowledge is relevant. Practitioner education tracks, where students learn while they work, could present themselves as an opportunity here. Lack of interest among construction companies and poor image of training programmes could be improved by using direct engagement with leading companies as best examples (ambassador approach). By creating personal promotional stories, (the employees of) other companies could be stimulated to participate in trainings.[39] These steps would help to increase the demand for quality trainings and a quality workforce and emphasise the importance of skilled workers. Furthermore, cross-sectoral and cross-speciality cooperation should be promoted, along with an increased focus of the building sector on energy efficiency as a central point of a future-oriented, sustainable construction method.

By developing a market for nZEB level energy renovations, an opportunity is created for providing training on EE (Energy Efficiency) and RES (Renewable Energy Sources). In all partner countries, there are already existing voluntary schemes for certain specialisations. Collaboration with the training providers of these schemes might be a good way to get missing cross-craft certifications implemented. Cooperation could greatly increase the

[38] BUILD UP Skills Technical working group 1 Finance (sustainability)
[39] BUILD UP Skills Technical working group 4 Market acceptance (incl. marketing and communication)

promotion and the public recognition of the schemes. The benefits of collaboration and evaluation of courses should be made clear to course providers. To ensure the efficiency of promotions, trainings should be described clearly and in detail. Furthermore, courses should be free of charge for workers which means that funds have to set up. Adaptation of relevant subsidies, better collaboration, and cooperation between governmental institutions and educational institutions or course providers could be a stepping stone.

The certification and recognition of the courses will provide value to construction workers.[40] A proof of completion and a system for the presentation of gained further education should be arranged and implemented because this is important for the self-belief and the encouragement of workers to follow further training. A skills register could be a means to achieve this. Alongside the visibility of competence, phone apps with games, such as, tests on EE and RES construction skills, can attract interest and also trigger motivation for additional training. Similar apps have been developed in Croatia and the Netherlands.[41] The Dutch BUILD UP Skills Advisor app also provides the ability to create a personal (informal) skill card through multiple short basic courses.

Completely closing the skills gap through better training proved too great a challenge for the BUILD UP Skills initiative. Synergies and follow-up initiatives have been sought out and encouraged, but these have mostly remained isolated. Nevertheless, the final report gave some valuable recommendations concerning the training format: 'it is better to have hands-on training than classroom training; keep the training practical, regional and short; the training course shall preferably be in the morning, not in the afternoon; start with motivated workers/frontrunners/ambassadors; make it clear to the employers what the benefits of trained workers are'.[42] Another recommendation was to not only look at the education level of workers but also at their function, and to include all workers active on the building site into the scope for training (for example, site foremen and quality assessors).[43] The question for

[40] BUILD UP Skills Technical working group 1 Finance (sustainability)
[41] BUILD UP Skills Technical working group 4 Market acceptance (incl. marketing and communication)
[42] BUILD Up Skills: Evaluation of the BUILD UP Skills initiative under the Intelligent Energy Europe Programme, Final Report
[43] BUILD Up Skills: Evaluation of the BUILD UP Skills initiative under the Intelligent Energy Europe Programme, Final Report

future analyses remains how broad the scope ultimately should be since the knowledge gap also exists among white collar workers and building users.

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